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BOOK OF ABSTRACTS

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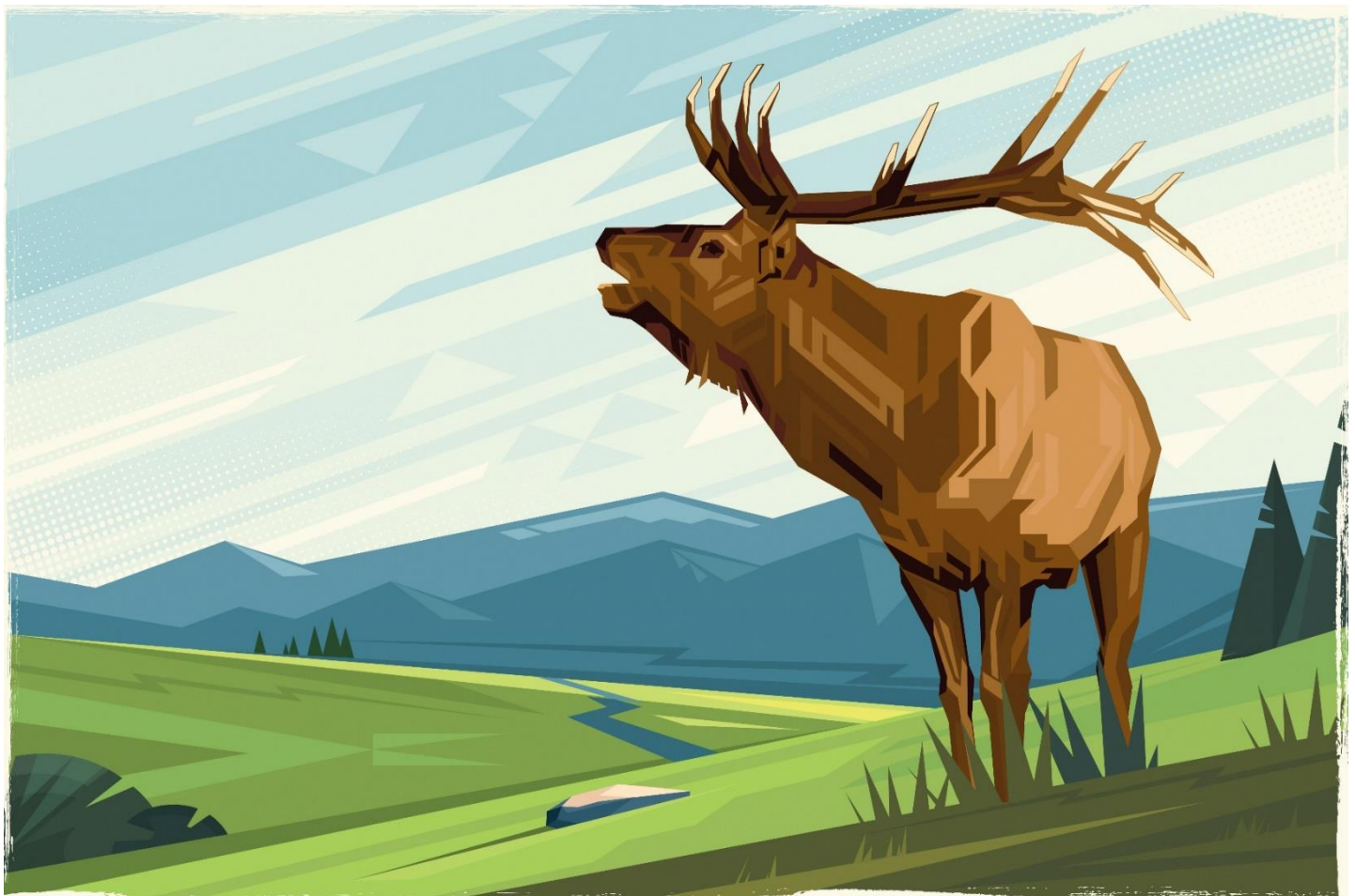
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Art by: JayCee Beyale (He/Him), is an enrolled member of the Diné Nation. JayCee received his BFA in Printmaking from the University of New Mexico. He grew up in the Four Corners area of New Mexico and is now based in Denver, Colorado. JayCee began his Artistic and Graphic Design career with his discovery of street art and graffiti. As a multidisciplinary artist, he celebrates the fusion of technology with his Indigenous identity to enhance awareness and resilience.

Acceptance type: E-Poster

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Agroforestry for climate change mitigation: Leveraging *Vitellaria paradoxa* C.F.Gaertn. and *Parkia biglobosa* Jacq. for carbon sequestration.

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Abstract

Agroforestry parklands with *Vitellaria paradoxa* C. F. Gaertn. and *Parkia biglobosa* Jacq. support carbon storage, crucial for climate mitigation, but structural and diversity parameters impact on the latter remains underexplored. This study assesses the carbon storage potential of these parklands in Sudanian (SZ) and Sudano-Guinean (SGZ) zones of Benin, focusing on diversity and structural parameters. Forest inventories (0.1 ha of plots) with data on diameter at breast height (DBH) and total tree height collected. Descriptive statistics were used to summarize structural, diversity, and carbon stock parameters in each zone. A multiple linear model was used to assess structural and diversity parameters effect on carbon stock. Results indicated that tree DBH and basal area were significantly higher in SZ than in SGZ, while tree density was significantly higher in SGZ than in SZ. Species richness and Shannon index showed significant differences between climate zones. Total carbon stock in the SZ was 18.18 MgC/ha and 45.54 MgC/ha in the SGZ. *V. paradoxa* and *P. biglobosa* contributed significantly to carbon storage with 55.79% and 10.85% in SZ; and 32.59% and 9.69% respectively in SGZ. Tree density, basal area and species richness had a positive effect on carbon storage, while Shannon index and DBH had a negative effect. These findings emphasize *V. paradoxa* and *P. biglobosa* crucial role in carbon storage and climate mitigation, highlighting the need for further research on sustainable management practices to enhance carbon sequestration while preserving biodiversity.

Keywords: Agroecosystems, Agroecological landscapes, carbon sequestration, climate change mitigation, West Africa

Co-designing an unfenced ecosanctuary and heritage reserve on Mātai Moana

Carles Martinez-Almoyna

Lecturer in Landscape Architecture

Abstract

Mātai Moana (Wellington, Aotearoa New Zealand) is a contested land that contains numerous heritage sites and holds a strategic ecological value. Despite its relevance, Mātai Moana does not have specific legal protection and has faced several attempts to be developed over the last years. These have failed thanks to the strong opposition of a substantial sector of the local community and mana whenua (indigenous people with historic and territorial rights over the land). With the aim to explore a point of encounter between the confronted parties, a participatory project has been facilitated by the landscape architecture programme of Victoria University of Wellington. The principle that has guided the project has been to protect and restore the land, revealing at the same time the fabulous heritage that the area contains, particularly Māori.

The participatory project builds on previous restoration work done by local stewards and is grounded on site knowledge, community aspirations and mātauranga Māori (indigenous knowledge). The integration of mātauranga Māori into landscape design has involved incorporating values and principles, conceiving the land as a living entity that needs to be honoured and understood. The participatory project has been structured over time through a series of seminars, workshops, reviews and exhibitions, providing a final say to mana whenua. The ending goal of the final consensus design is to inform the legal process towards land protection and the gradual transformation of the area. Finally, this project demonstrates that landscape architecture can facilitate complex community-led restoration projects based on inclusiveness and participation.

Putting together the elements for the ecological restoration and rehabilitation in Querétaro, México

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¹Cadereyta de Montes. ²Querétaro. ³México

Abstract

Ecological restoration and rehabilitation are necessary in Querétaro, Central México. Querétaro is a natural, cultural, and historic crossroads with different landscapes on a small surface.

The economic model for the development of Querétaro fostered uneven development across its regions. Economic activities and population increases have modeled the state territory with a duality of urban and rural municipalities. The landscape holds different types and levels of degradation that go from land use change to irreversible transformation. Querétaro has economic stability, organized administration, and an environmental framework. The state has an ecological ordinance model proposing a regionalization that divides the surface into landscape units with differentiated activities according to the local environment and circumstances. Querétaro's specialists in local biodiversity have developed models and proposals for restoration at specific spots. There appears to be pleasant coordination between governmental and high education institutions and research centers, which have produced a comprehensive study about Querétaro State Biodiversity, soon to be released.

Notwithstanding the above, ecological restoration is not happening on a state scale. Lack of sustained coordination might be the principal clue, along with defining priority places and surfaces and clear objectives, including landscape restoration and/or rehabilitation. The lack of sustained restoration practice is a problem that needs to be solved. Participation of stakeholders, land owners, users, NGOs, the academy, and the government is also crucial and required.

Our virtual poster analyzes solving this conundrum, overcoming administrative challenges, and promoting practical restoration and rehabilitation initiatives across the state according to local circumstances and needs.

Saving Critical Endemic Species through Private Sector Interventions: An innovative multi-stakeholder restoration initiative to develop Forest Corridors and Protect Sensitive lands in Sri Lanka

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¹The Wildlife and Nature Protection Society of Sri Lanka, Battaramulla. ²Preserving Land and Nature (Guarantee) Limited, Battaramulla

Abstract

In 2020, the Wildlife and Nature Protection Society of Sri Lanka (WNPS)- the third oldest conservation entity in the world, established PLANT (Preserving Land and Nature (Guarantee) Limited), to raise funds, to acquire and/or set aside private lands, directly or through partners, for conservation.

PLANT protects lands in their existing natural states, extends protected areas by converting private lands to conservation areas, and focuses scientific restoration efforts on degraded land brought into the entity. The Emerald Trails initiative of PLANT contributes towards creating reasonably connected corridors of natural spaces and ecosystems within the southwestern quarter of the island, which is home to more than 90% of its endemic species.

Within four years, PLANT has enlisted over 30 partners who represent corporates, plantation companies, individuals, and international donors, is engaged in 28 locations, and represents a footprint of over 2500 Acres. Sri Lanka's importance lies not in size but in the rich diversity of species present within each acre. Scientists revealed more than 1150 species in just ten locations surveyed, including over 125 Critically Endangered and Endangered species. PLANT has created 360 acres of emerging forests, which include the formation of two 9km and 13km long forest corridors, and over 26,000 plants were added from 165 species. Locations are being restored through the support of partners, conservation scientists, local communities, and volunteers with all funding raised privately. Primarily volunteer-run with only three full-time staff, PLANT is already Sri Lanka's largest conservation initiative and easily one of its most ambitious. www.plantsl.org

Quantitative estimation of restoration-induced resilience: initial insights

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Abstract

The conceptual link between ecological restoration and ecological resilience is strong and intuitive, as well-planned, well-conducted, and well-monitored restoration all contribute to resilient ecosystems. Behind this apparent simplicity, however, lies the paucity of quantitative approaches to resilience modeling in ecological science that may capture the complexity of ecosystems and social-ecological systems which allow the rational parameterization of the effects of restoration practices over the temporal span of the restorative continuum. This contribution provides an introductory insight into a novel quantitative framework for the estimation of restoration-induced resilience. The paper illustrates preliminarily the conceptual links between ecological restoration and resilience in the context of the SER Standards. Subsequently, it focuses on the fundamental aspects and glossary of the proposed framework, highlights its consistency with restoration standards, and discusses some of its main features, including: (1) the approach to the quantitative parameterization of the complexity of ecosystems through the concept of multi-dimensionality; (2) the parameterization of resilience and the possibility of assessing it with respect to multiple stages of the restorative continuum; (3) the role of reference models and indicators in the estimation and assessment of resilience; (4) the possibility of accounting for uncertainties in the restoration process; and (5) the possibility of aggregating resilience spatially to account for the possible spatial variability of chemical, physical, biological, ecological, and social-ecological resilience within a social-ecological system; and (6) the ways in which the outputs of resilience modeling can be used by restoration professionals for planning, implementation, and monitoring of restoration projects.

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Fauna associated with the ecological restoration process in Rio Canoas State Park, Brazil

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Abstract

The presence of fauna and their interactions within natural ecosystems are key components for restoring environmental functionality. Fauna monitoring serves as a valuable tool for understanding these ecosystem functions, enabling us not only to comprehend the relationships between fauna and their environment but also to generate hypotheses about how these interactions may be sustained over time.

This study was conducted at the Rio Canoas State Park, a conservation unit of the Atlantic Forest in Santa Catarina state, Brazil, and is part of the initiative “Restauração da Floresta Ombrófila Mista (REFORMA - <https://projetoforma.ufsc.br/>)”. The aim was to assess the occurrence of fauna and their trophic functions, seeking to understand the role of each group (mammals, birds, and reptiles) in the restoration process.

Data were collected through camera traps over five years of monitoring in two areas: 1) advanced forest vegetation and 2) an area undergoing restoration (5 to 10 years). A total of 79 species were identified, of which 74 are wild species (43 birds, 29 mammals, and 2 reptiles), along with 3 domestic species and 2 exotic species. In terms of trophic functions, 59.5% of the identified species were classified as dispersers, while 40.5% were classified as predators.

The results of the study highlighted animal groups that play crucial roles in seed and propagule dispersal, which are essential for ecological restoration processes, as well as the presence of predators, which are important for the establishment and maintenance of trophic webs.

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What is the role and importance of native forest seed sources for ecological restoration in the tropical dry forest in Colombia?

Jennifer Lopez Hoyos^{1,2}, Juan Carlos Villalba Malaver³

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Abstract

The Tropical Dry Forest (bs-T) in Colombia is one of the most degraded ecosystems, with a current remaining coverage of only 7%. This is due to its proximity to major urban centers, as it is located near the valleys of the Magdalena, Patía, and Cauca rivers. Despite its ecological importance, it lacks sufficient information, primarily due to the lack of research. In assisted ecological restoration processes, obtaining plant material is the main limitation. Therefore, the source from which the trees will be collected for seed harvesting, known as seed sources, must be taken into account. It is not only important to select the right plant material to achieve the desired results in the short, medium, and long term but also to ensure that the material is appropriate for restoration purposes. The aim of this research is to highlight the importance of seed sources and share successful cases of the use of forest species worldwide and in Latin America as seed sources in tropical dry forests. Finally, seed sources used in restoration processes have had a significant impact on the recovery of forest ecosystems through assisted restoration, ensuring the availability of high-quality seed.

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Requirements for successfully restoring forest ecosystems in AP Vojvodina, Republic of Serbia

Zoran Galić

Novi Sad

Abstract

The restoration project should first identify the main challenges in the area to be restored. The low percentage of forests in the lowland region of AP Vojvodina, Republic of Serbia, highlights the need for improved forest vitality, as well as the importance of wood production, carbon sequestration, biodiversity, and increased stand resistance. One of the key concerns in our region is the restoration of low-vitality forests into more sustainable ecosystems. Research in this area should explore the possibility of using mixed native forest species. Forest design should be based on site-specific data, such as soil properties and hydrological characteristics. In Vojvodina, the success of afforestation and restoration efforts largely depends on soil characteristics. Therefore, the initial step involves creating site maps based on soil types, which guide the selection of tree species at the forest management unit level. Following this, the restoration plan outlines recommendations for planting material, planting methods, and the spatial arrangement of seedlings. Additionally, for monitoring purposes, areas without revitalization measures are needed. Future plans include further site mapping and the careful selection of tree species, incorporating innovative approaches and knowledge from the Horizon SUPERB project.

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Participatory approach as a tool for ecological restoration: insights from the Reforma Project in an Agrarian Reform settlement (Brazil, SC)

Ana Luiza De Rosa Castro, Julia Goetten Wagner, Alexandre Siminski, Maurício Sedrez dos Reis, Karine Louise dos Santos

Pos-Graduate Program in Agricultural and Natural Ecosystems (PPGEAN)/Curitibanos

Abstract

In the Brazilian Atlantic Forest biome, only 12.4% of the original forest remains, and the situation is even more critical for the Araucaria Forest, where only 4.3% remains. In this context, the Reforma Project (Restauração da Floresta Ombrófila Mista - <https://projutoreforma.ufsc.br/>) aims to support the restoration of this ecosystem through a participatory approach that emphasizes community engagement and awareness. The project goal is the restoration of 302 hectares. One of its key implementation areas is the Indio Galdino Agrarian Reform Settlement, located in the municipalities of Curitibanos and Frei Rogério (Santa Catarina, Brazil). To foster the involvement of the 51 farming families in the settlement, interviews and didactic participatory workshops were held. These actions have provided opportunities for the participation and training of university students and researchers of the field of participatory restoration. Through a collaborative identification of local opportunities and challenges, the project promoted workshops on potential uses of fruit species, water protection, indicator plants, carbon credits, meliponiculture and medicinal plants. This exchange has encouraged farmers to reflect on the sustainable resource to restore the local forest. In addition to encouraging farmers to jointly describe and rediscover the multifunctionalities of plant species and the opportunities for generating income, the actions have helped to strengthen farmers' coordination and empowerment. Although there is still a long way to go, the actions of the Reforma project have successfully provided space for knowledge exchange and the training of human resources capable of promoting participatory restoration.

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Investigating the Affect of Seed Source on Restored Population Health

Juliet Kiester, Amy Angert

Vancouver

Abstract

The field of restoration ecology aims to improve the health of severely disturbed ecosystems through human stewardship. Substantial scientific evidence has indicated that plants do best within their own ranges, and restorationists have traditionally prioritized local seeds (An Assessment of Native Seed Needs and the Capacity for Their Supply, 2023). This is because plant populations genetically adapt to their local temperatures over long periods of time. However, as anthropogenic climate change causes average local temperatures to change relatively quickly, the health of local plant populations may decline. In these cases, plants from outside locations may survive better than local plants (Bontrager et al., 2020), so assisted gene flow could be a key tool to support biodiversity. More research is needed to evaluate the best strategy for sourcing planted material for restoration sites. This research aims to identify the best seedling compositions to improve productivity and biodiversity in restored habitats. I will compare the outcome of two seed sourcing strategies, local vs composite. The focal species is *Rubus spectabilis*. Planting sites are existing riparian restoration sites in the Pacific Northwest. I hypothesize that the increased genetic diversity of the composite group will give the composite population more resilience in the face of extreme weather events and changing climate.

I do not yet have data for this study. I have collected and germinated sample germplasm of my focal species and established government and NGO collaborations. I will plant next winter.

705

Remote sensing-based analysis to help shaping effective soil restoration strategies with experts and local communities around Andasibe National Park Madagascar.

Fanambinantsoa NOROMIARILANTO

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Abstract

In Centre-East Madagascar, swidden agriculture is the primary economic activity. Soil degradation due to erosion and nutrient depletion is a serious problem threatening farmer's livelihood, which are worsened by climate change. Although farmers have developed methods to combat erosion and adapt to climate change, there is a lack of integration between local knowledge and scientific practices. To address land degradation effectively, participatory approaches have been employed, aiming to merge local and scientific knowledge. This research focuses on two main objectives: (i) conducting a remote sensing analysis to track land use and degradation patterns from 1994 to 2021, and (ii) evaluating the main drivers of land degradation and assessing implemented and documented used to address soil degradation.

Land cover maps reveal significant changes, with cropland increasing by 33.71% at the expense of woodland areas. Bare land has expanded substantially, tripling in size over the last 27 years. Soil degradation, particularly erosion, is exacerbated by farming practices, including short fallow periods, and extreme climate events like prolonged droughts followed by heavy rains. Mining activities in the west part of the area have also contributed to extensive land clearing.

While various agronomic and biological techniques—such as direct seeding on permanent soil cover, mulching, crop rotation, and composting—have been introduced to reduce soil degradation, their implementation has been hindered by limited resources, insufficient training, and poor access to remote villages. To devise an effective restoration strategy, factors such as invasive plant management and the absence of breeding practices must be considered.

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Mapping Invasive Alien Plants (IAPs) in Bikkapathimund, Nilgiris: Impacts on Biodiversity, Toda Livelihoods, Culture, and the Need for Restoration

Harshavardhini Angappan, Mounthees Kuttan

Keystone Foundation, Kotagiri, Tamilnadu, India

Abstract

Invasive Alien Plants (IAPs) pose a significant ecological threat, driving biodiversity loss and disrupting ecosystem services. This study maps the distribution of four key IAPs—*Acacia mearnsii*, *Ageratina adenophora*, *Cestrum aurantiacum*, and *Lantana camara*—within a 1 km radius around Bikkapathimund, a Toda hamlet in the Nilgiris, Tamil Nadu. The Todas, a pastoralist community recognized as one of India's 75 Particularly Vulnerable Tribal Groups (PVTGs), rely on the surrounding forest-grassland mosaic for grazing their unique breed of buffaloes, known as Toda buffaloes, and gathering plants for sacred rituals. However, these lands have undergone drastic changes due to historical afforestation efforts and land-use modifications.

Using Google Earth Pro and ground surveys with Open Data Kit (ODK) forms, the study categorized land into seven zones: Acacia Patch, Eucalyptus Plantation, Shola Forest, Grassland, Mixed Forest, Community-owned land, and Settlement. IAP cover was classified into five density categories—Absent, Low, Medium, High, and Uprootable Seedlings. GIS-based analysis revealed *Acacia mearnsii* as the most dominant invasive species, replacing former grasslands, while *Cestrum aurantiacum* was concentrated near settlements and forest edges. *Ageratina adenophora* exhibited widespread dispersion, whereas *Lantana camara* had a more restricted presence. These invasions threaten native biodiversity, reduce grazing lands, and endanger culturally significant plant species essential to Toda traditions.

The study underscores the urgency of community-driven restoration efforts to mitigate invasive spread. Understanding invasion patterns can inform targeted restoration interventions, ensuring the ecological and cultural integrity of Toda landscapes while contributing to broader biodiversity conservation initiatives.

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Navigating the Complexities of Elephant Conservation in South Africa: Insights from Kruger National Park's Historical and Contemporary Strategies

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Abstract

Elephant conservation in South Africa is a dynamic and multifaceted challenge, shaped by ecological, social, and ethical considerations. This paper examines the historical trajectory and contemporary strategies of elephant conservation in Kruger National Park (KNP), one of Africa's most significant wildlife sanctuaries. The study explores key milestones, including the dramatic population decline of elephants in the late 19th and early 20th centuries due to unregulated hunting and habitat disruption. The establishment of KNP and subsequent conservation efforts enabled a remarkable recovery, though the increase in elephant numbers led to new ecological challenges, such as habitat degradation. Early management strategies, including culling programs, sought to regulate population sizes but were later abandoned in favor of more adaptive and ecologically informed approaches.

Modern conservation strategies emphasize natural ecological processes, habitat monitoring, and community involvement. Technological advancements, such as remote sensing and GPS tracking, have enhanced monitoring capabilities, while community-based initiatives aim to mitigate human-elephant conflict. However, challenges remain, particularly concerning the balance between elephant population growth, habitat sustainability, and human-wildlife interactions. This paper highlights the importance of adaptive management, policy evolution, and scientific research in ensuring the long-term survival of elephants. It concludes with recommendations for future conservation efforts, emphasizing the need for integrated strategies that balance ecological integrity, ethical considerations, and community engagement.

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Restoring a cultural-ecological relationship via community-informed education on Indigenous heritage to reconnect land and culture within the Little Conestoga Creek Watershed, Pennsylvania.

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Abstract

Stream and floodplain restoration projects in Pennsylvania are typically recognized for their function (such as how much pollutants can be reduced from flowing downstream into the Chesapeake Bay). While this is important, focusing on the functional aspects alone fails to engage people and culture in the process. Restoration paired with civic infrastructure, like trails and gathering spaces, has the capacity to move beyond function towards reestablishing ecologically healthy relationships between nature and culture.

The local landscape carries the legacy of Indigenous cultural-ecological relationships where people lived with nature, though these legacies are sometimes buried, often hidden, and/or are largely inaccessible to the public. The purpose of this project is to educate people working within the conservation field and general public about the interconnections between water quality, ecological restoration, and cultural heritage with a focus on the Little Conestoga Creek Watershed.

In Pennsylvania, there is no state or federal recognition of Indigenous tribes, making it difficult for people with Indigenous heritage to claim legitimacy and for determining who has the authority to speak for the land. As a result, this project engages with many voices through community organizations, local leadership and experts, and Indigenous allies. RiverStewards and LandStudies partnered with Circle Legacy Center, Blue Rock Heritage Center, and the Conestoga-Susquehannock Tribe to inform the development of an educational digital tour in the format of an ArcGIS StoryMap, a framework for community engagement to replicate this kind of work in other watersheds, and presentation for local conservation organizations.

780

USE OF AN INTEGRAL INDEX OF STRUCTURAL DIVERSITY IN DYNAMIC REFERENCE MODELS OF FOREST ECOSYSTEMS

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Abstract

Ecosystem restoration requires the use of dynamic reference models to capture the spatio-temporal variability of the structural, compositional and functional attributes of ecosystems. When monitoring them, it is becoming increasingly important to be able to combine multiple attributes in a single indicator, and there is consensus that ecosystem structure plays a crucial role in maintaining ecosystem functions. The objective of this study was to evaluate the variation of an integral index of structure for different stages of development of reference forests dominated by *Nothofagus pumilio*, in southern South America, in Torres del Paine National Park, Chile. Based on 45 plots located in 5 stands, different attributes of structure were calculated and subsequently unified into an additive index of structural diversity. Our results show that the highest structural diversity is found in a forest of advanced succession (LS; 44%), followed by one of intermediate succession (MS; 34%) and early succession (14%). The variables that showed the highest values for LS were biomass, basal area, DBH Gini index, quadratic mean diameter and volume. When monitoring ecosystems, it is important to use indexes that allow the integration of multiple attributes, providing a more complete picture of the state of the ecosystem. At the same time, it is crucial to use dynamic reference models to monitor the progress of restoration in relation to an ecosystem that coincides with its state of development, and to establish ecological goals consistent with advanced stages of the forest ecosystem.

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799

Ecosystem Services and Riparian Restoration: A Socioecological Assessment of the LIFE Alnus Taejo Project

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Abstract

Ecosystem services are essential for ecological conservation and human well-being. In the framework of restoration activities over the riparian forest involves in the Spain-Portugal cross-border LIFE Alnus Taejo project's, this study assesses people perception regarding their hydrological, wild harvested products, and cultural/recreational ecosystem services, before the restoration works starts, and also, how the planned activities may affect those services, over three different regions: Montemayor del Río, Villasbuenas de Gata, and Fundão. Using the TESSA methodology approach, a mixed-methods approach combined surveys, free-listing, and geospatial mapping to assess community perceptions and expectations of future conservation actions. Findings reveal regional variations, highlighting the need for tailored conservation strategies. Water quality perceptions differed, with 75% of Villasbuenas de Gata respondents reporting seasonal turbidity concerns, while Fundão residents cited chemical contamination. In Montemayor del Río, minor issues such as occasional turbidity and foam were noted. Anticipated flood risk reduction was highest in Fundão (71.4%) and lowest in Villasbuenas de Gata (50%). For harvested wildlife products, 92.9% in Villasbuenas de Gata collected natural resources, compared to 63.6% in Montemayor del Río and 66.7% in Fundão, indicating strong economic dependence. In cultural and recreational services, 100% of Fundão's respondents saw tourism potential, while 85% in Villasbuenas de Gata supported ecotourism but raised accessibility concerns. Over 75% of participants across locations expressed interest in conservation initiatives. These results provide a baseline for evaluating future conservation efforts and ecosystem services, aligning with global restoration strategies, and emphasizing adaptive, community-driven conservation planning to optimize ecological and socioeconomic benefits.

807

Stream restoration strategies often designed to perform in baseflow may be ineffective in stormflow regarding nonpoint pollution abatement

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Abstract

There is a critical need for studies on restored streams under stormflow conditions in tropical regions to assess whether stream restoration strategies positively, neutrally, or negatively impact water quality. This study evaluated the effects of in-situ structural restoration interventions (cross-vanes and riffles) on the water quality of an urban tropical stream in Southeastern Brazil during rainfall events. We compared mass-volume [M(V)] curves and event mean concentrations (EMCs) of suspended solids and dissolved nutrients between pre- and post-restoration periods. Evidence of nonpoint source pollution was observed for all assessed water parameters in most monitored rainfall events. Pre-restoration, a substantial first flush of suspended solids occurred, a pattern absent post-restoration, likely due to hydromorphological changes in the stream channel. However, post-restoration EMCs were either similar to or higher than pre-restoration values. While the interventions appeared to mitigate the first flush of suspended solids, they did not significantly reduce the overall downstream export of sediments and nutrients, as indicated by EMCs. To enhance water quality improvements, these structures must be specifically managed for solids removal and integrated with processes targeting nutrient reduction. Restoration efforts should extend beyond the stream channel to encompass the entire watershed. These insights are crucial for guiding future tropical stream restoration projects.

809

Effects of Riparian Vegetation Restoration on Ecosystem Functioning in Tropical Streams of Southeastern Brazil

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Abstract

Tropical stream ecosystems face increasing human pressures, underscoring the urgent need for effective restoration strategies and expanded knowledge in this field. This study assessed the impact of riparian vegetation restoration and environmental context on stream ecosystem functioning by measuring key processes — gross primary production (GPP), ecosystem respiration (ER), and nutrient uptake of ammonium and soluble reactive phosphorus — across ten tropical streams in southeastern Brazil. These streams spanned a gradient from clear-cut areas (impacted reaches) to relatively pristine conditions (reference reaches), including intermediate stages of vegetation recovery (restored reaches). In the short term (~ 15-20 years after restoration), restored reaches exhibited reduced GPP, similar to reference reaches. However, ER did not increase as expected, suggesting that a longer recovery period is needed for restored streams to fully emulate reference conditions. Furthermore, restored reaches did not attain the nutrient uptake efficiencies observed in either impacted or reference reaches, indicating only partial functional recovery. These findings highlight that while riparian vegetation restoration positively influences certain ecosystem functions, other factors, such as discharge and hydromorphology, play significant roles in stream functioning. This underscores the need for a more holistic restoration approach that incorporates hydromorphological and habitat enhancements. By emphasizing ecosystem function metrics as indicators of ecological recovery, this study provides valuable insights for improving tropical stream restoration efforts.

815

Coupled floodplain inundation – forest succession modelling improves management actions through collaborative development and evaluation of alternative scenarios of vegetation management and hydrological regimes

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Abstract

Most of the world's river-floodplain ecosystems are simultaneously undergoing modifications to their hydrological regimes and experiencing vegetation changes, such as species invasions. The simultaneous nature of such changes makes it unclear whether species interactions (e.g., competition, succession) are the main drivers of ecosystem change or whether plant communities are responding to underlying changes in the hydrological regime of rivers. Management actions, as a result, may not address the main causes of changes in plant communities in these systems. We developed a coupled floodplain inundation – forest succession model in collaboration with management agencies and applied it to a 2500 ha portion of the Upper Mississippi River floodplain (Reno Bottoms, IA) as part of the restoration planning process. We evaluated the effectiveness of timber harvest, planting, and suppressing invasive *Phalaris arundinacea* under two different future 100-year hydrological scenarios: a future maintaining the average flooding conditions of the past 40 years (random) and a future that projects an observed upward 40-year trend in flooding conditions forward (trending). By comparing mapped outputs under different scenarios, we were able to locate areas where management actions focused on vegetation could be most successful under the different hydrological regimes, thus improving the likelihood of restoration success.

941

Using the SER 5-Star Evaluation Tool to evaluate the success of an ecosystem restoration project in South Africa

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Abstract

The Buffelsdraai Community Reforestation Project (Durban, South Africa) aims to restore biodiversity and ecosystem functionality to 800 hectares of degraded sugarcane lands. The project's progress was evaluated using the Society for Ecological Restoration's (SER) 5-star evaluation tool. Key ecosystem attributes were measured to determine the success of restoration efforts and identify ongoing challenges. Inputs included practitioner observations, and historical monitoring records (*viz.* baseline biodiversity assessments, biennial monitoring reports, and comparative analyses with a reference ecosystem). Metrics included species composition, structural diversity, ecosystem function, and external exchanges. The analysis confirmed significant improvements, over ten years, in species composition, structural diversity, and ecosystem function. It also showed a positive recovery trajectory for most attributes, though some aspects, such as soil structure and invasive species control, had not improved much. These results align with other assessments in confirming a need for increased funds for control of invasive alien plants. The budget did not include for remediation of soil contamination – a legacy from previous farming practices. The increased biodiversity and improved functional ecosystem processes suggest that the project is on a trajectory towards resilience. While full recovery remains a long-term goal, the SER 5-star tool has provided managers and decision makers with valuable insights into the progress made, and the priority work-areas going forward. These include ongoing management, with a focus on refining the invasive species control efforts, enhancing ecological connectivity to other natural spaces in surrounding areas, and ongoing monitoring and adaptive restoration approaches.

953

Conservador das Araucárias: A collaborative approach to scaling Atlantic Forest Restoration

Carolina Schaffer, Miriam Prochnow

Apremavi, Atalanta, Santa Catarina, Brazil

Abstract

The Atlantic Forest is a global biodiversity hotspot, yet extensive degradation has reduced its original vegetation to 12%. This biome provides critical ecosystem services, including water security for over 100 million Brazilians. In response to deforestation and the need for ecological connectivity, Apremavi and Tetra Pak launched the Conservador das Araucárias Project, aiming to restore and conserve 7,000 hectares of native forests in the Araucaria Forest region through multi-stakeholder collaboration.

The project integrates natural regeneration, tree plantation, ecological enrichment, and environmental compliance support for rural landowners. It contributes to climate mitigation by sequestering an estimated 70,000 tCO₂eq. Governance and transparency are ensured through three structured groups: the Executive Group, the Advisory Group (including TNC, CI, and Klabin), and the Transparency Group, engaging national and local stakeholders.

Since its inception, the project has restored 1,248.92 hectares across six municipalities in two states, encompassing 285.25 hectares of tree planting, 676.82 hectares of active ecological enrichment, 534.74 hectares of passive enrichment, and 37,36 hectares of tree plantation. Apremavi has produced 156,608 native seedlings from 62 species, utilizing paper-based packaging to reduce plastic waste by 222 kg. The initiative's success is monitored through Apremavi's Environmental Portal.

The Conservador das Araucárias Project exemplifies how collaboration between corporations and civil society can drive large-scale ecological restoration, enhance biodiversity conservation, and promote sustainable land-use practices. Its scalable and replicable model contributes to global restoration goals and efforts toward climate resilience.

954

A Monitoring and Transparency Tool for Atlantic Forest Restoration in Southern Brazil

Miriam Prochnow, Carolina Schaffer

Apremavi, Atalanta, Santa Catarina, Brazil

Abstract

Since its establishment in 1987, the Associação de Preservação do Meio Ambiente e da Vida (Apremavi) has played a crucial role in forest restoration and conservation initiatives. By collaborating with a diverse network of partners, including landowners, governments, private companies, and NGOs, Apremavi has successfully facilitated the planting of over 10.5 million native trees in Brazil's Atlantic Forest region.

To enhance project planning and restoration monitoring, Apremavi has developed the Portal Ambiental (<https://portalambiental.apremavi.org.br/>), an online geospatial data platform. This platform incorporates remote sensing, satellite imagery, and drone technology to track restoration progress by established indicators and evaluate project outcomes effectively. It provides comprehensive access to project details, implemented restoration methodologies, property land use maps, and field photographs of the before and after results. The Portal also prioritizes transparency and data accessibility for landowners, financial partners, and the general public.

Currently, 1,229 properties are registered on the Portal Ambiental, spanning 52 municipalities in Santa Catarina and 24 municipalities in Paraná. Of these properties, 435 have undergone thorough environmental assessments, mapping approximately 2,800 hectares of riparian areas and 8,500 hectares of conserved land. Furthermore, Apremavi is actively restoring and monitoring 767 hectares of riparian areas.

By integrating advanced monitoring technologies with stakeholder engagement, Portal Ambiental establishes a high standard for restoration quality, effectiveness, and long-term success. This comprehensive model has the potential to inspire the expansion of ecological restoration efforts on a global scale.

1027

Effects of Watershed Restoration on Arroyo Vegetation at Different Life Stages

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Abstract

Watershed restoration has varied success and poor documentation in drylands, demanding scientific monitoring. In desert arroyos prone to disturbance from monsoons, the goal of restoration is to establish vegetation by increasing soil deposition and moisture retention, thereby increasing ecosystem storage of stormwater. We will test the hypotheses that changes in sedimentation and soil water content 1) differ between restoration and control states/sites, and 2) can be correlated to changes in vegetation at seed, seedling, and mature life stages. We will assess impacts of restoration structures by sampling within structures' potential area-of-effect. LiDAR scanning drones and soil moisture probes will assess sedimentation and moisture. Soil cores and quadrat surveys will assess these vegetation components: seedbank diversity, seedling emergence, and shrub water stress. We will use linear mixed models to determine differences in response variables between control and restoration states/sites, subsequently assessing relationships between soil moisture and vegetation responses using linear regression. We predict that compared to control sites, restoration structures will 1) increase seedbank diversity with upstream deposition, 2) extended soil moisture and germinate more seeds, increasing seedling emergence diversity, and 3) extended soil moisture and increase shrub water content. Water's effects on vegetation at different life stages may help explain the common difference between above and below ground vegetation. These effects are measured around local structures but can be scaled up to watershed levels with the clustered nature of restoration. This study will clarify how watershed restoration practices impact soil moisture and vegetation at large spatial scales.

1031

A decade of WCS restoration in Colombia, a multi-stakeholder, large-scale and multifunctional strategies approach.

Selene Torres, Leonor Valenzuela, Carlos Saavedra, German Forero, Catalina Gutierrez, Yulieth Avila, William Bravo, Pilar Aguirre, Silvia Alvarez

WCS, Bogota, Bogotá, Colombia

Abstract

Restoration of degraded areas and conservation of high integrity forests offer the greatest potential of all nature-based solutions for climate change mitigation and Colombia's ecological and social conditions make it one of the most strategic countries for achieving these goals. WCS leads restoration initiatives in collaboration with local NGOs, communities, private actors and public entities to improve ecological integrity and guarantee benefits for people in the Andes, Choco, Caribe, Orinoquia, and Amazon regions. Our working model focuses on creating the conditions for governance, planning and working with communities so that restoration can be effective, socio-economic and environmental diagnosis, prioritisation of areas, co-designed strategies and signed conservation agreements to implement restoration strategies. We have signed almost 300 conservation agreements, supported the creation of 25 nurseries, and planted 570,000 plants belonging to 250 species on nearly 700 hectares. At least 1 maintenance and 380 permanent monitoring have been established. We have also created local jobs, green businesses through community nurseries, and empowered local people. Habitat restoration for endangered species; improvement of water and ecosystem health; conservation of high integrity ecosystems; agroforestry and silvopastoral systems; and enrichment of degraded forests are the main strategies implemented. Large-scale, multifunctional restoration strategies and long-term funding are essential to reverse the trends, to protect biodiversity, to increase landscape integrity and connectivity, to achieve productive security of territories, and to improve human well-being. Although there is great potential for expanding restoration in Colombia, achieving large extensions depends on the potential for restoration to become a profitable economic option.

1033

**Monitoring the impact of restoration as a Nature-Based
Solution: Positive outcomes for nature, sustainable livelihoods, climate
innovation, and long-term sustainability in three landscapes in
Colombia**

Leonor Valenzuela, Yulieth Avila, Pilar Aguirre, Carlos Saavedra, German Forero, Selene Torres

WCS, Bogotá, Bogotá, Colombia

Abstract

Nature-Based Solutions aim to address environmental, social, and economic challenges by conserving, restoring, and sustainably managing ecosystems to promote biodiversity and human well-being. Restoration of degraded areas offers the greatest potential, and Colombia is one of the most strategic countries to achieve these goals. The Wildlife Project-PVS has been working for 10 years in three strategic areas: Middle Magdalena, Bita Basin and Andean Amazon Foothills, in collaboration with local stakeholders to conserve biodiversity, restore degraded ecosystems, and ensure sustainable livelihoods. We implemented a monitoring system to assess the impact of these actions on positive outcomes for nature, sustainable livelihoods, climate innovation and long-term sustainability. According to result indicators, the PVS achieved 59,417ha under conservation agreements, 115 agreements signed, 3,689ha protected by firebreaks, 211ha under restoration, 109,584 plants planted, 20 nurseries strengthened, 18 strategies and 130ha associated with climate change adaptation and innovation, 38ha restored to improve water health, 986 local people hired, income generated through the sale of plants, and 45% of properties committed to maintaining restoration activities. These actions have had a measurable positive impact on areas under conservation agreements, promoting forest permanence and reducing the incidence of burned areas. They have increased connected forest cover by up to 43%, supported the recovery of threatened timber species, expanded restoration areas, and enhanced riparian forests, silvopastoral systems, and agroforestry practices. Finally, we hope that the trained multiplier agents in their territories, along with the growth of green businesses, will contribute to the long-term sustainability and scalability of large-scale restoration efforts.

1051

The Dot(s): Small Acts, Vast Impacts – Restoring the Post-Mining Landscape in Bangka, Indonesia

Nudia Aufia

Periboemi Initiative, Bangka, Indonesia

Abstract

The core idea of ecological approaches is that nature already provides solutions, and with technological interventions, architecture can play a role in solving environmental issues. To determine how the exact boundaries can specifically address the post-mining land crisis, it is necessary to establish clear parameters, known as '*design toolbox*'. Before any intervention takes place, it is essential to understand the existing territorial conditions, especially the differences between artificial (human-made) and natural morphologies. One way to address the biodiversity fragmentation caused by post-mining impacts is through *ecological corridors*. These corridors connect fragmented habitats, creating new living spaces for displaced ecosystems. According to Sawaya et al. (2013); Sharma et al. (2013), the effectiveness of these corridors plays a crucial role in restoring the loss of biodiversity.

In post-mining landscapes, the breaking up and shrinking of nature due to land changes become a major challenge. Notion leads to an unconventional solution—creating small, scattered habitat patches that serve as shelters. Respectfully placing vegetation or water sources to reconnect isolated ecosystems, which over time, these limited actions form a network, allowing species to adapt and repopulate degraded lands. Rather than relying on large-scale interventions, this quality of works tries to localized restoration efforts as a collective of 'dots'.

This experimental idea aims to propose an alternative for the local community affected by illegal post-mining destruction in their homeland. The chosen case project location is based on where critical indigenous native forests were. Demonstrates a wake-up call that we can start small, from a 'dot'.

1075

RESTORES NORTH COAST: FROM CATASTROPHE TO CLIMATE RESILIENCE

Fernanda Carbonelli

ICC, SÃO SEBASTIÃO, SÃO PAULO, Brazil

Abstract

The objective is to highlight the innovative practices that the project is adopting to build resilient infrastructure, prevent future disasters and promote climate justice for the most vulnerable populations. Innovative technologies will be discussed, such as the aerial dispersion of biocapsules via drones and natural regeneration methods to restore more than 203 ha of degraded areas, in addition to the methodology of active dialogue with local communities and environmental education for young people. The relevance of this panel lies in the urgency of adapting territories to climate change, anticipating risks and minimizing inevitable impacts. The symposium will also address new forms of financing and partnerships to make these actions viable.

We aim to provide a comprehensive overview of the urgent need to develop infrastructure capable of facing the inevitable effects of climate change. It is crucial to discuss how we can build urban and environmental systems that not only withstand extreme weather phenomena, but also directly improve the population's quality of life, building resilient communities. The symposium will focus on how to mobilize new financing models, including partnerships between public and private sectors, international fundraising and inter-federative collaborations. The panel will seek to offer practical solutions and innovative strategies to improve the capacity of cities and communities to deal with extreme weather phenomena, answering how these actions can be replicated and improved to face the challenges of climate change, transforming vulnerable areas into models of sustainability and recovery socio-environmental.

1307

Restoring a Landfill Site in Quebec City: Revitalizing Mont-Brillant for Nature and Community

Marianne Gilbert, Sophie Ouellet, Alexandra Jobin

Agiro, QC, Canada

Abstract

Agiro, a nonprofit dedicated to environmental protection and monitoring, is leading the restoration of a 1.8-hectare former landfill located within Quebec City's future Mont-Brillant nature reserve. This initiative, funded through SER's Standards-based Ecological Restoration in Action program in collaboration with Microsoft, seeks to restore ecological functions, enhance biodiversity, and engage the community. The project integrates SER's international standards, focusing on soil regeneration, reintroduction of native species, and invasive species control, while creating topographic diversity and habitat complexity to support a variety of plant and animal life.

Restoration strategies included the importation of high-quality material and creating habitat "islands" that mimic various local ecosystems. Species selection prioritized ecological function and attraction of local fauna. Invasive plants like Japanese knotweed and common reed were suppressed through physical barriers and manual removal. Community participation was encouraged via a pre-restoration bioblitz, volunteer planting, and informal engagement with local residents.

The outcomes include the planting of 580 trees and shrubs, the identification of over 160 plant species and nearly 60 animal species and increased public awareness. Long-term monitoring will assess progress toward a self-sustaining native ecosystem. The project demonstrates how ecological integrity can be restored through collaborative, standards-based approaches that integrate technical expertise, community engagement, and environmental education.

Acceptance type: Keynote**1312****Lessons Learned from the World's Largest Salmon Restoration Effort**Dave Coffman

RES, USA

Abstract

Dave Coffman (RES) is leading a team undertaking a massive landscape restoration effort integral to the largest dam removal and river renewal project in history – a task vital to the future of several imperiled salmon populations on the West Coast.

The Klamath River and its tributaries were once home to the third-largest salmon population in the West. But then the dams went in. Some salmon runs were extirpated while others plunged toward extinction in the century after the first dam cut off access to more than 400 stream miles of historical fish habitat.

With the dams now removed and an extensive restoration effort in full swing, salmon and steelhead once again have access to not only the Klamath, but also tributaries including the Sprague, Williamson, and Wood Rivers of southern Oregon. It's a massive effort, building on decades of scientific study and stakeholder engagement.

The ecological benefits of the project are enormous, but everyone working on this epic task has learned that the positive impacts to people are equally huge. Tribal communities have depended on the Klamath River since time immemorial, but their customs and cultures were severely impacted as toxic blue green algae covered reservoirs, degraded the river and contributed to fish disease. Farms and ranches suffered the loss of irrigation water as regulatory agencies tried to use increased flows to combat water quality degradation. Community vitality suffered as the river deteriorated.

A river is being restored – people are being restored.

1313

Revitalizing the Future of Restoration

Danielle Frank

Rios to Rivers, USA

Abstract

This keynote will explore what it means to restore not only ecosystems but relationships—between people, place, and purpose. Danielle Frank, a Hupa and Yurok leader from the Klamath River Basin, will share her journey growing up as a Native youth in a community of changemakers, where restoration is rooted in culture, responsibility, and deep connection to land and water. Drawing from lessons learned on the banks of the Klamath and Trinity rivers and from Indigenous communities across the globe, Danielle will offer reflections on how frontline leadership can shape the future of ecological restoration.

Through stories of intergenerational learning, global advocacy at the United Nations climate and biodiversity conferences, and grassroots mobilization at home, this session will highlight the transformative power of Indigenous-led restoration. Danielle will speak to the urgent need for the ecological restoration field to invest in tribal leadership and youth engagement—not as a gesture of inclusion, but as a pathway to long-term resilience and healing for lands, waters, and communities.

Attendees will walk away with a renewed understanding that restoration is not only technical—it is cultural, spiritual, and political. And investing in river communities is, ultimately, an investment in the river itself.

1314

Dream to reality – Restoring the Golden Steppe at scale — Work of the Altyn Dala Conservation Initiative

Vera Voronova

Association for the Conservation of Biodiversity of Kazakhstan, Kazakhstan

Abstract

The Altyn Dala Conservation Initiative in Kazakhstan represents the large efforts to restore temperate grasslands. Encompassing over 180 million acres of steppe ecosystems — incorporating “wetland islands in the sea of grass”, to arid southern areas transitioning into desert steppe. Altyn Dala, meaning ‘Golden Steppe’ in Kazakh, was driven initially by the urgent need to conserve the migratory saiga antelope (*Saiga tatarica*). While saiga recovery served as the early focus, the broader objectives have always been the long-term restoration of steppe ecological processes, habitats, and their biodiversity, over vast landscapes.

Established in 2005 as a multi-stakeholder partnership — comprising the Government of Kazakhstan, national and international conservation organizations — Altyn Dala integrates science-based conservation planning and delivery, policy development and enforcement, education and capacity building. Key interventions include landscape-scale protected area expansion and restoration planning, anti-poaching and anti-trafficking enforcement, species recovery, including reintroductions, alongside long-term ecological monitoring. The initiative has applied satellite telemetry, remote sensing, ecological modeling, and targeted field research to identify and safeguard critical habitats and migration corridors and enabling both passive and active restoration approaches.

Since its inception, protected steppe and wetland areas have increased fivefold, and saiga populations have recovered from below 40,000 individuals in 2005 over 2.8 million in 2024, which are now driving grassland restoration. These remarkable outcomes are directly linked to sustained investments in institutional capacity, public engagement, and evidence-based decision-making, building institutional capacity, and ongoing public engagement especially in remote rural steppe communities.

Recognized as a UN World Restoration Flagship in 2022 and then winner of The Earthshot Prize in 2024, Altyn Dala is demonstrating the ecological and socio-economic potential of restoration in underrepresented biomes such as temperate grasslands. Current priorities include scaling up habitat protection and restoration planning, expanding species recovery programs to include reintroduction of wild horses and enable recovery of migratory steppe eagles. Efforts are also shifting focus to foster collaboration with key large-scale temperate grassland restoration projects, from Mongolia to Argentina and the USA.

1315

Indigenous Stewardship: Conservation Through Relationships

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¹Parks Canada, Canada. ²Indigenous Stewardship Council, Canada

Abstract

Parks Canada Parks Canada has embarked on a process of organization-wide renewal, centered around a vision of protected heritage area management and governance that is respectfully aligned with Indigenous ways of stewarding lands, water, and ice. At its core is the Indigenous Stewardship Framework and Policy, which respectfully advances reconciliation and support implementation of the UNDRIP. Done in collaboration with Indigenous Leaders, the Indigenous Stewardship Policy (ISP) seeks to support the continuity of Indigenous cultures and advance how the priorities of First Nations, Métis, and Inuit peoples alongside Parks Canada's mandate can be accomplished together to advance environmental, economic and community well-being. This session will share both Parks Canada and Indigenous perspectives of the ISP, key lessons learned and next steps.

1316

Coastal Comeback: Biodiversity gains with coastal wetland restoration

Valerie Hagger

University of Queensland, Queensland, Australia

Abstract

The world's coastal ecosystems have suffered significant biodiversity declines from human impacts, which are being exacerbated by climate change. Restoration of coastal wetlands that enhances biodiversity and ecosystem services is urgently needed to address global biodiversity loss and climate change. A promising strategy is community or Indigenous-based management to achieve conservation outcomes.

We identified opportunities for restoration of coastal wetlands that have been lost or degraded across Australia, however we revealed several challenges with implementation. (1) Most of the land identified was in private hands, with limited areas having Indigenous land rights, thus novel opportunities for Indigenous people to lead restoration projects are needed. (2) The presence of threatened species in hydrologically modified wetlands reduced the amount of land available for restoration, therefore, mitigation of potential impacts on threatened species is necessary. However, the restoration of remaining areas can provide rich biodiversity benefits. (3) While carbon markets can incentivise restoration of coastal wetlands, high carbon prices are needed to make restoration profitable on productive agricultural land or urban land.

Verified biodiversity benefits alongside carbon credits to attain higher carbon prices or generate separate biodiversity certificates under emerging nature markets are both potential solutions. Characterising biodiversity gains with coastal wetland restoration is a challenging problem because of differences in vegetation structure and species composition along environmental gradients and it is unclear which species and metrics are indicators of biodiversity in coastal ecosystems that have low plant diversity.

We developed and combined multiple indicators of condition and biodiversity, specific to mangrove, saltmarsh, and supratidal wetland ecosystems, to assess biodiversity gains with restoration across landscapes. Key considerations for global biodiversity standards for coastal wetland restoration include (1) modelling of restored vegetation types considering current conditions, tidal inundation, and future sea-level rise, (2) using predicted vegetation types to inform selection of reference benchmarks, and (3) incorporating metrics of plant species composition and functional diversity of key fauna taxa, such as birds, bats, and benthic macroinvertebrates, to detect biodiversity changes with ecosystem transitions (rather than species diversity).

1317

Why Bother? A Story of Coral Resilience and Renewed Hope for Reefs

Phanor Montoya-Maya

Coral Restoration Foundation

Abstract

Coral reefs are in crisis. The 2023 global bleaching event was the most severe in recorded history, pushing restoration practitioners to confront a difficult question: Why bother? In this plenary, Dr Phanor H Montoya Maya, Restoration Program Manager for Coral Restoration Foundation, will share a story of resilience, adaptation, and hope—centered on Carysfort Reef in the Florida Keys National Marine Sanctuary, once the benchmark for coral health, now a proving ground for large-scale restoration.

Through a decade-long effort, CRF and its partners have reintroduced over 66,000 corals to Carysfort, testing innovative techniques to enhance reef resilience. Yet, in 2023, record-breaking ocean temperatures devastated reefs worldwide, erasing years of progress. But not everything was lost. Survivors at Carysfort provide critical insights into genetic diversity, species selection, and the scalability of restoration in the face of climate change.

This talk will explore lessons learned, scientific advancements, and the next phase of coral restoration—from applied nucleation techniques to climate-adaptive strategies. More than just a case study, Carysfort represents a global call to action: Restoration is not just about rebuilding ecosystems; it's about sustaining coastal communities and economies. Hard does not mean impossible. This plenary will inspire practitioners, policymakers, and researchers to push boundaries, integrate science with community-driven action, and reimagine what's possible for the future of coral reefs.

Acceptance type: Lightning Talk

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Forging alignments: Responsible lowland peatland management realized through collaboration between farmers and a Wildlife Trust in the Northwest of EnglandZoe Lipkens

University of Leicester, Leicester, Leicestershire, United Kingdom

Abstract

Policymakers from the Department for Environment, Food and Rural Affairs have identified 'responsible' lowland peatland management practices, such as wetter farming or paludiculture, as potential nature-based solutions to help reach England's net-zero targets. These practices aim to shift the management of England's lowland peatlands from draining practices that result in carbon emissions to responsible practices that reduce carbon emissions. However, adoption of responsible management practices on lowland peat partly depends on the willingness of landowners and farmers to adopt these practices. This research explored how responsible peatland management practices have been received, adopted, and shaped by actors in the Northwest of England, through engaging with farmers, landowners, NGOs, and government organizations. In particular, time was spent with a Wildlife Trust to understand how they implemented and influenced responsible peatland management in the Northwest. The research findings indicate that farmers and landowners are motivated to adopt responsible peatland management practices for various reasons, but their capacity to do so depends on their relationship and collaboration with the Wildlife Trust. During the collaboration, the Wildlife Trust ensured that farmers and landowners remained actively involved in decision making and the development of the on-the ground-trials. Additionally, this research reveals that collaboration was strengthened by the Wildlife Trust employees' motivation to not only implement peatland management for environmental benefits but also to support and secure farmers' livelihoods. This research can help improve policymakers' understanding of how and why responsible peatland management practices are adopted on the ground and to understand what successful collaboration resembles.

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New Delta Dawn on the Provo River in Utah, USA

Eric McCulley

Salt Lake City, UT

Abstract

The Provo River Delta Restoration Project represents one of the largest ecological restoration initiatives undertaken in the Intermountain West region of the United States. Following a decade of meticulous planning and nearly five years of intensive construction, this pivotal project has reached completion and is now accessible to the public. This restoration has re-established a critical delta ecosystem at the confluence of the Provo River and Utah Lake, which enhances habitat availability for the threatened June sucker (*Chasmistes liorus*) during key life stages from larvae to juvenile. The project features approximately five miles of newly constructed river channel and encompasses approximately 200 acres of open water, thus creating diverse recreational opportunities for local residents and visitors alike.

This presentation aims to elucidate the strategic partnerships necessary for executing large-scale restoration efforts and to articulate the multifaceted challenges encountered during implementation, particularly in proximity to urbanized environments. The project demanded a visionary approach, resilience amid obstacles, and extensive public engagement to facilitate successful completion. Furthermore, a comprehensive monitoring framework has been established to evaluate the restoration's efficacy concerning aquatic and wetland habitats. This framework will employ an Adaptive Management Strategy to ensure long-term ecological integrity and management sustainability. Insights gained from this project may serve as a valuable model for future restoration endeavors in similar settings.

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Sage Grouse R & R

Josh Oakleaf

WDEQ-AML, Lander, Wyoming, USA

Abstract

Greater Sage-Grouse populations have witnessed an 80% range-wide decline since 1965, and the annual rate of decline has not slowed in recent decades. This decline may best be described as death by a thousand cuts and has the potential for the greater sage-grouse to be listed under the Endangered Species Act. An endangered species listing would potentially severely impact Wyoming's two most iconic industries, agriculture, and mineral extraction. Could a solution be a million stitches? A dedicated group of interdisciplinary professionals has been working closely with Wyoming AML, building off past Wyoming AML reclamation success to expand future goals to include life cycle-specific sage-grouse habitat restoration. In 2019, Governor Gordon strengthened Wyoming's Sage-Grouse Core Area Management Strategy by making habitat restoration and enhancement a conservation priority. Wyoming AML identified this Executive Order as an opportunity to maximize reclamation efforts by setting goals to establish functional sage-grouse breeding, brood rearing, and nesting habitats into large-scale geomorphic restoration projects.

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Wyoming AML Vegetation & Evaluation Standards

Josh Oakleaf

WDEQ-AML, Lander, Wyoming, USA

Abstract

Throughout the lifecycle of Wyoming's Abandoned Mine Land (AML) reclamation projects, hundreds of decisions and actions are made annually by various stakeholders. Each seemingly minor choice has profound impacts on achieving desired vegetation outcomes.

The Wyoming AML Vegetation & Evaluation Standards (WAVES) program was established to introduce a standardized, statewide approach to fulfilling AML's goals of establishing diverse native vegetation communities. WAVES offers proactive best practices, providing access to a wealth of hyperlinked reference documents and tools spanning vegetation planning, construction management, evaluation, and reporting. Furthermore, WAVES is designed to align Wyoming AML efforts with the Greater Sage-Grouse Conservation Strategy and the Governor's Invasive Species Initiative.

WAVES serves as a valuable resource for informing effective remediation techniques while mitigating habitat fragmentation in ecologically critical areas.

The Safe Use of Arsenic-contaminated Mining Lands and Surrounding Areas in Southern China

Rakhwe Kama

Guangzhou

Abstract

The Safe Use of Arsenic-contaminated Mining Lands and Surrounding Areas in Southern China

Arsenic (As) contamination from mining has become a major global environmental issue. Mining and smelting produce large amounts of As-containing wastewater and sludge, which can accumulate in agricultural soil and pose health risks to human and food security.

Two strategies have been adopted to ensure safe use in mining and surrounding As-contaminated areas. The first is applying ecological restoration principles by planting different functional plants and combining different modes of arrangement to achieve ecological green. During the initial phase of ecological restoration, mixed sowing of legume (*Crotalaria pallida* Ait) and compositae (*Zinnia elegans*) enhanced *Zinnia elegans* biomass (20.33%) and As content (71.67%) than monocropping. Furthermore, the mixed sowing system has increased the concentrations of alkali-hydrolyzable nitrogen, rapidly-available phosphorus, rapidly-available potassium, and SOC in rhizosphere soil by up to 83.16%, 108.53%, 106.36%, and 30.15%, respectively.

The second is establishing appropriate intercropping models by screening super/highly accumulating plants and agricultural or cash crops to achieve the objective of “repairing while producing”. We have screened two intercropping models: (i) In the peanut (*Arachis hypogaea* L.)/hyperaccumulator plant intercropping system, As removal rate was higher under intercropping than monocropping with the highest removal rate of 88% under intercropped peanut/*Pteris cretica*/*Spinacia oleracea* L., followed by peanut/*Spinacia oleracea* L. (81%) and peanut/*Pteris cretica* (80%).

(ii) The intercropping model between the medicinal crop (*Gynostemma pentaphyllum*) and the hyperaccumulator plant (*Pteris vittata* L.) demonstrated a reduction in As concentration in *Gynostemma pentaphyllum* leaves during intercropping, from the original 17% exceeding the national food safety standard (GB2762-2017) to 1.82 mg/kg, which is lower than the standard, in comparison to monocropping. Additionally, the intercropping model enhanced the yield of *Gynostemma pentaphyllum* (31.90%).

Overall, the results highlight the potential of using plants and intercropping systems as sustainable and practical approaches for the remediation of As-contaminated soils while ensuring food safety.

Art That Matters: How Invasive Species Materials Are Shaping My Fine Art Practice and Engaging the Public in Restoration Efforts

Laura Shape

DENVER

Abstract

As a fine artist, my search for ethically-sourced materials led me to an unexpected discovery: leather made from invasive lionfish, Burmese pythons, and carp. What started as a creative exploration has evolved into a unique business model that actively engages collectors in ecosystem restoration.

I create abstract paintings that showcase these materials' distinctive qualities while telling the story of their ecological impact - like how a single lionfish can consume up to 70,000 native fish in its lifetime. In 2024, this artistic approach resonated strongly with audiences: an open studio event drew approximately 100 visitors, with many expressing surprise about invasive species issues they'd never considered before.

The art's ability to spark curiosity led me to developing educational displays that pair tactile experiences (touching the leathers) with accessible information about each species' impact. To reach broader audiences, I launched an ad campaign for open edition art prints in December of 2024 that has already been seen by hundreds of people, engaged dozens of new collectors, and generated organic conversations about ecosystem restoration via email and social media.

Furthermore, by buying my art, collectors help fund the removal of these invasive animals by enabling me to invest in more leathers. And their purchases of my printed merchandise generate donations to species-specific conservation organizations.

This presentation shares my experience as an artist creating commercially viable work that not only sparks dialogue about environmental restoration but actively engages collectors in conservation efforts.

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Environmental management in the Paramo ecosystem (Colombia): Connecting peasant knowledge and ecosystem services

Paulina Vergara

University of Minnesota, St Paul, Minnesota, USA

Abstract

This research explores the intersection of traditional ecological knowledge (TEK) and ecosystem services in the Rabanal páramo, a high-altitude ecosystem in Colombia's Andean region. Through a participatory research approach, this study recognizes the role of peasant communities as key custodians of the páramo's biodiversity and ecological health. By documenting and analyzing their knowledge systems, the study illustrates how local agricultural and land management practices contribute to the conservation of ecosystem services like provision, including water regulation, carbon storage, and biodiversity conservation. The research draws from interviews, participatory mapping, and community-based observations, offering a comprehensive understanding of how traditional practices align with contemporary environmental management strategies. Furthermore, this study highlights the significance of integrating peasant knowledge into future environmental policies, fostering sustainability and resilience in the Rabanal páramo. The findings aim to provide evidence for the value of TEK in conservation efforts and emphasize the importance of community-based approaches for sustainable ecosystem management in high-altitude environments. By connecting past practices with future challenges, the paper contributes to the ongoing dialogue on environmental governance and the inclusion of indigenous perspectives in ecosystem service management. This research underscores the potential for collaborative environmental management that bridges knowledge systems and supports sustainable development in sensitive landscapes such as the Rabanal páramo.

MUVE-ing Restoration Forward in Collaboration with the Community

Juliana Grilo, Cameron Bogle, Shannon Jones, Giselle Garcia

Frost Science, Miami, Florida, USA, USA

Abstract

Museum Volunteers for the Environment (MUVE) is a volunteer-based coastal habitat restoration and community science program based at the Phillip and Patricia Frost Museum of Science in Miami, Florida. Since its founding in 2007, MUVE has engaged more than 13,000 volunteers in hands-on restoration activities, transforming coastal habitats and fostering environmental stewardship through museum exhibits, outreach, and eco-art. The program has enhanced over 30 acres of coastal ecosystems, including mangrove forests, coastal hammocks, and beach dunes, and planted over 85,000 native plants. To further the program's goal of making science accessible, volunteers also contribute to environmental data collection through platforms like CleanSwell and iNaturalist. MUVE serves as a strong example of how collaborative, community-driven efforts can support ecological restoration outcomes. By partnering with local schools, community organizations, and environmental initiatives, MUVE fosters connections among diverse stakeholder groups to promote both conservation and education. The program removes barriers to participation by offering sponsorships that provide transportation and lunch for volunteer groups, encouraging broader involvement from under-resourced communities. MUVE also incorporates educational trail signs and hands-on restoration activities to increase environmental awareness and engagement. By integrating volunteerism, place-based education, and community science, MUVE serves as a model for fostering stakeholder collaboration in ecological restoration. Its emphasis on partnerships with local schools and organizations ensures the sustainability of its initiatives while contributing to long-term habitat restoration and stewardship. MUVE demonstrates how conservation programs can serve as effective platforms for advancing restoration outcomes through community engagement.

Mangrove Restoration and Environmental Monitoring: Highlights from Friends of The Earth Ghana

Nehemiah Odjer-Bio

Accra

Abstract

The presentation will highlight two main strategies Friends of the Earth Ghana is using to ensure successful restoration outcomes. These include local community engagement and stakeholder consultation strategies. This encompasses a host of activities we undertake to ensure a broader stakeholder participation and involvement in our interventions. It is the most important stage of the process and bypassing this stage results in projects that don't gain any traction with the local communities. There is also the Diagnostic Stage: At this stage, the expectations of community members are well documented and factored into the business case for the project through different stakeholder engagements. There is also the Participatory Planning Stage, where the different land use issues and problems in the landscape are thoroughly discussed with the community and different stakeholder groups.

At the Implementation and Monitoring Stage, communities are given the opportunity to participate in the demarcation of degraded areas to be restored and planning the layout of the nurseries. They play an important role in the collection and planting of tree propagules, reporting of restoration monitoring data they collect periodically.

The relevance of the stages outlined cannot be underestimated. Successful implementation and establishment of a restoration project is highly linked to effective stakeholder consultation and involvement from the project idea phase through to the design, implementation, and monitoring phase and beyond. It is thus very relevant to pay critical attention to all the stages to ensure success.

Restoration of Northern Leopard Frog (*Lithobates pipiens*) Habitat on City of Boulder Open Space and Mountain Parks, Colorado: Addressing Invasive Species and Habitat Degradation

Ryan Prioreschi, William Keeley

City of Boulder Open Space and Mountain Parks

Abstract

Northern leopard frogs (*Lithobates pipiens*; NLF), have experienced significant population declines in the western United States due to habitat loss, invasive species, and disease. In Colorado, NLF are considered a species of greatest conservation need by Colorado Parks and Wildlife. To improve habitat conditions for NLF, City of Boulder Open Space and Mountain Parks (OSMP) staff began habitat restoration efforts in 2012. OSMP manages approximately 19,000 ha of grasslands and foothills habitat along the Front Range in Boulder County, Colorado.

Habitat degradation caused by changes in land use, hydrologic regimes, and incompatible grazing techniques have contributed to the increased abundance of invasive American bullfrogs (*Lithobates catesbeianus*) and monotypic stands of cattails (*Typha* spp.), both of which contribute to decreased NLF occupancy of otherwise suitable wetland habitat.

OSMP staff employ a variety of restoration techniques to improve habitat conditions for NLF. These include: removing cattails from ephemeral wetlands that should support NLF to increase habitat heterogeneity; increasing cover of low-emergent, native vegetation through seeding and planting; removing invasive bullfrogs at select sites via hand capture, air rifle, and water control techniques; adopting rotational grazing schedules to align with frog phenology; and translocating NLF larvae locally from robust populations to recently restored sites.

Since restoration efforts began, annual surveys indicate that NLF breeding sites have increased threefold, with most new sites receiving restoration. Restoration efforts to improve NLF habitat on OSMP, although time- and energy-intensive, have been successful at increasing successful breeding of a declining species.

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Stakeholder perceptions on the restoration approaches by mining companies

STANLEY LIPHADZI

Water Research Commission, Pretoria, Gauteng, South Africa

Abstract

A study was conducted to assess mining employees' perceptions about their companies' use of sustainable restoration approaches in mining operations, , and to investigate what stakeholders viewed as gaps or areas requiring improvement for the mining companies to improve environmental wellbeing socio-ecological sustainability. The results indicated that the sustainability approaches of the coal and iron ore mining companies to improve water management and sustainability included the development of strategies and plans for water conservation, reduction of water withdrawal to curtail water use or consumption, prevention of water pollution by mine wastewater and effluent, and ethical and honest disclosure of water issues. The study also identified areas that required improvement to enhance water sustainability in the mining industry. According to the stakeholders, the development and implementation of corporate water strategies or plans, employment of skilled people to work on mine-water issues, and the improvement of green infrastructure were critical areas requiring improvement. The study has raised critical issues that mining companies, policy makers, and researchers should consider in planning and operations of the mining companies.

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Identifying Potential Mine Sites for Ecological Restoration in Tamil Nadu, India: Integrating GIS and Ground Truthing.

Manjula Arumugam

Auroville, Tamil Nadu

Abstract

Restoring post-mining landscapes is crucial for maintaining ecological balance and addressing climate change. This study, titled *"Identification of Potential Mine Sites in Tamil Nadu for Restoration"*, aimed to comprehensively map and evaluate mines across the state to identify sites with the highest potential for ecological restoration. Employing Geographic Information System (GIS) technology to map, identify and study mines, the project developed a systematic methodology to assess restoration potential based on environmental degradation severity, restoration feasibility, and biodiversity impact at the ground level.

The study employed a multi-step approach, including mapping mine sites by district, developing selection criteria, engaging with stakeholders, and conducting site visits for validation. Key considerations included mine size, substrate quality, water availability, land stability, ecological connectivity, and ownership. The results yielded GIS-based maps highlighting priority sites and categorizing mines based on restoration potential, enabling a targeted approach to transforming degraded landscapes into thriving ecosystems.

Restoration efforts from this study can enhance biodiversity, increase green cover, and support sustainable land-use planning in Tamil Nadu. At the policy level, it offers actionable insights to balance development with ecological preservation, aligning with sustainability goals. The methodology has global applicability, providing a replicable model for using geospatial tools and ecological criteria to guide restoration in post-mining regions, advancing global sustainability and climate resilience. Additionally, this methodology (mapping and analysis) lays the groundwork for large-scale land-use planning, enabling green initiatives such as blue-green corridors and wetlands restoration.

The Leyte Sab-a Peatland Forest Restoration Initiative Project (2018-2021)

Heremerose Matutes^{1,2}, Judith Jomadiao³, Syrus Cesar Decena³, Jayson Baldesco³, Libertine Agatha Densing³, Edwin Relevo³, Reynaldo Peja, Jr.³, Jerome Montemayor⁴, Magnolia Rosimo⁵, Juvilyn Salazar⁵, Paulina Lawsin⁶, Ronan Christian Reposar⁷

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Abstract

The Leyte Sab-a Basin Peatland (LSBP) is the largest peatland on tropical Leyte Island, Philippines, with current estimates of 2,107.64 hectares. It is one of the two confirmed peatlands in the Philippines. Despite its various ecosystem services and ecological significance, LSBP is heavily threatened by land use conversion, including peat drainage and agriculture. The Leyte Sab-a Peatland Forest Restoration Initiative (LSPFRI) is a multi-stakeholder collaborative project that follows the Forest Landscape Restoration process, aiming to restore the ecological functions of a degraded forest landscape while improving the well-being of the population across the landscape. The initiative espouses a holistic and integrated approach to developing and implementing peat swamp restoration mechanisms and sustainable forest management. This approach is science-based and ecological, has a legal backbone, and is participatory and gender-responsive.

The 4-year project has achieved the following outcomes: 1) Developed a baseline for the LSBP to guide policy by updating the physical, biodiversity, and socio-economic profiles of peatland and land ownership through legal research on CARP areas and identifying proposed reinstatement strategies; 2) Increased awareness of the peatland's role and functions among multi-scalar stakeholders. Engaging CARP beneficiaries and landowners has led to the restoration of 48 hectares and tested peatland-friendly livelihoods as part of rehabilitation strategies; 3) Established the LSBP Peatland Management Council as a backbone for continued collaboration in peatland restoration efforts; and 4) Created numerous knowledge products to raise awareness and enhance the understanding of peatland (e.g., videos, manuals, books, posters, and case stories).

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Reducing risks to human health by reducing plant invasion through ecological restoration – long-term result with *Ambrosia artemisiifolia*

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Abstract

Invasive species can have a direct health impact and, acting as vectors, can pose various health risks to humans, plants and animals. Ecological restoration can improve public health by increasing the number and area of healthy ecosystems that provide ecosystem services for human well-being, but also by directly reducing invasive alien species. The successes achieved so far with the control of common ragweed (*Ambrosia artemisiifolia*) provide a good example of how ecological restoration can have a measurable positive impact on human health. *A. artemisiifolia* is an invasive annual plant species that affects one in ten people on the European continent due to its allergenic pollen, and accounts for more than USD 8 billion in public health costs. The species invades most habitat types when soil disturbance occurs, but can disappear from above ground vegetation as succession progresses. We investigated the long-term effects of different treatments (mowing, carbon supplementation and seeding) on invasive species in the restoration of sand grasslands in Hungary. In degraded areas, such as abandoned croplands, *A. artemisiifolia* accounted for up to 14% of the total cover. Our long-term data suggest that restoration treatments, particularly the introduction of native species, accelerated the regeneration of sand grasslands compared to spontaneous processes and almost completely eliminated *A. artemisiifolia*. We conclude that restoration of disturbed habitats by sowing native species can effectively shorten the period available for *A. artemisiifolia* to spread and produce pollen, and significantly reduce associated health risks and costs.

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Protecting and Expanding Once Dominant Grassland Community in an Urban Setting: The Poplar Ford Park Restoration in Northern Virginia

Darko Veljkovic

Fairfax County Park Authority, Fairfax, Virginia, USA

Abstract

Native grasslands in Fairfax County were historically used for agriculture and, upon abandonment, transitioned into low-quality forests or invasive species-dominated shrublands, with small grassland remnants. Poplar Ford Park preserves three small, disconnected grassland remnants threatened by woody encroachment, presenting a unique opportunity for restoration. This project, initiated in 2016, aimed to protect, preserve, and expand uncommon grassland ecosystems. Additional project goals were connecting restored areas to adjacent habitats like the Manassas Battlefield grasslands and providing critical habitat for declining grassland bird populations.

Reversing ecological succession from forested and invasive-dominated shrublands to native grasslands posed challenges. The use of prescribed fire, as the most efficient way to maintain newly established grassland, was the main initial concern because of the implementation in the urban setting. The local community and the radio club whose members use the park for flying modeled aircrafts were supportive of creating an open space in the park. Aligning the objectives of these stakeholders helped propel the restoration effort, resulting in successful outcomes.

The restoration involved managing invasive species, reducing woody plant encroachment, and reestablishing native flora. Prescribed fire was used in maintaining newly established areas. By 2023, the project successfully transformed 44 acres into thriving native grassland, resulting in first ever breeding pair of grasshopper sparrows recorded in the county, return of northern harrier, eastern meadowlark, prairie warbler and occasionally bobwhite quail. This project underscores the value of collaborative restoration efforts in urban parks and their role in preserving biodiversity and ecological function while serving diverse community interests.

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Using Systems Archetypes to Design Sustainable Ecological Interventions

Ekaterina Lengefeld

Amrita Vishwa Vidyapeetham, Kollam, Kerala, India

Abstract

Systems archetypes are recurring patterns of behavior within complex systems that provide a robust framework for understanding and addressing the challenges of ecological restoration. They can be used as diagnostic tools to better understand the dynamics of underlying factors leading to undesirable conditions. By mapping interconnections and feedback loops, systems archetypes help identify the root causes of ecological degradation and leverage points for designing sustainable interventions.

This presentation focuses on a case study from the Western Ghats, India — one of the world's 36 biodiversity hotspots. It demonstrates the application of systems archetypes to diagnose and design strategies for addressing land degradation in this ecologically sensitive area. Archetypes such as "Fixes that Fail," "Shifting the Burden," and "Tragedy of the Commons" provide a valuable lens for analyzing the land degradation crisis in the Global South. They help illustrate the complex interactions between short-term fixes and long-term environmental sustainability. Moreover, they offer insights for overcoming systemic delays, resistance, and trade-offs when balancing ecological, economic, and social goals.

For ecological restoration practitioners, systems archetypes can serve as decision-support tools before intervention design to anticipate challenges and align restoration goals with system dynamics. This will help to improve resource allocation and quality of interventions. At the policy level, systems archetypes can guide the development of adaptive frameworks and policy recommendations that incorporate stakeholder perspectives and contribute to ecosystem, economic and social resilience. This work emphasizes the transformative potential of systems archetypes as a bridge between theoretical understanding and practical action in ecological restoration.

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Supporting Grassroots Advocacy and Coalition Building for Climate Resilience: Greening Five Points Case Study

Sarah Konradi

Denver

Abstract

Greening Five Points is a grassroots green infrastructure project in the historically Black Five Points neighborhood of Denver that has grown into a federally-funded, multi-neighborhood environmental justice movement. A group of frontline advocates, the Green Dot Coalition, worked shoulder-to-shoulder with landscape architects on a green infrastructure and restoration strategy rooted in community, on-the-ground engagement and demonstration projects.

Five Points, an historic Black neighborhood in Denver, faces challenges from a history of discriminatory redlining and disinvestment. Today, it has the most impervious surface, fewest parks and trees, and worst air quality in Denver. A group of Five Points business owners took matters into their own hands to add green infrastructure where the city has failed to and formed the grassroots Green Dot Coalition (GDC). A nonprofit landscape architecture team worked closely with GDC to spark a movement, demonstrating the power of collaboration between landscape architects and frontline communities to advance urban greening.

The GDC's work has now grown beyond Five Points. Following 15 years of calls for investment, the team helped the nearby Globeville community obtain a state permit to plant and manage a quarter linear acre of revegetation along Interstate 70, and has parlayed their case-making into a \$500,000 EPA Environmental Justice grant that will support long-term community stewardship and workforce training.

Greening Five Points is a model for environmental justice work with frontline communities that can inspire change in Denver and beyond.

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Improving the progressive land reclamation of mining sites to wetlands in Georgia

Jenelle Sams¹, Andrew May², Monty Sanders²

¹Roswell, GA. ²Sandersville, GA

Abstract

Imerys owns and leases several thousands of acres of land in Georgia (USA), for the extraction and transformation of minerals that are used in our daily lives. Aware of the impact that our activities have on biodiversity, we are focused on integrating the mitigation hierarchy to avoid, minimize, restore, and offset our impacts on biodiversity. In fact, Imerys has several decades of experience in the creation and rehabilitation of wetlands, bottomland forests, and aquatic ecosystems. During the presentation we will illustrate the principles and stages of past and current land reclamation and wetland creation projects (land grading, water management, topsoil application, seeding/planting, creation of microhabitats, monitoring, etc.), as well as results of how the habitats have evolved. We will present case studies of successful reclamation and wetland preservation over the last decade, as well as the lessons learned from past trials and the obstacles we have overcome to improve the quality of our ecological reclamation, demonstrating how restoration efforts can serve as effective nature-based solutions. Finally we will discuss ideas on how we are planning to improve and disseminate our actions, aligned with the company's biodiversity policy and aiming to involve local stakeholders to integrate a deeper scientific approach and to enhance local ecological connectivity. The objective is to provide documented results of the experience of a mining company in its journey to restore biodiversity through the elaboration and implementation of reclamation projects, which can complement scientific expertise and help scientists understand the needs, opportunities, and limits of practitioners.

Unlocking Genomics Research for Optimization of Constructed Treatment Wetlands for Water Remediation (GROW) through Multi-Stakeholder Collaboration

Amy-lynn Balaberda¹, Christine Martineau², Douglas Muench³, Carolina Berdugo-Clavijo⁴, Dani Degenhardt¹

¹Natural Resources Canada, Edmonton, Canada. ²Natural Resources Canada, Quebec City, Canada. ³University of Calgary, Calgary, Canada. ⁴Imperial Oil Resources,, Calgary, Canada

Abstract

Bitumen extraction from the oil sands in Alberta's Athabasca region has resulted in the accumulation of large volumes of oil sands process-affected water (OSPW), a complex environmental challenge for water resource management. Constituents such as naphthenic acids (NAs) can threaten aquatic ecosystems and require innovative, scalable solutions. Constructed wetland treatment systems (CWTS) provide a passive, low-energy, biological solution for remediating impacted water, however require optimization for NA treatment. This research project integrates genomics-based methods with mesocosm and pilot-scale wetland studies, combining insights from the fields of molecular biology, wetland ecology, and engineering to optimize CWTS for OSPW remediation. Key objectives include identifying conditions that enhance NA biodegradation, elucidating the underlying genetic and microbial mechanisms, and developing innovative tools and predictive models for wetland design and contaminant monitoring. These findings may have implications beyond Alberta, as CWTS can be adapted for remediating impacted waters from other sites in diverse geographies. This is a multidisciplinary collaboration in restoration and reclamation initiatives that integrates biodiversity, ecosystem resilience, and communities. This collaborative, multi-stakeholder approach brings together government agencies, academic institutions across Canada, and industry. By fostering connections between researchers, practitioners, and policymakers, these interdisciplinary partnerships demonstrate how collaborative efforts can advance scientific knowledge and improve restoration outcomes, developing potential solutions that are robust and cost-effective.

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Mongolians' Traditional Ecological Knowledge of Rangeland Conservation: Harmonizing Indigenous and Scientific Knowledge

Daginnas Batsukh

Darkhan

Abstract

Mongolians' traditional ecological knowledge (TEK) is rooted in centuries-old nomadic herding practices and a deep connection to and respect for the natural environment. This knowledge created land conservation strategies, including seasonal pastureland rotation, water source preservation, and sacred natural sites.

One of the traditional rangeland conservation practices is seasonal pastureland rotation, where one-tenth of the population is herders in Mongolia, and it is increasingly concerned with changing socioeconomics and climate change. To understand changing patterns in traditional seasonal pastureland rotation and determine factors that affect it, we selected 13 case studies conducted in Mongolia's different geographical locations or four regions: South Gobi, Central, Eastern, and Western. The study found the main factors (8 abiotic, 11 biotic, and 14 social) that affect the herders' decision to select seasonal and intermediate campsites, the number of traditional seasonal rotations between campsites per year (average 9 times in the Gobi, 3.2 times in Eastern and Central, 5 times in Western), and distance between seasonal and intermediate campsites (70-123 km in Gobi region, 60.2-90 km in Eastern, 51-82 km in Central, and 64-108 km in Western). Selected case studies integrated rangeland conservation TEK with geographical information system (GIS) (8 studies) and scientific ecological modeling (6 studies).

Based on the review findings and secondary data analysis, a harmonized framework was developed for a cooperative cross-disciplinary approach that respects Indigenous knowledge on rangeland conservation while employing modern science.

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Conserving Prairie Heritage: Building a Native Plant Seedbank Network for Western Canada

Renny Grilz

Meewasin Valley Authority, Saskatoon, Saskatchewan, Canada

Abstract

Western Canada's prairie grasslands face growing threats from habitat loss, invasive species, and climate change. Addressing these challenges requires a consistent supply of high-quality native seeds to support ecological restoration and biodiversity conservation. This project, conducted through the author's Nuffield Canada Agricultural Scholarship and in partnership with the Meewasin Valley Authority in Saskatoon, Saskatchewan, focuses on establishing a regional native plant seed bank for Western Canada.

The research includes extensive travels across Canada, the United States, and Europe to investigate best practices in seedbanking and native seed production. Visits to seedbanks and seed producers in Europe and North America provided valuable insights into preserving genetic diversity, enhancing seed accessibility, and scaling production to support large-scale restoration initiatives.

The proposed native plant seed bank in Saskatchewan will serve as a critical resource, housing a diverse repository of seeds adapted to Western Canada's unique grassland ecosystems. Beyond this initiative, the project emphasizes fostering partnerships and collaboration to create a network of local seedbank initiatives across the region. By connecting stakeholders and sharing knowledge, this effort aims to build a resilient infrastructure for native seed conservation, ensuring the long-term health and sustainability of prairie ecosystems.

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Can fire deplete persistent seedbanks of *Leucaena leucocephala* (Leucaena) while maintaining seed reserves of desired native species?

Alexander Leslie, Shane Campbell, Phillip McKenna, Bhagirath Singh Chauhan, Victor Galea
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Abstract

Leucaena leucocephala (leucaena) is a pantropically introduced woody legume significant to the livestock industry as a high protein fodder. However, it is also considered a major environmental weed in areas where it has escaped cultivation.

Even when leucaena is managed above ground the invaded seedbank can contain viable seed for 8+ years, presenting a persistent problem to land managers. Like many legumes, dormancy of leucaena is driven by a water impermeable hard seed coat. Breaking dormancy requires scarification or heat exposure. The optimum time and temperature exposure for dormancy breaking is between 90 and 100 °C for two minutes with longer or higher temperature exposure generating seed death.

In this study, we aim to determine whether prescribed burning can deplete the soil seedbank of leucaena by stimulating germination or seed death, and to gather information on the capacity of the invaded community's ability to recover after prescribed burns, therefore assessing the utility of fire for leucaena management.

Seedbank samples were collected from a leucaena and *Megathyrsus maximus* dominated community in Rockhampton, Australia, where fire had been excluded for at least ten years. The site sits on alluvial plains with a remnant overstory from the pre-invasion *Eucalyptus* spp. woodland. Seedbank samples will be subjected to simulated fire conditions via oven heating and the application of a commercially available smoke derived germination stimulant. Samples will then be germinated under greenhouse conditions for 30 days before enumeration and identification. At this time, January 2025, results and their implications for management are pending.

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From planning to evaluating restoration efforts in a hyper-arid ecosystem

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Abstract

Hyper-arid ecosystems are characterized by low productivity and little redundancy in the ecological roles of animals. Therefore, the focus of restoration efforts is often on the reintroduction of keystone species which will facilitate the return of other species. An important aspect in restoration programs is testing restoration techniques before scaling them up. Equally important is monitoring to evaluate if restoration goals are met. The implemented restoration strategies in two protected areas were tailored to the extent and scale of degradation in each area. One area has been protected from grazing and most human disturbances (off roading, hunting) for over 40 years whereas the other area was open to people until it became a protected area in 2021. We started pilot studies to assess efficient restoration techniques for flora and fauna. These included rainwater harvesting and tilling of the top crust for flora restoration and the introduction of key stone ungulates for fauna restoration. Through a suite of complementary monitoring techniques, we assessed the success of these different restoration projects. Rainwater harvesting is a relatively low cost technique and resulted in 20% cover by mainly annuals a few month after the rain. Encouraging was the result that perennials did persist although the cover was low. The same pattern was observed in the tilling experiment with even lower cover of perennials but persisting to a year after the start of the experiment. Reintroduced ungulates stayed within the reserve and were able to reproduce in the wild, two indicators of successful establishment.

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Is the view from space accurate? A comparison of data from remote sensing with ground-based vegetation data in Central European peatlands.

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Abstract

Peatlands in central Europe are highly sensitive and critically endangered habitats. Their degradation is most often caused by a lowering of the water table, which leads to increased water stress in plants during the summer period, to a change in species composition and a subsequent rise in vegetation productivity. These changes reflect profound shifts of these unique ecosystems, threatening their long-term stability and conservation value.

While ground-based measurements of habitat characteristics provide the most accurate data, they are inevitably subject to a degree of inaccuracy and error, moreover, they are time-consuming and expensive. This raises the question of whether remote sensing methods, such as satellite imagery, can effectively detect ongoing changes in the vegetation of peatlands that would otherwise require detailed on-site research.

The aim of this study is to explore whether the degradation of peatlands, as indicated by species composition and above ground biomass, can be observed, and differentiated through remote sensing techniques. Specifically, the focus lies on analysing satellite data from the Copernicus Sentinel program, managed by the European Space Agency (ESA), to assess its potential for monitoring and understanding changes in these ecologically significant habitats.

Global ecosystem restoration plays a minor role in climate change mitigation

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Abstract

Ecosystem restoration is increasingly recognized as a means of climate change mitigation. Former global-scale studies predicted that ecosystem restoration can nearly offset human carbon emission since the Industrial Revolution, but these were heavily criticized for their tree-centric view or questionable modeling approaches, which hinders planning large-scale, long-term restoration strategies. Here, we developed an improved model for the carbon capture potential of ecosystem restoration until 2100, and show that the maximum amount is 96.9 Gt of carbon, which is 17.6% of the anthropogenic emissions to date, and only 3.7–12.0% if taking into account future emissions until 2100. Thus, ecosystem restoration can play a minor role in climate change mitigation even if orchestrated with a pervasive shift towards sustainable, low-emission economies globally. In addition, if we plan restoration targets to match future climatic conditions and consider state transitions of currently natural ecosystems due to climate change, the potential for natural climate solutions related to ecosystem restoration is close to zero. Therefore, we recommend ensuring that ecosystem restoration is pursued primarily for restoring biodiversity, supporting livelihoods and resilience of ecosystem services (apart from carbon sequestration), as the climate mitigation potential of restoration is relatively minor and will vary depending on the actual state transitions that occur between major vegetation types.

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Open-Access Learning Ecosystem for Coral Restoration Strategies and Operations

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Coral Restoration Foundation

Abstract

With a 50% decline of global coral reefs since the 1950s and four global bleaching events since 1998, interventionist initiatives through coral reef management and restoration programs that combat coral reef decline have been on the rise. Coral Restoration Foundation™ is the world's largest non-profit organizations dedicated solely to the mission of restoring coral reefs and advancing the restoration field of practice. Established in 2007, CRF™ has been spearheading the development of coral restoration practices in Florida, facilitating learning exchanges and co-launching the Coral Restoration Consortium. The wide-ranging field of coral restoration practice features different approaches to strategy, impact and business practices. Here we will discuss an open-access, online tool developed to assemble theoretical and current coral restoration, strategic goals and impact metrics, instructional materials, case studies, and facilitate learning exchanges and workshops. This online community will also increase connections between coral restoration organizations and experts to strengthen collaborations and relations, as well as connect these individuals and groups to restoration resources in support of a rapidly growing field.

A global analysis of strengths and weaknesses in our scientific knowledge of tropical forest restoration

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Abstract

Tropical forest regions are home to ambitious large-scale restoration programs, such as Initiative 20x20 in Latin America and the Caribbean and the AFR100 in Africa. Concomitantly, much research has been done in these regions in recent decades. We compiled and analyzed scientific publications on tropical forest restoration since 1990, aiming to identify knowledge gaps and where research is concentrated. We retrieved scientific articles on tropical forest restoration in English, available in the Scopus database. We found 1,476 articles with 38,038 citations, which indicate that we have accumulated a great amount of scientific knowledge on tropical forest restoration so far, especially in the last 15 years (89% of all articles). However, publications are unequally distributed. Whereas articles were published in 71 of 120 tropical countries/territories, Brazil (376 articles), Mexico (163), and Costa Rica (116) accounted for 44% of publications. There was also a disparity in authorship; some countries had mostly lead authors from national institutions while others have mostly foreign lead authors. Montane and dry forests were less studied than lowland and wet forests. The most studied topics were, by far, the technical, ecological, and biophysical aspects of restoration; 83% of the articles covered at least one of these topics. With the caveat that publication counts incompletely represent accumulated knowledge, our results provide an indication of relative scholarship across biomes, themes, political units, and scientific leadership roles. From these, future research will be justified in moving forward on climate change, sociology, culture, economics, and local scientific leadership, particularly in Africa.

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Using bioacoustics to assess the impact of invasive cattail harvesting on waterbird occupancy at the Shiawassee National Wildlife Refuge

Madeline Palmquist, Brian Ohsowski, Shane Lishawa

Loyola University Chicago

Abstract

Laurentian Great Lakes wetlands host diverse populations of breeding and migratory birds by providing food resources and quality habitat. Invasive hybrid cattail (*Typha × glauca*), a prevalent emergent invasive macrophyte, dominates many Great Lakes wetlands. *Typha* reduces habitat heterogeneity, suppresses native vegetation and limits food resources for waterbirds. Loyola University Chicago researchers are partnering with U.S Fish and Wildlife Service managers to experimentally manage *Typha* via aboveground harvesting and subsequent flooding in a 100-hectare wetland at Shiawassee National Wildlife Refuge (Michigan, USA; SNWR). The effect of *Typha* harvesting on waterbirds is unknown. In my previous undergraduate work, a comparison of waterbird occupancy at a *Typha* invaded site and a high-quality site showed more detections and species present in the high-quality site. My current study assesses waterbird occupancy at the site actively managed for *Typha* and an adjacent, unmanaged wetland that will serve as a control. This project employs novel bird surveying methods, utilizing autonomous recording units and BirdNET call-recognition software for audio analysis, field vegetation surveys, and GIS-based landscape analyses. Preliminary (2024) and post-treatment (2025 – 2026) data will be assessed to quantify differences in waterbird occupancy during active *Typha* harvesting compared to the unmanaged site. I expect the site managed for *Typha* to have higher waterbird occupancy compared to the control site due to the increase in structural habitat complexity and food resource availability. This study will address the impact of active invasive *Typha* restoration techniques on bird populations and guide future management at SNWR and the Great Lakes region.

Post-agricultural Peatland Restoration

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Abstract

In post-glaciated landscapes along the temperate-boreal climatic tension zone, peatland and agricultural extents overlap and large areas of former peatland have been drained and converted to agriculture. The landscape homogenization caused by mass agricultural conversion depauperates biodiversity, habitat availability, and landscape resilience. In addition, peat soils under agriculture are large sources of greenhouse gas emissions, making them a priority for restoration actions to slow or reverse those emissions. These facts have seen some recognition and made agricultural peatland restoration a notable feature of green policy moves in Europe and North America. However, restoration of peat soils in post-agricultural settings is made more difficult because of the legacy effects of extensive alteration and need to accommodate ongoing agricultural activities in the surrounding areas. Due to these conditions, many early attempts at restoration have had limited success. How do existing methods of peat restoration work in post-agricultural sites, and what can be done to improve restoration outcomes in these challenging situations? This talk will review the challenges facing peatland restoration in post-agricultural areas, case studies of successful and failed peatland restorations, and describe existing and emerging methods to improve restoration success.

Increasing invasion resistance by sowing native species – effects of propagule pressure, priority effect and trait similarity

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Abstract

Ecological restoration can be used as a nature-based solution to control the spread of invasive alien plants by increasing the biotic resilience of native communities. We set up a pot experiment to investigate whether the introduction of native species reduces the establishment or growth of invasive alien species, based on the priority effect, the higher propagule pressure of native species, and the similarity of plant traits. In the pots, three invasive alien species (*Asclepias syriaca*, *Conyza canadensis*, *Tragus racemosus*) were sown with four native species (*Festuca vaginata*, *Galium verum*, *Gypsophila paniculata*, and *Saponaria officinalis*) separately and as a native seed mixture, simultaneously or adding invasive species one month later, in equal and fivefold seed rates. Seedlings of invasive species, plant height, leaf size, biomass and seed yield were generally negatively affected by the co-planting with native species. Establishment and growth of each invasive species was influenced by at least one of the factors investigated. Increasing seeding rates and giving priority to native species increased the control effects of native species. Contrary to our expectation, trait similarity had only a minor effect, rather seeding of competitive *Festuca vaginata* reduced establishment and growth of invasive species. We conclude that invasion-resistant restoration can be achieved through a combination of several factors in seed-based restoration, including early, high rate seeding of native species and the inclusion of competitive species in native seed mixtures.

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‘They’re like King Kong and Godzilla’ Understanding the relationship between rewilding and cultural heritage in the UK and the benefits of engagement within stakeholder relationships

Rob Swinbank

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Abstract

Rewilding is fast becoming a key component of landscape management strategy in the UK, increasingly part of mainstream dialogues and influencing landscape policy. The British landscape is rich with cultural heritage, tangible and intangible, that holds great significance for rural communities who live and work within it. Consequently, rewilding-style projects are often met with suspicion and hostility by local stakeholders who fear the loss of this cultural heritage, particularly intangible heritage that plays a key role in building identity and community, through alterations in land use. Despite this, there is still little engagement in cultural heritage from rewilding projects and relationships with heritage management bodies are often regarded as oppositionary. Furthermore, academic research on this relationship is scarce and often focuses on prior negative outcomes without proposing alternative solutions.

Working with five case study rewilding sites in northern England and southern Scotland, a series of in-depth interviews with rewilding practitioners and heritage management professionals have provided the first detailed understanding of this relationship. Projects understand the significance of heritage to local stakeholders and are keen to engage but lack the tools and knowledge to do so. This presentation will present these findings and discuss how innovative engagement in cultural heritage with local stakeholders has the potential to develop adaptive co-management relationships that can mitigate conflict over management decisions. Heritage must play a greater role in nature restoration to ensure constructive progress. Although UK centred, these findings are applicable to anywhere that people and nature co-exist within the same landscape.

A case study on the implementation of nature-based solutions after a forest fire in Central Italy

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Abstract

Forest restoration is advocated in burnt landscapes to rapidly recover forest ecosystem services, and it usually relies on extensive tree plantations to quickly restore the forest cover. This approach is apparently easy to implement, but it may impair post-fire natural recovery dynamics and it is costly. An alternative approach based on Nature-based solutions (NBS) requires the analysis of post-disturbance ecological processes, and can take advantage of biological legacies to increase forest restoration efficacy.

In a burnt pine forest in Central Italy we studied the effect of biological legacies on the micro-environment, and tested their facilitating effect on sown and transplanted forest regeneration.

We measured soil temperature and moisture around downed logs, and near-ground air temperature and illuminance close to downed logs, under shrubs, under clumps of branches, and along micro-terraces. We planted seeds and 1-year old seedlings in these positions to test the direct effect of biological legacies on forest regeneration survival.

The biological legacies decreased soil and air temperature, and decreased the amount of solar radiation on the ground. The improved microsite conditions were mirrored by a higher survival of artificial regeneration along downed logs and under shrubs and branches.

Similar studies increase our understanding of post-fire recovery dynamics and are the necessary starting point to apply NBSs. With various options at hand, land managers and stakeholders can define tailored solutions to restore forests after large and severe wildfires.

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Socioeconomic Effects of Coral Restoration

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Abstract

Coral reefs are crucial ecosystems that are currently facing alarming decline, with nearly 1 billion people relying on them for survival and subsistence. The vulnerable populations most affected by the loss of coral reefs are also disproportionately impacted by the impacts of climate change, further exacerbating their challenges. The socioeconomic framework of coral restoration programs encompasses various direct, indirect, induced, and total effects that can have far-reaching impacts on communities and economies. By examining these effects, we can gain a comprehensive understanding of how coral restoration programs contribute to both conservation and socioeconomic development. The work of the Coral Restoration Foundation in the Florida Keys serves as an exemplary model for examining the socioeconomic framework of coral restoration programs. Through its comprehensive approach to coral reef conservation, the foundation has demonstrated the potential to generate direct, indirect, induced, and total socioeconomic effects that benefit both the environment and local communities. By understanding and quantifying the direct, indirect, induced, and total socioeconomic effects of coral restoration programs, we can effectively evaluate their contributions to conservation and community well-being. This comprehensive understanding is crucial for informing policy decisions, securing funding support, and ensuring that coral restoration programs are designed and implemented in a manner that maximizes their positive impacts on both ecosystems and human societies.

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Beneficial reuse of dredged material can work alongside natural sedimentation processes to improve wetland restoration outcomes

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Abstract

Wetland restoration is a high priority for the San Francisco Bay estuary (SFBE) after the loss of substantial tidal wetlands over the last century. 'Beneficial reuse of dredged material' refers to the deposition of dredged material on target restoration sites to aid in restoration outcomes by increasing initial elevations therefore reducing subsidence. Despite the ongoing use of this technique, it is currently unknown how beneficial reuse of dredged materials influences marsh biogeomorphology and the rate and success of restoration projects. To provide insight into these dynamics, we measured physical and biological parameters of tidal wetlands that utilized beneficial reuse material, and compared their attributes to wetlands that have been restored through natural tidal sediment accretion. Further, we used historic imagery to examine changes in the vegetative community (as measured via NDVI) at over 20 restorations across the SFBE, to test if sites subject to beneficial reuse revegetate at the same rate as natural accretion sites. In both types of analyses, we found that the beneficial reuse of dredged sediment generally did not impact accretion rates post breaching or restoration status as measured by the vegetation community in any systemic way. The exception to this finding is that beneficial reuse sites had slightly greater occupancy by colonizing cordgrass (*Spartina foliosa*), and slightly less occupancy by later stage successional pickleweed (*Salicornia pacifica*). We conclude that beneficial reuse of dredged sediments is a viable tool to work alongside nature-based solutions (i.e., natural sedimentation processes) to improve restoration outcomes.

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Advancing strategies for managing invasive hybrid cattails (*Typha × glauca*) with biochar in eutrophic wetland systems

Brian Ohsowski, Shane Lishawa

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Abstract

In the Great Lakes region, aquatic eutrophication drives ecosystem susceptibility to biological invaders such as clonal hybrid cattail (*Typha × glauca*; hereafter *Typha*) leading to dense monocultures that reduce biodiversity. Harvesting *Typha*, although an effective land management tool, results in abundant, low-value biomass waste accumulation. Converting harvested biomass to biochar and applying it to managed wetlands has the potential to provide an ecologically beneficial use. Biochar, a carbon-rich material formed via low-oxygen organic waste pyrolysis, has gained significant research attention in agricultural contexts due to its ability to adsorb reactive nitrogen, phosphorus, and heavy metal pollutants while subsequently increasing long-term carbon sequestration. Basic research investigating biochar application for eutrophication mitigation, wetland invasive species management, and native plant species impacts is needed. In this study, we determined biochar amendment effects in three companion wetland mesocosm experiments to assess: 1) *Typha* biomass response, 2) native wetland plant (*Schoenoplectus acutus*; *Juncus* sp.) biomass responses, 3) shifts in *Typha*'s competitive dominance, and 4) shifts in plant available macronutrients (ammonium, nitrate, phosphate). We found *Typha* biomass was significantly reduced with biochar amendments when grown alone or in native plant competition and native plant biomass was not significantly influenced by biochar. Higher rates of biochar feedstock source (i.e., wood waste, *Typha* biomass) led to significant reductions in soil available phosphate and ammonium, and increased *Typha* tissue P accumulation. Our research illustrates the potential for biochar application to result in eutrophication reduction (N,P) in impaired wetlands, *Typha* biomass reductions, and a neutral response of native wetland plants.

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Assessing nutrient removal function of constructed wetlands after a decade without management

Michael Back, Nick Brocato, Kenneth Anderson, Lauren Kinsman-Costello

Kent

Abstract

Wetland restoration with the goal of nutrient removal is becoming increasingly popular in the Great Lakes region to curb the proliferation of harmful algal blooms. Wetlands slow the flow of water, allowing particulates to settle and dissolved phosphorus to be processed in the water and sediment. The effectiveness of restored wetlands at removing phosphorus can vary and often depends on management actions. We aimed to determine the phosphorus removal function of 10 constructed wetlands (10x20-meters by 2-meters deep) after a decade without management. The wetlands were constructed in 2001 with inflow and outflow water control structures allowing for active management of water level. Since 2013, water control structures remained at a consistent setting. The lack of management created substantial variability in hydrologic regime over the last decade. We set each wetland to a similar water level and monitored nutrient concentration, flow, vegetation, and sediment conditions from April-October 2024. Flow conditions were generally low and varied across the 10 wetlands, presumably due to the drought in Northeast Ohio and occasional blockages in water control structures. Surface water dissolved phosphorus was typically below detection limit, however bioavailable P in the sediment ranged from 3.2-34.4 g P/kg. Sediment accumulation varied across the wetlands (range=23.5-88.25cm) and was on average 14.4cm deeper near the inflows than the outflows. The constructed wetlands have stored phosphorus via sediment accumulation since construction, but without periodic maintenance on the inflows to allow water to enter the systems, the wetlands can become isolated and limited in nutrient removal functionality.

The Seed is Woman – When Restoring Ecosystems Also Restores Lives

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Abstract

The Xingu Seeds Network (XSN) exemplifies how ecological restoration transcends environmental recovery, fostering profound transformations in the lives of women involved in seed collection.

Comprising approximately 80% women, XSN not only provides an independent source of income but also offers a new perspective on how these collectors engage with the world.

By participating in seed collection and processing, participants develop a closer connection with nature and their territory, attentively observing the dynamics of trees, animals, and the changing seasons. Moreover, the work—primarily conducted collectively—strengthens social and intergenerational bonds, resulting in new friendships and support networks that extend beyond the professional realm.

Participation in the Network also opens up opportunities for travel and training, broadening horizons and fostering the development of female leadership. Within the Network, collectors organize into groups, each electing a member responsible for their coordination and representation. Of the 25 existing groups in XSN, 16 are led by women.

Over its 18 years of existence, XSN has observed that the effects of working with seeds transcend the economic dimension, extending to women's mental health—with reports of overcoming depression and anxiety—and to the strengthening of cultural practices. In this context, two groups of indigenous female collectors have composed songs about seed collection, highlighting the depth of their connection to the activity.

This work seeks to demonstrate how seeds emerge as symbols of renewal, showcasing real stories of women whose lives have been transformed and their central role in the ecological restoration process proposed by XSN.

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Improving restoration outcomes through meaningful collaboration with Traditional Owners in the Pilbara region of northwestern Australia.

Jonathan Fisher

Perth

Abstract

This case study examines an innovative approach to collaborative ecological restoration with Traditional Owners in a complex social and environmental context.

The Pilbara region, contributing over \$100 billion annually to Australia's economy through extractive industries, hosts major iron ore operations - an integrated system of mining hubs, rail networks, and port facilities. For the Traditional Owners, whose lands encompass multiple mines, rail infrastructure, and numerous exploration tenements, the relationship with mining companies has been complex and evolving over many years.

Our restoration project navigates critical questions around meaningful Indigenous engagement: How do we build trust in historically strained relationships? How can we respectfully integrate Elder knowledge into scientific restoration approaches while acknowledging cultural protocols? What strategies enable genuine co-design when balancing traditional wisdom with technical expertise?

This case study presents emerging solutions centred on three key principles: commitment to authentic engagement, embracing genuine co-design processes, and adoption of the Aboriginal seventh generation principle - making decisions that consider impacts seven generations ahead. We detail practical approaches for knowledge integration, relationship building, and creating culturally appropriate restoration outcomes that serve both ecological and social objectives.

Early insights suggest that prioritising long-term relationship building over quick technical fixes has been crucial for early project success. Our findings offer valuable lessons for practitioners working at the interface of Indigenous knowledge systems and ecological restoration.

An assessment of seed predation rate and direct seeding germination success in an active restoration scenario after a high severity wildfire in mountain forests

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Abstract

Alterations in disturbance regimes triggered by land-use and climate change have the potential to hinder post-fire regeneration, particularly in mountain forest ecosystems in the Mediterranean region. Therefore, it is crucial to reconsider current post-fire management strategies to mitigate the impacts of altered wildfire regimes on forest ecosystems after large, severe wildfires. In Autumn 2017 Piedmont Region (North-Western Italy) experienced unusually climatic conditions, characterized by high temperatures and low rainfall. This resulted in large wildfires that burned approximately 7.200 hectares of forests. The Susa wildfire was the largest event, burning nearly 4,000 hectares with mixed severity, with *Pinus sylvestris* stands being affected by the highest severity. After the disturbance, a reforestation project was started to restore forest cover and the provision of ecosystem services, particularly in high-severity areas lacking seed sources. Among the adopted restoration techniques, direct seeding was considered a promising option requiring careful planning, particularly to address challenges related to seed predation. To evaluate the magnitude of seed predation by different taxa and to assess the rate of seed loss, an experimental approach was applied within the high-severity patches of the Susa wildfire. Subsequently, a precision seeding experiment was designed to evaluate performance in terms of germination and establishment. Both experiments were conducted considering three different microhabitats (open areas, near shrubs and near coarse woody debris). Understanding the limitations and potential of direct seeding as a forest restoration technique is fundamental for developing targeted post-fire management strategies that could reduce restoration costs and maximize the likelihood of success.

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Bridging theory and practice to improve native plant material selection for restoration

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Abstract

Land managers often face the critical decision of what plant materials to select for ecological restoration. Selection depends on factors that span both environmental conditions and the level of human intervention in the restoration process, which can strongly influence the recovery of a degraded ecosystem. To improve the selection process, we review the scientific literature and compare insight from different study types to how five federal agencies, charged with managing or advising practices on large tracts of land in the interior western and central USA, guide selection in practice. We analyzed keywords associated with the abiotic, biotic, land management and producer practices that factor into plant material selection and contrast their proportional use between agency guidance and scientific literature. We found that the literature focused on local adaptation and genetic structure of plant materials and the tradeoffs of introducing gene flow and artificial selection during plant production. In contrast, agency guidance focused on the transfer of plant materials that were more generally considered genetically appropriate and environmentally suitable, and practical concerns including the cost, availability, and types of plant materials. Sourcing plant materials for federal land management could be improved by providing guidance for plant genetic and trait considerations, developing climate change adaptation strategies, and providing decision-support tools that apply scientific principles. We provide a direction forward, including highlighting several selection frameworks and tools that may be useful to decide what plant materials to use and how to use them.

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From Fish to Fork: a ponderosa pine's journey to the river

Taryn Contento, Daniel Bowker

Coalition for the Poudre River Watershed

Abstract

The Coalition for the Poudre River Watershed (CPRW) is a place-based watershed coalition in northern Colorado, working toward ecosystem resilience through both forest and stream restoration techniques. A long-planned wildfire mitigation and forest restoration treatment on a strategic private ranch in the Fish Creek drainage, implemented in partnership with the Larimer Conservation District, resulted in an overabundance of low-value woody material, which would normally have to be hauled at least 40 miles to be utilized in the local wood products market if possible, or disposed of at cost if not. However, as CPRW was in the midst of planning the South Fork stream restoration project at the same time, 400 of the logs were diverted to the stream restoration project, just 2 miles downstream of the forest restoration work.

The South Fork project was 3 years in the making and aims to improve water quality and riverscape health after the Cameron Peak Fire, the largest wildfire in Colorado history, burned across the Poudre watershed. The South Fork project was completed in 2024; runs along 0.6 miles of the river; and consists of 50 structures built with full length processed logs by hand labor and heavy machinery. Impacts of the project will be quantified by numerous researchers at Colorado State University and Rocky Mountain Research Station.

By utilizing this woody material in the stream restoration project, CPRW was able to complete two impactful restoration projects in the same area, and recover ecosystem services value from a monetarily low value product.

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Leveraging seasonal tree-ring growth to assess species climate adaptations facilitates successful restoration planning

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Abstract

Southwestern forests experience a bimodal precipitation regime, mediated by ENSO oscillations. This variance increases uncertainty in climate change predictions for seasonal precipitation, posing challenges to land managers when planning climate resilient forests. Many dominant native tree species depend primarily on snowpack, rather than monsoonal rains, for growth. Species at the northern edge of their range may have a competitive advantage as temperature, drought severity, and drought duration continue to increase. We developed earlywood (EW) and latewood (LW) chronologies of Chihuahua pine (*Pinus leiophylla*) at the northern edge of its range in central Arizona and New Mexico. Sub-annual EW and LW widths allow us to better understand how precipitation timing affects growth. We sampled tree cores from 270 trees at 16 spatially balanced sites to assess growth responses to climate variables (temperature, precipitation, and VPD). LW was highly associated with monsoonal precipitation, while EW was strongly correlated to precipitation from the fall preceding the growing season until the spring, indicating that Chihuahua pine growth is influenced by winter and monsoonal precipitation. Southern populations formed more frequent “false” rings, indicating sensitive growth response to precipitation fluctuations, a trait that will likely become more important for survival as climate changes. Identifying species with flexible growth responses will allow managers to efficiently allocate restoration efforts around species that have been previously underrepresented in forest planning. Employing strategies that create diverse pathways for forest persistence will improve chances for restoration success and preserve vital ecosystem services.

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A collaborative multi-stakeholder ANR approach for the Atlantic Forest: mixing native-exotic vegetation and shifting communities from illegal harvesting to active restoration

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¹São Paulo, Brazil. ²

Abstract

Neblinas Park is an environmental reserve under Suzano S.A., established and managed by Instituto Ecofuturo. Spanning 7,000 hectares, the reserve features Atlantic Forest in various stages of regeneration in São Paulo, Brazil.

Prior to Suzano's acquisition, the land was cleared for charcoal production, initially designated for eucalyptus plantations. The area subsequently underwent an Assisted Natural Regeneration (ANR) process since 2004, and today it stands as one of the largest private reserves of Atlantic Forest. To expedite regeneration, Ecofuturo dispersed 9M juçara palm seeds throughout the area, which still contains old eucalyptus trees (exotic plants) mixed with native vegetation.

Multi-stakeholder collaboration proved essential in this journey. Suzano, as a private entity, alongside Ecofuturo, engaged rural landowners and local stakeholders to promote sustainable development and environmental safeguarding. This included interaction with protective institutions and local oversight authorities. Notably, individuals previously involved in illegal juçara palm harvesting transitioned to participating in the regeneration process. Moving from a strictly commercial perspective to one that embraces ecologic restoration, these former antagonists have shifted their focus toward sustainable management rather than unregulated extraction.

This experience is relevant to the restoration community due to its emphasis on participatory approaches, as it:

- Demonstrated an integrative strategy for restoration projects, considering various stakeholders, including those initially opposed to restoration efforts;
- Exemplified how native species' insertion accelerates regeneration, even amidst remnants of exotic vegetation;
- Indicated that ANR methodology is suitable for contexts where restoration speed can overcome land-use conflict barriers;
- Became a successful case of engaging decision-makers and community leaders.

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An adaptive management approach for the production of native seed banks

Katie Anderson

The Phoenix Conservancy

Abstract

The largest limitation to efficient ecological restoration is the availability of native seeds and seedlings. Confounding this limitation is the availability of seed banks, natural or otherwise, where seeds can be collected for cultivation, distribution, or direct restoration efforts. In-situ seed banks, compared to manufactured seed banks or greenhouses, have the advantage of providing seedlings with the ideal conditions to grow in the ecosystem in which their seeds would be placed. This requires direct communication and collaboration with landowners to set aside a piece of property for seed stock. By writing seed collection into private landowner contracts and creating partnerships with various government land managers, we can collect, cultivate, and direct seed individuals from different genetic lines, further strengthening the future plants. By working directly with private landowners as well as federal, tribal, or state land managers, we have successfully created seed banks for three unique ecosystems, therefore reducing the limiting effect of availability. This approach also allows us to create an adaptive strategy for future conservation efforts by targeting multiple smaller patches for possible seedbank production, or a single large patch depending on the available resources and land ownership. Regions dominated by private land may benefit from focusing on small, urban patches with agreements for future seed collection. Conversely, rural areas with more federal land would benefit from collaborating with local land managers with agreements in place to collect seeds from the broader area.

Developing a Stochastic Cellular Automata Model to Estimate Saltmarsh Restoration Outcomes and the Delivery of Ecosystem Services

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Abstract

In order to justify and guide large-scale urban ecosystem restoration approaches, it is important to be able to quantitatively estimate the outcomes and benefits of restoration practices in terms of effectiveness, timeline, and delivery and economic value of ecosystem services. We extended a stochastic cellular automata model that focused on how the presence of ribbed mussels (*Geukensia demissa*) impacts saltmarsh cordgrass (*Spartina alterniflora*) recovery following a drought, to consider how including ribbed mussels in saltmarsh restoration programs may impact marsh spread, growth, and nitrogen removal in the short to medium term (1 - 20 years). The initial model focused on urban waterways found in Jamaica Bay, New York. Transition probabilities were estimated using field data collected in Jamaica Bay and the Harlem River in New York City, long term monitoring data of Jamaica Bay from the National Park Service, and other regional data on marsh restoration. Nitrogen removal under various marsh conditions was estimated using published data from core incubation studies focused on Jamaica Bay and other collected data estimating nitrogen removal processes in saltmarsh restoration contexts. The model was used to estimate how various restoration techniques, including restoring only vegetation, restoring vegetation and mussels, and no restoration, impacted marsh recovery and ecosystem service provisioning, including estimates of restoration value based on nitrogen removal. Outcomes were considered under a range of parameter values in order to consider how lack of parameter resolution impacts findings. The final model can be extended with other restoration parameters--such as oysters, inundation, temperature, salinity--for broader applicability.

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Community Perception Around Small-scale Urban Restoration

Sophia Blanco

Pullman, Washington

Abstract

Small-scale urban restoration projects are crucial for enhancing public awareness and increasing connectivity between larger intact native habitats, particularly in regions with limited public access to native green space. Despite these benefits, studies rarely explore both the ecological and social aspects of urban restoration. To assess general understanding and attitudes towards urban restoration, we created anonymous surveys given to homeowners participating in our Palouse Prairie “Pocket Prairie” native landscaping program, as well as non-clients in the community. We then linked this to quantitative data on the acreage restored and sites enhanced to date. This study contributes to the understanding of the often overlooked social dimensions of prairie restoration, focusing on small-scale landscaping projects. These findings provide valuable insight into the social aspects of private urban restoration efforts and help to inform future urban restoration programs, public outreach, and education initiatives.

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Partnerships for Peatland Restoration in Minnesota, USA

Maya Swope¹, Kristen Blann¹, Mark Felice¹, Christian Lenhart^{1,2}

¹The Nature Conservancy. ²University of Minnesota

Abstract

Peatlands store more than 30% of the world's terrestrial soil carbon and play a critical role in achieving climate mitigation goals. However, drainage and conversion of peatlands to agriculture and other land uses has caused ongoing damage and turned some peatlands from a carbon sink into a source of carbon emissions.

In Minnesota, USA, The Nature Conservancy and our partners are working collaboratively to develop a strategy to protect and restore local peatlands. By facilitating spaces for researchers, land managers, and agency representatives to collaborate, we are working to move forward science-based management of these politically and ecologically complicated landscapes.

In this presentation, I will detail our ongoing efforts to bring together partners from federal, state, and local governments, NGOs, Tribal Nations, private companies, and universities, to promote and prioritize peatland restoration and protection projects in Minnesota. I will share successes, challenges, and lessons learned from the past three years of this work. Although these efforts have had a local focus, the strategies and initiatives developed in this work can be applied to other peatland areas across North America and around the world.

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Trait based evaluation of multiple restoration strategies used to restore riparian plant communities

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Abstract

Evaluating restoration success has traditionally relied on the use of taxonomic indicators (e.g., diversity or abundance of target species). However, such indicators are location-specific and not a direct measure of plant community responses to environmental change. Plant functional traits directly capture such responses thus providing further insight into the mechanisms influencing recovery outcomes post-restoration. Despite this, few studies have used a trait-based approach to evaluate restoration in riparian ecosystems, and no study has used such an approach to directly compare multiple common restoration strategies. Here we use plant traits to evaluate restoration strategies applied within the Ebro River Basin in Spain. We are specifically interested in asking: 1) How does the type of restoration strategy influence trait responses within riparian plant communities 2) What restoration methods result in similar functional composition and diversity as natural riparian plant communities?

To address these questions, 33 restored and 19 reference sites were sampled with plant trait data related to species resource acquisition strategy, reproductive strategies, environmental preferences and disturbance tolerances collected from public databases such as TRY. To evaluate how functional responses varied among restoration methods, metrics of functional composition (e.g., guilds and CWMs) and functional diversity were calculated. Principal component analysis was then used to evaluate variation in trait responses among restored and reference sites. Results indicate that plant communities are responding to variation in soil characteristics, light exposure, and flooding disturbance with restoration success being dependent on the type of previous land use abandoned and site hydrologic connectivity and hydroperiod.

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Fly high or stay low - are green roofs in the city to pollinators worth it?Klara Rehounkova

Ceske Budejovice, Czech Republic

Abstract

Urban green spaces, including green roofs and ground-level urban habitats such as urban grasslands, provide essential habitats for key pollinators. This pilot study conducted in the Czech Republic investigated an indicator group of pollinators (Hymenoptera) on selected extensive green roofs and adjacent differently managed ground-level habitats, specifically intensively and extensively managed urban meadows. The aim was to understand the patterns of species distribution.

Reducing mowing frequency can improve the floristic resources of grasslands, leading to an increase in bee abundance and richness. Similarly, extensive low-maintenance green roofs offer pollen and nectar resources from early spring to late summer, in contrast to intensively mowed grasslands with limited resources, and can significantly impact bee and other pollinator populations. The study found an overlap of insect taxa across habitats, however, we also identified a significant decline in bee abundance and taxa richness with increasing management intensity during the growing season. These findings suggest that urban green spaces, including green roofs, can provide valuable habitats, with connectivity and habitat quality playing a critical role in shaping urban insect communities.

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Slowing down to speed up: systematically planned habitat restoration leads to rapid coho salmon recovery following implementation on California's North Coast

Derek Hitchcock

The Nature Conservancy, Nevada City, CA, CA, USA

Abstract

Coho salmon (*Oncorhynchus kisutch*) have hovered on the brink of extinction on California's central and northern coast for over two decades, driven primarily by severe watershed-wide habitat degradation from intensive 20th century logging practices. The flooding that followed the denuding of the landscape resulted in significantly altered geomorphology that over half a century later remained largely unchanged. Salmonid restoration was established as a strategic priority in the region in the 21st century. Despite the understandable desire to rush to "shovel ready" projects, restoration practitioners instead invested in a multi-year systematic scientifically driven planning phase that demonstrated the dramatically limiting factor to survival for coho salmon was an absence of winter rearing habitat in the lower watersheds. From 2018-2025, large scale restoration of this habitat was implemented on the Ten Mile River. This work was paired with robust monitoring of multiple stages of the coho salmon life cycle. This monitoring indicates a steady increase in Coho salmon numbers, culminating in surpassing the NOAA recovery target for spawning adults in the winter of 2023/24. The rapid recovery of the target species following implementation validates an approach that systematically planning habitat restoration improves the quality and impact of restoration interventions, delivering real results in a cost-effective manner. The same approach is being applied in the nearby Navarro and Garcia Rivers to further the regional recovery of an iconic keystone species whose recovery is both an indicator and profound contributor to overall watershed health.

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Linking the effects of wildfire and mechanical seeding on soil properties to plant responses.

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Abstract

The size and frequency of wildfires have substantially increased in semiarid rangelands of the western US. Following wildfire, restoration efforts often include mechanical seeding to assist in the recovery of plant communities. Seed drills make furrows with the intention of creating microsites to limit extreme temperatures and evaporation. While mechanical seeding improves the outcomes of seeding, we lack direct comparisons of how various drills affect edaphic properties and if these changes to soils contribute to the establishment of seeded species or invasive annuals. We compared how two drills change soil-water transportation, storage, and seedbed conditions favorable for seed germination. We found drills created differences in modeled hydrologic conductivity and saturated water content. These hydrologic properties contributed to the amount of time that seed beds supported seed germination and the establishment of different plant communities.

Measurements will be repeated throughout the next few years to investigate how soil conditions change with plant colonization over time. These methods will also be repeated across a greater number of fires occurring in Wyoming big-sagebrush ecosystems in the Seeding Evaluation and Experimental Design Strategies Project (SEEDS).

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Fuel treatments and wildfire across woodland expansion phases: plant community responses and implications for restoration

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Abstract

In sagebrush ecosystems of the Western United States, woodland expansion is associated with changes in fire intensity and vulnerability to invasive annual grass. These increased fuel loads can potentially intensify fire behavior, which can have cascading effects on plant community composition. While fuel treatments—prescribed burning, mechanical cutting, and mastication—are primarily used to reduce fire effects, there is little data showing how these treatments differ within woodland expansion phases. We analyzed data from a SageSTEP (Sagebrush Steppe Treatment Evaluation Project) woodland site that had undergone fuel treatments two years prior to subsequently burning in a wildfire to assess how fuel treatments and wildfire affect plant composition across three woodland expansion phases. We categorized plant composition into foliar and first-contact canopy cover to examine plant cover in conjunction with difference normalized burn ratio (dNBR), a measure of burn severity. Preliminary results show that prior to wildfire, perennial and annual grass cover varied by treatment, while perennial and annual forb cover generally increased after treatment in all phases. Post-wildfire, perennial forbs and grasses gradually increased in all phases and plots, while annual forbs and grasses decreased, especially in prescribed fire plots. Across all phases, burn severity was lowest in prescribed fire treatments while annual grass returned to similar or lower cover eight years after wildfire. Thus, fuel treatments and wildfire can interact differently among woodland expansion phases, influencing plant community composition post-wildfire. Ongoing monitoring of plant functional group cover will clarify the longevity of fuel treatments and help inform adaptive management.

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Rebounding Biodiversity: 14 years of rehabilitation after clear-felling tropical rainforest habitat for palm oil production

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¹United Plantations Bhd / PT Surya Sawit Sejati, Pangkalan Bun, Indonesia. ²Green Harvest Environmental, Cottage Grove, Oregon, USA. ³Copenhagen Zoo, Copenhagen, Denmark

Abstract

Worldwide oil palm plantation grew from less than 3 million hectares in 1990 to more than 20 million ha in 2024. The rapid expansion resulted in many tropical rainforest areas being cleared, some of which were left unutilized, because of marginal soil conditions with low growing potential. In 2011, United Plantations Bhd/PT Surya Sawit Sejati commenced on rehabilitating a 32ha landarea that had been clear felled by the previous owner. After identifying area specific native tree species and propagating seedlings, in 2011 a total of 3600 seedlings representing five native species *Gluta reinghas*, *Calophyllum castaneum*, *Cratoxylum arborescens*, *Shorea balangeran* and *Schima wallichii* were planted. Growth and survival rates were recorded biannually, and a baseline biodiversity survey was completed in 2015. Subsequently, the bird diversity was recorded annually, whereas the plants, and amphibian were surveyed in 2022 and 2024. After 14 years, our team has recorded 10 new tree species on a 1ha permanent study plot, an average of 435 trees with DBH ≥ 10 cm, 12 amphibians and 41 bird species. This shows a remarkable recovery with a natural tree density increase in excess of 210% and that vertebrate biodiversity too can rebound remarkably fast with dedicated and well-planned rehabilitation intervention. Ongoing annual biodiversity monitoring continues to chart ongoing ecological succession with increasing canopy height and cover density.

Reestablishing complexity and stability in the Cabañeros National Park (Spain) stream network.

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Abstract

Throughout the 20th century, the landscape of the alluvial sedimentary layer, termed “*raña*” locally, in the Cabañeros National Park (Spain) underwent numerous transformations that have modelled and shaped its current aspect. The most important changes were the deforestation and the ploughing up of the lands to convert them into crop fields, altering, among other characteristics, the natural stream network of the “*raña*”, which was either eliminated or modified to meet the production needs. To recover the planform of these Mediterranean streams with an extremely irregular hydrological regime a project financed by the European Union's NexGenerationEU funds is being carried out.

Based on the criterion of recovering as possible the original planform of the disappeared or modified streams, while increasing connectivity with other areas of interest and optimising the environmental benefit of the planned actions, a selection of stream sections with great potential for restoration has been proposed. The final selection includes actions on six sections from different streams, which means a total length of 13.12 km.

Tasks to recover the planform and the riverine vegetation, which are being implemented currently, include the excavation and conditioning of the former planform, the installation of perimeter fencing where needed to avoid herbivores, and the hollowing out and introduction of plants in those areas deemed most appropriate to improve the success of revegetation. Finally, an environmental monitoring programme has been designed to evaluate the achievement of the goals. It includes monitoring geomorphology, hydrological regime, vegetation colonisation, and macroinvertebrate communities' composition.

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The Weston Global Tree Seed Bank: Unlocked in Madagascar – building best practice using the framework species method for restoring tropical forests

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Abstract

The Global Tree Seed Bank (GTSB) is the largest programme of RBG Kew's Millennium Seed Bank. Funded by the Garfield Weston Foundation. It is currently working across 16 countries to conserve threatened, endemic and useful trees through seed collecting, to use these seeds to accelerate on the ground conservation through research and restoration, and to support partners through training, capacity building, networking and partnership building.

We will present our work on the GTSB in Madagascar, where we have introduced an innovative strategy aimed at restoring and conserving unique dry forest ecosystems, with a current focus on Ankarafantsika National Park. Central to this approach is the careful selection and planting of framework tree species, which are essential for promoting natural regeneration and enhancing biodiversity. Working to scale up native seed supply for restoration in collaboration with our partner Silo National des Graines Forestieres (SNGF), we are developing contextually appropriate and sustainable site-based containers and drying technologies for seed storage.

Madagascar's dry forests face significant challenges, including unique soil conditions, drought, low regeneration capacity, slow plant growth, and frequent fires. The framework species method aims to address such challenges by focussing on identifying native and pioneer species that thrive in post-deforestation open areas, exhibit rapid growth, add shade and leaf litter to the forest floor, attract seed-dispersing animals, and possess fire-adapted traits. Our research also aims to deepen understanding of root system ecology. We emphasise the critical need to integrate ecological expertise with community engagement to ensure the sustainability of restoration initiatives.

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Nature-based Solutions for Guidimakha: Enhancing Livelihoods and Building Climate Resilience

Almamy Soumaré

Nouakchott. Wompou. Geneva

Abstract

This project addresses urgent environmental and socio-economic challenges in Mauritania's Guidimakha region, the country's most rainfall-rich area and home to its last remaining forest reserve. Despite its natural resources, Guidimakha is Mauritania's poorest region, with 48.6% of the population living in poverty and high dependence on agropastoral activities. However, land degradation, desertification, soil erosion, biodiversity loss, recurrent wildfires, and climate-driven extreme heat threaten these livelihoods. Unregulated transhumance between Mauritania, Mali, and Senegal further intensifies overgrazing, depleting already fragile ecosystems and leading to frequent conflicts between herders and farmers.

This project implements an integrated ecological restoration approach based on Nature-based Solutions (NbS), including reforestation, agroforestry, sustainable water management, and climate-resilient agriculture. Special emphasis will be placed on rangeland restoration and water access to improve pasture availability, prevent soil erosion, and reduce land-use conflicts. These interventions will restore degraded ecosystems, enhance water availability, and boost agricultural productivity, while creating green jobs and supporting vulnerable populations, particularly women and youth.

A key component is community engagement and governance strengthening. The project will collaborate with local authorities, civil society, and regional institutions to ensure a participatory and inclusive approach, reinforcing climate resilience, food security, and sustainable resource management.

Aligned with Sustainable Development Goals (SDG 13 - Climate Action & SDG 15 - Life on Land), this initiative provides a scalable and replicable model for ecological restoration. Initially benefiting Mauritania's neighboring regions, such as Assaba and Gorgol, this initiative could later serve as a blueprint for sustainable development across West Africa, including Mali and Senegal.

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Evaluating Nutrient Function Across Diverse Wetland Restoration, Construction, and Enhancement Projects: The H2Ohio Wetland Monitoring Program, Ohio, USA

Lauren Kinsman-Costello¹, Olivia Schloegel¹, Richard Becker², Thomas Bridgeman², Kennedy Doro², Stephen Jacquemin³, Laura Johnson⁴, Ganming Liu⁵, Nathan Manning⁶, Kevin McCluney⁵, Helen Michaels⁵, W. Robert Midden⁵, Silvia Newell⁷, Ryan Winston⁸, Kristen Fussell⁸, Christopher Winslow⁸, Siena Larrick¹, Raissa Mendonca¹, Eric Saas⁸, Janice Kerns⁹

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Abstract

To assess the nutrient removal function of wetland restoration, enhancement, and creation being implemented as part of the H2Ohio Initiative (Ohio, USA), the Ohio Department of Natural Resources has established a unique independent monitoring program implemented by multidisciplinary scientists from six Ohio universities. The H2Ohio Wetland Monitoring Program (WMP) investigates nutrient cycling in diverse wetland projects under a unified framework in collaboration with state agency professionals, conservation partners, and wetland restoration practitioners. We are developing tools for nutrient budgeting and indicators of wetland nutrient function using a tiered sampling approach. Indices of soil and water nutrient status and wetland hydrology are measured in all monitored wetland projects, while we collect more intensive, high-resolution data for comprehensive nutrient budgeting in selected, representative “Focal Projects.” This tiered approach balances evaluation of broad, state-wide restoration program trends and robust, mechanistic understanding to inform management. A centralized data management and quality control system ensures data quality, long term storage, accessibility, and shareability in accordance with open science best practices. Sustained working relationships with wetland practitioners help capture relevant metrics to assess the impact of wetland design and management decisions. Frequent and regular meetings with state agency representatives ensures that research results inform restoration decisions and wetland management in an ongoing, iterative way. Initial results have demonstrated variability in wetland project nutrient retention and identified features that promote enhanced nutrient removal. This unique program exemplifies the challenges and opportunities presented by collaboration among researchers, decision makers, and practitioners to improve restoration outcomes.

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Assessing Invasion Risks of Exotic Species in Tropical Forest Recovery

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¹Universidade Federal do Rio de Janeiro. ²King's College London. ³Universidade Federal do Estado do Rio de Janeiro. ⁴MOMBAK

Abstract

One of the most common approaches in forest recovery is tree planting, yet a critical decision in this method is selecting the species to plant. These plantings may consist of a diverse selection of native species, or in some cases, a combination of native and exotic species. Exotic species are frequently used in forest recovery projects due to their advantageous traits —such as rapid growth, nitrogen fixation, and high seed production. However, these traits have also been linked to successful invaders. Using exotic species with these beneficial recovery traits often overlooks their potential invasion risk. This talk assesses the invasion risk of 79 exotic species used in tropical forest recovery, identified through our systematic review, by applying a Weed Risk Assessment. This approach uses a nine-question protocol based on functional traits, which scores invasion potential from 0 (lowest risk) to 22 (highest risk). Our analysis found risk scores ranging from 5 to 19. High-risk species account for 43% of the species assessed. These species typically originate from tropical climates, use multiple seed dispersal methods, produce numerous small seeds, and can reproduce vegetatively. Risk scores were positively related to species naturalization in tropical countries, indicating a key step in the biological invasion process. These findings highlight the importance of improving the quality of forest recovery actions by critically evaluating the trade-offs associated with using exotic species. This ensures that tree planting efforts are aligned with long-term conservation goals and avoids unintentional biodiversity loss, emphasizing quality over quantity in forest recovery.

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Response of Seeded Species to Three Common Herbicides Used for *Bromus tectorum* Control Over Five Years

Melissa Landeen, Kevin Gunnell, Danny Summers

Ephraim

Abstract

Chemical control of cheatgrass (*Bromus tectorum*) and other annual grass species is one of the primary tools employed to restore degraded rangelands in Western North America. However, many herbicides used to control cheatgrass may also inadvertently inhibit germination of desirable seeds planted following chemical treatment. We evaluated three herbicides: Imazapic (Plateau®), Indaziflam (Esplanade®), Rimsulfuron (Matrix®) and Indaziflam/Rimsulfuron in combination. We compared each product's ability to control cheatgrass over multiple years, as well as the unintended inhibition of seeded species in treated areas for up to five years after chemical application. Each fall, we seeded six common restoration species, bluebunch wheatgrass (*Pseudoroegneria spicata*), Siberian wheatgrass (*Agropyron fragile*), blue flax (*Linum perenne*), alfalfa (*Medicago sativa*), Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), and forage kochia (*Bassia prostrata*) into herbicide treated plots in Utah, USA. Rimsulfuron achieved the highest control of cheatgrass in the first year of application, but with a corresponding high inhibition of seeded species. However, Rimsulfuron plots were nearly identical to untreated control plots after the first year. Imazapic only ever achieved moderate control of cheatgrass, but also had the least severe impact on emergence of seeded species. Indaziflam consistently achieved the highest and most consistent control of cheatgrass throughout the five-year monitoring period. However, it also had the greatest inhibition of seeded species throughout the length of the trial. Seeded species only began to emerge in Indaziflam treated plots as the effects of the herbicide began to diminish in the fourth year after application.

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Integrating Bio-Cultural Knowledge into Invasive Species Management: An Ethnobotanical Framework for the Galápagos Islands

Mimi Salvador Lucero

Inside The Husk

Abstract

The Galápagos Islands are a symbol of ecological uniqueness and a living repository of cultural knowledge shaped by the landscapes and communities inhabiting them. This research focuses on integrating bio-cultural knowledge—encompassing ancestral ecological practices and culturally significant plant species—into invasive species management on San Cristóbal Island. Grounded in ethnobotanical principles, it emphasizes the dynamic relationship between human and plant communities as interdependent systems.

Using a weighted scoring framework, institutional practices are evaluated across three critical dimensions: ecological integrity, cultural resilience, and adaptive innovation. Findings highlight how traditional stewardship and ancestral knowledge systems inform conservation strategies that protect biodiversity while honoring cultural heritage. Culturally significant plants are pivotal in creating sustainable ecological interventions, empowering local communities to become active agents of stewardship.

This approach frames conservation as a shared, long-term endeavor that is cultural as much as it is ecological. Through collaborative knowledge sharing and adaptive practices, institutions can develop conservation strategies that transcend short-term funding horizons and embrace cultural and community-led solutions.

The research proposes a replicable framework that invites institutions to prioritize preventative conservation programs informed by local cultural contexts. This model underscores the potential of invasive species management to safeguard ecosystems while preserving bio-cultural traditions. The findings extend beyond the Galápagos, offering insights into how conservation strategies can evolve to be inclusive of community knowledge and foster resilience through reciprocity between human and natural systems.

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Wild Rice (Manoomin) Management and Restoration in Minnesota: Learning from Indigenous Knowledge and Collaboration

Kristen Blann

The Nature Conservancy, Cushing, USA

Abstract

Manoomin (Ojibwe) or wild rice, *Zizania palustris*, is an annual aquatic plant found in shallow lakes and slow-moving streams and rivers of the northern Great Lakes region that provides a critically important food resource for humans and wildlife. To the Ojibwe people, Manoomin is a gift and an animate being, central to identity, culture, and health. For conservationists, wild rice is a cultural and ecological keystone species, a sentinel indicator of overall watershed health, and an umbrella species (“systems conservation target”) for biodiversity.

Over the past ~150 years, land use change, altered hydrology and drainage, pollution, shoreland alteration and other changes have contributed to ongoing declines in the extent and abundance of wild rice. Climate change threatens to exacerbate all these stressors. Throughout this period, indigenous people and Tribal Nations have led the way on wild rice and clean water protections, via advocacy for harvesting regulations and monitoring, treaty rights, land and water protection, and recently on climate adaptation and vulnerability assessments.

For the past five years The Nature Conservancy in MN has sought to better understand restoration, protection, and climate adaptation needs for wild rice by participating in collaborative initiatives attempting to integrate science-based natural resource adaptation approaches with traditional ecological knowledge and management. The presentation will provide an overview of how and why learning from and partnering with Minnesota’s Tribal Nations has become an important part of our science-based conservation strategies.

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National Park Service DEWA Watergate Wetlands Restoration Project: An Adaptable Design for a Changing Climate

Matthew Holthaus, Laura Sarmiento, Robert Wachter

WSP USA Inc., Lawrenceville, NJ, USA

Abstract

Due to climate change, wetland managers must embrace a new approach to restoration: design beyond the pre-disturbance conditions and facilitate adaptation and long-term resilience. The United States National Park Service (NPS) proposed to restore wetlands associated with Van Campens Brook at the Watergate Recreation Site in Hardwick, New Jersey, USA through the removal of artificial dams and ponds, thereby reestablishing its floodplain connection. WSP USA Inc. provided full design, permitting, and construction services to achieve a high-functioning wetland and riparian floodplain system with natural fluvial dynamics.

The Watergate Recreation Site is a critical host to multiple special status species documented within the New Jersey Category 1 waterway of Van Campens Brook, in which its watershed and resource value is solely contained within NPS property. To develop the overall restoration approach, multiple design studies were conducted, including hydrologic and hydraulic modeling, climate resilience adaptation, geomorphology and reference site surveys, topographic survey, soil investigations and beneficial reuse classification, cultural resource investigations, threatened and endangered species surveys (flora and fauna) and mitigation plans, and invasive species treatment management. Key to the design and sustainability of the site was the evaluation of impacts to designed habitats as a result of climate change. Daily precipitation, evapotranspiration, and storm frequency rainfall depths were projected to the year 2100 by utilizing over 20 climate models to develop a regionalized temporal model. Adjustments were then incorporated into the restoration design to allow for the natural lateral migration of wetland habitats predicted within the Van Campens Brook floodplain.

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High-severity fire changes the trajectory of community assembly in a ponderosa pine forest

Ian Winick, Rachel Mitchell

Tucson

Abstract

Forests across the American West are entering a new chapter of transformation as disturbance regimes deviate from historical norms. Ponderosa pine forests of the American Southwest are adapted to frequent, low-severity fire. However, this fire regime is being replaced by catastrophic fires of high severity. A growing body of evidence suggests that high-severity fire is capable of converting forests to alternate community types, but the drivers and mechanisms of these conversions have yet to be resolved. In this study, we seek to understand how high-severity fire shapes trajectories of post-fire community assembly in ponderosa pine forests. We measured understory species cover across a burn severity gradient (unburned, low severity, high severity) for four years after a mixed-severity fire. Each year, we calculated taxonomic diversity (mean Bray-Curtis dissimilarity) and functional diversity (mean Rao's quadratic entropy) within each burn severity class. By calculating how different these diversity measurements are from those expected under random community assembly, we were able to disentangle the relative effect of fire severity on community assembly. We found that our unburned and low-severity plots assembled along similar trajectories over four years, but our high-severity plots assembled along a different trajectory. This altered trajectory was associated with a plant community that was taxonomically and functionally distinct from the unburned and low-severity communities. These changes in understory assembly may be evidence that high-severity fire is overcoming the resilience of ponderosa forest ecosystems. Our results underscore the importance of the historical context of disturbance regimes in setting restoration goals.

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Tó Nizhóní Ání and Natural Channel Design Engineering, INC Watershed Restoration (Kéyah Nábiyiilnaah) Campaign in the Black Mesa region of Navajo Nation

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Abstract

On the Black Mesa region of the Navajo Reservation, large-scale groundwater and mineral extraction has altered the upland mountainous landscape that is home to indigenous Navajo peoples and their livelihoods. Climatic changes, exacerbated by extractive stresses, has led to the necessary action of restoring landscapes and waterways to their natural state of being. Tó Nizhóní Ání is working in partnership with the technical expertise of Natural Channel Design Engineering, INC to restore headwater watersheds to expand native plant growth, encourage shallow aquifer recharge, reduce erosion and sedimentation in surface water flows, and create healthy ecosystems from denuded landscapes. Utilizing nature-based solutions, Tó Nizhóní Ání has completed a 4.35 square mile pilot project prioritizing construction of low tech rock structures with a local trainee workforce. Revegetation efforts were consulted by the Dził Yijiin Nanise' Project (Black Mesa Plant Project) for native seed planting activities. This watershed restoration work on Black Mesa reflects the concerns that native folks have observed in the past 100 years. In the age of restoration and conserving what natural resources we have left, we now turn to empowering the youth and local native communities to combine with technical design to maximize erosion control and land rehabilitation.

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Collaboration between a botanic garden and non-profit, state, and federal partners to increase production and outplanting of species of conservation concern

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Abstract

Conservation plans may establish strategies to safeguard threatened species and local genetics held in wild populations. These plans may aim to increase the size or numbers of threatened populations while maintaining the integrity of existing genetics. However, the authors of these plans may not have the time resources, information, or infrastructure to propagate and produce plant material originating from these wild populations. Partnering with a botanic garden can be an effective way to address these challenges. Mt. Cuba Center is a botanic garden located in the mid-Atlantic region of the United States that specializes in native plants. Our greenhouse and nursery production team collaborates with non-profit, state, and federal partners to produce plants for outplanting to bolster wild populations and enrich restoration projects. Additionally, we develop and share propagation protocols to facilitate other groups growing these species. We will present examples of work that produced plant material for transfer to the field and successfully increased local populations. Public gardens can provide critical support for conservation work by leveraging propagation and production resources. These partnerships build knowledge of underrepresented species, perform in-situ and ex-situ conservation work, and foster important connections between conservators and public garden professionals.

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A holistic approach to integrating ecological, agricultural and economic restoration strategies to revitalize underserved rural communities in the U.S.

Lee Forbes

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Abstract

Great advancements in ecosystem restoration, flood mitigation using nature-based solutions (NBS), restorative agriculture, and economic revitalization of underserved communities have been realized in the U.S. in recent years. These solutions are largely driven by federal/state-funded programs aimed at building resilient and sustainable communities. The resulting projects and programs, however, are typically out of reach for small, rural cities and villages that may receive funding for economic revitalization, but cannot afford ecosystem restoration, flood mitigation, or agriculture restoration without realizing direct economic benefits in return.

Ongoing projects are presented that will strive to revitalize three rural communities in southeast Arkansas using a holistic combination of ecosystem restoration, NBS-focused flood mitigation, and agriculture restoration to reconnect the communities to nature and each other, mitigate flooding, and revitalize their economies. An overarching concept of “Natural Awe Restoration” is introduced that intends to harness the power of nature to revitalize, reconnect, and re-inspire the communities economically, emotionally, and spiritually. Funding mechanisms are presented that include not only government grant programs, but also leverage public-private partnerships within an innovative community cooperative model to create sustainable, community-owned businesses.

Local citizens will be trained in the design, construction, management, and maintenance of ecological restoration, NBS-focused infrastructure, and restorative agriculture, while learning how to synergistically integrate them to develop a community-owned cooperative using restored industrial and municipal infrastructure. Citizens will be provided a means to work with nature as green infrastructure designers and contractors, farm laborers and managers, food manufacturers, and businessowners.

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Investigating natural regeneration to improve restoration strategies in Singapore

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Abstract

Forest nature reserves of Singapore consist of old growth Dipterocarp forests amidst a larger heterogeneous landscape of low diversity secondary forests. Active and passive restoration since the early 2000s has attempted to accelerate the slow natural regeneration but with mixed success. Twelve long term monitoring plots of 0.4 ha were established in 2011 to track changes in tree species at diameter cutoff of 1 cm, their functional traits, forest structure as well as environmental measures of soil fertility, light, air temperature and relative humidity across this landscape. Old growth forests showed increased signs of dominance by few species, while areas dominated by *Dicranopteris linearis* also showed slow recovery. We compare these data with those from old and new restoration plots to evaluate the relative importance of past land use on plant-environment feedbacks that hinder forest recovery, vs. that of seed sources limitation and invasive weeds. In particular, soil pH and nutrients differ significantly among old growth forests and younger secondary forests that were more recently cultivated, and likely influence subsequent regeneration of plant communities. We then share insights on how these inform future restoration strategies, such as selection of sites, species, functional traits and site preparation.

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Restoring Prescribed Fire to Long-Unburned Longleaf Pine Forests May Mitigate Carbon Loss Due to Wildfire

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Abstract

Restoring fire to long-unburned forests of the southeastern U.S. is a major management goal for maintaining fire-dependent ecosystems and reducing fuels, thus preventing catastrophic wildfires. However, there is concern that fire restoration will decrease forest carbon (C) storage, thereby limiting forest capacity to mitigate climate change. Here, we compared the C storage consequences of carefully implemented re-entry prescribed fires to wildfires in two montane longleaf pine sites in central Alabama, USA. At each site, we established 20-30 plots in each of the re-entry prescribed fire and wildfire areas to quantify C pools (i.e., live trees and snags, understory vegetation, leaf litter, organic soils, and downed woody debris) using a combination of allometric equations and harvesting. All C pools were measured pre-fire and immediately post-fire in re-entry prescribed fire plots, immediately post-fire in the wildfire plots, and the growing season after the fires in all plots to capture delayed tree mortality. Wildfires consumed 25% more organic soil C than prescribed fires, but this was offset by an increase in woody debris C in wildfire plots. Consequently, total non-tree C declined similarly (~ 30%) following re-entry and wildfires compared to pre-prescribed fire plots. C loss due to tree mortality was ~ 3 times higher following wildfire compared to re-entry prescribed fire. Our findings suggest that carefully restoring fire to long-unburned forests using well-planned prescribed fires will initially reduce ecosystem C pools, but this reduction will be substantially less, and recovery likely faster, than in the case of a wildfire.

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Predicting the spread of two southwestern invasive plant species, to better understand potential biodiversity loss in sensitive ecoregions.

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Abstract

Invasive species can significantly alter ecosystem stability and resilience by disrupting structure and function. *Cenchrus ciliaris* (Buffelgrass) and *Oncosiphon piluliferum* (Stinknet) are two aggressive invaders of the southwestern United States, particularly within the Sonoran Basin and Range and Madrean Archipelago ecoregions. These species contribute to increased fuel loads and landscape connectivity, intensifying fire risks in historically fire-limited desert ecosystems. Using species distribution models (SDMs) trained with Random Forest algorithms, we mapped the predicted distributions of *C. ciliaris* and *O. piluliferum*, incorporating bioclimatic and edaphic variables such as precipitation patterns, vapor pressure deficit, and soil composition. The models demonstrated high predictive performance (AUC: 0.92–0.93), highlighting key environmental drivers of each species' establishment.

To assess potential biodiversity impacts, we quantified the spatial overlap between these invasive species and species richness data across taxonomic groups (birds, mammals, reptiles, and trees). Our results indicate substantial habitat overlap, with *C. ciliaris* showing strong associations with arid and semi-arid landscapes with moderate clay content and annual precipitation between 200–600 mm. *O. piluliferum*, in contrast, was strongly influenced by seasonal precipitation and temperature variations, favoring areas with high vapor pressure deficits.

By integrating species distribution modeling with biodiversity assessments, our study underscores the potential threat these invaders pose to regional biodiversity. Understanding their ecological niches can inform targeted management efforts to mitigate habitat degradation and protect sensitive ecosystems in the southwestern United States.

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Leveraging Intergenerational Partnership to Improve Fungal Innovations in Small Water Cycle Restoration in the Mountain West & Connected Arid Rangelands

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Abstract

In the Mountain West and connected arid rangelands, deforestation, agriculture and urbanization disrupted the small water cycle, which is responsible for ~60% of an area's moisture. Here, these activities destabilized soils leading to dust on snow, early snowmelt, and less useful water for the watersheds. Now, snowmelt releases water to streams before farmers in the San Luis Valley can irrigate their fields with it, and early snowmelt threatens to strain habitat for the Sandhill Crane and other migratory birds. Humans have urbanized the forest and now have less organic matter in soils across the watershed. Lower soil organic content translates into less water-holding and overall disrupts the small water cycle. In this presentation, we share results from the intergenerational partnership of Mycoreach with Fungal Solutions. This partnership leverages decades of practical forestry experience with deep expertise in mycoremediation to improve efforts to restore the small water cycle through bolstering fungal activity in the forest and arid rangelands. To this end, we share how (1) we produced rigorous scientific studies documenting restoration success; (2) we have taken two paths (nonprofit, for-profit) to improve success likelihood; and (3) we broadened the area feasible to implement fungal restoration efforts. Our partnership allows us to stabilize soils so the dust cannot become airborne and improves water holding capacity in the forest soils, restoring the small water cycle in the Mountain West.

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Promoting understory forest regeneration through downed woody debris and forest overstory management.

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Abstract

The importance of downed woody debris (DWD) in forest restoration has long been recognized, with recent studies focusing on DWD-facilitated microsites for understory vegetation establishment and seedling regeneration. The main benefits of DWD microsites, including amelioration of surface temperatures and soil moisture deficits, can be altered on a larger scale by the forest overstory. By placing DWD under overstories with varying canopy cover, we will determine if overstory influences negate the need for microsite benefits, if microsites function independent of overstory, or if the two work jointly to optimize post-disturbance forest restoration and regeneration. We will intentionally place DWD in forests of varying canopy cover: 0%, 1-25%, 26-50%, and greater than 50%. We will measure species diversity and physiological response on selected species, such as broadly distributed Douglas-fir, next to DWD and independently of DWD within each cover class, as well as abiotic conditions of soil surface temperature and soil moisture. We hypothesize the response to DWD under varying canopy cover will vary by species and their shade and temperature requirements, but DWD will be most beneficial under low canopy cover. These results will inform DWD retention post-disturbance or logging and will guide management strategies to optimize forest re-establishment. Through project design, implementation, and dissemination of findings, we will collaborate with the commercial timber industry, private foresters, government agencies, and Tribes, engaging with those who make decisions about forest management on a broad scale and promoting uniform implementation of DWD as part of forest management and restoration plans.

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Accelerating Freshwater Wetland Restoration in the Chesapeake Bay Watershed: A Collaborative Approach in South Central Pennsylvania.

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Abstract

States across the Chesapeake Bay watershed are struggling to meet the Chesapeake Bay Program's freshwater wetland restoration goals. Pennsylvania has fallen short in meeting restoration goals, thus we targeted the Lower Susquehanna region to improve water quality and accelerate wetland restoration, as it supplies half of the nitrogen to the Bay, largely from agricultural lands. Collaborative efforts are needed to plan and implement a system-wide vision, frameworks, and delivery plans for habitat restoration. Thus, strong partnerships are crucial to accelerate large-scale restoration across the watershed. By creating and supporting regional partnerships, we aim to accelerate progress using a common framework, adapted to each landscape and community's unique needs. The long-term vision is for partners to unite around and advance wetland restoration strategies, with increased capacity to engage landowners in opportunities. In spring 2022, as part of a larger watershed-wide grant, The Nature Conservancy brought together local partners in two agricultural watersheds, developing robust partnerships to accelerate stream and wetland restoration in agricultural landscapes in south-central Pennsylvania. Each partnership created a 5-year strategic plan focused on utilizing full floodplain restoration and nature-based solutions that will be managed adaptively to reflect updates and changing conditions. The plan outlines strategies related to outreach, getting to scale, prioritization of restoration locations, identifying funding opportunities, and defining partner roles. With this collective plan, we built a shared vision, that identifies goals and opportunities for each partnership's collective efforts now and in the future and one which moves us towards rapid acceleration of completed restoration projects.

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Empowering Restoration: Innovative Decision Support Tools for Successful Project Planning

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Abstract

Decision support tools can increase the odds of restoration success, help users secure project funding, and enable the efficient use of limited resources. Early phases of restoration project planning and grant applications are often completed by local planners without direct involvement by restoration subject matter experts, which can compromise the quality of the restoration action. As restoration scientists, we developed innovative and practical decision support tools to assist local planners in identifying and ranking restoration needs, defining specific restoration objectives, and filtering applicable restoration techniques to meet those needs and objectives. These tools are customized to the user (local federal offices and a watershed coalition, to date) through a collaborative process that considers their existing processes, management priorities, and project goals. The tools' libraries of restoration techniques and site prioritization criteria are tailored to include proven approaches for the project region. The tool returns summarized information on appropriate techniques or project locations, with supporting data to facilitate further comparison (e.g., per-unit cost, methods, the level of effort, and the expected durability). Decision support tools do not need to be complicated to be highly functional; we demonstrate that Excel-based decision support tools are transparent about the datasets included, ranking metrics, and selection criteria. The process of using a decision support tool gives the local planners the benefit of guidance from restoration scientists and access to educational material on demand, empowering them to select the right project site and the right tool for the job, thereby improving the probability of restoration success.

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Persistence of a Rare Mojave Desert Annual Species at a Novel Utility-Scale Solar Energy Facility

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Abstract

Supportive policies, economic initiatives, and technological advances put renewable energy on course to meet nearly half of global electricity demand by 2030. Utility-scale solar energy (>1 megawatt capacity; USSE) is a primary driver of this boom, accounting for 80% of the projected growth in global renewable capacity by the end of the century. Mitigation is crucial to reducing environmental impacts. In situations where sensitive resources or unique habitats are not avoided, methods such as “drive and crush” and “overland travel” can minimize soil, vegetation, and hydrologic disturbance. The goal of our study was to understand the plant population and life history characteristics of a rare plant species, threecorner milkvetch (*Astragalus geyeri* var. *triquetrus* [A. Gray] M. E. Jones) under novel conditions within the Gemini Solar + Storage facility (north of Las Vegas, Nevada, USA) or if the modified environment is detrimental. This study analyzed threecorner milkvetch inside and outside the facility footprint and compared the effects of photovoltaic panel microsites (interspace, panel dripline, under panel) on demography and phenology. The results of this one-year study during a favorable year of rainfall demonstrate the persistence of a rare Mojave annual species within an altered environment at a USSE facility. Threecorner milkvetch at Gemini emerged earlier, had an earlier phenology, and had a higher fecundity yet lower reproductive effort compared to plants off-site. The results of this study can assist land managers in making decisions about land use choices as the demand for USSE grows.

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Remote sensing of fluvial geomorphological responses to Stage 0 restoration on an ephemeral stream in North Idaho using UAS-driven LiDAR

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Abstract

Stage 0 stream restoration is a novel, process-based approach to stream and riparian restoration in depositional valleys. Through the direct modification of the geomorphological template upon which the stream exists, Stage 0 is a high cost, high impact approach to restoration driven by the goal of creating a meta-stable, anastomosing network of channels across a broad floodplain. UAS-driven Light Detection and Ranging (LiDAR) offers an affordable, rapidly deployed solution for measuring geomorphological change on increasingly finer spatial and temporal scales, allowing for effective monitoring of stream channel evolution following Stage 0 restoration. Using a recent Stage 0 restoration along an ephemeral stream in north Idaho, UAS-driven LiDAR data were collected at the beginning of the water year, during the peak of spring runoff, and at the beginning of zero flow conditions during the 2024-2025 water year. These data were compared to detect areas of erosion and deposition, identify specific, stable large wood features driving changes to the channels, and assess the metastability of the floodplain's average width-to-depth ratio, entrenchment ratio, and sinuosity. Data were compared to pre-restoration aerial LiDAR to obtain a distance-to-degradation index and quantify the stability of the restoration project.

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Evolving Knowledge and Efficiency in Native Seed Propagation, Production, Harvest, and Cleaning Techniques for Restoration Across the Colorado Plateau

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Abstract

Quality ecological restoration success depends on high-quality, locally adapted plant materials. Since 1975, the Upper Colorado Environmental Plant Center (UCEPC) has focused on improvement and development of available plant material for restoration through collection, evaluation, propagation, and release of native species. Our ongoing research, in collaboration with the Bureau of Land Management (BLM) and the Colorado Plateau Native Plant Program (CPNPP), aims to increase the availability of locally adapted forbs, crucial for habitat restoration across the Colorado Plateau.

Current gaps in research on propagation, germination, and seed production of native forbs have resulted in insufficient technical guidance for restoration efforts. To address this, UCEPC has conducted a series of trials on the propagation, harvest, and cleaning techniques for nine native forb species, including *Penstemon* spp., *Sphaeralcea parvifolia*, *Packera multilobata*, *Eriogonum umbellatum*, and other regional species. These trials tested various methods to determine the most effective practices for seed yield and quality, including optimization of harvest timing, harvest equipment and seed cleaning techniques, providing data to improve native seed production efficiency.

The species used in this project are adapted to specific elevation ranges, soil types, and precipitation levels across the Colorado Plateau, with potential for broader application. Increasing the availability of genetically diverse, locally sourced seed reduces dependence on non-local or poorly tested materials, which may fail in certain environments due to mismatched adaptation. By expanding access to regionally adapted plant materials, restoration efforts can better meet the unique environmental needs of each site, enhancing long-term success and resilience

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Rebuilding a Lake-Facing Community: Cultural Restoration in the Great Salt Lake Watershed

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Grow the Flow, Salt Lake City, Utah, USA

Abstract

At Grow the Flow, we believe the Great Salt Lake can and must be saved. Currently, we are not on track to get enough water to the lake to reverse its ongoing ecological collapse. The substantial policy progress over the last five years has increased the amount of water flowing to Great Salt Lake by ~100,000 acre-feet of water annually—only 10% of the water needed to reverse the lake’s decline. Grow the Flow is a coalition that seeks to catalyze an unprecedented flood of public support and policy innovation to increase water security in the Great Salt Lake watershed. Our goal is to mobilize a geographically and ideologically diverse coalition of more than 100,000 people in and around the watershed to support the implementation of a lake rescue plan. We intend to reconnect the people of the watershed to the land, healing rifts torn by misinformation, overconsumption, and apathy. By working collaboratively with legislators, researchers, issue-experts, and advocates in the pursuit of non-partisan solutions, we strive to coordinate and elevate next steps for establishing lasting water security that includes all the human and nonhuman water users in our region. Simultaneously, our collaboration with indigenous groups, artists, poets, and writers seeks to rebuild a lake-facing people, bringing our community back to the water. To our knowledge, no community has yet succeeded in restoring a major saline lake after it tips into decline. It’s only together that Utah will become the first.

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"Mapping Interfaces, Mobilizing Solutions: The Wright-Ingraham Institute's Dust on Snow and Drought Tool Initiatives"

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Abstract

Effective environmental problem-solving requires bridging disciplines, communities, and knowledge systems. Collaborative, multi-stakeholder research can produce more locally responsive and resilient solutions to socio-ecological challenges. Wright-Ingraham Institute (WII) has been developing and refining tools to support this approach and will present its latest methodologies, which have led to effective community-based resilience projects in southern Colorado.

WII applies interdisciplinary, place-based research to address complex environmental problems. This presentation will highlight WII's collaborative model through two projects: Dust on Snow: Southwest Initiative on Land Health and Water Resources and Drought Interfaces, both integrating diverse knowledge systems to develop actionable solutions.

- Dust on Snow convened 21 scientists, artists, farmers, and community leaders to address accelerated snowmelt in the San Juan Mountains. This participatory project emphasized a "think like a watershed" approach, integrating social, ecological, and economic factors to develop land and water management proposals that reduce dust mobilization and align with community needs.
- Drought Interfaces, developed with Boston-based engineering firm Certain Measures, is a digital tool designed to help communities understand water rights in drought-prone regions. It translates complex legal and physical data into accessible insights for policymakers, researchers, and the public.

These projects exemplify WII's methodologies: interdisciplinary collaboration, place-based engagement, dialogue, and creative praxis. By addressing the interfaces within complex systems, WII provides a model for building interdisciplinary teams, engaging stakeholders, and translating knowledge into action for communities and the environment.

Riparian Restoration Planning in an Urban Setting: Working Across Jurisdictional Boundaries to Holistically and Collaboratively Prioritize Project Sites Through a Data-Driven Approach

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Abstract

Urban rivers exist within complex settings, constrained by modern development, overwhelmed by human use, markedly impacted by historical uses, and managed by a conglomeration of local, state, and federal agencies and private landowners. The mixed uses within and adjacent to riparian corridors commonly lead to environmental degradation, and the multi-jurisdictional nature of these areas creates complexities in management and permitting, making the pursuit and funding of restoration challenging. The urban stretch of the Truckee River, situated within the cities of Reno and Sparks, Nevada (USA), is impacted by impaired water quality, bank hardening and channelization, native vegetation loss, noxious and invasive species, degradation of threatened fish habitat, and an amplified hydrologic cycle. One Truckee River (the local watershed coalition) and its partner, Nevada Land Trust, are working to collaboratively prioritize vegetation management and restoration actions in the urban stretch of the Truckee River (study area). The project approach was centered on the engagement of a Technical Working Group, composed of local agencies and organizations. From the collection of data and development of the study design to the structure of the analysis tools, the input of this Technical Working Group was critical in generating prioritization criteria, compiling and collecting data, and analyzing a robust dataset of environmental, feasibility, and public need indicators for over 200 study area polygons. This dataset, and the accompanying tools, provide a mechanism for jurisdictions to apply their management priorities to identify projects and justify funding with a scientifically driven prioritization framework.

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Stakeholder engagement facilitation through the lens of a former educator.

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Abstract

Stakeholder engagement and facilitation act as a bridge, developing shared understanding between community members and technical specialists, much like student-led learning fosters a deeper understanding of content among students. In both cases, the goal is to create meaningful connections and shared understanding through active participation. Effective stakeholder engagement is not unlike planning for and managing a classroom. The facilitator, or teacher, seeks to keep participants actively engaged by encouraging collaboration and providing opportunities for individuals to share their thoughts and ideas in a variety of modalities, encouraging active participation throughout the process.

Methodologies used in facilitation will be evaluated alongside educational techniques that have similar outcomes and goals. Complementing methods may include workshops, focus groups, Socratic seminars, visual mapping exercises, collaborative design, and guided exploration. Examples will be provided of how these methods result in better outcomes, stronger relationships, and reduced conflict. Additional strategies will be explored and analyzed to further provide more insight into promoting participation in meetings and building trust and ownership throughout the engagement process. Stakeholders that feel ownership and have a clear understanding of the project's goals and processes are more likely to support its success.

Facilitation goes beyond collecting and sharing information, encompassing the creation of a shared vision and ensuring the community has a role in shaping the activities that affect them, just like that of a successful classroom. Participants will come away with a better understanding of educational strategies that can be utilized to complement stakeholder engagement for more effective facilitation.

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Rising Tides, Resilient Communities: How Grassroots Action is Restoring and Protecting Our Coasts

Carla Avila-Martinez

Surfrider Foundation, San Clemente, USA

Abstract

Coastal communities face rising seas, erosion, and habitat loss, demanding bold, community-driven solutions. The Surfrider Foundation's Climate Action Program empowers local communities to restore critical ecosystems and strengthen coastal resilience by providing resources, training, and guidance for local restoration and advocacy efforts.

From California to Puerto Rico, Surfrider's nationwide network of over 150 chapters and clubs leads grassroots restoration efforts to enhance coastal resilience. Local residents and students are revitalizing dunes, mangroves, and other essential habitats, bolstering natural defenses against climate change. In Puerto Rico, community-led mangrove and dune restoration is helping protect vulnerable shorelines. Carla Avila-Martinez will share insights from these projects, highlighting how hands-on engagement fosters long-term sustainability.

Beyond restoration, Surfrider's approach to adaptation planning prioritizes inclusive collaboration. Too often, adaptation efforts overlook meaningful community involvement, treating engagement as an afterthought. By fostering early partnerships with Tribal leaders, preservation groups, and government agencies, Surfrider transforms coastal planning into shared, actionable visions. This presentation will highlight successes at Surfers' Point (Ventura, CA) and San Onofre (San Diego, CA), where early community involvement has shaped effective resilience strategies.

Together, these efforts create a replicable framework for practitioners and policymakers, demonstrating how restoration and adaptation can work in tandem to protect coastlines while centering the needs of local communities.

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Modifying dryland connectivity alongside herbicide application to restore herbaceous cover in shrub-encroached grasslands

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Abstract

Many arid and semi-arid grasslands worldwide experience woody plant encroachment (WPE), which often reduces herbaceous perennial plant cover and increases bare soil exposure between encroaching woody plants. Bare soil interspaces can then form long, connected pathways through which ecosystem resources (e.g., soil, plant litter, seeds) are redistributed across the landscape by wind and water. Increased connectivity and sediment transport through these pathways can heavily impede the re-establishment of herbaceous species, creating a self-reinforcing feedback that hinders restoration. We installed four Connectivity Modifier (wire mesh formed into an “X” pattern; ConMod) and control arrays in bare soil interspaces on each of our 16 5-ha plots, half of which were previously treated with herbicide to control encroaching Honey mesquite (*Prosopis glandulosa* Torr.) shrubs on the Jornada Experimental Range in southern New Mexico, USA. We expected that ConMods would reduce sediment movement, increase retention of ecosystem resources, and support grassland restoration more effectively than herbicide application to reduce WPE alone. After two growing seasons, ConMod arrays retained more resources (plant litter, soil) than control arrays. Annual species only increased in response to herbicide and perennial forb abundance did not differ across any combination of the herbicide or interspace connectivity treatments. Perennial grasses, often the key functional group targeted in grassland restoration, were most abundant within ConMod arrays on herbicide-treated plots, however. Our results indicate that the combination of herbicide treatment to control WPE and ConMods to reduce connectivity can promote early re-establishment of perennial grasses in arid shrub-encroached grasslands.

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Tree related Microhabitats (TReMs) as a Novel Ecological Recovery Indicator in Forest Landscape Restoration

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Abstract

Global environmental change necessitates a paradigm shift towards evidence-based forest restoration as a critical strategy for mitigating climate change, conserving biodiversity, and maintaining essential ecosystem services. Restoration interventions aim to reverse forest degradation by restoring ecological integrity and enhancing socio-ecological resilience. However, the effectiveness of these efforts depends on robust monitoring frameworks that integrate comprehensive indicators to assess ecological recovery. Despite this need, current restoration monitoring often lacks robust metrics for evaluating structural diversity. Therefore, this study investigates Tree-related Microhabitats (TreMs) as a novel approach to bridge this gap, offering insights into ecological recovery and biodiversity restoration. It presents the first comprehensive assessment of TreM diversity and ecological significance in Himalayan Cedar forests within a protected area in India. Forty circular plots were randomly distributed across three forest ranges, and within each plot, three large trees were surveyed to record detailed data on TreM abundance and richness. The results indicate that epiphytic crypto- and phanerogams dominate these microhabitats, exhibiting considerable variability in abundance. Additionally, canopy class and diameter at breast height emerged as the primary predictors of TreM richness and abundance. This study establishes TreMs and standard dendrometric parameters as key indicators of forest recovery following restoration, emphasizing biodiversity enhancement, environmental degradation mitigation, and long-term conservation. By advancing a rigorous understanding of structural diversity in forest ecosystems, this research contributes to high-quality, evidence-based restoration practices in the Himalayas and beyond.

Keywords: Tree-related Microhabitats (TreMs), Forest Landscape Restoration, Biodiversity Conservation, Himalayan Ecosystems

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Exploring the eco-hydrological and animal movement effects of floating roads in the context of forest to bog restoration in the Flow Country.

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Abstract

Exploring the eco-hydrological and animal movement effects of floating roads in the context of forest to bog restoration in the Flow Country.

The global network of linear infrastructure is expanding worldwide as demand for resources increases. Yet the effects of linear infrastructure on ecosystems is poorly understood. Even less is known about if and how these effects could be reversed through road restoration. Further, much of our foundational data on ecosystem health is based on traditional and legacy monitoring methods that are easy and cheap to gather at the management scale. On the other hand, modern high throughput monitoring technologies may be able to elucidate these effects and provide faster and more reliable monitoring of intact and restored landscapes and landscape features. This project explores how unpaved floating roads affect peatland health, through eco-hydrology and animal behaviour in the Flow Country UNESCO World Heritage site in Northern Scotland. We used a mixture of traditional and emerging methodologies such as scat counts, camera trapping, DNA metabarcoding, in-situ water table depth and remote sensing (INSAR) to evaluate their usefulness for monitoring a wide range of ecosystem effects associated with floating roads, and comment on the scope for road-bog restoration in the Flow Country and peatlands in general.

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EcoTeam: Teaming up to create efficiencies in the Tualatin River watershed

James Steele

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Abstract

In order to create resilient, thriving landscapes, we have to act on unprecedented scale. Our approach has responded to the challenges of urbanization, climate change, agricultural vibrancy, and ecological diversity. Programs and partnerships, such as Tree for All (<https://www.jointreeforall.org/>), have proved capable of acting on a scale that ensures a healthy watershed now and for future generations through dozens of case studies. With partners engaging regularly, and early in project planning, we are able to more effectively carry out ecological restoration projects. Through collaborative management outlined in intergovernmental agreements, each organization is empowered to oversee projects on behalf of the other, as needed. This approach enables project management based on factors such as capacity, interest, local expertise, and alignment with adjacent projects. We have developed programs that allow local agencies to leverage and combine federal funding to reimburse landowners who consent to the ecological restoration of their properties. By coordinating efforts where feasible—such as when addressing vegetated corridor mitigation requirements—we can restore larger areas through the habitat conservation initiatives of partner districts. Long-standing relationships have fostered partnerships, enabling organizations that acquire large land tracts (e.g., land trusts, Metro) to efficiently access funding opportunities without the need to apply for grants. Such partnerships allow us to leverage knowledge, skills, and capacity to scale up and work on comprehensive restoration projects, not just single parameter, but multi-objective nature-based solutions

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USING MOWING AND PROPAGULE PRESSURE IN RESTORATION TO ALTER COMPETITION BETWEEN NATIVE AND INVASIVE ANNUAL PLANT SPECIES

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Abstract

Mowing and native seeding are common habitat restoration techniques as they can be cost-effective and less labor intensive than other methods. The purpose of this study was to 1) examine the interaction between mowing and varying native propagule pressures and assess their effects on competition between native and invasive annual species and 2) assess whether mowing will attract additional consumers and if there is an impact of their seed preferences on available propagules. Eight blocks, each with seven marked plots within them, were established in the Voorhis Ecological Reserve on the campus of Cal Poly Pomona. Half of the blocks were mowed with the resulting litter raked and removed. Six plots per block received a native seeding treatment of varying seed levels with two plots established as controls. Data collected included species abundance and photosynthetically active radiation in 2022 and 2023. Mowing had a greater effect than propagule pressure, contributing to decreased invasive abundance and slightly increased means and variability of native abundance and richness in both years. Higher native propagule pressure decreased invasive abundance in the first year of seeding, a season with low precipitation, but had no effect the second, a year with higher than average precipitation. Consumer visitation was higher in mowed blocks, however, there was no difference in amount of predation between mowed and unmowed treatments. Overall, mowing is an effective method to decrease invasive annual abundance in years with varying precipitation and more studies are needed on how to make native seeding successful long term.

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Transforming Green Deserts: Establishing Hedgerows to Enhance Biodiversity and Species Composition in an Oil Palm Plantation on Bangka Island, Indonesia

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Abstract

The oil palm industry is often criticized for not integrating biodiversity concerns into its operation. As with other industrial scale monoculture, oil palm estates are often likened to "green deserts", because of their structural ecological simplicity and lack of habitat variety. Despite increasing efforts in industry to set aside and manage conservation areas, most plantations continue to underperform in increasing the ecological diversity. Hedgerows are commonly established in temperate regions but remain a novel feature in tropical agriculture. They have proven important to a host of invertebrate and vertebrate diversity by providing food, shelter, and as corridors for natural gene dispersal. This study explores the effect of establishing hedgerows as microhabitats to enrich the existing plantation system and attract new and more species.

In MP Evans' oil palm estate on Bangka Island, Indonesia, three sites of hedgerows measuring 1,800m long and 3m wide were set up along powerlines and other non-productive land. To test the effect on local species diversity and palm oil production, each hedgerow was planted with 1,600-2,400 seedlings of native shrub, bush, and small tree species representing 10-26 species. The species were selected for functional benefits such as flowering, fruiting, structural complexity for nesting and protection, and ease of propagation to maximize biodiversity impact. At T₀, species baseline survey was undertaken (invertebrates and vertebrates) for each site. Collected species were kept in 70% alcohol and identified to family level at the laboratory. The survey was repeated monthly, and data were analyzed for potential changes over time.

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Supporting local communities and indigenous peoples to influence conservation of biodiversity mainly Sitatunga species in Lake Kanyaboli and the associated Yala swamp

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Abstract

Lake Kanyaboli and the surrounding Yala Swamp wetland have been recognized as an important biodiversity hotspot. Recent population, genetic and phylogenetic studies confirm the evolutionary importance of Lake Kanyaboli in preserving the cichlid fish fauna of Lake Victoria. The adjoining Yala Swamp harbours the endangered swamp antelope Sitatunga (*Tragecephalus spekii*) and several papyrus endemic birds. The lake and adjoining swamp play a critical role in the livelihood of the local communities who heavily depend on the wetland resources. Current ongoing large scale land use and changes within the swamp threaten the ecological integrity and functioning of this highly dynamic wetland ecosystem. It is therefore imperative that proper management and conservation measures are put in place to protect Lake Kanyaboli and the associated Yala Swamp. This paper presents a review of the biodiversity of Lake Kanyaboli and the associated wetland and the threats this ecosystem has to face. Polycultural finger-ponds aquaculture (see Figure 3), tourism and papyrus based industries as well as an all-stakeholders-driven management plan is suggested as a step towards achieving sustainable management, utilization and conservation of the Lake Kanyaboli ecosystem.

More about the Lake Kanyaboli and Yala swamp is in the link below:

https://www.google.com/url?client=internal-element-cse&cx=a3f3408b7d24d8336&q=https://www.researchgate.net/publication/228797813_Bio_diversity_and_sustainable_management_of_a_tropical_wetland_lake_ecosystem_A_case_study_of_Lake_Kanyaboli_Kenya&sa=U&ved=2ahUKEwtk8W8x8yKAXVfUqQEHTZqEq4QFnoECAUQAQ&usg=AOvVaw2nGOH52GGps3DTJDG_ByYY&fexp=72801196,72801194,72801195

https://www.google.com/url?client=internal-element-cse&cx=a3f3408b7d24d8336&q=https://www.kefri.org/assets/publications/articles/The_difficult_choice_to_conserve_the_living_fertilizers.pdf&sa=U&ved=2ahUKEwtk8W8x8yKAXVfUqQEHTZqEq4QFnoECAsQAQ&usg=AOvVaw3bR_14V2KEvFCYIVwLPPON&fexp=72801196,72801194,72801195

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Building Native Food Forests that Support Wildlife & People

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Abstract

In 2023, we planted a “Miyawaki food forest” at George Mason University in suburban Northern Virginia. Our mission is to grow food in a way that supports wildlife, fosters outdoor recreation, and advances climate resilience. To our knowledge, this is the first project to adapt the Miyawaki method of reforestation to create a 100% native food forest. This presentation will provide a case study of our project and guidance on replicating this project in other contexts.

The project covers 5,300 square feet and is planted with 2,000 native trees, shrubs, grasses and wildflowers. Over 57 plant species are represented at the site, including 26 edible and food-producing plants such as blueberries, plums, hazelnuts, and American chestnuts.

As a university, we also use our native food forest to facilitate education, research, and service learning. GMU students are currently tracking individual trees to record changes in plant phenology due to climate change; tracking changes in soil health after a soil improvement project at the site; and getting hands-on experience managing natural lands in and around the food forest.

Because native food forests support wildlife and people, they are a valuable tool in the urban restoration toolbox. Native food forests are ideal for schools, universities, community centers, houses of worship, HOAs, and even residential backyards. By creating safe foraging spaces, these projects help communities to rediscover the value of their native ecosystems.

Effects of the functional trait-environment relationship on the restoration of the Brazilian Atlantic Forest

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Abstract

The comprehension of how plants' functional traits contribute to the overcoming of environmental filters can represent a tool that complements usual restoration practices. The Structural Equation Modeling (SEM) technique was used in an exploratory data analysis to represent causal relations among plant functional traits and environmental factors in 5-year-old mixed tree species plantations for the recovery of the Atlantic Forest in Southeastern Brazil. Leaf and wood traits and soil and landscape attributes were sampled from 50 individuals planted in areas where mean annual rainfall ranges from 1,000 to 2,000 mm. The SEM is based on a path analysis to explore the correlations between plant traits and environmental attributes (latent variables), and the aboveground biomass (AGB) estimated for the plantations was used as the observed variable. We used the lavaan package in the R statistical programming language to perform the analysis. Preliminary results from path models that better fitted (higher R^2) showed that: soil K content had a positive and significant correlation with stomatal opening, which is suggested to affect aboveground biomass negatively; topsoil pH did not affect plant traits, but was positively and significantly correlated to AGB; slope and altitude showed a positive correlation with stomatal traits, but a negative correlation with AGB; topsoil K content and pH were not correlated with wood density, which was not found to affect AGB significantly. At the early stages of forest restoration, landscape factors, and soil attributes were suggested to be more relevant drivers of the performance of tree plantations.

Nature based restoration of sand dunes by Sea oats (*Uniola paniculata* L.) on the Georgia Coast, U.S.A.: role of Arbuscular Mycorrhizal Fungi

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Abstract

Coastal sand dunes are fragile ecosystems that serve as natural defenses to protect barrier islands and the adjacent mainland during severe storms. A high frequency of disturbances may result in dune erosion. Several strategies have been used for coastal restoration; however, previous practices often lack the connection between plants and below-ground microbial communities. Symbiotic arbuscular mycorrhizal fungi (AMF) are beneficial in supplying a range of limiting nutrients to the host plant while improving dune stability. This study assessed the diversity of the indigenous AMF and soil fungal communities associated with *Uniola paniculata* L. (sea oats) on natural dunes and restored dunes at Jekyll and Tybee Islands on U.S. Georgia's coast. At each site, samples were collected from 10 dune ridges that were randomly selected along a 100-m transect where sea oats were growing. The genomic DNA was extracted from 60 sand and sea oats root samples. A total of 13 amplicon sequence variants (AVS) of AMF were identified; seven were classifiable to the species level. The most abundant genera of AMF were *Glomus*; the most abundant species were unclassified *Glomus* spp., followed by *Glomus custos* and *G. deserticola*. Using the Sorensen-Dice coefficient, the study showed that AMF assemblages of the natural dunes of both sites shared a high similarity (0.73). However, AMF assemblages of the Jekyll Island natural site had no (0) similarity to one of the restored site on Jekyll Island. These findings demonstrate the need to manage AMF assemblages during coastal dune restoration.

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It Starts with Seeds: Building restoration success from the ground-up in arid lands

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Abstract

In disturbance-prone landscapes, such as the Southwestern United States, successful habitat restoration starts with access to seeds from the right species and sources catered to project site and region. Because diversity of seed for native species is extremely limited in commercial marketplaces, practitioners lack options for native seeds that can best support restoration success. Plant materials development, from wild collection through production, provides a crucial first step, ensuring the species used in restoration projects are both available and appropriate. The seed itself provides a foundation for success. As the seed continues its journey, it encounters many obstacles in parched and eroded arid landscapes that can be overcome with innovative techniques, such as watering strategies for establishment and survival (e.g., passive and manual watering, water harvesting methods), herbivory management, and effectiveness monitoring to continually improve practices. This presentation highlights innovative steps for successful restoration at different scales - from small recovery efforts using nursery stock to large scale seeding efforts. It draws upon insights from native plant materials development via the [_](#) and the regional River for Pollinators project that is restoring 20 steppingstone sites along a 200 mile stretch of New Mexico's Rio Grande corridor. Providing insights from the perspective of the seed helps illustrate the complexity and thoughtfulness required at every stage and has broad implications for restoration projects across regions, for diverse practitioners, and in response to a variety of restoration needs (e.g., wildfire response, mine reclamation, endangered species habitat degradation).

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The Coastal Habitat and Water Quality (C-HAWQ) Initiative - Marco Island, Florida

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Abstract

Marco Island is a 24 square mile island located within the Rookery Bay watershed in Southwest Florida. Built in the 1960s, the once mangrove-dominated island has become an affluent community connected by over 100 miles of constructed inland canals. Decades of aging septic system infrastructure, wastewater mismanagement and fertilizer use have led to an overaccumulation of nutrients within these interior waterways. Empirical evidence for the reduction in water quality has been reported by residents for years, evident in increased algal blooms, water turbidity, and reduction in once-prevalent wildlife observations. Drastic improvements are needed to improve water quality within the canals and surrounding high-quality conservation areas.

The C-HAWQ Initiative intends to address the primary source of water quality impairment that lies within the accumulation of nutrient rich sediments along the canal bottoms. The project proposes to dredge the sediments from the canals to achieve uniform bottom depths and subsequently utilize the dredged sediments to construct a series of islands within the inland canals and bays. Planted with native mangrove and salt marsh species, the islands will introduce beneficial biological systems to provide a means of denitrification through microbial processes and to a lesser extent, uptake into plant tissues. Structure will be provided for bivalve habitat, further increasing capacity for nutrient and sediment removal. While beneficial reuse of dredged sediment projects have been executed successfully both nationally and internationally, this project provides a unique solution regarding methods, layout, scale, and intent to improve water quality in the long-term.

Ecological restoration of *Prosopis juliflora* invaded lands using native species at Pudukkottai Tamil Nadu, Southern India

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Abstract

Prosopis juliflora has invaded the arid and semi-arid plains of India which threatens biodiversity. Besides conventional management methods, active ecological restoration interventions have emerged as a key strategy to control invasion of invasive species. Present study aims to restore *Prosopis juliflora* invaded lands at Pudukkottai Tamil Nadu involving native species and evaluate the role of shrub cover in restoration success. *Prosopis juliflora* cover was removed twice in the invaded lands, and 450 saplings of 24 native species, *Azadirachta indica*, *Vachellia leucophloea*, and *Ficus benghalensis*, were planted in four experimental plots classified under two models: Restoration Model With Shrub Cover (RMWSC) and Restoration Model Without Shrub Cover (RMWOSC). Shrub species including *Dodonaea viscosa*, *Jatropha gossypifolia*, *Senna auriculata*, *Phoenix pusilla* were introduced in RMWSC. Restoration monitoring was carried out for four years 2020 to 2024 and ecological profiles of the plots were closely monitored. Before restoration (2020) species richness of RMWSC and RMWOSC were 18 and 14 but after restoration (2024) species richness was 69 and 52 respectively. *Prosopis juliflora* density declined in RMWSC plots, whereas in RMWOSC, an initial decline was observed followed by a resurgence in later stages. K-means clustering revealed that RMWSC closely resemble benchmark sites. Bayesian regression indicated that native plant establishment was the key factor suppressing *Prosopis juliflora* reinvasion demonstrating biotic resistance. Present study highlights that active restoration interventions effectively suppress the invasion and promote the recovery of native plant community in *Prosopis juliflora* invaded eco-system.

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Can the Policy System Promote the Multiple Benefits of Forests from the Perspective of Forest Restoration Practices? — An Analysis of China's Current Trend and Challenges

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Abstract

The effective design and establishment of policy systems, coupled with institutional, financial, and other resource support, are crucial for ensuring that forest restoration prioritizes quality over mere quantity. However, there remains a lack of scientific understanding and evaluation of whether the existing forest restoration policy system effectively enhances restoration quality.

Taking China as a focal case, we examined whether the forest restoration policy system over the past 25 years (1999–2024) has effectively enhanced forest quality, including its ecosystem services and biodiversity conservation (hereafter referred to as the multiple benefits of forests). This study develops an assessment framework based on the practical needs of forest restoration to enhance multiple benefits, gathers policy documents related to forest restoration in China, and applies textual analysis to evaluate these policies.

A total of 300 policy documents on forest restoration in China were systematically analyzed, with a particular focus on biodiversity conservation and various ecosystem services, using diverse policy instruments. The analysis reveals that while China's forest restoration policy system demonstrates considerable comprehensiveness in addressing practical restoration needs, notable disparities exist in policy responsiveness across different ecosystem services. Cultural services receive comparatively limited attention within current policy designs. Nevertheless, temporal analysis indicates an evolutionary trend towards more integrated approaches to multiple forest benefits, accompanied by increasing multi-stakeholder collaboration in policy implementation. By examining the characteristics of China's forest restoration policy system, this study assesses its comprehensiveness, design robustness, and potential shortcomings.

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Integrated Watershed Action Plans (IWAP): Integrating ecosystem services, climate change scenarios, and land-use transitions for sustainable watershed management in Mexico

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Abstract

Water resources are highly sensitive to landscape changes, affecting the provision of hydrological ecosystem services (HES). Climate change intensifies these challenges, increasing droughts, extreme precipitation, and water availability imbalances. Addressing these pressures requires a transformative shift in public decision-making and territorial planning to enhance ecosystem resilience and sustainability.

In response, Mexico has developed **Integrated Watershed Action Plans (IWAP)** as diagnostic, planning, and management tools. These plans incorporate HES supply and demand, climate change scenarios, and land-use transitions to support restoration-based decision-making. IWAPs align conservation, restoration, and sustainable production strategies with ecological restoration goals, bridging science and policy.

Developed under the "**Connecting Watershed Health with Sustainable Livestock and Agroforestry Production**" (**CONECTA**) project, IWAPs are applied across **15 watersheds in Chiapas, Chihuahua, Veracruz, and Jalisco**. Their methodology combines high-resolution spatial data, HES modeling, statistical and network analyses, and participatory approaches with gender perspectives.

IWAPs represent a **systemic, long-term framework** that integrates fragmented initiatives, optimizes investments, and prioritizes restoration efforts at the watershed level. By identifying socio-ecological interconnections, they enable **evidence-based decision-making**, ensuring ecosystem service sustainability under future climate scenarios. This approach enhances ecological restoration by addressing geographic, biological, economic, and social dimensions in watershed governance.

This presentation will highlight how **IWAPs advance watershed restoration science, policy, and practice** by fostering an adaptive, integrated management framework, bridging conservation planning with ecosystem restoration goals in Mexico's watersheds.

822

Assessing Climate Vulnerability of Keystone Native Plants: A Collaborative Approach to Climate-Smart Restoration

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Abstract

Restoration practitioners and land stewards must navigate climate adaptation decisions within complex ecological, logistical, and social contexts. To inform decision-making, a trait-based climate vulnerability assessment framework was developed for keystone plant species in the Mid-Atlantic and South-Central U.S. Integral to this framework was collaboration with restoration professionals and land stewards. Through conversations with stakeholders across federal, state, local, non-profit, and private sectors, key challenges and decision-making priorities were identified to shape the vulnerability assessment and development of adaptation resources.

In this presentation, we will share methods and key findings from our conversations and assessment, including practitioner perspectives to incorporating climate information into plant selection decisions, top 'climate-smart' species, and implications for integrating climate adaptation into restoration planning. By linking scientific assessments with real-world decision-making contexts, this work aims to enhance the relevance and usability of climate adaptation resources, ultimately supporting more resilient and effective restoration outcomes.

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Mapping U.S. Peatlands: A New Tool to Conserve and Restore Carbon Sinks

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Abstract

The Pew Charitable Trusts, in collaboration with the U.S. Forest Service (USFS), Greifswald Mire Centre, and Michigan Tech Research Institute, is developing the first national peatlands map for the United States. The map, expected June 2026, will display current and historic extent of peatlands, with an emphasis on the continental U.S., but with additional data for Hawaii, Alaska, and U.S. territories where available. The map will be used to identify intact areas where further protection is needed for these irrecoverable carbon sinks, as well as restoration opportunities for degraded peatlands that would reduce carbon pollution and restore other ecosystem services like flood mitigation. By refining existing USFS mapping efforts with data from under-represented peatlands (forested, coastal, and floodplain) and incorporating new advancements in remote sensing, we aim to improve the accuracy and utility of a national peatlands map for protecting and restoring these carbon sinks in the U.S.

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Improving floral resources and pollinator visitation in Conservation Reserve Program Easements with diverse seed mix composition and soil amendments

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Abstract

Pollinator populations are declining in drylands due to climate change, land use, and habitat loss. The United States Department of Agriculture-Farm Service Agency Conservation Reserve Program (CRP), covering 1.8 million acres in Colorado, aims to re-establish native vegetation on retired agricultural lands. Particularly, CRP pollinator-focused plantings (CP-42) aim to increase pollinator-friendly forb density but often struggle in drylands due to arid conditions and weed pressure. Therefore, innovative strategies are needed to meet NRCS goals for CRP success.

Using a field study, we tested four restoration treatments: the standard NRCS seed mix and planting methods ("Business as Usual," BAU); composted manure + BAU to enhance soil organic matter; strip planting + BAU for targeted weed control; and a more diverse, forb-heavy seed mix for improved floral resources. We compared the total number of open inflorescences, density and diversity of flowering plants, and respective pollinator visitation.

Our preliminary results revealed that composted manure and strip planting significantly increased flowering plant density compared to BAU. However, the diverse seed mix showed no substantial improvement in floral density or open inflorescences. Our composted manure, strip planting, and diverse treatments attracted significantly more bee pollinators later in the season than BAU, while non-bee visitors remained unaffected.

Our findings highlight the potential of compost and strip planting to enhance floral resources and pollinator activity in CRP plantings. This study increases understanding of the capacity of alternative CRP restoration treatments to improve floral resource availability to pollinators across CP-42 plantings and supports restoration decision support in CRP projects.

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Strong Partnerships: The Key to Mussel Restoration and Working Towards Green Infrastructure

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Abstract

Freshwater mussels are in sharp decline worldwide. Such declines have led to loss of species and diversity, as well as loss of the important ecosystem services mussels provide. Re-establishing native mussel assemblages is key to making ecosystems and the communities they inhabit whole. Such native mussel green infrastructure benefits communities through ecosystem services such as improving water quality, increasing stream bed stabilization, providing habitat for benthic organisms, and processing nutrients. Often biodiversity is the focus of management agencies, and while important, biodiversity alone does not relay the importance of native mussels to people who benefit from the green infrastructure services they provide. Our approach illustrates the value of using green infrastructure to engage community support and build partnerships. We focused on delivering a message about the potential for mussel restoration to improve water quality, water recreation, recreational fisheries, and overall health of the Clinton River watershed in Metro Detroit, Michigan. We will show how we built upon established partnerships and developed new ones at all levels of the community. We worked with our state agency partners, county agencies, townships, private property owners, non-governmental organizations, and federal agency partners to build this pilot project that focuses on assessing native mussel habitat needs, assessing reintroduction success, and quantifying ecosystem uplift associated with mussel restoration, building the framework for more efficient and cost-effective restoration efforts in the future. Ultimately this project contributes to our goal of building community support for additional restoration efforts throughout the Great Lakes and beyond.

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Maturembá Ethnoecological Corridor: connecting biodiversity conservation and traditional social engagement

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Abstract

Ecological corridors increase the connectivity of the landscape and the living area available to species, restoring ecological functions and ecosystem services, and strengthening the resilience of communities and agricultural production in the face of climate change and anthropogenic activities. Together with small and medium-sized rural producers, this work is encouraging environmental adaptation, restoration and sustainable management on 478 hectares, in order to connect around 150,000 hectares of forests and other native formations between the south of Bahia and the north of Espírito Santo States, in Brazil. This initiative is part of Suzano's biodiversity commitment to connect half a million hectares in priority areas for conservation in the Cerrado, Atlantic Forest and Amazon biomes by 2030.

In 2024, iNovaland Brasil began implementing the corridor in two indigenous villages of the Pataxó ethnic group. In total, 50 hectares have been planted using different restoration methodologies and agroforestry systems to connect 51,000 hectares of two large forest fragments, the National Parks of Descobrimento and Monte Pascoal. The project also aims to provide food security and increase family income. A total of 32 families from the villages were involved. The seedlings of native species were purchased from nurseries of institutions in the region, strengthening the production chain.

Over the next two years, the communities will monitor and maintain the areas, aiming to ensure the success of the restoration and facilitate gene flow between the parks so that the positive impact on the landscape is continuous, combining biodiversity conservation and respect for indigenous culture.

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Global Rewilding Alliance: Fostering a global Rewilding movement.

Chloe Eckert

Global Rewilding Alliance, Switzerland

Abstract

The Global Rewilding Alliance (GRA), encompassing over 200 organizations, is dedicated to restoring wild lands and seas worldwide. Aligned with the "30 by 30" initiative, the GRA aims to protect 30% of Earth's surfaces by 2030, leveraging the collective strength of its partners, organizations, scientists, policymakers, & citizens.

Its purpose is to capitalize on the opportunity of the moment, to spread and mainstream the idea, theory, and practice of rewilding, and the emergence of a united, diverse, global rewilding movement.

Rewilding Alliance Partners bring expertise, fostering education and partnerships. Scientists develop and apply rewilding methods while monitoring impacts on biodiversity and climate. Policymakers utilize GRA-provided scientific data to craft robust policies, and citizens advocate for and participate in transformative changes.

The GRA creates common ground and joint action in communications, science, advocacy, and networking to mainstream rewilding into national and international dialogue, policy, decision-making, and action.

Since 2021, the Alliance has influenced rewilding projects over more than 7.2 million km² across over 120 countries, demonstrating the power of collaborative conservation efforts.

The GRA's key projects, "Taking Animals into Account" and "Animating the Carbon Cycle," highlight crucial roles of specific species in ecosystem services such as carbon sequestration. These evolving 'living' documents are updated with new data, promoting ongoing community involvement.

Now is the time to embrace a holistic, integrated systems perspective that explicitly includes biodiversity, especially animal diversity, and its interconnections with ecosystem carbon cycling and climate change. This approach underscores the effectiveness of a united strategy in rewilding the earth.

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Animating the Carbon Cycle: the power of healthy wild animal populations in carbon storage

Chloe Eckert

Global Rewilding Alliance, Switzerland

Abstract

(Re-) Animating the Carbon Cycle is a rapidly emerging science that sheds light on the powerful role of wild animals in carbon uptake and storage in healthy ecosystems.

Rewilding, specifically the return of diverse populations of wild animals, aids biodiversity and can supercharge climate mitigation. Wildlife species on land and sea are a key link between biodiversity and climate, offering a practical tool for addressing both crises simultaneously.

The protection and restoration of the populations of only nine species/species groups - marine fish, whales, sharks, grey wolf, wildebeest, sea otter, musk ox, African forest elephants, and American bison - could facilitate the capture of more than 95% of the amount needed annually to meet the global target of removing 500 GtCO₂ from the atmosphere by 2100.

Rewilding populations of key wildlife species worldwide could reduce emissions by billions of tonnes annually - an amount that rivals the top 5 of the IPCC's top mitigation measures combined.

Restoring wildlife populations to significant, near-historic levels is a cost-efficient, immediate, and scalable nature-based solution that addresses both our climate and ecological emergencies.

Moving forward, the significant and potentially game-changing impact of wild animals on the carbon cycle will become increasingly relevant as scientists and policymakers consider and advocate nature-based climate solutions.

The time has come to embrace a holistic, integrated systems perspective that explicitly includes biodiversity, especially animal diversity, and the interlinkages with ecosystem carbon cycling and climate change.

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Forest restoration for climate action: Understanding the impact of land use history and restoration techniques on carbon gains.

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Abstract

Restoring degraded ecosystems is crucial for mitigating climate change and biodiversity loss. Tropical forests, particularly in the Atlantic Forest, are vital for carbon storage. This study investigates carbon accumulation differences between Active Restoration (AR) and Passive Natural Restoration (PNR) across past land uses. We hypothesized that AR would be more effective in areas with intensive past land use, while PNR would perform in pastures, with agriculture negatively impacting carbon gain.

Using a comprehensive review and nonlinear modeling, we analyzed the impact of age, past land use, and environmental factors on Forest Carbon Stock (FCS) gain. Both methods showed similar FCS gain patterns, with AR reaching a threshold faster, primarily driven by age. However, the difference between AR and PNR was unpredictable. Past land use significantly influenced FCS gain. Pastures generally outperformed agricultural lands due to less soil disturbance. AR in past agricultural areas did not consistently result in a faster or more complete recovery than PNR.

These findings highlight the importance of considering past land use when selecting restoration strategies. While PNR can be successful, especially in pastures, AR may be necessary in heavily deforested landscapes or when specific goals exist. Both techniques can be complementary. Project objectives, resources, natural resilience, and history of land use should guide restoration choices. Further research comparing AR and PNR within the same past land uses is crucial for maximizing the impact of natural climate solutions in the Atlantic Forest.

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GRASS-Net: Connecting restoration practitioners to support restoration outcomes in maximizing biodiversity and climate resiliency

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Abstract

Efforts to restore grasslands have been effective by increasing native and limiting non-native species cover. However, to reduce project risks and increase restoration success, practitioners typically use the same six species across the state even though California is a biodiversity hot spot with high rates of endemism. Selective plantings could potentially contribute to regional biotic homogenization. Climate change will further complicate restoration efforts that result in selective planting for climate-tolerant species. Accordingly, we are developing the California Grassland Restoration, Action, Science and Stewardship Network (GRASS-Net), designed to connect restoration practitioners across the state. GRASS-Net will provide support for practitioners as a forum to discuss successful and context-specific management practices that help maximize local success; similarly, the network will help coordinate species selection across multiple agencies to allow risk-sharing and testing restoration of uncharacterized species diversity. Another goal is to develop drought-ready restoration plant selection models that can help optimize restoration under changing climates while diversifying species selection. To form the network and these tools, we have used an interdisciplinary approach that includes social science surveys and semi-structured interviews with restoration practitioners, field characterization study linking plant communities and plant traits to varying environmental site conditions, and a greenhouse study that evaluates the relationship between common plant traits and a lethal drought index. Our network and tools are informed in collaboration with practitioners from Tribal Nations, federal, state and local government agencies, non-profits, consultants and university-restoration organizations and will open the network widely for participation in late 2025.

Soil influence in tree growth and survival in forest restoration at Isla del Coco National Park, Costa Rica

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Abstract

Cocos Island has exuberant tropical rainforests, but its ecology is poorly known. Its acidic soils (pH:4.1) challenge plant adaptation and growth. We evaluated the effect of soil chemical variables on tree survival and growth. In June 2019, we planted the assay using *Ardisia compressa*, *Ochroma pyramidale*, and *Ocotea insularis*, with three treatments: calcium carbonate, soil translocation, and control applied three times every six months. We measured the trees every six months until November 2022 and September 2024. We completed five years of monitoring. The calcium carbonate treatment increased pH (6.6), Mg (2.8), calcium (8.7), and aluminum saturation (2.06) to optimal values for plants. No one treatment was the best for the three species. *Ochroma pyramidale* grew better with calcium carbonate ($p=0.003$), with survival of 89% and an average height of 15.5 ± 2.4 m. *Ocotea insularis* had a poor performance until year two and improved at year five; there were no differences between treatments ($p=0.28$), although the control reported better growth. The average height was 7.9 ± 1 m, and 78% of survival. *Ardisia compressa* had a high mortality reaching 78%. Soil chemical variables influence the success of the species in different ways. Liming allows *Ochroma pyramidale*, a pioneer species, to grow in areas with acidic soils. According to our results, *Ocotea insularis* has 2 to 3 years of adaptation with slow development, subsequently increasing its growth rate, and doesn't require soil treatment. More information on the ecology of the species is necessary to understand this insular forest's ecology and restoration approaches.

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Raising the Bar on Reforestation: Enhancing Quality and Resilience in Colorado's Wildfire Recovery

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Abstract

The increasing frequency and intensity of wildfires, exacerbated by climate change, threaten ecosystem resilience and biodiversity in fire-prone landscapes. In response, Land Life has developed a scalable and science-driven approach to reforestation in Colorado's wildfire-scarred landscapes. Land Life has operated for 4 seasons in Colorado, just going into our 5th season, where we have planted over 2.5 million trees in that time and recently signed a carbon lease with Colorado State Land Board. This presentation will evaluate the 5 seasons we have been operating, how our strategic interventions integrate cutting-edge technology, creative financing, supply chain investment, ecological science, and collaborative partnerships to enhance restoration outcomes.

Key strategies include leveraging remote sensing and field surveys to identify high-priority planting sites, implementing innovative planting techniques to maximize seedling survival, and utilizing diverse, climate-adaptive species to improve ecosystem resilience. We will discuss the role of rigorous monitoring methodologies, including density-based survival tracking and carbon sequestration assessments, in refining and scaling restoration practices.

Additionally, the presentation will emphasize the importance of cross-sector collaboration—working with nurseries, land managers, research institutions, and local stakeholders—to overcome logistical challenges and ensure long-term success. Through these efforts, we aim to establish reforestation as a viable nature-based solution for mitigating climate change, enhancing biodiversity, and protecting watershed health.

This case study of reforesting fire scars provides valuable insights into the integration of science, policy, and practice to improve restoration effectiveness. By prioritizing quality over quantity, we can create resilient ecosystems capable of withstanding future environmental uncertainties.

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Collaborative Forest Carbon Projects: Aligning Stakeholders for Restoration Success

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Abstract

Effective ecological restoration requires multi-stakeholder collaboration to align project goals, secure financing, and ensure long-term success. This presentation showcases a proof-of-concept private land carbon project developed through a partnership between Land Life, the Colorado State Land Board, and the Colorado State Forest Service.

Drawing on five seasons of operations in Colorado, where Land Life has planted over 2.5 million trees, we will explore the critical role of benefit-sharing, stakeholder mapping, and clear project targets in fostering alignment between private, public, and institutional actors. The case study will highlight the pathway to securing a carbon lease with the Colorado State Land Board, including stakeholder engagement strategies, financing mechanisms, and the integration of cutting-edge remote sensing technologies for site selection and monitoring.

Key takeaways include lessons learned in defining project goals, ensuring transparency in benefit distribution, and leveraging innovative financing structures to scale restoration efforts. We will demonstrate how participatory approaches and alignment on restoration objectives can enhance project resilience and ecological outcomes while providing economic benefits to landowners.

By fostering collaboration between researchers, land managers, private entities, and policy stakeholders, this approach raises the bar for restoration success, emphasizing quality over quantity and setting a replicable model for future restoration projects.

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Improving Restoration Outcomes through Collaboration: The Silam Coast Conservation Area (SCCA) Forest Restoration Project.

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Abstract

Preferred by Nature, an NGO with over 30 years of experience auditing land-use projects such as forestry and agriculture, launched its first forest restoration project in collaboration with the Yayasan Sabah Group in August 2024. This initiative addresses forest degradation caused by past logging practices and encroachment by local communities who planted oil palm trees within conservation areas.

The Silam Coast Conservation Area (SCCA) Forest Restoration Project faces challenges such as reversing land encroachment and forest degradation. A key strategy is fostering collaboration with local communities from the outset to instill a sense of ownership and commitment to protecting the area.

The project aims to restore the native coastal lowland dipterocarp forest ecosystem, a rare and valuable habitat. Local community involvement is central, offering employment through nursery establishment, tree planting, and participation in an environmental education program designed to raise awareness among youth and schoolchildren about the importance of conservation and collaborative restoration. This inclusive approach supports ecological recovery, provides socio-economic benefits, and ensures long-term protection against future disturbances, demonstrating a scalable model for successful forest restoration through multi-stakeholder collaboration.

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Repopulation of the Juçara Palm in São Paulo, Brazil: Social participation and technology for conservation of the threatened specie at state and federal levels

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Abstract

The public policy of São Paulo Estate for the repopulation of the juçara palm tree, implemented by the Forest Conservation and Production Foundation of the State of São Paulo, seeks to contribute to the reversal of the current state and federal threat of extinction of the specie. The juçara palm is endemic to the Atlantic Forest and serves as food for approximately 70 animals. To achieve effective results, the initiative isn't limited to the sowing of juçara, but aims to combat the illegal extraction of palm hearts by encouraging families historically involved in the activity to replace illegal activity with the management of the fruits as a sustainable alternative source of income. Juçara fruits have great potential in the restoration chain and for consumption given the ecological and nutritional relevance of the species. The fruits are similar in color and flavor to the Amazonian Açaí, but with even more robust nutritional characteristics. Since 2021 the project purchases seeds from traditional communities and small producers to disperse in protected areas that suffered with extraction of palm hearts. The repopulation also stands out for its technological innovation, using drones and helicopters to disperse the seeds. Social participation is central to the process, present from the formulation of the policy to its evaluation. Combining conservation, social development and technology strategies, the project seeks to contribute to the population growth of juçara palm and transform its conservation into an economic opportunity for communities that previously depend on the illegal exploitation of palm hearts.

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Payments for Environmental Services (PSA) as economic instruments for environmental conservation and preservation of traditional ways of life in Brazil: The juçara palm tree case

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Abstract

The Juçara Payments for Environmental Services (PSA) is a public policy of the State of São Paulo, implemented by the Forest Conservation and Production Foundation of the State of São Paulo, which seeks to contribute to the population growth of the specie, currently extinction threatened at state and federal levels. The juçara palm's endemic to the Atlantic Forest and serves as food for around 70 animals. Since 2022 the Juçara PSA has been paying traditional communities for the environmental services of cultivating and managing the specie in their community areas. The communities are selected with a focus on those that have traditionally preserved the juçara without receiving recognition or economic return, often on the contrary, suffering pressure to extract the juçara palm heart. In addition to recognizing the conservation effort, the project understands that for effective results it's necessary to act at the source of the problem, in this case, the lack of alternative sources of income that leads to environmental crime. Therefore, the project also includes communities that had or have the extraction of the palm heart as a source of income. The initiative, developed collaboratively with those involved, pays and monitors the environmental service providers for five years, during which they receive technical support and training to become independent after the public policy. The project's resources have replaced illegal palm heart extraction and provide stability, contributing to the permanence, continuity of traditional ways of life and investments in other sustainable activities - such the transition to Agroforestry Systems.

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A Nature-Based Best Management Practice Designed to Treat Urban Stormwater on a Floodplain Property in the West Fork White River Watershed

Jordan Holt, Sandi Formica, Steve Patterson, Becky Roark

Abstract

Legacy residential subdivisions generally have outdated, inadequate stormwater detention or treatment prior to runoff entering streams. A Fayetteville, AR subdivision constructed in the late 1990's is up gradient of a floodplain property along the West Fork White River (WFWR). With little detention, stormwater is directed through several outfalls to a hayfield prior to entering the WFWR. The Beaver Watershed Alliance was awarded a USEPA 319 grant and collaborated with the Watershed Conservation Resource Center (WCRC) and BioxDesign to demonstrate ecologically-based BMPs to treat stormwater utilizing floodplain properties.

A stormwater treatment plan and engineering design was developed and implemented on 4-acres of pastureland. The concept of sculpting a "mound-and-swale" topography modeled on prairie landscapes of Northwest Arkansas creates extended flowpaths, depressional storage, and mounds to treat stormwater and create pollinator and wildlife habitat. Also, a small incising channel formed from the stormflows down-gradient of a pipe outfall was restored and reconnected to its floodplain, helping distribute stormwater to the mound-and-swale system. Native plants appropriate for these sites were incorporated to stabilize soils, provide habitat, and enhance stormwater treatment. The nature-based BMP slows stormwater and removes pollutants before entering the WFWR. Partners worked with the landowner to allow for one cutting of hay each year. The WCRC implemented the project in the fall, 2023 and continues to monitor the site. Nature-based BMPs help to protect the areas drinking water source, Beaver Lake, and are an example of partner and landowner collaboration to retrofit stormwater systems of developments to improve water quality.

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Larval Habitat Suitability Assessment for Globally Vulnerable Regal Fritillary Butterfly: Implications for Ecological Restoration and Management across Grasslands in the Central and Eastern United States

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Abstract

The regal fritillary (*Argynnis idalia*) is a non-migratory prairie butterfly in the central and eastern US, with larval host plants in the genus *Viola*. Its conservation status is G3; in 2024, the USFWS proposed listing it under the Endangered Species Act. In the 1990s, The Nature Conservancy and partners began an 8,000-acre seed-based restoration project in northwest Indiana (Kankakee Sands) to connect prairie and savanna remnants and expand suitable habitat.

Surveys indicate the population has expanded from remnants to restored areas. However, the quality and extent of suitable larval habitat sites have never been quantified, which is crucial for resilient population health. Land managers need this information to optimize restoration practices.

We present a multi-agency larval habitat suitability assessment with management recommendations for this globally vulnerable butterfly. We defined 13 monitoring units on TNC and Indiana Department of Natural Resources lands, based on observations of adult regal fritillaries, violets, nectar sources, vegetation structure, soils, hydrology, and management polygons. Within each unit, we established 3 permanent transects at random locations and collected baseline data on host plants and other vegetation across various treatments, including prescribed fire, bison grazing, mechanical and chemical woody management, seed and transplant addition, and spontaneous recruitment.

We present preliminary results from two years of data and summarize recommendations for ongoing restoration management and research needs. The goal is to continue and improve upon the initial decades of addressing threats to regal fritillaries and provide data for use across their present and historic range.

918

Use of before-after-control-impact monitoring to evaluate success of large-scale floodplain restoration in California's highly altered Central Valley

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Abstract

Native floodplain habitat in California's Central Valley has been critically impacted by altered hydrology, agricultural conversion, and invasive species. The main Central Valley rivers and their tributaries are extensively managed by dams and water diversions, altering ecological processes and creating restoration challenges. Despite decades of floodplain restoration in the Central Valley, adaptive management and scaling lessons learned are limited by insufficient resources to perform baseline and long-term monitoring with standardized methods to evaluate success.

River Partners began using the Before-after control impact (BACI) design - a widely used framework for assessing effectiveness of habitat restoration. In 2024 and 2025 growing seasons, we performed baseline "before" monitoring at 10 planning sites and 10 reference sites in the Central Valley's San Joaquin and Tulare Basins. Reference sites are a mix of remnant floodplain habitat and older restoration sites. We blended traditional monitoring techniques with accessible technological tools. At eight randomly placed plots at each of our sites, we performed avian point counts, pollinator surveys, and vegetation surveys. We also deployed autonomous recording units (ARUs) and camera traps. We assessed acoustic data with BirdNET software leveraging machine learning to identify bird sounds, and with customized models for three focal species. We processed photos using Wildlife Insights, which uses an AI model to classify animals.

This presentation explores applications of BACI across a large-scale habitat restoration initiative in the highly managed Central Valley, and highlights considerations for selecting appropriate control and impact sites, challenges to implementing BACI designs, and methodologies for measuring restoration outcomes.

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Greening the Outback 2 - native grassland vegetation restoration

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Abstract

Collaborating with Desert Channels Queensland and researchers, landholders are striving to rehabilitate degraded land, reintroduce perennial grasses and restore bare areas affected by prolonged drought, monsoon flooding, invasive weeds, and intense grazing pressure.

Efficient, nature-based, regenerative, cost-effective methods are essential to achieve drought resilience for the \$75 billion Australian rangeland livestock industries. 47 million hectares of Mitchell grasslands (*Astrelba* spp.) are among the most valued grazing lands, with drought impacting and compromising farm economics and sustainability. Biocrusts (dominated by cyanobacteria and liverworts) cover the soil surfaces between the tussock grasses. Annually biocrusts prevent the dispersal of 700 million tonnes of dust worldwide. They are first responders in the succession of land regeneration, delivering essential ecosystem services including organic carbon for soil fertility, and natural nitrogen fertiliser worth ~\$400,000 yearly for a typical 100,000-hectare property. We anticipate they may play a crucial role in recovery.

Our approach includes collaboration with institutions such as University of Queensland researchers, supporting student projects and providing industry placement opportunities and engagement with new graduates. Large scale monitoring is achieved with UAV's, on ground site surveys and remote sensing. This work has led to >6,000 hectares of active rehabilitation to gain new insights such as how to enhance Mitchell Grass germination success. Priming seeds with local biocrust inoculum has shown potential improvement in germination.

The project, through skills and knowledge developed, allows landholders to apply these learnings and expand the project area providing significant value for investment and improved landscape resilience.

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Hybrid aspen plantations on the multi-metal contaminated former agricultural land

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Abstract

Heavy metals (such as Cd, Cu, Ni) are toxic pollutants that accumulate in the environment and living organisms. Their levels and uptake are influenced by biotic factors (e.g., microbes, volcanic activity) and abiotic factors (e.g., human activities like mining, fertilization and industrial pollution). In Estonia, afforestation with fast-growing species like silver birch and hybrid aspen has been used for over 25 years, helping meet EU climate goals.

The aim of this study is to assess the accumulation of heavy metals (Cd, Cu, Fe, Mn, Ni, Zn) in 24 hybrid aspen plantation stem wood biomass and soil, and to examine the uptake and distribution of these elements across tree rings over two decades.

We confirmed that studied plantations are multi-metal (Cu, Mn, Ni, Zn) contaminated. We confirmed that the wood from stands aged 1-10 years contains higher average and median heavy metal concentrations than the wood from stands aged 11-21 years. Soil pH had the strongest negative effect on Mn and Ni uptake, with Mn in all parts of the tree and with Ni in stembark, old stemwood and in biomass. Bulk density had a positive effect on young stemwood Ni uptake and on old stemwood Fe uptake. Soil Available Water Capacity had a positive effect on Mn uptake (in all parts of the tree), in addition to stembark Ni.

The findings will provide insights into the dynamics of heavy metal uptake in multi-metal contaminated former agricultural land and broaden the range of tree species suitable for phytoremediation and ecosystem restoration.

Pavna Collective: A Multi-Stakeholder Approach to Ecological and Cultural Restoration in the Sahyadri Western Ghats of India

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Abstract

The Sahyadri Western Ghats, in India, a UNESCO World Heritage site and biodiversity hotspot, host the Pavna catchment (115 sq km), a crucial watershed supplying water to millions in Pune, Maharashtra. However, deforestation, unsustainable tourism, and land alienation (40% to external developers) threaten water security, biodiversity, and local livelihoods.

For over two decades, the Shillim Institute (SI) has stewarded 2,000 acres of private forest, pioneering conservation, regenerative agriculture, and eco-restoration. These efforts have enhanced groundwater levels, habitat development, and biodiversity conservation.

In 2023, SI, along with its sister organization 'One Landscape', launched the Pavna Collective—a multi-stakeholder platform with partners including ATREE, WCT, Oikos, local communities, and government agencies. This collaboration aims to restore the entire Pavna catchment using science-driven, community-centered approaches. Multidisciplinary assessments undertaken highlight low (10%) groundwater recharge potential despite of rainfall as high as 3277mm annually culminating into low storage potential for Pavana Dam (fluctuates between 63% to 100% of 240 MCM). The assessments also highlight on need for comprehensive watershed planning, eco-restoration for biodiversity conservation and NRM based livelihoods to engage local communities.

The Pavna Collective's interventions focus on (i) Watershed management - enhancing additional 13.12 MCM water storage; (ii) Biodiversity monitoring, and conservation planning especially for rare species such as Indian Dhole and leopards (iii) Regenerative economy initiatives like agroforestry, regenerative agriculture (iv) Environmental education programs, promoting local stewardship.

By integrating restoration science, regenerative development, and community well-being, the Pavna Collective provides a replicable model for addressing ecological and socio-cultural challenges in high-pressure landscapes.

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Corridors for Life: Lessons Learned in 30 Years of Restoration Practice in Brazil

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Abstract

Sharing lessons learned in forest landscape restoration is essential for improving projects and maximizing impact. It helps refine techniques, avoid mistakes, and adapt strategies across ecosystems. Collaboration and knowledge exchange strengthen efforts by integrating scientific insights and local expertise, accelerating progress toward sustainable landscapes and climate resilience.

The Corridors for Life project, led by IPÊ in Brazil's, exemplifies over three decades in restoring the Atlantic Forest. This initiative enhances biodiversity and creates sustainable economic opportunities. Partnering with Ambipar since 2021, this "Corridors for Life ARR Grouped Project" has expanded restoration to over 7,000 hectares, reinforcing carbon sequestration and climate resilience. Reflecting on 30 years of engagement, key lessons provide insights into similar efforts elsewhere:

1) Community-based education must be continuous to drive change; 2) Regional landscape planning succeeds when local communities actively participate; 3) Collaboration requires understanding local needs and meeting communities where they are; 4) Agroecology, adaptive management, monitoring, and policy integration are crucial; 5) Sharing technical expertise fosters collaborative planning of wildlife corridors and conservation; 6) Trust enables effective communication, innovation, and adoption of new systems; 7) Using the landscape as a conservation laboratory reinforces large-scale restoration efforts; 8) Engaging communities in biodiversity conservation requires time, experience, and effort; 9) Regional planning and landholder support can rebuild landscapes from small fragments; 10) Institutional presence ensures long-term sustainability through continuous support and adaptive management.

These insights guide restoration efforts in other regions aiming to balance conservation and sustainable development.

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Analysis of the effectiveness of mitigation measures at roadkill hotspots in South Korea

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Abstract

Collisions between wildlife and vehicles or roadkill remains a persistent issue. This poses a significant threat to the safety of both wildlife and drivers. The lack of systematically managed roadkill records poses challenges for nationwide research and comprehensive assessment in South Korea. Since 2018, the Ministry of Environment (MOE), Ministry of Land, Infrastructure and Transport (MOLIT), and National Institute of Ecology (NIE) in South Korea have been implementing roadkill investigations and management. The areas selected for roadkill mitigation measures were determined by hotspot analysis based on nationwide roadkill data collected using the Korean Roadkill Observation System (KROS), an integrated online platform. In this study, the top 50 roadkill hotspots were selected, and appropriate mitigation measures, including wildlife fences, warning signs, and speed enforcement cameras, were implemented. A total of 190.6 kilometers of wildlife fences, 75 warning signs, and 27 speed enforcement cameras were installed. The results of these implementations revealed an average reduction in roadkill incidents of 80.2%. Subsequently, we compared and analyzed roadkill incidents before and after these mitigation measures were implemented. The comparative analysis based on hotspot grades showed that areas with lower grades had relatively lower reductions in roadkill incidents. Moreover, the study showed that the presence of multiple mitigation measures in a single area did not significantly differ from the effects of a single mitigation measure. This research will contribute to an enhanced understanding of roadkill mitigation measures and aid in preventing wildlife accidents on the road.

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Leveraging drone remote sensing capabilities to prioritize forest habitat restoration needs and monitor restoration success

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Abstract

To prioritize forest management and improve the quality of restoration efforts, this study employs an innovative methodology combining UAV-borne multispectral and LiDAR technologies. The primary objectives of this ongoing study are to develop an effective monitoring approach to; a) Characterize forest vegetation structural characteristics and species composition, b) Identify and prioritize sites for habitat restoration, and c) Monitor changes in forest habitat structure over time to inform adaptive management.

A GreenValley LiAir X3-H UAV LiDAR system and a MicaSense RedEdge-P multispectral sensor mounted on a DJI M350 RTK drone were used to collect high-resolution, high-accuracy data at two study areas totaling 400 acres in Maryland, USA. LiDAR point clouds were processed to generate 3D models of forest structure, deriving metrics such as canopy height models (CHMs), vegetation density, vertical stratification, and canopy gaps. Multispectral imagery was used to classify species composition, and assess vegetation health, using specific spectral indices. LiDAR and multispectral datasets are being integrated using machine learning algorithms to generate detailed maps of forest vegetation structure and composition.

Results provide vital insights into areas with structural and compositional degradation, helping land manager prioritize areas for appropriate restoration actions. Proposed treatments include prescribed fire to encourage oak and pine species regeneration, treating invasive species, selective non-commercial thinning to reduce mid-story competition, and creating canopy gaps for enhanced structural diversity. Initial results of this study demonstrate the efficacy of using drone LiDAR and multispectral sensors to accurately characterize forest structure and species composition and monitor treatment effects efficiently.

Use of agroforestry systems as a strategy to achieve global forest restoration goals

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Abstract

The Atlantic Forest, recognized as one of the most biodiverse and threatened biomes on the planet, is considered a biodiversity "hotspot." Originally, it covered more than 1.3 million km² along the Brazilian coast, spanning 17 states. Currently, only about 12.4% of its mature and well-preserved forests remain. The richness of the Atlantic Forest is remarkable, housing around 20,000 plant species, of which approximately 8,000 are endemic, meaning they occur exclusively in this biome.

In Espírito Santo, a state within the Atlantic Forest region, the Reflorestar Program was established and, over the past 14 years, has supported more than 5,000 rural landowners in transitioning from degrading land-use models to more sustainable practices, with a focus on agroforestry systems. These systems have accounted for between 50% and 60% of the choices among rural producers for restoration methods offered by the program, which also include natural regeneration, planting of native species, silvopastoral systems, and managed forest plantations.

Beyond the economic benefits provided to rural producers, agroforestry systems contribute to the conservation of the Atlantic Forest's biodiversity by offering better shelter conditions for fauna and promoting connectivity between forest fragments. Such practices are essential for enhancing the achievement of global restoration targets for natural environments and for preserving this rich and threatened biome.

This article aims to present the main benefits that the use of multifunctional forests, such as agroforestry systems, can provide, as well as how such arrangements can enhance the achievement of global natural environment restoration goals.

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Plant richness, but not phenological nor trait diversity shape microbial community assembly and community in a tallgrass prairie restoration

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Abstract

Restorations are often designed to maximize plant biodiversity. This biodiversity can be partitioned into phylogenetic diversity (evolutionary diversity) and trait diversity (physical traits), however how these differences in biodiversity impact below ground microbial communities remains relatively unknown. To evaluate this, a tallgrass prairie restoration was established at the Morton Arboretum in 2016 with plots of plants in monocultures as well as polyculture plots of varying trait and phylogenetic diversity. Soil samples were collected prior to planting, in 2018 and 2021. Neither plant phylogenetic nor trait diversity impacted bacterial nor fungal communities. The strongest determinant of both community composition, diversity and selection pressures for both bacteria and fungi, was plant species richness, i.e. was the plot a polyculture or a monoculture. Polycultures had lower microbial diversity than both monocultures and pre-planting soil. Within monocultures, plant group (aster, forb, legume, woody), impacted neither fungi nor bacteria. In polyculture plots, neither phylogenetic nor trait diversity impacted microbial diversity nor composition for bacteria, nor fungi. Based on these results, it appears that the number of species in a restoration is more important for below ground communities than the plant species identity.

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What sets the trajectory for biocrust recovery across three Sonoran Desert restoration sites?

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Abstract

Biological soil crusts, or “biocrusts,” provide critical ecosystem services such as soil stabilization, erosion resistance, and nutrient cycling to desert areas, yet these fragile components of healthy drylands are regularly damaged by human activity. We established a biocrust restoration experiment in three U.S. National Monuments within the Sonoran Desert in 2022, with the goal of testing an identical suite of restoration treatments across three unique locations. These sites, which are located along a climate gradient, also reflect three distinct but representative biocrust disturbance types in the region: construction activity in Organ Pipe National Monument, foot traffic in Casa Grande Ruins National Monument, and wildfire in Tonto National Monument. We applied varying amounts of biocrust inoculum and psyllium husk (a soil tackifier) across 40 plots at each site in a regression design. We also tested two types of biocrust inocula: crust salvaged from near each site (“salvaged”) and crust cultivated on-location in irrigated beds (“cultivated”). Crust type and crust amount had significant effects on crust recovery, and crust recovery in turn had a strong effect on soil stability. Community composition differs between crust types and sites. There is also a distinct difference in biocrust recovery at Tonto National Monument versus the other two sites, which suggests that the restoration site itself may be an important factor in how biocrust ultimately recovers, regardless of the restoration treatment.

Aboveground Biomass Accumulation after the initial phase of active restoration in two Atlantic Forest types with contrasting climates

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Abstract

Active restoration is one of the main approaches for climate change mitigation and adaptation due to the increase in aboveground biomass (AGB) during tree growth. AGB serves as a proxy for aboveground carbon stocks. However, AGB accumulation patterns can change in regions with climatic extremes, and reforestation sites of the same age may show divergent AGB patterns due to geographic variations in mean monthly temperature (MMT), mean monthly precipitation (MMP), altitude (ALT), and vegetation type. The Brazilian Atlantic Forest is one of the ecosystems with the greatest potential for active restoration in Brazil, but it exhibits diverse phytophysiognomies under different climatic conditions. We evaluated how climatic differences affect AGB in two Atlantic Forest types: Seasonal Semideciduous Forest (SSF) and Rainforest (RF). We modeled AGB as a function of MMP, MMT, and ALT in six active restoration sites (60 plots) for reforestation areas with three different ages in both forest types: 14, 17, and over 20 years. We found no influence of climatic variables on AGB. At 14 years, SSF and RF accumulated 110 and 92 Mg/ha, at 17 years, 66 and 109 Mg/ha, and at over 20 years, 138 and 110 Mg/ha of AGB, respectively. Although this is a chronosequence, since sites of different ages in each area are not the same, all are under the same climatic conditions within their respective regional scales. These findings suggest that AGB accumulation patterns are more related to forest type and age than to climatic variables at the regional scale.

1001

Atlantic Forest Strategy: Integrating Stakeholder Insights for Ecological Restoration

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Abstract

The Atlantic Forest is one of the most biodiverse yet critically endangered biomes, playing a key role in biodiversity conservation, climate regulation, and ecosystem service provision. Effective restoration requires integrating ecological, economic, and spatial intelligence to optimize decision-making and prioritize restoration efforts.

The Atlantic Forest Strategy is a collaborative initiative supported by the São Paulo Research Foundation (FAPESP) and conservation organizations, aiming to develop strategic actions for large-scale native vegetation restoration. This includes regulatory compliance, conservation planning, and voluntary incentive mechanisms. As part of this effort, a participatory Co-Production Workshop was held in 2024 to engage researchers, practitioners, and stakeholders in defining research priorities. The workshop gathered 57 research needs, later prioritized through partner voting.

Key themes identified include: (i) defining and projecting future degradation scenarios to assess restoration impacts; (ii) incorporating resilience and climate change factors into conservation assessments; (iii) evaluating biodiversity credits by reviewing existing concepts and data-driven approaches; (iv) developing economic models for productive restoration, addressing benefits and risks for different landholder groups; and (v) refining spatial resolution in restoration by integrating fine-scale variables such as land-use history, soil characteristics, and vegetation dynamics.

A key outcome was the recognition of the need for economic analyses in restoration planning. This participatory approach highlights the importance of multi-stakeholder engagement in shaping research priorities, strengthening the link between ecological restoration science and practical conservation strategies in the Atlantic Forest.

1002

Balancing conservation goals and competing land uses. Integration of local institutional arrangements in land use management in Kenyan drylands

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Abstract

The drylands of Kenya support about two thirds of countries livestock population and main source of livelihood for the pastoral resident community. Increased population and livestock herds, frequency of droughts and floods, changing land use and weak capacities for landscape planning have affected these landscapes. Towards ending drought emergencies project aimed to promote Ecosystem-based Adaptation approaches for increased conservation, resilience and effective planning of rangeland in Kenya. As part of the project's baseline on restoration stocktake, we assessed existing institutional arrangements and functional support for restoration through 20 key informant interviews and document analysis. Results indicate that changes in the country's community land legislation provided for private tenure within the rangelands, with potential effects on existing land uses, and changes in pastoral practices. We document two key institutional arrangements in the northern and southern rangelands that have been integrated into the formal governance frameworks. Dhetha management practices follow traditional methods of resource management through a set of by-laws enforced by elders. The system regulates dry and wetland grazing which have been integrated with modern restoration initiatives. In the southern rangelands, a unique model has been piloted to address growing interest in group ranch subdivision by influencing the direction of land subdivision through zonation and assignment of property rights. Authoritative, control and use rights are assigned in various zones to safeguard some sections of rangeland for pastoralism and conservation of pasture, water, woodlands and wildlife. Strengthening of these institutional arrangements and proper integration will ensure greater success in conservation of drylands.

1020

Hydrological services are an overlooked benefit of savanna restoration

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Abstract

Globally, grasslands and savannas are being lost due to various land use conversions. These include agricultural conversions, tree plantations, timber production, and urban or energy development. A general lack of recognition of savannas and grasslands as habitats valuable for conservation or recreation has been a major challenge in protecting these ecosystems. In response, the global community of ecologists and practitioners have called attention to and demonstrated the value of such habitats for biodiversity, carbon sequestration, and for grazing and pastoral communities. Hydrological changes of restored savannas, however, has remained overlooked. In this study, we argue that savanna restoration, in addition to the ecological benefits, could also bring about benefits related to landscape hydrology which can have positive outcomes for local water resources. In this review, we present an overview of studies in different savanna ecosystems (or savannas transformed either due to woody plant expansion or agriculture) to demonstrate: i) how hydrological functioning has declined in these landscapes, and ii) indicators of improved hydrology with restoration practices. In addition, we also highlight cases of ecological state changes where loss of savannas has had an obvious impact on the hydrology. However, despite being a focus of multiple ecology focused work, hydrology of these systems remains understudied. We argue for greater participation of (eco)hydrologists in the restoration ecology sphere to improve restoration outcomes in these grassy systems. This would not only lead to a better understanding of savannas but also may lead to stronger advocacy for restoration and protection of savannas.

1024

Evaluation of Wildlife Crossing Structures in South Korea

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Abstract

A total of 564 wildlife crossing structures have been constructed in South Korea to restore fragmented ecological corridors and reduce roadkill. This study investigates whether these wildlife crossing structures comply with the “Guidelines for the Installation and Management of Wildlife Crossing Structures.” The subjects of this study were 366 overpasses and 198 underpasses in South Korea. Overpasses were assessed based on nine criteria, while underpasses were evaluated using eight criteria. Among the overpasses, the compliance rate for topographical connectivity was the highest (65.6%), followed by the compliance rate for the installation of wildlife fences in both directions (59.0%). However, most fences were poorly extended (29.0%), and showed poor connectivity, with open gaps (14.5%). For underpasses, the highest compliance rate was for fences installed in both directions (58.1%), followed by topographical connectivity (57.6%). Yet, most fences were inadequately maintained (16.7%), and openness did not exceed 0.7 (16.7%). Overall, the compliance rate for overpasses was 41.1%, while underpasses had a compliance rate of 38.3%. Efforts to enforce compliance with the guidelines are necessary to enhance the effectiveness of wildlife crossing structures, and legally mandating these guidelines may be a practical solution.

1029

Developing a map-based peatland restoration user support toolMoira Hough¹, Rod Chimner¹, Erik Lilleskov²¹Michigan Technological University, Houghton, MI, USA. ²USFS, Houghton, MI, USA**Abstract**

Peatland restoration holds potential as a nature-based solution to climate change but can face significant hurdles in implementation of projects as managers wrestle with limited time, funding, and energy. One way to incentivize restoration is to lower the bar on beginning a project by providing tools that can reduce the time and energy required to select an appropriate site or assess the potential of a known site. The new US maps of peatland extent and condition represent an opportunity to provide such a tool, particularly when combined with existing map layers such as hydrology and land use. Here we report on the development of a map-based decision-support tool for peatland restoration.

1038

Soil amendments to improve soil properties at former mines in Northeast Ohio

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Abstract

Around the world, millions of acres of soil are degraded and damaged from mining, logging, agriculture, and other human activities. This intensive human use can lead to negative outcomes such as a lack of nutrients and organic matter in soil and changes in soil pH that are not optimal for plant growth, hampering restoration efforts. In Northeast Ohio at Cuyahoga Valley National Park, several former mine sites have been impacted by topsoil mining. Mine soil analysis has shown a lack of several nutrients necessary for optimal plant growth and high soil pH compared to undisturbed forest soil nearby. Low-cost soil amendments of fertilizer, sulfur, and woodchips have been studied for their ability to alleviate such soil deficiencies; however few studies have examined the immediate and fine scale impacts of these three amendments both singly and in combination on soil properties. Application methods used in many studies are labor-intensive, most studies use management plans that involve multiple applications or mixing of treatments into the soil; activities that can be disruptive to soil surfaces and may be impossible to realize over large restoration areas. In this study, treatments of sulfur, woodchips, and fertilizer, both singly and in combination, were placed on top of the soil in outdoor mesocosms and soil properties were monitored over 9 months. Results will help determine best practices for land managers wishing to improve soil conditions, especially in large restoration projects.

1041

Beaver Restoration Impacts on Vegetation in Dryland Stream in New Mexico

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Abstract

Wetlands in the arid landscapes of the Southwestern U.S. are critical for biodiversity, aquifer recharge, and habitat connectivity but are increasingly threatened by anthropogenic pressures and climate change. North American beavers (*Castor canadensis*) create and sustain wetlands through dam-building, yet their populations remain depleted due to the historical fur trade and continued removal. Process-based restoration efforts, such as beaver reintroduction, offer a potential strategy to mitigate climate-related challenges. In 2020, Bandelier National Monument reintroduced beavers to a first-order, seasonally ephemeral creek with low base flow (~2 cfs). Using field surveys from 2020, the summer of reintroduction, and field surveys four years post introduction, I evaluate the effects of beaver on Southwestern riparian vegetation. I empirically assesses vegetation community composition in response to beaver activity, revealing that abiotic drivers, such as elevation and fire history, exert the strongest influence. Beavers contribute within this broader ecological framework, stimulating the response of early colonizing species and obligate species in drylands – with increased vegetation providing surface roughness that slows floods and minimizes soil loss, ultimately aiding in the riparian succession cycle. These findings inform land managers of the current state of vegetation communities post introduction, with long term studies needed to understand the evolution of beaver wetlands on Frijoles creek.

1047

Evaluating Restoration Success: Assessing Migratory Bird Joint Venture Conservation Objectives

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Abstract

Migratory bird joint ventures are public-private collaborations formed to protect and restore critical bird habitats at landscape-scale in the United States. In California, the Central Valley Joint Venture (CVJV) uses science-based approaches to habitat restoration within productive agriculture landscape. The CVJV set ambitious bird conservation goals, including habitat protection and restoration, population targets, and breeding densities. We applied these quantitative objectives for CVJV focal species to evaluate restoration success. We performed point count surveys, vegetation surveys and audio recordings in known-age restoration sites, remnant riparian forests, and unrestored sites in 2023 and 2024. We compared CVJV focal species objectives to actual densities as calculated by point counts.

While the majority of sites met or exceeded the objectives for riparian focal species, all sites failed to meet objectives for several species. There was considerable variation among species, sites and habitat types in meeting CVJV objectives; however, when considering sites on a landscape scale, restoration has resulted in the creation of suitable habitat for riparian focal bird species. Notably, focal species not present at most sites were associated with early successional stages in riparian vegetation. Anthropogenic changes interrupt ecological processes that would drive a mosaic of successional stages in this landscape, therefore targeted management must increase the amount of early successional habitat across the landscape. Managers can disturb and replant dense, older restoration sites, and can also ensure new large-scale riparian restoration projects continue to occur so that at any given time are early successional vegetation across the landscape.

1048

Advancing Riparian Restoration for Climate Resilience in Mediterranean Agricultural Landscapes

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Abstract

As climate change intensifies, conserving and restoring riparian galleries is crucial for ecological resilience, agricultural sustainability, and long-term socio-economic stability. Mediterranean regions, particularly vulnerable to drought and high water demand, require integrated restoration strategies to reconcile productive landscapes with biodiversity conservation. The EU Nature Restoration Law provides an opportunity for transnational cooperation in river restoration, particularly across the Iberian Peninsula.

This study explores riparian restoration strategies in Mediterranean agricultural landscapes, focusing on the Enxoé watershed, a sub-basin of the transnational Guadiana River in southern Portugal. Characterized by an intermittent hydrological regime, the watershed exemplifies the challenges of Mediterranean temporary rivers. We conducted an ecological characterization of the riparian corridor through biophysical assessments, floristic sampling, and evaluations of pressures and threats.

Our findings highlight the potential of riparian restoration to enhance climate adaptation, mitigate water scarcity, and reduce habitat fragmentation while maintaining biodiversity in agricultural landscapes. We propose scalable restoration guidelines that strengthen ecological connectivity, improve water retention, and support biodiversity conservation. These solutions offer a replicable model for sustaining Mediterranean riparian ecosystems, particularly in transboundary watersheds shared with Spain. The insights gained contribute to a broader framework for implementing restoration strategies in Mediterranean-type ecosystems facing similar environmental challenges.

1055

Tree for All and Community-based Water Quality Trading: Assessing Multi-scale Indicators of Progress Toward a Healthy, Climate-resilient Watershed in the Tualatin River, Oregon

Richard Hunter

Clean Water Services, Hillsboro, OR, USA

Abstract

Since 2005, the Tree for All partnership (jointreeforall.org) has catalyzed transformational change through large-scale ecological restoration in Oregon's Tualatin River watershed. Driven by regulations like the Clean Water Act, Endangered Species Act, and Oregon State planning laws, the partnership leverages collective impact, uniting conservation groups, community organizations, and all levels of government agencies to achieve visionary shared goals. This collaborative approach integrates diverse resources to implementing nature-based solutions across urban and agricultural landscapes. Over two decades, Tree for All has achieved remarkable milestones: restoring over 170 miles of streams and 7,000 acres of wetland and riparian habitats, planting more than 18 million native plants, and saving millions of public dollars. By utilizing cost-effective, multi-functional green infrastructure, a regional water treatment utility (cleanwaterservices.org) has avoided expensive, energy-intensive treatment technologies. Furthermore, the partnership has developed innovative stewardship practices, designed to work with natural processes and keystone species like North American beaver (*Castor canadensis*) and connect with local people, fostering project success, data-driven decisions and community engagement. This study evaluates the partnership's effectiveness by assessing watershed health at various scales. Using extensive data, including environmental DNA, planting records, vegetation sampling, LiDAR and multi-spectral imagery, and social-demographic data, the research analyzes changes in canopy cover, habitat connectivity, plant diversity, water quality and habitat function. The study results demonstrate how Tree for All has enhanced the Tualatin River Watershed's climate resilience, identifies opportunities for program growth, and supports the next phase of collective shared goals.

1062

The Best Idea in The WorldRandy Preston, Toni Blackman

World Resource Institute, Washington DC, DC, USA

Abstract

The best idea in the world is bad if no one knows about it, especially when engaging with the idea requires awareness, like restoration of the natural world. More awareness of restoration should drive engagement in restoration projects in the local spaces where the work is taking place, and ultimately, worldwide. We have applied an awareness to action template to the brilliant idea of restoring the natural world with the power of human ingenuity and resolve, and illuminating local efforts with the goal of increasing awareness and engagement in those efforts. One approach is by activating the Restoration Artist Network. This collaboration of artists committed to approaching restoration themes within their art is creating a space for the general public to engage in restorative activities through improved awareness of Restore Local and other Restoration projects, using art as the medium.

1068

Native Seeds in Turfgrass: A Lawn Enhancement ExperimentLibby Shafer

Northwestern University / Chicago Botanic Garden, Evanston, IL, USA

Abstract

In a greenhouse experiment, we are testing whether 45 native plant species can be successfully broadcast-seeded into turfgrass (*Poa pratensis*) as a practical lawn enhancement, and whether seed traits influence germination success. Because clovers (*Trifolium spp.*) are commonly seeded into turfgrass, and they successfully grew in our pilot experiment, we are using *Trifolium repens* as a control. The native species that germinate and survive will later be seeded into outdoor lawns through a community science project and field experiment in the Chicago area. We hope to find solutions to widen community participation in urban biodiversity conservation in urban private yards and public parks.

1084

Aligning the interests of aquaculture in restoration: The SOAR (Supporting Oyster Aquaculture and Restoration) program in the US.

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¹The Nature Conservancy, Jamestown, Rhode Island, USA. ²The Nature Conservancy, Arlington, Virginia, USA. ³

Abstract

During Covid the oyster growers lost their market for oysters overnight with the shuttering of restaurants. In response the SOAR (Supporting Oyster Aquaculture and Restoration) program was established by The Nature Conservancy, Pew Charitable Trusts and partners, to purchase those excess oysters and match them with restoration projects as breeding biomass in larvae limited systems. The program also established a small grant program to support ideas from the industry for other ways to engage growers and the aquaculture industry in marine conservation. The program has been extended to 2026 and is working to establish a long term funding stream. Results to date and future directions are describe.

Acceptance type: Symposium

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Aligning to Target 2 - Insights and capacity needs to achieve ambitious ecosystem restoration targets under the Kunming- Montreal Global Biodiversity Framework (KM-GBF)

Khalil Walji

Nairobi

Abstract

The Kunming-Montreal Global Biodiversity Framework (KM-GBF), adopted in December 2022, aims to restore 30% of degraded ecosystems by 2030 under Target 2. In partnership with the FAO, CIFOR-ICRAF has led the Target 2 Pilots Project in Kenya, Burkina Faso, Peru, and Vietnam to advance restoration through national dialogues and stakeholder engagement. Brazil also aligned its initiatives through a workshop with FAO and its Ministry of Environment. These efforts have facilitated alignment on priorities, provided training on the FERM platform, and fostered collaboration among key actors.

Notable restoration commitments include Burkina Faso's pledge to restore 5 million hectares under the Great Green Wall, Kenya's strategy to rehabilitate 10.6 million hectares by 2032, Peru's commitment to 3.2 million hectares under ProREST, Vietnam's national action plan to address 20% of degraded ecosystems, and Brazil's PLANAVEG target of 12 million hectares.

National dialogues identified key bottlenecks and challenges that highlight the need for cooperative governance, policy coherence, resource mobilization, inclusive participation, and strong monitoring frameworks. Capacity-building assessments emphasize addressing technical gaps in restoration planning, monitoring, and data management, and improving coordination and cross-sector collaboration. Enhancing stakeholder engagement and securing sustainable financing are crucial for long-term success.

The Target 2 Pilots Project and its workshops offer valuable lessons to accelerate global restoration efforts. Leveraging partnerships, shared learning, and addressing identified gaps are essential for aligning national restoration efforts with the global biodiversity goals outlined in the KM-GBF.

Evaluating Biomass Control Strategies for Urban Waterways: A Case Study of Wonderland Creek

KristiLee Halpin

Mile High Flood District, Lakewood, Colorado, USA

Abstract

The Mile High Flood District serves the Denver Metropolitan area, by reducing flood risk and proactively managing our waterways to be high-functioning, low-maintenance systems. A challenge in urban waterways is the proliferation of monocultures of herbaceous wetland species in slow-moving streams, which reduces species diversity and may increase flood risk. Often, this issue has been addressed through dredging, a costly and ecologically harmful approach. Research on traditional biomass control strategies, such as herbicide application and mechanical control, shows that initial effectiveness depends on site-specific factors and long-term adaptive management. To determine a lower-impact approach for biomass control, we are conducting an experiment along Wonderland Creek in Boulder, Colorado. The study compares mechanical and chemical biomass control methods to maintain a 3-foot-wide open water channel and enhance native species diversity within the floodplain's inner berm. Treatments were applied during the 2024 growing season, and vegetation cover and species composition data will be collected in early summer 2025. Adaptive management efforts will continue into 2025, with findings presented at this symposium to inform future best practices for sustainable floodplain management.

Riparian Restoration and Public Engagement to Facilitate Beaver Habitat Expansion

Maureen Thompson

Think Wild, Bend, USA

Abstract

Riparian areas in Central and Eastern Oregon face mounting conservation challenges, including drought, wildfire, overgrazing, invasive species, and land-use pressures. These challenges are compounded by the decline of beaver populations, whose ecosystem engineering is critical for riparian health. Beaver Works Oregon, established in 2019, addresses these challenges with a three-pronged approach: habitat restoration, public outreach, and conflict mitigation.

Recognizing that the success of ecological restoration depends on diverse stakeholder involvement, our program fosters collaboration with watershed councils, agencies, landholders, and local communities. Together, we identify, plan, and implement low-tech, processed based riparian restoration projects designed to create stream reaches with adequate resources for beavers and promote human tolerance for their presence. Volunteers of all ages and experience actively participate in these efforts through weekends spent planting, camping, and learning about beaver habitat, healthy ecosystems, and working lands.

With over half of Oregon's stream miles on private lands, building relationships with landowners is critical. Our outreach efforts engage rural youth, adults, and agencies through participatory workshops, resources and educational programs that emphasize coexistence strategies and the benefits of beavers for watershed health.

In this session, we share how our innovative strategies for collaboration and community engagement across the restoration process—from planning to post-restoration monitoring—drive impactful outcomes. Our work serves as a model for how integrating restoration science with hands-on, multi-stakeholder participation can improve habitat outcomes, foster community investment, and build sustainable partnerships for long-term ecological resilience.

The view of multisectorial coalitions: Challenges and opportunities for scaling up Assisted Natural Regeneration in the Brazilian Amazon

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Abstract

The view of multisectorial coalitions: Challenges and opportunities for scaling up Assisted Natural Regeneration in the Brazilian Amazon. The Alliance for Restoration in the Amazon is a multisectorial coalition aimed at mobilizing diverse stakeholders to scale ecosystem restoration in the Amazon Biome, focusing on conservation and socio-economic benefits. Assisted Natural Regeneration (ANR) offers a cost-effective solution for large-scale restoration, relying on low input and labor costs. However, its success depends on strong legal frameworks and mechanisms to protect, manage and monitoring secondary forests. With 12 million hectares of the Amazon covered by secondary vegetation (SV), deforestation rates in these areas are 40% higher than in primary forests . To ensure SV contributes effectively to carbon sequestration, biodiversity restoration, and ecosystem service provision, several measures are essential. These include developing state-level legal frameworks for SV maintenance and sustainable management, enforcing the Native Vegetation Protection Law with incentives for natural regeneration, and expanding environmental service payment programs like carbon credits. Additionally, prioritizing SV in restoration programs with clear guidelines, integrating SV into monitoring systems, preventing deforestation leakage, investing in research and long-term monitoring, promoting educational campaigns. Also, encouraging secondary forest management and enrichment planting can be crucial for its adoption. These steps are vital for scaling ANR, conserving regenerating forests, and achieving broader restoration goals in the Brazilian Amazon.

The Redário Initiative: Community-Based Native Seeds for Restoration in Brazil

Danielle Celentano^{1,2,3}, Aline Ferragutti^{1,2}, Anabele Gomes^{4,5,2}, Eduardo Malta^{1,2}, Fabricia Santarém^{6,2}, Laura Antoniazzi^{7,2}, Milene Alves^{1,2}, Rodrigo Junqueira^{1,2}

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Abstract

The Redário Initiative: Community-Based Native Seeds for Restoration in Brazil

In Brazil, balancing the supply and demand of native seeds remains a significant challenge in the ecological restoration chain. Restoration projects often generate last-minute demands that conflict with the natural timing required for seed collection. Seed collectors face the inability to stockpile seeds without guaranteed sales due to their perishability, leading to financial instability and diminished engagement. Additionally, the sector faces political and legal obstacles, including stringent regulations and inadequate policies. Financial returns on seeds frequently fail to cover fair compensation for collectors and the operational costs of seed networks, requiring additional financial mechanisms such as tax incentives, Payments for Environmental Services, and philanthropic contributions. The Redário Initiative, a coalition of 27 community-based seed collector networks, addresses these challenges by building the capacity of seed collectors, improving market access, and advocating for sectoral support. Redário integrates traditional knowledge and prioritizes equitable trade, collaboration, genetic diversity, and traceability. This approach fosters socio-economic benefits for local communities, particularly women. Redário supports innovation and capacity building across technical, legal, and operational domains, contributing to the economic diversification and social resilience of these communities, along with promoting large-scale restoration. In 2024, Redário facilitated the commercialization of 14 tons of seeds from 163 species from all Brazilian Biomes, benefiting 1,277 seed collectors (64% women) and contributing to the restoration of approximately 1,500 hectares. This initiative exemplifies a scalable model for community-based ecological restoration, highlighting the potential of local communities to drive significant environmental and social outcomes.

Building Capacity for Community, Beaver Based Restoration Across the Pacific Northwest

Jean-Paul Zagarola

Bonneville Environmental Foundation, Portland, Oregon, USA

Abstract

(This session is affiliated with the panel session: (Understanding Beavers: The role of long-term restoration for effective beaver recovery and human-wildlife conflict resolution.)

While overwhelming support exists among practitioners, researchers and agencies to partner with beavers to address the impacts of climate change and restore critical habitat, most restoration practitioners lack the tools and information necessary to plan for and prioritize efforts to implement successful projects. In response, Bonneville Environmental Foundation has built a coalition of local, state and federal partners to take key steps in addressing major barriers to mainstreaming beaver-based restoration in Oregon and Washington. Building on successful pilot projects in the region, we are developing statewide beaver-based restoration planning tools using a community based approach. This includes field data collection across both states to calibrate and localize a regional decision-support tool for beaver based restoration planning, engagement of students and community members in the data collection process, and establishment of an online beaver-based restoration resource and storytelling hub for practitioners. This effort is in the early stages of launching and I will provide an overview of the goals and objectives of the program and successes to date.

Non-native plant and pollinator species in pollinator habitat established in solar facilities

Laura Figueroa, Grace Shiffrin

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Abstract

Ground-mounted photovoltaic solar facilities are rapidly expanding in the U.S. to meet net-zero carbon emission climate action plans. However, this rapid, large-scale expansion has the potential to significantly impact ecological systems. It is unknown whether the landscape context in which solar facilities are located and the management practices implemented, such as the planting of native wildflower species, influence the impact of solar facilities on wildlife. This study explores how solar facilities affect pollinators in the Northeastern United States, which is an understudied region in the context of solar impacts on wildlife, and whether site-level characteristics and landscape drive ecological patterns. Preliminary analyses highlight a high abundance of non-native flowers and pollinators in the facilities, independent of the landscape context. Floral metrics, including plant richness and proportion of native flowers, influenced flower visiting insect abundance and richness. We will discuss the implications of site and landscape level features on promoting pollinators while minimizing negative impacts during the energy transition.

The Seed Information Database and an online Platform for Native Seed Suppliers in Western Australia

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Abstract

The Seed Information Database, originally developed by the Kew Gardens and the Millennium Seed Bank, has been, for almost two decades, one of the main public resources for native seed trait information. In 2022-23 the database was transferred to SER, the interface was modernised, and it's currently managed by the International Network for Seed-Based Restoration <https://ser-sid.org/>. SID allows public access to over 180 thousand records on 54,802 species, and new functionalities have been developed to allow for bulk data entry and advanced queries for bulk data export.

Alongside SID, a new online platform is under development to support native seed collectors and suppliers in Western Australia and help them capture, organise, and keep track of seed batch information, thus ensuring transparency in the seed supply chain for ecological restoration. Such online tools are designed with seed suppliers, the Revegetation Industry Association of Western Australia, and the Indigenous rangers' group to provide useful functionality, such as a mobile app for seed collection in the field, seed processing, storage and inventory management, tools for seed quality testing and seed mix design, while ensuring that confidentiality of sensitive information (such as collection sites) are maintained. This presentation is part of the INSR/KEW symposia on Native seeds: Session 2: Collaboration and connection: data management and resources to support native seed supply

Co-developing business plans for upscaled coastal Nature-Based Solutions restoration: an application to the Venice Lagoon (Italy)

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Abstract

Upscaling coastal nature-based solutions (NbS), from the river to sea scale is essential to the success of restoration and requires larger investments, greater socio-economic engagement and a transformative shift in governance. Consequently, the ability to catalyze blended finance from public and private investors through business model innovation and accessibly written long-range business plans is imperative. This study proposes a methodology to systematically co-design, through iterative multi-stakeholder engagement effective business models for upscaling NbS coastal restoration, as well as a framework to develop business plans adaptable to different investors needs and financial criteria. This method was tested and validated in the Venice Lagoon (Italy), where saltmarsh restoration interventions have been implemented in the REST-COAST H2020 project. This research led to the co-development and advancement of a business model canvas, through stakeholder mapping and participatory approaches. The innovative approach combines the co-creation of workshops, consultations, in-depth interviews and surveys to deliver a business case centered on ecotourism complemented by a willingness-to-pay analysis. It also produced an innovative business plan conceptualized for the public sector, strategic for decision-making, fostering multi-stakeholder collaboration, and enabling synergies between public and private services, across multiple economic sectors. The resulting NbS business plan lays out the governance, management, business and financial strategies for successful restoration, from pre-planning to post monitoring, addressing specific issues, improving five main ecosystem services and biodiversity, and delivering NbS multifunctional environmental, economic, social and cultural benefits. The methodology has proven to be applicable beyond the Venice Lagoon saltmarsh case and types of restoration projects.

Coastal restoration platforms and tools to fill the implementation gap

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Abstract

Coastal systems are experiencing an accelerated degradation due to increasing climatic and human pressures. To offset this negative evolution, it is necessary to accelerate the pace and scale of restoration interventions for river-coast continuums. This paper will present the establishment of coastal restoration platforms (CORE-PLATS) at nine pilot cases along the European Union coasts, discussing how technological advances, new financial arrangements and a governance shift can support adaptation-through-restoration plans. These plans are being drawn for the nine pilot cases, which span Mediterranean, Black Sea, Atlantic and Baltic vulnerable coastal systems, such as deltas, wetlands or estuaries. The CORE-PLATS involve representatives from central and regional administrations, local municipalities, researchers and conservation groups. The platforms are regularly convened to discuss the hands-on restoration experiences and to steer larger scale restoration projects, for an upscaling commensurate with climatic change acceleration. The collaborative approach to coastal restoration also considers the need to coordinate riverine and coastal interventions. The CORE-PLATS apply engagement tools to support a coastal restoration contract, where a draft will be presented at the conference, so that the collaborative restoration interventions enhance biodiversity and ecosystem services to achieve an effective stabilization of coastal functions under present and future climates.

Restoring Meandering Streams in Urban Environments: Re-writing the history of historically singular engineering through ecological based riparian design.

Jessica Andersen

Denver Parks & Recreation, DENVER, CO, USA

Abstract

Past urban flood control and hydro-engineering was based on moving water as fast as possible through urban system. These systems were the result of single-objective design. This generally meant straight, concrete, or armored stream beds. These systems are prone to erosion at the interface of hardscape and soil, provide little ecological benefit or habitat, lower water quality, and are susceptible to flooding if infrastructure fails. The repair of these systems is expensive and requires large inputs and investment to fix. Denver has begun to look towards ecologically based stream corridor design to re-write the story to be multi beneficial instead of single objective. This shift is highlighted by the restoration of approximately 1-mile of highly degraded and incised channel along Cherry Creek. The project partners worked together to create a meandering channel and reconnected floodplain that would be representative of stable riparian systems found in natural environments. Upon completion of the heavy civil work, the channel, banks and floodplain areas were seeded with Colorado typical riparian and wetland flora that created variable habitat and improved water quality by filtering out harmful contaminants and provided niche foraging grounds for many types of fauna. This presentation will detail the challenging integration of hydrological, hydraulics, geomorphology, ecology and human values into stream corridor design within urban systems and will highlight the outcome of finding the synergies between these fields can result in a safe, ecologically beneficial, enjoyable, and beautiful amenity that serves the needs of humans and other species who share this space.

Pocket Forests: Community-based, biodiverse ecosystem restoration for urbanized spaces

Gillian Davies

BSC Group, Inc., Worcester, MA. Global Development & Environment Institute, Tufts University, Medford, MA

Abstract

Pocket Forests, or Miyawaki forests, accelerate restoration of forest habitat in degraded, urbanized environments. This presentation will discuss what pocket forests are; their significant differences from standard urban plantings; and why they are integral to the acceleration of ecological, forest, soil, and community healing and restoration. Our extensive experience in pocket forest planning, design, and implementation reveals limitations and opportunities in the urban context and leads to the next level in Nature-based Solutions: Chiefly the community healing and restoration that occurs through pocket forest installation and growth.

Policymakers at the highest levels have called for transformative change to meet the climate and biodiversity emergencies: “*Transformative change* in all parts of society and our economy is needed to stabilize our climate, stop biodiversity loss, and chart a path to the sustainable future we want. This will also require us to address both crises together, in complementary ways.” - Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) Chair Ana Maria Hernandez Salgar (2021).

Pocket forests not only deliver ecological and forest restoration, but also heal the people-nature relationship through simultaneously 1) applying sound scientific principles and methods to jump start a degraded ecosystem into a complex, connected, multi-species healthy forest and 2) doing so through community engagement, participation, and reconnection to nature, thereby achieving the type of transformative change that has been called for. This presentation will also provide an overview of how to structure community-based pocket forest projects, balancing community engagement and decision-making with the need for scientific and technical expertise.

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The UK Tree Seed Database: an interactive portal for data sharing at national, population and individual maternal plant scales.

Ted Chapman

Royal Botanic Gardens, Kew

Abstract

RBG Kew's Millennium Seed Bank (MSB) holds comprehensive collections of the UK's native trees and shrubs, comprising more than 1,500 population-level collections representing more than 11,000 individual trees across 73 woody species in 24 Native Seed Zones. Multiple collections are held across the native range of each species in the UK, with seed from individual maternal trees collected, processed and banked separately. Each collection is accompanied by data including location, population size and extent, associated species, seed processing data, seed mass, viability and germination test data.

This enormous collection and associated dataset is a unique resource for research, development and use in woodland restoration and native tree production, with applications to date including genomic studies of population structure, genetic diversity and local adaptation; the investigation of germination traits and adaptive "climate-smart" seed sourcing; the identification of genetic conservation units and registered seed stands for tree production; and the establishment of new tree seed orchards for large-scale supply.

To facilitate this work, we have created an open access data storage and sharing platform, built around the structure of this diverse dataset and the functionality and needs identified by potential end-users during an inclusive consultation phase. Technical challenges to working across multiple species at different spatial scales – from national to individual tree level – have been successfully overcome, enabling a step change in our ability to share information, collaborate with partners and maximise the value of our tree seed collections.

Supply, demand, education, policy, research and outreach - How the Xerces Society and partners improve the supply of pollinator-friendly native plant materials across North America

Stephanie Frischie

The Xerces Society for Invertebrate Conservation, Portland, OR, USA

Abstract

The Xerces Society for Invertebrate Conservation is a non-profit organization focused on the conservation of invertebrates and their habitats. Xerces has several initiatives to improve the availability of native plant materials for pollinator habitat through multiple avenues. On the supply side, we work with native seed farmers and native plant nurseries to identify species with high pollinator value and low commercial availability; assist with foundation collections; and provide agronomic technical support for field and greenhouse production, including pesticide risk assessment and non-chemical pest management recommendations. Our Bee-Safe initiative works with producers to reduce the negative impact of pesticides on pollinators during seed or plant production as well as after habitat installation. On the demand side, we follow internal procurement guidelines for our habitat projects, including Xerces Habitat Kit Program, that prioritize regionally appropriate species and ecotypes as well as consideration of pest management in the production of those plant materials. Application of these guidelines to our habitat work creates stable, ongoing demand for local ecotypes of key plant species, produced under pest management that reduces risks to non-target invertebrates. This demand supports suppliers through the years of cost and risk associated with making new native plant materials commercially available. Research on the factors that contribute to native seed prices inform policy makers and seed customers. As a final example, Xerces Native Plant, Seed, and Services Directory connects seed and service providers with customers through a searchable database that includes filters for suppliers' pest management practices.

Bridging the Gap: Cross-Agency Collaboration to Restore Ecosystem and Human Health

Matthew Struckhoff, Bethany Kunz, Keith Grabner, Kirk Barnett

US Geological Survey, Columbia, Missouri, USA

Abstract

The U.S. Geological Survey (USGS) participates in multiple collaborations to support ecosystem restoration and to develop, test, and promulgate methods for restoration monitoring. For example, the Palmyra Atoll Research Consortium provides research to support the restoration and management of terrestrial and reef ecosystems at a former WWII Naval Air Station. Consortium products informed the development and implementation of atoll management efforts, including remediation of contaminated areas, removal of invasive rats, and coconut removal for terrestrial habitat management. In the central United States, collaborations with the Department of Interior Office of Restoration and Damage Assessment (ORDA), the U.S. Fish and Wildlife Service (USFWS), U.S. Army Corps of Engineers and local practitioners compared sampling methods at forest restoration sites while documenting improved ecological structure and function and benefits to local communities. In Missouri, the USGS Environmental Health Program is examining the use of soil amendments to improve ecological function and reduce risk to human health at locations impacted by lead mining. Collaboration between ORDA, USGS and the Environmental Protection Agency (EPA) has allowed inclusion of more treatment types, expansion of analyses, and extension of sampling beyond the scope of the original project. Around the Great Lakes, USGS efforts are complementing those of EPA to assess and monitor post-contaminant ecological restorations and revitalize the human communities within them. These examples demonstrate how efforts to return ecological function to damaged systems and provide tools for monitoring have been improved through inter-agency collaboration.

Restoring key ecosystems in the North Central region of the U.S. after plant invasion and wildfire

R Chelsea Nagy, Nayani Ilangakoon, Wynne Moss, Jennifer Balch

Boulder, CO

Abstract

Ecological transformations can be caused by different disturbances including wildfire, invasive species, and other drivers. Examples of invasive species-mediated transformations in the western U.S. include the spread of invasive grasses (e.g., cheatgrass, medusahead, buffelgrass) into sagebrush steppe and forest systems. These grasses create abundant fine fuels which lead to more frequent burns, allowing grasses to outcompete native plants and perpetuate the invasive grass-fire cycle. The result is the elimination of key native species and significant alteration of ecosystem structure and function. Our work engages a regional network of stakeholders, the North Central Regional Invasive Species and Climate Change (NC RISCC), to understand the implications of species invasions, wildfire, and ecological transformations on carbon storage and evaluate management practices that enhance carbon storage and improve ecological resilience. The NC RISCC network has >150 members including stakeholders from all levels of government, NGOs, Tribal partners, and academic institutions. Our research team has identified where transformations have occurred (and the associated changes in carbon storage), as well as areas vulnerable to future transformation. Next, we will host a workshop (fall 2025) to investigate different management practices and their role in enhancing carbon storage, native biodiversity, and ecosystem resilience. We will explore agency/organization policy regarding carbon storage and how this translates to manager actions. The end product from the workshop will be a management menu, co-developed with local stakeholders, for management of invasive species and wildfire to restore and enhance carbon storage and native community resilience.

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Climate challenges to invasive species management: Themes in practitioner perspectives

Eva Colberg

Northwest Climate Adaptation Science Center, Climate Impacts Group, University of Washington

Abstract

Climate change and invasive species pose multiple intertwined challenges to natural resource management and restoration, requiring practitioners to be increasingly flexible, adaptive, and innovative. This presentation explores management perspectives on these interactions by drawing from a series of interviews with managers and practitioners in the Northeast US. The results of these interviews include common themes in management approaches to the combined challenges of climate change and invasive species and case studies of climate-smart invasive species management, defined as the approaches that managers and decision-makers can take to address the interactive effects of climate change and invasions. The themes and techniques described herein can be applied to invasive species management and restoration projects in other regions as well. In addition to presenting examples of how managers can consider the interactive impacts of climate change and invasive species, this work also highlights where internal and external barriers and policies can impact the ability of practitioners to adapt their invasive species management practices to a changing climate. As part of the session, "*Regional Invasive Species and Climate Change Management Networks: Boundary-spanning for ecological management*," this work also serves as an example of how the Northeast Regional Invasive Species & Climate Change Management Network uses knowledge co-production methods to determine and address management needs.

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The use of green infrastructure that mimics natural processes by using vegetation to slow, filter, and treat stormwater runoff.Colin Bell, Kate Williams

City and County of Denver

Abstract

Denver's Division of Green Infrastructure (DGI) strives to offset the impacts of urbanization and impervious cover growth by building and maintaining capital projects. Denver's definition of green infrastructure is a living system that use soil, roots, vegetation and other natural processes to manage stormwater, mitigate urban heat, and increase Denver's resiliency to climate change. This presentation will give an overview of ongoing activities in DGI, and the content will follow the life cycle of a green infrastructure project: First it will cover city-wide planning and project prioritization. Next, it will cover design resources like *Denver's Green Continuum: Streets Design Guidelines* which elevates the importance of mitigating urban heat island during stormwater projects. It will share photos from recently constructed projects built using diverse contracting approaches. DGI also has a full crew specifically devoted to maintaining its green infrastructure facilities. Finally, the presentation will share methodologies and key results from the performance monitoring program.

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Supporting Local Organizations and Communities to Protect and Restore Forests through the WWF Education for Nature Reforestation Grants

Flor Gomez Byers

Washington DC

Abstract

The Education for Nature (EFN) Reforestation Grant Initiative, sponsored by the World Wildlife Fund, has successfully funded 143 restoration and reforestation projects across 24 countries and four continents, engaging 98 local communities and organizations. This program is designed to empower these communities and organizations in their efforts to restore degraded landscapes, enhance their capacity for managing natural resources, promote diversified livelihoods, and advance gender equity. Furthermore, it offers small local organizations an opportunity to leverage additional funding and collaborate with local stakeholders and communities in their restoration initiatives. From 2013-2024, project implementers planted 3.45 million trees across 88,000 ha; 82% of the trees planted were native species. Over half (51%) of the projects established community nurseries and 27% of projects used natural regeneration. 93% of 135 projects assessed offered capacity-building and training activities, such as workshops involving local communities, farmers, schools, and officials from government agencies. 84% of projects encouraged the participation of local stakeholders and 79% increased environmental awareness of local communities. Through empowering the work of local organizations and communities, the EFN Restoration Grants program fills a critical need that no other program provides—an accessible opportunity for small and locally focused organizations to fund and support restoration work, capacity building and training involving local communities.

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Centre for Ecosystem Restoration: From Global Targets to Community Seed Banks Across Africa, East Africa, and Kenya

Jonathan Jenkins

Centre for Ecosystem Restoration, Kenya

Abstract

The UN Decade on Ecosystem Restoration faces a major bottleneck: the chronic shortage of high-quality, locally adapted native seeds. With only 410 seed banks globally—versus tens of thousands needed—the gap between restoration goals and seed supply undermines ecological recovery, especially in biodiversity hotspots where wild seed sources are vanishing.

A recent assessment across Burkina Faso, Cameroon, Ghana, and Kenya reveals serious weaknesses in native tree seed systems. Despite Africa's pledge to restore 100 million hectares under AFR100, expert surveys show systemic gaps, particularly in enabling environments due to weak policies, inadequate capacity building, and limited financial investment. A critical knowledge divide persists, as public institutions hold technical expertise, while local communities—the primary seed suppliers—often lack access to resources and support.

In response, the East Africa Seed Network for Restoration (EASNR), launched in 2022, fosters regional cooperation and technical capacity across Kenya, Tanzania, and Uganda. Without proper seed banking, native seeds lose viability in months, forcing reliance on non-native species and leading to ecologically fragile outcomes.

CER-Kenya is addressing this through a regional three-hub seed bank system designed to provide timely, provenance-matched seed supply for restoration and emergency response. Guided by the International Principles and Standards for Ecological Restoration, the model ensures genetic diversity, viability, and ecological integrity. Seeds are collected sustainably—only 20% from diverse mother plants—while community training, rigorous documentation, and laboratory testing (germination, moisture, 1,000-seed weight) ensure quality. By integrating livelihoods and restoration, CER-Kenya helps translate global goals into effective, locally driven impact.

Breaking Barriers: Advancing River Restoration Across Europe

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¹Essen. ²WWF-NL. ³McMillen Europe

Abstract

Europe has taken a bold step toward restoring its ecosystems through the European Nature Restoration Law, which sets an ambitious target of restoring the free-flowing status of 25,000 km of its rivers. Achieving this goal requires a robust technical framework, developed by the European Commission and Member States, to define and implement free-flowing river restoration through barrier removal. Beyond policy, a strong Community of Practice is emerging, fostering collaboration across agencies, sectors, and disciplines to accelerate the removal of barriers.

This presentation will provide an update on Europe's progress in barrier removal in 2024, highlighting key milestones and challenges. It will also showcase recent achievements from MERLIN (<https://project-merlin.eu>), an EU-funded innovation project that supports the large-scale restoration of freshwater systems. Specifically, the talk will cover methods for setting restoration priorities, modeling restoration effects, and evaluating cost-benefits, offering insights into effective decision-making processes. Additionally, the role of economic sectors in shaping a harmonized strategy for barrier removal will be discussed, emphasizing the importance of cross-sectoral cooperation.

The transdisciplinary nature of river connectivity restoration—involving academia, NGOs, agencies, and industry—is crucial to ensuring long-term ecological and socio-economic success. By sharing experiences and innovations, this talk aims to contribute to the international discussion of scaling up barrier removal efforts. The insights presented will help inform best practices and strategic approaches to achieving Europe's vision of revitalized free-flowing rivers.

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An Overview of the Regional Invasive Species and Climate Change Management Networks

Jenica Allen

University of Massachusetts Amherst, Amherst, USA

Abstract

The combined impacts of invasive species and climate change represent a critical challenge to conservation and restoration. The Regional Invasive Species & Climate Change (RISCC) Management Networks are a group of boundary-spanning organizations in the United States and Canada that aim to reduce the compounding effects of invasive species and climate change by synthesizing relevant science, communicating the needs of practitioners to researchers, building stronger scientist-practitioner communities, and conducting priority research relevant to their region. The work of the RISCCs follows a translational invasion ecology model to support co-produced and stakeholder-driven actionable science for the management of invasive species with climate change. This presentation will introduce the RISCC Management Network, outline the translational science model that we follow, and highlight outputs and outcomes from a collaborative approach between invasive species and climate change researchers and practitioners.

Assessing the Effects of Cyanobacterial Biopriming on Native Mojave Desert Plants

Michael Mba Kusibu¹, Rachel Weitz², Lindsay Chiquoine¹, Raul Roman¹, Nicole Pietrasiak¹

¹School of Life Sciences, University of Nevada, Las Vegas, Las Vegas, USA. ²Department of Molecular Biosciences, University of South Florida, Tampa, USA

Abstract

Restoring degraded areas within dryland ecosystems, such as found in the Mojave Desert, is crucial amid global change and land-use challenges. While direct seeding is widely used in dryland restoration, its success remains limited. Biopriming seeds with cyanobacteria is a promising strategy for seeding success. This study evaluated the effect of cyanobacterial biopriming and seed pretreatment to prepare for biopriming on germination variables of seeds from four Mojave Desert native plants—mucilaginous annuals *Plantago ovata* and *Salvia columbariae*, and non-mucilaginous perennials *Encelia farinosa*, and *Pleuraphis rigida*. Species were selected based on life history and ecological significance. Two cyanobacterial strains *Nostoc* sp. (plant growth-promoter) and *Oculatella coburnii* (biocrust-associated) were used. Bioprimed annuals had lower germination rates and shorter radicles than controls, while bioprimed perennials also showed reduced radicle length but no change in germination rate. The seed pretreatment experiment assessed chemical (calcium and sodium hypochlorite at 1 and 15 minutes) and physical (UV-C at 30 minutes) sterilization methods and their effects on germination variables. Trends suggest germination rate and radicle length varied across pretreatments and durations. Sodium hypochlorite tended to reduce germination rates, particularly at 15 minutes of seed soaking. Germination characteristics did not appear affected by calcium hypochlorite and UV-C. Further research is needed to optimize biopriming procedures for Mojave Desert species including seed pretreatment methods.

Best practices for marine ecosystem restoration: the CLIMAREST project

Cristina Gambi¹, Roberto Danovaro^{1,2}, Climarest Consortium¹

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Abstract

Seas and oceans, the largest biomes of the biosphere, show an increasing number of largely degraded habitats. The multiple human impacts on natural ecosystems are causing a widespread habitat loss, with consequent decline of biodiversity and ecosystem services. The overall aim of restoration is to restore the habitats, their ecosystem functions, and services, and recovering their biodiversity. The great challenge is to accelerate global development for restoration of degraded marine ecosystems from shallow waters to the deep sea, to fight the climate heating crisis, enhance food security, provide clean water, and protect biodiversity on the planet. The EU project CLIMAREST “Costal Climate Resilience and Marine restoration Tools for the Arctic Atlantic basin” aims at integrating multiple expertise into a holist approach for marine ecosystem restoration. The increasing experience acquired in the last decades on marine ecosystems at global scale provides evidence on the feasibility of restoration activities also in marine habitats. To maximize the chances of success for marine restoration the identification of the best restoration practices for the recovery target species/habitat is certainly a priority. Here we focus attention on the restoration efforts/protocols and methodologies available for different costal habitats: seagrasses, oyster reefs, algal and kelp forests to draw a general tasks and guidelines to consider when restoration actions are planned in coastal ecosystems.

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Boosting the restoration economy in the Brazilian Atlantic Forest

Paloma Pressato, Vinícius Almeida, Luciana Alves, Eduarda Thurler, Mariana Oliveira, Ana Cecília Gonçalves

WRI Brasil, São Paulo, São Paulo, Brazil

Abstract

This study describes the Forest Business Accelerator Program in the Atlantic Forest, an initiative of WRI Brasil. The program aims to support small and medium-sized businesses working in Atlantic Forest restoration through training, mentoring, and financial support. The study presents lessons learned, possible trends and challenges in the sector, and also details the program's methodology, including the selection process, challenges, the structure of the acceleration programs, and the results achieved. The accelerator supported 20 businesses linked to the restoration chain in the first phase, and in the second phase, it strengthened 5 businesses. This experience highlights the importance of adaptive and integrated strategies to strengthen the forest restoration chain, connecting environmental impact and economic development. The importance of acceleration initiatives to drive forest restoration and generate socioeconomic benefits for local communities should be highlighted.

Initiative 20x20: A Strategy for Restoring Multifunctional and Diverse Landscapes in Latin America and the Caribbean

Natalia Ruiz Guevara^{1,2}, René Zamora Cristales³, Victoria Rachmaninoff³, Margarita Gonzalez³, Luciana Gallardo Lomeli³, Jerin Tan³, Mary Gronkiewicz³

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Abstract

Initiative 20x20 is a country-led effort focused on combating land degradation through the restoration of multifunctional landscapes in Latin America and the Caribbean. Launched in 2014, the Initiative adopts a comprehensive approach of restoration, based on the recovery of functionality of degraded ecosystems. Its main goal is to protect and restore 52.6 million hectares of land in 18 countries. To achieve it, the Initiative engages a wide network of governments, technical and financial partners. The Secretariat, hosted by the World Resources Institute, facilitates dialogue and collaboration among stakeholders.

The Initiative's New Strategy (2024-2030) was developed through a participatory process that included the analysis of its historical progress and validation with 65 people from various countries, organizations and institutions. The Strategy is built upon four key pillars: policy, private financing, knowledge and gender and social equity. The policy pillar focuses on enhancing governance, monitoring frameworks and creating incentives for restoration. The private finance pillar aims to mobilize investments in restorative gender transformative businesses. The knowledge pillar promotes the sharing of best practices and innovative approaches through communities of practice. The gender and social equity pillar, a new addition, sets a roadmap to collectively ensure that restoration efforts are inclusive and address social inequalities.

The Strategy includes a three-levels monitoring framework, with indicators tracking impact, results and performance of the Initiative. Thus, the Initiative's success is measured not just by the area restored but also by the enabling conditions created through policy improvements and stakeholder engagement.

Gender Equity in Model Forests: Advances and challenges in landscape governance for conservation and restoration

Natalia Ruiz Guevara^{1,2}, Claudia Rojas Ríos², Cristina Fueres³, Steffanny Bashi Pizarro³, Andressa Sayori Minato³

¹WRI, Lima, Lima, Peru. ²RLABM, Lima, Lima, Peru. ³CATIE, Turrialba, Cartago, Costa Rica

Abstract

The Latin American Model Forest Network (RLABM) groups 34 territories working on landscape governance in 15 countries. This study compiles the progresses made by the RLABM to understand the intricate gender dynamics within its scope of work and how gender inequalities impact governance and landscape management. Since its first Gender Strategy launched in 2017, the Network has promoted four researches identifying generalities across the network and three case studies from the Apurímac-Abancay (Perú), Los Altos (Guayemala), and Pichanaki (Perú) Model Forests .

The synthesis underscores that despite women's vital roles and knowledge in conservation and restoration, they are frequently marginalized in decision-making processes at community and landscape level. This inequity is rooted in traditional gender roles, unequal access to education and economic resources (specially land tenure), and systematic undervaluation of women's contributions. In all the three territories, was found women's limited representation in leadership positions, disproportionate workloads and gender-based violence. Intersectional factors like ethnicity, geographic location (rural vs. urban), and age exacerbate these inequalities.

Comprehensive strategies to address these issues include transforming socio-cultural norms, ensuring genuine participation of women in decision-making and valuing their traditional knowledge. Specific recommendations for each territory include culturally sensitive approaches, integration of gender into landscape management, and support for women's access to resources and education. The importance of transforming masculinities and understanding power dynamics within communities is underscored. Intersectional approaches that consider the compounded effects of gender, ethnicity and location are crucial for addressing inequalities.

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Engaging Communities for Successful Pocket Forest Project Implementation

Aqsa Butt

BSC Group, Worcester, MA, USA

Abstract

This presentation will outline strategies for effectively engaging diverse communities in pocket forest projects, focusing on a comprehensive approach to community involvement. We will explore how to identify priority populations, those disproportionately impacted by climate change, and how pocket forests can address these challenges by improving air quality, reducing the urban heat island effect, managing stormwater runoff, and enhancing biodiversity. The presentation will cover the development of a public engagement strategy that fosters meaningful participation, using tools such as storytelling, crowdsourced mapping, and multilingual outreach materials to ensure inclusivity. Additionally, we will discuss promotional efforts through social media, flyers, press releases, and local media outlets to maximize community engagement. Interactive components, including community foraging days, service planting events, and educational materials, will be highlighted as ways to foster community ownership and active involvement in the installation of pocket forests.

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SeedPOD, the Seed Portal for Online Data

Naomi Carvey

RBG Kew, London, United Kingdom

Abstract

Ecological restoration initiatives are currently hampered by a widely acknowledged global bottleneck in native seed supply. Quantitative and qualitative analysis of this bottleneck is made difficult due to the lack of availability of high-quality, detailed data on collections of native seeds and the wild populations they derive from. In practise, restoration practitioners can struggle to find seed sources, especially sources of high-quality, genetically diverse, native seeds. Compounding these issues, means for knowledge exchange between researchers and restoration practitioners and native seed custodians is often fragmented.

To help address these issues, SeedPOD is an exciting new open access resource for restoration and research communities due for open release in 2026. SeedPOD will unlock detailed field, processing, seed quantity and viability test data on wild plant species throughout their global distribution range and will link related seed collections stored at multiple locations for easy identification and comparison. SeedPOD will also disseminate germination and propagation protocols, to assist the process of transforming native seed back into thriving plant communities. SeedPOD will link to complimentary resources and information sources. Significantly SeedPOD will include a point of request for seed samples from all participating native seed custodians.

Native seed custodians will have in SeedPOD a user-friendly, reliable platform to disseminate their seed list easily and for free, while researchers and restoration practitioners will be able to access high-quality data, and to identify appropriate seed sources available for use.

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Bringing the forest home, how to become a forest community

Caseylee Bastien

BSC Group Inc., Boston, MA, USA

Abstract

When individuals share direct action, a story can change how they see their role in the environment. This is how we create human forest communities where people are invested in their land, especially those where biodiversity has become distant and abstract.

With both research sources and lessons learned from decades of shared experience in performing restoration/ replication of many types we show how to bring best practices forward through the Pocket Forest and what to leave behind. This section will share the tools and techniques that elevate design beyond basic planting. And it will cover where divisive ideas took hold, how to root them out and what to replace them with. Participants will learn how to make specific implementation approachable and repeatable through a viral set of ideas that follow you home and can set new standards for private and municipal management.

The presentation will provide links to references for why and how to get started and how to maintain a young forest through infancy and how to leverage them. It includes what and how to forage responsibly and how to inoculate new forests with old growth. It will cover habitat details, soil interpretation and amendment with sources and lists for specific forest functions and an understanding of the difference between duplicating a plant group and expedited biomimicry for the process of succession.

Learning how to restore biocrusts to degraded rangelands: a 10-year retrospective of a University-NGO collaboration

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Abstract

Biological soil crusts (biocrusts) are a major pillar supporting ecosystem function in water-limited rangelands. While researchers around the world are working to develop viable biocrust restoration methods, a limiting factor has been sustaining effort in an environment of 3-5 year funding cycles. In contrast, Northern Arizona University and MPG Ranch (an NGO dedicated to conservation, restoration, science and education) have been systematically developing methodologies to restore biocrusts on the MPG Ranch property for a decade. Through this unique, sustained collaboration, we have been able to innovate new growing systems for biocrust inoculants, determine the barriers limiting establishment of added inoculants, and develop products and methods of field delivery of biocrust inoculants that overcome some or all barriers. Examples include: 1. Advancement of biocrust restoration techniques focusing on moss biocrusts (as opposed to cyanobacterial biocrusts, another common type), 2. Development of fog culture techniques for biocrust production, 3. Testing outdoor biocrust farming practices, leading to expanded production capacity, 4. Testing of mechanized dispersal of biocrust biota, 5. Creation of biocrust-covered cloths to facilitate establishment and discourage exotic plants, 6. Creation of biocrust infused pellets to enhance establishment rates, and 7. Investigation of the likely impacts of biocrust restoration practices on vascular plants. Standing on a decade of research and development, we are now aiming to take the next steps to overcome scale limitations by integrating biocrust restoration with cutting-edge native plant restoration methods, incorporating these important but currently missing ecosystem components into landscape-scale restoration practices.

855

Seeding of common native forbs into moss increases germination, height, and volume of individuals

Lea Condon¹, Alexandria Quinlan², Carrie Barker¹, Peter Coates³

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Abstract

Restoration of vegetation in arid landscapes has been notoriously difficult. Challenges are often attributed to variability and limitations in soil moisture. Tactics used to increase success include applications of mulch and irrigation. Biological soil crusts (biocrusts) can be seen as nature's mulch, contributing to increased soil moisture where they occur. Mosses in particular have shown promise in facilitating restoration of vascular plants, however little is known about their associations with annual forbs. Forbs currently being studied for use in restoration across the Great Basin include *Collinsia parviflora* Lindl., *Microsteris gracilis* (Hook) Greene, and *Mentzelia veatchiana* Kellogg. In this study, we tested if the moss component of biocrust facilitates the germination and growth of these three native annual forbs. We also examined how the source population of the seeds affects growth and how precipitation affects the timing of germination and the growth of the target species. Preliminary results show that the growth of forbs was higher with the addition of moss. Findings varied by seed source population, with more mesic sites tending to have larger growth with the application of moss. Cumulative precipitation had a significant positive influence on growth, with most growth occurring during the wetter part of the experiment. This study demonstrates that there are likely benefits to restoring annual forbs with mosses and highlights important factors to consider, like source population and precipitation. Information is preliminary and provided for best timely science.

966

Collaborating with Public School Teachers to Incorporate Schoolyard Pocket Forests into Curriculum

Amanda Smith

USA

Abstract

This presentation will outline strategies for incorporating pocket forests into public school curriculum and explore ways that schoolyard pocket forests create equitable access to nature, foster socio-ecological literacy, and demonstrate the social and ecological benefits of nature-based solutions in addressing today's climate challenges including improving air quality, reducing the urban heat island effect, managing stormwater runoff, and enhancing biodiversity.

We will explore ways that schoolyard pocket forests provide opportunities for experiential learning, applied research, and real-world application of coursework at school. Schoolyard Pocket Forests are ecological hotspots where students of all ages can interact with and learn about native, edible, and unique plants; study the complex interactions between soil, plants and wildlife; and engage in real-world applications of restoration, plant care, and land stewardship practices. Additionally, they create a unique opportunity for students to learn about and explore complex topics including environmental justice, climate change, sustainability and resilience.

Pocket Forests are a living laboratory where students can observe and experience how nature-based solutions and climate resilience projects directly address today's climate challenges including improving air quality, reducing the urban heat island effect, managing stormwater runoff, and enhancing biodiversity. Additionally, they foster student engagement and exposure to ways we can collaborate to make our communities more resilient and provide a case study for them to directly experience the social resilience benefits that emerge as the forest grows and becomes a popular space for people to gather and cool off on hot summer days.

1015

Community Participation in Pocket Forests: Benefits & ChallengesBeth Suedmeyer

Devens Enterprise Commission, Devens, MA, USA

Abstract

From 2022-2025, two communities in Central Massachusetts partnered to install five pocket forests, three of which involved collaboration with public schools. The pocket forest project allows the communities to increase climate resilience and ecological restoration, while also increasing quality of life, climate literacy, and connections to nature. Community members, including teachers, students, local businesses, and nonprofit groups have engaged in pocket forest planning, installation, monitoring, and maintenance. The project engagement involved climate vulnerable populations and expands the understanding of climate threats and how we can collaborate to make our communities more resilient and hopeful. These forests better connect people with nature and offer physical and mental health benefits. The Pocket Forest project reflects priorities established in community climate action plan development which highlight actions implementing nature-based solution projects, such as pocket forests. Broad community partnerships, funding pipelines, and volunteer engagement will be discussed.

1067

Meshing restoration ecology and landscape architecture: how can we build a stronger collaboration?

Steven Handel

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Abstract

Restoration ecologists have developed many skills to advance habitat structure and function in damaged landscapes. However, it is landscape architects that have the skills and legal authority to create blueprints for new public and private parks and other social spaces. It is their detailed designs which are approved by governments at all levels and are the basis for contracted work. These designed landscapes represent major opportunities to improve biodiversity and to link existing habitat fragments. The two professions, ecology and landscape architecture, have different training and perspectives, yet they must collaborate closely to improve our hope for widescale greater ecological function. What organizational and operational steps are needed to improve this partnership? As an example of how this partnership can be strengthened, studies done on a vast urban landfill in New York City show that ecological links still exist, even in urban centers, and can be exploited to improve ecological functioning of these areas. These links include seed dispersal, pollination potential, and invasive species movements. Landscape architects must confront these processes to understand the ecological processes present around the sites which they are designing. These processes can change the future performance of their design work and emphasize the hidden connections between design work for a site and adjacent landscapes' influence. These connections could have positive or negative impact on the success of a landscape architect's work. Regardless, they cannot be ignored.

1076

Scaling up spatially patterned restoration: Insights from applied nucleation in Chilean Mediterranean forests

Pablo Bravo-Monasterio

Centro de Investigación en Interacciones Ecológicas y Restauración de Bosques (CiiRES), Linares, Linares, Chile. Universidad Austral de Chile, Valdivia, Valdivia, Chile

Abstract

Forests are highly dynamic systems that often require intervention to sustain their structure and function. Disturbances such as wildfires, prolonged droughts, deforestation, and land conversion to commercial plantations drive ecological transformations across multiple spatial and temporal scales, leading to the degradation of forest structure and significant alterations in ecosystem composition, functioning, and development. Chilean Mediterranean forests have been particularly affected by these disturbances, emphasizing the urgent need for large-scale restoration strategies to enhance ecosystem resilience and facilitate recovery. A promising approach, rooted in both community-based and forest restoration practices, is applied nucleation, a technique integrated into restoration ecology theory. This method has been recognized for its ability to enhance local biodiversity and support ecological conservation and recovery. This presentation evaluates the effectiveness of a planting technique derived from nucleation-based restoration across diverse environments in Chile. It also explores the role of these plant clusters in promoting plant establishment and increasing vegetation diversity. Our findings indicate that clustered planting significantly improves seedling survival, particularly under high-stress conditions, with an increase of up to 35% compared to individual plantings. This study aims to provide practical insights into large-scale ecological restoration, addressing the need to adapt restoration methodologies to the pressing challenges posed by climate change and recurrent wildfires in Chile's Mediterranean region

1077

Restoring the European Atlantic cold-water coral reef belt

Anthony Grehan¹, Marie-Claire Fabri², Veerle Huvenne³, Murray Roberts⁴, Stefan Ragnarsson⁵, Franck Lartaud⁶, Marina Carreiro Silva⁷, Oisín Callery¹, Emanuela Fanelli⁸

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Abstract

Cold-water coral reefs, located in deep waters (>200m) along the European Atlantic continental slope, create complex 3D habitats that support an abundant and diverse reef fauna. Early maps of the distribution of these reef ‘massifs’ suggest that the reefs occurred further up the slope than is the case today. The cumulative impact of over 100 years of demersal trawling is considered the main contributing factor for the disappearance of reefs from these shallower slope depths. One of the objectives of the Horizon Europe ‘REDRESS’ project is to demonstrate the feasibility of active reef restoration in areas where corals have been damaged or removed with the goal of restoring the European Atlantic coral reef belt. We will deploy 3D printed artificial reefs at several sites along the Atlantic margin: Bay of Biscay (France), Porcupine Bank (Ireland), the Darwin Mounds and Shetlands (United Kingdom) and south of Iceland. These sites were chosen for their ecological significance and differences in their environmental and management regimes, facilitating intercomparison. We are actively following the Society of Ecological Restoration international principles and standards in the development of our ecological restoration plans, monitoring strategies, and audit criteria.

1078

Futures thinking for restoration: a case study from the Kazakh Steppe

Adam Devenish¹, Michele Bowe¹, John Ingram², Monika Zurek², Aibek Samakov², Geoff Griffiths³, Alyona Koshkina⁴, Genevieve Stephens¹, Sarah Robinson², Irina Grigoryeva⁴

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Abstract

Rangelands cover half of the world's land surface, supporting biodiversity and human livelihoods. However, these ecosystems are increasingly under threat from agricultural expansion, overgrazing, and climate change, which disrupt ecological processes and diminish their capacity to sustain wildlife and communities. On the Kazakh Steppe, rising livestock populations and the recovery of saiga antelope (*Saiga tatarica*) from less than 50,000 in 2005 to over 2.8 million individuals in 2024 intensify competition for limited resources, further complicating efforts to balance conservation goals with pastoralist livelihoods. Planning for restoration in such landscapes requires approaches that incorporate diverse priorities, evaluate trade-offs, and address uncertainties.

This study explores how futures thinking can contribute to restoration planning in Western Kazakhstan. Participatory workshops with national and local stakeholders were used to co-develop land-use scenarios reflecting ecological, social, and economic dimensions. These scenarios were translated into spatial maps to evaluate potential trade-offs and synergies between competing futures. Spatial analyses, combined with species distribution models, were used to identify biodiversity hotspots and areas where restoration and conservation actions could be prioritized.

Our findings suggest that futures thinking can support restoration planning by fostering collaboration between stakeholders and providing tools to navigate uncertainties. While scenario planning methods can be used for a range of purposes, here it provides a framework for discussing trade-offs and aligning biodiversity conservation with community priorities. These insights contribute to advancing more sustainable and adaptive restoration efforts in Central Asian rangelands.

1079

Overview of spatially patterned restoration methods and symposium

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Abstract

Spatially patterned restoration methods, such as applied nucleation and strip planting, have been promoted as restoration approaches that enhance habitat heterogeneity and are cost effective to implement, thereby facilitating scaling up restoration projects using limited resources. Nonetheless, these approaches have largely been tested in small-scale scientific experiments and rarely implemented in restoration projects. Moreover, studies of spatially patterned methods have been focused on forest ecosystems. In this talk, we will provide an overview of the symposium and summarize outcomes of spatially patterned restoration methods across a range of ecosystem types. We will highlight key ecological, social, and logistical strengths and challenges of spatially patterned approaches to restoration. For example, spatially patterned methods can be effective in facilitating recovery of forest ecosystems in systems where there are not strong barriers to seedling recruitment, such as strong competition with invasive species. But the irregular planting patterns can be more challenging to implement and may not be consistent with landholder preferences. Scaling up spatially patterned approaches will require collaborations between scientists and practitioners to test methods that are logistically, financially, and socially feasible in a given setting. These restoration methods should be directly compared to other restoration methods and the costs and outcomes clearly documented.

1080

Collaborative Restoration for Resilient Watersheds: Harnessing Partnerships, Funding, and Stakeholder Engagement for Lasting Impact

Deb Hummel

The Watershed Center, Longmont, CO, USA

Abstract

Successful watershed restoration depends on collaboration among diverse partners to build resilience for both the environment and communities. At The Watershed Center, we bring together landowners, water managers, conservation groups, and government to align priorities, secure funding, and implement science-based restoration. By integrating ecological, agricultural, recreational, and municipal needs, we create projects that enhance water resources, mitigate flood and fire risks, and support long-term resilience. Join us to learn about our collaborative approach and how we navigate complex, multi-stakeholder projects to find common ground and drive meaningful restoration.

1082

Restoring marine ecosystems: needs, opportunities and challengesRoberto Danovaro, Cristina Gambi, Cinzia Corinaldesi

Polytechnic University of Marche, Ancona, Italy

Abstract

Deep-sea ecosystems are increasingly threatened by several direct and indirect impacts. Their conservation is crucial to protect biodiversity, yet several systems have been degraded or damaged and require specific actions for their recovery. Marine ecosystem restoration is a new frontier in the deep-sea biological research and is a key challenge of the present UN decade dedicated to “Ecosystem restoration”. However, appropriate tools, technologies and methodologies along with success stories are needed to incentivize society and private enterprises to build capacity and stimulate investments in marine ecosystems. Yet, we still must demonstrate that restoration efforts can effectively contribute to achieving the restoration targets. Here I will present an overview of active restoration interventions in marine ecosystems including deep-sea habitats worldwide. Available information indicates that also deep-sea ecosystem restoration is possible and highly successful. Restoration interventions can profit of the coupling between active and passive interventions. These results demonstrate the immediate feasibility of a global “blue restoration” plan even for deep-sea ecosystems, enabled by increasing availability of new and cost-effective technologies.

1085

The governance of tree planting and forest restoration: whose decisions, what norms, and what outcomes?

Stephanie Mansourian^{1,2}, Christian Kull¹

¹University of Lausanne, Lausanne, Vaud, Switzerland. ²Mansourian.org, Crassier, Vaud, Switzerland

Abstract

"The governance of tree planting and forest restoration: whose decisions, what norms, and what outcomes?" is a 4-year project run by the University of Lausanne (Switzerland) funded by the Velux Stiftung. It aims to explore who decides where to plant trees, which tree species, with whom, on whose land and who maintains them – all of which are important governance questions. The **overall objective** of this project is to improve integration of governance dimensions in forest restoration implementation. One pillar of the project is an interdisciplinary panel made up of 14 experts who represent different regions, different organisations, and different disciplines. Through a collaborative exercise we discussed governance definitions and governance challenges and solutions in the framework of forest restoration. Our divergent disciplinary backgrounds and experiences enabled us to identify governance challenges and possible governance solutions for forest restoration. We focus on a specific governance challenge, namely balancing global and local benefits of forest restoration. More specifically we address the question: *How can large scale political processes promoting forest restoration/tree planting (e.g., AFR100) and large scale investments (e.g., large multinationals offsetting their emissions through tree planting) contribute to the needs of local people so that benefits can accrue at all spatial scales, from global to local?*

1087

Predictive Mapping of the Moss Component of Biological Soil Crusts

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Abstract

Biological soil crusts (biocrusts) are soil surface communities that can include cyanobacteria, lichens, and mosses. Biocrusts commonly grow in the interspaces between vascular plants and contribute to essential ecosystem functions such as water cycling, nutrient cycling, and the prevention of soil erosion. We focus on the moss component of biocrusts because mosses can be more tolerant of land uses such as grazing by livestock and are more successfully reintroduced through restoration than other biocrust components. We are carrying out a study that examines the distribution of the moss component of biocrusts across a sagebrush dominated portion of the northwestern Great Basin. Over 2023 and 2024, we surveyed 102 plots randomly stratified across environmental gradients to assess how abiotic and biotic factors influence the distribution and abundance of moss, including information on fire as well as use by cattle and free-roaming horses. Preliminary findings highlight the complex impacts of fire and grazing on moss distribution while identifying key environmental conditions such as cooler minimum temperatures supporting their growth. By developing a predictive model and distribution map, this study provides valuable insights for land managers seeking to protect and restore mosses. Restoring biocrusts can improve soil health, reduce erosion, increase water infiltration, and enhance rangeland productivity, ultimately supporting sustainable grazing practices and wildlife management. These tools can help guide post-disturbance restoration efforts by identifying areas with suitable habitat conditions, supporting ecosystem resilience and management in arid landscapes. Information is preliminary and provided for timely science.

1088

Toolbox for scaling of marine ecosystem restoration

Lara Veylit, Elina Willert Søråsen, Ida Beathe Øverjordet

SINTEF Ocean, Trondheim, Trondheim, Norway

Abstract

Due to climate change and other anthropogenic pressures, marine ecosystems are heavily degraded along worldwide coastlines. Currently, about 40% of the world's population lives within 100 km of the coast, making ecosystem restoration and climate resilience initiatives a top priority. The recent Nature Restoration Law by the European Union presents an opportunity for the growth of the marine restoration community, which is currently characterized by small-scale experimental projects. CLIMAREST (2022-2025) is an EU project aimed at scaling up marine restoration through the development of tailored tools and guidelines tested across five demonstration sites, from Svalbard in the High-Arctic to Madeira in the south. CLIMAREST provide relevant information and tools to policymakers as well as restoration practitioners to improve the long-term success of marine restoration projects and provide blueprints for scaling up, out, and down.

The project will achieve this by developing and delivering a digital toolbox for ecosystem restoration and coastal climate resilience hosted by The Society for Ecological Restoration. This toolbox aims to bring science-backed best practices to marine restoration, maximizing the effectiveness of restoration actions by connecting users to established networks, experts, and tools. The toolbox includes resources for all phases of restoration, case studies with accessible data and code, and materials for stakeholder engagement and ocean literacy campaigns.

CLIMAREST outputs contribute to preserving crucial habitats, improving marine restoration outcomes, and ensuring a more resilient future for European coastal ecosystems.

1089

Active restoration of biological soil crusts: A Great Basin perspective on providing economical solutions to increase site productivity.

Lea Condon¹, Carrie Barker¹, Peter Coates²

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Abstract

Over the last decade, ecologists and land managers have shown a strong interest in methodological improvements to restore biological soil crusts (hereafter, biocrusts), the soil surface community that includes lichens, mosses, and cyanobacteria. These efforts are especially sought after in the Great Basin, USA, ecoregion as these organisms are associated with the preservation of soils and increased productivity of perennial grasses on rangelands. Here, we present an overview of past and current practices that have been carried out within the Great Basin. Past efforts include transplanting salvaged biocrusts into areas that were devoid of biocrusts. One notable practice developed in the Great Basin is the use of jute net to restore biocrusts. This treatment allows for an increase in the boundary layer, a zone of high humidity surrounding arid land mosses, and has resulted in significant and regular increases in cover of biocrusts. Additionally, the use of the tackifier, psyllium, has facilitated increases in cover, especially in comparison with other commonly used tackifiers, i.e. guar and polyacrylamide. We continue to build upon these findings by placing them in settings that vary based on environmental conditions, existing biotic communities, as well as past and present land uses. We will discuss advances in practices that allow for the active restoration of biocrusts as well as how these efforts could fit within the context of sustainable land management that includes biocrusts as management targets. Information is preliminary and provided for the best timely science.

1090

Providing ecosystem solutions in Great Basin landscapes: Examining biocrusts within the context of drought and grazing by livestock and free-roaming horses.

Lea Condon¹, Kierstin Acuña^{1,2}, Diana Tataru³, John Bradford^{4,5}, Daniel Schlaepfer^{4,6}, Kate Schoenecker⁷, Aleta Nafus⁸, Peter Coates⁹

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Abstract

Drylands face multiple stressors related to land use, disturbance, and climate. These stressors have known repercussions on plant communities, but less is known about potential repercussions on biological soil crusts (biocrusts). Biocrusts are soil surface communities associated with reduced soil erosion and reduced likelihood of invasion by invasive annual plant species. The existing paradigm has been that all components of biocrusts are fragile and highly susceptible to disturbance. We evaluate the hypothesis that specific components of biocrusts will vary in their susceptibility to disturbances and land uses in the Great Basin, USA, where a primary land use practice is grazing by domestic livestock. In this region, free-roaming horse numbers are increasing exponentially. The state of Nevada, which is at the core of the Great Basin, has the highest number of horses compared with any other state. This region is also projected to increase in temperature and aridity in the future. We address the influences of these stressors on the more ruderal components of biocrusts, specifically cyanobacteria and mosses. Preliminary results indicate that cyanobacteria are favored by soil moisture in the spring whereas some mosses are favored by start and length of soil moisture in the fall, more so than periods of drought. Across various seasons of grazing by livestock, cyanobacteria were found to be the most abundant component. Additionally, efforts to reduce feral horses resulted in trends towards higher cover of biocrust groups. Information is preliminary and provided for timely science.

1091

Informing land management that maintains biological soil crusts.Lea Condon¹, Peter Coates²¹Western Ecological Research Center, US Geological Survey, Reno, NV, USA. ²Western Ecological Research Center, US Geological Survey, Dixon, CA, USA**Abstract**

The contribution of biological soil crusts (hereafter, biocrusts) to ecosystem functions, such as the prevention of soil erosion and the hinderance of establishment by fire-promoting invasive annual grasses, is increasingly recognized. Such functions are often critical reasons to restore biocrusts. However, when biocrusts are present, it is critical that we understand how to manage for them. We discuss the responses of various groups of biocrusts to common land use practices and disturbances (anthropogenic and natural). Globally, wildfire is becoming an increasingly common and more frequent disturbance. We discuss how some components of biocrusts survive wildfire and while others benefit from this disturbance. Grazing by livestock is a major land use practice within semi-arid environments, such as the Great Basin, USA, where much of our research is conducted. Biocrusts can be particularly sensitive to higher levels of grazing intensity on unstable soils. We are partnering with land managers and administrators to identify different regimes of grazing intensity, and other common land use practices, in various settings that support healthy biocrusts communities and maintain ecosystems functions. We discuss the findings of this work here. Information is preliminary and provided for best timely science.

1092

Creating habitat in a dynamic world: interdisciplinary collaboration in restoration design of Breton Island, Louisiana

Sophie Williams

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Abstract

The Natural Resource Damage Assessment (NRDA) Trustees for the 2005 Breton Sound B51 Platform and 2010 Deepwater Horizon oil spills in the Gulf of America used funding from NRDA settlements in each case to implement restoration on Breton Island off the mainland coast of Louisiana to help compensate the public for injuries to natural resources caused by these spills. Breton is an eroding remnant of a historic Mississippi River delta and continues to evolve in response to processes including storm erosion, subsidence, sea level-rise, and reduced sediment supply. As lead for restoration implementation, the United States Fish and Wildlife Service convened an interdisciplinary team of wildlife biologists, engineers, research oceanographers, and geomorphologists to develop an engineering and design and modeling framework simulating the potential impacts of storms and sea level-rise to habitat availability for existing and future conditions to maximize the longevity of target habitats. Modeling simulations quantified the potential for erosion, overwash, and inundation of the pre- and post-restoration beach and dune system and evaluated potential drivers in habitat evolution to help evaluate the effect of the preferred restoration alternative on habitat distribution. Results informed the selection of the final design, engineering design, and construction decisions. Through this process, the multidisciplinary team 1) provided a range of technical expertise for expert elicitation, 2) enabled iterative project feedback and development of tools to meet evolving management questions, and 3) developed techniques that expanded on existing approaches that were insufficient to provide information needed to guide decisions for this project.

1093

The role of seed banks in ecological restoration: An analysis of native seed supply in Africa

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Abstract

Multiple ecological restoration pledges have been made to tackle the dual crises of climate change and biodiversity loss, but the world's capacity to deliver large-scale, high quality restoration is often said to be limited by an inadequate supply of appropriate seed. Using the continent of Africa as a case study, we examine the availability of seeds of native tree and herb species, looking at who is providing the seeds, and analysing the accessibility, purchasability, nomenclature, native species richness, ancillary data and genetic diversity of the seeds available. To improve the supply of native seeds worldwide, we propose a global network of 'restoration seed hubs', located close to the point of restoration need, and equipped to source, store and distribute seeds of genetically diverse, native species in the quantities required for landscape restoration, presenting examples drawn from the Millennium Seed Bank Partnership. We identify barriers to scaling up the seed supply for restoration and suggest research, resources and tools to overcome them.

1094

Coastal restoration through a collaborative platform: The case of the Ebro Delta (Spain)

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Abstract

The Ebro Delta, located on the Spanish Mediterranean coast, is experiencing significant coastal reshaping due to the near-total blockage of sediment flow by the river's dams. This reshaping is expected to be intensified by climate change driven sea-level-rise.

The study focused on La Marquesa Beach, a highly erosive shoreline that has historically retreated up to 6 m-yr⁻¹, where an historic embryonic dune system was restored. The final design constructed 62 low-crested dunes perpendicular to the shoreline. Posidonia wrack, often treated as waste, was repurposed to reinforce the core of a dune as a pilot experiment. The intervention aims to increase the roughness of the emerged beach, improving resilience to erosion and flooding.

The project was planned, implemented, and monitored collaboratively through a coastal restoration platform (CORE-PLAT) of stakeholders, including mayors of involved municipalities, local farmer coalitions, relevant ministries, engineers, and researchers.

Restoration success was assessed with 17 field campaigns and UAV imaging to construct digital elevation models spanning a year. While the results show the dune crests decrease with time, the troughs increase in elevation, maintaining an enhanced coastal roughness. Shoreline erosion slowed to 1-2 meters during the study. Sand recycling along the beach indicates the intervention reduces erosional processes, enabling the sediment budget to reach equilibrium. The results indicate improvement to La Marquesa Beach's resilience, especially when Posidonia wrack reinforces the embryo dune core. The CORE-PLAT led to wider local involvement, better understanding of the restoration by the community, and potential for scaling to other beaches in the delta.

1096

The view from government agencies: Multi-stakeholder perspectives on harnessing Assisted Natural Regeneration for forest restoration in the Asia-Pacific region

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Abstract

Various Forest and Landscape Restoration (FLR) initiatives have been introduced to enhance biodiversity, ecological functions, and rural livelihoods, including Assisted Natural Regeneration (ANR)—a set of low-cost approaches that enhances natural recovery and functionality in degraded landscapes. Despite its potential, ANR implementation in FLR projects remains limited and largely unsustainable, undermining its broader impact. This study examines ANR implementation across socio-ecological and policy dimensions in the Asia-Pacific region, using case studies and mixed-method qualitative surveys to highlight multi-stakeholder perspectives, particularly from government agencies. We showcase real-world ANR applications and identify key drivers influencing stakeholders' adoption. Socioeconomic incentives, particularly income and livelihood opportunities, are the primary motivators, followed by environmental benefits like biodiversity conservation, watershed protection, climate change mitigation, and disaster risk reduction. Institutional mandates and intrinsic conservation values also play a crucial role. We categorize the barriers to ANR into eight major themes, with critical obstacles including short-term and insufficient funding, limited livelihood integration, and environmental threats. Weak policy frameworks, inadequate monitoring, and governance gaps further hinder ANR's long-term viability. Restrictions on native tree use, as seen in the Philippines, also limit ANR integration into broader FLR strategies. To enhance ANR effectiveness, we recommend extending project timeframes, securing long-term funding, improving protection and monitoring, integrating sustainable livelihoods, and strengthening policy support and evidence-based advocacy to attract diverse financing mechanisms. These findings offer practical insights for scaling ANR within (government-led) restoration programs.

1098

“A Living Island” returning St. Patrick’s Island to the Bow River Ecosystem – A critical collaboration between Ecologists and Landscape Architects

Scott Jordan

Civitas Inc., Denver, CO, USA

Abstract

Over the years, Calgary’s St. Patrick’s Island had been engineered and armored to increase the usable park space, while minimizing the potential impacts of flood events. Unforeseen consequences of the armoring had resulted in an island that experienced a loss in native riparian habitats and a decrease in overall biodiversity.

The philosophy of the design was simple - draw on the island’s ecological history to restore its ecological function and increase biodiversity to create a “Living Island”, while providing new amenities to engage visitors with the natural processes of the dynamic Bow River. A collaboration among Ecologists, Geomorphologists, and Landscape Architects involved extensive research and analyses to understand how the island had (d)evolved, to empower the design team to return the Island as a functional piece of the Bow River ecosystem. An important tool utilized by the design team was a pre-construction and 10-year post-construction diversity assessment in the form of a 24-hour Bio-Blitz performed by the project ecologist, professors from the University of Calgary, and countless volunteers to provide real-world data to support the original design intent, and to evaluate the project’s overall effectiveness.

St Patrick’s Island is a new waterfront experience for Calgary. By allowing the 20ha (30-acre) island park to interact with the seasonal flow of the river, new ecologies were opened to exploration, while simultaneously a more diverse habitat was created for animals. This mix of greater ecological diversity with creatively controlled areas for use by people resulted in a model of resilient design.

1099

Overview of the Ecosystem Restoration Integrated Program: A collaborative approach to global restoration

Monica Harris

Conservation International, Arlington, VA, USA

Abstract

Ecosystem restoration is essential for addressing climate change, biodiversity loss, and sustainable development. The Ecosystem Restoration Integrated Program (ERIP)—a six-year initiative funded by the Global Environment Facility (GEF) and led by Conservation International (CI)—brings together seven GEF Agencies and 20 national projects across Asia, Africa, and Latin America. With a goal of restoring 1.8 million hectares and improving management on 5.9 million hectares, ERIP integrates policy, finance, and capacity building to scale up restoration globally.

This session will introduce ERIP's multi-stakeholder model and its contributions to the UN Decade on Ecosystem Restoration. Following an overview of the program's approach, expert speakers will delve into key restoration strategies, including assisted natural regeneration (ANR), peatland restoration, watershed restoration, and large-scale ecosystem restoration. Presentations will highlight innovative practices, cross-sector collaboration, and success stories from participating countries. The session will provide insights into how ERIP strengthens governance, advances nature-based solutions, and builds local capacity to sustain long-term impact.

Join us to explore how ERIP is mobilizing global action to restore ecosystems at scale.

1100

Integrating Design, Ecology, and Engagement on Staten Island’s “Living Breakwaters”

Brad Howe

SCAPE, New York, NY, USA

Abstract

Living Breakwaters consists of 732 meters (2,400 feet) of near-shore breakwaters—partially submerged structures made of stone and ecologically enhanced concrete units along Staten Island’s South Shore —that break waves, reduce beach erosion, and provide various habitat spaces for oysters, finfish, and other marine species. The Living Breakwaters concept was developed by a large, multidisciplinary team, including marine biologists, engineers, and designers. SCAPE led the project, based on a winning proposal for "Rebuild By Design," the U.S. Department of Housing and Urban Development's (HUD) design competition following Superstorm Sandy. The design team advocated for integrating urban ecological restoration into the infrastructure design and tested innovative ideas with regulators and computational modeling tools to reach a consensus on the final design. Community outreach and engagement were crucial in building a strong stewardship constituency for the project, involving students and educators from the Billion Oyster Project and the New York Harbor School. Unique engagement strategies, such as "shore tours" and virtual reality "fish-eye views," immersed community members in the future underwater habitat and educated them on the co-benefits of living infrastructure.

1101

Changing Mindsets to Create More Effective Ecological Restoration Law and Policy

Anastasia Telesetsky

California State Polytechnic University San Luis Obispo, San Luis Obispo, CA, USA

Abstract

In the symposium "**Getting to 30 X 30: Developing a Model Law to Incentivize Practical Ecological Restoration Efforts**" designed to look at the obstacles to creating more effective restoration policy, this presentation will emphasize that much of what constitute ecological restoration today is "reactive" often in response to particular events (e.g. new development, an oil spill). This policy approach is unlikely to yield the results that will be needed to restore large "ecoscapescapes" and restore the relationships that are needed to ensure long-term ecological health. There are numerous barriers to doing restoration sometimes built into regional laws that delay or prevent certain types of restorative activities (e.g. setting fire without permits in a fire-adapted landscape to achieve restoration outcomes). Fixing these types of laws and policies will advance ecological restoration but there is a bigger picture. Restoration has not been a political priority, meaning that in many places it has not been financially supported. This funding gap can be overcome but in order for it to be overcome, there is a need to address one of the primary barriers to effective ecological restoration: human mindset. This presentation will examine the role that the global movement of "rights of nature" is playing in shifting thinking about what ecological restoration is and what it needs to achieve with a particular focus on North American efforts by cities and indigenous groups.

1102

History and success of moose reintroduction in Colorado

Chuck Anderson

Colorado Parks and Wildlife, Fort Collins, CO, USA

Abstract

Historically moose sightings in Colorado were uncommon, but have been consistently recorded since the 1860s. These sightings typically consisted of individuals or small adult groups with calf sightings being extremely rare. Evidence of population establishment in Colorado was lacking, but this was largely due to dispersing moose commonly being shot shortly after they arrived in the state. In the 1970s, Colorado Division of Wildlife considered translocating moose to establish viable populations and decided to pursue this effort arguing that moose would have established naturally without human exploitation. From 1977 - 2010, five translocation efforts have resulted in increasing and expanding moose populations throughout western Colorado. Following the establishment of viable moose populations in Colorado, recent research has addressed moose habitat use, survival, reproduction and population growth rates to inform future management decisions. These results will be presented for consideration relative to future expected changes including wolf reestablishment, climate change and social factors associated with an increasing human population.

1103

Incorporating below-ground properties into monitoring of tropical forest restoration

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Abstract

There is growing recognition that tropical forest restoration plays a critical role in sequestering carbon and enhancing ecosystem resilience. Most carbon and biodiversity in tropical ecosystems are found in the soil, yet belowground recovery is largely overlooked in restoration monitoring frameworks. Here, we present a road map to harmonize above- and belowground recovery outcomes in tropical forest restoration by: 1) examining how belowground properties pre- and post-intervention influence recovery; 2) evaluating whether aboveground recovery can serve as a proxy for belowground dynamics; and 3) proposing a blueprint for monitoring soil physical (bulk density, aggregate stability), chemical (organic matter/carbon, pH), and biological properties (decomposition rate, macrofauna abundance) in resource-constrained projects. While we highlight some aboveground proxies for assessing belowground recovery, expanding the understanding of above- and belowground dynamics across diverse restoration interventions remains essential. Overall, we provide an actionable path towards integrating belowground recovery into restoration design and assessment.

1104

Alternative approaches to deep-sea ecosystem valuation for restoration prioritisation

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Abstract

With the adoption of the EU Nature Restoration Law in June 2024, the European Union has now legally binding targets to restore at least 20% of land and 20% of sea areas by 2030 and all ecosystems in need of restoration by 2050. While the prioritisation of restoration projects under the EU Nature Restoration Law should mainly be based on the scientific assessment of vulnerability and need for intervention, the economic tools of cost benefit analysis and cost effectiveness analysis will have a roll to play especially in deciding between similarly worthy restoration efforts where there are limited resources available. Critical to such economic assessments will be the quantification and valuation of the likely ecosystem service benefits to be achieved assuming successful restoration. This paper therefore explores the different approaches that can be used to estimate the welfare impacts on society of deep-sea ecosystem restoration. It reviews both qualitative and quantitative valuation methods and pays particular attention to non-market valuation approaches which have particular relevance for deep sea ecosystems where many of the generated benefits are cultural, regulatory or supporting in nature.

1105

Governing ecological restoration in the deep-sea

J.P.M. van Tatenhove¹, N. Papadopoulou², J.S. Buerkert³, C. Smith³, M. Kraan³, H. Vieira³, S. Stevenson-Jones³, S. Hynes³, C. Gambi³, R. Danovaro²

¹WAGENINGEN UNIVERSITYalway, Netherlands. ². ³Ireland

Abstract

Deep-sea ecosystems can be hotspots of unique biodiversity and provide a variety of ecosystem services. However, many deep-sea ecosystems in the European seas are degraded and damaged due to various anthropogenic activities and pressures on the ocean floor. Restoring deep-sea ecosystems is therefore one of the priority areas for EU member states in fulfilling their duties under the 2024 EU Nature restoration law, and a rising area of research more broadly. Considering multiple and competing uses of the ocean space where restoration takes place, legitimate governance is paramount for the effectiveness and sustainability of marine restoration activities. This paper analyzes the governance arrangements surrounding deep-sea restoration, focusing on the actors, rules, resources and discourses pertaining to deep-sea restoration processes. Working on qualitative data from several case studies in the EU Horizon Project REDRESS (Restoration of deep-sea habitats to rebuild European seas), we explore constraining and enabling conditions and mechanisms for deep-sea restoration from a governance perspective. The paper is based on 5 contrasting cases using a variety of restoration practices to highlight the different involvement of actors and resources and regulations that shape restoration and can impact the success of restoration actions.

1106

Rewilding the Southern Plains of North America via restoration of keystone ecosystem processes

Henry Pollock

Southern Plains Land Trust, Lamar, Colorado, USA

Abstract

The Great Plains of North America, once a veritable American Serengeti teeming with wildlife, has seen the destruction of more than 50% of its original extent since the 1800s. What remains is largely privately owned and utilized for agricultural purposes such as cattle grazing. To provide a future for native wildlife of the Southern Plains, the Southern Plains Land Trust (SPLT) is rewilding more than 60,000 acres of shortgrass prairie in Southeast Colorado. Our focus at SPLT is on re-establishing keystones - both keystone species and keystone ecosystem processes - to accelerate the pace of rewilding and restoration of the shortgrass prairie. Here, I present a comprehensive overview of keystone focal species (bison, prairie dogs, beavers) and ecosystem processes (animal movement, fire) that SPLT is using to re-wild the Southern Plains. I also summarize efforts at SPLT's preserves to shift to empirically based, data-driven rewilding and highlight several case studies that exemplify how science can enhance rewilding efforts and management outcomes.

1107

The view from scientists: Using spatial intelligence to prioritize areas in forest biomes for assisted natural regeneration

Robin Chazdon

University of the Sunshine Coast, Sippy Downs, Queensland, Australia

Abstract

Leveraging the potential for natural regeneration is a key success factor for reaching scale and effectiveness in forest restoration programs. This potential can be predicted from spatially-explicit models based on where forests have regenerated naturally in the past. In this presentation, I describe how spatial intelligence has been used to identify priority areas for assisted natural regeneration in the Atlantic Forest of Brazil, the Amazon Basin of Brazil, and at the global scale. For example, in the Atlantic forest region, areas suitable for assisted natural regeneration accounted for 30% of the entire restorable area. Globally, using 2020 as a baseline, over 215 million hectares of deforested land across the tropics have biophysical conditions suitable for natural regeneration. Information on the potential for natural regeneration can also be combined with other spatially-explicit coverages, such as opportunity costs, implementation costs, and benefits of carbon storage in forest vegetation and biodiversity benefits for threatened or endangered species to provide decision-support tools for use at local and national levels. Strategic planning using spatial intelligence provides critical input for decisions regarding where and how to restore forests and to enhance the integrity of landscapes.

1110

The view from restoration implementers: Use of ANR in ecosystem restoration projectsJuliana Chapel, Isabel Hillman, Yulan Lu

Conservation International, Arlington, VA, USA

Abstract

In January 2020, Mastercard launched the Priceless Planet Coalition (PPC) to focus the efforts and resources of its network and accelerate positive impact on climate change. To achieve this goal, project implementers were guided by the monitoring framework Conservation International and the World Resources Institute developed to scale up restoration efforts across various countries. The practice of Assisted Natural Regeneration (ANR) introduced innovative and cost-effective methods in areas where forest recovery using this method is feasible, incorporating strategies to assist the restoration in these areas.

For project implementers, it is important to recognize that natural regeneration relies on the ecological conditions of the site. This approach offers new perspectives, which are enhanced by methods such as enrichment, direct seeding, tree planting, applied nucleation, invasive species control, cattle fencing, and other strategies to assist natural regeneration. It requires intensive, ongoing management by local communities to maintain regeneration areas until the desired species can thrive independently, making community involvement essential for the project's success.

1112

Playing the Long Game: Promoting Resiliency by Integrating Human-Beaver Conflict Solutions in Long-Term Restoration Strategies.

Loren Taylor

Beaver Institute, Southampton, MA, USA. Core Roots Consulting, Driggs, ID, USA. Utah State University, Logan, UT, USA

Abstract

Beavers are having a moment! Increasingly, beavers are recognized as nature-based solutions, with significant ecological benefits driving the global expansion of beaver reintroduction programs, beaver-based restoration initiatives, and beaver management plans across the United States, Canada, and Europe. These efforts highlight the species' cost-free role in improving biodiversity, water storage, and wildfire and flood mitigation. However, as beaver populations grow, the frequency and intensity of human-beaver conflicts are expected to rise, potentially impacting the sustainability of these restoration strategies. To sustain and promote resilient beaver-centric restoration efforts, integrating science-based, long-term human-beaver conflict solutions is imperative.

Historically, lethal removal has been the primary management approach, but it offers only resource-intensive temporary relief while suitable habitats remain. The removal of beaver or the removal of habitat is in direct opposition to these burgeoning global beaver-centric restoration efforts. Instead, we advocate for non-lethal tools such as flow devices, culvert protection fences, and diversion structures, which leverage beaver biology to mitigate common issues like flooding and infrastructure damage. By empowering people with functional pathways for cost-effective, sustainable solutions, we foster greater acceptance and support of beavers on the landscape. This integration of conflict resolution into restoration efforts is essential to ensure the long-term success and resilience of beaver-centric restoration strategies.

1113

Considering Assisted Migration for Dryland Restoration with Biocrust Cyanobacteria

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Abstract

Biological soil crusts (biocrusts) are thin, cohesive and photosynthetic soil surface layers engineered and inhabited by communities of mosses, lichens, and microorganisms. Biocrusts contribute substantially to ecosystem function, but are vulnerable to physical disturbance and, therefore, targets for restoration. When biocrusts are cultivated for restoration, it is common to collect local materials because they are most likely to survive and establish. However, with drought more common and climate more variable year to year, it may be beneficial to include non-local organisms (e.g., hot-adapted, drought tolerant, or diverse mixtures). We explored this approach by cultivating biocrusts at an outdoor facility on the Colorado Plateau. The cultivation included local (Colorado Plateau) and non-local (Mojave and Sonoran Desert) biocrusts and a mixture of the three with irrigation and habitat amelioration treatments. We assessed the microbial community composition of the cultivated biocrusts using 16S rRNA marker gene sequencing and qPCR, with a bioinformatic focus on the cyanobacteria. Both local and non-local cyanobacteria survived the cultivation process, but all communities shifted in composition toward local biocrusts. Habitat amelioration was necessary to maintain the cyanobacteria abundance and richness in all inocula types. Theoretically, including hot-adapted cyanobacteria in cold desert restoration could increase the resilience of restored biocrusts to changing climate, but we need to determine if there are functional benefits to this approach. With careful planning and coordination, scientists and land managers may be able to mitigate potential risks associated with moving soils to new regions (e.g., invasions or pathogen spread) while realizing restoration benefits.

1114

Achieving scale and quality of restoration through assisting the natural regeneration of forests

Robin Chazdon

World Resources Institute, Washington, DC, USA

Abstract

Assisted natural regeneration (ANR) is a set of practices and interventions designed to enhance and accelerate the recovery of natural and managed ecosystems. Biodiversity and ecosystem services are greatly enhanced through assisting natural regeneration. ANR approaches are inherently flexible, as they address conditions specific to sites and landscapes. Spatial predictive models can be used to identify suitable areas for assisted natural regeneration with high certainty, based on locations where natural regeneration has already occurred and persisted. Applying these methods across the Brazilian Atlantic Forest found that 21.8 million hectares, 30% of the entire restorable area, presented good opportunities for ANR. At the global level, an estimated area of 215 million hectares, larger than the entire country of Mexico, has potential for natural forest regeneration with low levels of assistance. Despite its tremendous promise and potential widespread application, the practice of ANR remains underutilized and poorly appreciated. Together with the GEF8 Ecosystem Restoration Integrated Program, the Assisted Natural Regeneration Alliance will coordinate two programs to empower countries to implement ANR as a major component of their country projects: (1) Community of Practice on ANR; and (2). an ANR Practitioner Training Program, an eight-week online course (total of 16 hours) for restoration implementers and practitioners across all 20 GEF8 countries. For both programs we will produce brief factsheets explaining concepts and principles, compile standards of practice for ANR, and describe case studies of ANR implementation in different contexts. These materials will also be freely accessible and available in different languages.

1115

Hydrothermal Influence on Moss Physiological and Vegetative Reproduction: Implications for Biocrust Restoration

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Abstract

Vegetative reproduction in mosses forms the foundation for biocrust restoration. As poikilohydric plants, the physiological activity and regenerative capacity of moss fragments are critically influenced by the habitat's hydrothermal conditions. This study examined the desiccation tolerance, physiological and regenerative responses of four dominant moss species (*Bryum argenteum*, *Barbula unguiculata*, *Didymodon vinealis* and *Didymodon tectorum*) from biocrusts on the Loess Plateau of China to dry-wet cycles under varying temperatures. Our results revealed significant interspecific variation in desiccation tolerance, with *D. vinealis* exhibiting the highest tolerance. Both temperature and the duration of dry spells substantially affected photosynthetic pigments, osmoregulatory compounds, and malondialdehyde levels, which in turn influenced the structural and non-structural carbohydrate content in moss fragments. These biochemical changes directly impacted the vegetative regeneration potential of the moss fragments. Notably, the species with higher desiccation tolerance (*D. vinealis*) exhibited only a 4.7% reduction in regeneration capacity under dry-wet cycles, while the desiccation-sensitive species (*B. unguiculata*) experienced a 59.4% reduction in regeneration capacity. The divergent responses were linked to differential activation of antioxidant systems and carbohydrate metabolism pathways. Our findings demonstrate that natural water-thermal combinations drive physiological trade-offs that ultimately determine moss vegetative reproduction efficiency. For successful biocrust restoration, we emphasize the importance of optimizing microclimates prior to and during the early stages of inoculation, particularly by maintaining appropriate humidity and temperature during the first 20 days post-inoculation, to support the vegetative reproduction potential of mosses. This study provides empirical guidelines to enhance biocrust rehabilitation in semi-arid ecosystems under natural field conditions.

1116

Comparing seed mixes in a common garden: Outcomes of increased within-species genetic diversity for restorationApril Goebel, Rebecca Hufft

Denver Botanic Gardens, Denver, CO, USA

Abstract

Planting native species is a proactive approach for restoring biodiversity and ecological function following ecosystem degradation. Semi-arid grasslands, a dominant biome in the western United States, are increasingly degraded by human impacts and climate change. Following grassland disturbance, a primary aim of active restoration is rapid establishment in current conditions as well as long-term persistence in a changing environment. To achieve this aim, identifying seed with appropriate genetic diversity is crucial. Seed from local source populations can be advantageous as local adaptation can lead to optimal performance. However, a seed sourcing approach that extends beyond a local source to expand genetic diversity, via composite or admixture sourcing, may have ecological and evolutionary advantages as well. There has been little empirical work comparing these two seed sourcing approaches. Here, we present a multi-year, multi-site common garden experiment to test the effects of local versus mixed seed sourcing on plant performance. Using a common grassland sub-shrub, *Artemisia frigida*, as the focal species, we established two common gardens in 2022 in disturbed prairie sites in Southern Colorado, U.S.A. Thus far, we have collected two years of data on plant and plot performance across sites. Data on seedling emergence, survival, vegetative and reproductive cover will be presented. Results will be discussed in the context of seed sourcing and comparing the potential benefits and drawbacks of increasing within-species genetic diversity for restoration.

1117

Future directions for spatially patterned restoration research and implementation

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Abstract

Spatially patterned restoration methods have the potential to assist ecosystem recovery across relatively large areas at low cost, but questions remain about how and where these methods may best be applied. Applied nucleation, for example, generates edge habitat and is contingent on sites retaining some natural regeneration capacity. As such, applied nucleation projects may be less feasible in locations that lack seed sources or seed dispersal processes, have strong environmental filters not impacted by revegetation (e.g., rabbit herbivory, wildfire), or have strong invasive species pressure. Among many remaining questions about spatially-patterned restoration, two areas that warrant further study are the suitability of spatially-patterned methods in environments different from the forested regions where these methods were first developed and optimization of spatially-patterned methods, e.g., through species selection or site selection within heterogeneous landscapes. We will explore these apparent limits and future research directions through a case study and a synthesis of key themes and recommendations from the symposium panelists. Our case study illustrates challenges and research frontiers for spatially-patterned restoration through a highly-impacted urban stream restoration system in the Chesapeake Bay Watershed in eastern North America. More than half of stream restorations in Maryland, USA are associated with increased cover of non-native and invasive plant species. Can spatially-patterned restoration be usefully applied in this low resilience context with nearly ubiquitous invasive propagule input? With the remaining time, we will facilitate a discussion with the panelists and audience about future directions for spatially-patterned restoration.

1118

Building mining restoration guidelines: theory to practice

Klara Rehounkova

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Abstract

Effective restoration of post-mining sites involves turning scientific knowledge into tailored guidelines that can be implemented into the practice. Successful restoration begins with an understanding of the regional specificities and unique environmental conditions of the affected areas. Natural processes can be effectively incorporated into restoration, but first, it is essential to assess local opportunities and constraints such as soil quality, topography, climatic factors and ecological connectivity. A balanced approach that combines assisted and spontaneous restoration (also called natural revegetation) is often more cost-effective and environmentally friendly.

Developing practical, context-specific restoration guidelines is essential to provide actionable recommendations for managing extractive operations. Biodiversity conservation should be prioritised at every stage of extractive operations. Therefore, the guidelines should include adaptive management that allows for ongoing monitoring and adjustment. Moreover, the long-term data, including easy-to-use and reliable biodiversity indicators, are essential for evaluating the effectiveness of restoration practices. Furthermore, these guidelines must foster collaboration among mining companies, policymakers, restoration experts, and local communities ensuring that restoration activities are aligned with both environmental and socio-economic objectives

Restoring post-mining sites aligns with the UN Decade for Ecosystem Restoration and the recent ambitious EU Nature Restoration Regulation, which aims to restore 20% of degraded land by 2030 and all needed ecosystems by 2050. Post-mining sites represent an opportunity for biodiversity restoration, but clear restoration targets need to be included in national policies and action plans so that successful restoration projects should be integrated into wider conservation networks.

1119

“Yes, in My Backyard” Social Acceptance of Spatially Diverse Planting as a Restoration Concept

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Abstract

Spatially diverse planting (SDP) strategies were a novel/forgotten concept when selected by land managers in Fairfax County, Virginia, USA as a technique to achieve reforestation across a larger landscape (> 1 hectare). Typical active restoration plantings on an even grid from a limited palette dominated the reforestation practice in the mid-Atlantic, US. We implemented a modified applied nucleation approach, clustering mixed tree and shrub species across the entire planting acreage, with mulch, but no other soil amendment. Since the success of the Virginia SDPs in 2016, individual homeowners, homeowner associations, environmental organizations, and governmental agencies have implemented variations of applied nucleation on a range of lands from single lot owners (~2000 square meters) to abandoned agricultural fields (>7 hectares). Working with suburban and rural landowners, and a range of practitioners, there have been frequent questions about how to implement a SPD while maintaining site specific constraints. However, quantifying ecosystem outcomes after implementation has given insight into specific ecosystem services (soil Total Carbon, tree canopy, leaf litter and more) not achieved by traditional reforestation methods. There are implications for reforestation in suburban and rural areas and scalability.

1120

A Historical Perspective on the Challenges and Successes of Restoration Effectiveness Monitoring in the Great Basin

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Abstract

Monitoring of the effectiveness of restoration projects on public lands in the Great Basin has evolved as societal and management objectives have changed. Prior to the implementation of the Bureau of Land Management's 1976 Federal Land Policy and Management Act, increasing livestock carrying capacity by expanding nonnative grass production was a priority. This Act specified that public lands would be managed for multiple uses and sustained yields, which accelerated a slow transition from seeding introduced wheatgrasses to using adapted native species to restore wildlife habitat and for post-fire rehabilitation seedings. Effectiveness monitoring was project oriented and often utilized non-random, permanent study plots to monitor success and longevity of restored areas. In the 1990's, land management agencies implemented several landscape initiatives including the Interior Columbia Basin Ecosystem Management Project and the Great Basin Restoration Initiative (GBRI). GBRI was initiated in 1999 as a result of wildfires that burned 1.7 million acres of the public land in the Great Basin. This Initiative promoted a proactive restoration strategy of "Protect the best then strategically restore the rest." The evaluation objectives of this initiative were to monitor restoration projects to assess progress towards meeting landscape goals and to improve future restoration success. Restoration effectiveness monitoring now requires a multi-scale approach (project to landscape level), partnerships, and the support of the scientific community.

1121

Listening to recovery: Integrating ecoacoustics, AI, and remote sensing to monitor tropical forest restoration

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⁶WildMon, Puerto Rico. ⁷Catona. ⁸Trees For The Future. ⁹WeForest. ¹⁰Ipê

Abstract

Tracking biodiversity recovery is critical for assessing the success of tropical forest restoration, yet traditional monitoring methods are often labor-intensive and limited in scale. Integrating ecoacoustics, remote sensing, and AI-driven modeling offers a transformative approach to efficiently and cost-effectively monitor species responses, providing deeper insights into ecosystem recovery at large temporal-spatial scales.

We present findings from two restoration projects: Brazil's Atlantic Forest and Kenya's agroforestry landscapes. Both employ an AI-powered pipeline that analyzes soundscape recordings to detect species, combines occupancy models with satellite-derived habitat metrics, and evaluates biodiversity responses at species and community levels.

In Brazil, we assessed biodiversity recovery in restored wildlife corridors within a fragmented landscape. Across 137 sites, we detected 187 species (six endangered and 17 endemics). Restoration sites exhibited species richness comparable to old-growth forests, with biodiversity patterns strongly influenced by forest cover, habitat connectivity, and proximity to water.

In Kenya, we monitored biodiversity in a community-led agroforestry Forest Gardens program (FGP). Across 120 sites, we detected 157 species, with FGP sites showing significantly higher species richness than conventional agricultural sites. Species richness increased with years of FGP enrollment, driven by NDVI and time since program initiation. Woodland and forest-associated species increased by over 50%, highlighting a positive biodiversity outcome in agroforestry sites.

These findings demonstrate how integrating ecoacoustics, AI, and remote sensing can transform biodiversity monitoring and support restoration initiatives. By refining these methods and integrating above- and below-ground recovery metrics, we can advance data-driven approaches to restoration science and inform more effective conservation strategies.

1122

Developing capacities to advocate for policies that support and incentivize effective and inclusive ecosystem restoration

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Abstract

Policies that support and incentivize effective and inclusive ecosystem restoration are key to achieving the ambitious global restoration goals. To enhance capacities of restoration actors to advocate for this, the FAO-led Task Force on Best Practices for the United Nations Decade on Ecosystem Restoration developed a Capacity, Knowledge and Learning Action Plan which includes, among others, one initiative called the “Restoration Policy Facility”. This initiative aims to provide resources, tools and experiences to enhance capacities of policymakers to analyze and reform existing policy instruments; improve or design forest and land use incentive programs; effectively monitor policies to measure impacts; and engage multiple sectors and actors in policy-making. The initiative builds on the Restoration Policy Accelerator designed by the World Resources Institute (WRI) to work with policy innovators to better understand the factors that enable and hinder the effectiveness of the incentive policies for restoration in their respective countries. As part of the Restoration Policy Facility, and under the leadership of *Commonland*, WRI and FAO, a global call was launched in 2025 to document good practices that have been shown to improve policy coherence or policy integration across a range of geographies and ecosystems in landscape and seascape restoration initiatives. An overview of the results obtained through the call will be provided during the symposium, which will be the basis to develop a policy brief and a repository of good practices, illustrating the range of actions that have been effective in improving policy coherence in support of landscape restoration initiatives.

1123

Communication approaches driving successful beaver-based restoration

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Abstract

Effective communication forms the foundation of successful beaver restoration and coexistence efforts, particularly on private lands where landowner support determines outcomes. Drawing from interviews with 23 beaver restoration practitioners, we synthesize approaches that foster trust and promote engagement. Our research reveals a three-part framework: (1) listening through seven key questions aligned with capability, opportunity, and motivation; (2) tailoring messages to address these behavioral drivers; and (3) implementing specific trust-building practices throughout the adaptive management cycle. These practices reduce landowner vulnerability, demonstrate practitioner trustworthiness, and build essential relationships. Communication isn't merely a supporting element of beaver restoration — it's foundational to success. As practitioners navigate complex social-ecological landscapes, their ability to listen, build trust, and tailor messages directly influences whether beavers remain and restoration projects endure.

1125

Nature-based solutions for human health: leveraging biodiversity to reduce vector-borne disease risk

Adrian Carper

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Abstract

Vector-borne disease is a major global concern but especially for municipal governments who are tasked with protecting public health from vector species, including vulnerable communities. However, controlling vectors of disease can also have unintended consequences for both human and ecosystem health, including non-target impacts on biodiversity and exposure of vulnerable communities to potentially toxic chemicals. Increasingly though, scientists are understanding the benefits that biodiversity provides for regulating vector populations, community dynamics, and disease transmission risk. Applying these principles to vector management is a difficult process though, and one that weighs the costs and benefits of management and public health. The City of Boulder's Ecological Mosquito Management Program has maintained extremely low risk of West Nile Virus to our communities by fostering diverse wetlands, targeting only larval vector mosquito species with natural biocides, and avoiding adulticides and their environmental and human health impacts altogether. This has been accomplished using a combination of standard Integrated Pest Management principles, a focus on nature-based strategies, and the development of a dedicated and highly collaborative monitoring and management program. Ultimately, our best evidence suggests that competitive and predatory interactions within our wetlands offer significant buffers against mosquito-borne disease risk. Moreover, these natural defenses outweigh the benefits that non-specific chemical control of adult mosquitoes provide, and avoid the negative ecosystem and human health risks of chemical use. We suggest that by exploring targeted, natural strategies for vector management, cities could help protect urban communities while supporting climate resilient wetland ecosystems.

1126

Opportunities for the extractive sector to contribute to the Global Biodiversity Framework, National Biodiversity Strategies and Action Plans

Thomas Sebrechts

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Abstract

The extractive sector is responsible for a significant amount of biodiversity loss through land use, water use and emissions. However, with the right priorities, sustainable management of resources by the extractive sector can contribute significantly to the achievement of the Sustainable Development Goals and align with the vision of the Global Biodiversity Framework (GBF) – to halt and reverse biodiversity loss by 2030.

The presentation outlines these priorities and how they are aligned with sustainable development and the GBF, as National Biodiversity Strategy and Action Plans formalize the role of non-state actors in its implementation. Additionally, we explore the opportunities that lie within these priorities and the reasons why the extractive sector specifically, and business in general, would take action on biodiversity recovery.

The opportunities are illustrated by examples of reclamation of extractive sites as a restoration opportunity, cross-sector advocacy for policy implementation, and landscape-scale operating environments that create win-win scenarios. We show how these impact the sector's license to operate and how it can create a legacy that goes beyond direct economic impact, providing benefits for local communities and society as a whole.

1127

A transdisciplinary approach towards restoring selected South African peatland ecosystems and their catchments

Alanna Rebelo

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Abstract

South Africa's peatlands, vital for water security, carbon sequestration, and biodiversity, are under significant threat from invasive alien species, unsustainable practices and anthropogenic climate change. These carbon-rich ecosystems are increasingly degraded, largely due to water table drawdown, gully erosion, and alien tree invasion. This degradation threatens local livelihoods, especially in water-stressed regions where agriculture depends heavily on groundwater linked to peatlands. The drivers of this decline are complex, involving socio-economic pressures and governance challenges. Despite their importance, peatlands face significant barriers to restoration, including fragmented efforts and a lack of data, sustainable finance, and coordinated strategies.

This project employs a transdisciplinary approach, engaging diverse stakeholders through inclusive quarterly workshops and innovative futures visioning exercises. Hydrological modeling and scenario analyses guides decision-making, ensuring an informed restoration plan. Restoration efforts will stabilize water tables, mitigate carbon emissions, and enhance biodiversity, while fostering community resilience. Benefits include improved water security, enhanced ecosystem services, and livelihood improvements.

The impacts of peatland degradation are evident across the three pilot sites: Goukou (Western Cape), Molopo/Molemane (Northwest Province), and Maputaland (KwaZulu-Natal). Research exposes water table drawdown, gully erosion, and alien tree invasion as key drivers, all exacerbated by climate change. The project will address these issues by restoring ecosystem function and promoting sustainable land use practices. Long-term, embedded monitoring will assess restoration success, providing evidence to support innovative financing mechanisms. This holistic approach aims to build sustainable, scalable models for peatland restoration that can be replicated globally.

1128

A Case Study in Community-centered Nature-based Solutions: Cool Boulder and the Pollinator Advocates Program

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Abstract

Restoring urban ecosystems requires connecting people to places, as well as nature, the earth, and each other. And by centering restoration projects around social, cultural, or economic needs within urban environments, communities can better value the relationships between nature, human health, and well-being. The Cool Boulder campaign is a partnership between the City of Boulder and many local organizations, to connect communities to nature-based climate actions in support of both biodiversity and climate resilience. One of our most successful programs, the Pollinator Advocate Training Program, has been connecting residents, educators, and vulnerable communities through free city-sponsored training on how to design, install, maintain, and monitor pollinator gardens. This course offers not only technical expertise, but historical, ecological, spiritual and cultural context for the importance of pollinators to biodiversity, climate resilience, equitable access to sustainable urban agriculture, and connection to mother earth. To date, over 50 graduates have completed the program, collectively installed thousands of sq ft of pollinator gardens, and shared their newly developed passion and knowledge for pollinator conservation and urban habitat restoration with their own communities. It has also enabled us to work with local indigenous, economically disadvantaged, and climate vulnerable communities, to understand different ways of thinking and foster urban food production, biodiversity conservation, and community building. These types of programs are extremely important in addressing the needs of our urban communities, and vehicles through which cities can connect with communities most in need of protection from the worst effects of climate change and biodiversity loss.

1133

Addressing the biodiversity crisis in built spaces is vital to realizing climate change goals.

Scott Hoffman Black

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Abstract

Designing effective mitigation for climate change is difficult in towns and cities because human activities have degraded, destroyed, and fragmented habitats. However, nature-based solutions in built spaces can simultaneously address climate change, biodiversity loss, and nature-based equity issues. Climate change and biodiversity loss are interlinked, and coupling climate mitigation targets with ecosystem-based approaches is essential. It is impossible to address the loss of biodiversity without addressing climate change, but equally impossible to tackle the full impacts of climate change without work conserving biodiversity. Equity is a very important address in nature-based solutions in built spaces. Nature-based solutions can help address climate change and biodiversity loss by: (1) reducing greenhouse gas emissions related to land use, (2) capturing and storing carbon dioxide from the atmosphere, and (3) improving climate resilience of ecosystems, helping plant and animal (including human) communities adapt to climate change.

In built spaces these practices can range from protecting, enhancing, or restoring as much of the remnant natural landscape as possible to creating new habitat in parks, along roadsides and in other public spaces. Diverse native trees are an essential part of this solution, but native meadow plantings, shrubs and even hedgerows can be planted in spaces where trees are not appropriate. Focus needs to be placed beyond plants as animals need places to live and refuge from pesticides. These solutions can also address nature deficit and equity issues by beautifying landscapes, impacting microclimates and bringing nature to areas of the city that need it most.

1134

Restoration outcome synthesis and networked experiments reveal strategies to increase effectiveness across multiple scales

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Abstract

Land managers need effective strategies to restore degraded ecosystems. In drylands, seeding practices have limited success due to low and variable water availability, which will be made more challenging under future increases in aridity. To improve restoration outcomes, we present a synthesis of lessons learned from historical restoration treatments and experimental results from RestoreNet, a restoration field trial network co-produced by scientists and land managers. Since 2018, RestoreNet has systematically tested different seed mixes, soil surface modifications, seeding timing, outplanted greenhouse-grown seedlings, invasive plant control measures, soil microbial inoculations, seedballs, and targeted livestock treatments across a growing network of over 20 sites that span environmental gradients in the southwestern U.S. Overall, we found that seed mixes with species adapted to historical climate conditions performed equally well or better than mixes adapted to future warmer, drier conditions. Using soil surface treatments with seeding promoted up to 3× greater seedling emergence densities compared with seeding alone, and soil pits (small depressions in the soil) were the most effective treatment across the network. Near-term precipitation relative to seeding and treatment was critical to seeding success. Emergence from seeding was positively correlated with outplant survival in the cooler sites but had no relationship in the hottest sites. Taken together, synthesis of historical restoration treatment outcomes and RestoreNet experimental findings provide successful restoration strategies to bolster the recovery of degraded ecosystems.

1135

From the Ground Up – Building a community through a prairie restoration-based open space system at the former Stapleton International Airport near Denver, Colorado.

Joshua Eldridge¹, Scott Jordan²

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Abstract

Restoring a prairie ecosystem on the site of a former airport is at the heart of Denver's Central Park transformation. This project integrates ecological renewal with community spaces, ensuring nature and urban life thrive together. The restoration prioritizes both social and ecological needs, creating a sustainable, resilient landscape.

This presentation explores the collaboration between ecologists and landscape designers to restore short- and mid-grass prairie ecosystems. Science-driven strategies guided the redevelopment, resulting in one of Denver's most successful open spaces.

Three key principles shaped the design:

Restoring native prairie ecosystems by reintroducing diverse plant communities and wildlife habitat to enhance biodiversity and resilience.

Balancing ecological function with community needs, creating spaces for gathering, recreation, and solitude while preserving natural landscapes.

Reestablishing natural drainageways to manage stormwater while enhancing ecological function. Historic waterways were restored to mimic natural hydrology, slowing, filtering, and infiltrating runoff to reduce flood risks. Native vegetation and wetlands were integrated into the stormwater systems, improving water quality and supporting habitat diversity.

By weaving community and ecology together, this project transforms a former airport into a thriving urban prairie landscape. The site's ecological restoration not only provides a model for sustainable urban redevelopment but also demonstrates how stormwater systems can function as integral components of a resilient, biodiverse open space. This project showcases the power of landscape restoration to heal the land while fostering deep connections between people and nature in the heart of an urban environment.

1137

Coherent Landscape Governance for social benefits in the Bioeconomy

Rocio DIAZ-CHAVEZ

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Abstract

The global demand for biomass is increasing, driven by its diverse end-uses, contributing to renewable energy targets and the Bioeconomy goals worldwide. In Europe, biomass plays a key role in achieving renewable energy objectives through the revised Renewable Energy Directive and Bioeconomy Strategy. Similar initiatives are emerging globally. National and regional governance typically relies on traditional legislation, but alternative governance approaches are needed to address sustainability concerns, including certification standards, policies, legal frameworks, and innovative solutions. Regional governance models promoting cooperation among stakeholders are seen as key for sustainable production at larger scales, regardless of end-use.

A major challenge is understanding the effectiveness and legitimacy of regional governance in measuring the sustainability of bioenergy and biomaterial supply chains. Policy incoherence also complicates efforts, as conflicting policies at different levels undermine sustainability goals. Landscape governance, rooted in landscape ecology, is increasingly applied to sustainable commodity value chains and aligned with standards and certification schemes. It is recognized globally as a strategy to meet biodiversity and climate goals, contributing to agreements like the Paris Agreement and the New York Declaration on Forests.

In recent years, novel regional governance approaches have gained prominence in the agricultural and forestry sectors linked to Bioeconomy resources. These approaches vary in terminology and stakeholder involvement but share a focus on sustainability governance at the regional level rather than individual entities (Diaz-Chavez and Van dam, 2020).

1138

American Prairie: Rewilding 1.3 million hectares of the Northern Great Plains

Daniel Kinka

American Prairie, Zortman, MT, USA

Abstract

Montana holds one of the largest areas of intact prairie in North America with some of the greatest species diversity anywhere in the Great Plains. These grasslands are converted to croplands at an alarming rate, and while species-level biodiversity remains high, artificially suppressed and shrinking abundance of numerous bird and mammal species threatens the overall functioning and resilience of the system. American Prairie seeks to restore a vast and fully-functioning prairie ecosystem around the Charles M. Russell National Wildlife Refuge (CMR-NWR), that contains ecologically meaningful populations of all non-extinct native species, with management focused on maximizing the integrity, complexity, and resilience of the system. Since 2004, American Prairie has completed 43 land transactions to build a habitat base of 213,253 ha. Of this total, 56,835 ha are privately owned by American Prairie and 156,417 ha are leases on public lands. When combined with the nearby 445,154 ha CMR-NWR we are about halfway to the 1.3 million hectares necessary for a fully-functioning short-grass prairie ecosystem. The American Prairie bison (*Bison bison*) herd was established in 2005 with the reintroduction of 16 animals, and currently numbers around 900 animals. Bison grazing has positive impacts on riparian and rangeland health associated with increased wildlife diversity and occupancy. Collaborative efforts are also underway to restore populations of two other ecosystem engineers: prairie dogs (*Cynomys ludovicianus*) and beaver (*Castor canadensis*). In this talk, I will discuss American Prairie's approach to large landscape restoration, our measurable successes to date, and our interdisciplinary rewilding strategy.

1140

Importance of linking conservation, restoration and sustainability.Emanuela W. A. Weidlich

Leuphana university, Lüneburg, Germany

Abstract

The years 2011 to 2020 marked the United Nations (UN) Decade on Biodiversity, which aimed to support conservation biology, by strengthening networks for implementation of the Convention on Biological Diversity. The UN then declared 2021–2030 as the Decade on Ecosystem Restoration, aiming to foster the restoration ecology worldwide, and to push ongoing restoration initiatives. Both initiatives have promoted public awareness on the importance of conservation biology, restoration ecology, and sustainability science. However, these disciplines are not often connected. This talk aims to show how the topics restoration, conservation and sustainability are connected in scientific literature. By showing results from a literature review we will highlight the importance of connecting these three disciplines and explore how restoration ecology affects conservation and sustainability mainly in the global south.

1143

Restoration in sub-Saharan Africa where interdisciplinarity is key to sustainability

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Abstract

Forest landscape restoration (FLR) is a complex endeavor that must balance the diverse needs and priorities of multiple stakeholders. This complexity presents significant governance challenges in implementation processes, which influence subsequent social and ecological outcomes. As such, framing FLR as complex social-ecological systems and adopting an interdisciplinary approach that integrates both social science and natural science perspectives is essential to address these context-specific governance intricacies and to fully capture related multiple outcomes.

In this presentation, I will showcase our research project, *"Socio-Ecological Outcomes and Monitoring of Restoration in Mosaic Dry Forest-Grassland Ecosystems" (ECO-DRYFOREST)*, to illustrate how we can leverage interdisciplinary collaboration to effectively examine the multifaceted governance issues and assess resulting outcomes, trade-offs, and drivers. This project brings together experts from ecology, geography, social forestry and rural development, land-use governance, and political science to investigate the trade-offs between social and ecological restoration outcomes at multiple scales. The multi-institution team includes several US and Southern African partners, whose varied expertise enables a comprehensive examination of how restoration impacts not only ecosystem integrity and climate mitigation through C-storage, but also livelihoods, food and energy security, and other human wellbeing dimensions. Through interdisciplinary collaboration, our project aims to develop a multi-scalar assessment and monitoring approach that is both broadly applicable and policy relevant.

By integrating diverse perspectives, we can better examine the governance challenges of FLR and understand how restoration efforts benefit various stakeholders from local communities to global initiatives, toward addressing potential inequities and exclusions.

1144

Marine restoration from a Marine Spatial Planning perspective

Simonetta Fraschetti¹, Erika Fabbrizzi¹, Ibon Galparsoro², Sylvaine Giakoumi³, Stelios Katsanevakis⁴, Tundy Agardy⁵, James Aronson^{6,7}, Angel Borja², Emma Cebrian⁸, Roberto Cimino⁹, Roberto Danovaro¹⁰, Cristina Gambi¹⁰, Jeffrey O. Hanson¹¹, Dimitri Justeau-Allaire¹², Nadia Papadopoulou¹³, Remment ter Hofstede¹⁴, Megan Saunders¹⁵, Chris Smith¹³, Andrea Troncoso¹⁶, Leonardo Tunesi¹⁷, Ida Beathe Øverjordet¹⁸, Lara Veylit¹⁸, Vanessa Stelzenmüller¹⁹

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Abstract

Multiple anthropogenic pressures and ineffective management of marine resources have led to loss of biodiversity and degradation of marine ecosystems. Reversing current biodiversity crisis requires well-connected networks of Marine Protected Areas and large-scale restoration to improve overall conditions (*sensu* Marine Strategy Framework Directive - MSFD). The ambitious targets set by the Global Biodiversity Framework and the European Nature Restoration Regulation (NRR) represent important opportunities to significantly enhance conservation and restoration efforts. However, new challenges exist in terms of spatial prioritization, especially considering increasing demand for space driven by the growing blue economy. The lack of strategic integration of conservation and restoration within the Ecosystem-Based Marine Spatial Planning (EB-MSP) framework further complicates balancing ecological and socio-economic objectives. Here, we present insights from a workshop with leading experts, having different backgrounds in marine research, providing criteria, methodologies, and tools to guide restoration prioritization within the Systematic Conservation Planning framework and enhance its integration with EB-MSP. This includes adopting core principles such as recognizing ecological connectivity, addressing cumulative effects of multiple pressures, managing multi-use of marine space, embracing change, learning and adapting. Emerging priorities include the development of decision-support tools grounded in ecological and economic metrics for effective restoration prioritization, advancing technological innovations, and private sector collaboration for upscaling restoration efforts. Finally, we highlight the need for improved coordination between directives such as MSFD, MSP and NRR, as well as between top-down policies and bottom-up initiatives, fostering stakeholder engagement to enhance marine ecosystem recovery and their full capacity to deliver ecosystem services.

1145

Extractive site restoration and its role in species conservationCarolyn Jewell

CRH, Dublin, Ireland

Abstract

With over 46,000 species classed as threatened, and ambitious restoration targets to be met globally, actions by all parts of society to reduce the drivers of loss and to turn the tide are critical. The potential contribution by post-extraction sites is clear and has been for some time, for example the European cement sector recorded over 2,500Ha of either restored or temporary habitats in 2021 alone. While the hectarage is easy to monitor, it is often harder for the industry to fully evaluate how significant site rehabilitation is in terms of restoring wider ecological function.

During this presentation we will present a number of case studies across North America and Europe where through monitoring species responses we are being able to evaluate the success of habitat restoration and management actions. These examples demonstrate that land use change to natural habitats, often in historically human impacted landscapes, as well as smaller discreet actions can significantly contribute to local and national biodiversity initiatives. We will also discuss the benefits of taking this species-lens approach including stakeholder engagement, alongside an indicator of habitat restoration success and landscape scale impact.

1146

Engagement Tools to Upscale Restoration: Application, Dashboard, and Serious Games

Boris Barov^{1,2}, Chiara Trozzo³, Frederic Jehan⁴, Gabriela Popova¹, Giulia Galluccio³, Mathilde Joly³

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Abstract

Restoring coastal ecosystems is critical to reversing biodiversity loss and enhancing ecosystem services. The REST-COAST project has developed innovative engagement tools designed to scale up restoration by engaging a wide range of audiences, including students, educators, local tourism offices, coastal visitors, local, environmental and coastal authorities and resource managers.

This session will showcase three complementary tools aimed at raising awareness, promoting learning, and supporting decision-making through interactive and gamified experiences. The **mobile application** educates users on coastal biodiversity, highlighting connections between ecosystem components, human pressures, and restoration strategies. It guides users through scenarios illustrating how restoration can improve biodiversity, ecosystem services (e.g., carbon sequestration, flood risk reduction), and socio-economic outcomes.

The **serious video game** focuses on scenarios for ecological restoration through deployment of nature-based solutions to approximations of real case studies—a medium-sized port town and a small fishing town with a tourism-based economy. It allows users to explore restoration pathways, understand trade-offs, and experience system dynamics in context-specific settings.

The **dashboard** presents indicators about the REST-COAST project in a simplified and analytical way through graphs and maps. It describes site conditions, pressures, and restoration responses. It serves as a decision-support tool for stakeholders, including project partners, local and environmental authorities, and coastal natural resource managers.

Together, these tools demonstrate the power of interactive engagement and gamification in boosting ecological literacy, fostering participatory planning, and building broader support for nature-based solutions. The session will include live demonstrations and key lessons learned from piloting these tools in REST-COAST case study sites.

1148

How can the extractives sector contribute to landscape-scale restoration?

Tom Cabuy¹, Nigel Symes²

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Abstract

Addressing the biodiversity crisis and achieving the targets set for ecosystem restoration in the Global Biodiversity Framework is of paramount importance to society. Industries, like the extractive sector, have a key role to play in both remediating their impacts and in restoring ecosystems at a landscape scale.

Minerals extraction is limited to where accessible mineral occurs determined by geology and geophysical processes. This frequently means that extraction sites are aggregated in certain landscapes, for example current and former floodplains with extensive sands, gravels and clays resources.

Cohesive utilisation of a number of approaches; modern planning tools (GIS and remote sensing), restoration principles for ecosystem rehabilitation, and collaborative approaches between industry, community and municipalities, provides opportunities to realise ecosystem restoration at scale driven by minerals extraction to make significant contribution to biodiversity recovery and to provide a range of services to society derived from the newly functioning ecosystems.

Using examples and best practices, a model for collaborative, at scale restoration approaches will be described together with indications of economic viability and values of the societal / community benefits that can result. The intention is to demonstrate how business sectors are well positioned to make significant contributions to global, regional and country commitments to restoring ecosystems functions.

1149

Building a data framework for biodiversity recovery: geospatial data and novel techniques

Wies Vanstockem

SCR-Sibelco NV, Antwerp, Belgium

Abstract

Sibelco, as a mineral extraction company, manages a large amount of land. Due to mergers, acquisitions, and other transactions it is a continuous challenge to keep oversight on its managed land, how it is or will be used, and what's on it.

Therefore, Sibelco has created a data framework with two goals: Smart land management and delivering added value for biodiversity after restoration. The data framework consists of several layers of geographical data. The layers were created using local knowledge and satellite imagery, but Sibelco is also looking at novel approaches to better analyse its land.

A new approach maps the habitats existing in an area, based on visual and non-visual bands of satellite images combined with vegetation inventories, boosting Sibelco's knowledge of its managed land and surrounding areas. This method is objective and lowers the amount of site visits needed, making an analysis of all land possible instead of having to limit to focus areas.

New data delivered by this method will connect with other data layers. Restoration and biodiversity actions can be monitored and compared to requirements of restoration plans and biodiversity management plans. Carbon sequestration and natural capital estimates can be calculated, adding new data layers to the framework. Target habitats can be chosen based on current habitats, and existing restoration plans can be adapted where necessary. The result will be a data framework which allows Sibelco to have complete oversight over the lifetime of an extractive site, from its former land use state until completed restoration.

1150

Urban Ecosystem Restoration as Climate Action and Equity-Centered Community Development

Amy Yarger

Butterfly Pavilion, Westminster, CO, USA

Abstract

Collaboration is key when it comes to connecting the community with their local natural areas. Urbanized natural areas often struggle with a high degree of ecological disturbance due to fragmentation, pollution, traffic, and invasive species, and yet they are instrumental in providing equitable access to nature. The Urban Prairies Project (UPP), which began in 2015, brings public and private partners together to devise habitat restoration work plans, raise awareness about public green space issues and develop a deeper understanding of the biodiversity and ecological function of our local open space parks. UPP celebrates the expertise of community members and provides avenues for their valuable contributions. At the core of UPP are over 30 dedicated Restoration Master Volunteers (RMVs). RMVs build upon their own personal experiences and become subject matter experts on the open spaces in their neighborhoods. This local knowledge, in combination with the extensive RMV training course, creates an informed and connected core of leaders for local habitat improvement projects. RMVs serve as crew leaders for volunteer events and are passionate ambassadors for pollinators and other urban wildlife. RMVs are also instrumental in monitoring populations of native plants, birds, and pollinators at UPP sites. This data is used by open space staff to evaluate the effectiveness of restoration efforts and create adaptive management plans. Because of the program's emphasis on collaboration and local place-making, UPP has grown over the past ten years to include 9 municipal partners, 149 trained community members, and over 1700 acres of urban natural areas.

1151

S206 : Enhancing Forest Biodiversity in the Taihang-Yan Mountains by Restoring North China Leopard HabitatsXIAONAN LIU

WWF China, Beijing, Beijing, China

Abstract

The Taihang-Yanshan region, a critical biodiversity hotspot in northern China, is home to the elusive North China leopard (*Panthera pardus japonensis*), with fewer than 400 individuals remaining. Yet, forest fragmentation, monoculture plantations, and timber-centric management threaten this big cat and its ecosystem. Since 2022, WWF-China has piloted a restoration-driven project across five state-owned forest farms, spanning over 1,100 hectares, to integrate biodiversity conservation into forest management. Using the North China leopard as an umbrella species, this initiative shifts traditional practices toward a model that enhances ecosystem resilience and fosters human-nature coexistence. This presentation explores the project's innovative strategies, on-the-ground actions, and measurable outcomes, showcasing how big cat conservation can spearhead forest restoration. It also highlights the potential for scaling this approach as a blueprint for sustainable landscapes beyond protected areas.

1152

Building a Roadmap for People Living in Harmony with Nature – Enhancing Forest Biodiversity in Taihang-Yan Mountain Region through Conservation-Based Forest Management

XIAONAN LIU

WWF China, Beijing, Beijing, China

Abstract

The Taihang-Yanshan region in northern China, a critical biodiversity hotspot, faces significant ecological challenges due to forest fragmentation, monoculture plantations, and timber-driven management practices. Launched in 2022 by WWF-China, this project aims to enhance forest biodiversity through conservation-based forest management across five state-owned forest farm pilots, spanning over 1,100 hectares. By integrating biodiversity restoration into forest management practices outside protected areas, the initiative seeks to address ecological gaps and establish a sustainable model for forest landscape restoration. This approach not only strengthens ecosystem resilience but also offers a scalable framework for harmonizing human activities with nature. The presentation will explore the project's strategic design, key implementation actions, preliminary outcomes, and its potential as a replicable blueprint for biodiversity-focused forest restoration in degraded landscapes.

1153

Innovations for cost-effective spatially patterned restoration methodsPedro Brancalion¹, Karen Holl²¹University of São Paulo, Piracicaba, São Paulo, Brazil. ²University of California, Santa Cruz, California, USA**Abstract**

Spatially patterned restoration methods have been proposed to reduce implementation costs and the number of seedlings required, and consequently increase the financial and operational viability of restoration. However, there is limited evidence on these topics. Another important knowledge gap is in the management of unplanted areas, which could be used to generate income through food and timber production and help offset restoration costs. We will present evidence from multiple experiments in the Brazilian Atlantic Forest on the costs, operational efficiency, and income generation of spatially patterned restoration methods. We will report on a 7 years old, 25-ha experiment testing 25% and 50% planting of experimental plots using two planting designs (nuclei or strips) plus a reference full planting treatment, and of two large-scale experiments of interplanting strips of eucalypts in the unplanted areas between native species. Planting seedlings in nuclei and strips results in similar survival and cover of planted trees after 7 years. However, planting in strips resulted in lower grass cover, was cheaper, and was more logistically feasible to implement than planting nuclei. Income from wood production of interplanted eucalypts offset 44-75% of restoration costs. Together these studies show that planting in strips a more cost effective and practical approach than planting nuclei, and that intercropping eucalypts and native species can increase the engagement of farmers, reduce the risks associated with fires and cattle invasion, and offset restoration costs.

1155

Incentives, Management, and Restoration: A Tale of Three TacticsVirginia Dale¹, Keith Kline²¹University of Tennessee, Knoxville, Tennessee, USA. ²Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA**Abstract**

Incentives for improved management are important to enable and expand ecological restoration. Achieving most restoration goals requires investments in analysis, planning, implementation, monitoring, and evaluation to continually adapt and improve management to the evolving conditions and needs in a particular context. Incentives can range from charging fees for pollution or ecosystem damage to facilitating permits that integrate appropriate restoration actions and payments for ecosystem services. Determining restoration goals requires consideration of desired future conditions as defined with stakeholders, the scale and extent of the projects, and restoration constraints and issues. Restored forests typically support habitat for species of special concern (biodiversity), habitat connectivity, and carbon sequestration. The interaction among incentives, management, and restoration are discussed in relation to forest ecosystems in the southeastern United States.

1156

Integrating common garden performance with seed germination traits for two arid land forbs used in restoration

Sarah Barga¹, Francis Kilkenny², Jessica Irwin³, Kimberly Rizkowsky²

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Abstract

Seed germination is a barrier to plant establishment that can present a challenge for restoration practitioners. This is especially true for arid land forbs, which are often locally adapted and experience seed dormancy that is released by specific moisture and temperature cues. Common garden work often relies on the ability to collect performance measures for mature plants, but tends not to focus on traits like seed germination. We conducted a seed germination study examining differences in response to varying lengths of cold stratification, a common dormancy breaking mechanism for arid land plants, and compared germination response across 20 populations for each of two widespread forb species found across the western US, *Chaenactis douglasii* and *Machaeranthera (Dieteria) canescens*. These populations were also included in a large-scale common garden study where adult performance traits were measured, enabling us to explore relationships between germination strategies and adult plant performance. We found species and population-level differences in total germination, relative germination rates, and within population variability in germination in response to our treatments. We then compared these results to important fitness traits for the adult plants (e.g. plant height, leaf traits). Here, we will identify patterns in the relationships of these performance metrics, as well as explore relationships between plant performance and source climate (e.g. precipitation and temperature). Identifying relationships between these performance metrics may identify traits that can be used for screening populations and informing the selection of appropriate genetic material for restoration use.

1157

Advancing collaboration for restoration at scale through RESULT Asia-Pacific

Illias Animon¹, [Christophe Besacier](#),²

¹FAO, Thailand. ²FAO, Italy

Abstract

[RESULT Asia-Pacific](#) was launched in December 2024; this Regional Programmatic Framework was designed in line with the Asia-Pacific Regional Strategy and Action Plan on Forest and Landscape Restoration, and the UN Decade on Ecosystem Restoration. It aims to support immediately 20 countries to achieve their restoration commitments of 100 million ha under the three Rio Conventions and national aspirations. RESULT Asia-Pacific Implementing Network (RAIN) was set up with 38 partners that comprise several key FLR players in the Asia-Pacific region to support and work together closely with the 20 countries to restore at scale. This presentation will explain how the RAIN partners are supporting the implementation and monitoring of the regional framework through collaboration to help restore at scale. The lessons learnt and challenges in operationalizing the framework will also be presented.

1158

Practical experiences with extractive site restoration, lessons learnedShane Sparg**Abstract**

Being part of the mineral extractive industry, habitat restoration forms part of the requirements in the license to operate. Even with their limitations, modified landscapes like quarries can present opportunities to create unique habitats that can support a wide variety of fauna and flora, and therefore contribute to ecosystem restoration and biodiversity targets.

However, the success of extractive site restoration, and restoration in general, is variable. Designing, implementing and post management of restoration projects can come with its challenges and even failures. When dealing with legislative or design changes, terrain constraints, colonising by invasive species, unforeseen shortages in biotic and abiotic materials, or more recently, the impacts of severe weather due to climatic instabilities, it is important to be able to adapt when working with nature.

As the effects on biodiversity are mostly observed at a local level, having a global footprint means dealing with a wide range of local conditions. From the experience gained on different projects, it is understood that there are no quick fixes when it comes to extractive site restoration. Often it can require testing multiple restoration methods and techniques to obtain the desired results. Looking at various extractive site restoration case studies, we will discuss some of the high and lows in trying to deliver positive restoration outcomes.

1161

Transformations for effective high-quality forest and landscape restoration in Latin America

Trevor Walter

WWF Chile, Valdivia, Chile

Abstract

Transformational Initiative on Forest and Landscape Restoration in Latin America is a multinational platform where WWF seeks to promote and support the implementation of national restoration commitments. Governments at the level of the region have committed to restoring over 52 million hectares, but this level of implementation requires a pace of action yet to be seen. WWF's Transformational Initiative has identified key barriers to scaling up, which at a high level include governance, participation, the private sector and ensuring the quality of interventions using the principles of Forest and Landscape Restoration. The use of the landscape approach is crucial to the effective implementation of restoration at scale and ensuring that outcomes are significant and impactful. From priority landscapes, the Initiative promotes the implementation of the UN Decade on Ecosystem Restoration, with targeted interventions and innovation. Work to develop enabling conditions in governance includes, advocacy for high-level policy commitments in the framework of the UNFCCC, CBD, UNCCD and the SDGs, all of which are at key moments on the road to 2030. Landscape governance itself is not unknown, but often difficult to implement with varied motivations of different and conflicting stakeholders. WWF works to ensure that local voices are clearly heard and also include the private sector to inject resources into restoration efforts, through corporate responsibility, impact investment and value-chain development. All of this within a transparent, planned approach to recover ecological functionality and human well-being within these landscapes. This presentation shares the approach and examples.

1162

Researching impacts of wolves on ungulates and vegetation in Colorado

Ellen Brandell¹, Danielle Johnston², Andy Holland¹, Michael Peyton³, Brian Gerber^{4,3}

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Abstract

Gray wolves are re-establishing in Colorado through natural dispersal and voter-mandated reintroduction. The addition of this native predator, previously absent for eight decades, may cause changes in prey density, distribution, or behavior. Subsequently, browsing pressure could change, impacting the growth and recruitment of particular plant species. These community effects of predator re-establishment will take years to decades to unfold, and can only be evaluated using long-term research with a robust study design. However, Colorado landscapes are complex; untangling how plant communities respond to wolves via herbivory is complicated by impacts of other predators, weather and disease events, and site-specific characteristics. In this talk, we outline how Colorado Parks and Wildlife is approaching this topic. We are designing a large-scale, primarily observational, research study focused on indirect effects. We are capitalizing on existing long-term mule deer monitoring areas and recently created elk monitoring areas to examine browsing pressure on important forage species. More specifically, we aim to link predator distribution to prey distribution, then prey distribution to prey diet and plant growth and recruitment. We are using simulation modeling to design the study and evaluate our ability to detect changes of varying magnitudes. This work will elucidate the impact of wolves on ungulates and vegetation, but also provide a framework for designing long-term ecological research.

1163

The joint importance of implementation and effectiveness monitoring for ensuring successful restoration outcomes

Peter Smiley

USDA Agricultural Research Service, Columbus, Ohio, USA

Abstract

It is common knowledge that many restoration projects do not receive any type of monitoring. This is a serious issue for the science and practice of ecological restoration because the lack of knowledge about restoration outcomes reduces the quality of future restoration efforts. Broadly, there are two types of monitoring important for ecological restoration – implementation monitoring and effectiveness monitoring. Implementation monitoring is often conducted by practitioners to document for funders that the restoration project was implemented as designed and promised. Effectiveness monitoring is usually conducted by scientists before and/or after the implementation of restoration project to understand the restoration outcomes. In many cases implementation and effectiveness monitoring are conducted independently, which weakens the overall evaluation of the subsequent restoration outcomes. To strengthen restoration project monitoring efforts implementation and effectiveness monitoring need to be inseparable and doing so will strengthen restoration outcomes by providing needed information on the outcomes of restoration efforts and strengthening the collaborations between practitioners and scientists. To build on these concepts, I will share recommendations for improving both implementation and effectiveness monitoring derived from my personal research experiences and those developed by the Interagency Ecological Restoration Quality Control Committee.

1164

Governing Landscape Futures: Good Practices for Promoting Policy Coherence

Victoria Gutierrez¹, Rocio Diaz-Chavez², Marta Koch², Andrea Romero Montoya³, Natalia Estrada Carmona⁴, James G. Hallett^{5,6}, Anita Diederichsen^{7,6}, Milena Engel¹, Emma Ligtermoet⁸, Simon Kraemer⁹

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Abstract

Achieving suitable policy coherence and integration is critical to the success of landscape restoration, by reducing fragmentation, avoiding policies and outcomes that conflict, and promoting effective governance that meets local needs. It is therefore also important for achieving broader global objectives, including biodiversity, climate change, land degradation neutrality, and sustainable development goals. However, many governments and restoration actors face challenges in addressing policy incoherence, mainly due to limited cross-sectoral coordination, siloed agency mandates, and conflicting priorities. The complexity of ecosystem and landscape dynamics further complicates a comprehensive approach to landscape restoration. In 2024, a collaborative initiative, Governing Landscape Futures, led by Commonland, emerged from a two-day multisectoral workshop to promote the need for improved policy coherence and multi-level governance in landscape and seascape restoration. Building on this work, the authors recognise that effective policy integration across sectors and levels of governance is key to achieving long-term restoration success, and that policy coherence requires active consideration by actors at all levels of governance throughout the full restoration process. As a first step, and alongside the UN Decade on Ecosystem Restoration's call to document good practices in policy coherence for landscapes, we present a policy brief with recommendations and case studies on how to promote policy coherence in support of landscape restoration.

1166

Reintroduction of Desert Bighorn Sheep to Colorado
Reintroduction of Mammal Species in the Central Rocky MountainsAndy Holland

Colorado Parks and Wildlife, Fort Collins, CO, USA

Abstract

Desert bighorn sheep (*Ovis canadensis nelsoni*) were reintroduced to southwest Colorado from Arizona, Nevada, and Utah. From 1979 to 2001, Colorado Parks and Wildlife conducted 12 transplant operations in collaboration with other state agencies to translocate 218 desert bighorn sheep. As a result of these significant and expensive transplant efforts, Colorado has three desert bighorn sheep herds, in the Dolores River, Gunnison River, and Colorado River drainages. Desert bighorn sheep are managed as Tier 1 (highest priority) with a total 2024 post-hunt population estimate of 500 desert bighorn sheep.

1167

Comparing above and belowground properties from chronosequence versus longitudinal data

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Abstract

While the importance of monitoring tropical forest restoration efforts is widely accepted and restoration standards require it, funding to implement monitoring is generally unavailable or limited to a short time period (<2 years). Here, we (1) synthesize what restoration standards require from projects for monitoring, verification, and reporting of restoration outcomes; and (2) identify gaps and synergies between what standards seek and what the restoration projects are currently doing. We also showcase the ongoing work of our synthesis group, aimed at analyzing existing datasets from restoration projects and networks from across the tropics in order to design a standardized cost-effective set of monitoring guidelines. We will discuss the various dimensions that our analysis will cover, and present how interested practitioners and projects can contribute to this effort. The results of this analysis will help better inform monitoring efforts and help the restoration community in the tropics plan monitoring activities, choose metrics for monitoring, and budget funding for monitoring.

1168

The roots of restoration: Understanding the role of mycorrhizal fungi and biocrusts in native plant restorations

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Abstract

Understanding the mechanisms that promote native seedling establishment in invaded ecosystems is key to improving the biodiversity and function of landscape restorations. In a field experiment over seven growing seasons, inoculation with prairie microbes, including arbuscular mycorrhizal (AM) fungi, improved native plant establishment in the restoration of an invaded grassland. This is because invasions can negatively impact soil microbial communities, yet soil microbes are rarely considered in revegetation efforts. In the Pacific Northwest, the annual grass, *Ventenata dubia*, is rapidly invading, but its impacts on biocrusts and soil biota are not known. In a glasshouse and field survey of plots varying in percent cover of *V. dubia* across three field sites, we investigated the impact of *V. dubia* invasion on the abundance and composition of biocrusts and AM fungi. Soil inocula was used in a glasshouse experiment to test how the abundance of AM fungal propagules may vary across invasion levels and under biocrusts. Amplicon sequencing was used to characterize the AM fungal communities in each plot and to identify AM fungal taxa that were differentially impacted by invasion. We found that annual grass invasion was associated with lower biocrust cover, distinct biocrust and AM fungal community structure, and lower AM fungal abundance below biocrusts. By considering belowground communities at the same time as revegetation efforts, microbial inoculations may be used as a nature-based tool to accelerate the recovery of invaded grasslands. This research supports broader UN Sustainable Development Goals focused on the protection and restoration of terrestrial ecosystems.

1169

Restoring a river for beavers and what we learned

Ian Wilson

Greater Hells Canyon Council, Lostine, OR, USA

Abstract

The vast majority of river restoration projects in the Pacific Northwest are funded and implemented to restore habitat for threatened or endangered Pacific Salmon. The goals and objectives of these projects often focus on specific limiting life stages or habitat factors for these species and the processes that will contribute to their recovery. However, far less planning and goals go into restoring habitat for beaver occupancy and the natural processes they create and restore for a myriad of plants and animals, including endangered or threatened salmonids. This is a story of a stream restoration project on the Wallowa River in northeast Oregon where one of the primary objectives was to restore habitat for beavers to take over the stewardship and restore natural processes for aquatic and terrestrial flora and fauna and what we are learning from this experience. Beavers returned much sooner than expected, flora and fauna responses have exceeded expectations and traditional ideas surrounding required beaver habitat are not always accurate. We hope to impart our lessons learned for future river stewards to guide techniques and standards designed to attract and maintain beaver occupancy in floodplain environments for long term ecological success.

1171

A jurisdictional and hydrological multi-stakeholder governance approach to landscape restoration for climate adaptation: the Valdivia River Watershed

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Abstract

The Valdivia River Watershed is located in the Los Ríos Region in the temperate rainforest of southern Chile. Historic annual precipitation was often recorded above 2000mm. However, in the 2021 hydrological year measured just over 900mm. While, this is still considerable precipitation, patterns of human habitation across the watershed were not established with this paradigm and 21,500 were without access to secure water supply. Both climate and land use change are driving the tendency to reduced precipitation. The regional government convened the Regional Water Roundtable and six action areas were identified. One on Restoration and Integrated Watershed Management recognized the function of healthy forest ecosystems in regulating the sources of surface water supplying the majority of vulnerable rural communities. WWF partnered with the regional government to develop an action plan, based on multi-stakeholder governance, strong science and concrete on the ground action. This collaboration strengthened the roundtable itself, provided new science-based inputs for decision-making, catalyzed funding for restoration and demonstrated the use ecological restoration of forests for water provision. Climate change scenarios were used to model the decreasing trend in surface runoff patterns and then applied to the results of a restoration prioritization model. This information orients planning processes for restoration, both actions and commitments, serving as a solid basis to involve new stakeholders in restoration, for example the Ministry of Public Works. Restoration designed through multi-stakeholder governance as a nature-based solution for green infrastructure is an important action for climate change adaptation for the Los Río Region.

1172

The view from NGOs: Challenges and opportunities for scaling up Assisted Natural Regeneration in Latin America and the Caribbean

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Abstract

Assisted Natural Regeneration (ANR) is a cost-effective strategy for restoring degraded land and aligns with Brazil's National Plan for the Recovery of Native Vegetation (Planaveg). By harnessing natural processes and leveraging existing seed banks, ANR accelerates ecosystem recovery, helping Brazil achieve restoration targets, preserve biodiversity, sustain ecosystem services, and bolster climate-change mitigation through enhanced carbon sequestration. Its frameworks and best practices can also guide other Latin American and Caribbean nations facing similar ecological challenges, fostering regional cooperation in sustainable development.

Effective institutional arrangements are vital to ANR's success under Planaveg, uniting federal, state, and municipal agencies through multi-level governance. NGOs play a decisive role by bridging scientific and local expertise, delivering technical training, and facilitating collaboration among government bodies, communities, and private stakeholders. Stable legal frameworks and long-term funding protect regenerated areas, maximizing ecological benefits while fulfilling Planaveg's ambitious goals. Regional coordination across Latin America and the Caribbean amplifies these efforts, strengthening commitments to biodiversity and climate resilience.

Robust governance and legislation also expand opportunities for private-sector engagement. Companies pursuing deforestation-free supply chains and strong ESG (Environmental, Social, and Governance) strategies can partner with the public sector and NGOs to invest in ANR initiatives. Mechanisms such as payment for ecosystem services encourage corporate participation, while multi-stakeholder platforms ensure restored landscapes remain both ecologically and economically viable. By benefiting local livelihoods, ANR also fosters socio-economic resilience, further aligning with sustainable development goals. Broad adoption of ANR thus addresses regional restoration and climate objectives, ultimately reinforcing Planaveg's overarching mission.

1173

Ash trees and lowland hardwood forests of the Upper Midwest: Tools to support managing for change

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Abstract

The emerald ash borer, climate change, and altered environmental conditions are impacting the wetland and floodplain forests of the Upper Midwest in multiple ways that compromise ecological, economic, social, and cultural values. Natural resource managers and land stewards in these systems are grappling with ash mortality, limited tree regeneration, competition from non-native invasive plants, changing hydrology, shifting species ranges, and an increase in extreme weather events. Meeting these challenges will require identification and implementation of practical management solutions that center the reality of current and future environmental change. Many practitioners and applied researchers throughout the Upper Midwest are already conducting silvicultural field trials and experimental treatments including planting of ash 'replacement' species. By synthesizing the results of these case studies, and determining how ecosystem characteristics may influence outcomes, the Northern Lowland Hardwood Adaptation Network is developing information and decision support resources to support knowledge-based management actions across diverse lowland hardwood forests.

1174

Louisiana's Coastwide Reference Monitoring System: A case study from an established large-scale monitoring network supporting restoration planning, project evaluation, and assessment of ecosystem change

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Abstract

Since 1932, Louisiana has lost over 2,000 square miles of its coastal land area. Land loss is driven by natural processes, including storms, subsidence, and sea level rise, as well as anthropogenic factors such as development and oil spills. To reduce the risk of land loss and coastal flooding, Louisiana has been implementing wetland restoration projects since the 1990s. Efforts accelerated after the devastating hurricanes of 2005, with the formation of the Coastal Protection and Restoration Authority (CPRA) and development of a Comprehensive Master Plan for a Sustainable Coast. The Coastwide Reference Monitoring System (CRMS) - a network of nearly 400 sites throughout the coastal zone that track changes in hydrology, vegetation, sediment, and land area - was developed in 2007 to be the backbone for evaluation of restoration effectiveness. CRMS is a collaborative effort between CPRA and the U.S. Geological Survey, with stable, long-term funding through the Coastal Wetlands Planning, Protection, and Restoration Act. Sites in the CRMS network can be separate from monitoring that is established within restoration projects, but project monitoring is designed such that CRMS sites can serve as a landscape-scale reference for project outcomes. Because pre-restoration data are often not sufficient as a baseline for evaluation, the broad network of CRMS sites provides a reference based on spatial variation in conditions across the coast. We will describe lessons learned in developing methods for monitoring and evaluating change across scales, which range from a single CRMS site, to large restoration projects, to the Louisiana coast as a whole.

1177

Climate adaptive restoration techniques using biocrust sods

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Abstract

Climate change and land use impacts on the Colorado Plateau affect ecosystem function and services. In this region, biocrusts are powerhouses in providing both: stabilizing soils and keeping dust out of the air, fixing carbon and nitrogen and promoting soil fertility, intercepting and slowing soil evaporation. To test methods to restore biocrusts to degraded landscapes using climate adaptive techniques we collected biocrust from Mojave, Sonoran and Colorado Plateau sources from areas slated for disturbance and cultivated in fields outside of Moab on substrates including various biodegradable and synthetic weed fabrics or jute, with and without shade (burlap or synthetic shade fabric). After two growing seasons, we harvested biocrusts on their substrates in 3m lengths, rolling onto a pvc pole and transporting to two restoration sites on the Colorado Plateau. We installed arrays of “biocrust sods” in blocks including untreated areas as controls. We quantified biocrust, weeds and disturbance on sods after one and five years. Weed barriers continued to abate weeds over time, and biocrust cover varied by substrate and source. Burlap shading had the strongest positive effect on biocrust cover. Mojave and Colorado Plateau had higher cover at both time points compared to Sonoran. Cattle disturbance damaged some sods but biocrust colonized in and around disturbances. Sods have potential in a variety of settings to bring back mature biocrust in islands, with weed abatement and soil stabilization. Further, sourcing biocrust materials from hotter/drier places has potential as a climate adaptive restoration strategy with more research.

1178

Early Insights and Adaptive Management of Wolf Restoration in Colorado

Brenna Cassidy¹, Eric Odell¹, Ellen Brandell¹, Reid DeWalt², Brian Dreher², David Klute², Adam Baca¹

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Abstract

The reintroduction of gray wolves (*Canis lupus*) to Colorado represents a landmark ecological restoration effort, initiated after the passage of Proposition 114 in 2020. Colorado Parks and Wildlife (CPW) has undertaken a multifaceted approach to wolf restoration and management, engaging a broad coalition of stakeholders, including state and federal agencies, livestock organizations, conservation advocates, tribal representatives, and the general public. The first phase of reintroductions (wolf translocations) in winters 2023 and 2025 brought both successes and challenges, highlighting the complexity of restoring a keystone carnivore to a dynamic landscape.

To inform adaptive management decisions, CPW has implemented a monitoring program that integrates multiple methods to track wolf distribution, survival, and reproduction. A robust monitoring program is central to the adaptive management of Colorado's reintroduced wolf population. With the second year of translocations complete, continued monitoring will be critical for guiding future management decisions. Preliminary data suggests the survival, reproduction, dispersal, and pack formation rates are typical of a translocated population of wolves. Our findings emphasize the importance of an adaptive, science-based approach to large carnivore restoration and coexistence in a multi-use landscape. This talk will discuss key lessons from the first two years of wolf restoration, including ecological findings and management challenges.

1179

Restoring Wolverines to Colorado

Robert Inman

Colorado Parks and Wildlife, Fort Collins, Colorado, USA

Abstract

Wolverine conservation in the contiguous U.S. requires collaboration at the landscape scale because a metapopulation consisting of a few hundred individuals naturally exists in high-elevation, alpine “islands” spanning eight western states. The species occurs primarily on public lands, but these habitats are managed by numerous sub-units of the United States Forest Service, the National Park Service, the U.S. Fish and Wildlife Service, the Bureau of Land Management and each state. In addition, eight different states with varying statutes are responsible for managing this naturally small population, and privately-owned lands must often be conducive to dispersal movements across a vast landscape. Metapopulation conservation priorities include landscape-level connectivity, restorations to unoccupied areas of historical range, and a monitoring program. The Western Association of Fish and Wildlife Agencies recently established a collaborative wolverine monitoring program that occurs once every 5 years and will soon include international collaboration. Scientific efforts to identify dispersal corridors have made significant progress and are being incorporated into conservation easement discussions with willing private landowners. Colorado is actively planning a restoration effort into the largest block of historic range that remains unoccupied. This effort can increase population size in the contiguous U.S. by >20% and would place a genetically diverse sub-population of wolverines in an area that may be a climate refugia for this circumboreal species. Collaboration within Colorado is essential for success, including with land managers, tribes, rural communities, surrounding states, and the U.S. Fish and Wildlife Service. Restoration to Colorado will significantly benefit the contiguous U.S. population.

1180

Functional trait-based urban forest restoration for heat reduction, resilience, and biodiversity: a case study in Boulder, Colorado

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University of Colorado, Boulder, Boulder, Colorado, USA

Abstract

As cities warm due to climate change and urban development, there is substantial interest in tree planting to reduce urban heat. However, we know little about which tree species are ideal to plant to provide maximum cooling benefits. Moreover, tree planting to mitigate heat exists in the broader context of urban ecosystem restoration. To meet the promise of a nature-based solution – to be inclusive, sustainable urban restoration – tree planting for heat reduction must also support biodiversity, ensure ecosystem resilience, and engage the community. A functional trait approach can help identify planting palettes to achieve these goals.

The Boulder Urban Heat Project is investigating which species provide maximum cooling of urban microclimates and what species traits might be the drivers of cooling effects. In a 2024 pilot study, we installed air temperature sensors under 56 trees and found that trees of different species in close proximity differed in average cooling by up to 5°C, suggesting that species may play a role in cooling. Data collected in 2024 also indicates that species can vary widely in traits expected to be related to cooling such as canopy volume and wood density. Additional trait information could be used to select species that provide the greatest cooling, are most likely to be resilient to climate change, and match community needs and values. Furthermore, using trait databases, we could identify a broad palette of species with traits that should maximize cooling, allowing us to achieve both heat reduction and high urban forest biodiversity.

1181

What can you do when legal change is impractical? The Australian experience in overcoming legal barriers to restoration

Justine Bell-James

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Abstract

NOTE - THIS IS FOR SYMPOSIUM 'Getting to 30x30: Developing a Model Law to Incentivise Practical Ecological Restoration Efforts'

2024 was a landmark year for ecological restoration law, with the passage of the EU Nature Restoration Law. Although this law is not without its criticisms, it has set the international bar for the enshrinement of restoration objectives at a high level through legislative reform.

While high-level legislative objectives might be the gold standard, this type of change is unlikely to occur in countries like Australia, where environmental law reform is notoriously difficult to progress. This means that restoration is largely 'opportunistic', motivated by short-term drivers like available of funding. It also means that restoration proponents get caught up in legal complexities around permitting, tenure, and liability.

This presentation explores the question of how law can incentivise restoration in circumstances where large-scale law reform is not possible, through searching for small and achievable 'levers' within existing frameworks to smooth the path of projects and continue progress towards the 30 x 30 target.

1182

The potential ecological impacts of jaguar reintroduction

Emiliano Donadio¹, Quimey Gomez², Alejandro Welschen², Belén Avila², Gisela Bruhn³, Natalia Ferreyra³, Melanie Browne², Francisco Cataudela², Simón Kraemer², Octavio Priotto⁴, María José Corriale², Agustín Paviolo², Carlos De Angelo², Cecilia Kopuchian², Adrián Di Giacomo², Mario Di Bitteti²

¹Rewilding Argentina, Argentina. ²CONICET, Argentina. ³NA, Argentina. ⁴Universidad Nacional de Río Cuarto, Argentina

Abstract

Reintroducing key species is presumed to provide various benefits to ecosystems by restoring ecological processes. One such process is predation. Consequently, the repatriation of apex predators has become a focal point in conservation programs. Ecologically functional populations of apex predators can initiate trophic cascades, wherein predators influence the numbers and behaviors of herbivore prey, leading to indirect and beneficial effects on vegetation. Additionally, apex predators can kill and displace mesopredators, thereby benefiting the prey populations of these mesopredators. In Argentina, jaguars are recognized as apex predators; however, their population and geographic range have significantly declined. Presently, fewer than 200 individuals remain in the country, occupying approximately 5% of their historical range. The Iberá wetlands (-28.24, -57.33) are among the regions from which jaguars were completely eradicated. Here, after ~70 years of absence, Rewilding Argentina released in 2021 four adults, one male and three females, two of which had 2-4 months old cubs. By December 2024, this reintroduced population had increased to over 32 individuals. We discuss the extent to which jaguar reintroduction has revived previously lost predator-prey interactions, with subsequent effects on other wildlife populations and plant communities.

1183

Coordinated Multi-Stakeholder Engagement in Natural Forest Landscape Restoration: An Innovative Monitoring and Evaluation Framework for China

Jie ZHAO

Chinese Academy of Forestry, Beijing, Beijing, China

Abstract

China's degraded natural forest landscapes face systemic challenges, including habitat fragmentation, biodiversity loss, and unsustainable livelihoods. Under the WWF and GEF projects a novel Monitoring and Evaluation framework has been developed to address ecological, economic, and social dimensions of forest landscape restoration (FLR). These projects present a participatory, cost-effective, and scalable indicator system comprising 30 metrics across four core principles: vegetation recovery, ecosystem service enhancement, ecological corridor establishment, and community well-being improvement.

By integrating multi-scale data (stand and landscape levels) and fostering collaboration among government agencies, local communities, and scientific institutions, the framework enables real-time adaptive management. Key innovations include gender-inclusive metrics, policy-driven livelihood incentives, and simplified monitoring protocols tailored for grassroots implementation. Case studies from pilot regions demonstrate how coordinated stakeholder engagement enhances restoration outcomes while balancing ecological integrity and socio-economic resilience.

This framework offers a replicable model for Asia-Pacific nations grappling with similar challenges. It emphasizes the critical role of cross-sectoral cooperation, participatory governance, and knowledge-sharing in scaling up FLR initiatives. The findings advocate for integrating localized traditional knowledge with global standards (e.g., IUCN's Nature-based Solutions) to achieve the Bonn Challenge targets and SDG 15.3 (Land Degradation Neutrality). By bridging policy, science, and community action, China's experience provides actionable insights for fostering regional collaboration in ecological restoration.

1184

Lessons, learnings and methods for an indigenous-led, long-term plan for regenerating environment, culture and place (Ngāti Whātua Ōrākei, Tāmaki Makaurau, Aotearoa)

Jessica Hiscox

Ngāti Whātua Ōrākei, Auckland, Auckland, New Zealand

Abstract

Ngāti Whātua Ōrākei, the indigenous people of Tāmaki/central Auckland, have recently developed and are actively implementing Ko Te Pūkākī:2040, our intergenerational environmental regeneration plan. It consists of two, interconnected parts; Mahere Hōmiromo - our detailed, time aligned management plan for years 1-5, and Tiroiro Whānui – a public snapshot into the kaupapa (project). Together, as Ko Te Pūkākī: 2040, they lay the pathway for the continued regeneration of our whenua (land) from now until 2040. This plan provides a clear and strategic vision for our whenua, based on a set of mātaḥono (principles) that guide all actions. We have set up a series of habitat types based on our unique landscape, established planting palettes for these areas, and built timelines for the regeneration of our whenua. Geo-spatial and project management technologies have been meshed with existing knowledge to map out methodologies, resourcing and timelines we will follow to maximise regenerative effect of our mahi, overtime. Throughout it all we have placed our people, our place, and our culture at the heart of all this mahi. We will talk about this plan, its creation, its contents, and the lessons we have learnt on our path.

1185

A whakapapa of regenerative practice: Ngāti Whātua Ōrākei, Tāmaki Makaurau, Aotearoa

Kingi Makoare, Mervyn Kerehoma

Ngāti Whātua Ōrākei, Auckland, Auckland, New Zealand

Abstract

Ngāti Whātua Ōrākei are the indigenous people of Tāmaki/central Auckland, the largest and most densely populated city in Aotearoa/New Zealand. Located ten minutes from the city centre, Tumutumuwhenua our traditional carved ceremonial house stands proudly at the centre of our thriving papakāinga (contemporary tribal village) upon the whenua (land) we know as Te Whatu Toto (our heart's blood). This papakāinga is the centre of our unique reo (language), culture and practices, those things that define us and guide us to a bright and prosperous future. We have been undertaking regeneration mahi (work) since mid-2000's when we finally began to receive our stolen whenua back from the Crown. Building upon the bones of our early mahi, we have recently developed and are now actively implementing Ko Te Pūkākī:2040, our intergenerational environmental regeneration plan. It draws from our mātauranga, the traditions and knowledge of place left to us from our pasts, both distant and recent. It meshes seamlessly with digital technologies and western science, but at all times returns to this whenua, and to us as a native and natural part of this environment. Our presentation will share who we are, where we have come from and what regeneration means for Ngāti Whātua Ōrākei now and into the future. We talk about disconnection, learning, re-learning of Māturanga Ōrākei (our knowledge) and te ao Ngāti Whātua Ōrākei (our world view). Lastly, we will provide a modern indigenous understanding of self-determination, actively hauling the future we want for our grandchildren to us

1186

Harmonizing Livelihoods and Forest Landscapes: insights from APFNet projects, APFNet

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Abstract

Integrating livelihood development into forest landscape restoration (FLR) is essential for ensuring long-term ecological and social sustainability. APFNet's work across the Asia-Pacific region demonstrates that FLR is most effective when it addresses not only environmental degradation, but also the needs and aspirations of forest-dependent communities. By embedding community well-being at the heart of restoration planning and implementation, APFNet promotes models where livelihoods and landscapes are restored together—not separately.

This presentation shares insights from APFNet's regional experience, emphasizing the importance of inclusive participation, equitable benefit-sharing, and locally adapted strategies. Rather than treating livelihoods as secondary outcomes, APFNet positions them as integral to the restoration process, supporting rural resilience, reducing pressure on forest resources, and enhancing social acceptance of restoration efforts.

Key reflections will explore how restoration can serve as a platform for diversifying income sources, strengthening community stewardship, and linking ecological outcomes with economic opportunity. The presentation also discusses the institutional and policy conditions needed to mainstream livelihood-sensitive FLR at scale.

Ultimately, harmonizing livelihoods with forest landscapes is not only a matter of social justice, but a prerequisite for successful and lasting restoration. APFNet's work offers practical lessons and regional perspectives to inform global efforts in building FLR approaches that are ecologically sound and socially inclusive.

1187

Australia's Restoration Decade Alliance – a national approach to attaining nature positive restoration in Australia

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Abstract

Australia's native ecosystems are deteriorating from increasing pressures from climate change, habitat loss, invasive species, pollution, resource extraction, and unsustainable land and water usage. Motivated by the urgent need to upscale restoration, Australia's Restoration Decade Alliance (RDA) ran a series of workshops and a symposium titled 'Towards a National Restoration Plan'. Through this engagement, the RDA identified several significant policy gaps for Australia to fulfil its vision for nature positive outcomes, namely: need for more genuine engagement with Indigenous Australians (as a first principle) in Australia's restoration efforts, inadequate vision for ecosystem restoration, lack of large-scale funding, insufficient capacity, and need for actionable strategy and ambitious and inspiring targets. In October 2024, the RDA issued a position statement "A national approach to attaining nature positive restoration in Australia". We identified the important issues for funding restoration, and priorities to enable terrestrial and aquatic restoration. Restoration of terrestrial ecosystems requires addressing degradational factors (invasive plants and feral animals) and multiple interventions such as revegetation, habitat restoration, faunal reintroductions and reinstatement of appropriate hydrological and fire regimes. Restoration of aquatic ecosystems requires some additional restoration methodologies, consideration of climate change adaptation in coastal wetland ecosystems, and catchment-scale restoration to address stressors. Wetlands not associated with riverine systems are also in dire need of restoration. Based on the collective wisdom of the RDA's member organisations, we have identified 10 actions required to enable restoration. These actions link to Australia's commitments to the UN Decade on Ecosystem Restoration and the Kunming-Montreal Global Biodiversity Framework.

1188

Scaling Up Forest Landscape Restoration in Asia: Collaborative Approaches and IUCN's Role

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Abstract

Forest Landscape Restoration (FLR) is crucial for ecological integrity, biodiversity, and human well-being in Asia. However, the scale of degradation requires innovative, collaborative approaches. This presentation will showcase how IUCN facilitates collaboration to scale up FLR across Asia. Key elements include multi-stakeholder engagement, technical guidance, capacity building, policy advocacy, monitoring, and financial mechanisms. Case studies will illustrate how these approaches address challenges and achieve restoration outcomes. The presentation will also discuss lessons learned, opportunities, and the role of FLR in meeting regional and global targets, including the UN Decade on Ecosystem Restoration and the Kunming-Montreal Global Biodiversity Framework. We will discuss the use of key tools, such as the Restoration Opportunities Assessment Methodology (ROAM) and the Restoration Barometer, and how we leveraged key initiatives such as the GEF8 Indo-Malaya Critical Forest Biome program, Mangroves for the Future, and The Restoration Initiative (TRI), demonstrating IUCN's on-the-ground impact. The presentation will emphasise how IUCN's science-led approach, policy engagement, and project implementation contribute to scaling FLR and supporting countries in achieving their restoration commitments.

1189

Upper Paraná: how to position a Tropical Landscape as a benchmark of global targets

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Abstract

The Upper Paraná ecoregion is the only one trinational landscape of the Atlantic Forest composed by Argentina, Brazil and Paraguay. This region is characterized by three sub-landscapes, in each country, that have different trajectories of land use land cover dynamics, communities and legal aspects. However, the restoration agenda is a theme that promote the connection between the three countries to discuss about challenges and solutions that affect the Trinational Atlantic Forest region, and the way used is a multistakeholder platform called Trinational Alliance for Atlantic Forest Restoration that together with a landscape vision of the territory, builder by local stakeholders was possible to plan and work regional targets for biodiversity, people and climate. Currently, the Upper Paraná region is being focus of actions that integration species conservation, protected areas, productive restoration, ecosystem services and social benefits with focus that to have an action on the ground that connect the NDC and NBSAP's targets. Thus, with a stakeholder platform with landscape vision for future, placed on international geographic composition among three countries, a history action in the territory of engagement and restoration interventions, that helped to be a Global Restoration Flagship of the UN Decade Restoration, together with Atlantic Forest Pact, the Upper Paraná landscape is a true region with conditions to implement global integrated targets.

1190

Developing strategies for biocrust induction by cyanobacteria inoculation to restore dryland soil functionality

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Abstract

Ecosystem restoration is especially challenging in drylands due to increasing anthropogenic pressure and the resulting degradation, as well as inherent environmental stresses that hinder plant establishment, often causing restoration failure. An alternative approach to overcome these challenges and improve restoration success can be through the recovery of a key soil component, biocrust. By restoring biocrusts, soil functions such as soil fertility, erosion control, water regulation, soil biodiversity can be reestablished, aiding plant establishment and helping to achieve restoration goals. Different biocrust organisms have been used to foster biocrust formation, one of the most interesting are cyanobacteria, pioneer and ubiquitous components of biocrust communities. Cyanobacteria have the ability to fix the atmospheric carbon and many of them also the atmospheric nitrogen, and incorporate them into the soil, increasing soil fertility. They also secrete exopolysaccharides that enhance soil aggregation and water retention at the soil surface. Previous studies show the possibility of isolating different cyanobacteria strains from biocrusts and using them as inoculum, individually or as a consortium, to induce biocrust formation. However, under field conditions, different barriers need to be overcome for the successful establishment of the inoculum. In this work, we investigate the role of soil inoculation with cyanobacteria in prompting biocrust formation and improving soil properties and functions. Field application in semiarid areas of southeast Spain demonstrate the suitability of habitat ameliorating strategies such as soil fixers, soil covers or organic amendments to promote biocrust development. Advances and limitations for large-scale application of cyanobacteria-based biocrust restoration approaches are discussed.

1191

Short-term monitoring informing long-term ecosystem recovery: comparing above and belowground properties from chronosequence versus longitudinal data

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Abstract

Restoring ecosystems is a long-term prospect. However, few forest restoration projects in the tropics undergo monitoring beyond two years, which is likely the time horizon of most research grants or PhD theses. Moreover, the costs of long-term monitoring are not often included in grants to practitioners. Some studies of forest succession circumvent this through using space-for-time substitutions, i.e., chronosequences, which also have limitations. A major knowledge gap is whether the long-term trajectories of restoration projects can be easily inferred from short-term data or chronosequences. Put simply, when thinking about monitoring diverse restoration outcomes, how long is enough?

We address this challenge in two ways: first, we compile long-term datasets for restoration projects in the tropics and second, we compare chronosequence studies to longitudinal data. We highlight one example of long-term observations collected from chronosequences of plots in different stages of recovery in naturally regenerated tropical dry forest in Costa Rica. These data suggest that recovery trajectories for properties such as species composition and soil carbon storage differ depending on whether one considers the plots as chronosequences or through time, underscoring the importance of long-term monitoring. Future analyses we do will consider how long monitoring periods should be in order to provide robust and cost-effective guidelines for future restoration projects.

1192

Networked Civil Society Coalitions for Multi-level Policy Integration across Climate, Biodiversity and Livelihood Goals

Samuel Tabor

Collaborating for Resilience, Washington, District of Columbia, USA

Abstract

This presentation is a contribution to the symposium on “Shaping the Future of Landscape Restoration: Pathways to Integration.” While policy coherence for integrated climate and landscape restoration solutions is rightly an inter-governmental and inter-ministerial priority at the highest levels, there is also an opportunity to leverage bottom-up, networked efforts at integrated policy coherence responding to the ground-level expertise of civil society, social entrepreneurship, and Indigenous authority organizations. This presentation shares diverse examples in which networks or coalitions of civil society actors—drawing on work in Guatemala, India, and Kenya—work to shape and better integrate landscape-relevant policies across multiple levels of governance, from sub-national, to national, to international scales. The challenge of policy coherence and integration is front and center in such efforts as organizations with different types of expertise and agendas—e.g. the rights-based agendas of land defenders vs. the market access and commercialization agendas of agroecology social enterprises—strategize together about ways to push for policies and reforms that speak in coherent and integrated ways to the challenges faced by smallholder farmers and communities managing shared ecosystem resources at the landscape scale. The examples highlight opportunities and challenges of networked CSO strategies for shaping coherence and integration across domains, sectors, and government line agencies. Specific focus is given to sharing concrete policy integration strategies that have emerged from such efforts, as well as considering how bottom-up CSO-led efforts at policy integration can be better aligned with policy coherence and integration discussions happening at other levels of governance.

1193

Evaluating the Impact of the 4 Returns Framework in Holistic Landscape Restoration in five landscapes: Implications for scaling

Victoria Gutierrez, Milena Engel

Commonland, Amsterdam, Netherlands

Abstract

Founded in 2013, Commonland promotes a holistic approach to landscape restoration through the 4 Returns Framework (4RF), supporting multi-stakeholder partnerships that seek multiple benefits (social, natural, financial and inspirational). This framework guides restoration efforts in over 25 landscapes worldwide, emphasising the importance of a landscape approach, multi-stakeholder processes, long-term commitment and process funding. We present the results of an ongoing study that assesses the application and relevance of the 4RF in five diverse landscapes in India, South Africa, Spain, Australia and the Netherlands. The study examines the effectiveness of partnerships in driving restoration outcomes, focusing on both positive and negative outcomes. Key objectives include assessing how stakeholders interpret, implement, and navigate holistic restoration strategies, with a focus on the challenges and successes encountered during implementation. Data was gathered from multiple sources, including annual reports, impact assessments, monitoring data and holistic landscape restoration plans. A mixed-methods approach was employed, including focus group discussions, interviews, sense-making workshops, and a tailored survey to address data gaps. We discuss the factors that enable or hinder the success of locally-led landscape restoration initiatives, as well as the role of the 4RF in shaping restoration practices. Finally, we offer guidance for improving the scaling of landscape restoration efforts, contributing to the broader field of landscape governance, and informing future policy and practice for holistic, integrated restoration strategies.

1194

Forest and Landscape Restoration and its importance to the Rio Conventions.

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⁴Commonland, Amsterdam, Netherlands

Abstract

The Global Partnership on Forest and Landscape Restoration (GPFLR) is a proactive global network uniting governments, international organizations, and research institutes, under a common goal: to restore the world's lost and degraded forests and surrounding landscapes. The GPFLR's primary purpose is to catalyze dynamic, voluntary action through sharing diverse experiences on restoration efforts that deliver tangible benefits to both local communities and nature through a landscape approach. The Partnership also encourages political commitments to forest and landscape restoration (FLR) and prioritizes the promotion of strong linkages between Bonn Challenge commitments, the UN Decade on Ecosystem Restoration with an integrated approach, and alignment with the objectives of the Rio Conventions—the CBD, UNFCCC, and UNCCD.

FLR is “a planned process that aims to regain ecological integrity and enhance human wellbeing in deforested or degraded forest landscapes”. It focuses on re-establishing functions and key ecosystem processes through specific interventions within the context of a whole landscape rather than restoration of individual sites. FLR is a well-recognized approach for contributing to achieving the Rio Conventions objectives: for CBD, FLR supports effective restoration of degraded areas, and aligns directly with Target 2 of the Global Biodiversity Framework; for UNFCCC, FLR contributes to carbon sequestration, adaptation, and resilience-building; and for UNCCD, FLR plays a crucial role in reversing land degradation and achieving land degradation neutrality (LDN) targets. The work of GPFLR members demonstrates the importance of FLR and promotes further scaling-up to meet our environmental challenges.

1195

Forest Restoration and Connectivity: A Pathway to Big Cat Conservation

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Abstract

Big cats are keystone species and indicators of ecosystem health, relying on intact, connected landscapes for survival. This symposium explores how forest restoration enhances connectivity, mitigates human-wildlife conflict, and strengthens ecosystem resilience, emphasizing big cats' role as landscape champions. Experts will discuss jaguar conservation in Brazil, Colombia and Mexico and tiger conservation in Nepal and China, highlighting restoration efforts that secure movement corridors and critical habitats.

Jaguar conservation projects in Latin America reconnect fragmented landscapes, ensuring genetic flow and reducing conflicts through ecological corridors. In Asia, tiger initiatives focus on habitat restoration, protected area expansion, and prey population strengthening to sustain viable populations.

As moderator, I will facilitate discussions that integrate science, policy, and practice, fostering a dynamic exchange among conservationists, restoration practitioners, and policymakers. Through case studies and cross-regional insights, we will explore scalable solutions that align restoration with big cat conservation, demonstrating how these efforts support biodiversity and climate adaptation.

This symposium aims to inspire innovative approaches to restoring landscapes for apex predators and the ecosystems they anchor, reinforcing forest restoration as a pathway to global biodiversity targets and the future of these iconic species.

1196

Natural establishment of biological soil crusts and associated soil properties on abandoned mineral sites in the boreal forest of Eastern Canada

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Abstract

Biological soil crusts (BSCs) may be among the first to form and colonize degraded mineral landscapes following industrial abandonment. BSCs are communities of organisms, including bryophytes, lichen, and bacteria, that bind together with soil particles to form a thin surface crust. BSCs provide many critical ecosystem functions, such as soil formation and stabilization, alteration of water infiltration and retention, fixation of carbon and nitrogen, and facilitation of vascular plant germination and establishment. BSC in the boreal ecosystem are posited to be ephemeral communities that could transition to later stage successional states over decades or centuries if continuing disturbance is absent. However, basic knowledge concerning boreal BSC is lacking, impeding our understanding of their role on the landscape and limiting their potential applications in restoration projects. To investigate representative taxa of boreal BSC communities and their associated abiotic variables, we studied BSCs in Eastern Canada's boreal forests naturally colonizing degraded mineral sites. Bryophyte and lichen species comprising the BSCs are common pioneer species of the boreal ecosystem with an emphasis on cephalolichens of the genus *Stereocaulon*. The BSC can be organized into three transitional groups: early successional cyanobacteria and bare ground BSC, *Stereocaulon*-dominated BSC, and the moss *Racomitrium canescens* and *Stereocaulon*-dominated BSC. Soil texture is an important soil property driving the species composition of BSC, along with available phosphorus. The association of each BSC group to certain soil properties suggests matching appropriate BSC species to soil properties will be important when considering the use of BSC in restoration practices.

1197

GEF Restaura Biomas: Governance and Prioritization Lessons to Scale Up Restoration Across Brazilian Biomes

Ludmila Pugliese De Siqueira¹, Bruno Coutinho^{1,2}, Akel Saliba¹, Neila Cavalcante¹

¹Conservation International, Campinas, SP, Brazil. ²

Abstract

The *GEF Restaura Biomas* project seeks to enable large-scale ecological restoration across Brazil's six biomes by supporting the coordinated implementation of the National Policy for Native Vegetation Recovery (PROVEG) and its action plan (PLANAVEG). The initiative addresses structural barriers to restoration through a combination of public policy strengthening, capacity-building networks, and innovative financial mechanisms.

A central feature of the project is its multi-level, collaborative governance model, grounded in the Union for Restoration — a strategic alliance led by four major environmental organizations (Conservation International Brazil, The Nature Conservancy Brazil, WRI Brazil, and WWF-Brazil). This model enhances coordination among stakeholders at federal, state, and local levels and strengthens territorial implementation capacity by integrating civil society, the private sector, and government actors.

Another key innovation lies in the project's flexible and adaptive area prioritization process. Instead of setting predefined intervention targets, the project developed a dynamic "opportunity map" covering 3 to 4 million hectares with high potential for restoration. This process drew on multiple geospatial data layers, including Forest Code liabilities, the presence of Protected Areas and Indigenous Lands, ecological connectivity, natural regeneration suitability, estimated restoration costs, and climate vulnerability. This approach ensures alignment with public policies, local realities, and long-term ecological and socio-economic outcomes.

With ambitious goals to restore 600,000 hectares, implement sustainable management practices on 1.2 million hectares, and directly benefit 200,000 people, *GEF Restaura Biomas* offers valuable and replicable lessons for scaling restoration through inclusive governance, strategic prioritization, and integrated landscape planning.

1198

Multi-stakeholder platforms for restoration in Africa: The role of stakeholders

SEVERIN KALONGA

WWF, DAR ES SALAAM, UBUNGO, Tanzania, United Republic of

Abstract

The African continent is endowed with abundance of natural resources. However, a couple of decades have shown that these natural resources have severely suffered from land degradation and deforestation as result of poor coordination and limited understanding of the impact of natural resources depletion to people and nature. To reverse this situation, the African Union under the AUDA-NEPAD, established a continental platform, the African Forest Landscape Restoration (AFR100) Initiative to coordinate restoration efforts in the continent by engaging governments and all range of stakeholders at landscape level. Landscape Restoration initiatives in Africa require collaborative and integrated approaches that address the continent's diverse environmental, social, and economic challenges through multi-stakeholder platforms (MSPs).

The MSPs serve as a critical mechanism for fostering such collaboration by bringing together diverse actors, including governments, local communities, non-governmental organizations, private sector players, academic institutions, and international agencies. This session explores the role of stakeholders within MSPs in driving restoration efforts. It highlights their unique contributions, ranging from policy-making and funding to knowledge-sharing and on-ground implementation. The integration of local communities and indigenous knowledge with scientific expertise appears as a pivotal factor in achieving sustainable outcomes. Moreover, this session underscores the challenges inherent in MSPs dynamics, such as power imbalances and conflicting priorities, while advocating for inclusive and equitable practices to enhance collective impact. Finally, the session suggests that well-coordinated MSPs can serve as a transformative force for ecological restoration and resilience-building across Africa, benefiting both people and nature.

1199

Large scale Forest Landscape Restoration and transformational change: paths and lessons learned on how to engage the corporate sector and investments in Atlantic ForestDaniel Venturi, Trevor Walter

WWF-Brasil, São Paulo, SP, Brazil

Abstract

Creating enabling conditions and mobilizing financial mechanisms are essential for driving transformational change on the ground. In recent years, WWF-Brasil has been leveraging corporate engagement and multi-scale platforms to generate lasting impacts in the Atlantic Forest. Through different approaches, we have gained valuable insights from these experiences, guiding us along diverse long-term pathways to scale up our restoration impact in this biome.

Our on-the-ground restoration initiatives provide crucial lessons and insights, informing the development of financial mechanisms and corporate partnerships to expand Forest Landscape Restoration (FLR) across multiple regions of the Atlantic Forest. In this session, WWF-Brasil will share lessons learned from two distinct approaches in key areas of the Atlantic Forest: the Upper Paraná Ecoregion and the state of Espírito Santo. Strengthening these strategies is essential to achieving the ambitious goals of the UN Decade on Ecosystem Restoration—particularly as the Atlantic Forest has been recognized as a UN Decade Flagship—ensuring the long-term sustainability of ecosystems and their benefits for both people and nature.

1200

Using functional traits to understand native forb performance in a common garden array

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Abstract

Cold deserts in the western United States are threatened by invasive annual grasses, increased wildfire risk, and other disturbances and stresses associated with global change. In light of these numerous threats, maintaining and restoring native plant diversity, especially native forbs, is key to the continued functioning of these ecosystems. As such, identifying the attributes of native forbs that improve their performance in different environments is critical for the selection of appropriate plant material for restoration. To assess native forb performance and its relationship with plant functional traits, we grew plants collected from 80+ populations of two native forbs—*Chaenactis douglasii* and *Machaeranthera canescens*—at six gardens across the Intermountain West and measured four functional traits—leaf area, leaf mass per area, seed mass, plant height. We found that different amounts of variation in traits were attributable to population, site, and population-by-site effects and that traits had different impacts on plant performance and associations with plant climate of origin. This work highlights the challenges of identifying appropriate plant material for restoration in an era of massive global change.

1201

Scaling up landscape restoration in Africa: The role of faith-based organisations

SEVERIN KALONGA

WWF, Dar es Salaam, Ubungo, Tanzania, United Republic of

Abstract

Scaling up landscape restoration in Africa involves expanding efforts to restore degraded ecosystems on a larger scale while addressing the continent's unique environmental challenges. Scaling up landscape restoration in Africa is not just about ecological recovery, it's also about fostering sustainable development, improving food security, increasing water availability, and ensuring livelihoods. It's an integrated approach aiming at harmonizing environmental, social, and economic benefits at landscape level across the continent.

Landscape restoration in Africa presents immense opportunities for addressing ecological degradation while improving livelihoods and fostering resilience against climate change. Faith-based organizations (FBOs) are uniquely positioned to play a critical role in scaling up restoration initiatives due to their extensive networks, moral influence, and trusted relationships within communities. This session examines the contributions of FBOs in promoting sustainable restoration practices, emphasizing their ability to mobilize grassroots action, advocate for ethical stewardship of natural resources, and integrate spiritual values into environmental advocacy. The FBOs have demonstrated success in fostering partnerships, raising awareness, and catalyzing community-driven projects that harmonize ecological restoration with socio-economic development. However, challenges such as resource constraints and varying theological perspectives call for innovative strategies and capacity-building efforts. The conclusions suggest that empowering FBOs as key stakeholders can significantly amplify restoration efforts across African landscapes, facilitating transformative change for both the environment and society, while contributing to the UN Decade on Ecosystem Restoration goal by 2030.

1202

Building Evidence of BIL-funded Restoration Success from Implementation to Impact

Alisa Wade

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Abstract

This talk will delve into the challenges and insights gained from implementing a Department-wide restoration program within the Department of the Interior, following the ecosystem restoration funding authorized by the Bipartisan Infrastructure Law (BIL). The Ecosystem Restoration (ER) program successfully collaborated with various bureaus and offices to identify restoration priorities and support over 650 coordinated projects, benefiting all 50 states, territories, insular areas, and over 40 Tribes and Native Alaskan communities. However, the program revealed significant discrepancies in the types of data collected, which varied by temporal and spatial scales and restoration types, with some projects lacking data altogether. Additionally, the existing data is not stored in a unified system, making it challenging to compile and assess what has been collected. A critical finding was the absence of standardized restoration project metrics, which impeded our ability to effectively evaluate project outputs and measure overall impact. In response, we developed a straightforward menu of shared output measures; however, these metrics alone do not provide the comprehensive data needed to assess restoration outcomes or summarize cumulative impacts. To address this limitation, the US Geological Survey (USGS) is collaborating to establish a robust framework for shared restoration outcome measures. This framework aims to enhance project-level adaptive management and deliver a landscape-scale summary of the benefits and impacts derived from restoration investments. By fostering a unified system across public lands, we can improve the effectiveness of restoration efforts and ensure that investments yield maximum benefits for communities and ecosystems.

1203

Innovative Digital Solutions for Forest Landscape Restoration in Ukraine

Ganna Lobchenko

WWF-Ukraine & WWF-CEE, Kyiv, Ukraine

Abstract

Ukraine's forests, already under pressure from climate change and commercial exploitation, have suffered further degradation due to war-related deterioration, fires, and increased risks of illegal logging or overuse. Covering only 15.9% (9.6 million ha) of Ukraine's land - far below the EU average of 43.5% - half of these forests are (semi-)natural, while the rest are monoculture plantations with low resilience to climate change and natural disturbances. A science-based, multi-scale approach to forest landscape restoration is critical to ensuring long-term ecological and socio-economic benefits. The Digital Platform for Ukrainian Forest Restoration, developed by WWF-Ukraine in partnership with SoftServe, is an innovative tool designed to support climate-smart and nature-based restoration efforts. It provides essential data and guidance to businesses, policymakers, and landowners, answering key questions on what, where, and how to restore forests. The platform integrates scientific insights with practical recommendations, offering site-specific reforestation suitability assessments, step-by-step restoration planning, carbon sequestration assessment, database of experts, nurseries, and funding opportunities along with legal framework. By leveraging corporate investment, the platform aligns restoration efforts with global and national sustainability commitments, such as the Paris Agreement and Ukraine's Large-Scale Reforestation Program (Presidential Decree No. 228/2021). By aligning corporate investments with global and national sustainability goals, the platform ensures that forest landscape restoration contributes to biodiversity conservation, climate resilience, and green economic development. This session explores how digital innovation and corporate funding scale forest restoration.

1205

PROCESSES OF ECOLOGICAL RESTORATION OF FOREST LANDSCAPES IN THE NORTHERN AMAZON OF COLOMBIA

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Abstract

The Colombian Amazon comprises nearly 50 million hectares of which more than 85% is natural forest. It has multiple subregions and corridors, including the forests of the Andean-Amazonian foothills, the transitional forests of the Orinoquia and portions of the Guiana Shield. However, due to different factors, in recent decades there have been high rates of deforestation. Between 2002 and 2024, the loss of forests in Colombia has exceeded 3 million hectares, half of them in the Amazon region, the main causes being: land grabbing, expansion of the agricultural frontier, illegal mining and infrastructure, among others. WWF Colombia has been developing different processes to contribute to the resolution of socio-environmental conflicts, seeking to increase biodiversity conservation and improve local livelihoods through integrated environmental management, strengthening territorial governance in more than 200,000 hectares, improving the capacities of local people and institutions to implement sustainable practices through participatory processes, consolidating participatory land use plans at the farm and landscape level that allow the implementation of restoration actions under different approaches; strict ecological restoration, rehabilitation (productive restoration: based on the management and use of biodiversity - non-timber products) as well as treatments for the good living of local communities, as well as community monitoring processes that allow measuring the response of ecosystems to the implemented actions and their benefits in biodiversity and ecosystem services.

1206

Shared Governance Platforms and the role of people for Restoration Action with a Focus on the Caatinga Biome

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Abstract

The Caatinga is an exclusively Brazilian biome, composed of a dry forest important to understanding the effects of desertification process and home to 32 million people and to thousands of species of plants and animals across its 84 million hectares. The inappropriate use of natural resources threatens its conservation and it is estimated that more than half of native vegetation has been lost in recent years. The Network for the Restoration of the Caatinga (RECAA) is a collective of organizations, to promote a political, socially fair and intelligent ecological restoration, culturally linked with the people of the Caatinga, which currently brings together 186 members representing national organizations to consolidate restoration with the aim of increasing the scale of maintaining the biome and generating employment and income opportunities. The Network's governance is structured around the activities of a rotating multi-institutional council, a Working Group with strategic themes and dialogue with members through targeted consultations. This structure promotes articulation and strategic partnerships between members and partner organizations, guides and shares lessons learned in the restoration of the Caatinga and encourages the inclusion of people in all phases of the biome's restoration. The governance presented works to achieve the goals defined for three guiding axes: motivate, facilitate and implement, guided by Planaveg. Culturally linked to the people of the Caatinga, the Network has the goal of restoring 250 thousand hectares of restoration, generating 105,000 direct jobs in the restoration sector in the biome and improving management in 1.4 million hectares by 2030.

1208

Cis- vs Trans-crustivoltaics: Breaking the scalability barrier for biocrust restoration

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Abstract

A large portion of the Earth's drylands are under the process of degradation or are already degraded, making them prone to soil erosion and the loss of nutrients. Biocrust armor dryland soils against erosion and provide nutrients to the soil. Therefore, restoring these biocrust communities is essential to recover degraded drylands. In the past decade biocrust restoration efforts have been constrained to small spatial scales, as the inoculum had to be salvaged or carefully tailored in laboratory and greenhouse settings. We have recently proven that existing photovoltaic (PV) power plants can be used as biocrust nurseries, where the partial shading and microclimate created by PV panel arrays enhance biocrust growth. Results using this "crustivoltaic" approach have shown significant improvements in biocrust biomass that can potentially serve as inoculum, making this approach a scalable and cost-efficient method for large-scale restoration. However, logistical challenges arise due to the distance between PV power plants and remote restoration sites. This study addresses this challenge by testing the "trans-crustivoltaic" method in which an alternative target soil substrate - gypsum soil - is relocated and set as a top layer of soil under the PV installation and inoculated with the target biocrust communities. Gypsum soil was selected as a target soil for this study, because gypsic soils host distinct cyanobacterial species compared to low-gypsum soils, allowing us to keep track of any shifts in the community composition of the inoculum produced.

1211

JAGUAR CORRIDOR, CONSERVATION PROCESSES IN THE NORTH OF THE COLOMBIAN AMAZON

juan garcia, JAIME CABRERA, JEIMY CUADRADO, EDUARDO MOLINA

WWF, BOGOTA, Colombia

Abstract

Jaguars are the third largest felids in the world. They are distributed from Mexico to northern Argentina, across 18 countries, reaching an estimated global population of $\sim 173,000 \pm 35,000$ individuals. Jaguars are classified as Near Threatened on the IUCN Red List, however, national species lists have determined jaguars to be Endangered or Critically Endangered.

Deforestation in the Colombian Amazon accumulates close to 1.5 million hectares. Agricultural expansion, particularly cattle ranching, continues to be the most important driver of these transformations. In addition to eliminating jaguar habitats, it generates proximity between cattle and jaguars, causing human-jaguar conflict and is one of the main causes of jaguar mortality due to retaliation by cattle ranchers.

WWF Colombia has been developing actions in the area known as the “jaguar corridor”, which covers more than 492,000 strategic hectares, as it forms a biological corridor that connects the Amazon, the Andes and the Orinoquia, including tropical forests, transition forests and natural savannahs. The corridor connects three national parks of global importance, Chiribiquete National Park, Macarena National Park and the Nukak National Reserve.

The activities carried out range from connectivity analysis, restoration priorities, community monitoring through camera traps to know the distribution and behavior, identify where conflicts occur and design management measures to reduce pressures and allow the development of productive activities by local communities

1212

Unlocking potential: Maximizing the use of trait data to improve restorationJulie Larson

University of Washington, Seattle, WA, USA

Abstract

Sourcing appropriate seed for restoration is a complex task involving many pieces of information – from cost and availability, to environmental suitability and ecosystem benefits. Measurable traits of plant species and populations can inform how they will respond to the environment and affect ecosystems, leading to the proposed use of trait databases as tools to guide seed selection and use in restoration. In this talk, I will discuss how trait databases are already being engaged in higher-level restoration decisions (with an emphasis on US systems) and identify opportunity areas to build on these efforts. In particular, trait data that directly advance our understanding of environmental responses at seed, seedling, and established stages have the potential to inform how seeds are adapted to – and can be used more successfully – in restoration environments. I will highlight promising research efforts and databases that are centering these trait data on several fronts and draw attention to ongoing knowledge gaps. Maximizing the impact of trait data at broader scales will depend on coordinated efforts to compile and test the traits that are most useful to native seed sourcing and use in local environments.

1213

Bio-social diversity, Community Prosperity, and Resilience to Disruptive Change—Towards a New Paradigm of Urban Nature-based Solutions

Brett KenCairn

City of Boulder Colorado, Boulder, CO, USA

Abstract

The development and adoption of the Global Biodiversity Framework at the 2022 UN Convention on Biodiversity in Montreal, Canada represented a major milestone in international recognition and commitment to addressing the global biodiversity crisis. This Framework also advanced a new standard of connecting international commitments to local action through the initiation of target setting and reporting systems that enable local communities to develop, implement, and monitor biodiversity protection initiatives. A growing imperative in these efforts to protect biodiversity is the demonstration of how these efforts will address and integrate the needs and issues facing urban communities, particularly around climate change magnified impacts such as extreme heat, flooding, drought, water supply, fire, and food security. Simultaneously there has been a dramatic growth in interest and actions surrounding “nature-based solutions”. Unfortunately this term is frequently used in ways that imply biodiversity benefits when such claims are neither demonstrated or in some cases may be false. In this unique context surrounding urban biodiversity and its relationship to human community well-being, there is a need for a more rigorous bio-social diversity approach that integrates biodiversity (humans benefiting nature) and nature-based solutions (nature-benefiting humans) in ways that can create verifiable benefits for both spheres of concern. This talk will outline such an integration framework and provide examples of efforts underway to advance this approach in Latin America, North America, and Europe.

1216**Communicating the socio-ecological foundation of beaver-based restoration**Sarah Koenigsberg

Utah State University, Logan, UT, USA

Abstract

Will circle back, just want to be sure I get into the system.

1217

Perspectives from cattle ranchers on reforestation in Para, Brazil

Vivian Griffey, Starry Sprenkle-Hyppolite

Conservation International, Arlington, Virginia, USA

Abstract

Reforestation is one of the five largest climate mitigation measures across all sectors, but from 2000-2020 only 25% of reforestation's technical *annual* potential has been achieved. Reforestation needs to solve three barriers on a global scale to achieve full mitigation potential: cost, leakage, and speed. One possible solution is using low-cost natural forest regeneration to reforest low-density grazing land in high carbon accumulation areas, thereby minimizing cost and leakage and maximizing speed of regrowth. We mapped areas where low opportunity cost (high carbon accumulation and low cattle density) intersected high potential for natural forest regeneration in order to identify where restoration efforts should first be focused, if stakeholders are properly involved and invested in restoration success. Much of this opportunity exists in areas that are low cost (both implementation and opportunity), such that over half (56%) of the removals can be achieved for less than 20USD/tCO₂ and nearly all (93%) for less than 50USD/tCO₂. This opportunity is concentrated in South America and secondarily Southeast Asia. We then interviewed cattle ranchers in the Paragominas municipality of Para state, Brazil to investigate their views on natural regeneration, silvopasture and rotation grazing, and openness to restoration projects, including voluntary carbon market projects. We report on views from rural agrarian settlements as well as from private property with different levels of tenure security, representing different levels of land degradation, management practices, and financial stability.

1218

Islands vs oceans: Developing biocrust restoration techniques at multiple scales and intensities

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Abstract

The harsh environment of the Mojave Desert makes restoration uniquely challenging, with restoration projects often failing. An emerging field in arid restoration is the use of biological soil crusts (biocrusts), which are vital for soil function and may aid in establishing vascular plants. Biocrust is a community of lichen, moss, cyanobacteria and other organisms with live together on the soil surface, and are integral to healthy and stable arid soils as they fix nutrients, protect the soil from wind and water, and have complex relationships with vascular plants. We are exploring two new technologies in biocrust restoration in a series of experiments in the California Mojave Desert: biocrust sods and biocrust capsules. Biocrusts sods are portable biocrust communities cultivated on fabric, either burlap or biodegradable weed cloth, that can be deployed to protect targeted sites from erosion, potentially used as a living fuel break, or co-applied with native seeds or seedlings. Biocrust capsules are a novel method of packaging biocrust, native plant seeds, and other additives into water soluble pill capsules which can be easily dispersed across a large area. We are testing these methods in three contexts: a post-fire Joshua Tree woodland, within a utility-scale photovoltaic site, and on lands degraded by off-highway vehicle recreation.

1219

Building a Restoration Outcomes Assessment Framework for DOI Lands

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Abstract

Bureaus within the Department of the Interior (DOI) manage lands on behalf of the American public and are committed to restoring and improving public lands. Targeted ecosystem restoration strengthens economies, recreation, and reduces risks associated with natural hazards, such as prolonged drought, wildfire, or floods. DOI bureaus coordinate and leverage restoration investments to achieve benefits at larger scales. Most recently, DOI coordinated with bureaus to implement hundreds of ecosystem restoration projects across the United States.

This presentation will focus on a partnership between DOI, National Park Service, Fish and Wildlife Service, Bureau of Land Management, Bureau of Indian Affairs, and the U.S. Geological Survey (USGS) to develop a foundational, cross-bureau framework with shared indicator and metrics across DOI-managed lands for assessing restoration project outcomes at the landscape level. USGS is collaborating with those bureaus to leverage existing monitoring efforts and data to develop this framework which will aid in implementation. This effort will promote an approach that facilitates consistent and coordinated assessment of restoration outcomes and provides insight into restoration successes and failures. By identifying factors most important to restoration success at the project scale, this framework can be used to inform adaptive management and prioritization of future efforts to meet landscape level goals. This is a unique opportunity to support DOI bureaus in assessing restoration outcomes across DOI lands and ensure the effective application of public funds.

1221

Navigating the world of research partnerships: How to be a good partner with indigenous groups

Dan Hikuroa

Waipapa Taumata Rau/University of Auckland, Auckland, Auckland, New Zealand

Abstract

Indigenous groups and organizations know their dreams and aspirations, and increasingly are taking the lead in determining and mapping out their own research strategies, policies and plans. In such spaces, research organizations who focus on how to be a good partner thrive. How this manifests is variable, but business-as-usual approaches are unlikely to be effective. Rather, a good partner is comfortable with co-creation, and suggest open-ended research frameworks like the IBRLA model – where Initiation (of research), Benefits (of research), Representation (of methodologies and knowledge), Legitimation and Accountability are the first step. A good research partner seeks respectful, responsive and reciprocal relationships, from which trust emerges.

In this presentation I will share my 23 year research journey with Ngāti Whātua Ōrākei, which was not founded in a legally binding contract or memorandum of understanding, but in something much stronger – a commitment to work together to realise their dreams and solve challenges, where my research expertise could be applied. From the outset we determined that any research created under that commitment belonged to Ngāti Whātua Ōrākei, and that we should present it back to the people. Initially all research ideas came from Ngāti Whātua Ōrākei, and in time, as I learnt more, occasionally proposing ideas I felt may be of interest. Ultimately it is the tribe who determines what happens, and it is a privilege to work alongside them.

1223

Harnessing positive interaction theory to advance ecosystem restoration.Brian Silliman

Duke University, Durham, NC, USA

Abstract

Positive interaction theory predicts that neighbors should have a mutually beneficial relationship under high stress, and a negative one under low stress. This theory is rarely tested or incorporated into restoration designs, despite the fact that restoration sites are typically locations of high stress. In seagrass, oyster reef, and salt marsh ecosystems, work from my research group shows that if restoration designs harness intraspecific facilitation, interspecific facilitation, mutualisms, or trophic facilitations their outcome can flip from failure to success and lead to whole ecosystem restoration recovery up to 4x faster. Survey of the restoration literature shows that the minimize-negative interaction theory prevails in restoration designs across the world, Our results show that the restoration paradigm for all ecosystems much expand to focus on systematic harnessing of positive species interactions.

1224

From Regional Strategy to RESULT Asia: a journey for improving collaboration for restoration

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¹FAO, Bangkok, Bangkok, Thailand. ²FAO, Rome, Rome, Italy

Abstract

[RESULT Asia-Pacific](#) was launched in December 2024; this Regional Programmatic Framework was designed in line with the Asia-Pacific Regional Strategy and Action Plan on Forest and Landscape Restoration, and the UN Decade on Ecosystem Restoration. It aims to support immediately 20 countries to achieve their restoration commitments of 100 million ha under the three Rio Conventions and national aspirations. RESULT Asia-Pacific Implementing Network (RAIN) was set up with 38 partners that comprise several key FLR players in the Asia-Pacific region to support and work together closely with the 20 countries to restore at scale. This presentation will explain how the RAIN partners are supporting the implementation and monitoring of the regional framework through collaboration to help restore at scale. The lessons learnt and challenges in operationalizing the framework will also be presented.

1226

Exploring field collaborative actions to onboard local governance in large-scale restoration strategies

Julien Dalle¹, Mathis Cognat¹, Marie Martinot¹, Agustin Sanchez-Arcilla²

¹Seaboost, Montpellier, France. ²Maritime Engineering Laboratory (LIM/UPC BarcelonaTech), Barcelona, Spain

Abstract

The Arcachon Basin, a semi-enclosed lagoon on France's Atlantic coast, is undergoing significant transformations due to climate change, including topographical shifts and ecological disruptions. A striking example is the 40% decline in seagrass meadows between 1989 and 2010. As part of the REST-COAST project, we have developed and implemented an innovative large-scale restoration protocol based on biomimicry and hydrodynamic control. This presentation highlights the crucial role of stakeholder collaboration in expanding the project's scope and impact. Since our legal status prevents us from participating in local governance processes, we have explored alternative approaches to scaling up ecological restoration efforts. Field activities have thus served as key levers for upscaling, enabling us to collaborate with local stakeholders to identify barriers to expansion and opportunities for restoration actions. We can now explore the potential for a shared resource with local institutions or assess the feasibility of a business model for ecological restoration applied to shellfish farming. Here, we will briefly outline the results achieved within the REST-COAST framework, discuss perspectives and barriers to upscaling, and demonstrate how we leveraged field activities to overcome these challenges and unlock new opportunities.

1228

Mexican Alliance for Ecosystem Restoration (AMERE) – restoring Mexico through multistakeholder and multisectoral collaboration. Advances two years apart from Darwin, Australia

Rosa del Carmen, Pilar Jacobo

Abstract

The Mexican Alliance for Ecosystem Restoration (AMERE) is a multisectoral collaborative platform that addresses environmental degradation, climate, and food crises. It mobilizes willingness, resources, and conditions to promote and accelerate inclusive restoration actions in terrestrial, freshwater, and coastal-marine ecosystems, aiming for sustainable, large-scale impacts. AMERE is the first national alliance in Mexico to join the UN Decade on Ecosystem Restoration. Its primary objectives are to articulate initiatives, generate and share information, and influence both public and private policies related to restoration.

Mexico, one of the world's top five megadiverse countries, faces alarming environmental challenges. The nation loses about 180,000 hectares of forest annually, while one-third of its land area is severely degraded. Latin America overall presents one of the most critical global scenarios of deforestation and biodiversity loss, having lost over 94% of its vertebrate populations in the last five years. In this context, AMERE seeks to recover ecological and productive functions of ecosystems, fostering resilience across landscapes, watersheds, coastal and marine areas. Restoration approaches also consider umbrella species such as the jaguar, to ensure both ecological and cultural relevance.

AMERE demonstrates how restoration can provide solutions through a collaborative, multistakeholder platform that scales efforts, including initiatives like a National Restoration Program. By positioning restoration as a transversal issue, AMERE bridges private and public policies with environmental and productive approaches. Since SER Darwin 2023, the platform has expanded its membership, strengthened operations, gained governmental recognition, and strategically positioned itself to shape policies for environmental restoration in Mexico.

1229

Coastal restoration platforms and tools. Action site: Ems-Dollard case in the Netherlands (Wadden Sea)

Albert Vos¹, Matthijs Buurman¹, Mindert de Vries², Joanna Staneva³

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Abstract

In the cross-border Ems-Dollard case a multi-party coalition has been working together for a decade towards a system that keeps ecology and economy in balance, resulting in: restored natural functions, reduced estuarine turbidity, maintained high value agricultural production and area kept safe from flooding.

The complex interacting problems in this coastal zone, including subsidence due to peat oxidation, sea level rise and an estuary in an undesirable ecological state, makes it necessary to respond integrally in solutions. Besides, the natural system dynamics does not adhere to the man-made boundaries of countries, laws and regulations and responsibilities.

By not dumping the dredging sludge from the harbors back into the estuary, but putting it to good use on land, low-lying agricultural land can be raised. Also, after drying, the dredged sludge can be used to strengthen the dikes as clay. These measures have been worked out for several years on both coastal zones in Germany and the Netherlands.

On the Dutch coastal zone, a letter of intent between six regional organizations was signed in June 2024 for an integrated coastal development for the next 10 years. In addition to this Dutch 'coalition of the willing', the operation of silt dynamics, for example, is being coordinated jointly. Within Rest-Coast, joint modeling of the sediment's behavior is an example of the developed system understanding, fundamental for policy choices. Among others, this has led to signing by German and Dutch representatives a combined ecological sediment management strategy in April 2025.

1231

Lessons for a natural scientist on how an interdisciplinary lens helps to address governance in restoration

Karma Bouazza

Consultant, Beirut, Lebanon

Abstract

Social structures are very diverse globally, with different social groups, from micro-communities to governmental institutions in rural and urban regions, having specific needs and are steered by different economic drivers. Different drivers generate a wide range of pressures on natural and modified ecosystems, leading to large scale degradation of natural landscapes, specifically forests. For forest restoration projects to have a meaningful and sustainable impact on natural resource management, biodiversity conservation and human wellbeing, all drivers and pressures need to be taken into account, whether ecological, social or economic. An interdisciplinary lens should be integrated in the planning of restoration action plans and projects, and needs of the diverse social groups should be integrated to ensure that the project restores connectivity on landscape (ecological), social and economic levels. We will present different case studies from Lebanon, Jordan and Madagascar that exemplifies the integration of an interdisciplinary lens into planning of small-scale and large-scale restoration projects and how proper capacity building programs, related to different drivers within a society, can align small community and indigenous people's interests, private sector interests and government institutions interests under restoration.

1232

Restoring the future in SE Asia – a proposal for accelerating forest and landscape restoration (FLR) through a governments-finance-land managers partnership across ASEAN

James Bampton¹, Anita Diederichsen², Aye Myat Thandar³, Demis Galli⁴, Heron Holloway⁵, Kongkeo Sivilay⁶, Sothea Seang⁷, Tam Le Viet⁸

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Abstract

The tropical forests of SE Asia, like the Amazon and Congo forests, are among the most important globally for biodiversity and climate. Halting deforestation and degradation and restoring ecological functionality in these regions is a global priority. The pace and scale, and often the quality, of FLR in SE Asia is below what is desirable and possible.

Initiative 20x20 and AFR100 in Latin America and Africa are stoking interest to adapt the model for SE Asia. This experience suggests that establishing something similar can be done most efficiently using existing institutional frameworks.

We propose that ASEAN is an appropriate institution through which to establish a regional Restoration Platform, which, seated within and governed under the auspices of ASEAN, would be led by ASEAN Member States.

We aim to mobilise hundreds of millions of blended public and private funding, for the widespread implementation of a suite of tangible, high-quality FLR interventions, at scale in SE Asia through a portfolio of different financial instruments related to the varying revenue generating potential of different interventions.

The platform would align with national and regional priorities, policies, strategies and programmes, as well as with international commitments, and would be supported through coordinated technical assistance from competent partner organisations. Shared issues can be explored jointly, as a regional approach allows for ecoregional planning, and quality and effectiveness can be enhanced through region-wide standards for planning and robust and transparent monitoring and reporting.

1233

Lessons from applying UN Decade on Ecosystem Restoration principles in different contexts in mainland southeast Asia through diverse approaches in different contexts

James Bampton¹, Anita Diederichsen², Aye Myat Thandar³, Demis Galli⁴, Heron Holloway⁵, Kongkeo Sivilay⁶, Sothea Seang⁷, Tam Le Viet⁸

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Abstract

WWF supports diverse FLR interventions in the Greater Mekong determined by contextual factors, applying the UN Decade on Ecosystem Restoration principles to ensure high quality. Our focus is on forest landscapes with high biodiversity values in different ecoregions, usually comprising a core of protected and conserved areas, but also comprising natural and plantation forest areas, as well as a wide variety of large-scale and small-scale agricultural production, settlements, infrastructure and mining.

In 2023 we assessed and reported our progress against the principles to guide the UN Decade on Ecosystem Restoration and found areas where improvements could be made. We have reassessed our progress against the same principles again in 2025, and we are adapting our approaches accordingly. The objective remains the same - to generate benefits to nature and people within landscapes, both locally and globally, whilst engaging stakeholders broadly and addressing the drivers of degradation.

The lessons from the last few years are numerous and clear. We need to take a long-term programmatic and partnership approach, with individual projects being designed to fit into the programmatic framework as and when resources become available. We appreciate more acutely the drivers of the existing land use choices being made by land managers and are identifying sets of common situations whereby land designation, land tenure, existing land use and type and degree of degradation determine what FLR interventions are appropriate and acceptable to land users to reverse degradation and provide benefits for land users, and for climate, nature and landscape overall.

1234

Harnessing the power of diverse scientific disciplines for improved forest restoration

John Parrotta

IUFRO, Falls Church, VA, USA

Abstract

The Interdisciplinary Panel of Experts (IPE) on the governance of tree planting and forest restoration convened by the University of Lausanne included 13 senior social and natural scientists and practitioners representing a range of disciplines (e.g., agroforestry, anthropology, botany, conservation, economics, forestry, geography, policy science), all with forest restoration expertise in different regions and diverse social, political and economic conditions and organizational contexts. The group identified three key forest restoration-related governance challenges, namely: (1) ensuring effective interaction between governance levels; (2) addressing inequalities in power dynamics; and (3) recognizing the need for diverse objectives and benefits. These were discussed and evaluated from an interdisciplinary perspective, i.e., by amalgamating aspects and concepts from the various disciplines represented by the team, which enabled a more inclusive and multifaceted perspective on these challenges. This resulted in a more complete and realistic menu of possible solutions than would likely have been possible from a narrower disciplinary evaluation. The panel's deliberations yielded several recommendations for restoration policy, planning and practice. These included, among others, the importance of recognizing the diversity of benefits of forest restoration, at different scales, reaching different stakeholders, and the need to balance these out, emphasizing the importance of local benefits.

1235

Reconnecting Mountains to the Gulf: Lower Alabama River Fish Passage Project

Jason Throneberry

The Nature Conservancy, Birmingham, AL, USA

Abstract

Watershed integrity and resiliency to climate change is paramount for The Nature Conservancy in Alabama. Alabama is the most aquatically biodiverse state in North America. The Mobile River Basin drains more than 32,000 square miles in Alabama, all of which flows through the 300 square mile Mobile-Tensaw Delta and into the Gulf of America at Mobile Bay. Within this vast watershed, the Alabama River is one of the most biodiverse ecosystems in North America and connects the Gulf of America to the Appalachian Mountains. Many species supported by these rich waters are migratory, including several federally protected species. The Cahaba River, with its headwaters in the Appalachian foothills, boasts the most aquatic biodiversity in this system and is critical for aquatic species and their life history and ecological needs.

Since dam construction on the Alabama River, a historic and ecologically important migratory corridor has been disconnected. Recent studies have yielded that past fish passage efforts were not successful. In response to species decline and recognition of critical timelines for species survival, The Nature Conservancy and the U.S. Army Corps of Engineers have completed a Feasibility Study for fish passage at these sites. Fish passage implementation at these structures would ecologically reconnect approximately 6,000 river miles. With this reconnected migratory corridor, and given the monumental aquatic biodiversity of this system, this will be the most ecologically significant river restoration in North America. Holistic watershed assessment and restoration are crucial for sustainability and resiliency of our most diverse freshwater ecosystems.

1236

Restoring the Big Bend of the Jordan River in Salt Lake County, Utah with Collaboration and “Partners in Persistence”

Christine Cline¹, Eric McCulley²

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Abstract

The Jordan River in West Jordan Utah was injured by the disposal of mining wastes into its channel and on its banks from mining in the adjacent Wasatch Mountains from 1870 to the mid-1960s. At the “Big Bend,” the river was dredged and realigned to make space for tailings piles associated with a mid-valley ore processing facility. The 1991 Sharon Steel Natural Resource Damages Settlement provided \$2.1 million to restore these injuries. The 70-acre Big Bend Riparian Habitat Restoration Project is among the earliest and most ambitious efforts to restore the Jordan River, receiving initial funding in 1998 from the natural resource Trustees (the U.S. Department of Interior, the U.S. Fish and Wildlife Service and the State of Utah). An injury assessment prepared for the settlement indicated that a historic lack of value placed on the river’s natural resources by the area’s residents was one of the factors contributing to its degradation; consequently much of the Trustees’ focus throughout the years has been on developing “partnerships in persistence” with local stakeholders as the project has proceeded through a series of ups and downs. Over time, this has created both a conservation community and an infrastructure that can support the longevity and sustainability of restoration efforts at the Big Bend and other natural areas on the Jordan River. This presentation will showcase strategies for collaboration and the development of partnerships that facilitate successful restoration outcomes, and we share insights and lessons we have learned during this journey.

1237

Global Context for Landscape Restoration

Anita Diederichsen¹, James Hallett²

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Abstract

The Global Partnership on Forest and Landscape Restoration (GPFLR) is a proactive global network uniting governments, international organizations, and research institutes, under a common goal: to restore the world's lost and degraded forests and surrounding landscapes. GPFLR purpose is to catalyze dynamic, voluntary action through sharing diverse experiences on restoration efforts that deliver tangible benefits to both local communities and nature through a landscape approach. The Partnership also encourages political commitments on forest and landscape restoration, in the context of the Bonn Challenge, its regional offshoots, the UN Decade on Ecosystem Restoration (Decade), and CBD targets. As we embark on the halfway point of the UN Decade on Ecosystem Restoration, considered the most emblematic and relevant moment for the restoration agenda, it is crucial for us to pause and reflect. The Decade demands urgent changes to sustain ecosystems on the brink of extinction and the thousands of people vulnerable to climate change. Innovative approaches are needed to protect existing biodiversity, increase native ecosystem coverage, and reconnect people with nature. GPFLR members are actively contributing to the progress of the UN Decade. This presentation will cover the global context of the FLR agenda and key actions and case studies on how GPFLR members are effectively contributing to implement and upscale high quality forest and landscape restoration. It will also cover lessons learned, share challenges and discuss future priorities at the global and landscape level.

1238

Canada Lynx restoration in Colorado: a bit of history, lessons learned, current status, and future challengesJake Ivan, Tanya Shenk

Colorado Parks and Wildlife, Fort Collins, CO, USA

Abstract

In effort to restore a viable population of Canada lynx to Colorado, the Colorado Division of Wildlife initiated a reintroduction effort in 1997. From 1999-2006, 218 wild-caught lynx from Canada and Alaska were released in Colorado. Survival of initial cohorts was not adequate, and there was no evidence of breeding during the first two years of the project. Restoration activity was paused for two full years while the program was re-evaluated. Upon restarting translocations in 2003, under new soft-release protocols, survival improved and lynx successfully reproduced. In September, 2010, the reintroduction program was officially declared a success as population models based on Colorado-specific vital rates indicated that the newly established population of lynx in the state was on a stable, or increasing trajectory. We recount the details leading to the successful establishment of this threatened species to the state, and discuss lessons learned along the way. We also discuss ongoing research and population monitoring efforts and offer a prognosis for continued success of the restoration.

1239

A Praxis for Cross-cultural Collaborative Restoration

Andrew Knight^{1,2}, Davida Davida Asante-Nimako², Simone Pedrini³, Raquel Tardin-Coehlo^{4,5}

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Abstract

Restoration professionals and volunteers are turning to cross-cultural collaboration to secure outcomes that offer greatest potential for positive impacts for People and Nature. Securing these positive impacts requires navigating the dynamic complexities of social–ecological systems, ‘spaces’ where differences in the values, cultural backgrounds, perspectives, politics, histories, wisdom and geographies of individuals and groups may challenge effective and ethical collaboration. Cross-cultural Collaborative Design offers a transdisciplinary methodology that guides the development of effective and ethical relationships through the fusion of philosophies, theories, methods and tools from a variety of non-ecological sectors to achieve ambitious goals for the common good. This offers a ‘praxis for collaborative cross-cultural restoration’ which is evolving through several initiatives focused upon fusing Indigenous and Western ‘ways of being’ to achieve landscape-scale restoration in, and around, Kwongan, a part of the Southwest Australia Biodiversity Hotspot. We present our approach to Cross-cultural Collaborative Design as forged from the lessons learnt through these initiatives, as we seek to promote an Indigenous-led ‘Restoration Economy’. It is driven by shared values, a commitment to fostering resilient relationships, proactively fostering Cultural Proficiency, and learning from setbacks, surprises and successes. Our cases offer insights on how the thinking and approaches used by restoration professionals and volunteers from a diverse suite of cultural groups including ‘settler’ communities, ‘new’ Australians, and People of the Noongar Nation transform collaborations for a deeper understanding of each other and of ‘place’, providing ‘Culturally Safe Spaces and Opportunities’ for Indigenous Australians (and others) to lead restoration of Country.

1240

Scientific monitoring and forest restoration for overwintering of the Monarch butterfly in Mexico

Eduardo Rendón-Salinas¹, Adriana Valera-Bermejo², César Ávalos-Tello¹, Anuar Martínez-Pacheco²

¹World Wildlife Fund, Zitácuaro, Michoacán, Mexico. ²World Wildlife Fund, Mexico City, Mexico City, Mexico

Abstract

The Monarch butterfly (*Danaus plexippus*, L.), is known for its extraordinary migration across North America, where millions of them travel each fall from Canada and the United States of America to the oyamel fir and pine forests in Central Mexico, where they establish their overwintering colonies.

For over three decades, WWF has done conservation efforts in the Monarch Region, particularly in the Monarch Butterfly Biosphere Reserve (MBBR). The scientific monitoring and forest restoration are the most important projects to preserve these forests for people and Monarchs through ecosystem services production.

In 2004, the federal government and WWF implemented the systematic monitoring program of overwintering colonies. During the 2024–25 season, data revealed that colonies occupied 1.79 hectares (*ha*), a 99% increase of forest area occupied by Monarch colonies compared to the previous season.

Since 2003, WWF has led the monitoring of the forest canopy changes in the core zone (CZ) of the MBBR. Between 2023-24 were affected 3,728 *ha*, that meant a decrease compared to 4,112 *ha* affected the previous year. Since 2008 the forest degradation in CZ has been maintained at a very low level.

To bring back healthy forests for water catching, carbon sequestration and to provide habitat for Monarchs WWF has been supporting forest reforestation since 2005 and directly supporting the production of local saplings since 2007. Currently 21,515 hectares have been reforested in central Mexico with 22.5 million trees and local people produced 21.1 million of those trees.

1241

Restoring nature and people of the Atlantic Forest as a rupture point to a better AnthropoceneMarcia Marques

Universidade Federal do Paraná, Curitiba, Paraná, Brazil

Abstract

In most tropical landscapes, ecosystem degradation is closely related to the accentuation of social inequalities since exploiting natural resources is the basis for capital accumulation, labour exploitation, and poverty. In these situations, restoring the ecosystem is only part of the solution to the problem if we do not consider restoring the lives of people who have been increasingly removed from productive areas and condemned to poverty. Therefore, restoration must be more than an ecological process; it must also be a political action to empower people to achieve a more just and resilient society. In the Brazilian Atlantic Forest, where the history of devastation over more than 500 years of colonization and exploitation has resulted in a reduction to 12% of its original area and dramatic social inequality affecting almost 70% of the country's population, this problem is especially relevant. In this talk, I will address the idiosyncrasies of economic development in the Atlantic Forest and discuss how ecological restoration can be a turning point in the development model that has accentuated social differences and collapsed one of the most extraordinary biodiversity on the planet.

1242

Botanical Gardens as untapped resources for guiding restoration and reducing plant invasions

Evelyn Beaury

New York Botanical Garden, Bronx, NY, USA

Abstract

As centers for plant science, horticulture, education, and outreach, Botanical Gardens across the world have a critical role to play in informing plant conservation and restoration strategies and in encouraging practices that reduce invasion risk stemming from horticultural trade. This presentation will cover new initiatives at the New York Botanical Garden that aim to tackle these challenges, including progress updates, lessons learned, and ways to get involved in emerging opportunities. First, the 'Nurturing Nature Initiative' brings together a global network of botanical gardens to identify and overcome barriers to large-scale restoration for climate resilience. These include a lack of plant material for active restoration at scale, uncertainty about what species to plant in order to facilitate climate adaptation, and how to approach restoration in severely degraded areas. A core goal of this initiative is to address these gaps in decision-making by leveraging fundamental botanical and horticultural resources. Second, the Invasive Species Working Group aims to establish best practices for horticultural institutions regarding knowledge, action, and awareness of invasive species issues. This effort aims to develop removal, risk assessment, and monitoring protocols for horticultural (and other active land management) institutions to ensure gardening practices promote biodiversity conservation as well as maintain horticultural diversity. Importantly, both initiatives are implementing resources and processes developed by the RISCC networks, with co-production and collaboration at the core of project development and implementation. Key resources include climate-smart native plant resources, research on invasive species introductions through horticulture, and best practices for translational invasion ecology.

1244

Science Based Targets for Land: Leveraging voluntary corporate commitments on nature with landscape restoration objectives.Craig Beatty

WWF, Washington, DC, USA

Abstract

Science Based Targets for Nature have emerged as the gold standard for voluntary corporate commitments to nature. Spanning target frameworks on land, freshwater, oceans, and the biodiversity inherent in these realms, SBTN requires companies commit to materially relevant place-based actions. This session will explore the role that corporate commitments to land targets within the SBTN framework can play in broadening the appeal of, and investment in landscape scale restoration initiatives. It will explore the motivations of companies in supporting restorative actions for natural land and within commodity production landscapes and the potential to scale up corporate investment within and beyond their value chains in support of landscape and stakeholder restoration objectives.

1245

Conservation at the Continental Scale: Collaborative Migratory Bird Habitat Restoration Under NRDAR

Matthew Reddy

Ducks Unlimited, Inc., Fort Collins, Colorado, USA

Abstract

The damages to wildlife populations resulting from contamination-induced incidents are not localized to the landscapes within which they occur. Waterfowl – a group of migratory bird species often targeted by NRDAR restoration plans - are a guild whose population dynamics are determined by habitat conditions at continental scales. Abundance, recruitment and survival rates of these birds improve when seasonal wetland habitat conditions in Canada, the United States and Mexico are provided in time and place demanded by the ecological requirements of these transient populations. Addressing damages to those populations, therefore, requires aligning restoration activities within those spatial and temporal scales. To redress impacts to waterfowl DU utilizes a life-cycle approach to restoration planning and delivery. We utilize NRDAR resources to conserve waterfowl breeding habitats in Canada, waterfowl migration habitats in the U.S. and wintering waterfowl habitats in Mexico. Working with a diverse set of private, state, and federal partners across all three countries, we utilize settlement funds to acquire, restore, enhance and establish the wetlands and grasslands upon which these birds depend. These activities are performed in breeding, migration and wintering habitats known to be seasonally occupied by impacted populations. This not only allows us to address the direct damage contaminants have on waterfowl and their habitats, but it also incorporates NRDAR restoration activities into the larger North American waterfowl conservation program. An approach which allows successful engagement with a broader set of stakeholders with interest in environmental restoration.

1246

Terai Arc Landscape: a global restoration flagshipAnanta Bhandari

WWF Nepal, Kathmandu, Nepal

Abstract

The Terai Arc Landscape initiative aims to protect a biodiversity hotspot shared by India and Nepal that was rapidly degrading. The initiative was launched in 2001 through Terai Arc Landscape Program, a joint initiative of the Government of Nepal and WWF. In the Terai Arc Landscape, local communities teamed up with government and civil society to protect and restore forests, boosting biodiversity and supporting wellbeing of local communities. Key outcomes of the initiatives include restoration of natural ecosystems, increase in forest cover and functionality of forest corridors, and increase in the population of endangered species. It also helped trickle down the conservation benefits to local communities through green enterprises, nature-based tourism, and ecosystem services-based livelihoods. It resulted in the recognition of United Nations World Restoration Flagship in 2024. As a World Restoration Flagship, the Terai Arc Landscape is recognized as one of the best examples of large-scale and long-term ecosystem restoration in any country or region.

1247

Landscape restoration and big cats in the Terai Arc LandscapeAnanta Bhandari

WWF Nepal, Kathmandu, Nepal

Abstract

The Terai Arc Landscape initiative aims to protect a biodiversity hotspot shared by India and Nepal that was rapidly degrading. On Nepal's side alone, more than 7.5 million people and a plethora of wildlife – tigers, rhinos, elephants, black bucks, buffaloes, crocodiles, and birds – depend on the vast Terai Arc Landscape, stretching across 2.47 million hectares. As poaching, habitat loss, degradation, and human tiger conflict increased, the forested area receded, and wildlife decreased. The initiative – which started with the Government of Nepal's launch of the Terai Arc Landscape Program in 2001 in partnership with WWF – has already brought back to life of forests of 66,800 hectares, particularly in the corridors within the landscape increasing functionality of the forest corridors and nearly tripled its tiger population to 355 from 121. In the entire Terai Arc landscape, shared by India and Nepal, the population more than doubled to 1,174.

1248

Restoring Rivers, Restoring Communities: Dam removal as a multi-benefit restoration toolBriana Bergstrom

Resources Legacy Fund, Williamsburg, VA, USA

Abstract

Since 2016, Resources Legacy Fund's Open Rivers Fund (ORF) program has helped dozens of communities across the American West restore rivers by removing obsolete dams and modernizing water infrastructure. With more than 100 ORF-supported projects now complete, ORF staff will share how their locally-driven model leads to better outcomes for both the environment and communities. A series of case studies will showcase how projects that bring together diverse local stakeholders not only restore fish passage and improve stream health, but also improve irrigation efficiency, eliminate safety hazards and liability, restore Tribal rights and traditions, save money, enhance recreation, and more. This collaborative approach to dam removal offers a model for catalyzing community-supported projects and improving restoration outcomes.

1249

Bridging the Divide: Integrating Ecological Restoration within Coastal Infrastructure for Enhanced Resilience

Aliza Leit

ECONcrete, New York, New York, USA

Abstract

The increasing need for coastal protection infrastructure often presents a perceived conflict with ecological restoration goals. However, innovative nature-based solutions, such as ECONcrete's ecologically enhanced concrete, offer a powerful pathway to address both objectives. This presentation will explore strategies for cohesively bridging the gap between infrastructure and ecology, demonstrating how protection and restoration can be integrated within a project.

Drawing upon the case study of Living Breakwaters in Staten Island, New York, will illustrate how engineered structures, such as submerged breakwaters, can be designed and implemented to not only reduce wave energy and mitigate coastal erosion but also to actively enhance ecological function. Living Breakwaters exemplifies this integrated approach by utilizing ECONcrete's ecologically enhanced tide pools, designed to create complex habitats that support the return of native oyster populations, improve water quality, and increase overall biodiversity.

Critical elements for successful integration include interdisciplinary collaboration between engineers, ecologists, and material scientists; the careful selection of materials and construction methods, including the use of ecologically enhanced concrete; and the incorporation of ecological performance metrics into project goals. The Living Breakwaters case study and N-EWN approach offer a compelling model for "dovetailing" infrastructure efforts with ongoing restoration initiatives, transforming perceived oppositions into opportunities for mutual benefit and ecological uplift.

1250

Great Lakes Restoration Initiative Pollinator Task Force; Innovation in native bee conservation

Meredith Holm

U.S. Fish and Wildlife Service, East Lansing, MI, USA

Abstract

The Great Lakes Restoration Initiative Pollinator Task Force is a collaborative effort among seven federal agencies to address the critical ecological crisis facing native pollinators in the Great Lakes Basin. Utilizing a strategic, data-driven approach, the Task Force implements on-the-ground habitat conservation efforts informed by the latest technological tools and research. Our focus spans the diverse landscapes of the Basin, promoting pollinator conservation in both rural and urban settings. To ensure resources are effectively allocated, we are developing models and tools to identify optimal restoration areas for native bee habitat while considering challenges posed by pesticide hazards, climate change, other environmental stressors and economic factors.

A key aspect of our research includes evaluating the efficacy of environmental DNA (eDNA) as a method for surveying native bee communities and monitoring population dynamics over time. By bringing together a diverse team of scientists, researchers, biologists, and ecologists, the Task Force is not only advancing the conservation of pollinators but also enhancing collaborative practices among stakeholders. Throughout this initiative, we are committed to learning from one another and sharing valuable insights on effective conservation strategies. This presentation highlights our innovative approaches and collective achievements aimed at safeguarding native pollinators, ultimately benefiting both the ecosystems of the Great Lakes and the communities that depend on them.

1251

Dam Removal as a Strategy for Climate Resilience

Serena McClain¹, Sarah Null², Greg Goodrum²

¹American Rivers, Washington, DC, USA. ²Utah State University

Abstract

There are more than 554,000 dams in the U.S., many of which were built to provide flood risk reduction, water supply, hydropower generation, recreation, and early industry. Climate change has created increasingly volatile weather over the past century, resulting in more frequent drought, catastrophic flooding events, and warming water temperatures. These threats alter the cost-benefit of maintaining dams and barriers by: (1) reducing dam utility and benefits; and (2) presenting the need for dam retrofits to avoid failure, sustain aquatic ecosystems, and protect communities downstream of dams. Dr. Sarah Null, et al conducted a literature review of peer-reviewed and gray literature on dam/barrier removal and climate resilience. A large majority of literature describes the impacts of dams on people and the environment, with a recent surge of research describing how removing dams restores rivers. They identified roughly 40 studies that linked dam/barrier removal with climate resilience, focusing on a wide range of climate resilience benefits, including connecting aquatic ecosystems, reducing the risk of dam failure, reducing methane emissions from reservoirs, maintaining biodiversity and water quality, etc. In this presentation, we will discuss these findings and how climate change alters the benefits of dams, including by reducing reservoir water storage and hydropower generation during droughts, while complicating flood management as storms intensify. This presentation will summarize recent literature on dam removal as a strategy for climate resilience and methods for considering multi-criteria decision analysis in identifying dams that could be removed.

1252

Combining eDNA and vane traps to characterize pollinator communities and their associations with at-risk and invasive flora.

Aron D. Katz^{1,2,3}, Sasha J. Tetzlaff^{4,3}, Catherine E. Dana⁴, Mark D. Johnson^{5,3}, Olivia M. Clausen⁴, Rene C. Tam⁴

¹US Army Corps of Engineers, Champaign, Illinois, USA. ²Department of Entomology University of Illinois at Urbana-Champaign, Urbana, Illinois, USA. ³Illinois Natural History Survey, Prairie Research Institute, University of Illinois Urbana-Champaign, Champaign, Illinois, USA. ⁴Engineering Research and Development Center, Champaign, Illinois, USA. ⁵Engineering Research and Development Center,, Champaign, Illinois, USA

Abstract

Surveying biodiversity to document plant-pollinator interactions is often time-consuming, labor-intensive, and difficult to scale, which limits our ability to inform effective conservation strategies. To address these challenges, we utilized environmental DNA (eDNA) to survey pollinator diversity associated with flowering plants across ten sites at U.S. Army Garrison Camp Grayling, Michigan. Each site was sampled in June, July, and September 2024, with two sites containing the federally threatened and state endangered *Solidago vossii* (Voss' Goldenrod). A total of 343 eDNA samples were collected from over 80 species of flowering plants using a flower "wash" approach, in which floral material was rinsed in water and filtered through 0.8 µm nitrocellulose membranes. DNA was extracted from the filters, amplified using an invertebrate-specific COI metabarcoding assay, and sequenced on the Illumina Nextseq platform. Preliminary results identified 1,134 unique taxa, among which were two state-imperiled species, 88 introduced or invasive taxa, and more than 320 anthophilous (flower-associated) insects with potential pollination roles, including 52 bee species. Passive vane traps were also deployed to sample pollinator communities independently to augment the local reference sequence library and detect species not captured via eDNA, potentially due to incomplete floral sampling, primer bias, or low visitation rates. Ongoing efforts include optimizing bee-specific eDNA assays, characterizing pollinator assemblages associated with *S. vossii*, and performing network analyses to identify significant plant-pollinator associations. This study demonstrates the utility of eDNA-based approaches to efficiently characterize pollinator communities and assess plant-pollinator associations across landscapes, offering a scalable tool for ecological monitoring and conservation planning.

1253

Growing the Circle – Extending the Partnerships in Research and Practice

Brendan Cousino

LimnoTech, Ann Arbor, MI, USA

Abstract

The Network for Engineering with Nature (N-EWN) serves as a collaborative research and implementation platform advancing the integration of nature-based solutions (NBS) into infrastructure systems. To scale adoption and maximize impact, the Network has expanded its partnerships to include federal and state agencies, local governments, academic institutions, non-governmental organizations (NGOs), and private-sector corporations. These expanded relationships enhance the technical rigor, regional relevance, and scalability of EWN initiatives, as well as increase the opportunities for project implementation.

This presentation will highlight efforts by N-EWN partners to seek opportunities for collaboration to expand the use of NBS, including interagency working groups, shared data platforms, knowledge transfer, and cross-sector investment for project implementation. Case studies include:

- (1) Outreach to the US Army Corps of Engineers (USACE) districts to highlight the benefits of nature-based solutions in successfully executing their missions for civil works, flood protection, and enabling commerce.
- (2) Cooperation with NGOs, USACE, and others to develop guidance documents and standards for NBS benefit quantification for infrastructure planning, corporate sustainability, ecological restoration and monitoring within NBS projects, and promoting social justice via NBS, and enhancing biodiversity.
- (3) The Mississippi Basin Water Action Collaborative, which was established to address the ambitions of the CEO Water Mandate's Water Resilience Coalition to mobilize corporate water stewardship in 100 basins globally.

By formalizing collaboration pathways, N-EWN is institutionalizing practices that support long-term adoption of EWN principles across public and private infrastructure portfolios. These efforts are transforming isolated projects into a scalable system-of-systems approach, fostering resilience through coordinated action.

1254

Establishing a Free Rivers Accelerator that increases the rate of river restoration through blended finance, technical services, and coordinated partnerships.

Brenda Bergman¹, Charles DeCurtis², Beth Styler Barry², Marea Gabriel³, Erick Crockenberg⁴

¹The Nature Conservancy, USA. ²The Nature Conservancy. ³The Nature Conservancy. ⁴

Abstract

The Nature Conservancy is developing the “Free Rivers Accelerator”, a dedicated team focused on scaling up dam removal across the Eastern U.S. To design this in a way that addresses real-world needs and bottlenecks, a multi-state working group conducted a needs assessment through interviews with organizations, agencies, and firms involved in dam removal. We identified that barriers to scaling dam removal include the lack of a strong pipeline of the most impactful projects, supported by local communities and backed by engineering analyses, as well as the need for improved policy and regulatory environment within states. To address these issues, we outlined a strategy that delivers funding and technical assistance across four key areas: community engagement, engineering and design, policy and government relations, and fundraising and financing. We are starting in the Northeast and expanding to Southeast across the Appalachian region within three years. We are also evaluating a similar model in Europe.

1256

The experience of 16 years of articulation, governance and Knowledge Pact's Governance

Alex Mendes¹, Amanda Fernandes¹, Barbara Paes¹, Rubens Benini^{1,2}

¹Atlantic Forest Restoration Pact, Piracicaba, São Paulo, Brazil. ²The Nature Conservancy, São Paulo, São Paulo, Brazil

Abstract

The Atlantic Forest Restoration Pact (PACT) is a multistakeholder coalition emerged in 2009 with the goal to accelerate and increase the scale of restoration of the Atlantic Forest biome through the recovery of 15 million hectares of degraded areas and forests by 2050. The action is based on: i) Large-scale restoration; ii) Establishment of governance systems, with the active participation of the various actors and in the different stages of the process; iii) Development of theoretical framework in the solution of knowledge gaps and restoration practices. The PACT is composed of 350 organizations members, four Working Groups and seven Task Forces, 16 Regional Units and Coordinating Council, Executive Secretariat, National Coordination. During its 16 years, the PACT and its members have produced several reference documents that include scientific articles, books, monitoring protocols and materials for wide dissemination of the restoration and the movement. The purpose of these materials is to support decision-making by our members and influence public policy. The PACT also mapping of potential areas for restoration in Brazilian Atlantic Forest (17,7 Mi hectares), compilation of 114 thousand hectares of restoration projects members and mapping of areas in the process of recovering native vegetation by remote sensing that can be viewed on an online geospatial platform. The articulation work and the results achieved in the field were recognized by the UN as one of the most promising and relevant in the world, declared of the World Restoration Flagship Initiatives and continues to inspire other restoration initiatives around the world.

1257

GBF upscaling the restoration around the world.MATHEUS COUTO¹, YELENA FINEGOLD¹, Cristiane Sater Melnik²¹FAO, ROME, Italy. ²FAO, Brazil**Abstract**

The Kunming-Montreal Global Biodiversity Framework (KM-GBF) Target 2, adopted during the Convention on Biological Diversity's COP15 in 2022, sets an ambitious global restoration target: ensuring that 30% of degraded areas of terrestrial, inland water, and marine and coastal ecosystems are under restoration by 2030.

KM-GBF Target 2 builds upon and significantly increases the ambition of previous restoration targets set by the Convention on Biological Diversity (CBD) and other international conventions. For instance, the previous CBD restoration target aimed to restoring 15% of degraded areas but lacked clear definitions and measurable criteria. To overcome these challenges, the KM-GBF provides a monitoring framework with guidelines and measurable indicators. In addition, the KM-GBF target 2 includes qualitative elements, requiring enhancement of biodiversity, ecosystem functions, and services, as well as ensuring ecological integrity and connectivity

The Food and Agriculture Organization (FAO) has been tasked with assisting countries in reporting areas under restoration for KM-GBF Target 2 with the Framework for Ecosystem Restoration Monitoring (FERM). The FERM is comprised of a geospatial platform and a registry of restoration initiatives, serving as the official monitoring tool for tracking global progress and disseminating best practices during the UN Decade on Ecosystem Restoration. This framework supports the UN Decade's flagship initiatives, such as the Trinational Atlantic Forest Flagship Initiative, by providing tools to track progress and share successful strategies.

1258

Large-scale cost-effective methods for evaluating restoration and rewilding outcomes in temperate grasslands

Andy Boyce¹, Maya Rayle¹, Ashlyn Herron², Susan Ellis-Felege²

¹Smithsonian's National Zoo and Conservation Biology Institute, Washington, DC, USA.

²University of North Dakota, Grand Forks, ND, USA

Abstract

In most regions, retention of currently protected temperate grasslands will not be sufficient to maintain or return to fully functioning ecosystems. Accordingly, effective and scalable restoration is required. To help fill this need, our team is partnering with restoration practitioners to apply novel techniques to evaluate and inform restoration actions within temperate grasslands at a landscape scale. We work with conservation practitioners ranging from ranchers, conservation NGOs (e.g. Nature Conservancy & National Wildlife Federation), agencies (e.g. Bureau of Land Management & Montana Fish, Wildlife and Parks) and a large rewilding organization, American Prairie. All of these stakeholders have large-scale restoration goals and limited capacity for dedicated monitoring of these efforts. To test the effectiveness of various restoration techniques (e.g. reseeding, low-tech process-based restoration, bison reintroduction...etc) we are deploying low-cost autonomous sensors to evaluate outcomes and provided a scientific basis for adaptive management. We will present preliminary data from ongoing, collaborative projects in Montana and North Dakota to support the idea that these methods, including microclimate sensors and autonomous recording units, represent objective and scalable solutions for evaluation of biodiversity and productivity outcomes of restoration activities in temperate grasslands.

1259

Building capacities and enabling conditions as a strategy to achieve global goals

Amanda Augusta Fernandes^{1,2}, Alex Fernando Mendes¹, Rubens Benini^{3,1}, Luisa Toller¹

¹Atlantic Forest Restoration Pact, Piracicaba, São Paulo, Brazil. ²Rede Nativas - Mulheres na Restauração Ecológica, Piracicaba, São Paulo, Brazil. ³The Nature Conservancy Brasil, São Paulo, São Paulo, Brazil

Abstract

The Atlantic Forest Restoration Pact represents a pioneering multi-stakeholder coalition that has driven large-scale ecological restoration in Brazil's Atlantic Forest biome over sixteen years. By integrating diverse actors - including governments, NGOs, researchers, and companies. Pact has developed an effective governance model that translates ecological commitments into landscape transformations. The coalition has systematically built technical and governance capacities through two training courses on Carbon Restoration Projects in the Atlantic Forest, where approximately 80 professionals from 40 organizations were trained. As one of the results of the training courses, it is systematizing potential carbon restoration projects to be developed by Pact's members, as well as the drafting of a participatory document of Principles and Criteria for restoration projects in the biome. Another training session held in partnership was related to evidence-based fire management distinguishing prescribed burns from destructive wildfires, with participation of approximately 40 professionals from different organizations; and regional governance strengthening through annual knowledge-exchange meetings. Pact scientific approach has advanced restoration ecology through peer-reviewed publications, standardized monitoring protocols, and the establishment of long-term research plots. The network has trained professionals, influenced national policies, and inspired similar initiatives in other Brazilian biomes. Recognized as a UN World Restoration Flagship in 2022, Pact demonstrates how sustained investment in network building and capacity development can achieve scalable environmental and social impacts. Its legacy serves as a model for biome-scale restoration efforts globally, proving that multi-actor collaboration grounded in science can effectively address biodiversity loss and climate change challenges while delivering economic benefits.

1260

Integrating NEWN & Ecological Restoration Practices into Federal Flood Risk Management Projects.Jared Bramblett

Moffat & Nichol, Charleston, SC, USA

Abstract

From New York to Miami and Charleston to San Francisco, the US Army Corps of Engineers (USACE), in partnership with non-federal sponsors (NFS), is advancing Coastal Storm Risk Management (CSRМ) and Flood Risk Management (FRM) feasibility studies aimed at reducing risks to life, property, and critical infrastructure from surge or riverine flooding. While most of these efforts emphasize structural solutions-floodwalls, levees, flood gates, or pump stations-there is a growing interest from the public and NFSs to incorporate natural-based solutions (NbS) to provide ecological restoration principles alongside flood protection measures. This presentation will explore successes, challenges, and emerging opportunities from ongoing CSRМ and FRM studies across the country, highlighting how NEWN and ecological restoration practices can be integrated into federal flood risk management.

1261

Policy and People: Continuing evolution of the regulatory frameworkJessica Norris

Biohabitats, Columbia, MO, USA

Abstract

As practitioners, participants in the Network for Engineering with Nature (N-EWN) are well-positioned to diagnose and help repair weaknesses or inefficiencies in local, state, and federal regulations that pose barriers to Nature-based Solutions. As a true network of organizations with differing perspectives, interests, and insights, N-EWN functions as a clearing house for policy as well as technical innovation. The presentation will organize and present some of the recognized barriers to implementing restorative approaches and review opportunities for collaborative advocacy to encourage decision-makers to facilitate innovation.

1262

Following nature's timeframes and values for investment: Innovations in Cost Benefit Analysis

Chris Behr

HDR, Washington, DC, USA

Abstract

Designers are regularly asked to compare NbS and traditional infrastructure using economic evaluation methods that are standard practice in traditional engineering designs. However, NbS represents a range of solutions that adapt to local environmental conditions in conjunction with new or existing traditional engineered options. Accordingly, economic evaluation methods must adapt to these new alternatives to account for potential cost savings, new sources of benefits generated by NbS, and differences in who benefits. In addition, complexities can arise in accounting for uncertainties in NbS performance in meeting design goals. Some federal agencies, such as FEMA and USACE, have recently formulated standards for evaluating NBS among project alternatives, though they have not yet arrived at complete consistency. This presentation outlines sources of data, methods and related uncertainties in performing benefit-cost analyses for NbS. The discussion will also discuss how economics can account for the long-term value of NbS. Perspectives on NbS value will be drawn from site-specific research into natural capital accounting. Ultimately, the paper will conclude with recommendations on how to approach NbS valuation on a new site.

1263

Catalyzing Large-Scale Landscape Restoration in Latin America and the Caribbean through Initiative 20x20

Victoria Rachmaninoff

World Resources Institute, Washington, DC, USA

Abstract

Through Initiative 20x20, 18 countries in Latin America and the Caribbean and three regional programs have committed to begin the process of restoring over 52 million hectares of land by 2030, an area of roughly Paraguay and Nicaragua combined. With just five years to meet this ambitious target, the Initiative is working through a multipronged approach to catalyze policy, finance, and monitoring to scale implementation. The Initiative has also developed two innovative programs, the Landscape Policy Accelerator, and the Landscape Monitoring Accelerator, to support member countries in developing robust restoration policies and monitor their impacts. These programs support regional collaboration and knowledge sharing between 20x20 governments as well as connect government institutions working to meet their climate, biodiversity, and desertification goals for the three Rio Conventions. This talk will explore the past, present, and future of Initiative 20x20, including lessons learned and opportunities, and how Initiative 20x20 is working with the GPFLR to scale learning outside the region.

1264

Supporting Cross-Country Collaboration for Large-Scale Landscape Restoration in Latin America and the Caribbean through Initiative 20x20

Victoria Rachmaninoff

World Resources Institute, Washington, DC, USA

Abstract

Launched in 2014, Initiative 20x20 is a country-led effort to begin the process of restoring over 52 million hectares of land in Latin America and the Caribbean by 2030. With 18 member countries and three regional programs working towards this goal, as well as over 160 technical and financial partners, the Initiative is a critical mechanism for scaling learning and supporting cross-country collaboration for large-scale landscape restoration in the region. The Initiative has created two flagship programs, the Landscape Policy Accelerator, and the Landscape Monitoring Accelerator, that aim to connect country governments to identify mutual challenges and build solutions to develop restoration programs that meet each country's diverse needs. These programs also aim to align country efforts between ministries and agencies to meet the three Rio Conventions. This talk will explore the role of Initiative 20x20 in connecting the restoration movement in Latin America and the Caribbean and how the Initiative can scale learnings of success such as the work of the Trinational Atlantic Forest Pact.

1265

Changing paradigms in forest and landscape restoration

James Hallett

SER/GPFLR, Washington, DC, USA

Abstract

Development of forest and landscape restoration (FLR) approaches in the early 2000s was the logical outcome of the blossoming of the fields of landscape ecology and restoration ecology in the late 1980s. The added value of FLR is the recognition that our ability to sustain viable ecosystems and maintain biodiversity requires understanding and addressing the varying needs of people that live within or are affected by conditions on the landscape. The FLR approach was propelled by commitments to restore millions of hectares of forest through the Bonn Challenge and related initiatives. Turning these commitments into actions on the ground has often been slow or has led to disappointing outcomes. Publication by the Global Partnership for Forest and Landscape Restoration of key principles for FLR has set the stage for a transition to improving the quality of outcomes from simply considering the area under restoration. This paper outlines some of the principal pathways for ensuring high quality FLR, and considers how these restoration efforts can be accelerated.

1266

Change is Hard: Community Engagement in Dam RemovalsMolly Payne Wynne, Eileen Bader Hall, Kathleen Epstein, Tamara Lee Pinard

The Nature Conservancy, Brunswick, Maine, USA

Abstract**Change is Hard: Community Engagement in Dam Removals**

Large-scale river restoration projects present immense opportunities for building climate resilience, restoring freshwater biodiversity and habitat, and enhancing access to river systems for Indigenous and non-Indigenous livelihoods and cultural lifeways. In many cases, realizing these benefits requires a great deal of change well beyond the change of the river view. From our experience in recent projects at dams in Maine, USA, public support for dam decommissioning and removal within communities ideally starts with a common understanding of the project elements and resources to support community-led decision-making. In this presentation we will share our perspective on how deep listening and community engagement are among key enabling conditions for dam removals.

1267

Forest Restoration and Connectivity: A Pathway to Big Cats Conservation

Sandra Petrone, Pilar Jacobo

WWF, Mexico, Mexico, Mexico

Abstract

WWF's Regional Jaguar Strategy aims to secure the long-term survival of the jaguar (*Panthera onca*) across its range by protecting core populations, stopping jaguar killings, and restoring connectivity through a network of corridors. Given that jaguars require large, connected territories to thrive, restoring forest cover and ecological linkages is essential. One key pillar of the strategy is to recover functional connectivity between fragmented habitats—making ecological restoration a fundamental tool.

In Mexico, WWF works in two priority jaguar landscapes—the Selva Maya and the Central Pacific—where connectivity models have identified core areas and ecological corridors critical for the species' survival. These models guide strategic conservation and restoration actions in regions increasingly threatened by deforestation, land use change, and infrastructure development.

In the Central Pacific, WWF and partners are implementing an integrated restoration approach that combines ecological reforestation with sustainable productive practices in livestock ranching areas and other productive sites. These efforts aim to enhance forest cover, reduce fragmentation, improve prey availability, and mitigate human-jaguar conflict by promoting coexistence strategies.

Forest restoration in key corridors not only improves habitat connectivity for jaguars but also contributes to broader biodiversity and climate goals. By strengthening community governance and supporting long-term conservation mechanisms such as Voluntary Conservation Areas and Community Conservation Enterprises, these efforts secure ecosystem services that sustain local livelihoods, including water provision, food production, and nature-based tourism.

Through this integrated approach, we aim to restore ecological integrity and position the jaguar as a symbol of sustainable, inclusive landscape conservation

1269

Inclusive restoration in Cerrado Biome: placing people at the center of the process.

ANABELE GOMES

Araticum, Brasília, Distrito Federal, Brazil. University of Brasília, Brasília, Distrito Federal, Brazil. Rede de Sementes do Cerrado, Brasília, Distrito Federal, Brazil. Redário, Brasília, Distrito Federal, Brazil

Abstract

Inclusive restoration is an approach that goes beyond the recovery of degraded ecosystems. It proposes a participatory process that actively integrates diverse local groups, especially women, youth, indigenous peoples, traditional populations, and family farmers in decision-making throughout the ecological restoration process.

This practice seeks to promote social and environmental justice through a collective narrative in which all people recognize themselves as protagonists of ecological restoration and sustainable development.

Inclusive restoration needs to be a continuous process that integrates local socioeconomic systems, promoting structural transformations that strengthen territories and guarantee the sustainability of communities and the environment.

In Brazil, in the Cerrado Biome, for the past 4 years, Araticum (Articulation for the Restoration of the Cerrado) and the Rede de Sementes do Cerrado (Cerrado Seed Network) have been leading and promoting projects that involve communities in all phases of restoration, from seed collection, selection of areas, soil preparation, planting, monitoring and maintenance, training and providing technical assistance. By this arrangement 250 hectares have already been restored in three Brazilian states, with four communities that include family farmers, quilombolas, indigenous people and geraizeiros.

By adopting an inclusive approach, traditional, technical and academic knowledge are combined, the chances of restoration success increase, as it encourages local stakeholders to take joint responsibility for ecological recovery, in addition to creating new opportunities and jobs. In this way, inclusive restoration not only restores nature, but also rebuilds bonds, strengthens local economies and transforms people's relationship with the environment, placing them at the center of solutions.

1270

Applying Standards-Based Ecological Restoration in Corporate Sustainability Programs

Chelsea Keefer¹, Joshua Anzalone¹, Holly Latteman²

¹Stream + Wetlands Foundation, Lancaster, Ohio, USA. ²The Dawes Arboretum, OH, USA

Abstract

This symposium will explore the transformative role of private industry in advancing standards-based ecological restoration, spotlighting a wetland restoration project completely by the Stream + Wetlands Foundation at The Dawes Arboretum in Licking County, Ohio. As part of Microsoft's collaboration with the Society for Ecological Restoration (SER), this project exemplifies how corporate sustainability initiatives can drive ecological and community benefits beyond traditional compensatory mitigation. Formerly an agricultural field converted to a young prairie, the site has been restored to vibrant wetland pools through a partnership involving the Stream + Wetlands Foundation, which designed and delivered the technical expertise, and The Dawes Arboretum, which provided the site and locally sourced plant and seed material. Guided by SER's international restoration standards, the project reflects Microsoft's commitment to aligning global best practices with local ecological knowledge and community priorities. This session will detail the ecological goals, community engagement strategies, and long-term stewardship plans underpinning the effort. By highlighting this project, the symposium aims to inspire other corporations and NGOs to embrace standards-based restoration as a means of advancing environmental and social equity through authentic, place-based partnerships.

1271

Agroecological applied nucleation: Where nucleation as an ecological restoration technique enters into dialog with silvopastoral systems and regenerative agriculture

Abdon Schmitt^{1,2,3}, Paulo A. Sinisgalli⁴, Arcangelo Loss^{1,2}, Lui M Schmitt¹, Daniele C. Kazama^{1,2}, Joshua Farley^{5,3}

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Abstract

The Silvopastoral System with Nuclei (SPSnu) was designed inspired by applied nucleation theory (AN) to ecologically rehabilitate treeless pastures in a former forested biome. The interweaving of these fields of knowledge led to agroecological applied nucleation (AAN), in which nucleation as an ecological restoration technique enters into a dialog with silvopastoral systems and regenerative agriculture. The aim of this work is to understand the structure of SPSnu and how it affects the microclimate. The main feature of SPSnu is forty nuclei of 25 m² per hectare, arranged equidistantly and fenced to allow the trees to grow as successional agroforestry clumps. Each nucleus consists of twenty native trees and four banana plants, divided into four functional groups according to the species ecology. On two consecutive days in each season, microclimatic variables were collected in different areas of the SPSnu and the treeless pasture (TLP). We measured air temperature (°C), relative humidity (%), illuminance (lux), wind speed (m/s) at 120 cm height and near the ground, and soil surface temperature (°C). The temperature and humidity index (THI) was calculated for each condition. An influence analysis was performed using Generalized Linear Models to evaluate the effects of the systems on the microclimatic variables. All microclimatic variables analyzed were affected by SPSnu. SPSnu and TLP showed different microclimatic patterns ($p < 0.05$) for air temperature (SPSnu 23.5°C, TLP 25.9°C), illuminance (SPSnu 20.408 lux, TLP 49.909.5 lux), the wind speed (SPSnu 0.5 m/s, TLP 0.9 m/s), the soil surface temperature (SPSnu 20.3°C, TLP 23.1°C) and the relative humidity (SPSnu 54.5%, TLP 34.74%) at 120 cm. The distinctness of the microclimate was also observed near the ground with lower air temperature (-2.64°C) and illuminance (-23,346.29lux). During summer, the air temperature under SPSnu decreased by -4.21°C and the soil temperature decreased by -3.21°C. We concluded that ANN under SPSnu improved the microclimate at 120 cm height and near the ground. An improved thermal environment may partially mitigate some of the effects of climate change on ecosystem processes and services and create the conditions for ecological rehabilitation of agroecosystems. These conditions could be enhanced at the biome level once the adoption of SPSnu on treeless pastures is facilitated by public policies, including payment for ecosystem services.

1272

Ecological rehabilitation and carbon dynamics above the soil on Silvopastoral System with Nuclei: Biomass and carbon uptake

Daniele Cristina da Silva-Kazama¹, Abdon L Schmitt Filho Schmitt Filho^{1,2,3}, André de Almeida Silva¹, Stéfano Gomes Kretzer¹, Joshua Farley³, Paulo A. Sinisgalli⁴

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Abstract

Just as agriculture is the main cause of environmental degradation and contributes to a significant portion of greenhouse gas (GHG) emissions, silvopastoral systems (SPS) have promoted the ecological rehabilitation of various agroecosystems. Silvopastoral systems with nuclei (SPSnu) also mix livestock, forestry and pasture, but in a very different way. It was developed based on applied nucleation (AN) theory, which when applied to agroecosystems is called agroecological applied nucleation (ANN). The objective of this study was to evaluate the carbon sequestration potential of SPSnu when applied to treeless pastures (TLP) in southern Brazil. Today, TLPs dominate the southern Brazilian Atlantic Forest biome, one of the global hotspots for biodiversity conservation in the world. We measured biomass and carbon stocks in 40 tree nuclei (SPSnu), as well as pasture cover and carbon and nitrogen stocks in both treatments (SPSnu, TLP). We also assessed the relationship between biomass and carbon accumulation with tree species richness and density and the presence of tree legumes in each nuclei. Biomass and carbon stocks in the nuclei were 19,188 Mg ha⁻¹ and 3,847 Mg ha⁻¹, respectively, over a four-year period. Biomass was associated with species richness and density in the SPSnu ($R^2 = 0.08$; p -value = 0.04). SPSnu had higher pasture cover measured as dry matter production (SPSnu 3573.3 kg/ha vs. TLP 3256.8 kg/ha), higher carbon content (SPSnu 1508.21 kg/ha vs. TLP 1379.9 kg/ha) and higher nitrogen content (SPSnu 90.4 kg/ha vs. TLP 81.9 kg/ha) in the first year compared to TLP. In the second year, there were no differences in pasture cover (SPSnu 3714.1 kg/ha vs. TLP 3737.8 kg/ha), carbon (SPSnu 1567.2 kg/ha vs. TLP 1613.5 kg/ha) and nitrogen (SPSnu 94.53 kg/ha vs. TLP 95.9 kg/ha). Our results show that SPSnu is an important carbon sink and does not have a negative impact on pasture production and pasture carbon stocks. The system has the potential to partially mitigate the impacts of treeless conventional grazing on various ecosystem processes and services, greenhouse gas emissions and biodiversity.

1273

Agroecological applied nucleation, silvopastoral system with nuclei and habitat rehabilitation: The ecology of birds, ants, and bees

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Abstract

The diversity of a landscape is an essential aspect of biodiversity. In Brazil's Atlantic rainforest, most agricultural landscapes are a mosaic of cultivated areas, treeless pastures and forest remnants. In this study, the silvopastoral system with nuclei (SPSnu) is analyzed using biodiversity indicators such as birds, ants and bees in southern Brazil. SPSnu is a silvopastoral system (SPS) whose design was inspired by applied nucleation techniques with multispecies agroforestry nuclei, now called agroecological applied nucleation. SPSnu would restore some of the biodiversity and resilience of the ecosystem. We found that SPSnu's agroforestry multispecies nuclei are a stepping stone for improving connectivity between forest remnants. The use of SPSnu, which integrates species-rich agroforestry nuclei into former treeless pastures, increased bird diversity. When comparing the biodiversity of bees in SPSnu, treeless pasture (TLP) and forest fragments (FFL) in southern Brazil, we found that SPSnu promoted an increase in the abundance of *A. mellifera* bees compared to TLP. The SPSnu is characterized as a source of resources and shelter for bees and promotes associated ecosystem services. The total richness of ants in the SPSnu was similar to the total richness inside the forest remnants (FFL) and much higher than the number of species in pastures without cores (PSA). In summary, the use of SPSnu in an agroecological context can reconcile agriculture, landscape rehabilitation and biodiversity conservation.

1274

Soils rehabilitation under Silvopastoral System with Nuclei: Chemical, physical biological, and qualitative attributes

Arcangelo Loss¹, Abdon Schmitt Filho^{2,3}, Agnes Mitsuyo Shimosaka¹, Joshua Farley¹, Carolina Soares Marques¹, Paulo A. Sinisgalli^{1,4}, Luiz Fernando Zin Battisti¹, Raphael Ramon Buch¹

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Abstract

Population growth and the prevailing economic model have driven the deforestation of natural ecosystems to make way for agriculture and livestock, resulting in monocultural green deserts and degraded pastures. Complex ecosystems, consisting of many interactions and processes, are now unable to protect and nourish local biodiversity, resulting in a global soil loss of 25 to 40 billion tons annually. In search of a viable solution to restore agroecosystems, we investigate the effects of agroecological applied nucleation (ANN) under silvopastoral systems with nuclei (SPSnu) on the physical, chemical, biological and qualitative properties of soil. Following applied nucleation, SPSnu consists of multiple successional agroforestry nuclei per hectare. SPSnu resulted in the highest soil aggregation indices (average geometric diameter and sensitivity index, both for the 0-10 cm layer), higher values for phosphorus, potassium, total organic carbon and total soil nitrogen (0-30 cm) compared to treeless pastures (TLP) and secondary forest ($P < 0.05$). In another study, we analyzed light organic matter (MOL) content in water, particulate organic carbon (COP) and total glomalina in plots with SPSnu, TLP and fruit tree monoculture (FTM) with legumes as intercrop. The highest values of MOL, COP and glomalin were found in SPSnu and TLP compared to FTM. Our results show the potential of SPSnu to promote soil physical structuring, improve soil fertility, increase carbon and nitrogen content and enhance soil biological activity in only four years. Agroecological applied nucleation under SPSnu promoted soil ecological rehabilitation of agroecosystems in the Atlantic forest biome in southern Brazil. SPSnu represents a low-carbon cropping system that has the potential to be adopted through payment for ecosystem services programs.

1275

Restorative agricultural economy and agroecological applied nucleation: Insights from a case study in Santa Catarina, southern Brazil

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Abstract

Agriculture is the most important economic sector and at the same time the greatest threat to the ecosystem functions on which all complex life depends. It is therefore a logical starting point for the development of a restorative economy. We need to develop and disseminate agroecosystems that are capable of ensuring food security for all while restoring vital ecosystem processes that have been damaged by conventional agriculture. We look back on 25 years of transdisciplinary work on an agroecology project in Santa Rosa de Lima, Santa Catarina, Brazil, and draw some important lessons for like-minded efforts. We apply Participatory Action Research and Postnormal Science methods to integrate the knowledge, insights, and goals of farmers, diverse scientists, agricultural extension agents, and policy makers to design silvopastoral systems with nuclei based on applied agroecology capable of improving farmers' livelihoods and to propose policies that support their adoption by aligning farmers' and society's interests. We explain the scientific basis of our project and document the resulting improvements in farmers' livelihoods and ecosystem services. We then examine the socio-economic barriers to the diffusion of our innovations and the policy measures that could overcome them, and describe our pragmatic approaches for engaging with policy makers. We conclude that the integration of natural science, socio-economic analysis, and policy is necessary but not sufficient to promote large-scale adoption of restorative agriculture. We argue that building a restorative economy also requires a fundamental extension of humanity's moral values to the rest of nature, drawing on evolutionary science. We do not offer a recipe for successful projects, but our message is that developing a restorative agricultural economy in an ever-evolving system is an ongoing participatory process with no endpoint.

1276

From Pledges to Progress: Scaling FLR through High-Impact Partnerships, Bold Flexibility, and Purposeful Funding

Natalia Ruiz Guevara^{1,2}, Mary Gronkiewicz³

¹World Resources Institute, Lima, Lima, Peru. ²Latin American Model Forest Network, Lima, Peru. ³World Resources Institute, Washington DC, USA

Abstract

Over the past decade, countries have pledged to restore millions of hectares of degraded land through a variety of initiatives: SDGs, NDCs, NBSAPS, the Bonn Challenge, and more. But what now? How do countries make good on these commitments, deliver action on the ground, and accurately monitor and report their progress? We know there's no one-size-fits-all answer, and countries need support tailored to their unique restoration journeys, players, and objectives. That's where initiatives like the FLR Hub come in. A joint undertaking between IUCN, WWF, and WRI, the Hub seeks to unify fragmented efforts and help six countries across Latin America and Africa take a holistic, needs-based approach to FLR implementation. Yet to stay flexible and responsive to changing country contexts, the Hub and projects like it must mobilize equally adaptive funding – a constant challenge. The success of these endeavors depends on committed, innovative donors and strong collaboration among governments, technical partners, and local communities.

In this session, participants will learn:

- a) How the FLR Hub is strengthening three key pillars to create (1) smart, accessible policies and incentives, (2) capable, shovel-ready projects that can absorb significant capital, and (3) robust monitoring systems that capture and aggregate best available biophysical and social data.
- b) How technical assistance providers can join the Hub and support our efforts to break down siloes and unite FLR movements to accelerate progress.
- c) How donors can get involved and refine their funding models to better align with country goals, bottlenecks, and timelines.

1277

Transforming restoration in Latin America and the Caribbean: Co-Creating a Gender and Social Equity Accelerator for Initiative 20x20

Natalia Ruiz Guevara^{1,2}, Kalpana Giri³, Maria Inves Miranda⁴

¹World Resources Institute Metropolitana de Lima, Lima, Lima, Peru. ²Red Latinoamericana de Bosques Modelo, Turrialba, Cartago, Costa Rica. ³World Resources Institute Metropolitana de Lima, Washington DC, USA. ⁴Wise Women Chile, Chile

Abstract

Since 2014, Initiative 20x20 has promoted landscape restoration in Latin America and the Caribbean, organizing its work around three strategic pillars: public policy, private finance, and knowledge management. Nevertheless, accumulated experience and multiple studies have shown that the sustainability of these efforts depends on a just transition addressing social and gender inequalities. In response, its new 2025–2030 strategy incorporates a fourth pillar dedicated to Gender and Social Equity (GSE), with the aim of accelerating transformative and co-created actions oriented to enable conditions for an inclusive landscape restoration.

Initiative 20x20 has launched a methodological proposal for the inception phase of the GSE pillar, structured in two participatory phases: in-depth research and design of the Gender and Social Equity Accelerator. The first phase is identifying key stakeholders in the 20x20 network through mapping and interviews, with potential to contribute actively to the crafting of the pillar, as well as identifying common barriers and strategies to implement restoration under a gender transformative approach. The second phase will consist of the co-creation of spaces to collectively analyze barriers, share experiences and develop political, technical, and financial solutions to close equity gaps. The outcome will be the first methodological proposal of the accelerator serving as a platform to build capacities, connect actors, and generate recommendations for the Initiative's other three pillars.

This effort represents an innovative step toward the inclusion of women, youth, and Indigenous peoples in restoration governance.

1278

Innovations for diversifying reforestation

Pedro Brancalion

University of São Paulo, Piracicaba, SP, Brazil

Abstract

More diverse forests are needed to maximize multiple benefits, especially biodiversity conservation, carbon sequestration and water-related services. However, there are still critical knowledge and technological barriers holding the large-scale implementation and management of more diverse forests. In this talk, I will present an overview of some of these opportunities, exploring potential approaches to transition from tree monocultures to forest restoration. One first opportunity is to manage abandoned monocultures for promoting native species regeneration, in order to gradually convert monocultures into diverse forests. Secondly, it is possible to implement mixed plantations of commercial tree species with multiple native trees, using the income obtained from timber harvesting to finance the transition for a diverse forest stand. Then, the forestry technologies developed for industrial monocultures can be adapted for developing scalable, affordable, and effective forest restoration methods. Forestry technologies have to be, however, complemented with specific technologies for restoration, especially regarding operations in marginal lands and to address the inherent complexities of managing higher levels of biodiversity. Drone-based operations and artificial intelligence are promising for resolving these challenges. To conclude, I'll present the case study of a forest restoration Brazilian company that has been implemented these approaches across thousands of hectares, and present their lessons learned so far. Integrating science into innovative business is a powerful approach to move restoration beyond vague, ambitious promises and wishful thinking.

1279

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1280

Anticipating regenerative futures: the restoration agenda meets the discipline of Anticipation

Fabio Rubio Scarano

Museum of Tomorrow, Rio de Janeiro, RJ, Brazil. Federal University of Rio de Janeiro, Rio de Janeiro, RJ, Brazil

Abstract

Science excels in its forecasting and foresight capabilities as ways of using the future to inform better decisions in the present. Nevertheless, this is not always translated into action. The risks of future climate change scenarios are by now well understood, but society keeps drilling oil and breaking records of greenhouse gas emissions every year. Pandemic events and risk maps have been anticipated nearly 10 years before the outbreak of covid-19, and no action was taken until the disease spread worldwide. By analogy, it would appear that all the very relevant scientific exercises – such as modelling future restoration scenarios, defining priority areas, assessing costs and benefits, etc. – shall not be enough to circumvent present and future threats to biodiversity, climate and human wellbeing. My argument is that this major gap between understanding and taking preventive action relates to an incapacity to feel. This results from the curbing of emotions, intuitions and instinct, which I claim to be an outcome of both the “dictatorship of reason” (as coined by John Ralston Saul) and the “double alienation” (as defined by Hannah Arendt). Finally, I will discuss how the discipline of Anticipation can help circumvent that and be brought into the restoration agenda.

1281

Challenges of forest restoration in urban areas of the Atlantic Forest – case of Hortolândia, São Paulo – Brazil.Rafael Fernandes, Ana Liaffa

SOS Mata Atlântica Foundation, Itu, São Paulo, Brazil

Abstract

The Atlantic Forest is present in 17 states of Brazil and occupies 15% of the national territory. It is the most devastated biome in Brazil, because of more than 500 years of predatory economic cycles, the expansion of the agricultural frontier and urban areas. Only 30% of its native vegetation remains and there is only 24% of forest cover, below the minimum for biodiversity conservation. It is the second largest biodiversity hotspot in the world and is the only biome in Brazil protected by a special law, the Atlantic Forest Law. Seventy percent of the Brazilian population lives in this territory (about 150 million inhabitants), concentrating 3,429 municipalities, forest spaces within urban areas are rare and gaining more importance in a context of global warming and continuous growth of cities. Restoring forest ecosystems in urban environments adds a series of challenges, including cultural, social, economic, and environmental issues, and sensitizing people to measures like this is not an easy task. In a project that covers 9.1 hectares, during buildings and houses in Hortolândia, this experience has been happening, linked to a series of environmental education and communication actions, as a disseminator of knowledge and awareness of the benefited community. How does this happen? What are the challenges? This is all addressed within this panel.

1282

Leveraging Digital Innovations for Effective Land Restoration: Showcasing Advanced Technologies and Successful Case Studies

Devashree Niraula, Abd Salam EL VILALY

United Nations Convention to Combat Desertification, Bonn, Germany, Germany

Abstract

As land degradation continues to escalate due to climate change, deforestation, and unsustainable agricultural practices, innovative digital tools are becoming essential for effective monitoring, management, and restoration of degraded lands. These tools can provide real-time data, enhance decision-making, and optimize restoration efforts.

The side event will feature advanced technologies such as earth observation data for land restoration, AI-driven data analysis, drone-based monitoring, and blockchain for transparent project management. These innovations hold significant potential to enhance the efficiency and effectiveness of land restoration initiatives.

By showcasing successful case studies and innovative tools, the side event aims to inspire stakeholders to adopt and invest in digital technologies, ultimately accelerating global efforts toward achieving land restoration goals and contributing to sustainable development. In summary, these side events will serve as a platform to drive technological innovation and collaboration, crucial for tackling the urgent challenge of land degradation and promoting sustainable land management practices globally

1283

Accelerate monitoring and reporting on ecosystem restoration in Asia-Pacific - sub-regional, national and local experiences and challenges in achieving Target 2

Zhuo Cheng

FAO, Rome, Italy

Abstract

In 2024, FAO started to work with pilot countries to help them develop capacity in planning, monitoring and reporting restoration. As the country pilot work evolves, in 2025, FAO, CBD, and CBD's technical support centers are joining forces to deliver a series of sub-regional workshops to support a wider range of countries build capacity in Target 2 monitoring and reporting. The first workshop took place in Asia-Pacific. Participants representing 11 countries gained awareness of the regional restoration efforts and shared national restoration priorities and actions plans, in a collaborative knowledge exchange. Through the 4-day workshop, participants were able to identify and effectively use the various resources and tools outlined in the Target 2 resource guide, explain the key concepts, definitions, and reporting requirements associated with the target, and apply Target 2 guidance across the four stages of the restoration process. The workshop therefore enhanced country capacity to report national targets under the National Biodiversity Strategies and Action Plans (NBSAP) to the CBD reporting platform, and in line with requirements for the 7th national reporting process. This presentation shares sub-regional, national and local experiences and lessons from the workshop.

1284

Restoration Monitoring in Brazil: A Successful Collaboration Between Civil Society and Government

Tainah Godoy

Abstract

Monitoring is a critical component of effective ecosystem restoration, yet implementing large-scale, long-term monitoring remains a major challenge, especially in biodiverse and socioeconomically complex countries like Brazil. In response, a collaborative effort between civil society organizations and government agencies has emerged as a successful model to overcome institutional fragmentation and scale up monitoring efforts. This presentation will highlight the experience of the Brazilian Restoration and Reforestation Observatory initiative, a national platform that brings together 6 networks (each representing a Brazilian biome) to co-develop methodologies, indicators, and tools for tracking restoration. The initiative has led to the production of public, science-based restoration monitoring data, soon to be integrated into official platforms. We will share insights into the governance model that enabled cross-sector collaboration, the technical approach used to standardize monitoring across diverse ecological and social contexts, and the impact of the initiative on public policy, including its alignment with the National Policy for Native Vegetation Recovery. The experience demonstrates that sustained collaboration between civil society and government can generate credible, policy-relevant data while strengthening transparency and accountability in restoration. This case offers valuable lessons for other countries seeking to institutionalize restoration monitoring as part of their environmental governance and climate commitments.

1285

Train the trainers to scale up capacity development in Target 2 monitoring and reporting (TBD)George Gann**Abstract**

As restoration remains a relatively recent activity at the national level in most countries, Parties (countries) to the Convention on Biological Diversity need capacity development and training to achieve the intent of Target 2 (the restoration target) of the Kunming-Montreal Global Biodiversity Framework. To address this capacity need, the Target 2 Partnership, which includes SER, has developed a capacity building training program in partnership with regional centers in Asia, Africa, and Latin America. Part of the training program is the delivery of a 'Training of Trainers' component held as part of regional workshops. In addition to contributing to the core curriculum for how to plan, implement, monitor, and report restoration by countries, SER and the T2 Partnership have adapted that curriculum for future regional trainers to use. In this way regional trainers will have access to the global knowledge base, and to continued support from the T2 team, so that they can provide that content to their colleagues on a peer-to-peer basis. The aim is to achieve greater uptake and adoption of the knowledge shared and therefore increase potential for countries to succeed in their efforts to contribute to global restoration goals, including Target 2.

1286

Restoration Challenge in the Atlantic Forest of Brazil

Robin Le Breton

Iracambi Research Center, Rosário da Limeira, Minas Gerais, Brazil

Abstract

Although over 85% of the Atlantic Forest of Brazil has been destroyed, it still remains a biological hotspot. The expansion of human habitat, destroying the forests, resulted in an abandoned, unsustainable environment, now aggravated by climate change, threatening the once abundant water resources supplying the ever-growing urban populations and securing livelihood of the rural population. Maintaining the land's capability to sustain its inhabitants means an urgent need to restore the forest, both to prevent loss of more farmland from erosion and to preserve water resources. At the same time, the growing urban populations creates more air pollution which restored forests also mitigate.

For this reason, our organization works for reforestation, with particular emphasis on catchment areas. The main issues we face are: (1) predation, especially from ants and cows; (2) the need to compensate for depleted poor quality soils with supplementary fertilization. We may also have to consider soils moisture which becomes increasing unpredictable with climate change; (3) the humans, carrying out the work in the place of nature that used to do it, have to decide what kind of forest they plan to see emerge: that means considering the aims of the reforestation - habit restoration, water conservation, income generation etc.; the wishes of the landowner, the availability of the seedlings they'll need, the tools and labor they can count on and (4) what the maintenance needs will be met for whatever it is finally decided upon to plant. Any assistance in meeting these challenges would be very welcome!

1287

Restoration of The Eastern Deciduous Forest of the United StatesJohn Taylor

Ball State University, Muncie, IN, USA

Abstract

Despite differences between the Atlantic Forest in Brazil and the Eastern Deciduous Forest in the United States, both areas have similar histories of severe deforestation and natural resource degradation, and both areas face hurdles to species conservation due to landscape fragmentation. Our two areas share some of the same challenges to reforestation and other restoration work. Key to success, before field work begins, is to identify desired outcomes, anticipate common obstacles, design a periodic monitoring program, and create plans to mitigate unexpected setbacks. Ultimately, collaboration with community partners and buy-in from stakeholders is essential to restoration efforts, both north and south of the equator.

1288

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1289

Terraware: a free and open-source forest management platformRishi Das

Terraformation, Honolulu, HI, USA

Abstract

Sourcing and monitoring native seedlings are critical challenges when implementing large-scale, biodiverse reforestation projects. Traditional methods for cataloging where these seedlings come from and what ultimately happens to them, such as spreadsheets or even pen and paper, fall short. They do not efficiently track seed origins, inventory, and viability--and we can't properly manage what we don't properly monitor. This talk introduces Terraware, a free, open-source tool designed to make managing seed collections, nurseries, and plantings more effective and scalable. With Terraware, forestry practitioners can track the entire lifecycle of a forest with one piece of software: from seed collection to nursery management and ultimately plant tracking. In this talk, we will explain how to use Terraware to monitor the success of seed banks, nurseries, and planting sites, ensuring reliable and transparent reforestation

1290

Assessing and Managing Gold Spotted Oak Borer Infestation in Bearpaw Reserve: A Collaborative Geospatial and Ecological Approach

Heather Williams¹, Jesus Solares²

¹Pomona College, Claremont, CA, USA. ²Wildlands Conservancy, Oak Glen, California, USA

Abstract

The Gold Spotted Oak Borer (*Agrilus auroguttatus*), an invasive beetle native to Arizona, has become a major threat to oak forests in Southern California. This study investigated the prevalence and spatial distribution of GSOB infestation in Bearpaw Reserve, a 600-acre mixed forest ecosystem in the San Bernardino Mountains. Over the course of multiple field visits, our team surveyed 636 California Black Oaks (*Quercus kelloggii*) for signs of infestation—including exit holes, epicormic sprouting, and bark staining—using Survey123 for mobile data collection. Geospatial analysis via ArcGIS Pro and statistical modeling in R Studio revealed an infestation rate of 8.33%, with a moderate correlation between tree size and severity ($r \approx 0.27$) but no significant relationship with elevation, slope, or aspect. The study also noted an unexpected host specificity to black oaks, despite the presence of live oaks in the reserve.

In addition to identifying hotspot zones near human activity, the project assessed potential management strategies, including solarization, mechanical grinding, trunk injections with Emamectin Benzoate and Imidacloprid, and biological control via parasitoid wasps (*Calosota elongata*, *Atanycolus simplex*). These findings underscore the urgency of early detection, firewood transport regulation, and adaptive, evidence-based management to protect California's oak forests from further decline.

1291

Weaving Roots: Community-Led Restoration and Conservation of Coastal Wetlands in the Yucatán Peninsula

Pamela Saavedra, Ana Mitzi García, Yoali Lopez, Javier Warman

WRI Mexico, Mexico City, Mexico City, Mexico

Abstract

The RE3CO initiative (Restoration and Conservation of Coastal Wetlands and Community Development) stands out as an emblematic example of inclusive, territory-based restoration. Led by WRI Mexico and the Small Grants Programme (SGP UNDP) this initiative is being implemented in partnership with ten coastal communities in Campeche, Oaxaca, Tabasco, and Yucatán, aiming to restore and conserve mangrove ecosystems through sustainable community-based management strategies and local economic development.

RE3CO promotes a holistic vision that links the ecological restoration of mangroves with the strengthening of sustainable livelihoods through productive activities such as beekeeping, ecotourism, artisanal fishing, and non-timber forest product use. Through the creation of the Network of Mangrove Restoring Communities of the Yucatán Peninsula, community governance has been consolidated to enable more effective and sustainable management of coastal-marine ecosystems in the region.

The project integrates gender and youth perspectives across its actions, highlighting and strengthening the role of women and young people in the protection and management of mangroves. It also contributes to increasing climate resilience within communities and reducing their vulnerability to climate-related events.

RE3CO demonstrates that effective and lasting restoration is only possible when communities are recognized as the main actors in ecosystem restoration, advancing global commitments through solutions built from the ground up.

1292

Hubs of expertise and data established through The Global Biodiversity Standard: Compiling and making available to practitioners 10,000 propagation protocols

Marcello De Vitis, Paul Smith, David Batholomew

Botanic Gardens Conservation International, United Kingdom

Abstract

Botanic Gardens Conservation International, the Society for Ecological Restoration, and a coalition of global biodiversity experts have developed The Global Biodiversity Standard (TGBS) to act as a robust framework to recognise and promote best practice in ecosystem restoration and certify positive impact on biodiversity. TGBS mobilises local biodiversity and restoration expertise to assess restoration projects through establishing regional hubs of expertise where local certified assessors and trainers carry out the TGBS field assessments for projects that apply for certification, train new assessors, and mentor local projects who seek for support and guidance into improving their impact on biodiversity. These hubs also serve as biodiversity data hubs so that comprehensive, accurate local and regional data is more readily available and accessible to TGBS biodiversity planners and monitors, and restoration advisors. In this context, TGBS aims to compile and make available to the broader community of restoration practitioners a list of at least 10,000 germination and propagation protocols for tree species native to highly biodiverse countries. To achieve this, we are collaborating with the TGBS hubs and relying on the broader BGCI's largest network of botanic gardens and conservation organizations worldwide. As we are halfway through this process, we will share the procedure applied to achieve this goal and the progress made so far.

1293

The Collaborations We Need for the Ocean We Want”: Advancing Global Marine Restoration Through Alliances, Standards, and Innovation

Sahar Stevenson-Jones

Society for Ecological Restoration, Europe, Brussels, Belgium

Abstract

*As a global partner to the UN Decade on Ecosystem Restoration, SER is working to elevate marine restoration to meet the urgency and complexity of ocean recovery. This symposium, convened by members of SER-Europe Marine Restoration Working Group, will explore how collaboration, standardisation, and innovation can accelerate **seascape-scale restoration** efforts globally.*

*The session begins with an introduction by **Roberto Danovaro**, outlining the role and aims of the Marine Restoration Working Group. **Rod Connolly** will then examine how **artificial intelligence** can support restoration by identifying critical data types, spatial scales, and applications for synthesis. **Angus Garbutt** will present on **mapping and remote sensing**, using the Saltmarsh Breakthrough as a case study in how coordinated monitoring can enable effective action.*

*A dynamic panel discussion will follow, bringing together representatives from existing marine alliances—World Seagrass Alliance / Global Seagrass Nursery Network, the Global Mangrove Alliance, the Ocean Rescue Alliance, the Kelp Forest Restoration Alliance and the Locally Managed Areas Network. Emerging marine alliances focused on salt marshes and the deep sea will also be represented. The panel will examine **three core enablers of seascape-scale restoration**:*

*The session will conclude with a **call to action**: to formally establish a **Global Marine Restoration Working Group**, led by SER, that can convene diverse stakeholders, harmonize standards, and facilitate coordination across habitat-specific alliances. By promoting shared knowledge systems, ecological connectivity, and unified monitoring frameworks, such a group would serve as a critical platform to drive marine ecosystem recovery at the scale and pace the planet requires.*

1295

Importance of Standards to the Global Biodiversity Framework

Bethanie Walder

Society for Ecological Restoration

Abstract

In 2022, at the Convention on Biological Diversity 15th Conference of the Parties, the Kunming-Montreal Global Biodiversity Framework was adopted. This Framework, similar to the Paris Climate Agreement for climate/carbon, provides a plan for not only arresting, but reversing biodiversity loss. Central to that plan is ecological restoration and rehabilitation. Target 2 (of 23 total Targets) on restoration, calls for bringing 30% of degraded terrestrial, inland waters, and coastal and marine ecosystems under effective restoration by 2030. In 2024, the Secretariat of the CBD, the Food and Agriculture Organization, and SER released a Guide for implementing the restoration target. Within the guide, effective restoration is defined as standards-based restoration underpinned by agreed principles that results in appropriately balanced sustainable net gain that benefits and enhances biodiversity, ecosystem integrity and human well-being. This guide recognizes that standards-based restoration can reduce risk and uncertainty in the planning, implementation, management, monitoring and maintenance of restoration projects, while also increasing the likelihood of achieving intended outcomes. As countries set their restoration Target goals and then work to plan and implement those projects, doing so following recognized restoration standards (e.g. the SER International Standards or the UN Decade on Ecosystem Restoration Standards of Practice) is a critical component to ensuring their activities count. The CBD, FAO, SER, and other partners, are also working together on the Target 2 Roadmap to support countries to achieve their Target 2 objectives, including through a series of capacity building workshops which will be implemented in late 2025 and 2026.

1296

The UN Decade on Ecosystem Restoration Standards of Practice

Cara Nelson^{1,2}, Jim Hallett^{1,3}, Andrea Romero-Montoya⁴

¹University of Montana, USA. ²IUCN, USA. ³Society for Ecological Restoration, USA. ⁴Food and Agriculture Organization

Abstract

In 2024, Food and Agriculture Organization (with the UN Decade on Ecosystem Restoration Best Practices Task Force), International Union for Conservation of Nature (IUCN), and SER, in collaboration with many other organizations, released the Standards of Practice to Guide the UN Decade on Ecosystem Restoration (SOPs). The SOPs are tiered to a suite of UN Decade specific principles that were developed earlier by a similar collaborative process. The SOPs were built on the foundation of other guidance and standards documents from across the world, and were developed collaboratively over a two-year period. They include more than 300 different recommended practices and cover activities across the entire Restorative Continuum. Like other emerging restoration guidance, they are intended to help improve all phases of restoration and thereby enhance the ultimate outcome of restorative activities for both people and nature. To improve their utility, given the broad suite of guidance provided, FAO, IUCN, and SER have continued to partner together to create additional standards tools, including an interactive web tool that will help users understand which standards specifically apply to their projects, and an e-learning tool to help expand understanding of the content in the standards. Not only are the SOPs important for supporting restoration in practice in all ecosystems and at all scales, they also underpin many UN Decade activities, including, e.g., the designation of UN Decade Flagship projects.

1297

Introducing of the Third Edition of the SER Standards

Marina Best¹, George D. Gann²

¹Society for Ecological Restoration. ²Society for Ecological Restoration (SER)

Abstract

First created as a living document in 2016 and updated to its second edition in 2019, the International Principles and Standards for the Practice of Ecological Restoration (the Standards) are now undergoing their third revision. Since the release of the second edition, several international incentives and targets for restoration and biodiversity have emerged, underscoring the global escalation of interest and investment in restoration. This growing recognition of ecological restoration as a means to address numerous global social-ecological challenges further emphasizes the need for a guiding framework to ensure effective and impactful practices. As a result, the Standards are being updated to incorporate new knowledge into best practice and to better support global restoration initiatives. Specifically, the third edition more deeply explores the existing eight principles that underpin ecological restoration, broadens the practical guidance, and updates different key components (e.g. the Restorative Continuum) to reflect new understandings of ecological restoration in order to enhance biodiversity, ecosystem integrity, and human health and wellbeing.

1298

Restoration standards to support communities where we operate

Jonathan Clarke

Microsoft

Abstract

Recognizing the value of ecological restoration, but also the significant variation in quality of projects, Microsoft partnered with SER to develop and implement a community driven, standards-based restoration program. Microsoft found that SER's standards complimented their own principles for effective community projects while also improving outcomes. This program is implemented on an entirely voluntary basis as a part of Microsoft's commitment to support communities they operate in and is not part of any compensatory environmental mitigation. Through this program, Microsoft was particularly interested in applying standards-based restoration as a mechanism to reduce risk and uncertainty and improve the potential ecological outcomes and return from our restoration interventions. Through this collaboration, Microsoft works with SER to identify a local partner in Microsoft-priority locations, and then SER provides the guidance and oversight to ensure that the proposed restoration project is standards-based. Once a project is approved, SER then works with the local partner to provide standards-based restoration capacity building and upskilling, including, e.g., training to help local partners develop their reference models and use the ecological recovery and social benefits wheels. Consistent with multiple Microsoft objectives, our investments not only support standards-based restoration for the specific project funded, but also future ecological restoration projects conducted by that local partner. SER ensures the project is monitored for at least two years post-implementation, and that post-implementation recovery/social benefits wheels are completed for comparison to the baseline wheels. Numerous projects have already been completed with outcomes largely exceeding Microsoft expectations.

1299

The role of standards in insurance products for restoration

Lourdes Robaina

SCOR

Abstract

At SCOR, we aim to optimize our impact on nature and people by contributing to the welfare, resilience, and sustainable development of society. So we launched the NatReCo Initiative to offer clients innovative re/insurance solutions supporting nature-positive projects that address societal challenges such as climate change, health and wellbeing, food and water security, sustainable agriculture, and natural catastrophe risk. Healthy ecosystems are essential but unfortunately ecosystems are rapidly declining with some at risk of collapse, impacting public health, society, economies, and financial assets. Although there is a greater awareness, it is apparent that more financing for ecological restoration projects is required. The NatReCo Initiative bridges the gap between the growing demand for ecological restoration and the availability of financing by reducing investment risk and enhancing project viability. The Solution insures the costs incurred to get an ecological restoration project back on track following an insured event. One of the principal features, developed in collaboration with the Society for Ecological Restoration, addresses project quality during onboarding to ensure alignment with ecological restoration standards and principles. This integration significantly improves the Ecological Restoration Insurance Solution by increasing both the likelihood of project completion and confidence in achieving desired outcomes. This in turn provides a greater prospect of impact, greater security of investment and capital efficiency, which will attract greater financing for ecological restoration projects. SCOR's NatReCo Initiative directly addresses the urgent need for ecological restoration financing and thus expands the industry's role in global sustainability efforts.

1300

The Global Biodiversity Standard: Assessing ecosystem restoration sites for impacts on biodiversity

Marcello De Vitis¹, Amarizni Mosyafiani², George D. Gann³, Paul Smith⁴, David C. Bartholomew⁴

¹Botanic Gardens Conservation International (BGCI). ²Society for Ecological Restoration.

³Society for Ecological Restoration (SER). ⁴Botanic Gardens Conservation International

Abstract

Ecosystem restoration projects hold a large potential to protect, enhance, and restore biodiversity. There is, however, a lack of standardized criteria to accurately measure and quantify biodiversity outcomes. As a result, many climate and biodiversity interventions, including tree planting, land management and agroforestry practices, fail to deliver positive outcomes and can inadvertently cause harm to ecosystems and local communities.

In response, Botanic Gardens Conservation International, the Society for Ecological Restoration, and a coalition of global biodiversity experts have developed The Global Biodiversity Standard (TGBS) to act as a robust framework to recognise and promote best practice in ecosystem restoration to deliver biodiversity outcomes. TGBS mobilises local biodiversity and restoration expertise to assess restoration projects through the use of remote sensing and field based surveys, ensuring a high level of rigour. What distinguishes TGBS from existing initiatives are its site-based assessment processes carried out by regional biodiversity hubs; real-time monitoring capabilities, which significantly enhance the accuracy of assessing biodiversity outcomes; and its meticulous assessment methodology, developed by scientists and global experts, which builds on: 1) The SER Standards and its Ecological Recovery Wheel and associated Five-star Scales, 2) IUCN protected area & other effective area-based conservation measures (OECMs) categories, and Red list of ecosystems, 3) SER Social Benefits Wheel, 4) Restoration Project Information Sharing Framework, and 5) UN Decade on Ecosystem Restoration's Standards of practice to guide ecosystem restoration.

1301

Introducing ecological restoration project certification

George D. Gann

Society for Ecological Restoration (SER)

Abstract

Myriad ecological restoration initiatives are currently underway around the world, with extensive guidelines and best practices already available to practitioners. However, validating that projects align with agreed upon restoration standards to achieve effective restoration is still a gap. This is true from two perspectives: 1) process – how projects are designed, implemented, and monitored; and 2) outcomes and impacts, such as recovering biodiversity, increasing ecosystem integrity, and delivering more ecosystem services to improve human well-being. To help close this gap, and together with several partners, the Society for Ecological Restoration (SER) has been developing prospective project assessment, verification, and certification systems for ecological restoration. We have integrated and aligned SER's experiences on several fronts, including co-developing standards for Mediterranean forest restoration with WWF-Spain and SER-Europe, co-leading the development of the methodology underpinning The Global Biodiversity Standard (TGBS), assisting in the development of a regeneration certification programme at the Union for Ethical Biobusiness (UEBT), and partnering with the reinsurance company SCOR to produce insurance for restoration projects that relies on verification of standard-based projects. With a global launch expected in 2026, SER Project Certification aims to improve restoration project outcomes, reduce risk and uncertainty for funders and managers, support key business sectors, and elevate and promote high-quality restoration projects across the world.

1302

Restoring Seascapes: Improved reporting of benefits through automated monitoring

Rod Connolly

Griffith University, SE Queensland, Australia

Abstract

Automated monitoring has transformed marine science and is now advancing seascape restoration. AI-driven data extraction from underwater drones and cameras enables safer, more frequent, and cost-effective monitoring across wider areas. These technologies identify, count, and size animals, and track their movements between connected habitats.

I showcase how these tools assess fisheries and biodiversity benefits. On restored shellfish reefs, extensive underwater camera arrays with automated processing now deliver more accurate estimates of fisheries enhancement. Notably, benefits extend beyond the reef footprint, with a five-fold increase in adjacent habitats. In restored mangroves, cameras revealed the rapid return of key fish species within a year. Automated tracking also detected subtle differences in animal use of forest edges versus interiors, guiding more effective restoration placement and design.

I will also highlight innovations enabling monitoring in turbid and deep waters. These advances in cost-efficiency and data reliability support global standards in biodiversity monitoring - critical for reporting ecosystem health. Ultimately, reliable and reproducible measures of biodiversity and productivity help quantify ecological, social, and financial gains, strengthening the business case for large-scale restoration.

1303

The UN 2030 Saltmarsh Breakthrough: accelerating restoration through global coordination of targets for expansion, policy and funding.

Angus Garbutt

UK Centre for Ecology & Hydrology (UKCEH), Bangor, Wales, United Kingdom

Abstract

The United Nations Breakthrough Agenda was launched at COP26 to help the world close the “collaboration gap” and accelerate international action on climate change.

The Breakthrough Agenda provides a framework for countries, businesses and civil society to join up and strengthen collaborative actions every year in major emitting sectors, and a service to support coalitions of leading public, private and public-private global initiatives to deliver those actions.

Since its launch, the Breakthrough Agenda has established an internationally-recognised, annual, COP-centred, collaborative process – backed by 61 countries covering over 80% of global GDP, and more than 150 international initiatives – that enhances global cooperation in seven major emitting sectors: power, road transport, steel, hydrogen, agriculture, buildings, and cement and concrete, covering over 60% of global emissions.

UN 2030 Saltmarsh Breakthrough will act as the vehicle for international coordination and investment in expansion of saltmarsh and play a key role in countries and territories achieving NetZero targets. The first step in the process was the launch of the first ‘State of the Worlds Saltmarshes’ report on World Saltmarshes Day, 11th June 2025 at the UN Oceans Conference, Nice, France. The next steps are to develop a Theory of Change to explain how action leads to change for climate, nature and people, Secure endorsement from Governments, set finance and delivery targets and convene a Global Saltmarsh Alliance.

1304

Monitoring at Scale: Tracking Impact Across the Andes with Acción Andina

Constantino Aucua Chutas

Accion Andina

Abstract

Acción Andina is a collaborative restoration initiative working to conserve and restore 1 million hectares of native Polylepis forests across the 7,000 km stretch of Andes—vital for the region’s water and economic security. Through a culturally grounded model rooted in traditional practices of Ayni and Minka (reciprocal community labor), the initiative has expanded rapidly over the past eight years. Today, it spans six countries, engages over 150 local and Indigenous communities, manages approximately 100 native plant nurseries, and has planted over 12 million native trees. Its impact is multifaceted: strengthening water security, mitigating climate change, stabilizing endangered species, and improving livelihoods across high-Andean communities.

To ensure accountability and strategic growth, Acción Andina has embedded robust monitoring systems to track ecological and social outcomes. It recently launched Restoration Scope, a new interactive monitoring platform that visualizes restoration progress across the region. Restoration Scope provides:

1305

Tó Nizhóní Ání (TNA) Watershed Project

Nicole Horseherder

Tó Nizhóní Ání

Abstract

Tó Nizhóní Ání (TNA) a Diné (Navajo) led 501 c3 is based on the Dziłjiiin (Black Mesa) Plateau, on the Navajo Nation. The TNA Watershed project is focused on addressing the 5 watersheds within the 6,250 square miles of the plateau. Because of its size, remoteness, and arid climate, the region faces significant ecological challenges. Water availability is of the utmost importance to the region. Additional challenges include impacts from extensive surface mining across 60,000 acres in the upper (elevation) headwaters of the plateau. Excessive use of the ground water by coal mining has left critical springs and seeps dry. Continuing draught and climate change have led to further degradation of watersheds.

The objective of this project is to restore, enhance, and/or establish habitats that benefit federal trust species, species of special concern, and other wildlife on Tribal Land in Arizona. Restoration efforts will focus on reducing erosion, improving vegetation cover and forage, and increasing surface water quantity and quality.

A crucial part of the watershed project is the development of a workforce from within the communities. The objective is to create an opportunity to complete watershed training hours as well as sustainability for the maintenance of the watersheds.

1306

Scaling-up Forest and Landscape Restoration in Africa

Christophe Besacier¹, Mamadou Diakhite²

¹Senior Forestry Officer – Coordinator on Forest and Landscape Restoration (FLR), Forestry Division – FAO, Rome, Italy. ²Principal Programme Officer- Climate Resilience AUDA-NEPAD, Johannesburg, South Africa

Abstract

In Africa, land degradation and forest loss, exacerbated by climate change and unsustainable land use, threaten land productivity, food and water security, and the resilience of communities. Degradation affects 65% of land on the continent, with annual losses estimated at 3–7% of gross domestic product for croplands alone. The AFR100 Initiative was launched in 2015 to address the many environmental, social, and economic challenges that affect the sustainable management of natural resources in Africa. To do this, Forest and Landscape Restoration (FLR) is being implemented by 34 countries to restore ecological functionality and enhance human-well-being on over 100 million hectares of degraded forests and lands by 2030. This approach requires multiple workstreams including: strengthening the enabling environment for community-level FLR and related value-added creation by improving the governance capacities of local communities and their engagement in policy and legal frameworks, and by making finance and investment mechanisms available, including blended finance solutions that mobilize private-sector capital; restoring degraded lands controlled by local communities by providing support to improve technical know-how, including, for example, on the use of high-quality biodiverse planting material; enhancing value-added innovation and business incubation, especially restoration-related value chains, as a means for creating green jobs and livelihoods that support women and youth restoration entrepreneurs; and increasing the capacity of local communities to monitor and communicate results and to share experiences and lessons learnt among themselves and with other communities. AFR100 implementation has resulted in increased political will and funding for restoration, and ownership by communities.

1308

Scaling Impact: The Role of the SER-Europe Marine Restoration Working Group in Advancing Collaborative Marine Ecosystem Recovery

Roberto Donavaro¹, Cristina Gambi¹, Joel Lindholm², Sahar Stevenson-Jones³

¹Polytechnic University of Marche, Ancona, Italy. ²UnderYtan, Åland Island, Finland. ³SER-Europe, Brussels, Belgium

Abstract

The European Union has launched the Nature Restoration Law, a new binding legal instrument to promote the restoration of degraded habitats according to a plan of targets from 2030 to 2050. This law might pave the way for similar policy decisions all over the world but requires well defined protocols and measurable and standardised approaches enabling the up scaling of ecological restoration, especially at sea.

The SER-Europe Marine Restoration Working Group (MRWG) will play a central role in accelerating marine ecosystem restoration through cross-sector collaboration and adaptive knowledge exchange. The MRWG brings together scientists, policymakers, industries, NGOs, and local communities to co-develop and refine restoration strategies grounded in the latest science and practical experience.

By promoting shared learning and harmonizing best practices, the Working Group directly supports implementation of ambitious targets under the EU Nature Restoration Law and contributes to broader global goals under the UN Decade on Ecosystem Restoration.

The presentation will discuss the main existing gaps and challenges highlighted by the MRWG work, will present the main achievements and the potential for restoration implementation, and its impact on restoration planning and policy. Emphasis will be placed on the importance of integrated, science-based, and stakeholder-informed approaches that reflect ecological, social, and governance dimensions. Although rooted in the European context, the MRWG's experience offers transferable insights that can inform and inspire marine restoration efforts globally.

The final aim is the formal establishment of a global Marine Restoration Working Group within SER, drawing on the expertise of marine habitat restoration all over the world and able to create specific alliances for different habitat/ecosystem types.

The hope is that SER will catalyze an international engagement in marine ecosystem restoration, foster new partnerships, and advance coordinated, scalable restoration strategies worldwide.

1310

Storied Landscapes: Cultivating urban corridors with the African diaspora in the Ghetto Leanne in Port-Au-Prince & Five Points in Denver

Lee Lee

Virtual Voices, Denver, USA

Abstract

In collaboration with members of the Atis Rezistans over four iterations of the Ghetto Biennial, we installed a food forest in the Ghetto Leanne redzone of Port-Au-Prince, Haiti. Beyond the challenge of working in an area so densely populated there is not enough bedspace for everyone to sleep at once, the tangled footpaths shift to lend a dynamic, almost living quality to the architecture of the neighborhood. Through guidance from elders of the community, we uncovered sacred land relationships as expressed through Vodou; a confluence of indigenous practice from West Africa with Taino, the original inhabitants of the island. We listened to oral histories that define traditional social structures practiced in the Lakou, which attempted to resist top-down impositions of land management established by the plantation system. Leaning into existent conservation practices of tending endemic medicinal herbs found in surprising corners throughout the neighborhood, we wove together a stacked food forest by harvesting seeds during shared meals, supporting the community garden nursery at SAKALA in the notoriously crime-ridden Cite Soleil, and by traveling to the Sadhana Forest wherein a small forest is already being revived in the bleak, refugee-ridden southeastern corner of the country.

This work is deeply informed by Grace Stiles, founder of the Stiles African American Heritage Center. After four decades as a Denver Public School teacher, Grace recognized the gaps in curriculum and dedicated her retirement to shifting narratives to include contributions of African Americans to American society. As the Stiles Center leadership transitions from Grace to her daughter, Kala Greene, we are working to bring Grace's ethos from the center into the public sphere through transforming urban 'hell strips' to Health Strips. Through funding by Denver's Arts & Venues and the People & Pollinators Action Network, we started by reviving the land directly around the Stiles Center. Denver has long been a Sanctuary City, so we highlight plant relationships with three entrepreneurs who arrived as pioneers; Aunt Clara Brown/medicine paths, Barney Ford/food trails, and Madam CJ Walker/beautification. The Underground Railroad and Quilts are other primary themes as we share plant relationships from African American perspectives, along with seeds; encouraging community members to harvest from these 'living seed libraries' to grow and share in their own spheres. Together with the Colorado Native Plant Society & the Colorado Council of Black Nurses, we are expanding these Health Strips through the historically Black neighborhood of Five Points, bordering the north edge of downtown Denver.

1311

The other side of the coin: Climate-smart Native Plants (C-SNaP)

Jenica Allen¹, Evelyn Beaury², Daniel Buonaiuto³, Matthew Fertakos¹, Thomas Nuhfer¹, Kabbera Singh¹, Bethany Bradley¹

¹University of Massachusetts Amherst, Amherst, MA, USA. ²New York Botanical Garden, Bronx, NY, USA. ³University of Maryland,, College Park, MD, USA

Abstract

Planting native species as part of ecological restoration, invasive species management, and ecological landscaping is regular practice, bringing ecological benefits not found with introduced or invasive plants. However, native plants are not keeping pace with climate change and are likely to experience continued range retraction without intervention. At the same time, invasive plants are gaining ground through natural and human-mediated dispersal, including ornamental plant nurseries that serve as potential sources of invasive plant spread with climate change. Ecological restoration and gardening provide opportunities for climate adaptation to help native plants shift their ranges. Here, we will introduce a new initiative, Climate-Smart Native Plants (C-SNaP), aimed at providing resources and tools to inform climate-smart native plant selection and use. The C-SNaP website houses free, research-based informational resources about native plants and climate change in the Northeastern United States as well as two interactive tools, one for selecting climate-smart garden plants and another to aid the selection of seed collection locations for climate-adjusted provenancing. C-SNaP is a project lead by the Northeast Regional Invasive Species and Climate Change Management Network (NE RISCC) to promote the use of native plants as alternatives to invasives.

1318

Rebuilding Islands, Restoring Flow: Texas Projects under Deepwater Horizon NRDA

Tara Whittle

Texas General Land Office, NRDA Biologist, TX, USA

Abstract

The 2010 Deepwater Horizon oil spill caused significant injuries to Gulf Coast natural resources and the services they provide. Through the Natural Resource Damage Assessment (NRDA) process, BP committed up to \$8.8 billion for restoration, of which approximately \$238 million was dedicated to Texas-specific projects. These efforts span thousands of miles of habitat, encompass numerous species, and require collaboration among multiple partners, public input, and transparency.

This presentation highlights two completed Texas NRDA projects: the creation of a five-acre bird rookery island to support colonial nesting water birds, and a landscape-scale hydrology project to restore natural tidal exchange and create habitat for fish, shellfish, and migratory waterfowl. Both required navigating complex technical, legal, and logistical challenges, and are now in the monitoring phase. Lessons learned from these efforts offer transferable insights for future restoration initiatives, while providing tangible examples of what it means to “make the public whole.

1319

National Seed Strategy: The Power of Partnerships and CoordinationPeggy Olwell

Retired from US Bureau of Land Management, USA

Abstract

Extreme weather events are increasing in frequency, intensity, and impact across the U.S. With hurricanes and flooding in the east and serious drought conditions and altered fire conditions in the west, ecological restoration practitioners must be able to respond quickly to landscape scale ecological changes with appropriate native seed resources. The National Seed Strategy was developed in 2015 by the Plant Conservation Alliance, a public private consortium of 12 public agencies and over 325 non-federal partners. In addition, a business plan for the National Seed Strategy was developed at the same time. Those two documents provided a plan for restoration of public and private lands at all scales and a coordinated approach for federal, tribal, state, and private entities to develop genetically appropriate plant materials. The National Seed Strategy guided coordination of efforts to achieve four major goals: Assess seed needs, Define research needs to support seed production, Develop decision tools for land managers, and Communicate the importance of healthy native plant communities both internally and externally. Over the past 10 years, we have seen significant progress in all four goals of the National Seed Strategy. Success on a national scale is being achieved through a coordinated nationwide network of networks, including a network of native seed collectors, a network of seed researchers, a network of farmers and growers, a network of nurseries and seed storage facilities, and a network of restoration ecologists who know how to put the right seed in the right place at the right time.

1320

Plant Conservation Alliance – A National Collaboration for Native Plants

Patricia De Angelis

U.S. Fish and Wildlife Service, USA

Abstract

Now in its thirtieth year, the Plant Conservation Alliance (PCA) has fostered enduring collaboration between federal agencies and nonfederal cooperators to address pressing botanical and ecological challenges. Through its National Framework for Progress—focusing on collaborative conservation, education, restoration, research and development, sustainability, and data sharing—PCA has readily embraced implementation of the National Seed Strategy by supporting research, information sharing, and on-the-ground efforts that build capacity and coordination across agencies, jurisdictions, and ecological scales. This collaboration strengthens regional coordination and accelerates the availability of genetically appropriate native plants, advancing large-scale restoration and addressing growing ecological and climate challenges.

1321

Improving the native seed supply pipeline in the US

Kayri Havens

Chicago Botanic Garden, Chicago, IL, USA

Abstract

A [2023 report](#) from the National Academies of Sciences, Engineering, and Medicine (NASEM) says the insufficient supply of seeds from native plants is a major barrier to ecological restoration and other revegetation projects across the United States. The report calls for concerted action to build a more robust native seed supply and industry, especially as climate change increases the possibility of extreme weather events and wildfires that often damage natural areas. In most instances of large-scale restoration, seed availability is quite limited and seed must be developed through a step-wise process of wild collection and increase. The foundation of any native seed supply chain is good quality, genetically-diverse and genetically-appropriate seed of native plants. Seeds of Success, the national native seed banking program, has been providing this foundation for over 20 years. We will discuss progress in seed collection goals, findings and recommendations from the NASEM report, and recent activities since the report release.

1322

Why establish a DOI National Interagency Seed and Restoration Center?

Tim Hoelzle

U.S. Department of the Interior, Office of Restoration and Damage Assessment, USA

Abstract

Due to large-scale disturbances such as wildfires, natural disasters, and spread of invasive species, land managers are attempting to scale-up revegetation efforts, which in turn increases the need for native plant material. In 2014, federal leadership within the PCA called for collaboration with nonfederal partners to develop a national strategy to meet the growing demand for native seed, culminating in the 2015 National Seed Strategy. In 2023, the NASEM released “An Assessment of Native Seed Needs and the Capacity for Their Supply: Final Report.” Their recommendations include creating a centralized hub for interagency coordination of native plant materials as well as ecoregional hubs to support local needs. To that end, in 2024, several U.S. Department of the Interior (DOI) bureaus and offices entered into a Memorandum of Understanding to establish the DOI National Interagency Seed and Restoration Center. While still in its infancy, the National Interagency Seed and Restoration Center aims to provide strategic planning and management to fulfill the vision of having “the right seed in the right place at the right time.”

Acceptance type: Oral**1****Investigating the Relative Pollutant Removal Efficiencies of Biochar, Mulch, Coconut Coir, and Native Soils of Hawaii within Stormwater BMPs**

Amanda Cording¹, Joanna Castillo²

¹Paul Smiths College, Paul Smiths, USA. ²University of Hawaii, Manoa, USA

Abstract

The City and County of Honolulu stormwater rules require that new and re-development projects greater than 1-acre implement Green Stormwater Infrastructure (GSI) techniques for stormwater retention and treatment. Although these practices are now widely established in other parts of the U.S., dissolved nutrients, heavy metals, and bacteria removal remain highly variable and heavily influenced by the engineered soil media characteristics and the presence or absence of an internal water storage zone. Given the unique characteristics of the heavily weathered tropical soils of Hawaii, data from the continental U.S. or other non-tropical climatic regions is not likely to predict the performance of GSI systems in Hawaii.

Using locally available materials (soil, compost, mulch, coconut coir, biochar, cinder, and stone), this study investigated the relative removal of soluble and insoluble nutrients, total suspended solids, dissolved heavy metals, and bacteria (i.e., *Escherichia coli* and Total coliforms) within bioretention and infiltration trench mesocosms. Nine soil blends were dosed with synthetic stormwater and effluent was compared after 4 increasing saturation durations (free drain, 24 hours, 6 days, and 15 days retention time).

Results indicate that dissolved nutrients, many heavy metals, total suspended solids, and bacteria decreased with increasing saturation condition, although the results varied by soil blend, with increasing organic matter (e.g., wood chip mulch and low nutrient biochar) enhancing nitrate and bacteria removal, respectively. Infiltration trenches were found to have a negligible effect on pollutant removal.

Co-engaging Social Information for Ecosystem Restoration: Evaluating Stakeholders' Perceptions

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Abstract

This study investigated perceptions of individuals employed on a large-scale, community-based ecosystem restoration program, Working for Ecosystems (WFE) Program of eThekweni Municipality (South Africa), restoration practitioners, academia and senior local government managers who facilitate the implementation of the program, through a series of qualitative interviews addressing a range of topics. First, we aimed to understand stakeholders' perceptions on who benefits from the program and the importance of integrating social data (local community dynamics) into restoration decision making, including site selection. Our findings reveal a diverse range of opinions about restoration interventions, with many beneficiaries expressing limited awareness of supporting information that guides restoration. However, interviewees expressed acceptance that, irrespective of who or where restoration is implemented, everyone does benefit.

Additionally, we explored the sustainability of these programs, highlighting perceived threats to restoration, such as funding instability and challenges to upscaling. Interviewees expressed a critical view of whether restoration efforts adequately prioritize soil health, recognized as a foundational element for ecosystem functionality.

Lastly, we assessed potential consequences for ecosystem services should all involved decide to withdraw from restoration. The consensus among interviewees indicated that such a withdrawal could lead to significant declines in ecosystem health and service provision. Interviewees concluded by saying, despite challenges facing restoration – we cannot give up! This study underscores the necessity of incorporating local knowledge and perspectives into restoration planning, ultimately contributing to more sustainable, community-focused ecological interventions. By fostering partnerships, restoration programs can better align with community needs and enhance their overall impact on ecosystem resilience.

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The Impacts of Ecosystem Restoration Interventions on Local Soils - Soil Ecosystem Services

BEKA NXELE^{1,2}, Judith Daniels³

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Abstract

Herbicide application is a widely used method for controlling invasive alien plants. However, its long-term impacts on soil health and ecosystem services remain poorly understood. This study aimed to evaluate the effects of herbicide application on key soil health indicators over several years, with a particular focus on soil ecosystem functions. The significance of ecosystem restoration—especially during the UN Decade of Ecosystem Restoration (2021-2030)—is largely underscored as critical in addressing food shortages amid a growing global human population.

Soil samples were collected from sites with a history of herbicide application, and specific soil health variables were measured, including soil texture, pH, soil organic matter (SOM), and microbial activity (MA). Emphasis was placed on nitrogen cycling, phosphorus availability, and carbon sequestration. The data were analyzed to assess the influence of herbicide application on essential ecosystem functions, such as soil stability, chemical balance, pH regulation, plant productivity, and biodiversity.

Preliminary findings suggest that prolonged herbicide application may alter microbial activity and disrupt nutrient cycling, leading to increased nutrient leaching and reduced availability. These changes could impair soil ecosystem functions, ultimately affecting soil health and resilience thus reducing the ability of the land to support indigenous biodiversity.

These insights are vital for advancing sustainable land management practices that effectively manage invasive species while safeguarding essential soil ecosystem services. By integrating these findings, we can enhance strategies and policies to protect soil health and address pressing environmental challenges.

Ko te Pūkākī:2040 an indigenous, long-term plan for regenerating environment, culture and place (Ngāti Whātua Ōrākei, Tāmaki Makaurau, Aotearoa)

Jessica Hiscox

Ngāti Whātua Ōrākei, Auckland, New Zealand

Abstract

Ngāti Whātua Ōrākei are the Indigenous people of Tāmaki/central Auckland, the largest and most populated city in Aotearoa/New Zealand. Ten minutes from the city centre, Tumutumuwhenua (our traditional carved house) stands proudly within our thriving papakāinga (tribal village) upon the whenua (land) we know as the Whatu Toto (heart's blood). On our whenua (~90ha) we are leading a unique regeneration programme to establish a thriving, resilient environment which has our people, practices and culture at its heart. We have been undertaking restoration mahi (work) since mid-2000's when we started to receive our stolen whenua back. Building on this foundation we have recently developed and are actively implementing our intergenerational environmental regeneration plan Ko Te Pūkākī:2040. It draws from, and builds upon, the traditions and knowing of place left to us from our pasts, both distant and recent. It provides us with a clear and strategic vision for our whenua, based on a set of mā tāpono (principles) that guide all actions within the Plan. Geo-spatial and project management technologies have been meshed with existing knowledge to map out methodologies, resourcing and timelines we will follow to maximise regenerative effect of our mahi, over time. We will talk to this plan, its creation, its contents, and the lessons we have learnt on our path. In sharing our plan, we will discuss the importance of being the best ancestors we can be for our future generations.

Edge Feathering is an Effective Tool for Enhancing Light Heterogeneity, Understory Plant Diversity, and Species Richness in Forest-Meadow Ecotones

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Abstract

Ecotones, the transitional zones between distinct habitats, are vital for ecosystem functioning, increasing habitat connectivity. Despite their ecological importance, ecotones are poorly understood, and their management is often inadequate. Traditional practices frequently create abrupt boundaries, leading to stressful conditions for organisms. To address this challenge, an **underutilized** land management technique called 'edge feathering', which involves gradual thinning of the canopy, has been introduced. However, its impact on understory vegetation, particularly in temperate forest-meadow ecotones, remains unclear. This study, conducted at Holden Arboretum in Kirtland, Ohio, investigated the effects of edge feathering on light availability and understory plant diversity. Treatments included an edge feathered area and an unmanaged control area. Within each treatment, three transects with 6 plots each were established in a gradient from the forest interior toward the meadow. We calculated the **Coefficient of Variation (CV)** in light availability as light heterogeneity, and plant diversity indices at the plot level. The results showed that edge feathering increased light heterogeneity by more than **2.5-fold** ($p=0.0001957$), species richness by twofold ($p < 0.0001$), and both Shannon's and Simpson's diversity indices by approximately 1.5-fold ($p < 0.05$) compared to the control. These findings **further** demonstrate that higher light heterogeneity is strongly associated with greater understory plant diversity. These effects were observed within just 3.5 years of implementation, underscoring the rapid and measurable benefits of edge feathering. Edge feathering is a practical and cost-effective strategy for enhancing biodiversity, addressing the challenges land managers face with limited budgets and personnel.

The creation of the Aquetong Spring Park through a breach of the Aquetong Lake dam and subsequent restoration of Aquetong Creek.

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Abstract

The Aquetong Creek restoration site is located in Solebury Township, Bucks County, PA, at the location of the former 15-acre (6.1 hectares) Aquetong Lake. The main source of Aquetong Creek is Ingham Spring, an artesian spring formed at the contact of two geologic formations that flows at a rate of approximately 2,000 gallons (7,570 liters) per minute. Aquetong Creek flows approximately 2.5 miles (4 km) from Ingham Spring to its mouth at the Delaware River.

A 2004 study found that the impoundment was affecting downstream water quality, particularly water temperature. The dam was breached with the goal of reducing thermal impacts on the creek and supporting a high-quality cold-water fishery, while also avoiding dam maintenance. With the dam breached and the lake drained, a meandering channel formed through the exposed former lakebed, connecting the upper and lower reaches of Aquetong Creek.

A degree of stewardship was necessary to guide the early developmental stages of the former impoundment to not only enhance the establishment of desirable vegetation, but to foster the development of a productive surface water feature to maintain its native brook trout (*Salvelinus fontinalis*). The Aquetong Spring project is a truly unique restoration project where the removal of the dam will enhance brook trout and surrounding wetland habitat, address some associated stormwater issues and provide local / regional educational awareness. Importantly, this restoration project is integrated into a very popular public, passive recreational park.

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Restoring Mangroves, Reversing the Damage – A Collaborative Approach

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Abstract

Since its founding in 1992, Mangrove Action Project (MAP) has been at the forefront of global efforts to conserve and restore our planet's diminishing mangrove forests. This presentation reflects on over three decades of global collaboration in mangrove conservation, exploring the essential role of partnerships in achieving effective and lasting outcomes. Working collaboratively with NGOs, mangrove scientists, local communities, educators, media and government officials, MAP has forged an effective global network that promotes combined Education and Community-Based Ecological Mangrove Restoration (CBEMR) as "best practices" approaches to conservation and restoration of mangroves today.

Since its inception, collaboration has been the centerpiece of MAPs ongoing efforts. In the aftermath of the 2004 Indian Ocean tsunami, global interest in mangrove restoration surged, resulting in the creation of several international alliances. MAP has joined several of these alliances and networks such as Mangroves For the Future, the Global Mangrove Alliance, Save Our Mangroves Now, and the IUCN's Mangrove Specialist Group. MAP has also found it imperative to help support community-based NGO alliances in the Global South, working directly with communities to bolster conservation efforts in mangrove nations where it is most relevant.

Sharing resources, skills and experiences with a wide range of stakeholders is an imperative for long-term, positive results. This presentation will underscore the importance of these partnerships in addressing ongoing challenges and ensuring the resilience of mangrove ecosystems worldwide.

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Telepresence technology for protected areas management: limitless boundaries for endless possibilities to allow the needed scientific knowledge expansion.

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Abstract

Nowadays physical boundaries are no longer a true obstacle. Even the most remote sides of the Ocean are accessible to humans and can be investigated in a never seen before detail level. This is positive in terms of knowledge advancements, but it also means a higher risk for marine ecosystems conservation if not properly addressed.

For this reason, even the international scientific community of restoration experts, protected areas managers, environmental scientists and educators require to advance their skills and networking potential to be effectively connected and cope with the ongoing planetary challenges.

Telepresence technology is an asset allowing people to interact and collaborate as if they were present in the same place. When applied to ocean exploration, telepresence technology allows a potentially unlimited number of scientists onshore to participate in at-sea ocean exploration, adding their expertise to delicate and economically demanding missions. Along with providing inputs from a broad range of scientists coming from different expertise areas, telepresence allows the public to observe and follow expeditions in real-time getting them closer to the whole discovery process.

This contribution is the outcome of six telepresence-supported expeditions performed between 2023 and 2024, contributing to habitat mapping and data collection, aimed at supporting the decision-making process in the protected areas falling within the U.S. Economic Exclusive Zone. The expedition programs were implemented considering both the experts inputs and the indigenous people local ecological knowledge planning phase and the operations at sea, engaging them also as onboard crew members.

Native Mycorrhizal Fungi as a Nature-Based Solution for Tallgrass Prairie Restoration: Long-Term Impacts on Succession, Diversity, Invertebrates, and Non-Natives

Elizabeth Koziol

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Abstract

Restoring diverse, functional plant communities is challenging, especially in tallgrass prairies. Soil microorganisms, particularly arbuscular mycorrhizal (AM) fungi, play a critical role in prairie restoration. Our research demonstrates that native AM fungi significantly enhance prairie plant growth and establishment compared to fungi from disturbed soils or commercial sources. However, optimal distribution methods and long-term impacts remain unclear. To address these gaps, we revisited two prairie restorations seven and eight years after applying native AM fungal amendments.

In the first study, plots were inoculated with whole soil, native AM fungi, or left non-inoculated. Inocula was installed on the roots of transplanted seedlings. Native mycorrhizae and whole soil equally improved late successional seedling establishment, reduced non-native plants, and increased plant diversity. In year eight, these inoculations influenced invertebrate diversity through their impact on plant communities.

The second study examined an inoculation density gradient of native AM fungi, from 0 to 8192 kg/hectare. Inocula and seed were surface broadcast, and the top 4 inches of each plot was tilled. Positive effects on native plant diversity and reduced non-native species persisted and increased over seven years. Even low inoculation densities reduced non-native plants by year four. Notably, native AM fungi enhanced seed spread into neighboring unseeded edge plots, increasing native diversity and suppressing non-native species.

In summary, incorporating native AM fungi into restoration practices improves native plant establishment, limits invasive species, and fosters long-term ecological resilience. These findings highlight the potential of native microbiome amendments to amplify restoration success over time.

Can *Acacia mangium* plantations develop properties of remnant forests?

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University of the Sunshine Coast, Sippy Downs, Australia

Abstract

Tropical forests, essential for our planet's health by supporting high biodiversity, nutrient cycling, and storing carbon, are threatened by deforestation. Awareness of the need for forest services has increased over the years, leading to the extensive establishment of plantations on cleared lands. In the tropics, this was often accomplished by planting *Acacia mangium* for its ability to cope with harsh conditions, grow rapidly, and provide ecosystem services. Economic and social reasons commonly led to the abandonment of these plantations, leaving unanswered questions about their long-term ecological impact. To fill this gap, our research focused on understanding *A. mangium* plantation development by considering multiple ecosystem parameters. We studied above and below-ground recovery variables (tree species diversity, soil microbial community, soil fertility, and above-ground biomass) in minimally managed *A. mangium* plantations of different ages (2, 10, and 24 years) in the Philippines. Adopting a space-for-time approach and machine learning techniques we studied the evolution of these plantations in comparison to nearby degraded grasslands and remnant forests as negative and positive reference states, respectively. Our results show that *A. mangium* is increasingly being replaced by native species, with species (composition) and diversity approaching that of the remnant forest. Microbial communities progressively resemble the ones of the remnant forests over the development of the plantations, as the soil fertility and above-ground biomass. Through machine learning analysis we defined clusters separating the early stages of plantation development from the latest, highlighting a positive convergence of ecosystem characteristics towards those of remnant forests.

Nature Journaling: Bridging Art, Community, and Scientific Observation

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Abstract

“Plant blindness,” or indifference to plants in everyday life, is a real phenomenon. The consequences of this indifference can be disastrous for the environment. An appeal to that which makes us human—that is, our unique ability to create and appreciate art—can forge connections between people and plants. Nature Journaling, the centuries-old practice combining visual arts and written word to log observations of the natural world, is a medium that awakens attention to detail and holds great potential for community engagement in restoration. In this session, learn about Naples Botanical Garden’s (NBG) Nature Journaling program, including content and outcomes relevant to reconnection to nature.

Piloted in 2018 through a creative aging program grant for skill-based art series for older adults, NBG’s program now has more than 200 alumni throughout the United States and Caribbean. No prior art experience is necessary as a teaching artist leads adult students through curriculum on watercolor pencil technique, color theory, light and texture, plant anatomy, and more. Deliberate social engagement built into the program connects students to one another; culminating exhibits give students the opportunity to share their experience with a wider audience. Originally an in-person program, Nature Journaling transitioned to a virtual format in 2020.

Homework assignments throughout the course encourage students to explore nature near them—and it is during these self-guided explorations that students invariably document changes they observe in their local environments. From recovery after prescribed fire to restoration-in-progress, nature is an everchanging muse, once attention to it is awakened.

Fire Adapted Species are Not Impervious to Prescribed Fire: Restoration Lessons Learned with Longleaf Pine

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Abstract

Frequent, low intensity surface fire is critical for the restoration and maintenance of woodland ecosystems in the southeastern United States. Longleaf pine (*Pinus palustris* Mill.) plays a key role in supporting woodland flammability through its contribution of resinous needles and cones to the fuelbed and open canopy structure promoting fuel desiccation. Consequently, limiting longleaf pine mortality is emphasized in woodland restoration burns. While longleaf pine possesses several traits that provide a degree of fire resistance, it is not impervious to fire and often experiences high post-fire mortality under certain conditions at different life stages. Here, we synthesize the results of several prescribed burning experiments and identify conditions that contribute to longleaf pine mortality in prescribed fire. Additionally, we present mechanistic evidence demonstrating how longleaf pine is killed or survives and recovers post-burn. Finally, we provide recommendations for improving conditions that threaten longleaf pine survival in prescribed fire. While focused on longleaf pine, many of the topics discussed are germane to other fire-maintained ecosystems where structural retention is desired.

Accounting for biodiversity at onshore windfarms in Ireland.

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Abstract

To ensure that climate action and biodiversity obligations are met, the rapid growth of the renewable energy industry to combat climate change must be accompanied by tools to monitor, protect, and restore biodiversity surrounding renewable energy infrastructures. There is, however, a lack of understanding on the best approach to implement biodiversity action around renewable energy infrastructure that is supported by both scientific evidence and the industry. We are using a transdisciplinary approach to develop biodiversity action plans, incorporating smart-environmental monitoring, ecosystem accounting and stakeholder participation. We use the United Nations System of Environmental Economic Accounting (SEEA–EA) framework to create biodiversity-themed ecosystem extent and condition accounts for onshore windfarms in Ireland. These accounts highlight the biodiversity potential of some habitats, particularly peatland, marsh, and freshwater systems. The spatially explicit methodology also clearly identifies locations where improved management could enhance biodiversity. From semi-structured interviews with stakeholders from the wind energy industry, we collected perceived cost, feasibility, and biodiversity benefit of biodiversity actions. Raising awareness about biodiversity, biodiversity-positive management, and restoration were ranked as the most cost-effective actions. We combined both datasets to create specific and tailored biodiversity action plans for nine individual windfarms and for the wind energy industry in Ireland. Implementation of restoration is supported by acoustic models for vulnerable species, such as bats. We present an industry-inclusive approach to further our understanding of biodiversity surrounding windfarms, and to support nature restoration. These biodiversity tools ensure nature is accounted for across a sector which is critical for climate change mitigation.

Projecting population dynamics and range expansion of reintroduced wild boar in Scotland using Agent-Based Modelling

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Abstract

The number of species reintroductions is increasing globally; restoring wildlife populations whilst enhancing ecosystem functioning. However, species reintroductions can be unpredictable with uncertain outcomes which risks undermining reintroduction efforts, causing conflict between stakeholders, and harming local communities. Despite this, current reintroduction science is focussed on short-term population establishment, with little long-term modelling of reintroduced species' population dynamics and range expansion. In this study, we develop an agent-based model (ABM) to simulate the controversial reintroduction of wild boar in Scotland. The ABM uses probabilistic birth, death, and movement rules from the literature to stochastically simulate boar population dynamics from their initial release to 50 years in the future. Model evaluation demonstrates that the ABM behaves in predictable and explainable ways, reproduces real wild boar behaviour, and simulates boar populations which align with the current spatial distribution of sightings in Scotland. Furthermore, the ABM suggests that current boar populations will continue to grow and expand over the next 50 years, with the ABM confirming the existence and long-term persistence of four suspected boar populations. Our work highlights that, without external intervention, Scotland's boar populations are likely viable and will continue to persist and grow. As a keystone species, understanding their long-term population dynamics and range expansion of wild boar is important to help ensure that boar populations and associated ecosystem functions are maintained whilst potential negative impacts on local communities can be predicted and mitigated.

RESTORATION OF DEGRADED MANGROVE SHORELINE IMPACTED BY PETROLEUM HYDROCARBON IN OGOILAND NIGER DELTA NIGERIA.

Izuchukwu Uche, Nenibarini Zabbey, Damian Aguiyi

Hydrocarbon Pollution Remediation Project, Port Harcourt, Rivers State, Nigeria

Abstract

Mangrove degradation is a global challenge; in Africa, specifically in Nigeria, crude oil spills are one of the primary causes of mangrove degradation. In Ogoniland Niger Delta, Nigeria, oil spills have degraded over 4000 hectares of mangrove shoreline, leading to loss of biodiversity, livelihood and proliferation of invasive species like Nipa palm in mangrove ecosystem. Efforts to cleanup and restore degraded mangroves have intensified as over 900 hectares of shoreline have been remediated and verified using shoreline cleanup assessment technique (SCAT) and chemical sampling of mangrove sediments to determine the total petroleum hydrocarbon (TPH) levels in the soil. Assisted mangrove planting is also being used to restore degraded mangroves, as studies have shown that if the degraded mangroves are left after remediation without planting, it will take over ten decades to recover the degraded mangroves fully. Mangrove planting has commenced as over 500 hectares of degraded mangroves have been replanted. Ground truthing, high-powered drones and satellite imagery are being used to monitor the planted mangroves. Over 1,160,000 mangrove seedlings have been planted, and all three major species of mangroves in the region are currently being used for planting. Removal of the invasive Nipa palm plant has also been done in all areas where planting has occurred, and the survival of seedlings after one month is at 96%, with an average height and leave count of 60 cm and 12, respectively. Restoration (cleanup, planting and monitoring) is ongoing, and signs of ecosystem recovery can be visibly seen in restored areas.

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Fostering Equity in Coastal Restoration: The Impact of the Your Shores Program

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Phillip & Patricia Frost Museum of Science, Miami, USA

Abstract

Your Shores is a collaborative project at the Phillip and Patricia Frost Museum of Science in Miami, Florida, integrating efforts from Museum Volunteers for the Environment, Upward Bound Math and Science, and the museum's conservation department. Designed to foster equity and inclusion in marine and coastal science, the program engages high school students from under-served communities in Miami-Dade County by removing financial and logistical barriers to their participation. Participants receive stipends and gain practical skills through hands-on experiences in scuba diving, biodiversity monitoring, and coastal restoration, while also earning service hours, certifications, and research experience to support their academic and career aspirations. The first cohort of seven students achieved notable accomplishments, completing 11 scuba dives and enhancing coastal ecosystems by planting over 1,000 native plants and removing over 200 gallons of nuisance and invasive species from endangered plant habitats. Five of these students are now pursuing higher education degrees in marine and environmental science. In its second year, the Your Shores program expanded its impact with a cohort of nine students. Year 2 participants are building on the success of the first cohort, contributing to restoration and habitat enhancement efforts across coral reef, mangrove, and dune ecosystems. The program bridges generations by fostering collaboration between experienced conservation professionals, community volunteers, and youth participants, creating pathways for sustainable restoration outcomes. By combining volunteer-driven restoration with youth access to marine science resources, Your Shores exemplifies how collaborative, community-based programs strengthen social and ecological resilience while empowering the next generation of conservation leaders.

Wetland restoration: Predicting vegetation trajectories over 25 years

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Abstract

The global loss of wetlands has made their conservation a political priority and led to a multiplication of restoration programs. However, the lack of long-term monitoring limits our understanding of the processes that influence the vegetation composition of restored wetlands and our ability to predict outcomes over decades. Hydrologic regime, a key driver of wetland vegetation composition, and planting density, a known success factor in plant community restoration, should allow us to predict restoration outcomes.

Using correlation coefficients and generalized additive models, we assessed the role of planting density and hydrologic similarity in achieving and predicting restored vegetation similarity to reference plant communities over 25 years post-restoration in 12 wetlands in Mountain Village, Colorado.

We found a significant positive correlation between hydrologic similarity and vegetation similarity, peaking at 15 years post-restoration ($\rho = 0.61$). Similarly, planting density was positively correlated with vegetation similarity, peaking at 5 years post-restoration ($\rho = 0.75$). The similarity of restored vegetation to the reference can be predicted using hydrological similarity and planting density. Models combining these two variables outperformed single-variable models. However, model accuracy decreased after 25 years, making predictions inaccurate over two decades.

Hydrologic similarity to a reference, combined with appropriate planting densities, can serve as reliable predictors of restored vegetation convergence to the reference over a period of at least two decades. These findings provide valuable insights for managers, enabling them to assess the risk of failure prior to initiating wetland restoration and guiding them to improve the design of their restoration programs.

Reversing degradation in the Greater Maasai Mara, Kenya, by adopting biocultural approaches to community-led restoration.

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Centre for Ecosystem Restoration, Limuru, Kenya

Abstract

The intricate connections between biodiversity and cultural practices are increasingly threatened by environmental and socio-economic pressures. Kenya's diverse cultural and ecological landscapes offer a unique context for exploring biocultural restoration challenges and opportunities. The Maasai community in the Greater Maasai Mara ecosystem exemplifies Traditional Ecological Knowledge (TEK) rooted in sustainable land and resource use. Ethnobotanical data were collected through semi-structured interviews with key informants (n=20) and two focus groups (n=30). The descriptive statistical analysis summarized the data, and functional traits of frequently used species were obtained using the GIFT database. A total of 234 plant species were documented, contributing 1,850 use reports (URs) across 13 categories. The main categories were medicinal (60%), food (26%), and craftwork (21%). Over half (52.6%) of the use reports came from 27 species, including 20 trees (mean height: 11.8 m), 5 shrubs (5.5 m), 1 climber (10 m), and 1 herb (1 m). Of these, 18 species were evergreen, 8 deciduous, and 1 variable. Trees were the most culturally significant, with *Olea europaea* recording 158 URs across 11 use categories and a cultural importance index of 6.87, followed by *Tarchonanthus camphoratus* with 73 URs in 11 categories. While 71.4% of respondents reported landscape improvements due to restoration efforts, overgrazing, land fragmentation, and urban expansion threaten key tree populations. These findings highlight the importance of specific species in Maasai cultural practices and offer valuable insights for ongoing biocultural restoration efforts.

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Mangrove Forests as Refugia for Corals: A Literature Review on Climate Change Resilience and Restoration Benefits

Ali Egging

Mangrove Action Project, Seattle, WA, USA

Abstract

Mangrove forests are globally recognized as vital ecosystems, providing a multitude of ecological and societal benefits. Their restoration not only enhances carbon sequestration, coastal protection, and fisheries support but also strengthens biodiversity and climate resilience. For local communities, restored mangroves serve as natural buffers against extreme weather events, safeguard livelihoods through sustainable fisheries, and offer cultural and recreational value.

Beyond these well-established benefits, research highlights a novel role for mangroves as refugia for corals under climate change stress. Unique environmental conditions in mangrove habitats—such as shaded canopies, fluctuating salinities, and attenuated water temperatures—can mitigate thermal stress and ocean acidification, enabling corals to survive and even thrive in otherwise challenging conditions. Diverse coral communities documented in mangrove systems suggest these habitats provide an overlooked but critical lifeline for coral survival as traditional reef ecosystems degrade.

This presentation synthesizes practical restoration work from Mangrove Action Project (MAP) and findings from a comprehensive literature review, highlighting the connection between mangrove restoration and coral resilience. It explores case studies demonstrating how restored mangroves can amplify their ecological benefits by supporting diverse marine and terrestrial species, while also serving as an adaptive strategy for coral conservation in the face of global climate challenges.

Participants will learn about the benefits of mangrove restoration for ecosystems and communities, the integration of mangrove and coral conservation to enhance coastal resilience, and practical advice on adapting community-based mangrove restoration to support coral restoration.

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Spontaneous succession as a restoration tool – from local to global scaleKarel Prach

Ceske Budejovice

Abstract

Spontaneous succession is gradually becoming an important and inexpensive tool for ecological restoration. Restoration projects for specific disturbed sites must first of all take into account site factors and the character of the surrounding landscape, which can be determined in considerable detail. Accuracy in quantification of these factors decreases with increasing spatial scale, but on the other hand conclusions based on various broader meta-analyses are more generalisable. At a global scale, the following factors have emerged as decisive: disturbance type, macroclimate, and presence of species and alien species in the surroundings. Latitude can be used as an easily identifiable proxy factor. The conclusions are based on more than 500 studies worldwide. The accuracy of predicting successional changes at the level of participation of particular species decreases with increasing spatial scale, at larger scales there is more advantageous to predict successional changes at the level of life forms. The results of evaluation of restoration success exploiting spontaneous succession from particular sites to global scales will be presented using particular studies and their meta-analyses.

Effectiveness of Runnels for Improvement of Salt Marsh Habitat Across New England

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Abstract

The decline of vegetated salt marsh habitat through the expansion of shallow water pools and pannes has been widespread throughout the Northeast as a consequence of sea level rise interacting with abandoned historic agriculture infrastructure. Over the past decade, land managers and practitioners have removed standing water from the marsh platform and lowered the groundwater elevation through the creation of shallow swales, or runnels, that connect into nearby ditches or creeks. The long-term restoration goal of runnels is re-vegetation of the marsh platform by restoring tidal hydrology and reducing stressful biogeochemical conditions in the sediment (e.g., high anoxia and sulfide conditions). Despite early documented success in site-specific projects, the applicability of the technique has not been fully evaluated across a host of site and environmental conditions. We conducted a multi-state study in New England to assess the impact on hydrology, vegetation, and avian community from drainage enhancement across 21 projects. Generally, metrics improved as flooding duration and groundwater elevations decreased over the first three years post-restoration. Substantial re-vegetation required at least 6 – 9 years as *Spartina alterniflora* re-colonized pannes and pools compared to continued declines in non-restored marshes. The Saltmarsh Sparrow (*Ammodramus caudacutus*) density remained unchanged across restored marshes; preferred high marsh vegetation will require longer timeframes to replace *S. alterniflora*. We additionally documented the need for annual inspection of the runnels to ensure the swales are not clogged with sediment and vegetation as vegetation cover regressed at several sites

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Design, Implementation, and Management of a Large-scale Low-tech Process-based Restoration Site in the Colorado Western Slope

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¹National Forest Foundation. ²Westervelt Ecological Services, LLC

Abstract

From 2021 to 2024, the National Forest Foundation designed, planned, and permitted the Soda Creek Mitigation Site, the inaugural Colorado Western Slope In-lieu Fee Program Site in Summit County, Colorado. This represents one of the largest low-tech process-based (LTPBR) wetland mitigation sites in the United States. Design efforts comprised robust hydraulic and hydrologic modeling considering the historical valley wetland footprint, velocities and sheer stress, and an upstream reference reach with beavers (*Castor canadensis*). Because of the numerous public and private stakeholders, design efforts utilized on this site go above and beyond typical LTPBR site planning efforts. Site construction occurred in the summer of 2024. It included the installation of over 150 LTPBR installations (i.e., beaver dam analogs and post-assisted log structures) along Soda Creek and a tributary of Soda Creek, excavation and grading of high spots established by ranching and agricultural activities, seeding, and willow staking throughout the approximate 295-acre valley. Site construction included field-fitting structures to existing pools, addressing channel incision and scour, and placing newly established pools to attract beaver colonization. Mitigation standards require a five-year interim maintenance and performance period to demonstrate site success. The colonization of beavers within the restoration site will greatly influence site management and maintenance activities. This presentation will discuss lessons learned in planning/permitting, constructing, and managing this large glacial valley LTPBR restoration site in the presence or absence of beavers.

Opportunities to Improve Human, Animal, and Ecosystem Health by Incorporating Fire- integrated One Health into Ecological Restoration

Samuel Gilvarg¹, Brian Leydet², Martin Dovciak², Alistair Smith^{3,4}, Debra Miller^{5,6}, Shirley Luckhart^{7,8}, Marcus Lashley⁹, Andrew Vander Yacht¹

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Abstract

The reintroduction of historical fire regimes can assist with the restoration of disturbance dependent ecosystems throughout the globe. However, socioeconomic obstacles often impede the ability of restoration ecologists and land managers to successfully implement fire management at scale. The One Health approach offers a potential way to transcend such challenges by reframing the objectives and goals of fire management programs to include a more holistic definition of health – one that explicitly includes benefits that such management can afford to humans, animals, and plants, in addition to ecosystems. Concurrently, the scale and reach of the health benefits that can be realized via fire-integrated One Health have the opportunity to be magnified by being incorporated into ecological restoration programs. This presentation will expound upon the reciprocal benefits that can be realized by incorporating fire- integrated One Health into ecological restoration by highlighting specific examples that illustrate this principle – such as a potential mediation of tickborne disease risk in humans and animals by restoring disturbance dependent ecosystems with prescribed fire. This presentation will also consider an applied framework that can assist land managers and restoration ecologists with the process of incorporating fire- integrated One Health into their programs through the restoration of historical fire regimes.

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Our Once and Future Wetlands: Art, Ecology and Engineering

Lindsay Olson

Oak Park, IL. Chicago, IL (The Wetlands Initiative is in Chicago)

Abstract

All around the world, wetlands support a tremendous diversity of plants and wildlife. These ecosystems also improve water quality, reduce erosion, mitigate flood damage, and sequester carbon dioxide. Yet, they continue to be degraded and drained at an alarming rate. Restoring these valuable ecosystems is the work of The Wetlands Initiative (TWI). As their first artist in residence, I balance my training as a fine artist with what I learn in the field from the TWI staff to create textile art that helps explain these hardworking habitats. From “smart wetlands” designed for working farm fields, to reclaiming degraded industrial lands, to restoring conserved lands formerly used for a century of row-crop landscapes back to globally-significant biodiversity intensive agriculture, my textile work highlights the innovative restoration work of TWI.

I drew inspiration from the fresh floral collars buried in the tomb of King Tut that have survived for thousands of years. These funeral collars were symbols of life, death, and rebirth, echoing how humans have forever interrupted the natural processes of wetlands. Restoration reverses some of the damage we have caused and returns these parcels of land to beautiful, functional wetlands again.

My wetland-inspired textile pieces celebrate restoration successes, offering an intricate and informative look inside the ecology and engineering driving TWI’s work. For my talk, I’d like to share how my residency with TWI has offered new audiences a unique lens through which they can learn about the science, art, and hope of wetland restoration.

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Incorporating Restoration Alternatives for Critical Urban Infrastructure Projects - A Case Study of the Williams Pipeline Molasses Creek Restoration Project.

Halli Baumann¹, Matt Frackelton²

¹Williams. ²Arcadis

Abstract

Molasses Creek is tributary to the Cedar River located in a heavily developed area near Seattle, Washington and has been listed as an impaired waterway by the State since 2002. Bank erosion and scour uncovered a portion of an existing natural gas pipeline, threatening to compromise the integrity of the pipe. Instead of armoring the stream crossing with rip rap or concrete, Williams decided to proceed with a more wholistic approach and conducted a restoration project to address the underlying causes of erosion and to aid in restoring the riparian and aquatic habitat within the watershed. Williams worked collaboratively with Tribal, Federal, State and local regulatory agencies to design, implement and monitor the restoration project.

Following completion of the project, benthic macroinvertebrate scores downstream increased and for the first time in 21 years of monitoring, attained the threshold to remove Molasses Creek from the impaired waterbody list. Fish passage monitoring conducted pre- and post-construction identified an undocumented impassable barrier downstream. The barrier was unrelated to the project but was preventing anadromous fish from accessing Molasses Creek. Discussions are ongoing with the city to remove the barrier to once again allow salmon and steelhead access to Molasses Creek. Terrestrial species including bear, deer and a variety of birds were also documented using the creek and surrounding riparian habitat. The project was successful in protecting critical infrastructure while also improving the riparian and aquatic habitat, ultimately leading to a healthier macroinvertebrate community and helping to restore fish passage to the creek.

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Targeted restoration of hydrological stability and habitat condition in a Special Area of Conservation for the whorl snail, *Vertigo geyeri*, in Ireland

Aedín Mc Adams

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Abstract

Protection of habitats alone is insufficient to combat biodiversity loss. Targeted restoration is often necessary, with techniques adapted to specific degradation and ecological requirements.

This project uses an interdisciplinary approach of targeted restoration for a protected habitat using above-ground irrigation in Ireland. We integrate hydrological monitoring, lake-level linked irrigation system, qualitative and quantitative ecological assessments of habitat condition, meteorological impacts, and species-specific assessments to determine intervention success. A novel reintroduction experiment of less sensitive snail species was used to test the restoration intervention.

Water abstraction from the adjacent lake, supplying clean water to towns, resulted in local extinction of the protected whorl snail, *Vertigo geyeri*, in 2007, revealing hydrological instability prior to any significant change in habitat quality. The whorl snail is an indicator species of wetland habitat quality due to its stringent habitat requirements and sensitivity to hydrological instability.

Using a Before-After-Control-Impact approach, we found that irrigation improves hydrological stability and habitat condition. Using historical and contemporary data, qualitative assessments show an increase in favourable microhabitat condition, with quantitative assessments validating and extrapolating the conditions required for *Vertigo geyeri* survival. Translocations of less sensitive snail species demonstrated rehabilitation potential for the more sensitive *Vertigo geyeri*. Annual monitoring enabled differentiation between seasonal variation and intervention effects while evaluating long-term success of translocated snail populations.

Collaborating with the national water utility company, local councils, and landowners, this project uses a knowledge-based approach with targeted monitoring for designing and evaluating habitat rehabilitation as an important step towards functional restoration of degraded habitat.

Reforestation the City: Restoration ecology of planted urban forests

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Abstract

Urban development negatively affects ecosystems in many ways, such as increasing air and water pollution, altering water cycling, fragmenting habitat, and increasing pressure from invasive species. Ecological restoration in cities is hampered by infrastructure, cost, and competing political and social preferences. Urban tree planting programs have been implemented in many cities around the world, often with a focus on community participation and engagement. However, planted urban forests also represent a critical and understudied approach to ecological restoration. This presentation will characterize ecosystem structure and function of sites planted as part of the Reforest the Bluegrass program in Lexington, KY, an urban reforestation program that has planted a new forest patch annually since 1999. Planted trees have demonstrated good survival and growth, establishing vertical forest structure and diverse over- and understory plant communities. Furthermore, evidence from acoustic surveys demonstrates that these sites are well-utilized by both birds and bats. Finally, forests planted in riparian sites in particular show enhanced soil health, robust riparian buffer function, and potential stream-water quality improvement. Overall, urban reforestation confers a suite of ecological benefits in addition to the social benefits of community engagement and participation during planting.

Reducing competitive pressure from an introduced perennial grass: indaziflam herbicide as a tool for native plant community restoration

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¹Colorado State University. ²Graduate Degree Program in Ecology. ³Department of Forest and Rangeland Stewardship. ⁴City of Boulder, Open Space and Mountain Parks

Abstract

Invasion by introduced species is a widespread challenge across drylands, resulting in significant impacts on biodiversity, ecosystem functioning, and fire regimes. Indaziflam (marketed as Rejuvra® by Bayer CropScience) is a pre-emergent herbicide that has recently been approved to control invasive grasses. *Arrhenatherum elatius* (tall oatgrass), a perennial cool-season bunchgrass, is an invasive plant species found across North America. Indaziflam's effectiveness at controlling *A. elatius* and similar perennial grass species that rely heavily on seed-based reproduction, as well as its impacts on non-target species, has not been tested.

We conducted a field experiment in Boulder County, CO, and asked: (1) Can indaziflam be used to control *A. elatius*, and (2) How does indaziflam treatment affect non-target native plant species and community composition? We compared plant species cover and community composition in plots treated with a one-time application of indaziflam versus untreated controls at two sites: one post-agricultural site dominated by introduced species, and a formerly grazed site with higher native plant cover, over a three-year period.

Preliminary results show that *A. elatius* and other invasive species cover was lower in treated plots, with the greatest reduction at the post-agricultural site. This effect is more pronounced in year two, suggesting that the herbicide remains effective two years post-treatment. With reduced competitive pressure, where native propagules are abundant at the formerly grazed site, native cover is significantly higher post-treatment. These results suggest that indaziflam could be an effective tool for controlling *A. elatius* and increasing native plant cover, ultimately improving restoration outcomes.

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Comparison of seagrass ecological restoration initiatives on the Pacific and Caribbean coasts of Costa Rica within different socioeconomic contexts

Jimena Samper-Villarreal

San José

Abstract

Seagrass meadows provide us with many ecosystem benefits, including carbon sequestration, water purification, coastal protection, and serving as nursery habitat. Costa Rica has extensive seagrass meadows in both its Pacific and Caribbean coasts. Seagrasses on the Pacific coast of Costa Rica are dominated by small and pioneer species. In contrast, Caribbean seagrasses are dominated by a large and persistent climax species and an opportunistic mid-sized species. In the southern Pacific a long-term monitoring project revealed marked seagrass temporal variability. Meanwhile in the northern Pacific, a large meadow that disappeared in the mid 1990s has not recovered naturally in the past 27 years. In collaboration with a hotel development in the area at this site, a one year baseline study was carried out and active restoration initiatives are currently underway, making it the first and only seagrass restoration initiative within the Eastern Tropical Pacific. In contrast, seagrasses in the Caribbean have been monitored for over 24 years and shown a drastic decline in recent years linked to excessive sea turtle grazing. Ecological restoration efforts at this site are carried out in close partnership with the local community and government environmental agency, which work together in co-managing the national park. The approach, methods, and results in these two restoration initiatives differ not only in their natural environment but also their socioeconomic context and stakeholder engagement.

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Seeds of Grief, Seeds of Change: Principles for an Embodied Ecology Approach to Ecological Restoration Practice

Ember Bradbury, Caridad Souza, Caroline Havrilla, Anna Lavoie

Fort Collins, Colorado

Abstract

In the United States, land management is deeply entwined with colonization, cis-heteropatriarchy, and white supremacy culture. These systems are the driving forces of land degradation caused by extractive industry and infrastructure and have led to the anthropogenically-caused climate crisis. In this talk, I will begin by characterizing this wounding, particularly focusing on how systems of harm have shaped land management in the U.S. Intermountain West, and then will outline the Embodied Ecology framework, which I conceptualize as a connection of the scholarship of Indigenous, Black, and other scholars of color, material and eco-feminist work, and restoration ecology. By practicing restoration ecology in a way that critically historicizes landscapes, and incorporates principles of relationality, accompaniment, abolition, reflexivity, and spirituality, practitioners can move their practice towards true liberation from these systems that have devastated people and ecosystems since the colonial project began. I will conclude the presentation by considering how Embodied Ecology can be applied to the restoration of cheatgrass dominated landscapes in the Intermountain West.

Ecological Restoration of Former Mining Sites: Case Study of Limestone Mine Restoration in Pandalgudi, Tamil Nadu, India, Paving the Way for a Restoration Manual.

Manjula Arumugam

Auroville, Tamil Nadu

Abstract

Restoring post-mining landscapes can rehabilitate disturbed areas, create self-sustaining ecosystems, and provide habitats for native flora and fauna, significantly enhancing regional ecological health. Additionally, such restoration boosts ecosystem services like carbon sequestration, soil stabilization, and water purification, benefiting both the environment and local communities.

The ecological restoration of the 800-acre exhausted limestone mines in Pandalgudi, Tamil Nadu, South India, initiated in December 2018, stands as a good example of post-mining rehabilitation. The phased restoration strategy ensured efficient resource use and long-term sustainability. Situated in a rain-shadow region with minimal rainfall, the project faced climatic challenges. To address this, pilot projects conducted over two years tested the viability of native species for afforestation, underlining the critical role of species selection.

This initiative exemplifies effective corporate social responsibility (CSR), with a corporate team collaborating with ecological experts to undertake this project. The transformation of barren mining areas into vibrant ecosystems has bolstered biodiversity conservation while delivering socioeconomic benefits to the local community, such as employment opportunities and improved environmental quality.

The methodologies and insights gained from the project have informed the development of a comprehensive mine restoration manual. This manual provides a replicable framework, emphasizing ecological principles, community participation, and adaptive management. This manual also aims to inspire and guide future post-mining projects across India, positively influencing restoration policies.

The case study underscores the potential of ecological restoration to mitigate mining's environmental impacts while fostering sustainable rehabilitation practices globally. It highlights the importance of standardized guidelines for ensuring success across diverse landscapes.

Collaborative Catchment Care: Advancing Ecological Resilience Across the Lesotho–South Africa Border

Lesego Gaegane

Water Research Commission, Pretoria, Gauteng, South Africa

Abstract

The Caledon/Mohokare River basin, shared between Lesotho and South Africa, faces significant challenges from high sedimentation, land degradation and climate change, threatening the socio-economic activities and water security of both nations. This study focused on the ecological restoration of catchment areas on both sides, integrating efforts from multiple stakeholders in the public and private sector, and local communities in each country. Despite ongoing collaborative efforts like those of the Orange-Senqu River Commission, rising sediment loads have compromised critical reservoirs, notably Welbedacht Dam, threatening water availability and ecosystem health. Using existing data, field sampling, and hydrological modeling, this research identified high-risk sediment zones, quantified sediment sources, and formulated an integrated, costed implementation plan for ecological restoration for both countries. Citizen science initiatives aided the mapping of sediment transport patterns, promoting greater stakeholder engagement. Key outcomes include improved climate resilience frameworks, aligned sediment management strategies for Lesotho and South Africa, a comprehensive sediment transport map, refined sediment models, and a transboundary catchment restoration plan. By highlighting institutional coordination, policy harmonisation, and inclusive partnerships, the study demonstrates how ecological restoration in shared basins can safeguard water infrastructures. Beyond water security, local communities benefited from job creation and skills development, enhancing buy-in for catchment rehabilitation. These findings hold broader applicability for restoration professionals worldwide, illustrating actionable solutions for transboundary cooperation in managing sedimentation and land degradation. This study offers a scalable, interdisciplinary approach to strengthening water systems in a rapidly changing environment, underscoring the transformative potential of collaborative ecological restoration for long-term sustainability.

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Adaptive conservation and restoration strategies for dryland shrublands and woodlands – importance of climate, ecological resilience, and trajectories of change

Jeanne Chambers¹, Sofia Koutzoukis², Jessi Brown¹, Richard Miller³, Matt Reeves², Stephanie Yelenik¹, Robert Heckman⁴, Sarah Barga⁴

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Abstract

Ongoing global change processes in dryland shrublands and woodlands, including climate warming, altered disturbance regimes, and land use practices, are altering ecosystem recovery potentials and causing conversion to undesirable ecological states. Managing ecosystems to prevent conversion to these states requires knowledge of the ecological conditions of ecosystems, the trajectories of change, and the drivers of those changes. We describe an adaptive approach for evaluating the ongoing changes in climate and vegetation and for using that information to prioritize locations and strategies for conservation and restoration of dryland shrublands and woodlands at landscape scales. Steps include: (1) develop an understanding of the current climate regimes, the dominant ecological types, and their ecological resilience to disturbance and resistance to invasive plants (R&R); (2) evaluate the recent change (past 40 years) in cover of the dominant plant functional groups using remote sensing data; and (3) assess the influence of changes in climate and other drivers of change, like land uses and altered fire regimes, on ecosystem recovery potentials as indicated by R&R. To illustrate this approach, we use two USDA Forest Service Wildfire Crisis Landscapes, which were selected to address wildfire risk in locations where it poses immediate threats to communities, critical infrastructure, and natural resources. This approach can be used in landscape-scale planning to help determine locations where conservation and restoration actions can help direct ecosystems into conditions that increase recovery potentials, reduce vulnerability to climate change, and facilitate transitions to new, sustainable ecological states.

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Rapid change in tree expansion and invasive annual grass abundance influences treatment options in two shrubland-dominated ecosystems in the Intermountain West

Sofia Koutzoukis¹, Jeanne Chambers¹, Jessi Brown¹, Lisa Ellsworth², Karen Short¹

¹US Forest Service Rocky Mountain Research Station. ²Oregon State University

Abstract

In the U.S. Intermountain West, invasive annual grasses and pinyon and juniper (PJ) expansion are altering the integrity and function of sagebrush-dominated shrubland ecosystems. Removing woody fuels via prescribed burning and mechanical treatments can slow tree expansion, reduce fire behavior, and improve habitat quality by promoting shrub and perennial grass recovery. However, implementing fuel treatments when resistance and resilience (R&R) is low or tree and annual herbaceous cover is high can trigger a transition to a degraded, invasive-dominated state. The Elko Front in the Great Basin and Pine Valley at the Great Basin/Colorado Plateau interface are USFS Wildfire Crisis Strategy Landscapes (WCSL) that are threatened by PJ expansion and invasive annual grass dominance. WCSLs are a part of a national strategy to address the wildfire crisis in places where it poses the greatest threats to communities, infrastructure, and natural resources. We partitioned the Elko Front and Pine Valley landscapes into vegetation types and R&R categories to help guide treatment efficacy. We quantified change in Rangeland Analysis Platform vegetation from 1986-2023. We found that tree and annual herbaceous cover increased while perennial herbaceous cover declined, but these trends were not uniform across the landscapes. We developed a ruleset for identifying appropriate treatments based on vegetation type, R&R, and hotspots of change and stratified the landscape into treatment types that included treatable, treatable and at-risk, and not treatable. This information can facilitate ongoing planning in these high priority landscapes.

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Preparing to scale up: Germination potential of *Schoenoplectus acutus*, *Carex stricta*, and *Zizania palustris* following invasive *Typha*-derived biochar application in hydric, nutrient-rich soils

MacKenzie Michaels, Brian Ohsowski, Shane Lishawa

Loyola University Chicago, Chicago, IL, USA

Abstract

Invasive hybrid cattail, *Typha* × *glauca*, dominates eutrophic wetlands throughout eastern North America, reducing biodiversity and preventing native seed germination. Researchers and managers from Loyola University Chicago and Shiawassee National Wildlife Refuge (SNWR) in Saginaw, MI are conducting a large-scale *Typha* management study in Maankiiki Marsh, a 100-hectare formerly agricultural field that *Typha* quickly invaded following its hydrologic restoration in 2017. In 2024, we mechanically removed aboveground biomass from experimental plots and flooded the wetland, submerging the cut stems to kill the *Typha*. The harvested, low-value, invasive plant material was pyrolyzed *in situ* to create biochar, a negatively charged soil amendment, which will be experimentally applied to the wetland in 2025. Biochar has a high cation exchange capacity, facilitating immobilization of excess nitrogen and phosphorus, and likely reducing plant available nutrients. Preliminary research has shown reduced *Typha* growth in soils amended with biochar, but no known studies have assessed biochar's effects on germination and early growth of native macrophytes. To fill this knowledge gap, I am conducting a greenhouse experiment (to conclude in spring 2025) that will assess the effect of three biochar application rates (0, 25, and 50 Tons/hectare) on the germination and biomass production of three dominant, native species of restoration interest to SNWR (*Schoenoplectus acutus*, *Carex stricta*, *Zizania palustris*). The results will inform managers about the potential of using *Typha*-derived biochar in wetlands degraded by agriculture to promote the establishment of native species. Our findings will be incorporated into the long-term restoration plan for Maankiiki Marsh.

Restoring open ecosystems: an example of restoration in Palearctic shrub steppes using arthropods and birds as indicators

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Abstract

The Iberian shrub steppes, unique Palearctic open ecosystems, have undergone significant degradation in recent decades due to grazing abandonment, agricultural intensification, and afforestation. These changes have contributed to the decline of steppe bird populations, one of the most threatened bird groups in Europe. Active habitat restoration may be essential for their conservation, though evidence on effective management practices remains limited.

The LIFE Ricotí project (LIFE15-NAT- ES-000802), granted by the European Commission, implemented habitat restoration to restore open shrub steppe habitats and benefit Dupont's lark (*Chersophilus duponti*), a specialized insectivorous bird facing severe population declines. Restoration actions included the removal of 50 ha of pine (*Pinus* spp.) and thinning holm oak (*Quercus ilex*) on 250 ha. A four-year BACI study assessed restoration effects by monitoring arthropod biomass—a habitat quality proxy—and Dupont's lark abundance in restored and reference areas.

Arthropod biomass showed minimal overall variation between treatments, although pine removal significantly increased epigeal arthropods, particularly Coleoptera. Oak thinning had limited impact on arthropod biomass. Most notably, Dupont's lark territories increased from 15 to 27 in restored areas, while declining in reference ones (from 145 to 91).

Results demonstrate the positive impact of restoration on steppe habitat and Dupont's lark by improving habitat suitability and maintaining or slightly increasing arthropod biomass. This study highlights the potential of active restoration for conserving open ecosystems and their associated species, and the importance of integrating ecological knowledge into management practices to combat biodiversity loss in steppe habitats.

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High interreplicate variation in the first 20 years of an experimental tallgrass prairie restoration

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Abstract

We will present the results of the first 20 years of a 30-ha tallgrass restoration experiment (3 replicates of 3 treatments and two reference sites). The property, which is near the northern extent of the Texas Blackland Prairie, was formerly a diverse farm (row crops, dairy pasture, and beef cattle pastures). Experimental treatments are: (i) cattle exposure and mechanical control of woody vegetation, (ii) fire and mechanical control of woody vegetation, and (iii) cattle exposure, fire, and mechanical control. Replicates of each treatment are recovering but interreplicate variation is high. Recovery success to date appears to depend more on rainfall following seeding and upon relief and prior land use history (prior erosion) than upon management treatments. (Funding limitations precluded seeding all replicates during the same year of this opportunistic project.) Seeding and monitoring have prioritized grasses over forbs (for practical reasons and to arrest erosion). Conservative forb species remain rare. The project seeks to foster future restoration interest by relying on undergraduates and hosting schoolchildren on field trips. More than 1,000 undergraduates have contributed to the project by doing restoration work, collecting and analyzing data, and/or leading some 12,000 schoolchildren on field trips at the site. The project received the state's 2020 award as the environmental education project of the year.

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Lessons Learned from Fifteen Years of Collaborative Floodplain Wetland Restoration in Vermont

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Abstract

While the state of Vermont is home to exemplary wetlands including a Ramsar-designated Wetland of International Importance as well as what The Nature Conservancy describes as being “the largest and most biologically diverse swamp complex in New England,” it is estimated that 35 percent of the state’s wetlands have been ditched and drained for agriculture. The majority of these losses come from the watershed of Lake Champlain, a binational lake in the northeastern U.S. states of New York and Vermont and the Canadian province of Quebec which is located within the Atlantic Flyway. The U.S. Fish and Wildlife Service, in partnership with the U.S. Department of Agriculture’s Natural Resources Conservation Service, has worked for over fifteen years at implementing wetland restoration projects for the benefit of wildlife species, water quality and a host of wetland functions and values. To date, over 3,500 acres of floodplain wetlands have been restored and placed under permanent conservation easements, in partnership with over 60 landowners. This partnership with willing landowners collaborating with stakeholders and various experts has restored and protected valuable habitat blocks and corridors for species including migratory birds, rare and threatened wildlife species and game fish species. This presentation will discuss the prioritization, design considerations, challenges of project implementation, and follow-up results. A case study will be presented to illustrate the multiyear process to restore these sites and consider future challenges to wetland restoration including climate change and invasive species.

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Shore Friendly: A social marketing approach to achieving climate resilience, restoration, and protection across private shorelines of Puget Sound.

Lisa Kaufman¹, Jenna Jewitt²

¹Bellingham. ²Olympia

Abstract

The shorelines of Washington state are complex, geomorphically varied, and rich with life. They are also subject to pressures from human development and the impacts of sea level rise and climate change. These pressures can be challenging to address, as approximately one-third of the Puget Sound's marine shorelines contain hard armor, which reduces available spawning habitat for forage fish (a key food source for salmon), impedes natural sediment dynamics, and prevents marine shorelines from equilibrating in response to rising sea levels. Most of this armor is found on privately-owned properties and was erected decades ago, before the risks and ecological impact were well understood. Scientists now know that bulkheads are unnecessary on most Puget Sound shorelines and can actually worsen overall erosion. They also damage delicate habitat that is crucial to the survival of our coastal species, from insects and seabirds to salmon and orcas.

Nearly 1,400 miles (about 57 percent) of the Puget Sound shoreline is identified as residential, leaving shoreline landowners responsible for Washington's beaches. The Shore Friendly program incentivizes willing landowners to avoid and remove bulkheads, providing the triple benefit of protecting property, reducing shoreline armor and restoring shoreline habitat for fish, wildlife, and communities.

Providing services to shoreline landowners is a win for everyone. Social science research has shown that helping landowners overcome key barriers in property management decisions can lead to voluntary stewardship behaviors that recover and sustain critical beach habitats.

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Impact of Native Wildflowers on the Yield of Three Sisters Crops On Green Roofs

Izzy Rodelius

Fort Collins

Abstract

Urban areas are expanding throughout the world, increasing infrastructure and impermeable surfaces and concurrently decreasing quantity and quality of natural landscapes. With a decrease in green spaces, human communities experience an increase in food scarcity. Ecological communities experience a decrease in biodiversity and suitable habitat. Here, we aim to utilize native wildflowers, vegetable crops and urban infrastructure to provide healthy food as well as biodiversity options to urban areas. In this study we examine **(a)** how the presence of native perennial Colorado wildflowers may influence the yield of crop plants, specifically the three sister's guild of maize, beans and squash plus sunchokes and **(b)** to evaluate how the crop yields may differ between sites in full sun and partial shade landscapes. To do so we utilize green roofs and ground plots in Fort Collins, Colorado to evaluate the yield differences. We hypothesize that the crops with wildflowers nearby will produce a higher crop yield than the crops grown without wildflowers. Additionally, we expect that shade treatments will reduce yield compared to the full sun treatments. With this research, we hope to provide notable insight to continue working towards the most efficient crop growth on green roofs in urban environments.

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Comparing transplanted “wildlings” to greenhouse-grown “tubelings” as alternative approaches to establishing native shrub communities in former agricultural drylands

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Abstract

Land uses such as crop production, livestock grazing, mining and urban development have contributed to the degradation and loss of dryland ecosystems worldwide. Approximately 10%–20% of global drylands are considered severely degraded, an amount that is expected to increase, threatening the environment and ecosystem services that 38% of the global population relies upon. A need for re-establishing foundational perennial shrub communities on disturbed drylands has been identified; however, traditional, primarily seeding-based, restoration methods have largely been unsuccessful. To bypass the significant threats to plants during the seed and seedling stages, establishing plants from containerized greenhouse seedlings (“tubelings”) has become an increasingly popular method. In some settings, a potential alternative approach is to transplant larger, locally-collected plants (“wildlings”). We compared the establishment of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) from tubelings vs. wildlings on former agricultural lands in southeastern Idaho, USA. Poor planting quality was significantly associated with tubeling mortality in the first year. Chance of survival for wildlings one year after planting was significantly higher than that of tubelings (92% and 17%, respectively); these high wildling survival rates persisted into the third year (85% compared to 14% for tubelings). By year three, wildlings and tubelings both exhibited high reproduction rates, serving as an early seed source on-site. We tracked project expenses to calculate costs of tubelings vs. wildlings as modified by probability of survival and found that wildlings can be a cost-effective approach to establishing sagebrush in situations where plants can be locally sourced.

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Applying Nature-Based Solutions (NBS) to restore mountain biodiversity and ecosystems in Africa

Mohammed Sghir TALEB

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Abstract

Africa mountains cover an estimated 3 million Km². Approximately half of African countries have mountains higher than 2000 m.

Africa mountains are home to significant richness in biodiversity and ecosystems (8 of the world's 34 biodiversity hotspots are in Africa (including Morocco)).

This richness is currently subject to many natural (climate change, erosion etc.) and anthropogenic (deforestation, overgrazing etc.) pressures. To overcome this problem of degradation and loss of biodiversity, many actions have been carried out in Africa taking into account Nature-based Solutions approach. Thus, Africa is applying Nature-Based Solutions (NbS) tools in mountain biodiversity and ecosystems for restoring ecosystem, conserving biodiversity and ecosystem services and for combating desertification and mitigating the effects of climate change.

This work will be focused on how Africa draw inspiration from nature to implement transformative change for the restauration, conservation and sustainable management of mountain biodiversity and ecosystem services for human well-being and to achieve the 2050 vision "Living in harmony with nature".

Key words: Mountain, biodiversity, ecosystem, Nature based Solutions, restauration, Africa

Over 20 Years of Revegetation at the Rocky Flats Site, Colorado: Adapting to a Changing Environment.

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Abstract

The U.S. Department of Energy (DOE) Rocky Flats Site, Colorado, is located approximately 16 miles northwest of downtown Denver. DOE's Office of Legacy Management (LM) is responsible for the long-term surveillance and maintenance of the Site, which includes remedy implementation activities and general Site maintenance.

The Site was established in 1951 as part of the United States' nationwide nuclear weapons complex to manufacture nuclear weapons components. In 1992, weapons production halted, and the Site's mission changed to environmental investigations, cleanup, and Site closure. The cleanup required the decommissioning, decontamination, demolition, and removal of more than 800 structures at the Site. As a result of cleanup operations, approximately 650 acres of disturbed land required revegetation.

Some challenges and issues were addressed during the initial revegetation effort, including reaching an agreement on revegetation goals, addressing poor soil quality, working in sensitive habitats, selecting appropriate seed mixes, reducing pressures from invasive species, and controlling erosion. A variety of ecological restoration techniques were used at the Site to meet these challenges and have resulted in well-established vegetation communities in most areas.

Since the initial revegetation effort at the Site, LM has been addressing other challenges and ecological pressures, including the need for continued land-disturbing activities, introduction of new invasive species, shifts in large herbivore populations, changes in land use in the surrounding areas, impacts from climate change, data management, and knowledge transfer. In addition, land management goals have shifted from major revegetation efforts to maintaining habitat health and increasing biodiversity.

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From Salt Production Ponds to Tidal Salt Marshes: The Role of Upland Soil in San Francisco Bay Restoration

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Abstract

South San Francisco Bay is encircled by a mosaic of former salt production ponds, many of which were originally tidal salt marsh ecosystems. The South Bay Salt Pond Restoration Project (SBSPRP) is the largest wetland restoration effort in the western U.S., aiming to restore approximately 15,100 acres of former salt ponds across 3 pond complexes. Two of these are located within the Don Edwards National Wildlife Refuge (Refuge). The San Francisco Estuary Institute (SFEI) estimates that restoring these subsided salt ponds and supplying sediment to existing tidal marshes to address sea level rise requires an estimated 53 million cubic yards (CY) of sediment over 50 years. However, natural processes are expected to supply only 5 to 6.5 million CY of sediment, highlighting the urgent need to source additional sediment, including from terrestrial fill. To ensure that imported upland soil is safe for aquatic organisms, H. T. Harvey & Associates, in collaboration with the Refuge and SBSPRP, developed a regulatory-compliant Quality Assurance Project Plan (QAPP) to guide the soil screening and import process within the Refuge. Over the past 7 years, we have refined this document to provide greater flexibility in importing soil necessary for restoration while remaining protective of aquatic organisms. This presentation will provide an overview of the Refuge's QAPP process, its implementation, and some of the details which have allowed for the successful import of over 1 million CY of terrestrial soil for beneficial reuse as well as the win-win avenue of the "free dirt market".

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Applications of Tribal Science: The Seminole Tribe of Florida's Environmental Protection Office.

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Abstract

The Seminole Tribe of Florida is a Federally recognized Tribe whose citizens have lived in the southeastern portion of North America since time immemorial. Today, the Tribe's reservation lands are largely spread throughout the interior of South Florida and are geographically coincident with the world's biggest ecosystem restoration project, Everglades Restoration. Federal law has necessitated that the Tribe be engaged with restoration for over 30 years. In this paper we explore the growing capacity of the Tribes Environmental Protection Office to undertake ecological restoration on its own lands, through the lens of Tribal science, that is then applied to the broader Everglades system during government-to-government consultation. Knowledge authority structures are presented and discussed in relation to the ability of the Tribe to meaningfully engage in scientific discourse and provide meaningful input to project outcomes.

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Using long-term data to calibrate restoration goals within the Resist-Accept-Direct Framework.

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Abstract

Establishing an appropriate management goal is one of the most challenging aspects of ecological restoration. Long-term data sets, like those generated by the Santa Rita Experimental Range (SRER), can reveal on-going changes to vegetation that can help calibrate realistic management goals across a region. Monitoring at the SRER spans greater than 50 years, hundreds of meters of elevation, and a wide temperature and precipitation gradient. Over time and across the SRER, plant biodiversity has declined dramatically in the absence of changes to disturbance regime. Species richness has declined, and species composition has been altered in a consistent manner over time. These findings suggest that, across the desert Southwest, plant biodiversity is in peril, and restoring to even relatively recent historical baselines may be impossible. These findings help clarify what restoration goals are likely to be realistic at regional scales, and what management actions and goals are likely to be successful, given current trajectories of change. We contextualize these results into the Resist-Accept-Direct Framework for 21st Century management.

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Determining the Ecological Factors Influencing Bladderwort Distribution in Michigan, USA

Alex Risdal

Chicago

Abstract

Bladderworts (*Utricularia* spp.), an understudied genus of carnivorous plants, are widely distributed throughout North American wetlands and provide food, shelter, and habitat for insects, mammals, and waterfowl. *Utricularia* have complex adaptations for surviving in low-nutrient and low-oxygen environments, including specialized mechanisms for capturing and attracting prey. Nine of the eleven *Utricularia* species identified in Michigan have a Coefficient of Conservatism score of 8 or higher, indicating that they are restricted to specialized habitats and have a low disturbance tolerance. The spread of invasive species, anthropogenic impacts, and climate change threaten the habitat of Michigan's *Utricularia*, yet their specific ecological requirements are not well understood. To fill this gap, I sought to determine key environmental and biological factors associated with *Utricularia* and to develop a Species Distribution Model to predict the current distributions of this genus. During Summer 2024, I sampled sites with documented *Utricularia* occurrences based on iNaturalist and herbarium records and collected water quality, plant community, substrate, and water depth data. I statistically evaluated the relationship between measured variables and *Utricularia* distribution and discovered a strong relationship between several *Utricularia* species and water lilies (*Nymphaea* and *Nuphar*). These findings will inform a second year of study exploring the influence of water lilies on *Utricularia* diversity, allowing for the prediction of *Utricularia* occurrence based on water lily presence.

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Scaling Up Restoration in São Paulo State, Brazil: Launching a GIS-Based Platform for Atlantic Forest and Cerrado Recovery

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SÃO PAULO

Abstract

This project introduces an innovative GIS-based restoration platform ([Fundação Florestal](#)) designed to streamline and enhance restoration efforts within São Paulo State's Conservation Units, located in the Atlantic Forest and Cerrado biomes. The platform enables companies, landowners, NGOs, and other stakeholders to easily identify and submit restoration projects for open areas. By integrating over 80 environmental GIS data layers into a centralized database, the system employs machine learning algorithms to rank potential restoration sites. Key ranking factors include proximity to nurseries, seed banks, and roads, as well as soil characteristics, hydrology, and connectivity to existing forest patches.

The platform not only simplifies the process of locating suitable restoration sites but also ensures projects are strategically placed to maximize ecological and logistical benefits. This approach promotes more effective use of resources, increases connectivity among fragmented habitats, and supports biodiversity recovery. Moreover, the use of Big Data and advanced analytics provides a replicable model for restoration initiatives globally, contributing to international restoration commitments.

This presentation will showcase the platform's development process, its core features, and the preliminary outcomes from pilot implementations. By leveraging technology to bridge gaps between restoration science, policy, and practice, this project highlights a scalable pathway for large-scale ecosystem recovery and supports the long-term sustainability of restoration efforts in one of the world's most vital biodiversity hotspots.

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Barriers to recruitment of conservative plant species during prairie restoration

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Abstract

Restored tallgrass prairies often contain lower plant diversity and altered plant community composition relative to remnant prairies with little history of human disturbance. Conservative plant species, which are sensitive to environmental degradation, are often missing from restored prairies and are difficult to reestablish. These species may recruit poorly from seed additions because they 1) are typically sown at low rates, 2) are sensitive to early competition, or 3) are dependent on arbuscular mycorrhizal fungi (AMF) missing from restored prairies. We tested these hypotheses in a novel prairie planting established in January 2023. We sowed 25 pure live seeds each of 20 native prairie species into bare ground (32 1m² plots), and tested whether adding a commercially available AMF-inoculum (MycoBloom) to field soils or weeding out volunteer species differentially affected recruitment of low-conservatism (C-score < 7) and high-conservatism species (C-score ≥ 7). The seed mix was composed of 10 sets of phylogenetically paired species (one high-conservatism, and one low) from seven families. We recorded stem counts and cover of each species the following two summers and compared differences among treatments and phylogenetic pairs with generalized linear models. On a per-seed basis, low-conservatism species recruited at four times the rate of high-conservatism species. In the second year of sampling, we found a significant three-way interaction indicating that the high-conservatism species had greater cover in plots with both AMF addition, and removal of volunteer species. Understanding which treatments enhance the establishment of conservative species is key to recovering remnant-like composition in grasslands.

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Forest restoration treatments influence spatial and temporal heterogeneity in Northern Rockies dry conifer forestIsabella Smith, Sharon Hood, Justin Crotteau, Scott Ferrenberg

Missoula, Montana

Abstract

Decades of fire suppression and changing climatic conditions have increased the frequency and severity of wildfires across the western US. Efforts to decrease the occurrence and severity of wildfires focus primarily on fuel reduction treatments, which are typically performed using mechanical treatment, prescribed fire, or a combination of both. While a primary goal of fuel reduction treatments is to decrease the risk of wildfires, it can also be a tool to boost broader forest resiliency by increasing the variability of forest structure and composition (i.e. spatial heterogeneity). We analyzed over 20 years of forest spatial heterogeneity at local, stand, and landscape scales in response to initial restoration and subsequent maintenance mechanical and prescribed burning treatments from a long-term study initiated as part of the National Fire and Fire Surrogate Study in the Northern Rockies, Montana, USA. At the different scales, we quantified heterogeneity for fuels and different functional groups including overstory trees, saplings, seedlings, and understory vegetation. While the treatments collectively increased landscape-level heterogeneity in these groupings, when considered in isolation relative to the control they did not increase heterogeneity. At the landscape-level, initial treatments significantly increased overstory heterogeneity which then remained static until the maintenance treatments marginally increased heterogeneity 22 years later. Used in isolation, prescribed fire and mechanical thinning do not result in increased forest heterogeneity without additional planning to achieve these outcomes. A combination of these methods could be implemented in patches across the landscape to increase levels of heterogeneity.

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Decoupling of plant and microbial communities following long-term removal of an invasive grass

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Abstract

Invasive plants can disrupt feedbacks between plants and soil microbial communities. In some cases, those disrupted feedbacks persist even after the invasive species is removed. We investigated potential legacy effects of the invasive yellow bluestem (*Bothriochloa ischaemum* var. *songarica*) in a grassland in central Texas, USA. In a nine-year removal experiment, we measured diversity and composition of plant and soil microbial communities in invaded plots (dominated by the invasive grass), removal plots (where the invasive was continually removed), and native-dominated plots. With only passive recovery (i.e., no active seeding or planting), plant richness, native grass cover, and native forb cover in removal plots became similar to native-dominated plots in 1-3 years, although species composition was still different eight years after removal. In contrast, soil microbial diversity and composition (for fungi and bacteria) did not differ among the treatments, including no differences between invaded and native-dominated plots. These results suggest that microbial soil legacy effects will likely not limit grassland restoration after yellow bluestem removal. However, active seeding or planting may be required for more complete restoration of native plant communities.

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Maximizing carbon capture while achieving fuel reduction objectives in Ponderosa pine-dominant forests under a changing climate

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Missoula, Montana

Abstract

Fuels and tree density have increased because of fire suppression over the past century, resulting in higher wildfire frequency and severity. Consequently, fuel restoration treatments are increasingly implemented to restore and maintain forests by mimicking historical fire regimes. These approaches can effectively reduce fuels, tree density, and fire-intolerant species. In contrast, these carbon removal and redistribution methods could conflict with the desired ecosystem services forests provide (e.g. carbon assimilation and storage). In addition, the longevity and ecological impact of fuel treatments as a function of forest productivity and climate remain poorly understood. Using dendrochronology methods, we quantified climate-growth relationships in Ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) in a study of prescribed fire and mechanical stand density treatments initiated in 2002 and retreated in 2023/24 in a mixed-conifer forest in western Montana, USA.

Preliminary results show increased growth rates in treatments that included mechanical thinning compared to prescribed fire without thinning and control units. This result is likely due to a competitive release of remaining trees for resources. Responses to the treatments, however, were not uniform across different study blocks (a combination of stand-level and landscape influences) or over time due, in part, to responses of growth to interannual climate variability following the initial restoration efforts.

This work is highly relevant to restoration science as forecasts can be made on fuel treatment lifespan in an increasingly changing climate. In turn, these forecasts are mutually beneficial for maximizing carbon sequestration while still achieving fuel reduction objectives.

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How to start a career in restoration ecology – the unconventional way

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Abstract

You want to start a career in restoration ecology, you have a yearning to have a positive impact on the environment, or you work in another field but want a change. Where do you start?

There are several strategies that one can take, perhaps the most common is to start with a degree, specialize, and progress towards a doctorate.

But what if you don't want to take an academic approach, what if you have big ambitions of a prosperous career with limitless possibilities but want to forge your own path?

My journey in this field started at a young age, born into the experimental township of Auroville in Tamil Nadu, South India. Here, I was surrounded by a living, evolving environment of reafforestation and the goal of a society living in human unity.

My upbringing has been alternative, following the ideas of integral education and holistic learning. Still, I had planned to complete a conventional degree in engineering. All this changed during the global pandemic. With this time for self-reflection, my focus shifted back towards the environment and our anthropogenic impact on ecosystems.

In this presentation, I will discuss the challenges I have faced and some of the solutions I have found along the way of building a foundation for a career in ecological restoration.

Now, three years down the line, I coordinate the India hub of The Global Biodiversity Standard, where I am a certified Assessor and Trainer, and I am a recognized CERPIT by SER.

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Enhancing Transparency and Stakeholder Accountability in U.S. Timber Harvesting Laws to Support Ecological Restoration

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Abstract

Deforestation and unsustainable timber harvesting practices undermine ecological restoration efforts by contributing to biodiversity loss, climate instability, and ecosystem degradation. In the United States, existing regulations like the National Environmental Policy Act (NEPA), the Lacey Act, and the Convention on International Trade in Endangered Species (CITES) provide a framework for mitigating these impacts. However, gaps in transparency, stakeholder accountability, and enforcement hinder their effectiveness, often allowing harmful practices to persist.

This presentation examines the critical role of diverse stakeholder groups—including government agencies, private sector actors, and the public—in ensuring sustainable timber practices that align with restoration goals. Through case studies of enforcement challenges and corporate accountability failures, it highlights the need for innovative approaches to multi-stakeholder collaboration and participatory engagement across the restoration process.

Key recommendations include adopting enhanced traceability mechanisms like blockchain, implementing mandatory audits and forensic tools for timber verification, and fostering international cooperation. These measures, combined with improved public access to data and stakeholder mapping, are essential for closing regulatory gaps and empowering collaboration.

By advancing transparency and accountability, this work aims to connect stakeholders at every stage of timber management and restoration, from pre-planning to post-restoration monitoring. These strategies will better integrate ecological restoration goals with sustainable resource use, contributing to biodiversity conservation and climate resilience.

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Growing Connections: Advancing Canada's Native Seed Industry Through Collaboration and Producer Networks

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Abstract

Canada's native seed industry holds significant potential for ecological restoration, biodiversity conservation, and climate resilience but faces challenges like limited collaboration, seed availability, and market development. The author's 2-year Nuffield Canada Agricultural Scholarship project explores advancing the industry by fostering native seed producer networks and strengthening stakeholder collaboration.

The research incorporates insights from over 30 years of native seed grower and restoration experience and travels across Canada, the United States, and Europe. Visits to native seed producers and restoration projects in Europe and North America provided valuable perspectives on building resilient seed industries. Key lessons include the importance of cooperative networks, knowledge sharing, and tailored regional strategies to address diverse ecological needs.

The project emphasizes developing regional native seed producer networks to connect growers, restoration practitioners, government agencies, NGOs and ecologists. These networks can enhance seed supply, promote genetic diversity, and support market growth. By fostering collaboration and promoting the use of native seeds in restoration, the Canadian industry can meet growing restoration demands while supporting Western Canada's prairie conservation.

This initiative offers actionable recommendations to support policymakers, conservationists, and agricultural stakeholders, creating a roadmap for a sustainable and thriving native seed sector that addresses Canada's ecological restoration needs.

Incorporating Wetland Manager Perspectives on Decision-making in the Evaluation of Revegetation Techniques for Restoration

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Abstract

Revegetation is often essential for restoring wetland ecosystems and mitigating invasion by non-native species such as *Phragmites australis*. Selecting a revegetation technique (e.g., seeding; planting seedling plugs, bare root plants, or sod mats) involves a complex decision-making process that requires consideration of tradeoffs. We conducted semi-structured interviews with wetland managers in the Great Salt Lake Watershed to understand the tradeoffs they consider with different wetland revegetation techniques. We found that the most influential factors in manager decision-making are cost, capacity, the need for specialized equipment, plant establishment timeline, invasive species control (needs and capabilities), water availability and management capabilities, and the scalability of different techniques. Using these factors, we analyzed three commonly employed revegetation techniques—sod mats, seedling plugs, and seeding—which were applied at an experimental study site within the watershed. Techniques demonstrated distinct strengths and limitations across the identified decision-making factors, with no universally superior method. Based on our findings sod mats are appropriate in cases where high and rapid establishment is the primary goal, i.e. along dikes with high erosion risks, but are expensive and thus unlikely for large-scale restoration. Alternately seeding is appropriate when scalability is the primary goal and high mortality is acceptable. Finally, seedlings are appropriate when specialized equipment isn't available, capacity is high, and moderate mortality is acceptable. Our findings underscore the importance of selecting techniques that address the unique challenges and priorities of site-specific restoration projects and provide resources that enable wetland managers to make informed decisions based on these circumstances.

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Restoring overgrazed drylands with woody debris; a multipurpose tool to improve soil and vegetation and create habitat for fauna

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Abstract

Dryland restoration practitioners need cost-effective, scalable restoration techniques that account for the specific challenges faced in arid-zone environments. In these landscapes, traditional methods of revegetation, such as planting or direct seeding, are risky and often fail due to the scarce and unpredictable rainfall. These challenges are only expected to increase with climate change, therefore an approach to dryland restoration that facilitates natural regeneration, is likely to be more effective. The application of complex coarse woody debris (known as 'branching') can enhance ecological restoration outcomes by preventing erosion, trapping soil, seeds, nutrients and water to assist with germination, protecting seedlings from herbivory and providing habitat for terrestrial fauna. In this study, branching was trialled to remediate an over-grazed floodplain in the arid zone of southern Australia. Using a Before/After, Control/Impact design, we applied 30m x 30m squares of branching to three floodplain habitats and measured the vegetation response, topsoil accumulation and moisture, and the small mammal and reptile communities over five years. We found that plant species diversity and cover, including the establishment of perennial species, was higher in branching plots compared to the unbranched controls, and effects were greatest on erosion scalds, the most degraded habitat. Additionally, branching reduced herbivory, facilitated topsoil accumulation and the retention of soil moisture and enhanced the reptile and mammal communities, but effects differed among the three floodplain habitats. Branching is a cost-effective, multipurpose restoration tool, particularly in highly degraded areas devoid of vegetation and topsoil where passive recovery is impossible.

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Teaming Up to Restore: providing knowledge on ecological restoration practices to vocational students and workers to aid fulfillment of the European Nature Restoration Regulation.

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Abstract

With the 2024 European Nature Restoration Regulation comes the necessity to upscale ecological restoration practices and outcomes in Europe, including the need to train skilled workers to meet rising demand. The TEAM#UP project is 15 partner institutions from five European countries who are mainstreaming needed educational resources on ecological restoration for Vocational Education and Training (VET) schools and lifelong learners within the areas of agricultural, forestry, landscaping and gardening.

With a focus on vocational excellence, TEAM#UP partners from VET education, universities, and the private and civil sectors are developing teaching materials and implementing ecological restoration curricula with pilot VET schools in Czechia, Germany, Norway and Spain. In addition, national partners are working with VET teachers and students in developing ecological restoration demonstration sites to spur hands-on, learning by doing, while creating numerous virtual demonstration sites for classroom learning and digital skills improvement. The TEAM#UP project promotes collaboration between VET providers and higher education institutions by facilitating international student exchanges, meant to broaden perspectives and context of ecological restoration. Lastly, a special aspect of the TEAM#UP project is the implementation of an Ideathon with VET students, to showcase successful business models and career opportunities in the field of ecological restoration. These resources will be available on an open Digital Ecological Restoration Toolbox platform, hosted jointly by SER and SER-Europe. This talk will provide an overview of these important aspects of TEAM#UP while also showcasing the early stages of the Digital Ecological Restoration Toolbox.

#TeamUp2Restore www.TeamUp2Restore.eu

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Restoration as a Nature-based Solution: A Case Study of a Stream in Eastern Taiwan

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Abstract

In the context of climate change and rapid human development, ecological restoration as an essential approach of Nature-based Solutions (NbS), addresses social, economic, and environmental challenges. This study adopts the IUCN Global Standard for NbS to evaluate a cross-agency ecological restoration project in a stream in eastern Taiwan.

This project aims to restore the connectivity of river ecosystems through near-natural engineering methods, such as the removal of instream barriers and the restoration of key indicator species. It also incorporates the "Integrated Watershed Management Platform" to facilitate cross-agency collaboration and promote the planning and execution of the project. Additionally, the project balances the needs of local communities regarding water resource management and disaster prevention, creating a harmony between societal and ecological objectives.

Through a review of project reports and interviews with stakeholders, we found that this case aligns well with the IUCN criteria for addressing societal challenges (Criterion 1), biodiversity net-gain (Criterion 3), inclusive governance (Criterion 5), and sustainability and mainstreaming (Criterion 8). Furthermore, the project demonstrates compliance with design at scale (Criterion 2), balance trade-offs (Criterion 6), and adaptive management (Criterion 7). However, economic feasibility (Criterion 4) requires improvement, particularly in conducting long-term cost-benefit analyses and diversifying funding sources.

This case highlights the importance of applying the IUCN Global Standard throughout project lifecycles to achieve ecological, social, and economic goals, providing valuable insights for NbS implementation worldwide.

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Habitat restoration of riverine phosphorus pollution on lowland UK agricultural peatland

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Abstract

Eutrophication of wetlands caused by urban, industrial, and agricultural runoff is a critical environmental issue, characterized by excessive plant and algal growth due to increased bioavailability of phosphorus (P). The Somerset Levels and Moors (SLMs), covering 70,000 ha, represent the largest area of lowland wet grassland and wetland habitat in the UK. River catchments in this region are heavily influenced by intensive agriculture and wastewater inputs, resulting in nutrient contamination of inflow waters that fail to meet the UK Government's Water Framework Directive Good Status targets for P concentrations.

Established in 2013, the Somerset Catchment Partnership (SCP) unites central and local government, farmers, landowners, nature conservation organizations, and Wessex Water in a collaborative effort to restore the SLMs and achieve Good Ecological Status for the water bodies. Researchers at the University of Plymouth analysed macro-plant nutrient concentrations in ditches, dipwells, soil, sediment, and harvested plant biomass to assess the overall apportionment of P inputs, stores, fluxes, and loadings. The data reveal significant temporal and spatial variations in the concentrations of P and nitrogen (N) across the peat-rich soils.

Achieving consensus on land management solutions among multiple stakeholders has been challenging, necessitating a shared focus on climate resilience. Through collaboration, the SCP proposes that an altered hydrological regime and the harvesting of plant biomass in wet agricultural crops could mitigate further eutrophication. Additionally, researchers at the University of Plymouth have suggested that legacy P stored in the peat body could be mobilized by flooding and, over time, evacuated from the wetland.

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Applying the Theory of Change (ToC) Framework to Enhance River Restoration: Insights from the Tzipori Stream, Israel

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Abstract

The Theory of Change (ToC) provides a structured framework for linking interventions to long-term objectives by mapping causal pathways and underlying assumptions, thereby elucidating how restoration measures achieve intended outcomes. The Tzipori is an intermittent stream in Israel's Lower Galilee, draining approximately 300 km² from the foothills of Nazareth to Haifa Bay. The catchment encompasses intensive agricultural land, small privately-owned farms, and culturally and religiously diverse communities residing in rural and semi-urban settlements. A pre-restoration survey, conducted in collaboration with stakeholders, identified significant pressures affecting the Tzipori, including point and diffuse pollution, unauthorized water abstraction, in-channel cattle grazing, damming, and extensive agricultural practices. These anthropogenic stressors have resulted in degraded water quality, diminished flows, altered morphological conditions, reduced native biodiversity, and the proliferation of non-native species. Through the application of the ToC framework, stakeholders, including local communities, farmers, governmental and municipal authorities, environmental NGOs, and academic institutions, developed a master plan structured around five pillars: (1) restoring natural hydrological flow; (2) eliminating point-source pollution and reducing agricultural runoff; (3) enhancing biodiversity; (4) fostering social well-being, education, and sustainable economic opportunities; and (5) advancing best agricultural practices.

Within five years, the project became a model for river restoration and a foundation for up-scaling similar initiatives. The collaborative, evidence-based approach significantly improved ecological conditions and public perceptions, demonstrating the transformative potential of inclusive stakeholder engagement in achieving sustainable environmental outcomes.

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Conservation Biodiversity Financing: From Global Framework to Local Implementation, a Hawai'i case study

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Abstract

Hawai'i's coral reefs, natural lands, and watersheds are home to some of the planet's most unique and imperiled plants and animals. These natural lands and waters bring billions of dollars in value to the state's economy and provide essential resilience services. Investing in these natural assets is both good business and vital to Hawai'i's wellbeing and culture.

At a global level, there is a growing focus on understanding the financing levels needed to scale up countries' critical conservation and biodiversity efforts and meet global goals. UNDP's BIOFIN initiative that supports the Global Biodiversity Framework estimates an annual financing need of between US\$150 billion and US\$440 billion, beyond the annual current spending of \$52 billion.

Leveraging these global trends and to inform timely policy and resource decisions in Hawai'i, a community coalition, Care for 'Āina Now, produced an assessment of financing needs to protect, manage, and restore public lands and waters in Hawai'i.

Findings show that despite recent spikes in federal funding, a persistent and growing funding gap in public and private financing hampers Hawai'i's efforts to protect its natural assets in the face of growing climate and fire risk.

This 2024 assessment raises important questions regarding the State of Hawai'i's role in preventing and financing biodiversity loss and ecosystem resilience, and can serve as a model for other states and subnational regions looking to answer similar questions. The assessment

and the resulting policy strategy the Coalition produced will be discussed in this presentation.

Seeds of Renewal: Exploring Post-Wildfire Revegetation in Alpine Landscapes

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¹Denver. ²Matrix Design Group. ³Denver Water

Abstract

The Williams Fork Fire, a high-intensity wildfire active from August to October 2020, devastated approximately 14,833 acres in Grand County, Colorado, including the western slope of Jones Pass. The fire not only cleared nearly all vegetation but also heightened risks of slope failure, threatening critical infrastructure in the region. In 2023, Denver Water and Matrix Design Group, Inc. initiated a comprehensive investigation to assess post-fire conditions and explore revegetation strategies in this high alpine environment.

Baseline vegetation assessments, composite soil sampling, and unmanned aerial system (drone) imaging—including multi-spectral data—were employed to evaluate conditions within the burn scar. Additionally, Matrix designed and implemented a series of test plots to assess the effectiveness of four key treatments: log erosion barriers (LEBs), granular humate and mycorrhizal soil conditioners, light handheld raking, and supplemental seeding. Vegetation recovery was monitored through photo points, composite soil analyses, and randomized quadrat sampling, with results compared across treatments, control plots, and a reference area.

Preliminary findings indicate that supplemental seeding significantly enhanced vegetative cover, particularly forb growth, while the influence of soil conditioners remains inconclusive. Drone imagery closely aligned with ground-based data, confirming its value as a monitoring tool. These results provide critical insights into effective post-fire revegetation strategies, offering a framework for land managers, including Denver Water and U.S. Forest Service, to enhance ecosystem recovery and mitigate slope instability in high alpine wildfire zones.

This presentation will also provide results from the 2025 field season further expanding on treatment effects on high-alpine post-wildfire revegetation.

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Strategies for improving seed-based revegetation outcomes in Great Salt Lake wetlands in an uncertain water future

Hailey Machnikowski, Karin Kettenring

Logan

Abstract

The increasing frequency and severity of extreme hydrological events brings about additional challenges in wetland restoration. Great Salt Lake wetlands, the largest wetland complex in the Intermountain West, provide critical habitat and food to millions of migratory birds yet face the dual threats of drought and extreme flooding. The goal of this research is to improve the outcomes of seed-based revegetation in Great Salt Lake wetlands in the context of uncertain water availability. We compared a precision vs. bet-hedging restoration approach in a field experiment, two frameworks proposed for improving restoration outcomes. We found that at a site where water levels were ideal, a precision approach produced the most robust native plant community. At a site where conditions were drier, bet-hedging approaches were the only treatments to produce native cover. Simultaneously, to inform species selection for revegetation, we examined the responses of a community of ten native wetland plants to varying hydrologic regimes in a greenhouse experiment. The greenhouse experiment highlighted four native species with a capacity for drought and flood tolerance, two of which also established at the drier field site: *Rumex maritimus* and *Distichlis spicata*. These results indicate that it may be beneficial to tailor restoration plans according to the level of uncertainty of future site conditions. If site conditions are manipulable or predictable, a precision approach may prove more successful. When site conditions are uncertain, seeding species that have displayed a broad hydrologic tolerance may improve seeding outcomes.

Restoration implications of the role of climatic variables in structuring fish communities in channelized agricultural headwater streams in the Midwestern United States

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Abstract

Agricultural watersheds in the Midwestern United States, Canada, and Europe contain numerous channelized headwater streams that have been impacted by agriculture and still function as fish habitat. The influence of climatic variables on fish communities in channelized agricultural headwater streams has not been documented and needed to provide insights to fish community responses to future climatic conditions. Our research questions were: 1) what is the relationship of fish community structure with climatic variables in channelized agricultural headwater streams in northeast Indiana and central Ohio? and 2) is fish community structure in these streams better predicted by climatic variables or stream variables? We sampled fishes, compiled climatic data, and measured water temperature and hydrologic variables from 10 channelized agricultural headwater streams in northeast Indiana and central Ohio for 14 years. Mixed effects modeling indicated that fish diversity, abundance, and relative abundance of coolwater fishes, intermediate tolerant fishes, Percidae, Cyprinidae, planktivores, carnivores, brood hiders, and headwater fishes increased ($p < 0.05$) with increasing precipitation. Fish evenness and the relative abundance of insectivores, guarder-substrate choosers, and headwater fishes decreased ($p > 0.05$) with increasing air temperature. Additionally, hydrologic variables were better predictors of fish community structure than climatic variables. Our results indicate that fish communities in channelized agricultural headwater streams in the Midwestern United States are influenced by climatic and hydrologic variables. Thus, the implementation of restoration practices that can moderate water temperatures, reduce the frequency of stream drying, and improve degraded physical habitat conditions will benefit fish communities in these streams.

Decadal-scale changes in ecosystem functions in restored salt marshes: a case for long-term monitoring programs

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Abstract

In coastal wetland restoration projects, permit-mandated monitoring plans rarely cover time spans relevant to critical ecosystem functions such as food web support and carbon sequestration. We compared metrics of ecosystem function in salt marsh islands created in 2004 and 2012 to reference areas in Galveston Bay (Texas, USA). The restored sites resembled reference areas in terms of emergent plant cover (primarily *Spartina alterniflora*), but did not provide a full range of comparable functions. Carbon sequestration potential in the older restored sites, as estimated by root biomass and soil organic content, approached that of the reference sites. However, trophic support for coastal food webs differed among sites; restored sites had up to 4x more infauna but half as much benthic microalgae. The older restored sites showed evidence of substantial subsidence and loss of higher elevation habitat, indicating that restored sites, unlike reference areas, do not have a high elevation refuge for retreat in response to sea level rise. Overall, when considering metrics of ecosystem function, the restored sites are providing a unique set of values to the coastal ecosystem, but these functions may not persist over time under pressure from sea level rise. This analysis suggests that the strategy of placing dredge material to create low elevation marsh habitat creates sites that are unlikely to persist for more than a few decades. Long-term monitoring plans will help assess vulnerability and identify priority areas for adaptive management or intervention to sustain the provision of ecosystem functions.

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The Las Vegas Wash: 25 years of multi-stakeholder collaboration to protect and enhance a key ecological and hydrologic resource.Jason Eckberg

Southern Nevada Water Authority, Las Vegas, NV, USA

Abstract

The Las Vegas Wash (Wash) is the primary drainage channel for the 1600-square mile Las Vegas Valley, draining treated wastewater, urban runoff, shallow groundwater and storm flows to Lake Mead. The Wash is an integral component to Southern Nevada's water resources providing a conduit to return highly-treated wastewater to Lake Mead. The Wash also has a substantial impact on the water quality of Lake Mead. The Las Vegas Wash Coordination Committee (LVWCC) was formed in October 1998 to create and implement an adaptive management plan for the Wash, which had suffered significant erosion, degradation of water quality, and loss of wetlands in prior decades. In January 2000, the 28-member LVWCC published the Las Vegas Wash Comprehensive Adaptive Management Plan, a document outlining 44 action items necessary to stabilize the channel, improve water quality, and restore ecological functions, including reestablishing wetlands. Since 2000, the LVWCC has been implementing these action items through a collaborative stakeholder process. Achievements include construction of 21 erosion control structures, removing more than 500 acres of invasive plants, revegetating more than 600 acres with native plants, initiating several water quality and biological resource monitoring studies, and conducting numerous outreach events to communicate the importance of the area to the public. This presentation will highlight how utilizing an interagency approach for ecological and hydrological issues has numerous benefits.

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Abandoned Mine Land Restoration of the USFS Burke-Martin Mine, Summit County, Colorado

Randy Mandel

New Castle, Colorado

Abstract

Abandoned Mine Land Restoration of the USFS Burke-Martin Mine, Summit County, Colorado. It's estimated that there's over 47,000 abandoned mines on federal lands. These sites are associated with ecological hazards that include acid mine drainage, watershed sedimentation, air pollution, and various physical hazards. Since 1992, our team has worked with the USFS to restore Colorado abandoned mine land (AML) sites to reduce ecological risk, facilitate site stabilization, improve water quality, protect watersheds, and enhance wildlife habitat through improved biodiversity and ecological functions and services. Species prioritization is based on the primary site-specific native grasses, forbs, and woody species, and has consisted of propagule collection, increase, and planting of these materials. Propagule collection has been accomplished in partnership with the USFS, whereas plant propagation has been primarily through private nurseries and the Colorado Correctional Industries (CCI). Similarly, plant installation has been implemented by CCI's State Wildland Inmate Fire Team (SWIFT) in association with our team and the USFS. We're currently working with the WRNF to restore the Burke-Martin AML site located in Summit County. Burke-Martin Mine is located above Dillon Reservoir which provides water to the Colorado Front Range and its approximately 5 million inhabitants. Our project efforts include collection/increase of native plants through creation of propagation protocols and oversight of plant production; reclamation design; revegetation layout and oversight; compilation of seeding and planting mixes; and ecological site assessment. The restoration plan includes approximately 9,700 containerized plants representing approximately 60 native ecotypes.

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Innovative collaboration on Colorado's rural western slope to train the next generation of restoration practitioners.

Micah Russell¹, Julie Nania², Briget Eastep¹

¹Western Colorado University. ²Coldharbour Institute

Abstract

Restoration practitioners across Colorado's rural western slope approached Western Colorado University's Clark Family School of Environment and Sustainability with a request to start a restoration training program. These partners do not have the capacity to meet the enormous backlog of projects and have been turning away funding. To cultivate perennial training opportunities for our students, establish a pipeline of qualified applicants for our restoration partners, and institute the first continuing education restoration workshops available in our region, the Clark School initiated a graduate level Ecosystem Restoration Certificate. The Clark School has long been a testbed for restoration techniques on public land and we are increasingly working with ranching families to employ students in the design and implementation of habitat restoration and regenerative grazing projects on private lands. We first tested the certificate's feasibility through a 3-day intensive and subsequent surveys. Courses will include ecosystem restoration, project management, mining reclamation, water law, GIS, NEPA, and a hands-on technical skills course with weekend workshops taught by both faculty and experienced practitioners. Most courses can be taken remotely and are scheduled outside of traditional work hours. Students in the program can also qualify for the Society of Ecological Restoration's Certified Ecosystem Restoration Practitioner in Training program. By partnering with the Coldharbour Institute, we have secured grant funding to start the program in fall, 2025. Given enthusiastic stakeholder support, we expect students and professionals from a wide array of demographic backgrounds to benefit from this unique collaboration between academia, industry, and the public sector.

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Eccleston is for the Birds: How a Trout Restoration Project was Designed to be a Birding Hotspot in Maryland

Jeremy Koser

Baltimore

Abstract

The Eccleston Restoration Site, completed in October 2022, is a large-scale stream and wetland restoration project located in the Upper Jones Falls River catchment area within the Gunpowder-Patapsco Watershed in Baltimore County, MD. The project restored a 99-acre parcel, via floodplain restoration and upland practices, with special attention paid to preserving and enhancing habitats for the brown trout fishery.

The Site was developed by the Maryland Transportation Authority (MDTA) to provide compensatory mitigation for unavoidable impacts to state and federally regulated aquatic resources resulting from the I-95 Express Toll Lanes (ETL) Section 200 Improvements. The total restored is protected by a perpetual conservation easement, includes 22-acres of wetland restoration, enhancement, and preservation along with over 10,000-linear feet of stream restoration, creation, and preservation.

This presentation will describe the techniques for restoration that resulted in 122 (and counting) bird species utilizing a former agricultural site, the expansion of a dwindling trout spawning population, and the correlation of trout spawning locations with observed bird species and diversity. Through modified floodplain restoration techniques which focus on a seasonal inundation of parts of the site through groundwater, mitigation goals were met as well as the development of a regionally significant resource for the fishery, residents, and migratory birds. The benefits of upland preservation and management in relation to bird, benthic, and fish communities will be explored, as well as how community stakeholder involvement was essential for the project.

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Open forest restoration redistributes ecosystem carbon

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Abstract

Intentional fire exclusion across the southeastern U.S. is contributing to increasingly dense forests, motivating open-forest restoration with prescribed fire. This densification increases aboveground carbon (C), but open forests (i.e., woodlands and savannas) may store more resilient and/or protected C in understory vegetation and associated roots and mineral soil. Here, we investigated how gradients of open forest restoration affect C storage and vulnerability. Study sites were distributed throughout the southeastern U.S., including stands varying in overstory and midstory species composition and density. Modified Forest Service protocols in combination with published and/or laboratory-determined allometric equations, bulk densities, and C contents were used to estimate tree, woody debris, understory vegetation, forest floor, mineral soil, and fine root C pools.

Total forest aboveground C was higher in closed-canopy (130 Mg ha^{-1}) forests than in woodlands (84.8 Mg ha^{-1}) or savannas (27 Mg ha^{-1}). Understory vegetation C increased with gradients of open forest restoration, whereas leaf litter and organic soil C decreased. Fine root C was higher in savannas (4.3 Mg ha^{-1}) than closed forests (2.7 Mg ha^{-1}), while mineral soil C was similar across stand types. As the ignition probability of unrestored closed forests increases with climate heating and drying, there is an increasing need to better understand how restoration influences all C pools. The ability of open forest restoration to increase C pools that recover quickly or remain protected in the face of fire or other disturbances highlights the importance of maintaining and restoring a diversity of forest structures.

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Reef Islands Initiative: Connecting researchers, industry, community and government to restore critical island habitats in the Great Barrier Reef World Heritage Area.

Clarissa - Elakis

Brisbane

Abstract

The Reef Islands Initiative brings together Traditional Owners, scientists, industry, government and the community to protect and restore critical island habitats in the Great Barrier Reef World Heritage Area. Since 2018, the program has been working with stakeholders to pilot and scale marine and terrestrial restoration techniques with the aim of building ecological resilience and capacity for long-term locally-led stewardship.

Restoration projects are delivered using a place-based delivery model and a four phased approach of: 1) partnership development 2) collaborative prioritization and planning 3) implementation and 4) refining and positioning to scale. Through this approach the program has fostered science-tourism and public-private partnerships to successfully implement a suite of restoration projects. Most projects are in the 'refining and positioning to scale phase'. Examples of early outcomes include: demonstrated ecosystem restoration at scale via public-private partnerships to restore over 15 hectares of *Pisonia Grandis* forest to near benchmark levels on a heavily degraded remote coral cay; equipped the tourism industry as coral restoration practitioners to support local coral recovery via science-tourism partnerships; provided exemplars to aid fundraising and scaling; and contributed to testing regulatory frameworks and developing a social license for coral and seagrass restoration methods.

In this presentation we will share learnings from establishing and maintaining public-private and science-tourism partnerships for restoration, including multi-stakeholder project design and adaptive management, enabling conditions and key considerations that have emerged. For example, transition planning and enduring governance to support local adoption and continuation.

Identifying the role, diversity and plant community structure of Fertility Islands in hyper-arid environments

SAMI YOUSSEF¹, Mohamed Djamel Miara¹, Robin Sallio¹, Jerome Nespoulous¹, Baptiste Kerfriden¹, Yassine Fendane¹, Hassan Boukcim¹, Sami Almalki², Shauna Rees², Benjamin Lee², Abdalsamad Aldabaa², Ahmed Mohamed²

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Abstract

In hyper-arid environments, vegetation is mainly structured into discontinuous patches called "fertility islands" (FIs) according to the variation of local biotic and abiotic factors, such as water, nutrients and organic matter. These FIs contrast with the often bare or sparsely vegetated desert soils. Little is known regarding their diversity, community structure, functioning and role in ecosystems as dispersal sources contributing to the creation of potential new FIs. The purpose of this study is to better understand the function and formation processes of FIs in hyper-arid environments by studying their floristic composition, structure, and natural regeneration in connection to soil characteristics. The study was carried out in Sharaan National Park in northwest Saudi Arabia, where 20 vegetation patches (FIs) were identified using high-resolution satellite images. At each of the selected FI, four vegetation surveys (20mx20m) were conducted: three within the FI and one outside as a control. In total, 80 soil samples were collected and analyzed using X-Ray Fluorescence (XRF) to identify soil chemical characteristics. Fertility islands are expected to demonstrate a particular floristic and structural diversity correlated to the soil chemical composition. They act as dispersal sources helping in creating new, but floristically and structurally similar FIs when the soil conditions are favorable. Additionally, this study may help to clarify the concept of FIs, and enable better planning of active restoration actions to restore degraded areas in hyper-arid environments altered by the combined action of anthropic activities and climate change.

Can co-planting of native and non-native species be used to restore diverse plant communities and suppress weeds?

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Abstract

As global change increasingly requires restoration of ecosystem functions and services, so must restoration increasingly consider the role of non-native species. One restoration approach is to bet-hedge against unpredictable weather conditions by co-planting native plant species intended to meet biodiversity goals with non-native species that more reliably establish under sub-optimal conditions. However, the extent to which this approach yields diverse communities and suppresses weeds is unclear. In a dryland system we field tested a) whether inclusion of high-performing non-native grasses in restoration seed mixes suppressed abundance and diversity of co-seeded native species, b) whether inclusion of non-native species increased overall performance of the seed mix (e.g., weed suppression), and c) how increased seeding rates and species richness of seeded species affected a) and b). We planted eight seed mixes comprising factorial combinations of exclusion vs. inclusion of non-native species, conventional vs. increased seeding rates and conventional vs. increased species richness, replicated across two planting years at each of nine sites in Utah, USA. We found that inclusion of high-performing non-native species suppressed abundance (but not diversity) of co-seeded native species, but this could be moderated by increasing the richness of native seeded species. Additionally, native-only seed mixes yielded lower overall grass abundance than those that included non-native species, but were nonetheless equally able to suppress weeds. Overall, our results indicate that co-seeding native and non-native species reduced some aspects of seed mix performance, but such reductions were partially overcome by increasing seeded species richness and seeding rates.

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Harnessing Biodiversity: Strategic Land Use Planning, Restoration Development, and Conservation Identification for a Large Landholder in Texas

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Abstract

In an era where sustainable development and environmental stewardship are paramount, large landholders face the challenge of balancing economic growth with ecological preservation. This study presents a case analysis of a client committed to achieving a nature-positive goal across 17,000 acres in Texas. By leveraging the Americas Biodiversity Metric (ABM), the client established a baseline for existing habitats across their extensive landholdings, providing a robust foundation for informed decision-making among diverse stakeholders.

The ABM was instrumental in identifying areas of varying ecological value and habitat condition, guiding strategic decisions regarding development, conservation, and restoration. This methodology ensures stakeholders make informed choices, facilitating the protection or restoration of vital ecosystems and enhancing overall biodiversity. The study details the methodology for assessing and quantifying biodiversity, criteria for prioritizing conservation and restoration efforts, and practical implementation steps including documenting and monitoring restoration outcomes.

The findings underscore the benefits of integrating biodiversity metrics into land use planning, including improved ecosystem services, increased resilience to environmental changes, and enhanced corporate sustainability. The case study emphasizes the importance of collaboration among restoration ecologists, land managers, real estate departments, and stakeholders to achieve successful outcomes for the company and land. This innovative approach aims to inspire other large landholders to adopt similar strategies, contributing to global biodiversity conservation efforts.

From Data to Action: Establishing an eLTER European Restoration Hub to Inform Policy and Practice

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¹Lisboa. ²Budapest

Abstract

Meeting global restoration targets is hindered by several challenges, including the necessity for long-term research and robust monitoring to assess success, the need for collaborative efforts across sectors and stakeholders, and securing stable funding. However, these critical elements are often lacking, thereby limiting the effectiveness of restoration efforts. The Long-term Ecological Research Network Europe (eLTER) presents an opportunity to generate actionable knowledge on the long-term outcomes of ecological restoration to support sustainable land-use decision-making. Over recent years, substantial progress has been made in understanding and documenting restoration activities across eLTER sites. A survey identified 62 restoration experts and 42 projects from 18 countries, covering most European habitat types with varying degradation levels and restoration methodologies. This survey underscored the potential for establishing a dedicated knowledge hub aimed at fostering knowledge exchange, enhancing collaboration, and promoting future activities to scale up restoration efforts. Such a hub would play a crucial role in achieving the objectives outlined in the recently approved European Nature Restoration Regulation (NRR). To advance this initiative, three workshops have been conducted at international conferences, focusing on defining the functions and activities of the hub, identifying the added value eLTER offers for ecological restoration, and exploring how eLTER can support NRR implementation. Building on these efforts, a workshop is planned for early 2025 to formally initiate the development of the eLTER Restoration Knowledge Hub, with a focus on fostering intergenerational partnerships. This initiative aims to synthesize restoration research and translate it into impactful policy guidance, supporting global restoration goals.

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How to be Outside: Guided Observation as an Outreach and Engagement Strategy for Urban Ecological Restoration

Sarah Low

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Abstract

Observation is a foundational step in any restoration activity. As practitioners, we visit a site scanning around to see what plants are there, what disturbance is apparent, where there may be water, how the space is being used by humans and wildlife, and so on. As practitioners, we learn this way of reading the landscape early on, but community members do not always have this trained skill for observing. As people become increasingly dependent on devices for connection, it is important to offer intentional guidance to assist people with engagement in nature. Guiding people to observe the natural spaces around them using all of their senses can help them build appreciation for nature and an attachment to the place, develop an interest in stewardship, and cultivate personal wellbeing. Involving community members in stewardship activities may require taking steps to help community members connect with the outdoors.

During this talk, Sarah will share some techniques for guiding participants to mindfully notice the natural areas they are visiting, caring for, and stewarding. She will offer a short guided practice for audience members to experience for themselves during the talk.

Sarah C. Low has many years of experience planting, managing, and planning tree planting and habitat management in urban natural areas in Pennsylvania, New Jersey, Massachusetts, and Washington State. In the past seven years, she has regularly guiding people on nature mindfulness walks and neighborhood tree walks, and has observed the powerful impact that time outside can have on people.

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Identifying Climate Refugia for Bison through Stakeholder-Informed Habitat Suitability Modeling: Supporting Restoration Considerations in Colorado

Emma Galofré García¹, Sarah Weiskopf², Karen Bailey¹

¹University of Colorado Boulder. ²National Climate Adaptation Science Center, U.S. Geological Survey

Abstract

Bison (*bison bison*) are a keystone species and ecosystem engineers that contribute to heterogeneous and productive landscapes. With intensifying climate change impacts, bison also play an important role in ecosystem resilience. As a result, there is increased interest in restoring the species across its historic range, including in Colorado, where Colorado Parks and Wildlife (CPW) is evaluating the potential to actively restore the species. However, with increases in drought conditions and extreme heat events in the state, it is important to understand how climate change impacts restoration efforts, including how habitat suitability for the species may change into the future and locations of possible climate change refugia. Our project addresses these considerations by working with CPW, species and climate experts, and other stakeholders to develop a habitat suitability index (HSI) for bison in Colorado that incorporates climate change projections. The HSI incorporates data from a meta-analysis of habitat selection studies, as well as expert knowledge and local insights on bison habitat use and responses to extreme weather events. Guided by principles of actionable science and co-production, we conducted a needs assessment with stakeholders and iteratively refined the HSI based on their feedback. The resulting HSI, paired with future development of a user-friendly web-based application, allows CPW and other stakeholders to explore habitat suitability under multiple climate scenarios for bison in Colorado. Additionally, this tool helps identify areas that can support bison populations over the long term, facilitating climate resilient restoration planning in the state.

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Trees in Croplands: Evaluating Impacts on Heat Stress in Agricultural Workers

Njamasi Chiwanga

LEAD Foundation, Tanzania

Abstract

This presentation explores the potential of integrating trees in croplands (agroforestry) to alleviate heat stress in agricultural workers, contributing to the "One Health" concept that recognizes the interconnectedness of human, animal, and environmental health. In Tanzania, where 70% of the workforce is engaged in outdoor agriculture, heat exposure poses a significant health and economic burden. This study will evaluate the impact of trees in croplands on reducing heat stress and improving health outcomes among agricultural workers.

The research will involve ethnographic studies to understand local perceptions and practices related to heat-health risks and adaptation. Microclimate data will be collected using sensors and satellite imagery to assess the cooling effect of trees. Physiological data, such as core body temperature, hydration status, and kidney function, will be collected from farmers working in areas with varying tree densities. The study will also involve capacity building and dissemination activities to share findings and promote the adoption of agroforestry practices.

This research is led by the LEAD Foundation in collaboration with the London School of Hygiene and Tropical Medicine, MetaMeta Research, the University of Dar es Salaam, and the University of Dodoma, with funding from the Wellcome Trust.

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One Health Framework for Resilience Capacity Building

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Houston

Abstract

Community resilience depends on the durability of natural systems to buffer and support human health. Environmental quality, wildlife health, and biodiversity are key determinants of human adaptability to climate-related stresses. Associated long-term physical and mental health impacts can be ameliorated by integrating ecological restoration in the built environment based on One Health principles.

We will discuss the basis of ecosystem restoration and management from a One Health perspective, where animal and wildlife well-being are integral to human physical and mental health. Ecosystems services and additive benefits of robust environmental quality are demonstrated through examples of landscape models adapted to flood, heat, and air quality resilience. Transformative layering of biodiversity richness within the built environment brings community health to the forefront and sustains it well beyond what traditional urban planning allows.

We will highlight Harris County's One Health actions including the One Health in the Built Environment Toolkit; One Health Index; and One Health Action Hub, with specific examples of 1) connectivity along our region's waterways; 2) connectivity along utility rights-of-way that support endemic prairie habitat; and 3) multi-objective infrastructure (detention basins, parks, campuses) where ecologies are co-located.

We will explore communications strategies that embed a One Health framework into infrastructure planning, resilience policy, and ecological restoration. Fostering resilience and embedding additive benefits of biodiversity into the urban framework creates accessibility to nature that is equitable and inclusive. By weaving ecosystem elements into the built environment, we are providing fair and just public health benefits and breaking down social determinants.

Effect of grassland restoration using hay transfer on pollinators; a case study from southern France.

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Abstract

Restoration methods may influence the order of arrival and successional trajectory of flowering plant communities. However, it remains unclear how the succession of lower trophic levels influences the assembly of biotic communities in higher trophic levels. To compare the effects of restoration on multiple trophic levels, plant-pollinator interactions were sampled across a former peach orchard in southern France that was restored with assisted regeneration (AR – hay transfer) and natural regeneration (NR). Within this landscape, we selected four sites that were restored through AR, NR, and native grasslands that served as a reference (n = 12 sites). At each site, we recorded plant-pollinator interactions during 3-hours on one 50-m long × 2-m wide transect. Plant communities were sampled in five 2m×2m quadrats placed along transects. Fifteen years after restoration, plant community composition on restored plots was still different from that of the reference, which had a greater plant richness. Half the interactions recorded on the reference were on *Euphorbia seguieriana* and the most active pollinators were Coleoptera and Diptera. On AR and NR, most interactions were recorded on *Galactites elegans*, *Lobularia maritima* and *Diplotaxis tenuifolia*. On NR, Coleoptera and Hymenoptera were the most active pollinators, while on AR, Coleoptera, Diptera and Hymenoptera had a similar activity. NR had the highest flower cover, followed by AR, due to species with large flowers, such as *Galactites elegans*. Compared to the reference, hay transfer (AR) does not allow plant-pollinator network restoration because it does not markedly improve plant community composition.

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Evidence of altered seed rain and disperser communities in regenerating forests in eastern Madagascar

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Abstract

Researchers and managers are increasingly assessing quality of restoration programs based on the impacts on ecological processes key for ecosystem resiliency. In the case of animal-mediated seed dispersal, there is limited understanding of how different disperser groups (e.g., primates) facilitate these dynamics in regenerating habitats. In Madagascar, endemic primates serve as primary or sole dispersers for most native trees, but sensitivity to disturbance and threatened status of these animals may contribute to the slow and limited regeneration of Malagasy forests. To understand the state of primate communities and seed dispersal in restoration ecosystems, we conducted an observational field study a community-managed site in Maromizaha Natural Resources Reserve, eastern Madagascar. From May—August 2022, we used visual distance sampling and seed trapping across sites in intact rainforest, intentional restoration, and early natural regeneration habitats. While we recorded some evidence of seed dispersal by a large-bodied frugivorous lemur (*Eulemur fulvus*) at a restoration site, our surveys suggested limited use of regenerating forests by large primates in contrast to intact rainforests. Conversely, small nocturnal mouse lemurs (*Microcebus* spp.) were observed in high densities at restoration and natural regeneration sites. We found that intact forests had reduced seed rain compared to regenerating habitats, with patterns largely driven by dispersal of small-seeded plant species that characterize disturbed habitats in the region. Our findings suggest a possible outsized role of small-bodied animals like mouse lemurs in facilitating seed dispersal in regenerating forests and will inform ongoing restoration efforts by local managers in Madagascar.

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Corporate governance to mainstream application of mitigation hierarchy

Gay Landwehr

Alcoa, Perth, WA, Australia

Abstract

The mitigation hierarchy is frequently mentioned in frameworks and ultimately aims to decrease the loss of biodiversity and the areas requiring restoration. How does a company encapsulate the intent to ensure that application of the hierarchy becomes business as usual? This paper will share the recent work undertaken to provide a governance framework that formalises the awareness of the mitigation hierarchy by formulation of a biodiversity strategy and standard, with detailed guidelines for risk assessments and action plans. These action plans capture the reduction of risk by application of the 'AVOID and MINIMISE' steps of the hierarchy in decision-making processes, and ongoing progressive rehabilitation ('RESTORATION') with an adaptive management loop to ensure high quality outcomes. Corporate external reporting requirements may ask for the demonstration of the application of the mitigation hierarchy. This paper will also share the guidance document developed to assist in the formal capture of the application to assist in meeting reasonable assurance auditing by third parties.

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Developing SEEDS: A new network of experimental, post-wildfire seeding sites

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Abstract

Nearly half of all treatments applied in the Great Basin, USA, are wildfire rehabilitation, which accounts for >3.76 million acres or 12.5% of the Bureau of Land Management public lands in the region. As fire frequency and size continues to increase with climate change, the need to improve rehabilitation efficacy using adaptive management decisions derived from systematic monitoring and experimentation is paramount. While large-scale rehabilitation treatments are applied across this landscape, there are no standardized monitoring methods used to evaluate efficacy, and novel experimental treatments are not always pursued. We convened a cadre of scientists and managers to develop the Seeding Evaluation and Experimental Design Strategies (SEEDS) project, which is a partnership to design, install, and monitor large-scale seeding experiments across multiple wildfires to test novel techniques and increase the pace of learning about sagebrush ecosystem restoration. This team asks interdisciplinary questions and looks to link plant and soil processes in post-wildfire recovery, with intentions to expand to other trophic levels. Experimentation will include comparing different drill configurations, seeding rates, seed sources, site preparation, interseeding, and other relevant questions as influenced by local management needs. We share our experience installing two experiments to-date, including logistics of working with local field office managers, obtaining seed and seeding equipment, determining experimental treatments, and monitoring.

Improving restoration outcomes through trait-based approaches: bridging knowledge gaps and fostering cross-system collaboration

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Abstract

Under accelerating global change, trait-based approaches are becoming essential tools in the restoration toolbox, providing insight that can help predict ecosystem trajectories and restore desired functions. Trait-based methods also provide a common language that extends beyond species- or system-specific contexts to allow for the translation of information across organisms and ecosystems, which can be critical during the restoration planning process. However, the application of trait-based approaches to restoration has often progressed independently within target ecosystems, limiting innovation and collaboration. To foster cross-system collaboration and advance restoration practices, our working group synthesized diverse perspectives and existing knowledge on trait-based restoration methods, distilling this information into three key findings: (1) context dependency and trade-offs in trait-function linkages shape restoration outcomes at distinct ecological scales and project stages, which can impact long-term success; (2) trait-informed restoration varies across ecosystems and focal organisms, with top-down approaches targeting individual organisms or populations and bottom-up approaches focusing on community-level organization; (3) organizational siloing limits communication between practitioners and researchers, preventing broader advances in trait-based approaches across ecosystems. We further highlight current trends and potential avenues for improving the application of trait-based approaches to ecological restoration, leading to more cost-effective, context-sensitive strategies that can succeed under global change. As novel environmental conditions arise, a more integrative approach to trait-informed restoration that spans across ecological scales, promotes knowledge-sharing between diverse ecosystems, and fosters management-science collaboration can help close knowledge gaps and facilitate greater connectivity within the field, helping to unify and advance restoration efforts under future climate scenarios.

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The Global Biodiversity Standard: Developing a framework for assessing and certifying biodiversity outcomes of restoration projects.

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Abstract

The accelerating Sixth Mass Extinction, driven by anthropogenic activities, threatens global biodiversity, with 38% of tree species at risk of extinction. Land-use changes, invasive species, pollution, and climate change exacerbate these declines, necessitating urgent action to reverse biodiversity loss. The Kunming-Montreal Global Biodiversity Framework's Target 2 to restore 30% of degraded areas by 2030, serves as a guiding target for restoration initiatives. However, many projects prioritize carbon sequestration or monoculture tree plantings over biodiversity, typically establishing non-native fast-growing species. This highlights the need for evidence-based frameworks to guarantee that restoration efforts benefit local biodiversity and communities.

The Global Biodiversity Standard (TGBS; [https://www.tgbs.org/](#)) addresses this need by providing a site-based methodology to assess ecosystem restoration projects. TGBS evaluates projects against eight criteria encompassing ecosystem integrity, legal protection, stakeholder engagement, and monitoring, aligned with other international restoration frameworks such as the Society for Ecological Restoration's Ecological Recovery Wheel. Developed through a multi-year iterative process involving over 100 restoration sites across nine countries, TGBS published its methodology in a manual available in four languages.

Field testing by national TGBS hubs demonstrated its applicability across diverse ecosystem and restoration types, emphasizing local biodiversity recovery, native species prioritization, adaptive management, and robust methods of monitoring. This paper outlines the development, field testing, and application of TGBS as an international standard to guide and certify restoration projects toward achieving biodiversity, carbon, and livelihood outcomes, thereby addressing critical gaps that existed in global certification schemes.

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On the road to conservation: practitioner perspectives on barriers and solutions for roadside conservation efforts in Germany

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Abstract

Roadsides are vital for nature conservation in agricultural landscapes, providing secondary habitats and refuges for plant and insect species. Preserving and enhancing roadsides can mitigate biodiversity loss and improve connectivity in fragmented landscapes. However, roadside management often prioritizes traffic safety and logistical convenience over conservation objectives. Despite growing evidence supporting biodiversity-friendly management strategies, large-scale implementation remains rare. Our study aims to a) identify prevalent management strategies and barriers hindering successful implementation from the local to the supra-regional scale and b) propose practical solutions for overcoming these barriers.

We conducted semi-structured interviews with project managers from 26 roadside management projects across Germany, representing conservation management, governmental authorities, foundations, and researchers. Findings revealed common management concepts include retrieving over-cropped roadsides, introducing species, or adapting management. Key barriers to biodiversity-friendly roadside management include legal constraints on biomass utilization, which is classified as waste, a lack of sustainable utilization concepts, and insufficient stakeholder engagement and training. Further, the low conservation priority attributed to roadsides and related resource shortages such as machinery or personnel is problematic. Interview findings suggest that changes in management regimes often fail due to implementation barriers rather than methodological flaws.

Building on our results, we propose solutions that could serve as a framework for developing strategies applicable in other areas. We advise policy changes to simplify the utilization of biomass. Further, to facilitate the transition of management regimes on a larger scale, we suggest training managing authorities and harnessing synergies with other conservation efforts, such as sharing experience and equipment.

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Building on the past: exploit disturbance legacies to restore disturbed forest ecosystems

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Abstract

Natural disturbance commonly affects forests worldwide and severely affects the original stand. Given that society strongly relies on ecosystem services provided by the forests, it is critical to manage the forest restoration after a disturbance, especially in the case of a stand replacing one. Passive or active restoration strategies can be adopted depending on the post-disturbance scenario, but, overall, the aim is to maximize the intervention efficiency and minimize the economic cost. Disturbance legacies are valuable resources to achieve these results, since they can create microsites facilitating plant establishment and growth. Quick and precise identification of such microsites is useful to plan and design the restoration strategy. Here we present an innovative approach to estimate the role of the disturbance legacies in creating favorable microsites for forest regeneration, and some examples of restoration activities in the Italian Dolomites after windstorm. Seedling density was surveyed one, two, and four years after the storm, while drone-derived surface roughness is used as proxy to assess the disturbance legacies. Results show an increase in the seedling density up to three years after the storm, indicating a positive role in enhancing seedling establishment. Surface roughness was identified as a good proxy to describe the disturbance legacies induced roughness, and its influence on short-term regeneration dynamics. Based on these results we present some examples of restoration based on a cluster-assisted restoration, taking advantage of the presence of disturbance legacies (especially deadwood) to enhance the seedling establishment and survival probability, both for natural and artificial regeneration.

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Supporting seed-based restoration through the Millennium Seed Bank Partnership

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London

Abstract

The Millennium Seed Bank Partnership (MSBP) is known for conserving global wild plant diversity, but it also supports seed-based restoration with a focus on species' traits, propagation, genetic diversity and improving seed supply of native species. In the UK the MSBP investigates how germination traits interact with climate change to influence restoration outcomes, and how seed can be used more effectively in calcareous grassland restoration. In Indonesia and Madagascar, the MSBP is applying the framework species approach to forest restoration, investigating framework traits of native species and supporting propagation at active restoration sites. In Thailand and Ghana, we are mapping the genetic diversity of selected tree species to define seed zones and assessing the genetic diversity of seed from mature restoration forest plots to determine their suitability as seed 'orchards'. In Mexico, the MSBP is working with local communities across the whole seed value chain. In the Dominican Republic, we are restoring threatened Magnolia forests, capturing genetic diversity and propagating magnolia species and associated forest species, then using these for reinforcement plantings. In Madagascar and Ghana the MSBP is developing short-term seed storage facilities at restoration sites. Seed sourcing remains an issue in many countries. Access to known provenance, wild origin seed collections with germination test data is limited. A new online data source, SeedPOD, will provide practitioners with this information and a seed ordering system. New training materials have been developed around these topics, and we are supporting knowledge and skills exchange between our partners.

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What are the effects of peatland rewetting on biodiversity in Northern Sweden?

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Abstract

Peatlands cover less than 3% of the earth's surface while storing 30% of the world's carbon and providing key ecosystem services. In Sweden, the major historical cause of peatland degradation is drainage for timber production, which generates environmental and societal costs, such as increased vulnerability to droughts and floods, reduced water quality, degraded biodiversity and net release of greenhouse gases. To regain the lost benefits of peatlands, rewetting by blocking or filling ditches is becoming popular. However, research is needed to assess the outcomes of rewetting. In particular, little is known on how invertebrate communities react to the restoration of peatland.

I will summarize the results of two intensive field surveys of arthropod (ants, spiders, dragonflies, butterflies) and vascular plant communities across more than 40 rewetted, drained and pristine peatlands in northern Sweden. I will underline key implications for action and reflect on what is still missing to understand the impacts of peatland restoration on arthropods. I will present how my data - in cooperation with restoration practitioners and researchers - can help to establish a long-term monitoring scheme that will optimise the biodiversity outcomes of rewetting.

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The Mangrove Breakthrough: Transformative Collaboration Across Scale, Sectors, and Ideologies

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Abstract

Mangrove forests hug the tropical coasts of our planet, providing resources and resilience to the communities and biodiversity that depend on them. Their strength as critical nature-based solutions stem from their interconnected nature, not unlike the networks of organizations and governments binding together to protect and restore them.

This presentation will highlight lessons learned from the Global Mangrove Alliance (GMA), a civil society coalition that has grown from just a few of the world's largest global conservation organizations to nearly 100 NGOs, universities, and research institutions worldwide. The GMA has ambitious goals of halting anthropogenic loss of mangroves, doubling their protection, and restoring half of recently lost mangroves by 2030. Members work together to produce resources, tools, and guidance that are reciprocally used and influenced by in-country Chapters of the GMA, ensuring impact on the ground. Recognizing civil society cannot achieve these goals alone, the GMA has bound with partners across sectors within the Mangrove Breakthrough that brings together governments, researchers, organizations and financial institutions to collectively mobilize \$4 billion to protect and restore 15 million ha of mangroves by 2030.

This type of transformative collaboration across the public, NGO and private sectors often presents a challenging landscape to navigate. Accounting for the needs and expectations of actors from local communities to global financial institutions requires thoughtful consideration of institutional norms, political priorities, and cultural ideologies. The presentation will focus heavily on the human-centered approaches at the heart of these initiatives, from which other conservation coalitions could draw inspiration.

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The Living Laboratory: Designing for Biodiversity to Connect People with Nature in the Pollinator and Bird Garden

Emmanuel Didier

Fort Collins

Abstract

This oral presentation explores the Pollinator and Bird Garden at the Arboretum at Penn State as a living laboratory and catalyst for change in urban habitat restoration. Integrating art, culture, and science, the garden fosters a visceral connection with nature, inspiring the reimagination of urban spaces as vibrant ecosystems.

Formerly a 3.5-acre monoculture pasture, the garden was transformed into a series of rich, biodiverse habitats via a collaborative, multidisciplinary design process. Today, as a field lab for the Center for Pollinator Research, the garden serves as a hub for outreach and education, showcasing the ecological and social benefits of pollinator-friendly habitats. Ongoing research provides valuable insights into urban biodiversity and restoration techniques, informing sustainable planting choices and habitat design.

Extending the surrounding agricultural-woodland-hedgerow tapestry, the garden features a diverse array of native plants, sculpted terrain, and varied soil conditions to create microhabitats that support a wide range of pollinators and birds. Interactive elements like the tilted Pollinator Disc and the Beehive structure engage visitors and promote a deeper understanding of ecological processes.

Emmanuel Didier, landscape architect, principal of Didier Design Studio, and lead designer for the Pollinator and Bird Garden, will discuss how, by integrating artistic expression with scientific inquiry, the garden becomes a powerful tool for raising public awareness and support for urban restoration initiatives. Didier will use graphics and photos to illustrate how this award-winning garden is a best-practice example of how art and culture can inspire and mobilize communities to actively participate in creating ecologically resilient cities.

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Governing AI-Driven Precision Restoration at ScaleFernando Morales-Rueda¹, Maganizo Kruger Nyasulu², Jorge Castro Gutiérrez¹¹Granada University. ²Stockholm University**Abstract**

As the urgency to restore degraded ecosystems grows, precision restoration—leveraging artificial intelligence and drone technologies—offers a promising path to scale up efforts efficiently. By enabling data-driven site selection, optimizing seed deployment, and improving monitoring, AI-powered restoration has the potential to enhance ecological recovery. However, its success depends on more than technological advancements alone. Without robust governance frameworks, the integration of these tools risks exacerbating inequalities in access, overlooking local ecological knowledge, and misaligning with broader restoration goals. We explore how governance can guide AI-driven precision restoration to ensure its ecological and social relevance. Through a review of governance practices in large-scale restoration initiatives, we analyze how top-down policies and bottom-up engagement can be integrated to maximize both efficiency and inclusivity. We identify key governance principles, including multi-stakeholder collaboration, equitable resource distribution, and mechanisms for long-term knowledge sharing. We highlight that scaling AI-driven restoration requires financial models adapted to nature's timescales, beyond short-term tree-planting metrics. Moreover, ensuring local communities and restoration practitioners have access to AI tools is crucial for long-term success. By designing governance structures that prioritize inclusivity and accountability, precision restoration can transition from a promising innovation to a transformative force in ecosystem recovery.

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Ecological restoration and management of polluted soils

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Abstract

Ecological restoration has become an attractive management option for polluted soils thanks to its many advantages, e.g., costs that can be significantly reduced (e.g., no excavation of soil for off-site treatment), the numerous co-benefits associated with nature-based solutions ("no regret measures"), a way of meeting the need for nature in dense urban areas, public subsidy opportunities. In this context, in 2023, the use of Ecological Restoration was included in the French regulation associated with the management of polluted sites and soils.

Therefore, the development of ecological restoration as a management option needs to be supported and framed by a reference method adapted to the context of polluted sites. This method should (i) integrate the knowledge and best practices of the fields involved, e.g., ecological restoration, management of polluted soils, health and ecological risk assessment; (ii) take into account the operational constraints that may be encountered in concrete field projects; (iii) be consistent with the content of the Proposal for a European Directive on soil monitoring and soil resilience (2023). In particular, the method should be adaptable to different types of regulatory context (e.g., those setting limit values for pollutants in soils (e.g., United States, Germany, Belgium) and those basing management on use (e.g., France)). The aim of this oral presentation is to outline a proposed method for the French Ministry of Ecology, based on an analysis of feedback from field projects and a review of the scientific literature.

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Advances in the Ecological Restoration Strategy of a private company at the midpoint of the UN Decade

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¹São Paulo. ²

Abstract

Halfway through the UN Decade on Ecosystem Restoration and the launch of Suzano's Restoration Strategy, the company has contributed to achieving national and international targets for native vegetation recovery, initiating restoration on more than 10,000 hectares between 2020 and 2024. With a forest base of 2.8 million hectares, of which 1.1 million are dedicated to environmental conservation, Suzano SA, a leading forestry company specializing in bioproducts derived from cellulose, has recorded over 40,000 hectares under restoration and more than 17 million seedlings planted, since the start of the program, making it one of the largest private restoration initiatives in Brazil. Beyond meeting legal requirements, certification and voluntary commitments, Suzano's Ecological Restoration Program has enhanced connectivity and integrity of natural remnants while strengthening the restoration chain in the Atlantic Forest, Cerrado and Amazon biomes.

During this period, Suzano has also improved its management processes by: (i) improving the technical list of operations and costs, with methodologies ranging from US\$ 0.00 to US\$ 3,900.00, making physical and financial planning more assertive and controlled; (ii) integrating the restoration database, technical list, legal and voluntary commitments deadlines, and annual operating capacity to design the Multi-Year Restoration Plan, a document that will guide future planning, as it indicates the areas to be worked on and costs of each year to achieve long-term goals.

In collaboration with stakeholders, Suzano has strengthened partnerships with collectives initiatives such as Atlantic Forest Restoration Pact, Amazon Restoration Alliance and Araticum – an organization dedicated to Cerrado restoration efforts.

The use of dynamic reference models to monitor ecological restoration in temperate forest ecosystems of South America.

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Abstract

Facing the second part of the UN Decade on Ecosystem Restoration, there are enormous challenges in terms of ecosystem restoration for the temperate forests of South America. The time has come to start evaluating restoration success in terms of ecosystem integrity to know if we are only summing areas with established trees or if we are restoring functional forests for the future decades. In this context, using reference models that capture the spatio-temporal variability of ecosystem structural, compositional, and functional attributes is crucial for restoration practitioners, because it allows them to predict with some clarity the future composition, structure, and functions of disturbed stands once restoration efforts are initiated. In this study, we explore how structural, compositional, and functional reference attributes (e.g. Forest Structure Index FSI, Shanon entropy, natural regeneration), vary along temporal and spatial reference gradients along the temperate bioclimatic region of South America and how this information can be used to create dynamic reference models for ecological restoration. Based on 45 reference plots, we developed dynamic reference models that include the complete successional trajectory (>400 years), in three forest types dominated by *Nothofagus* species along a 1,500 km north-south latitudinal range. Our results confirm the importance of considering stand age and site characteristics in a reference model since this allows us to monitor whether restoration plantings follow a successional trajectory with attributes of structure, composition, and function of an equivalent reference age and site condition.

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Creating globally scalable solutions: Leveraging NASA Earth Observation products to monitor restoration successes and inform future conservation interventions on islands

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Abstract

Removing invasive species from islands is a proven conservation intervention to prevent the extinction of native taxa. Encouragingly, there is growing evidence that the removal of invasive species from islands also functions as a nature-based solution for climate resilience through the recovery of native vegetation. To guide future conservation interventions on islands, we developed a globally consistent and scalable framework to evaluate vegetative changes using remotely sensed indices from the NASA Earth Observation program. Using five study islands encompassing multiple ecoregions with documented vegetation changes, we explored spatially explicit changes in tree canopy cover, NDMI, NDVI, EVI, and MSAVI2 over a 40-year period (1984 – 2023) following invasive species removals and native species repatriations. We then validated remotely sensed trends using in situ monitoring data, providing insights into the potential for these metrics for natural resource managers to complement or improve restoration trajectories. Vegetative indices varied in space and time, with significant spatiotemporal changes reflecting invasive species removals and native taxa repatriations. Using these data, we developed a Shiny application for natural resource managers to examine spatiotemporal changes in remotely sensed indices to identify and prioritize areas for future conservation intervention, inform intra-island reintroduction site selection, and determine where to implement in situ monitoring to maximize efficiency and adaptive management capabilities.

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Assessing the recovery of communities in landscape restoration

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Abstract

Ecosystem restoration is widely recognised as a critical solution to addressing the global biodiversity loss and climate crises. However, to ensure their sustainability, restoration actions must be designed to achieve effective recovery and long-term resilience of the restored ecosystems. This requires predictive models capable of capturing the dynamics of complex ecological systems, accounting for the interactions among species and their relationship with the landscape. However, the lack of a general modelling framework currently limits our understanding of the ecosystem recovery process, and this, the effectiveness of our restoration efforts.

In this study, we explore the dynamics of recovery of ecological communities following landscape restoration. By employing spatially explicit metacommunity models, we assess the rates and trajectories of community recovery under various scenarios. Specifically, we investigate how the interplay between the spatial landscape structure, the metacommunity structure and species' dispersal abilities affects: (1) recovery times and (2) recovery debts which describe the recovery trajectory by quantifying the deficit in population size.

We show that landscape with large habitat patches tend to have shorter recovery times and lower recovery debts than landscape with many small patches, but the same total habitat area. However, the magnitude of this effect is mediated by species dispersal abilities, with long-distance dispersers being less sensitive to restoration scenario. Moreover, number of mutualistic interactions in a community has a positive effect on its recovery. Our results highlight the importance of considering species dispersal, interactions between species, as well as the spatial habitat arrangement in planning restoration projects.

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Integrated assessment and restoration strategy for the Pueblito River, Querétaro, México.

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Abstract

Urban river restoration is a significant challenge worldwide due to complex interactions between multiple stressors and the need to balance the natural and built-in environments. Restoration problems are exacerbated in urban rivers of the Global South, where information necessary for effective management is lacking, and restoration practices are still incipient. This is the case of the Pueblito River, the last urban river in Queretaro that maintains a semi-natural structure. Local management practices have increased water quality and habitat for the endemic freshwater crab in some river sections. However, a lack of information and shared vision have limited the effectiveness of the interventions.

In this study, we performed an integrated hierarchical assessment based on biophysical and social data to assess the river's current state. We found several pressures on the system, including alterations in the hydrological cycle, modifications of the river channel, the introduction of invasive species, and the lack of social connection to the river. Based on the results, we created a model of the social-ecological system of the Pueblito River utilizing the Driver-Pressure-State-Impact-Response framework to understand better the processes affecting the system. With the help of the local managers, we created a shared vision for the river and a set of management recommendations to restore it.

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Creating a Landscape Typology: Developing a localized landscape classification system in GIS to help inform data-driven ecological planning, management, and long-term trend tracking.

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¹Cedar Creek Associates. ²Matrix Design Group. ³City and County of Denver

Abstract

The urban ecosystem is a unique matrix that comprises a very granular interaction of living environments, like parks and waterways, that abut areas of lifeless hardscape like roads and buildings. These components are further segmented by the presence of invasive, non-native, and native vegetation. Ecoregions are a typical landscape classification tool, however they are ill equipped to be used at the granular scale of urban spaces. Yet, understanding the urban matrix is key to help better inform ecological stewardship actions. By making small changes and connections in the urban matrix we can help to increase the connectivity of high functioning systems, create biodiversity in spaces that are lacking, inform regular management activities and help humans to better understand the importance of the urban landscape in preserving ecological function.

To help fill the gap in understanding within the urban matrix, Denver Parks and Recreation commissioned the development of a Landscape Typology tool. This tool helps to breakdown the living landscapes within Denver's Park system through a combination of rapid field and geospatial assessment. Data collection included species cover/diversity, habitat type, ecosystem function and overall aesthetic, among others. Once data was collected, polygons were drawn in ArcGis to better understand geospatial reference. This presentation will outline the process that Denver Parks and Recreation, along with their project partners, took to develop, test, and implement the Landscape Typology tool. By doing so, we hope to provide a framework for better understanding the ecological interactions taking place in the complex urban environment.

A case for arid soils: Using conceptual illustration to convey pedogenic processes and inform dryland restoration strategy.

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Abstract

Some concepts cannot be adequately captured in narrative form, such as spatial relationships, interdependent processes, multivariate interactions, and divergent outcomes. Illustrative conceptual models provide a medium to communicate complex processes through simplified visual representations. Here we present a series of conceptual models that illustrate the micro- to landscape-scale processes that form various biological soil crust (biocrusts) and desert pavement morphological types within the arid Mojave Desert (USA). We consider how the introduction of fine-grained sand into a weathering-limited geologic system influences the trajectories of biocrusts and desert pavement development and eventually control biogeochemical dynamics (e.g., fertile island formation). Understanding the processes and patterns of soil features across the landscape can help scientists and land managers predict ecosystem responses to disturbances and potential success of restoration interventions.

We share a conceptual model illustrating the distribution of a rare perennial shrub (*Eriogonum corymbosum* var. *nilesii*), which is endemic to the Mojave Desert of southern Nevada (USA). This illustrative model clearly identifies soil surface and subsurface features that are found in occupied habitat. These soil features are considered critical to the species' survival and are important to replicate through habitat restoration.

Finally, we demonstrate how these conceptual models have potential to inform ecological restoration efforts for utility-scale solar and transmission infrastructure in the arid southwestern USA. We provide quantitative evidence that conserving soil and vegetation resources helps maintain ecological services within these energy corridors and may support co-existence of renewable energy development and native ecosystems.

Restoring my backyard: the flora of "La Caleta" an urban mangrove located in the backyard of the Independencia neighborhood, as a tool for its restoration.

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Abstract

The urban mangrove "La Caleta" represents an important natural reservoir on the Isla del Carmen. It is located in the backyard of the houses established in the colonia Independencia, wich favors its degradation. For its restoration, a diagnosis of the plant diversity in 5 ha of surface was carried out. 74 species of vascular plants are reported in 71 genera and 59 families. Highest diversity is found in Apocynaceae, Arecaceae, Euphorbiaceae, Fabaceae, Malvaceae, Poaceae and Rubiaceae with 32 species. The herbaceous life form is the most diverse with 27 species that present four types of growth: erect, prostrate, climbing and decumbent. There are 21 arboreal elements, 13 shrubs and 2 vines. 57 native species, 14 exotic species and 3 invasive species are recorded, mainly from Africa and tropical Asia. Four species were recorded in the trheat category (A), according to NOM-059-SEMARNAT-2010 and could be in danger of disappearing. A phenological record of the species was made. 40 are in a vegetative state; 18 in flowering and fruiting, 14 only in flowering and two species in fruiting. Despite anthropic pressure, vegetation is still preserved with the evident contamination by solid wastes. The diagnosis motivated the establishment of an eco-trail that allows residents to access an urban green space that houses a natural ecosystem where restoration activities are carried out to reduce environmental impact and preserve biodiversity

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Controlling burns: Evidence for indirect reduction of wildfire through tropical humid forest restoration in Madagascar

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Abstract

Escaped wildfire poses existential threats to tropical humid forests lacking natural fire regimes, but directly managing community fire-setting behaviors poses numerous logistical and ethical challenges. Instead, co-benefits of restoration programs could present effective, indirect opportunities to reduce wildfire threats by disincentivizing behaviors that harm forest and community livelihoods. After we implemented restoration activities in a newly protected humid forest fragment in southeastern Madagascar, Ivohiboro, we received anecdotal reports that nearby communities had substantially reduce fire setting near the forest. We believed our prioritization of direct compensation for participation in restoration (e.g., payment for digging firebreaks, planting novel “Foxhole Forests”) indirectly encouraged communities to alter fire setting behaviors. Therefore, we examined whether fire detections near Ivohiboro decreased after restoration initiatives began. Specifically, we performed a linear mixed effects difference-in-difference analysis of VIIRS satellite fire detection density within one kilometer of Ivohiboro and detection density between one and ten kilometers away, both five years before and after restoration project implementation. We found fire detection density decreased by approximately 45% within one kilometer of Ivohiboro, from 0.22 to 0.12 detections per square kilometer, compared to an approximately 7% reduction in the surrounding ten-kilometer area, from 0.29 to 0.27 detections per square kilometer. Our results demonstrate strong evidence for indirect effects of restoration activities on local fire use and suggest communities may alter behaviors on their own. We believe these results are relevant to restoration initiatives globally, particularly those working with impoverished communities whose harmful activities are primarily driven by economic desperation.

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Preventing Project Backslide by Designing Restoration to Maximize Co-Benefits Across Time Scales

Christopher Duke

Phoenix Conservancy, Pullman

Abstract

Decades are often required for restoration sites to be considered fully regenerated, yet funding constraints often force practitioners to focus only on initial planting and incentivize counting an area as "restored" once planted. However, projects that fail to address root causes underlying initial degradation are likely to be degraded again, effectively wasting restoration resources. To make functional progress in global restoration, projects must be carefully designed to continually and passively provide multiple co-benefits to local stewards at all time scales, without requiring continual resource input from restorationists and funders. Here, we present the framework used to develop a 20-year rainforest restoration project in Ivohiboro, Madagascar. Now in its fifth year, this project centers on strategic species selection and implementation which ensure that maturing restoration sites generate maximal immediate, middle-term, and long-term co-benefits, optimized for both ecological succession and social enterprise. In presenting this framework and resulting project, we seek to provide a helpful conceptual starting point for early-stage restoration projects.

An exploration of the human-nature wellbeing reciprocity in the context of ecological restoration

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Abstract

This study examined how mindful-affective meditation practices by restoration practitioners affect both native tree seedling growth and practitioner wellbeing during ecological restoration in central Chile. The research explores the connection between human-nature alienation and environmental crisis, suggesting that healing opportunities exist for both humans and nature through mindful engagement practices. The experiment involved two plots with sixteen 5-year-old *Quillaja saponaria* seedlings each. One plot received 20 sessions of 30-minute affective-meditation from six restoration practitioners (MAF plot), while the other served as a control. After six months, researchers measured seedling survival and morphological parameters, and practitioners completed a wellbeing survey. While both plots showed 100% seedling survival, MAF plot seedlings demonstrated significantly lower increases in height (4.5 cm vs 16.3 cm), diameter (0.6 cm vs 1.9 cm), and aerial biomass (7.0 g vs 12.6 g), but MAF seedlings developed a better shoot-to-root biomass ratio (1.08 vs 2.03) according to the semiarid environment. The study revealed positive outcomes for human participants, with practitioners reporting improved wellness and greater awareness of human-nature interconnectedness during the experiment. These findings suggest that incorporating mindful-affective practices in ecological restoration projects may influence both plant growth patterns and human wellbeing, though further research is needed to understand these relationships fully

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Initial post-dam removal vegetation response in the Klamath reservoirsChhaya Werner¹, Maya Ceja¹, Tallulah Fattorusso¹, Joshua Chenoweth²¹Southern Oregon University, Ashland, OR, USA. ²Yurok Tribe Fisheries Department, Revegetation and Monitoring Branch**Abstract**

The removal of four dams on the Klamath River marks one of the largest river restoration projects ever conducted. The drained reservoirs—over 2,000 acres of bare ground—will change rapidly as plants come in to this space, both through intentional seeding and planting of native species and unwanted spread of nonnative species common in our region. We studied plant community response in seeded and unseeded sections of the reservoirs to quantify establishment patterns in the years immediately following dam removal. We found that native species dominated seeded areas, with higher cover and richness than non-native species across multiple seeding treatments. In contrast, vegetation in unseeded areas was more mixed, with native cover slightly lower than non-native cover. Interestingly, total vegetative cover correlated positively to sediment depth in seeded areas, but negatively in unseeded areas. We will present on which species were successful in early establishment and how we predict plant community recruitment will progress in the next few years.

Understanding human-wildlife conflicts on the Kazakh steppe through case studies of saiga and wolves

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Abstract

Restoring the steppe ecosystem in Kazakhstan requires addressing the complex interactions between saiga antelope (*Saiga tatarica*), wolves (*Canis lupus*), and local communities. Saiga populations have rebounded to over 1.8 million in the absence of functional predator populations, intensifying competition with livestock for water and pasture, increasing damage to haymaking grasslands, and heightening zoonotic disease risks. Wolves, as keystone predators, play a critical role in regulating ecosystems, but their presence often leads to conflicts with herders, particularly in regions where livelihoods depend on livestock.

From 2020 to 2023, we conducted participatory mapping and interviews with 150 stakeholders, including herders, conservation practitioners, and local authorities across key regions in Kazakhstan. We also surveyed 1,068 respondents to assess attitudes toward wolves and perceptions of human-wildlife conflicts. Geospatial analyses were used to identify areas where these conflicts are most acute, combining data on saiga distribution, livestock density, and community-reported hotspots of conflict.

The findings highlight significant regional variability in conflict drivers. While attitudes toward wolves were often neutral to positive, herders in areas with high livestock losses reported negative perceptions, driven by fear and economic concerns. Overlap between saiga and livestock intensified in regions with limited water access.

By integrating biodiversity conservation with community priorities, this study provides important insights for fostering coexistence and advancing restoration efforts. These results support targeted approaches for navigating trade-offs and promoting more sustainable management of the Kazakh Steppe.

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BioBA: A biodiversity benefit accounting methodology to drive private sector participation and investment in ecological restoration through water stewardship.

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Abstract

One of the UN Decade on Ecosystem Restoration's core tenets is that "it will only succeed if everyone plays a part." This call to action provides an opportunity for water-intensive private industries to play a substantial role in achieving ecosystem conservation and restoration by improving their operational water efficiency and advancing sustainable management of shared water resources. Corporations have adopted water stewardship approaches to address water-related risks and shared water challenges. Their efforts help improve conditions onsite and in watersheds and communities where they operate through ecosystem restoration and other stewardship activities. As corporations embrace water stewardship, there are opportunities to recognize multi-benefits and synergize water and biodiversity efforts. While many corporate-focused biodiversity resources exist, there is a lack of standardized approaches for corporations to quantify biodiversity-related outputs, outcomes, and impacts from investments made in water stewardship projects. The Pacific Institute, CEO Water Mandate, LimnoTech, The Nature Conservancy, and Second Nature Ecology + Design are developing standardized methods for terrestrial and aquatic biodiversity benefit accounting (BioBA) of water and ecosystem stewardship activities. BioBA will provide water stewardship practitioners with standardized guidance to identify ecologically appropriate and scientifically backed indicators, metrics, and measurement methods to quantify biodiversity benefits of water stewardship activities. BioBA will be technically robust yet pragmatic and feasible to implement and will provide valuable linkages to important existing water stewardship initiatives. BioBA will help ensure biodiversity benefits are transparent and, where possible, quantified, to drive a stronger business case to invest in activities supporting biodiversity conservation and restoration.

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Engaging students in the restoration of an endangered ecosystem through place-based education

Shannon Collins

Pullman

Abstract

Interacting with nature is vital for youth development, mental and physical health, and fostering current and future community action. However, children often have limited access to both biodiverse green space and environmental education, especially in underserved communities. We present a case study of a place-based education program in Palouse Prairie, a rural area of eastern WA, that aims to increase K-12 student connection with and understanding of a critically endangered ecosystem. Towards this aim, we (1) restored Pocket Prairies on school campuses and in public parks and (2) developed Next Generation Science Standards-aligned place-based educational materials for grades K-12 that emphasize student participation in all stages of those restoration efforts. This program increases student exposure to native biodiversity, evidenced by the number of students served, predicted increases in campus native plant species richness, and estimated time spent in Pocket Prairies. Trial program before-and-after assessments show improved student awareness and understanding of the Palouse Prairie ecosystem, the importance of native biodiversity, and how connecting with their local communities can foster positive change. Our preliminary results suggest that similar place-based education programs can be used to simultaneously improve student access to biodiverse green space, support learning outcomes, and increase public awareness of endangered ecosystems.

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Reviving the Desa'a Dry Afromontane Forest: A Community-Led Effort to Combat Land Degradation and Poverty in the semi-arid environment of the Northern Ethiopia

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Abstract

The Desa'a Project, led by WeForest, is dedicated to restoring the Dry Afromontane Desa'a forest in Northern Ethiopia, a crucial resource in the Great Rift Valley and the Great Green Wall belt. The forest, once spanning 154,000 hectares, now has only 30% of the dense remaining. This unique ecosystem is home to diverse flora and fauna, including the endangered Dragon tree (*Dracaena ombet*), and supports over half a million people from the Tigray and Afar communities. Since its inception in 2018, the project has restored 23,000 hectares and planted and managed over 22.5 million trees with a 90% survival rate. Above-ground carbon stock has improved by 15% and soil carbon stock by 3%. The project has benefited over 16,000 households, including war-affected families, through sustainable income-generating activities like beekeeping, small ruminant farming and agroforestry. Community-lead soil and water management practices have been instrumental, capturing about 1.7 million m³ of rainwater annually and preventing the loss of nearly 0.5 million tons of soil. Integrating alternative energy sources has reduced household fuelwood consumption by 35%. By 2030, the project aims to restore up to 40,000 hectares and engage over 20,000 households in sustainable income generating activities. The forest recovery is expected to enhance carbon stocks in both vegetation and soil, leading to an estimated GHG removal of 174,000 tCO₂-e per year. The Desa'a Project exemplifies the power of community-led forest and landscape restoration efforts and demonstrates how collective action can yield significant results in a short period, even in the semi-arid regions.

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Planting for Pollinators: The Effect of Pollinator Habitat Site Establishment Methods on Native Bee Utilization

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Abstract

Native pollinators provide vital interactions that significantly contribute to essential ecological processes, including sustaining the resource base for wildlife and improving the quality and quantity of many crop species that humans rely on. Native pollinator habitat installations can serve to reestablish and enhance this ecological function through supplementing floral and nesting resources for pollinators in landscapes where resources are scarce, such as in conventional farming operations. While non-native plant competition control is considered the most important step in pollinator habitat installation, recommendations are inconsistent and vary among sources. Additionally, the effect that various habitat installation procedures may have on visiting pollinators is unknown. To address this, a collaborative study was initiated to assess the relative efficacies of various competition control systems on pollinator habitat establishment and native bee visitation rates.

Six competition control systems including various numbers of herbicide spray applications and conventional tillage were implemented. A shortgrass meadow wildflower seed mix was installed across the study site using a no-till seed drill. System efficacy will be determined using native bee surveys, vegetation surveys, and drone-based imaging, within each plot for a three-year period following seed installation. Native bee surveys will be conducted using passive and active sampling, as this is the most effective way to target the entire bee community. Preliminary results suggest conventional herbicide use and practices incorporating greater numbers of herbicide applications, which leads to greater weed competition control, will have a positive influence on pollinator visitation rates, abundance, and diversity.

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Dam Removal Projects: How Much is Enough Collaboration?Eileen Bader Hall

Brunswick, Maine

Abstract

River restoration through dam removal is a highly interdisciplinary field at the intersection of science, communication, implementation, community values, and decision-making. Restoration practitioners in this field often seek to bring a diverse swath of federal, state, non-profit, tribal, business, and community partners and stakeholders together to think about and identify solutions to complex and challenging issues, with mixed results. It is rarely a straight-forward path to determining who should be involved in the decision-making process, how the process should best unfold, and when various partners and stakeholders should be engaged. This presentation will explore two case studies of two small to medium size dam removal projects in Maine and the various tools, resources, and approaches utilized in each project. Mistakes, lessons learned, successes, and “should-have-done” will all be highlighted in an attempt to synthesize key themes and approaches applicable to a wide-array of river restoration and dam removal projects and to advance a collective understanding of the question: “how much is enough collaboration?”.

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Using Connectivity, Ecosystem Service Modeling, and Climate Exposure to Prioritize Forest and Grassland Restoration in the Upper Midwest, USA

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Abstract

Climate driven range shifts are an important adaptation strategy for many species, but in the Upper Midwest, USA, movement is constrained by ecosystem alteration. Connectivity modeling can help us understand current movement potential, consider exposure to climate change, and identify where restoration could improve connectivity. Ecosystems also provide services to society that are threatened when degraded, including water filtration, carbon storage, and support for pollinators. Facing limited budgets alongside the need to restore degraded lands, improve connectivity, and consider interactions with climate, restoration practitioners need tools to help maximize the benefits of restoration. We collaborated with federal and state agency practitioners and local Tribal Nations to identify priority locations in Minnesota and surrounding US states for habitat restoration to both enhance connectivity that supports species' range shifts and contributes valuable ecosystem services. We used Circuitscape to identify current patterns of structural landscape connectivity for grassland and forest ecosystems. From the regional-scale maps, we selected focal areas and conducted local scale evaluations of the connectivity and ecosystem service benefits of restoration actions. Ecosystem service benefits were modeled using the InVEST model, which is well parameterized for this region. Finally, we integrated and will share the connectivity and ecosystem service restoration priorities to identify areas where multiple benefits can be achieved. The multi-criteria restoration prioritization models and results for this region provide a framework for practitioners with different objectives (e.g., social or ecological) to better coordinate their actions and engage a broader segment of the public in support of restoration.

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Lessons learned from a community-based seed network in the Brazilian Cerrado

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Abstract

The UN Decade on Ecosystem Restoration and other international initiatives aim to restore millions of hectares by 2030. In Brazil, the mandatory restoration of environmentally sensitive areas and the national target of recovering 12 million hectares of degraded land by 2030 have created significant demand for seeds. This presents an opportunity to not only restore ecosystems but also support local communities through community-based seed networks. Here, we present the lessons learned from a community-led initiative of seed collectors in the Brazilian Cerrado, the Cerrado de Pé Association, which has successfully contributed to the inclusive restoration of the Chapada dos Veadeiros National Park, in Goiás state. Composed mainly of quilombola (maroon) people, the Association pioneered the use of direct seeding for restoring grasslands, savannas, and forests, incorporating a variety of species of grass and forbs, often overlooked in tropical savanna restoration. Since 2017, the Association has supplied 70 tons of seeds from 120 native species to restore more than 224 hectares of land, while delivering over U\$400,000 in household income for approximately 240 families. Key success factors include regulatory support, multi-stakeholder partnerships, local knowledge integration, income generation, and strong community leadership. Challenges include a lack of large seed buyers, stringent legal requirements for seed quality, high restoration costs, and limited seed production infrastructure. This case highlights the potential for community-driven models to achieve ecological restoration goals while benefiting local communities but also underscores the need for further support to overcome existing barriers.

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Mapping Connections for Restoration: The Social Landscape of the Caatinga as a Driver of Socio-Environmental Transformation

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Abstract

The Caatinga biome, an exclusively Brazilian semi-arid ecosystem, faces significant degradation challenges but holds great potential for socio-environmental transformation. Forest and Landscape Restoration (FLR) emerges as a key strategy in this process, promoting the recovery of degraded ecosystems, mitigating the effects of climate change, and strengthening water and food security for local communities.

The Restoration Opportunities Assessment Methodology (ROAM), developed by the World Resources Institute (WRI), was applied to map the social landscape and promote inclusive governance actions in three Caatinga territories: Cariri Ocidental, Paraíba state, Sertão do Pajeú, Pernambuco state, and Sertão do Apodi, Rio Grande do Norte state. The results identified 261 actors in these territories, highlighting their interconnected roles in areas such as finance, materials, technical information, and monitoring.

The analyses revealed the influence of rural associations, public institutions, and community initiatives in enabling restoration efforts. Municipal governments played a central role in coordinating financial flows, while grassroots organizations, such as women-led seed banks, were key actors in resource distribution. The networks also demonstrated the critical role of public-private partnerships in sharing technical knowledge and essential inputs for successful restoration efforts.

Mapping these connections revealed a dynamic social infrastructure that supports restoration initiatives. Strengthening collaboration among local actors and integrating diverse perspectives, especially from historically underrepresented groups, has proven fundamental. The results reinforce that building resilient social landscapes is the foundation of FLR, enabling the Caatinga to become a large-scale model for socio-environmental transformation.

Mountain Pine Beetle-Induced Lodgepole Pine Forest Canopy Openings Provide Opportunity for Whitebark Pine Regeneration

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Abstract

Whitebark pine (*Pinus albicaulis*), a federally-threatened keystone species in high-elevation ecosystems, is declining due to threats including whitepine blister rust (pathogen = *Cronartium ribicola*), altered fire regimes, mountain pine beetle (MPB; *Dendroctonus ponderosae*) outbreaks, and climate change. These declines threaten biodiversity and ecosystem service functions, including soil stabilization, snowpack retention, and wildlife support. Restoration projects are being implemented to counter whitebark pine losses. Recent MPB infestations in mature lodgepole pine (*Pinus contorta*) forests in Yellowstone National Park (YNP) have created canopy openings, potentially favoring the natural regeneration of whitebark pine, a moderately shade-intolerant species. Here, we investigate the relationship between MPB-induced canopy openings and whitebark pine regeneration in primarily lodgepole pine forest communities, presenting a nature-based approach to restoration in high elevation ecosystems. In YNP, we established 78 circular plots across three sites, each representing lodgepole pine forests previously affected by MPB. We recorded environmental variables including canopy closure using a crown densiometer, slope, aspect, elevation, and coarse woody debris, and seedling height and tree diameter. Preliminary results show that whitebark pine regeneration density increases with greater canopy openness and higher elevations, while dense ground vegetation negatively impacts regeneration. Slope and aspect influence sunlight availability, further affecting regeneration success and emphasizing complex interactions among site characteristics and canopy dynamics. Additionally, the height and diameter of mature whitebark pine trees negatively correlate with seedling density, suggesting reduced nutcracker caching or lower seedling survival near larger trees. These findings suggest MPB outbreaks may create restoration opportunities for whitebark pine in high-elevation ecosystems.

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Developing and Testing an IUCN Green Status of Ecosystems Framework

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Abstract

The Green Status of Ecosystems (GSE) is a framework under development by the IUCN to measure the past, current and future recovery of ecosystems from degradation caused by human activities, relative to a "fully recovered" reference state. Despite increasing focus placed on the restoration of ecosystems, conservation efforts currently lack a standardised system to evaluate the recovery of ecosystem types globally. In this project, we contribute to the creation of a global framework to measure ecosystem recovery by testing and refining the proposed methods for the GSE using a case study of the southern and eastern Australian oyster reefs. The oyster reefs are a culturally significant and Critically Endangered ecosystem that provided both Indigenous communities and early colonists with food, clean and safe water, and a sense of place. More than 99% and 92% of flat oyster and Sydney rock oyster distribution has been lost in Australia since colonisation due to overharvesting, but recent restoration efforts are showing early successes, increasing a need to monitor and project recovery. Our results show that the recovery score of the oyster reefs is increasing due to restoration but they remain in critical condition. We also use this case study as an opportunity to develop guidelines for the inclusion of human contributions to ecosystem integrity as well as ecosystem services within the GSE framework. Our results will inform and motivate restoration efforts as well as inform the development of standardised GSE methods.

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Identifying urban habitat connectivity in Denver, Colorado through the lens of a Halictid Bee and Bumble Bee

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Abstract

Based on the Biological Deserts Fallacy (Spotswood et al., 2021), we understand that even highly urbanized areas are able to support a rich diversity of native species. Unfortunately, urban areas are often left out of regional assessment tools used to help identify habitat and wildlife corridors. This phenomenon was experienced in the lack of data available for Denver Colorado in the Metro Denver Regional Conservation Assessment. The omission of Denver was likely due to a large difference in the scale of vegetated landscapes in and outside of the city. To help fill this gap in understanding of habitat connectivity within Denver, Denver Parks and Recreation hired Biohabitats to develop a habitat connectivity tool intended to help identify habitat areas and where they might connect based on the habitat and foraging requirements/conditions for a suite of umbrella species. These species included a small sized Halictid Bee and a large Bumble Bee.

Methodology for this tool involved compiling existing geospatial data, classifying land cover, assessing high-quality habitat, and conducting geospatial analysis to assess connectivity, leading to the development of an interactive geospatial framework. Preliminary results from the study show that patches of urban prairie provide high quality nodes of habitat, while areas of forested medians provide suitable transportation corridors between nodes. By understanding the location of these nodes and corridors, public agencies like Denver Parks and Recreation can better plan management actions, the locations for restoration projects, and opportunities for interagency partnership.

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Plant biodiversity changes in spontaneous succession on abandoned agricultural land in Europe: A literature review

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Abstract

Plant biodiversity changes in spontaneous succession on abandoned agricultural land in Europe: A literature review

As land abandonment shapes European landscapes, understanding the potential of spontaneous succession as a nature-based solution is crucial for effective restoration. We reviewed the literature on plant biodiversity changes during spontaneous vegetation succession on abandoned agricultural land in Europe, focusing on long-term studies using chronosequence and permanent plot approaches. A systematic search in academic databases, combined with a snowball approach, identified more than 100 relevant studies spanning six European ecoregions—Alpine, Atlantic, Boreal, Continental, Mediterranean, and Pannonian—across more than 25 countries. The research primarily examines the transition of abandoned croplands into forests, grasslands, and shrublands. Species richness, plant cover, diversity indices, and plant traits were the main indicators used to evaluate biodiversity trends. Former land use, management practices before abandonment, and environmental conditions were key factors influencing successional trajectories. While notable contributions come from the Czech Republic, Poland, Spain, and Hungary (Continental, Mediterranean, and Pannonian regions), the Boreal, Atlantic, and Alpine regions remain underrepresented, highlighting the need for further studies to fill knowledge gaps. Future research will synthesize these patterns and integrate additional datasets for a comprehensive European-scale analysis. Understanding these successional processes is essential for informing rewilding initiatives, as natural regeneration on abandoned agricultural land is a key nature-based solution for ecosystem restoration and biodiversity enhancement across Europe.

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Forest restoration in the Amazon: Lessons and Innovative Arrangements for the Implementation of ANR and AFS in Agrarian Reform Settlements

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World Resources Institute - Brazil — R. Cláudio Soares, 72 - 1510 - Pinheiros, São Paulo - SP, 05422-030

Abstract

The project "Promoting and Implementing Assisted Natural Regeneration (ANR) in Mato Grosso and Pará" aims to restore degraded forests in the Brazilian Amazon by using ANR in priority areas of the states of Pará and Mato Grosso. Agrarian reform settlements, which account for 15% of the Amazon's secondary vegetation areas (PINTO et al., 2021), are central to this strategy. In partnership with the Landless Workers' Movement (MST)—which fights for agrarian reform in Brazil while promoting healthy food production and sustainable agricultural practices—the project combined ANR and Agroforestry Systems (AFS) as a restoration strategy in five settlements in the metropolitan region of Belém (PA). The project engaged 150 families, and its implementation took place in three phases:

(I) Restoration planning, including participatory mapping activities and geographic data collection, carried out primarily by a collective of young people from the settlements;

(II) Participatory knowledge-building on ANR and AFS, incorporating methodologies applicable to the realities of smallholder farmers;

(III) Implementation of restoration areas, with participatory planning by families to define species arrangements.

The results showed that restoration in agrarian reform settlements does not follow a single model. However, strengthening community movements and providing local training at all stages are crucial for the maintenance and continuity of restoration efforts, delivering clear social and environmental benefits.

This experience highlights restoration as a socio-ecological process capable of driving local transformations and demonstrates that agrarian reform settlements can serve as productive territories for such initiatives in the Amazon.

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Utah Watershed Restoration Initiative Partnership

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Abstract

The Utah Watershed Restoration Initiative (UWRI) is a partnership-based program, administered by the Utah Department of Natural Resources, which seeks to improve the functional capacity of high priority watersheds throughout the state. Since its inception in 2006, the UWRI partnership has completed 2,840 projects to restore or rehabilitate nearly 2.7 million acres and 2,650 stream miles in Utah watersheds. The UWRI program is unique to the west, in that it transcends jurisdictional boundaries, and local, state, and federal management authority to focus finite resources on completing high priority conservation projects. For additional information, please visit the website at: <https://watershed.utah.gov/>

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Riparian Habitat Improvements along the Muddy River on the Warm Springs Natural Area in Moapa Nevada

Von Winkel

Las Vegas, Nevada

Abstract

The Warm Springs Natural Area (WSNA) in Moapa, Nevada, is owned and operated by the Southern Nevada Water Authority (SNWA).

The North and South Forks of the Muddy River located on the WSNA are deeply entrenched because of past modifications for agriculture, and intense flooding in the 1800s. Before entrenchment, these streams meandered through the floodplain, and the water table was high and supported marshes, meadows, mesquite woodlands, and riparian corridors. As entrenchment progressed, the water table dropped, and the riparian species dependent on the high-water table died and were replaced by invasive plant species such as California fan palms (*Washingtonia filifera*). From 2016 to 2023, approximately 0.7 miles of streambank along these entrenched streams was widened by excavating approximately 8500 cubic yards of soil. This increased riparian habitat ten-fold to 0.60 acres. Over 1100 native ash trees (*Fraxinus velutina*), 50 cottonwood (*Populus fremontii*) poles, hundreds of coyote willow (*Salix exigua*) cuttings and over 2500 understory plants were installed in this new habitat. Survival of trees exceeds 80%. In addition to the propagated plants, over 400 volunteer cottonwood trees have established along this section of the Muddy River. Plant species richness has tripled in five years. These improvements should benefit the endangered Moapa dace (*Moapa coriacea*) as well as provide valuable habitat for native birds such as the endangered southwestern willow flycatcher (*Empidonax traillii extimus*) and threatened yellow-billed cuckoo (*Coccyzus americanus*). Plans are underway to repeat this process along the larger mainstem of the Muddy River.

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Seeding diversity interacts with soil attributes to enhance understory restoration and climate resilience

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Abstract

Restoring diverse understory vegetation is critical for biodiversity and ecosystem recovery but remains challenging due to exotic species dominance and altered soil conditions driven by past land use. Topsoil removal is one strategy that has been applied to address these barriers, yet its impacts on aboveground and belowground restoration outcomes remain poorly understood. Conventional low-diversity seeding methods often limit restoration success, and projected increases in rainfall variability may further challenge ecosystem resilience. We explored how seeding diversity interacts with soil physicochemical and biological attributes to influence native understory species establishment and exotic species suppression across two soil depths under simulated future rainfall scenarios. A mesocosm experiment used topsoil (0–10cm) and subsoil (15–25cm) collected from a degraded grassy woodland area (mixed native and exotic understory cover, no canopy). Native understory species were seeded into low (1), medium (4), and high (12) diversity treatments under low, average, and high watering regimes. We found 90% higher plant cover in the topsoil than in the subsoil, regardless of diversity treatment. Exotics dominated topsoil, but in high-diversity treatments, native plants outnumbered exotics. Low rainfall treatments reduced plant survival, particularly in low-diversity plantings. Topsoil had higher nutrient content and microbial activity, likely influencing plant responses. Belowground variables, including microbial diversity shifts, are being further explored as potential drivers of restoration success. This study offers practical insights to balance urgent restoration needs with long-term success, demonstrating how interventions considering local seed banks, seeding diversity, soil properties, and climate variability can enhance restoration effectiveness.

Automated monitoring of coastal restoration: integrated, cost-effective tracking of biodiversity outcomes

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Abstract

For all the major effort to restore coastal ecosystems, the monitoring of biodiversity outcomes to evaluate performance against objectives is often piecemeal, not done for long enough, or lacking altogether. The ideal ‘what’, ‘where’ and ‘when’ to monitor coastal restoration outcomes are known. It’s the lack of resources for monitoring that usually falls short. We show how measurements can be made safely, more often, in more places through automated monitoring cutting-edge monitoring of biodiversity with the latest advances in AI data extraction from imagery. We have automated monitoring in 20 countries to provide frequent, cost-effective local data on wildlife abundances, both above water (e.g. birds, crabs) and below water (e.g. fish). Animals recorded by video are automatically identified, counted and measured. These data are integrated with automated water quality data and remotely sensed vegetation metrics. We showcase automated applications in restored mangrove forests and oyster reefs. Examples include rapid recovery of fish populations in restored mangroves, fine-scale comparisons of animals in edge and interior habitat zones, monitoring in turbid water and at night, detection of feral and invasive species, and tracking animal movements for seascape connectivity in multi-habitat restoration. Automation provides rapid reporting of quality-assured data that is vastly improving assessments of biodiversity outcomes from restoration.

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To bury or not to bury? Improving the yield of seed-based seagrass restoration for the tropical species *Thalassia hemprichii*.Evie Furness, Timothy Smith, Paul York, Michael Rasheed

James Cook University

Abstract

As the need for seagrass restoration increases, so does the reliance on wild stock to replenish depleted populations. Seed-based restoration offers a non-destructive approach to supporting and restoring threatened seagrass meadows. However, success of seedling establishment is often low, with high losses associated with water movement, predation, and germination failure. Focusing on a dominant tropical species, *Thalassia hemprichii*, we trialled seed planting over a depth gradient, from the sediment surface to 4 cm below, in both controlled aquaria and in an established tropical seagrass meadow.

The aquaria trial provides the first example of nursery stock cultivation for this species. While surface seeds in tanks showed 100% survival, the exposed roots were prone to necrosis and smothering by algae. A 1 cm burial depth had 98% survival and produced healthier and more productive seedlings.

In the field trial, surface-scattered seeds saw high losses. Burial to 1 cm doubled the seedling survival compared to surface seeds and resulted in an average of seven times higher survival than seeds buried at 4 cm. This study is the first look at field-based seed restoration for *T. hemprichii*. The significant increase in yield observed at the 1 cm burial depth provides baseline knowledge for fine-tuning and automating seed deployment. It highlights the impact small changes to planting technique and environmental conditions can have on seedling survival when considering best practice for large-scale restoration of this ecologically significant tropical seagrass species.

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Finding positive solutions to global problems through science, art and philosophy

Jill Wagner

Kailua Kona

Abstract

The book, *Limits to Growth*, which was written in 1972 by Donella Meadows, et. al, has been a seminal book for scientists and people trying to understand the factors that are causing the big breakdowns of the planet, especially biodiversity loss and global warming. We know the factors but we are not moving quickly enough to make positive changes for all life. Part of the reason is that people feel overwhelmed, and that their contributions are small and don't have much effect. But that is not the case. In the new book, *International Cooperation Against All Odds, The Ultra Social World*, Mai'a K. Davis Cross describes how humans have made significant changes by building global consensus and creating networks that do good. This presentation will lay out the problems and show how the solutions are within our ability through cooperation. The examination of global society will be woven with words and art. The artistic metaphor for these ideas is Indra's Net, from the ancient Atharva Veda of Hinduism, and later in the Mahayana school of Buddhism. Art can be a vehicle for transformation and human beings need to transform our way of living upon the Earth. Indra's net represents the web of connections and interdependences of all things.

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Mexican Alliance for Ecosystem Restoration: articulating initiatives in favor of terrestrial and coastal marine ecosystems.

Frida Murillo, Asis Alcocer, Emilio Cruz, Mitzi García, Norma Arce, Pamela Saavedra, Pilar Jacobo, Rosa del Carmen Luege, Yoali López

Mexico City

Abstract

The Mexican Alliance for Ecosystem Restoration was established in 2020 and aims to promote, align, and coordinate efforts and resources by working alongside the government, academia, communities, Non-Governmental Organizations (NGOs), and the private sector in favor of the restoration of terrestrial, aquatic, and coastal-marine ecosystems in Mexico.

The Alliance works through four areas of intervention: 1) advocacy, 2) implementation, 3) markets and entrepreneurship, and 4) financial mechanisms, as well as two cross-cutting areas of work: communication and innovation.

In addition, it hosts the Mexican chapters of the Global Mangrove Alliance and the One Trillion Trees initiative through two of its four working groups and has organized participatory spaces such as the “Dialogues for Restoration,” through which the topic of restoration is addressed from various perspectives (e.g., analysis of priority sites for restoration in the country, the private sector's involvement in the restoration agenda, the role of communities and their challenges in restoration, among others), with over 100 participants per session. This has led to the creation of a directory of more than 500 individuals with an interest in and/or actions in the field.

It has strategic partnerships related to the generation and dissemination of information on restoration, such as the government team leading the National System of Environmental Restoration Information (SNIRA), and it is the first national alliance in Mexico to be recognized by the United Nations Decade on Ecosystem Restoration at the global level.

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Outcomes of fuel management treatments in sagebrush shrublands experiencing woodland expansion: lessons learned from an unexpected wildfire

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Abstract

Juniper (*Juniperus* spp.) woodlands are native but expanding communities that were historically limited by the fire return interval of sagebrush (*Artemisia* spp.) shrublands. Lengthened fire return intervals contribute to expansion and increased potential of high-severity crown fire, creating concern for sagebrush conservation. Prescribed fire and mechanical cut-and-drop fuel treatments are commonly used to prevent continued expansion, reduce wildfire risk, and restore understory vegetation. Despite widespread and long-term use, it is uncertain if desirable fuel and vegetation conditions following fuel treatments persist post-wildfire. The Stansbury site in the Sagebrush Steppe Treatment Evaluation Project burned in a wildfire in August 2009, two years after fuel treatments were implemented. We present preliminary results from 2007 pre-treatment, 2008 and 2009 post-treatments, and 2010, 2013, 2017, and 2023 post-wildfire data. We used field data and the Fuel Characteristic Classification System to estimate surface fire behavior in treated and control plots. Differenced Normalized Burn Ratio images were used to estimate of burn severity. Before wildfire, shrubs were eliminated by prescribed fire but remained unchanged in mechanical and control plots. Prescribed fire increased herbaceous biomass relative to control and pre-treatment conditions, resulting in faster modeled surface rates of spread (ROS; m/min) than in the control. Immediately post-wildfire, burn severity was lowest in the prescribed fire treatment and highest in the control. Modeled ROS in prescribed fire and mechanical treatments were more similar to the control post-wildfire. Ultimately, wildfire may reduce the restoration benefits of prior fuel treatments, reducing differences in vegetation and modeled surface fire behavior.

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That's a WRAP, Folks: Restoration Planning in a Post-Fire Landscape on the Gila National Forest

Aaron Sidder

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Abstract

In May 2022, the Black Fire erupted on the Gila National Forest in New Mexico. When the fire was finally contained, it was the State of New Mexico's second largest wildfire on record, burning 327,000 acres and more than 90 percent of the Aldo Leopold Wilderness Area. Just weeks later as the fire still smoldered, a record-setting monsoon settled over the Forest, drenching the recently charred landscape and precipitating massive flooding and sediment transport throughout affected watersheds. To address the compounding disturbances and jumpstart restoration, the Gila National Forest partnered with Bat Conservation International (BCI) to develop a Watershed Restoration Action Plan (WRAP). The WRAP contributes to the Forest Service's national Watershed Condition Framework and provides a comprehensive approach to evaluate the condition of watersheds; prioritize watersheds for restoration or maintenance; strategically implement integrated restoration; and track and monitor outcome-based program accomplishments. The effort culminated in a completed WRAP in September 2024 after months of collaboration between the Forest Service, BCI, local governments, and other nonprofits. The document outlines how restoration actions in the Black Fire burn scar will benefit wildlife (including an emphasis on bats) and enhance ecosystem resiliency in the face of climate and ecological disturbance. This presentation will describe how watershed restoration is vital to bats and their habitats, recount the WRAP process and the collaboration between governmental and nongovernmental organizations, and outline the planned restoration efforts for the Gila National Forest over the next 10-15 years.

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Advancing mine rehabilitation and forest management through collaborative, science-driven research

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Abstract

The Forest Research Centre, a leading research team within Alcoa, is pioneering transformative mine rehabilitation within the Jarrah Forest of South-West Western Australia. Building upon a legacy of over 50 years of research, the Centre champions collaborative research with diverse stakeholders, including Traditional Owners, government agencies, and leading academic institutions.

Its interdisciplinary approach integrates ecological, social, and economic perspectives to effectively address key rehabilitation challenges, including implementation and early establishment, plant community dynamics, native and non-native fauna ecology, water stewardship, and cross-cultural science. This holistic approach recognizes the interconnectedness of these factors, ensuring integrated rehabilitation.

The Centre fosters strategic partnerships with leading researchers across disciplines, creating a network of expertise that drives impactful solutions. It actively involves research users within the company in co-designing and implementing research projects. Current projects focus on critical areas, such as understanding the role of the topsoil seedbank, improving plant survival, and fauna return.

Rehabilitation areas serve as living laboratories, with rigorous long-term trials assessing the ecological effectiveness of rehabilitation efforts to inform adaptive management strategies. By establishing robust rehabilitation criteria based on a deep understanding of the reference forest ecosystem, the Centre ensures that rehabilitation outcomes meet the highest ecological standards.

These efforts have resulted in optimized seeding techniques, enhanced plant survival, reduced fertilizer rates, and lower tree stocking rates to enhance growth. The Forest Research Centre is committed to driving innovation in mine rehabilitation, delivering solutions that ensure the long-term ecological and social sustainability of the Jarrah Forest and inspire best practices globally.

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Sharing Experiences in exploring sustainable models of ecosystem restoration: A Collaborative Model for Sustainable Tropical Forest Restoration in Xishuangbanna, China

Yangjie Zheng

Shanghai

Abstract

Good to Nature has developed a **Sustainable Restoration Loop Model**, integrating **scientific ecological restoration, enhancing local habitat pride and livelihoods, and mobilizing global citizens and businesses for sustainable participation**. This 3-Approach Synergy Solution has been effectively implemented in Xishuangbanna, offering scalable solutions and resource connections for global restoration projects.

The **Menglun Rainforest Restoration Project** restored 20 acres of degraded rubber plantations into a tropical rainforest using natural regeneration, framework species planting, and nucleus planting. Key results include the **return of Class I and II endangered wildlife**, the **natural recovery of 90 plant species**, and a **97% seedling survival rate**. The project fostered **rainforest pride** among local youth by facilitating exchanges between rural and urban students, deepening their sense of ecological responsibility. Additionally, innovative art initiatives engaged **1 million people**, connecting **148 brands, frontline rainforest conservationists, media, and artists**, amplifying impact across **77 countries and 9.38 million people**.

The **Anle Village Tea Plantation Restoration Project** implemented the **20/80 rural revitalization model**, where **20% of the land is allocated for ecological corridors**, while **global stakeholders support local livelihoods through the remaining 80%**. This initiative addressed land-use conflicts, enabling **2,000 acres of voluntarily contributed land** for ecosystem restoration. Social sector involvement led to the launch of an **eco-tea brand, educational tourism, and scientific tea cultivation programs**, fostering the next generation of environmental leaders.

By integrating **scientific restoration, community participation, and cross-sector collaboration**, the **3-Approach Synergy Solution** provides a **scalable and replicable model** for sustainable global restoration efforts.

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Making Baltic Sea coastal wetlands visible via virtual tours

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Abstract

Virtual tours as ecological management awareness tools emerged during the 'Supported by Nature' project.

The project aims to create Learning Sites that demonstrate the management of biodiverse coastal wetland habitats, the rehabilitation of watercourses, and the integration of multifunctional wetlands into agricultural practices. The severe issues of eutrophication in the Baltic Sea and the fragmentation of coastal habitats resulting from several anthropogenic influences are widely recognised, yet, examples of effective ecological management and guidance on regenerative coastal agricultural techniques are less publicized.

This talk will show virtual Learning Site tours from the Finnish Archipelago Sea and West Estonian Archipelago Biosphere reserves. A virtual tour is essentially an online simulation of an existing place. Immersive 360 videos and photos, coupled with soundscapes and alternative perspectives akin to a bird's-eye point of view or underwater videos; graphical representations of landscapes, including maps, cross-sections, and other text/visuals to make research visible and educational for the local community and broader audience. The digital and visual nature of the tours can make inaccessible places accessible and bridge the physical distances plus the language gap.

The hope behind creating virtual tours is to encourage people to care for coastal habitats and understand anthropogenic implications: draw connections between 'what we do in our backyards' and the sustainability of sea habitats, as we are interconnected by the water.

The presentation will include QR codes for the audience to engage with the virtual tours using mobile devices. Feedback is much appreciated, as this is a work in progress

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Habitat Heterogeneity in Restored and Remnant Riparian Forests along the Sacramento River, California

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Abstract

Natural ecosystems are inherently heterogeneous, though humans often homogenize them through various land-use practices. Increasing heterogeneity in degraded ecosystems can improve biodiversity and habitat resilience but rarely is a focus in restoration. We quantified topographic and vegetation heterogeneity in 2,870 ha of riparian forests abutting over 100 km of the Sacramento River, California, degraded by intensive agriculture and flood control and the focus of large-scale restoration since the late 1980s. We compared how measures of topographic and vegetation heterogeneity differed between restored and remnant forests and how these measures relate to forest age and distance to the Sacramento River. We computed three heterogeneity metrics – topographic ruggedness index, overstory rugosity, and foliage height diversity – at 2- and 10-m resolution using LiDAR data. At a fine scale, terrain ruggedness index was 63% lower in restored forests than remnant forests and did not recover with forest age, likely due to a lack of natural flooding in this dam-controlled river. Remnant forests had 39% greater foliage height diversity and 31% greater overstory rugosity than restored forests in the first 10 years after restoration, but by 30 years of age restored and remnant forests had similar levels of vegetation heterogeneity. Since restored forests did not increase in topographic heterogeneity over time, future forest restoration efforts should consider recreating more topographic heterogeneity during initial restoration efforts. Our study shows the potential of LiDAR data to evaluate recovery of forest structure over large and inaccessible areas.

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Consequences of land conversion to underground carbon storage in tropical open ecosystems

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Abstract

In recent decades, global restoration initiatives have focused predominantly on tree planting to enhance carbon sequestration and mitigate climate change. While significant, these efforts often neglect open ecosystems like grasslands and savannas, perpetuating the misconception that they contribute minimally to carbon storage. This oversight has led to increased land conversion in these ecosystems for afforestation, agriculture, and exotic pastures, with significant conservation and ecological consequences. To assess what is lost when exotic pastures replace native savanna areas, we excavated ten 1m x 1m x 1.20 m deep plots in the Cerrado core area (Goiás State), the Brazilian savanna, to quantify carbon storage in underground structures. We focused on the ground layer, the most biodiverse yet often neglected component of these ecosystems. Our results show that carbon stocks in natural areas (8.3 Mg C ha⁻¹) are 35% higher than in exotic pastures (5.4 Mg C ha⁻¹). Although coarse root carbon stocks (~3 Mg C ha⁻¹) were similar between the two land uses, fine root carbon in conserved areas was 51% greater despite no significant difference in soil volume occupied by roots and rhizomes. These findings underscore the critical role of conserving the ground layer in savannas, not only for its astonishing biodiversity but also for its contribution to essential ecosystem services like carbon storage. Conservation efforts in tropical countries should prioritize these ecosystems alongside forests to meet climate and biodiversity international agreements.

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Reintroduction of grasses for Neotropical Savanna restoration: the role of seedling planting and direct seeding

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Abstract

Tropical savannas have been neglected in restoration projects, especially due to the lack of effective techniques for reintroducing herbaceous species essential to recovering structure and resilience. Planting seedlings and direct seeding are the most widely used techniques for restoring degraded ecosystems worldwide. In this study, we compared the establishment and growth of native grasses through seedlings and seeds over two growing seasons. We used seeds and seedlings of four perennial grass species native to the Brazilian Savanna (Cerrado). The seedlings were cultivated with and without fertilizer in the nursery for five months. Seedlings and seeds were planted in the rainy season and assessed for survival, growth, and reproductive phenology after one year. Grass survival ranged from 72 to 91% in both techniques. However, the number of plants recruited from seeds was lower (2%) than the emergence potential observed in greenhouse tests (25%). Using fertilizer in seedling production was not a predictor for survival and growth after planting. Grasses introduced by seedlings and seeds did not differ in height after one year, but basal diameter was greater in those introduced by seedlings (69.4 vs. 28.15 cm), indicating potential for faster soil cover. Two of four species introduced by seedlings also reached reproductive maturity earlier than those seeded, starting dispersion and colonization sooner than seeded plants. Our results show that the choice of restoration technique influences the outcomes, and this should be strategically considered in restoration planning.

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If you plant it, they will come: transplanting macroalgae into mussel reef restoration sites to facilitate juvenile mussel recruitment

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Abstract

In recent decades, there has been a global push to restore depleted shellfish reefs and the array of ecosystem services they provide, but this work is met with many challenges. Efforts to restore historically decimated green-lipped mussel (*Perna canaliculus*) reefs in Aotearoa New Zealand include the transplantation of large quantities of cultured adult mussels to the seafloor, but a lack of natural recruitment to these restored populations threatens their long-term sustainability. Looking to wild, remnant mussel reefs for understanding and solutions revealed that macroalgae, turf-forming coralline red species in particular, are critical settlement substrates for juvenile *P. canaliculus* on intertidal reefs. Macroalgae are currently lacking at restoration sites due to habitat degradation from increased sedimentation over the last century. To determine if the recruitment bottleneck at restoration sites is caused by substrate limitation and test a novel method for substrate enhancement, coralline macroalgae were transplanted from a remnant mussel reef into a restored mussel population in the intertidal on the South Island, New Zealand. Mussel settlement directly onto and surrounding the macroalgae was measured over three months to assess the effect of this substrate's presence on recruitment facilitation. Additionally, the condition of the macroalgae was monitored to determine the extent that macroalgae sourced from healthy, wild reefs will survive and grow in the degraded environments often targeted for mussel reef restoration. The results provide insights to whether this technique presents a viable option for restoration efforts and a chance to improve the self-sustainability of restored mussel populations going forward.

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Closed cycles for urban restoration : embracing recycled construction wastes to restore species from threatened native plant communities in cities and townsKatherine Horsfall

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Abstract

Urban development in many of the world's cities has resulted in the loss of grassy ecosystems, contributing to global biodiversity loss. In south-east Australia, urbanisation has severely impacted native grassy ecosystems, including temperate grasslands and grassy eucalypt woodlands. In response, we have developed restoration techniques to reinstate species from these ecosystems in cities in the form of native wildflower meadows. These methods enhance urban biodiversity and give residents the opportunity to encounter native plants that have become rare in cities. Low nutrient substrates, used to cap urban soils and receive seed, reduce the impacts of weed invasion and enable these wildflower meadows to be reliably created at scale. Whilst mined sands are effective, alternatives are available in the form of recycled construction wastes, improving the sustainability of these approaches.

Recent research undertaken in Melbourne, Australia, has demonstrated that recycled materials such as clay subsoils can be diverted from waste streams to effectively support the establishment of wildflower meadows. By incorporating waste-derived substrates, we can address multiple goals: restoring urban biodiversity, enhancing public green spaces, supporting resilient cities, and promoting circular economy principles. This approach aligns with global restoration commitments while delivering meaningful benefits for both nature and people.

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Effects of Canopy Gap Size on the Recruitment of Tree Seedlings in the Terai Forests of Nepal

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Abstract

Gap-dynamics is a crucial ecological phenomenon in the forests and is usually caused by both anthropogenic and natural stressors, such as logging, treefalls, windstorms, and fires. Though the canopy gaps are important in shaping forest ecosystem assemblages, little is known about how the gap sizes have affected the vegetation establishment in forest ecosystems, particularly in lowland Nepal. The present study includes two lowland national parks and the adjoining buffer zones, viz., Parsa and Bardiya, to assess the influence of gap sizes on the recruitment and establishment of tree seedlings. Altogether 120 gaps were sampled ranging from 71 to 914.5 m², which were categorized into small gaps (< 200 m²), medium gaps (200-400 m²), and large gaps (> 400 m²). Seedlings were categorized into germinating (< 0.3 m), surviving (0.3 - 0.5 m) and growing (> 0.5 m) based on their height. The average density of seedlings per square meter was significantly higher in small compared to the medium and large canopy gaps. The small gaps provide the favorable conditions for seedling recruitment, possibly due to a balance between light availability and competition. Furthermore, regression analysis showed a significant inverse relationship between seedling numbers and the size of the canopy gaps. These results indicate that the larger gaps might have feeble seed dispersal ability of the species for longer distances. Therefore, maintenance of gap sizes is necessary to foster the natural regeneration of tree seedlings in forest stands of lowland Nepal.

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Safeguarding and ecological Restoration of a *Posidonia oceanica* Seagrass meadows using transplantation: a case study in Monaco.

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Abstract

To avoid the destruction of a seagrass meadow threatened by a construction project, we developed a sod-based transplantation technique. The method was used in the city-state of Monaco in 2017 and efficiently relocated 384 m² of *Posidonia oceanica* meadow in 24 days. This transplantation also contributed to the restoration of a nearby meadow that was severely degraded in the past and now located in a marine protected area.

Despite two years of nearby maritime construction, the health indicators of the transplanted meadow quickly aligned with those of control site. Three years after the transplantation, the seagrass was flowering in synchrony with the control one, and after eight years, its area had expanded beyond the initial transplant.

Given the slow natural horizontal growth rate of *Posidonia oceanica* (1 to 6 cm per year per apex), it would have taken at least 400 years for the meadow to naturally recolonize the transplantation area (28 m wide) without intervention. However, thanks to ecological restoration efforts full recolonization is expected within approximately 15–20 years without further human intervention.

These results challenge the long-held belief that this species is "non-transplantable" and support recovery and transplantation as viable and ecologically sound alternatives to destruction and compensation measures in coastal development projects. By confirming the effectiveness of careful transplantation techniques, the study underlines that transplantation should be fully considered as a relevant mitigation measure in the 'Avoid-Mitigate-Compensate' sequence, but also as a restoration technique to kick-start the recovery of a site where the meadow has disappeared.

Assessing the potential of plant transplantation to restore tropical open ecosystems

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Abstract

Key functional groups, critical for resilience of tropical open ecosystems, are currently absent in restoration practices. To test an alternative technique for introducing these groups, we installed an experiment based on plant transplantation in the Chapada dos Veadeiros National Park, Brazil. This method transfers patches of vegetation, including soil, microorganisms and belowground structures, from a conserved remnant to an area under restoration. We opened 33 gaps (0,40m x 0,30m x 0,15m) in a conserved donor site, transplanting 100 vegetation nuclei (above, belowground and soil patches) in quincunx arrangement (2m x 2m spacing). Restoration success was assessed by comparing experimental areas with conserved areas (reference) and controls (without planting). Over two years, we assessed species establishment and colonization in the experimental area and donor site recovery. The technique demonstrated potential for restoration, achieving mean species richness in a square meter of 10 spp in the experiment compared to 17 spp in the reference area and only 3 spp in control, while controls plots presented only on average. Floristic composition ($R^2 = 0.49$, $F = 11.58$, $p = 0.001$) and belowground functional diversity were more similar to the reference ecosystem. The donor site recovery density and richness ($F = 3.26$, $p = 0.07$; $F = 1.09$, $p = 0.3$), but not vegetation cover ($F = 2.15$, $p = 0.14$). Despite the potential for restoration, it is necessary to develop ways to use plant transplantation without overloading conserved areas, such as creating protocols for seedling production, increasing possibilities for restoring tropical open ecosystems.

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The great turning: How art can help communities process eco-grief and support restoration efforts

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Abstract

Art can catalyze environmental restoration by creating spaces for communities to process eco-grief and envision regenerative futures. The collaborative team Hammonds + West creates multi-media, eco-arts installations that combine sculptural elements, poetry, sound, and large-scale drawings in order to invite viewers to examine their relationship with environmental degradation and restoration. The scale and multi-media elements of the pieces invite viewers to have a whole-body experience of natural disasters fed by a refusal to tend to nature, as well as possibilities of what a healthier, more sustainable human-nature relationship could yield.

In this presentation, Hammonds + West will share how their shows have been used in communities for teaching and reflective purposes, drawing especially on experience from exhibitions across Texas and in Ohio. In particular we will offer models for how art exhibitions can bring a public together and offer opportunities for artists to engage audiences in guided reflection about gratitude and grief, developing deeper connections to restoration work through artistic practice. The artists will discuss ways they have encouraged participatory work by viewers and how they combine interactive elements in which community members contribute their own reflections on nature and climate to sculptures. These contributions form an evolving archive of community perspectives on natural spaces and environmental change. Initial feedback shows that this approach invites participants to move beyond eco-anxiety toward active engagement with restoration efforts by providing creative tools for processing environmental loss while imagining and working toward ecological recovery. This builds on a presentation given at TXSER 2024.

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Role of biochar in the UN Decade on Ecosystem Restoration with special focus on Northern Arizona

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Abstract

The UN Decade on Ecosystem Restoration (2021–2030) emphasizes preventing and reversing ecosystem degradation, with biochar offering a scalable, nature-based solution. In Northern Arizona, where forest degradation, post-wildfire soil erosion, and declining soil fertility are major challenges, biochar enhances soil health by improving soil structure, water retention, and nutrient availability. Additionally, it provides long-term carbon sequestration, reduces wildfire risks, and supports plant growth. In this study, biochar produced from ponderosa pine snags produced in a CharBoss® was applied in a wildfire effected soil in Flagstaff. Biochar produced had a yields of 9% -17% (bone-dry ton basis), 68% of total carbon content and ash content of 27%. From the results, after one year of application, the pH, electrical conductivity, soil water holding capacity, soil organic carbon, and cation exchange capacity were influenced by the biochar application. However, according to the time study for plantation, the biochar application compared to no biochar application takes about 3 times longer. These findings highlight the potential of biochar in restoration efforts, particularly for post-wildfire recovery in Ponderosa pine forests, where low-value biomass accumulates. Biochar enhances reforestation, community-led restoration, and climate adaptation strategies through improving soil structure in burn scars. Incorporation of biochar into restoration will help enhance the resilience of fire-susceptible and dryland ecosystems to help further the UN Decade mission. The study highlights the role of biochar in utilizing waste forest biomass and application for degraded soil restoration and thus is a useful tool for sustainable land management in Northern Arizona and beyond.

Assessing Growth Rates in Atlantic Forest's Passive Restoration Areas through Repeated LiDAR Scanning

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Abstract

The Atlantic Forest (AF) is one of the world's most biodiverse yet endangered ecosystems. Its extent has fallen below the critical 30% threshold required to sustain native species and ecosystem services, making the restoration of approximately 200,000 km² of forest a pressing priority. Over the past decade, large-scale restoration efforts have been underway, driven by the forest's capacity for natural regeneration. While previous studies have highlighted this potential, a comprehensive assessment of growth rates across the AF is still missing. To address this gap, we analysed a large dataset (>140 km²) of repeated LiDAR scans collected seven years apart in passive restoration sites. Using a state-of-the-art pipeline, we processed the data into high-resolution canopy height models (1m) and performed quality control to minimise bias from differences in terrain, point density, and phenological effects. Growth rates were estimated at a 10 m scale by subtracting the first canopy height model from the second and dividing by the time difference between surveys. Finally, we used a land cover map to evaluate recovery across forest and abandoned pastureland classes. Our findings show that growth rates in early secondary development are twice as fast as the medium stage, and three times as fast as the advanced stage. We also found that abandoned pasturelands showed almost no growth over the evaluated period, while areas with more bushes and trees exhibited higher recovery rates. This study quantifies the AF's growth rates for the first time, offering valuable insights in planning restoration efforts and predicting their outcomes.

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Reviving Ecosystems with Moss and Lichen Magic: Harnessing *Sphagnum* and Biocrusts for Restoration

Line Rochefort

Partnership Research Chair in Ecosystem Restoration. Centre for Northern Studies

Abstract

Mosses and lichens, particularly *Sphagnum* for peatlands and biocrusts for mining sites, play crucial roles in ecosystem restoration. These organisms are pioneers in colonizing disturbed environments or paving the way for the re-establishment of complex ecosystems.

Despite the self-amplifying feedback of *Sphagnum* mosses as ecosystem engineer, peatland restoration throughout the world still relies on rewetting actions only. Latest meta-analysis (2024), modelisation (2021) and review syntheses (in press), partly based on the monitoring of 120 degraded peatlands in Canada, will present how emergent trait-driven feedbacks can be instrumental to the success of peatland restoration projects.

Biocrusts, on the other hand, are composed of lichens, mosses, and cyanobacteria, stabilize soil surfaces, reduce erosion, and enhance soil fertility by fixing atmospheric nitrogen. They are resilient and can thrive in harsh conditions, making them ideal candidates for restoring degraded mining soils, sand or gravel pits.

In practical applications, working with *Sphagnum* and biocrusts involves several steps. Collection and propagation techniques must be adapted to the specific requirements of each group of invascular plants. For *Sphagnum*, this might include the use of donor sites or cultivation in controlled environments to produce sufficient propagules for restoration efforts. For lichens and biocrusts, restoration may involve inoculating soil with cultured fragments or encouraging natural colonization through substrate preparation and moisture management with woody debris.

Ultimately, understanding the ecological functions of mosses and lichens is essential for successful ecosystem restoration. Mosses and lichens can be invaluable in the quest to heal damaged landscapes and restore ecological balance.

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Landscape legacy: Investing in the long-term success of ecological restoration

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Fairfax

Abstract

Too often, municipalities' efforts to protect and improve natural resources focus solely on the initial implementation actions and associated challenges. However, the time and financial investments made to restore or preserve these natural areas can be wasted if sustained efforts are not prioritized. This presentation outlines the Landscape Legacy and Sustainability (LLS) Program in Fairfax County, Virginia. This long-term initiative is aimed at protecting, maintaining, and managing ecologically restored natural areas across county parkland.

With over \$8 million invested by residents since 2008, the program focuses on ensuring the success and maturity of restored ecosystems, which ultimately provide critical ecosystem services such as biodiversity, climate mitigation, erosion control, and wildlife habitat. These efforts are vital for preserving high-quality natural areas that benefit both the local ecology and future generations of park visitors.

As Fairfax County's urban environment continues to grow, the program addresses the increasing pressures on restored ecosystems, including invasive species, forest pests, overabundant wildlife, and human impact. To combat these challenges, the LLS team emphasizes a stewardship approach that integrates long-term preservation activities, monitoring and innovative management strategies aimed at improving long-term habitat health.

Looking forward, the program will continue to focus on refining monitoring and management techniques, expanding the scope of restoration areas, and ensuring equitable access to nature while enhancing the ecological health of Fairfax County's natural areas. Through these ongoing efforts, the LLS program strives to meet the evolving challenges of natural area management, including the expanding inventory of restored and preserved ecosystems.

A long and winding road: A dynamic control framework to contextualize restoration progress through long-term monitoring of reference and restored sites

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Abstract

Assessing the progress of restoration processes usually relies on reference sites that are generally static baselines characterized before or at the beginning of the process. However, external natural and anthropogenic factors are increasingly relevant stressors to which ecosystems respond and need to be considered in restoration monitoring. Their effects may influence areas under restoration and reference sites at the same time. So, in addition to characterizing the original reference site, we need to understand how the landscape changes and responds to climatic and anthropogenic factors to adjust restoration goals and times. This is important in complex human-modified landscape mosaics, where most restoration initiatives occur. Instead of relying on static reference site variables, measured in the past, we propose to generate long-term data from the reference or control sites in parallel with sites under restoration. We tested this framework in a restoration project involving a 408 km-long buried gas pipeline built to transport gas from Amazonia over the Peruvian Andes to the Pacific coast. Since 2012, we have conducted annual surveys of permanent paired vegetation plots along ~270 km of the pipeline, each pair comprising one plot on the pipeline (restored) and an adjacent plot in natural vegetation (control). The annual (2012-present) survey of control plots allowed us to build a continuously updated reference (control) mean. This framework enables us to detect spatial and temporal restoration trends, identify external confounding events that may influence the process (e.g. ENSO, droughts, fires), and provide better guidance to reach our restoration goals.

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Use of Biochar to improve reclamation and soil health and resiliencyAmir Hass, Robert Cantrell, Ameris Chadband

West Virginia State University

Abstract

Biochar, a charcoal like material composed mostly of stable organic carbon, can improve soil ecosystem services. Anthropogenic practices and activities resulted over the years in depletion of arable lands soil organic carbon pool due to poor cultivation practices, and in increase in atmospheric carbon pool, mostly due to burning of fossil fuels. Converting organic biomass to biochar and its use as soil amendment offer a dual opportunity of withdrawing carbon from the atmospheric pool while increasing soil organic carbon pool. Here we present results from a monitoring field study where the impact of land use of biochar as soil amendment is tested at sites of different soils and land management history. The sites, located at the Eastern Ohio Valley and at the Southern West Virginia coal field regions include three reclaimed mine sites and two agriculture lands. Regionally produced mixed hardwood biochar was applied at 0 to 96 Mt ha⁻¹. Selected sites and treatments were instrumented with soil greenhouse gas monitoring system, and with soil moisture temperature and salinity sensors. Additionally, selected soil properties are tested annually. All sites were seeded with pasture mixture and crop yield is recorded every harvest cut. Initial results show significant increase in soil organic carbon, plant biomass, and in soil moisture as biochar application increases. Demonstrating and show-casing the benefits of the use of biochar as soil amendment on regional soils is essential in order to increase public awareness as the overall societal impact of the practice depends on its wide acceptance and adoption.

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Stream Restoration within an Urban Wildlife Migration Corridor, Lessons Learned During the Willow Creek at Sterling Ranch, Colorado Project

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Abstract

Willow Creek, a perennial stream with headwaters in the Pike National Forest, flows through Roxborough State Park and the Sterling Ranch development before joining the South Platte River near Chatfield Reservoir. As a designated wildlife corridor and habitat for the federally threatened Preble's meadow jumping mouse, the stream plays a vital ecological role.

Recognizing the need for a resilient and community-integrated stream restoration, Sterling Ranch Development Company collaborated with Douglas County and the Mile High Flood District (MHFD) to include Willow Creek in MHFD's Development Improvement Program.

In 2018, a multi-disciplinary team that included engineers, landscape architects, and ecologists, was hired by MHFD to design higher functioning and lower maintenance (HFLM) stream improvements. The design team made use of the abundant space made available by Sterling Ranch to construct a resilient stream and floodplain system that not only considers the future changing hydrology, but also the wildlife and public amenity that open space provides. The resulting project was constructed in the fall of 2021 and has shown immediate improvements on stream function, aesthetics, and habitat value.

Rather than focusing solely on stream design, this presentation will explore key lessons learned in integrating wildlife considerations into stream restoration, including designing effective wildlife passage structures, incorporating habitat-friendly elements, and balancing ecological goals with community access. By sharing these insights, we aim to provide practical takeaways for future restoration projects in urban and suburban areas, ensuring that stream corridors serve both wildlife and people effectively.

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Restoration designs create persistent spatial patterns of tree recruits in recovering tropical forests

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Abstract

Small-scale floristic heterogeneity across varied microenvironments is a hallmark of mature tropical forests, and promoting such qualities during the assembly during restoration should produce more resilient and biodiverse systems. Yet, the effect of different restoration approaches on habitat heterogeneity are rarely considered in restoration scenarios. We used complete census data of all tree recruits ≥ 20 -cm from mapped sampling grids in 25 experimental forest plots in southern Costa Rica. The plots were restored 16-18 years prior using natural regeneration, applied nucleation (planting clusters of trees), or conventional mixed-species tree plantation arrays to evaluate how the degree of intervention influenced the spatial recruitment patterns. Specifically, we examined within-plot diversity patterns and species-level occupancy across plot space. Mean local species density of seedlings (species per 6×6-m quadrat) was significantly greater in plantation (11) and applied nucleation (8.5) than natural regeneration (5), which still consistently showed large patches with no recruits. Floristic heterogeneity (within-plot β diversity) did not differ among restoration treatments and remained significantly lower than in reference forests. Recruits from large-seeded species were significantly more clustered in natural regeneration, in part due to occurrence nearer to plot edges. Overall, we find differences in spatial recruitment patterns in restoration treatments, which corresponds with the extent of canopy cover produced by the planted trees and is likely linked to dispersal limitation. However, initial restoration approaches did not have strong effects on small-scale heterogeneity after nearly two decades, which may be due to mortality of planted trees.

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Training early career researchers on generating actionable science for public land managers through coproduction

Lydia Bailey

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Abstract

Scientists are rapidly producing knowledge about land management and restoration practices, but their findings and methods are often not easily accessible to public land managers. Increasing focus on science communication can alleviate some accessibility issues, but coproduction further spans the knowledge-action gap. Coproduction is an approach to producing actionable science through collaboration between researchers, planners, managers, and related stakeholders to inform policy and management decisions. This can help science products more directly address the issues resource managers face, and support science-informed decision making. We are developing a workshop series to teach early career scientists about coproduction - one strategy for helping ensure that applied science products are actionable for public land managers. In these workshops, piloting spring 2025, we will introduce participants to characteristics of science products that can make them more likely to be useful and used by public land managers through a focus on one new type of science delivery product: structured science syntheses. These syntheses present four types of science information - relevant data, scientific studies, analysis methods, and mitigation actions - about a specific management issue in a structure aligned with the decision-making process typically used to address that issue. Our objective is for participants to leave the workshop with a clear understanding of why coproduction matters, how to incorporate it into their work, and characteristics of synthetic science products that can increase their usability. We will share our approaches to these workshops, and the challenges and successes we experience and learn through evaluation.

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Understanding the Role of Burning, Grazing, and Initial Habitat Quality in Remnant Restoration

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Abstract

Adaptive management is crucial for the effective restoration of remnant grasslands via grazing and burning. This approach allows for adjustments based on new information, ensuring cost-effective and efficient progress towards management goals. The Grassland Monitoring Team (GMT), a cross-agency collaboration between The Nature Conservancy, the MN Department of Natural Resources, and the US Fish and Wildlife Service, focuses on understanding management impacts on native tallgrass remnant prairie in the northern Great Plains with recent extension to some mixed-grass remnants. The project monitors over 2100 transects across 238 distinctly-managed remnant prairies. We analyzed data from the first 1.5 decades of the GMT project to understand how burning and grazing affected habitat quality indicators, using a mixed modeling approach to analyze habitat quality responses to management regimes over 6-year intervals.

Our results indicate that initial habitat quality is a strong predictor of management efficacy. In low-quality habitats, burning increased native species cover (particularly forbs: $p < 0.001$) and decreased shrub cover ($p < 0.01$). In high-quality habitats, burning increased native grass cover ($p < 0.001$), and both burning and grazing maintained native species cover and prevented the takeover of Kentucky Bluegrass. Unmanaged high-quality habitats experienced significant declines in the cover of native grasses and forbs ($p < 0.001$). Across all habitat qualities, burning was the most effective tool at increasing habitat quality (especially native grass cover: $p < 0.001$), and the presence of burning was generally more important for improving habitat quality than increasing burn frequency. These findings highlight the importance of adaptive management and cross-agency collaboration in achieving successful restoration outcomes.

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Assessing forest restoration progress using tree-related microhabitats: insights from north-east Italy

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Abstract

Assessing outcomes of forest restoration actions is crucial to determining progress towards achieving specific forest structures and functions. One key aspect is understanding the contribution of restored forests to biodiversity. An original, useful method to assess the potential of trees and forests to support biodiversity is by surveying tree-related microhabitats, i.e. structures that species can use during at least a part of their life cycle to develop, feed, shelter or breed. Surveying and monitoring the development of these structures can shed light on the capacity of restored forests to support species, providing valuable insights into ecosystem functioning. Comparing restored forests with reference forests, such as old-growth, remnant, or even managed forests, can provide valuable insights into ecological dynamics and progress toward restoration targets. To illustrate this, we will present examples from north-east Italy to showcase preliminary results from the application of tree-related microhabitats as a proxy to assess forest restoration outcomes. Specifically, we will present specific results from the activities carried out in the urban Carpaneda wood in the municipality of Vicenza (north-east Italy), which was planted in 2009, as well as from other forest sites. Preliminary results indicate that even young, restored forests can host and develop tree-related microhabitats. Finally, to address social perception, participants in a citizen science event actively surveyed tree-related microhabitats, fostering a deeper connection with the restored forest while enhancing their awareness of the role of trees in supporting biodiversity.

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Is habitat a useful proxy for biodiversity more widely? Lessons from Biodiversity Net Gain efforts in post-industrial landscapes in England.

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Abstract

Biodiversity Net Gain (BNG) has emerged in recent years as an ambitious policy, which aims to use habitat retention, enhancement and creation to create biodiversity gains for development projects in England. There are concerns that BNG, like other offsetting policies, could trade certain losses in the present for uncertain gains in the future if ineffectively monitored and enforced. Despite a risk of noncompliance for on-site biodiversity gains due to a lack of funding, knowledge and resources, these units could be directed off-site, to 'habitat banks'. Directing off-site gains towards post-industrial sites could support the restoration of degraded land in England and help to meet national habitat restoration targets.

As a habitat-driven approach, there are concerns that BNG could neglect important components of ecosystems, such as invertebrates, and will not be effectively monitored or enforced. This PhD aims to assess how different forms of biodiversity assessment align with the statutory BNG metric as measures of biodiversity. Biodiversity variability is being examined on former open-cast mining sites at different stages of restoration in the North East of England. As key functional groups, surveys to assess pollinator and carabid species richness and diversity are conducted. Soil samples are collected for laboratory analysis of physical, chemical, and biological properties, as well as microbial respiration, and vegetation and habitat surveys are being conducted in the field.

As England's BNG metric is influencing global derivatives, I will discuss how effective area-condition metrics are at assessing biodiversity and how this can inform restoration of post-industrial land.

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Denver Parks Youth Stewards – How Denver Parks and Recreation (DPR) is engaging the next generation of park stewards

Emily Zeller

Denver

Abstract

In 2021, Denver Parks received a two-year grant from Great Outdoors Colorado to create and launch a new youth-focused environmental stewardship program. The program employs local youth to work in Denver's park system, providing an opportunity to learn about green jobs and gain applicable skills in ecological restoration as well as take ownership over public spaces in their own community. Due to the program's success during the 2 years of grant funding it was continued by DPR and hopes to expand into the future.

Through the Youth Stewardship program, Denver partners with community-based non-profits who recruit and hire youth crews which are then plugged into projects in Denver Parks. Since inception, the program has reached over 350 participants (ages 14-24) and completed over 100 projects related to resilient landscapes. Projects include creation of native habitat niches, riparian restoration, water quality improvements, wildlife and vegetation interaction, improving biodiversity, and native seed bank development. Youth are trained in tool use, hand powered equipment operation, planting, flora and fauna identification, and learn about various ecological topics.

This presentation will provide an overview of the program while discussing key successes and challenges in launching and sustaining the program. It will demonstrate the power of partnerships, youth engagement, and tips on leveraging grants and other funding opportunities.

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Networks of People, Plants, and Animals: Using Participatory Network Mapping to Explore Community-Based Ecological Restoration

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Abstract

Montana's Northern Great Plains contains one of the world's last intact grasslands. However, conserving these grasslands is difficult because of conflicts related to rangeland economies and cultural values surrounding land use (Epstein et al. 2021). Multistakeholder partnerships offer a promising vehicle for collaborative conservation (Williams et al. 2013). Within this region, novel ecological restoration projects include American Prairie's large-scale rewilding effort, the Fort Belknap Reservation's grassland reseeding and wildlife reintroduction programs, and the Ranchers Stewardship Alliance and Winnett ACES' working lands conservation initiatives.

This study draws on data collected from three summers of community-engaged sociological research exploring ecological restoration efforts in Montana's Northern Great Plains. Using Buckingham et al.'s (2018) participatory network mapping strategies, it employs social network analysis to examine these conservation networks' social, economic, and ecological dimensions. By investigating network attributes such as shape, betweenness, and centrality, I illustrate the regional power dynamics and the social barriers to ecological restoration (McIlwain et al. 2023; Mañas-Navarro et al. 2023). These networks identify the vital role of non-traditional partnerships in overcoming sociocultural barriers and promoting multistakeholder collaboration. I also draw on more than 60 in-depth interviews with regional practitioners to tell the story of how these innovative efforts emerged to support socioecological resilience.

By using both social network mapping and qualitative interviews, this research advances a broader multidisciplinary goal of identifying new areas for increased collaboration among broad groups of stakeholders and facilitating collaborative efforts that can benefit the region's socioecological systems and help inform other grassland restoration initiatives.

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Bull Kelp Culturing & Outplanting for Restoration in the Greater Farallones National Marine Sanctuary, California, USA

Julietta Gomez¹, Rachael Karm², Gina Contolini¹, Angela Zepp¹, Tyler Mears¹, Brent Hughes², Rietta Hohman¹

¹San Francisco. ²Cotati

Abstract

Bull kelp (*Nereocystis luetkeana*), an essential canopy-forming species, provides food and shelter for many marine organisms. However, a marine heatwave and an overpopulation of its predator, the purple sea urchin (*Strongylocentrotus purpuratus*), have caused a 90% decline in bull kelp within the Greater Farallones National Marine Sanctuary in northern California. Despite this, some remnant patches remain in a few coves within the Sanctuary. To restore bull kelp habitat, the Greater Farallones Association (GFA), NOAA's Greater Farallones and Cordell Bank National Marine Sanctuaries (GFNMS/CBNMS), and Sonoma State University are collaborating on restoration efforts.

At the UC Davis Bodega Marine Lab (UCD BML), we culture bull kelp for outplanting at the Fort Ross Cove restoration site. By maintaining kelp cultures year-round, we manipulate their growing season to align with their natural cycle, ensuring they are ready for outplanting in the spring. In the lab, we maintain gametophytes, sporophytes, juveniles, and reproductive adults. To test low-cost outplanting methods, we implemented two approaches: soral bags and inoculated twine. Soral bags replenish the spore stock by delivering reproductive material directly to the benthos, while inoculated twine creates a temporary forest for the season and replenishes spore stock when juveniles mature. Preliminary analyses show that inoculated twine has successfully grown hundreds of sporophytes and proved to be a simple, cost-effective restoration method. Now in Year 3 of the project, we are expanding outplanting efforts to Timber Cove to supplement ongoing urchin removals.

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Dietary pathways of contaminant effects on bats: implications for damage assessment and restoration

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Abstract

Globally, insectivores and piscivorous bats are more vulnerable to certain aquatic-associated contaminants than bats of other dietary guilds because of potential exposure through their diet. Most North American bat species are insectivores that forage near water, thus dietary pathways of aquatic contaminant exposure and effects are likely to be an important source of injury. Natural Resource Damage Assessment and Restoration (NRDAR) cases are often located within the range of bat species of conservation interest. However, few cases directly consider injuries to bats. To aid practitioners in conducting damage assessment and restoration for bats, we 1) systematically review the literature on diet-mediated effects of contaminants on bats, 2) contextualize the relative strength of these effects with other pathways of effect (maternal transfer, dermal, drinking water) using meta-analysis and 3) develop a conceptual framework for aiding determination of diet-related injury to bats in NRDAR and similar processes. The conceptual framework incorporates potential pathways of exposure, bat species foraging traits, types of contamination, and types of injury that can be quantified to determine adverse effects to bats at contaminated sites compared to reference sites in the field during the NRDAR assessment or similar investigations following a contaminant release or oil spill. In some cases, the unique ecological and physiological characteristics of bats may make it beneficial to assess bats separately from other surrogate species like birds or shrews.

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A mesocosm experiment exploring alternatives to straw mulching for hydrometeorological conditioning and *Sphagnum* establishment in peatland restoration

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Abstract

The Moss layer transfer technique (MLTT), developed by the Peatland Ecology Research Group, Université Laval, Canada, has been applied for the restoration of *Sphagnum*-dominated peatlands in North America. During the restoration process, it is crucial to protect the moss diaspores from desiccation to ensure their successful establishment, given the hostile conditions on residual peat deposits after extraction. Conventionally, wheat straw has been used as a mulch material to protect the reintroduced mosses. However, wheat straw is in high demand for horticulture, urban greening, and livestock and varies in availability from region to region. Utilizing mulch materials sourced directly from peatlands could enhance the sustainability of peatland restoration.

To select suitable alternative mulch materials for initial *Sphagnum* establishment, an outdoor mesocosm experiment was conducted at Université Laval botanical garden (Québec). *Sphagnum* carpet growth and hydrometeorological conditions were assessed under different mulch treatments, including no application (control), wheat straw (positive control), cattail straw mulch, residual root material from peat extraction, low and high densities of *Ericaceae* branches, and low and high densities of black spruce branches. Mesocosms were prepared by filling them with rewetted peat, and *Sphagnum* diaspores were applied at a 1:10 ratio. The growth of *Sphagnum* carpet thickness and associated hydrometeorological conditions were monitored over the first year.

This presentation will discuss the impact of alternative mulch materials and their associated hydrometeorological conditions influencing *Sphagnum* carpet establishment during the initial year of restoration.

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Advancing Long-Term Monitoring: On The Use of LiDAR to Predict and Track Changes in Old-Growth Forest Structure.

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Abstract

Successful ecological restoration hinges on identifying specific, measurable indicators that can be used to assess progress toward long-term recovery objectives. Consistent with the International Principles and Standards of Ecological Restoration, such objectives generally involve restoring to historic reference conditions, which, in forested settings are often associated with "old-growth" characteristics. However, where there is limited data on historic forest structure, reliance on old-growth concepts can promote idealized conditions that have little relation to historic structure. As a result, identifying specific indicators for use in monitoring can be subjective, relying on individual characteristics such as large-diameter trees or canopy gaps, which can be present in various stages of forest development. Methods incorporating multiple structural characteristics identified as indicative of old-growth structure have been developed into an old-growth index for western US forests. However, despite the use of such an index in monitoring development towards old-growth conditions, quantifying structural characteristics is often time-consuming and cost-prohibitive, especially in a restoration context. As a result, there is a need for rapid and cost-effective assessments of forest development to facilitate monitoring towards long-term recovery objectives. In this study, we assessed the ability of LiDAR-derived metrics to predict old-growth structure using a modified form of Ackers (1998) old-growth index. Additionally, we used multi-temporal LiDAR data to examine abiotic and biotic influences on the rate of development towards old-growth conditions. This study highlights the ability of LiDAR to capture ecologically meaningful metrics for monitoring forest development towards old-growth conditions and offers insights into the factors influencing forest recovery.

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Increasing ecosystem resilience through restoration in Central Texas grasslands

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Abstract

Longer drought periods and more extreme heat are predicted for Central Texas with climate change, which will likely impact biodiversity, ecological function, and ecosystem services. Grasslands in the region are already under threat due to woody encroachment and invasive species. Ecological restoration of these grasslands, which generally involves conducting regular prescribed fires and seeding native forbs and grasses, increases diversity and is likely to increase ecosystem resilience to drought. We conducted a full-factorial experiment across two years (2022-2024) to test the impacts of extreme drought in the fall or spring (simulated with rainout shelters) compared to ambient levels of precipitation on plants and soils in native-restored versus invaded grasslands of the Texas Hill Country. We measured floral resources monthly across two years, aboveground and belowground biomass in spring 2024, and soil organic matter (SOM) in deep and shallow soils. We also measured SOM and aboveground biomass at two other restored prairies and found similar results. In all cases, soil carbon was higher in native-restored compared to invasive-dominated grasslands growing on the same soil types, suggesting that restored prairies may sequester more carbon. Restoration also increased the plant community's ability to adapt to climate change by maintaining floral resources and biomass production throughout the dry summer season even under extreme drought, and thereby providing food and forage for local pollinators, birds, and other wildlife. Our results highlight the multiple benefits of grassland restoration in a changing climate, including enhanced mitigation and adaptation.

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Carbon storage in understory vegetation after different times of restoration in prairies in Middle Tennessee, USA

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Abstract

Millions of hectares of the southeastern U.S. landscape have transformed from open ecosystems to croplands, or closed-canopy forests due to human activity and altered fire regimes. Restoration has been essential to restoring prairies and their ecosystem services, especially high plant biodiversity. However, new disturbances may impact carbon (C) storage in understory vegetation, where different functional types influence C storage. This study addresses this concern by investigating C pools in mesic and dry prairies after 4 and 7 years of restoration compared to remnant prairies, and how C storage varies among plant functional types (woody, forbs, graminoids, vines, and moss). Several plots were established in various prairie sites in central Tennessee, where C was measured in different pools (leaf litter, understory vegetation, organic soil) using harvest techniques and allometric equations. Results indicated that in 4-year restored prairies, 100% of the C stored is found in the understory vegetation (UV) in both dry and mesic prairies. In 7-year restored prairies, the UV pool represents 78.36% (8.35 tC/ha) and 85.61% (11.21 tC/ha) of the total C stored in dry and mesic prairies, respectively. The remaining C is in the leaf litter pool in both prairie types (dry:2.30 tC/ha; mesic:1.88 tC/ha). Additionally, graminoids showed the greatest potential for C storage (34.34 tC/ha), with dry prairies after 4 years of restoration storing the most C in grasses (7.71 tC/ha). These insights help understand aboveground carbon dynamics, highlighting differences between restored and remnant prairies, and among various plant functional types.

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Seed collection to seed production: A wholistic approach to addressing knowledge gaps to improve the native seed supplyMaggie Eshleman¹, Michaela Owens¹, Olga Kildisheva², Hannah Demler¹¹The Nature Conservancy, Lander, USA. ²The Nature Conservancy, Bend, USA**Abstract**

A lack of native seed availability in limits restoration and reclamation projects' ability to successfully provide quality habitat and forage for wildlife. There are many well-known challenges to improving native seed supply, including critical knowledge gaps. The Nature Conservancy in Wyoming is working to address these knowledge gaps in a wholistic way from wild collected seed to reclamation reseeding. We begin by collecting wild seed from high priority species with unknown seed dormancy. As part of this phase, we assess the ease of seed collection and how viable seed harvesting might be in a cultivation setting. In the lab, we test and determine dormancy break protocols for each collection. Next, we move the seeds into the field where we seed them at reclamation sites in Wyoming to test their establishment success in significantly disturbed lands. We use this information to make recommendations about what species are most likely to be successful in a variety of restoration and reclamation projects. Lastly, we are working toward growing these species in a cultivation setting to answer critical questions about water requirements, pests, seed set and other factors important to seed producers. So far we have completed dormancy break testing on 12 species and field trials on 5 species. Our hope is that by gathering this comprehensive set of information and being able to provide it to potential seed producers we can begin to address the numerous challenges present in improving the native seed supply.

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How Green Infrastructure Monitoring is Helping to Enhance Interagency Collaboration in Denver

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Abstract

In 2021, Denver published a One Water Plan to coordinate efforts to promote healthy watersheds in Denver in an equitable, economically, and environmentally beneficial manner. The development of the plan was accompanied by the formation of Denver's One Water Leaders (OWL) Team. The OWL is made up of representatives of key agencies and organizations that manage water resources and waterways in Denver. The group's role includes advancing One Water Plan strategies and tracking and supporting One Water Project Opportunities by providing project sponsors with coordinated multi-agency support.

One area in which the OWL team has fostered collaboration is data collection, sharing, and interpretation. Subsequently, a Green Infrastructure (GI) Monitoring Workgroup consisting of City agencies and partners was formed to leverage limited monitoring resources. This group aims to collect data that can be used to inform and prioritize capital expenditures, document the effectiveness of green infrastructure and ecosystem restoration projects, improve GI design, and develop regulations and incentives programs. Collaboration among members has led to the development of a common language related to GI and an inventory of GI projects. When completed, the inventory will be used to identify opportunities for future collaboration, share monitoring resources, and ensure resource allocations are directed to areas with the highest needs and to initiatives with highest positive impacts.

The Denver team has submitted multiple 15-minute segments (including this one) highlighting benefits of enhanced community and interagency collaboration, that we invite reviewers to consider accepting and grouping together as a set.

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Green Roofs in Czechia: Balancing Biodiversity Benefits with Invasive Species Risks

Petra Janečková

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Abstract

Green roofs serve as an important tool for urban biodiversity conservation and climate adaptation. We conducted a vegetation survey of 48 extensive green roofs in thermophytic and mesophytic regions of Czechia (Central Europe) to assess their role in supporting plant diversity. Our study recorded all plant species present and analyzed plant community composition in relation to environmental factors, including substrate conditions, roof height and size, and substrate depth. Among these variables, substrate depth was the most influential factor shaping plant communities. Approximately 60% of recorded species were native, and notably, 10% were listed on the national red list. This finding highlights the potential of green roofs as important spaces for wildlife, particularly for species that suffer from losing their natural habitats. However, one-third of the identified species were non-native, with the most common invasive neophytes being *Conyza canadensis* and *Erigeron annuus*. These findings highlight both the conservation potential and ecological challenges of green roofs. While they offer refuge for threatened species, they may also serve as stepping stones for invasive plants. This study underscores the need for thoughtful design and management of green roofs to maximize their role as green infrastructure for biodiversity conservation while minimizing ecological risks. Our results contribute to the discussion on urban green infrastructure as a tool for reducing environmental impact and enhancing urban resilience.

Confronting Challenges Through Collaboration: Long-Term Riparian Restoration on Lower Cache Creek, Yolo County, California, USA

Andrew Rayburn¹, Paul Frank^{1,2}, Mark Tompkins^{1,2}, Lynne Haralson³, Felicia Wang³, Ivy Liu³, Chris Alford⁴, Charlie Tschudin^{4,5}, Tanya Meyer⁶, Amy Williams⁶, Casey Liebler⁵

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Abstract

Cache Creek is a highly-managed California river undergoing long-term, climate-smart restoration after an intensive land-use history including more than century of gravel mining. Providing habitat for more than 230 native species of wildlife, fish, and invertebrates including special-status birds, reptiles, and insects, Cache Creek is a hotspot of biological diversity in a landscape mostly converted to agriculture, extractive industries, and urban development. The Cache Creek Resource Management Plan (CCRMP) is a multi-decadal restoration program implemented by diverse collaborators including agencies, NGOs, mining operators, consultants, and landowners. The CCRMP goal is riparian vegetation recovery, yet 25+ years of observations and modelling has shown that active restoration is severely constrained by abiotic extremes in temperature and precipitation, limited soil moisture, groundwater variability, invasive plant species, and a dynamic flow regime (10–30,000+ cfs) including high winter flows that annually scour and reshape the channel. Accounting for these challenges has resulted in a longer restoration timeline, a greater need for collaboration, and more focus on passive restoration including aggressive invasive species control, reduction of motorized recreation impacts, channel maintenance to protect mature vegetation, and consideration of environmental flows to support establishing vegetation. Active restoration continues, but is now strategically focused on off-channel and upper bank sites that are protected from scouring flows while still being hydraulically connected to the floodplain. Public participation and landowner engagement are also emphasized in both passive and active restoration efforts, as a critical component of collaborative conservation and climate change adaptation.

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Reviving Urban Waters: Five Years of In-Water Restoration at Lake Washington's Southern Shore

Ashley Townes

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Abstract

Addressing the critical environmental challenges within urban ecosystems, the Rainier Beach Link2Lake Open Space Committee's research at Be'er Sheva Park in Rainier Beach, a multicultural neighborhood in South Seattle, focuses on combating invasive species, enhancing shoreline and estuarine habitats, and revitalizing salmon migration corridors. This five-year endeavor is pertinent given the historic neighborhood's location at the southern end of Lake Washington, where we completed significant in-water restoration efforts at the park. This project includes the strategic placement of logs and an innovative earth mound plant structure designed to bolster juvenile Chinook salmon populations and support emergent plant growth, aligning with the theme "Restoration in my backyard – urban context" by demonstrating local ecological restoration. Furthermore, in a novel approach to ecological monitoring, our team, in collaboration with the Seattle Parks Foundation, has integrated advanced technologies such as small remotely operated vehicles (ROVs) with traditional snorkel surveys. This mixed-methodology facilitated a comprehensive pre-restoration assessment of juvenile salmon abundance, capturing detailed movement patterns across various depths, and remains integral during ongoing post-restoration monitoring. The use of these technologies not only enhances our understanding of salmon behavior, movement and habitat utilization but also serves as a reliable method for continuing monitoring of fish populations. This project exemplifies urban environmental stewardship, highlighting the critical role of innovative monitoring techniques in urban restoration. By leveraging cutting-edge technology in concert with community engagement, our initiative underscores the transformative potential of urban green and blue spaces in fostering ecological and social resilience in densely populated areas.

569

Five-years of post-construction structural and biological monitoring shed light on successes and lessons learned on a large-scale nature-based project in the Gulf of Mexico.

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Abstract

In 2019, The Nature Conservancy implemented a large-scale restoration project to protect the coastal community of Bayou La Batre, Alabama from future coastal hazards and to revitalize a locally important waterfront area that lost over 500 feet of shoreline in a century. Designed by coastal engineers of Moffatt & Nichol and guided by scientists from Dauphin Island Sea Lab, the Lightning Point Restoration project included 1.5 miles of segmented breakwaters; more than 40 acres of marsh and scrub-shrub habitats; 2 miles of excavated tidal creeks; and installation of almost 90,000 native plants. The site was tested immediately after completion in Summer 2020 against four major named storms with minimal damage and showcased immense resiliency. Project success stems from its thoughtful nature-based engineering design team and feedback from experts who helped develop a strategic 5-year Monitoring and Adaptive Management Plan to capture key structural and biological parameters. By measuring both structural and biological metrics annually and simultaneously post-construction, the team collated lessons to design future optimal nature-based solutions. Findings indicate successful integration of engineered and ecological components. The breakwaters maintained their integrity and expected settlement rates, while stabilizing the 43-acre coastal habitat expanse without significant sediment loss. The stability of the breakwaters has allowed native plants to flourish over the newly created portions of the sites and less non-native species are encountered across the protected marshes. The team will highlight critical green and gray components to be evaluated in monitoring plans for successful, sustainable and resilient nature-based solutions.

572

Whitebark pine restoration planning and collaboration: Managing multiple threats in an imperiled species

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Abstract

In 2023, whitebark pine (*Pinus albicaulis*) was listed as threatened under the U.S. Endangered Species Act; the species was listed as endangered in Canada in 2012. Whitebark pine, an ecologically important forest tree, inhabits ~80 million acres across the higher mountains of the western U.S. and Canada. Threats to whitebark pine include the non-native fungal disease white pine blister rust (WPBR) (pathogen=*Cronartium ribicola*), mountain pine beetle (*Dendroctonus ponderosae*) outbreaks, changing fire regimes, and climate warming. These threats interact in complex ways, some incompletely understood. Population declines are especially great in the Canadian and northern regions of the U.S. range. The pine depends on a bird Clark's nutcracker for seed dispersal, which complicates restoration efforts. Over a quarter-century, managers and researchers have collaboratively developed conservation and restoration actions, especially the identification of trees resistant to WPBR—essential for successful restoration. In 2023, the draft National Whitebark Pine Restoration Plan was released, emphasizing priority restoration areas within federal and tribal lands; and the U.S. Fish & Wildlife Service Whitebark Pine Recovery Plan is under development. Major restoration goals are to build genetically diverse populations resistant to white pine blister rust, promote climate adaptation, reduce competition, create forest conditions less vulnerable to mountain pine beetles, and protect high value trees against high severity fire and mountain pine beetle outbreaks in regions currently heavily impacted. In addition, managers aspire to build resilience in regions where whitebark pine is not yet widely damaged. Restoration projects will be most effective if targeted to climate refugia.

573

The Use of AI Wetland Mapping for Landscape-scale Restoration Planning: Learnings from Colorado and New Zealand

Marinus Boon

Lynker, Fort Collins, USA

Abstract

There is a growing need for up-to-date high-resolution information to facilitate landscape-scale restoration planning. AI technologies such as machine learning (ML) provides the opportunity for a more accurate, efficient, and data-driven approach to landscape-scale restoration planning. Lynker has modeled and mapped high resolution statewide surface water, wetland boundaries and beaver ponds across Colorado, the Colorado River basin and regional wetland mapping in New Zealand using a combination of machine learning techniques and collaboration with human experts (Ecologists, other domain experts). For the work in Colorado, we are generating multiple time-periods of wetland data and have developed and deployed a ML model to detect beaver ponds over the past decade enabling our partners to track the number of beaver ponds, pond acres and beaver activity metrics. In New Zealand our wetland detection and mapping models support councils to track the health of wetlands in their region and provide a baseline for restoration efforts.

This presentation will delve into examples of how these outputs are and can be used to improve restoration success ranging from detecting ecosystems, understand ecosystem composition, detecting changes, restoration suitability mapping, automated monitoring and facilitate adaptive management. The presentation will also look at the challenges, limitations, and the improvements we are currently working on.

582

Nature-based Solutions for Climate Adaption & Coastal Resilience

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Abstract

Coastal wetlands provide essential ecosystem services, including carbon sequestration, flood protection, and critical habitat for biodiversity. However, climate change and human activities are accelerating their degradation. Restoration efforts often prioritize scale over long-term ecological function and resilience. Yet, with innovative, quality-driven restoration techniques that use nature-based solutions, restoration efforts can enhance ecological integrity and adaptive capacity. Using case studies from the West Pond living shoreline and Randall's Island salt marsh-restoration projects in New York designed by Great Ecology—we illustrate how strategic vegetation community selection, implementation of erosion control structures, and incorporation of microhabitats can greatly enhance long-term ecosystem resilience and biodiversity. Modeling sea-level rise, monitoring elevational profiles, and examining the soil and water quality informed the design and contributed to the improved resilience of these sites in the face of global change. Additionally, placement of overlapping erosion control structures such as coir logs, shell-bag breakwaters, and tree vanes resulted in stabilized soils and enhanced biodiversity and functionality. Implementing these measures together improved restoration quality and sustainability. By using nature-based solutions that improve quality, not just quantity, coastal restoration efforts can achieve multiple benefits at once.

586

The Urban Habitat Renaissance: Transforming Spaces, Restoring Ecosystems

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Abstract

Urban areas hold incredible opportunities for restoration that can promote biodiversity, mitigate urban environmental impacts, and benefit people. Here, using case studies from our work at Great Ecology, we show how strategic urban restoration initiatives can have synergistic benefits—promoting ecological health, mitigating environmental impacts, enhancing education, and shaping inclusive spaces for local communities. For example, in New York City, as part of the restoration effort for the Bronx Kill, we implemented a design that provides public access along the waterway, enhancing local community engagement with nature while simultaneously supporting urban biodiversity. Similarly, in Woodbridge, New Jersey, we led a comprehensive wetlands restoration project focused on tidal wetland enhancement while developing trails and boardwalks for improved accessibility. These efforts provided the community with access to the Raritan River for the first time in over a century. Additional efforts, such as partnering with the local school districts to develop educational programs in these spaces further extended their benefit. Thus, strategic and comprehensive urban restoration projects can serve multiple essential functions simultaneously: mitigating environmental impacts, enhancing ecological function, and creating community spaces that reconnect residents with natural ecosystems. By integrating ecological restoration with community engagement and educational initiatives, urban degraded sites can be transformed into powerful tools for conservation and sustainable urban development.

592

Inspiring Ecological Stewardship Through Art and Science

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Abstract

Science communication must make complex concepts accessible to the public, and the arts provide a compelling way to do so. Cross-disciplinary thinking drives innovation, and the fusion of art and science has historically led to groundbreaking discoveries. Together, they can inspire diverse communities, fostering deeper connections to ecological conservation efforts.

The Desert Research Institute (DRI) Conservation Ecology Lab has developed a guide to identify Mojave Desert native plant seeds and seedlings on the U.S. Bureau of Land Management, California restoration target list. Featuring botanical illustration and focus stacking photography, the guide supports soil seed bank analysis, restoration projects, and serves as an educational tool to promote native plant conservation. To complement this, hands-on microscope and art-based programs were developed to engage individuals from various backgrounds—including PreK-12 students, at-risk youth, educators, and the general public—in exploring ecology, ecosystems, and biodiversity through both scientific observation and artistic expression.

Educator and student feedback suggests that incorporating art into ecological education enhances engagement and comprehension, making restoration concepts more tangible and relatable. This interdisciplinary approach not only deepens public understanding of biodiversity and restoration but also inspires stewardship and strengthens conservation support—demonstrating the transformative role of art in mobilizing restoration efforts.

593

Restoration as a Collective Act: How Inclusive Collaboration Unlocks Resilience

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Abstract

Ecological restoration can achieve greater success through innovative multi-stakeholder collaborations. Key collaboration strategies include stakeholder mapping, iterative communication frameworks, and aligning ecological goals with cultural, social, and economic values. Drawing upon lessons learned from over 1,400 completed projects in the United States and internationally, we provide actionable frameworks and insights to integrate stakeholder collaboration into restoration science and practice. First, we illustrate how stakeholder mapping can be used to understand the interests and relationships of those who influence or are impacted by a project. This can be done through ethnographic interviews, utilization of mapping programs such as GIS, and modeling. Secondly, we outline how iterative communication is critical to a project's success and should be guided by the principle of "early and often." Early collaboration fosters critical buy-in and provides invaluable insights, such as cultural practices, local economic priorities, and local ecological knowledge. These are essential for designing resilient, context-sensitive restoration projects. Finally, maintaining engagement throughout a project's life cycle, through regular outreach at defining key milestones, ensures that stakeholder contributions remain integral to every phase of the restoration process. By applying these lessons together, restoration practitioners can overcome barriers, such as siloed knowledge and conflicting priorities, advancing ecological resilience and community empowerment. Overall, we demonstrate how effective stakeholder engagement fosters exceptional results, creating restoration projects that are socioeconomically sensitive and ecologically resilient.

597

Willow Improvement in the Charlie Meyers State Wildlife Area Habitat Enhancement Project

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Abstract

The improvement site is a 1.5-mile-long reach on the South Platte River within the 1,370-acre Charlie Meyers SWA in Park County, Colorado. Controlled by the Spinney Mountain dam it is a major source of water for Denver, Colorado, and a trophy trout fishery for Rainbow, Cutthroat, and Brown trout.

The Colorado Parks & Wildlife (CPW) project was completed during 2014-2016. The goals included increasing adult trout biomass and density, stabilizing eroding banks, creating deep pools for winter habitat, reducing channel width, enhancing stream habitat diversity and natural riverine processes. In creating a sinuous pattern, CPW focused on deep pools and associated outer meanders with a log wood base layered by toe wood, boulders and sod mats. Given the montane-subalpine grasslands, prolonged cold and short growing season, supplemental willow planting was vital to bank stabilization. In 2017, the Pikes Peak Chapter of Trout Unlimited (PPCTU) volunteers took over the willow planting on an annual basis.

In 2023, willow survival was reassessed, and overall plant survival was poor. Not only was it considered a poor outcome, but it was also a misuse of volunteer time and effort. Working with CPW, PPCTU critically reexamined the multi-step process with latitude to research the scientific literature, perform private sector outreach and site visits, explore tool manufacturing and volunteer education. This resulted in a restructured planting process focusing on quality over quantity with improved 2024 results, including greater 1st year willow survival, better summer growth and multi-generation volunteer involvement.

598

PLANGEA Web: a decision-support platform to optimize global and national actions for ecosystem restoration and conservation

Bruna Pavani, Fernanda Gomes, Breno Valle, Eduardo Lacerda, Renata Capellão, Luiz Oliveira, Diogo Rocha, Joana Krieger, Francisco Albertas, Paulo Branco, Rafael Loyola, Carlos Scaramuzza, Agnieszka Latawiec, Bernardo Strassburg

International Institute for Sustainability (IIS), Rio de Janeiro, Brazil

Abstract

PLANGEA is a modelling tool that integrates multiple criteria, benefits, costs, and legal considerations across all terrestrial ecosystems to support science-based decision-making at different levels. To shape perspectives, inspire action, and deepen connections to maximize benefits for people and nature, it was used creative approaches to develop PLANGEA Web. As a decision-support platform designed for simulating and visualizing priority areas for ecosystem restoration and conservation, it enhances public engagement, enriches decision-making, and facilitates the land-use strategic planning.

The platform's user-friendly online interface allows users to simulate and visualize results applied to different scenarios on a national or global scale. PLANGEA Web bridges scientific data with real-world challenges, such as biodiversity conservation, climate change mitigation, and socio-economic considerations.

The interactive map facilitates strategic land-use planning enabling users to explore different goals, compare results across targets, and evaluate alternative approaches to enhance and protect nature. It employs interactive data visualizations, geospatial storytelling, and statistical graphs to illustrate the benefits and costs of restoration and conservation actions. Additionally, the platform is flexible and undergoes continuous development, allowing for the integration of new functions and outputs from ongoing research.

This fusion of accessible visual data makes PLANGEA Web more intuitive and engaging for a wide range of stakeholders, including policymakers, experts, researchers, communities interested in restoring and protecting their lands. It seeks to inspire a broader audience and promote nature-based solutions as effective strategies.

Please visit <https://plangea.earth/> to explore all its features.

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Urban Restoration: Balancing Community Values While Implementing Green Infrastructure in the Front Range of Colorado

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Abstract

Colorado's population growth percentage was 14.8% between 2010-2020 and the sixth-highest among U.S. states. During that time, 95% of the population growth occurred along the Front Range of Colorado, an area east of the southern Rocky Mountains and spanning from the Wyoming border down the I-25 corridor and encompassing the metropolitan areas of Denver, Boulder, Fort Collins, Greeley, Colorado Springs, and Pueblo. This ecosystem naturally is semi-arid, short-grass prairie, and with few trees. As communities have grown, so too has an interest in implementing urban conservation and restoration projects. Unique challenges already exist when planning and implementing restoration in a semi-arid environment, and when added to variability in community values, goals, and regulations, leads to a need for strong adaptive management in each local context for success in ecological restoration projects. Several Front Range communities have spent the last decade navigating the balance between design, function, aesthetic and regulatory needs associated with such projects. We discuss the drivers behind many of the urban restoration initiatives along the Front Range of Colorado and lessons learned. We will explore some of the barriers to implementation and management of green infrastructure and solutions to balance the at times competing technical, social, aesthetic and regulatory aspects of ecological restoration in semi-arid populated areas. Finally, we will share ideas for continued normalization of the restoration of degraded habitats and improving ecological services in urban areas in the Front Range to contribute to the goal of restoring 30% of degraded ecosystems by 2030.

600

Brazil's pathway to achieve net zero emissions while safeguarding biodiversity

Bruna Pavani

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Abstract

Nature based Solutions (NbS) bring essential commitments to protect our planet. However, these commitments are frequently hindered by a lack of robust national policies, a challenge notably observed in Brazil. This work assesses biodiversity outcomes in compliance levels to Brazilian environmental policies by 2050 by establishing three scenarios: i) baseline, ii) legal enforcement, and iii) NbS plus enforcement plus NbS. The scenarios combine quotas for NbS or engineering technologies, weighing contributions from the land use and energy sectors. They were evaluated on three metric sets: i) net carbon sequestration; ii) biological potential, including species extinction debt, changes in ecosystems integrity, and ecoregions vulnerability; and iii) economic costs, such as land opportunity cost and restoration implementation costs. Conservation had the greatest contribution in achieving net zero emissions while safeguarding biodiversity. However, halting the illegal and legal deforestation and enhancing large-scale native vegetation restoration would ensure high biodiversity conservation, mainly in biomes outside the Amazon. Combating illegal deforestation is insufficient to protect the Brazilian Cerrado, which is highly important in biodiversity conservation metrics. While protecting nature, promoting more ambitious NbS actions would avoid higher monetary expenditure on energy sector infrastructure. Brazil must incorporate biodiversity targets into its commitments and combine them with the climate agenda, enhancing its environmental governance.

601

CoCreating a Regional Vision for Nature and People through Practice

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Abstract

The Metro Denver Nature Alliance (Metro DNA) has been laying the foundation for a regional collective impact model to connect people and nature, which includes restoration as a key goal. In the initial program development, The Nature Conservancy and Biohabitats helped develop a Regional Conservation Assessment (RCA) to identify high-priority places in the seven-county metro Denver region to protect, connect, restore, and enhance for people and nature. See <https://metro-denver-rca-tnc.hub.arcgis.com/>. In parallel with the RCA, MDNA also conducted an Equity Assessment to identify community values and needs. These two assessments are now coming together to guide an innovative and exciting approach to inspire ground-up habitat and neighborhood improvement projects,

Since 2023, MDNA and its ~50 partners have started providing funding for multiple demonstration projects designed to help prioritize and catalyze greater investments in habitat improvements and equitable access to nature across the seven-county metro Denver region. In 2024, six unique and incredible demonstration projects were completed, which are already having impact across the region. In 2025, the second round of projects will begin prioritizing projects that strive to make unique and tangible positive impacts for both nature and people. By providing funds, tools, process, and partner convenings to share experience and aspirations, MDNA and the demonstration projects are helping identify best practices in urban conservation in the region, which we hope others can learn from to inspire hope and leverage resources in their communities.

604

Indigenous Data Sovereignty : Perpetuating Right Relationships and Commitments to Empowering Indigenous Rights and Values through the Lens of Conservation in Hawai'i.

KaiLei'a Duriano

The Nature Conservancy, Honolulu, USA

Abstract

An 'Ōlelo No'eau, or Hawaiian Proverb reads I ka wā ma mua, I ka wā ma hope - The future is in the past. As climate change rapidly approaches, the pressure on Indigenous peoples increases to provide our traditional methods, cultural values, and ways of knowing to guide and lead restoration efforts and conservation solutions. In the past, right relationships between organizations/researchers and Indigenous peoples were pushed to the side, overshadowed by the demanding need for efforts. This perpetuated the cycles of mistrust and has led to valid barriers between each. This ongoing issue has raised focus on addressing how to continue building relationships with Indigenous peoples at the forefront. As data proves to be a necessary tool in discussing climate change, we must acknowledge that Indigenous peoples hold data for ecosystems for generations and have carefully maintained, protected and fought for the rights of land and waters since then. Indigenous data sovereignty is a mechanism that upholds, empowers and sets the standard of how to ensure that future efforts of conservation see people, culture and nature as one. Conservation and restoration place-based work in Hawai'i is actively promoting data sovereignty alongside communities to build capacity and ensure that traditional values of Native Hawaiians not only lead efforts but are protected and valued every step of the way with hope to inspire others to look in the past for the solutions of the future.

606

Women as Songs: The Chipko Movement, Activism and Ethics of Care

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Abstract

In her book, *Images of Women in the Folk Songs of Garhwal Himalayas*, Anjali Capila categorizes the songs created by rural women in North India, highlighting women as a carrier of the oral traditions (2002). This paper examines songs sung by women involved in the Chipko movement, India's foundational forest conservation movement, acknowledged globally as a hallmark of ecofeminism. These songs not only express women's resilience but also serve as tools of agency and activism fostering forest restoration and against environmental exploitation. I argue that these songs reveal an understanding of the role music plays within environmental justice, especially when emerging from marginalised communities.

Fieldwork conducted in summer of 2024 provides a unique basis for my argument. Coming from the same state in India, I bring an insider's perspective to these songs, having witnessed their significance in both personal and communal settings. I examine two songs, the first song, *Bhumyal* is dedicated to Earth God/Goddess. This song refers to sacred groves and is an ode to earth, bringing out the religious importance of the natural world and how religion could enforce environmental restoration. The second song, *Meeting Jaula*, (let's go to the meeting), reflects women's environmental activism during the Chipko Movement. I employ theoretical analysis grounded in ecofeminism and enchantment to understand women's position and the role religion plays in environmental activism. By examining the lasting impact of music, I explore the extent to which music can foster environmental awareness and mobilize collective action in marginalised communities.

613

Assessing greenhouse gas fluxes under peatland restoration and drainage in Minnesota

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Abstract

Peatland soils are a globally important carbon reservoir and sink. However, Minnesota has a legacy of peatland drainage, which alters peatland hydrology and causes loss of stored carbon to the atmosphere. Rewetting can effectively slow carbon loss and in some cases, eventually restore carbon uptake. However, Minnesota peatlands present a unique drainage context that is poorly represented in the literature, and key uncertainties remain surrounding the magnitude of GHG flux in drained and rewetted systems; tradeoffs between reduced carbon dioxide emissions and increased methane emissions; and factors that impact restoration success. In this multiyear study, we used chamber-based techniques to monitor GHG flux and quantified potential environmental drivers of GHG flux in several Minnesota peatland sites representing undisturbed, drained, and rewetted states. Preliminary results show important roles for restoration status, water table depth, soil temperature, sphagnum cover, sedge/grass cover, and pH, which show promise as predictors of GHG flux. Results also highlighted the importance of methane fluxes originating from open water in drainage ditches, with implications both for evaluating the climate benefits of peatland restoration and for restoration practices. Results of this work inform efforts to estimate regional peatland restoration GHG benefits and inform restoration implementation and monitoring techniques for achieving greater climate benefits.

614

Sometimes less is more: low diversity seed mixes as a first step in rebuilding a diverse prairie ecosystem

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Abstract

The Palouse Prairie, a highly endangered grassland in Eastern Washington and Western Idaho, USA, is characterized by rolling hills of loess soils. Less than 1% remains after agricultural conversion. To increase biodiversity, sequester carbon, provide research opportunities, and educate the public, Eastern Washington University is restoring ~50-ha of prairie on campus. Here, we describe prairie restoration approaches being undertaken, and challenges faced, including the need for cost-effective restoration seed mixes that optimize species critical for ecosystem function. We also present lessons learned three years after seeding on a 6-ha pilot site established to test whether higher diversity seed mix would improve long-term restoration outcomes by increasing native plant diversity and reducing nonnative plant cover. We tested three seed mixes (6 grass species, 14 and 21 grass and forb species) across the varied topography of the campus prairie restoration site (ridge tops, swales, and north-facing slopes) using a factorial study design. We sampled 144 1-m² plots one and three years after seeding and explored whether first year results were indicative of longer-term outcomes. Increased seed mix diversity did not improve restoration outcomes after one or three years, and seed mix effects were strongly influenced by topography and nonnative species. Ironically, the lowest diversity seed mix resulted in 46% more native species being established on average, though results varied with topography. Our project highlights some of the unexpected outcomes and complexities associated with prairie restoration.

619

Rodents, Ungulates, and Water, oh my! A Story of Community Assembly in the Soil Seed Bank

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Abstract

Many plant species store viable seeds in the soil, forming a seed bank that facilitates community level resilience and awaits suitable germination conditions. Seed banks can inform our understanding of community assembly, and ultimately restoration potential, through abiotic and biotic filters. Via experimental manipulation, we assessed the effects of two biotic filters (ungulate and rodent presence and absence), and an abiotic filter (water amount) on soil seed bank species. As important drivers of community assembly, for our biotic filters, ungulates influence plant communities through selective grazing and rodents influence plant communities through seed predation. For our abiotic filter, water availability influences seedling emergence, recruitment, and survival. These filters are found across nearly every restoration project and their influence impacts restoration outcomes. Our study is in a temperate grassland in Western Montana, USA, and had five geographically different sites each with paired ungulate, rodent, and watering treatments installed in the summer of 2020 and watering treatments starting the following growing season of 2021. While site-level soil seed bank density and diversity variability existed, a high density of forbs related to different filters were observed in the soil seed bank that were not reflected in the aboveground plant community. Our results illustrate which filters are influencing the species that are present in the seed bank to inform future seed-based restoration actions and native seed mixes. This study contributes knowledge that can help land managers optimize the use of soil seed banks in restoration efforts.

623

Ecological thinning in box-ironbark woodlands of southeastern Australia: 20 years on

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Abstract

Ecological thinning has been proposed as a tool to restore or enhance various ecological values to forests that have been impacted by decades or centuries of land-use change, logging, fires, and floods. Despite a growing body of evidence demonstrating the benefits of thinning for ecological outcomes and resilience to climate-related disturbances from other parts of the world, there has been little research on ecologically oriented thinning in Australia. In 2004 Parks Victoria initiated an ecological thinning trial in Box-Ironbark woodlands in north-central Victoria. These are Australia's longest running thinning trials with an explicit focus on restoring ecological structure and function. Here we provide an overview of the box-ironbark ecological thinning trials, summarise the lessons that have been learned over the past 20 years, and consider its relevance to ongoing discussions about ecological thinning in Australian forests

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Forest restoration for economic outcomes in Laos

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Abstract

Almost all of Laos is capable of supporting forest, but large areas of the historic forest cover have been lost. Between the 1960s and 2010, forest cover fell from 72% of land area to 41%. Of the remaining forest, 82% is highly degraded. This loss of forest cover has accompanied Laos's ongoing transition from a subsistence to a market economy. The Lao government is committed to an ambitious target of 70% forest cover by 2030. This has been supported by significant contributions from diverse donors and development agencies. However, for forest restoration in Laos to be successful, it must promote economic opportunities for local communities. We provide an overview of forest conditions, forest restoration activities, and the complex challenges to forest restoration that exist in Laos. We detail several ongoing projects and explore various lessons that have been learned about forest restoration in Laos and continental Southeast Asia.

629

Towards Sustainable Phosphate Mining: Ecosystem-Based Reclamation Research in the Negev Desert

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Ben-Gurion University of the Negev, Beer Sheva, Israel

Abstract

Phosphate strip mining in the Oron-Ziv region of the Negev Desert has been ongoing for over six decades, severely impacting the hyper-arid ecosystem and fragmenting the landscape. Over the past 17 years, a reclamation-oriented mining approach has been introduced, where topsoil and overburden are separately stockpiled and then replaced in reverse order to maintain key landscape features. To evaluate the ecological effects of this method, we adopted an ecosystem-based approach with two main objectives: (1) To compare physical and biological components (soil, microorganisms, plants, and arthropods) between natural and restored sites, and (2) To propose additional practices to enhance reclamation success. Guided by a conceptual model, we established research plots across four sites for soil sampling and biological monitoring. Soil analysis revealed significant differences in biological components between natural and restored areas. Genetic analysis showed a marked decline in photosynthetic microbial groups, such as cyanobacteria, in restored sites, hindering the formation of functional soil biocrusts. Plant experiments indicated that germination failures result from the absence of a seed bank, as seeds do not accumulate in loose, biocrust-deficient soil. Additionally, while generalist arthropods dominate restored sites, natural sites support a diverse array of specialist species. Our findings highlight the crucial role of geomorphologic stability and biophysical heterogeneity in ecosystem recovery, primarily driven by soil biocrusts. Building on these insights, our current research focuses on active measures to enhance habitat diversity and promote native biodiversity.

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Generating drought resilience in native plant materials: a case study using *Plantago patagonica*, a US southwestern restoration species

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Abstract

As climate change advances, local plant populations may experience physiological stress beyond their tolerances, leading to declines or extirpation. To enhance ecosystem resilience and mitigate these risks, some restoration practitioners are proactively selecting plant species or seed mixes suited to anticipated hotter, drier conditions. However, selection criteria for which plant material to choose remains debated. Choosing plants based on their ability to modify phenotypes across generations to cope with rapidly changing environmental conditions—‘transgenerational plasticity’—may help managers select plant materials better suited to future climates. Research into how transgenerational plasticity can be leveraged by restoration practitioners is still relatively new. Here, we investigate the effects of multi-generational drought on woolly plantain (*Plantago patagonica*, PLPA), a self-pollinating annual and priority restoration species designated by New Mexico Bureau of Land Management. Eleven PLPA populations were collected across the American southwest and exposed to two generations of drought in a fully factorial greenhouse experiment. We found that drought in the offspring generation significantly harms reproductive success in PLPA. However, previous drought experience in the parental generation provides a slight transgenerational benefit, with parental drought increasing the probability of offspring flowering, but not enough to compensate for the negative effects of offspring drought. Understanding how PLPA responds to multi-generational drought can provide valuable insights into where to source and use wild-collected PLPA seed and the best practices for grow-out operations of this priority restoration species.

637

How the *Recooperar* Platform Helps Brazil fulfill international agreements through ecological restoration of deforested and degraded areas

Raquel Lacerda, Iria Pinto

IBAMA, Brasília, Brazil

Abstract

Restoring native vegetation on a national scale requires agile and reliable tools to monitor progress toward their goals. This panel will introduce the Brazilian Recooperar Platform, an innovative tool developed to support Brazil's ecological restoration efforts. Launched in 2024 by IBAMA, Recooperar consolidates real-time data on degraded areas eligible for environmental recovery, driven by both authorized and unauthorized deforestation, under federal responsibility. This platform provides a reliable resource to monitor progress toward Brazil's commitments to the UN frameworks on Climate Change, Biodiversity, and Desertification. During this session, we will explore the motivations behind Recooperar, how it works, and the types of data it aggregates, including over 329,000 hectares monitored since 2019, with a significant focus on the Amazon region. That approach may also contribute to the reduction of more than 3 Mton of greenhouse gas emissions in the last years due to the illegal deforestation in Brazilian Amazon, and biodiversity protection. We will discuss other key challenges such as desertification combat in semi-arid regions through ecological restoration at Caatinga. Looking ahead, we will outline next steps for enhancing initiatives and strategies across Brazil's diverse biomes, prioritizing areas such as indigenous lands and protected zones. As Brazil advances toward the Restoration Decade targets, the Recooperar Platform will be essential in achieving national restoration goals.

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Do restoration guidelines adequately capture social determinants and outcomes of restoration?

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Abstract

Increasing global commitments to restoration have led to a proliferation of guidelines for restoration, however it is not clear how these guidelines incorporate social scientific understandings of restoration. We focus on two social aspects of restoration which are of importance to any restoration project: the social factors that contribute to restoration outcomes, and the social outcomes of restoration processes. We review eight significant publications that purport to establish guidelines for restoration, notably including the Society for Ecological Restoration guidelines. All of these guidelines point to the importance of participation by locally affected parties as an important element of restoration practice, yet none of the frameworks provide specific information about how this can be accomplished, nor do they provide scientific citations to bodies of work that support aspects of this practice. Beyond this core similarity, there are significant differences, with some frameworks strongly emphasizing social factors, while others primarily focus on ecological factors, indicating a lack of consensus about how important social systems are in determining restoration outcomes and about how relevant social outcomes are to restoration projects. Among few areas of explicit disagreement, some frameworks indicate a need for restoration projects to be socially profitable in order to be sustained, while other frameworks indicate that profit should not be considered in restoration. Across all recommendations from the guidelines considered there is a lack of clarity about what is a normative goal for restoration, and what is an empirically supported guideline designed to support specific desired restoration outcomes.

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Montana EcoRestore Project and Database

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Abstract

Current efforts to repair degraded landscapes, protect cultural values, and enhance economic benefits depend on effective tools to help guide restoration practitioners. One such web-based tool that has been initiated in the United States in Arizona and Utah is EcoRestore. EcoRestore provides practitioners, of any level, with accessible information about native plant species best suited for their location and restoration needs. EcoRestore Montana is being developed to expand the growing number of states this tool could be used. Montana is a large state in the western US characterized by many distinct habitat types that face increased invasive annuals, drought, wildfires, and land use changes. EcoRestore Montana follows a similar approach as the broader EcoRestore to create this comprehensive online tool. The species list for our database was compiled from native plant guides co-referenced with native seed producers and plant nurseries throughout the state. Using public databases (e.g., USDA plants, FEIS) and research articles, we compiled data on species characteristics, habitat, and functional traits for each individual plant. In addition to Utah and Arizona EcoRestore tools, certain characteristics were identified and built in to help further guide Montana restoration specifically. Examples of Montana focused efforts are fire resilience or enhancement, specific wildlife habitat and forage information, and additional germination requirements. Access to this resource will benefit Montana stakeholders by providing user-friendly information that helps inform decisions to meet native plant restoration goals and further contributes to the growing number of accessible tools to help increase restoration success in the Western US.

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The Bois d’Arc Lake Project: A Collaborative Approach to Watershed-Scale Ecological Restoration

Matthew Stahman

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Abstract

Between 2018 and 2022, the North Texas Municipal Water District (NTMWD) constructed a surface water reservoir in Fannin County, Texas to supply the needs of a growing regional population; the first of its kind in Texas in 30 years. Ecological impacts from resulting Bois d’Arc Lake were offset by restoring, enhancing and preserving approximately 15,000 acres of wetland and upland habitats and nearly 70 miles of ephemeral, intermittent and perennial streams within the same watershed. NTMWD used a full-service provider contracting mechanism to reduce project cost and transfer long-term risk to Resource Environmental Solutions (RES).

The scale of this ecological restoration project is significant: approximately 8,500 acres of forested, emergent and scrub shrub wetland; 2,700 acres of upland forest; and 3,300 acres of native grassland restoration and enhancement; and over 392,000 linear feet of stream restoration, enhancement and establishment. Seven years into the restoration and perpetual protection of these habitats has resulted in decreased erosion, sedimentation, and nutrient loads in a significant portion of the Bois d’Arc Creek watershed that drains into the Red River between Texas and Oklahoma.

This presentation will provide background on development of the Bois d’Arc Lake Ecological Restoration Project as well as its current status in its seventh year. We will discuss the variety of habitats, geology, technical challenges and lessons learned to date on ecological restoration at this scale. We will also discuss NTMWD and RES collaborative approach to ecological restoration at scale, profiling our technical/construction team as well as our community stakeholders.

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Restoring People's Relationships to the Land

Fendi Despres

City of Aurora Open Space, Aurora, Colorado, USA

Abstract

The mission of the Prairie Restoration Project is to restore relationships between people and nature, and support healthy thriving ecosystems, through land stewardship rooted in respect and reciprocity. This is a volunteer program that focuses on increasing the biodiversity of the shortgrass prairie at the Plains Conservation Center by restoring people's relationships to the land they live on through service learning and connective experiences inspired by indigenous restoration methodologies. This project is an innovative approach to restoration work in that it aims to facilitate intimate relationships between people and nature with the goal of changing people's emotional connections with nature to influence environmental stewardship in every day life and decisions, while performing traditional restoration practices e.g. removing invasive plant species, performing high density seeding, population monitoring, and an experimental component to determine ecotypic species to use for the best restoration results. Restoring people's relationships is done through facilitated experiences e.g. harvesting and using plants using traditional methods, practicing "thought activities" where volunteers reflect on their roles for the environment, practicing respect with nature by using pronouns for plant and animal life, integrating creative activities like painting with brushes made from yucca plants, and more. This project is a collaborative effort between staff and volunteers. The project aims to be inclusive in that anyone can participate without any required experience or knowledge of the ecosystem. It's educational in that volunteers learn about the ecosystem by immersing and working in it alongside knowledgeable staff and dedicated project volunteers.

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Beaver dam analogs and plug-and-pond stream restoration treatments rapidly recover riparian ecosystem structure and function

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Abstract

Widespread channel incision degrades riparian ecosystems by lowering water tables and disconnecting floodplain habitats. Stream restoration often aims to reverse these impacts and recover riparian areas by slowing runoff, aggrading channels, and increasing overbank flooding. Recently, implementation of stream restoration projects has increased rapidly. However, many projects receive minimal monitoring, and treatment effectiveness has not been validated. We report on a before-after-control-impact study that evaluated the impacts of two restoration treatments—beaver dam analogs (BDAs) and plug-and-ponds—on streamside communities, aquatic-to-terrestrial subsidies, and riparian food webs. Bayesian analysis of plant functional trait data show that treatments likely increased water availability and fluvial disturbance, the dominant environmental filters through which streamside plant communities assemble. Additionally, the abundance of wetland plants doubled post-treatment. We found the abundance of emergent aquatic insects increased following restoration, and that this food resource was incorporated into riparian consumer diets which affected riparian food webs. Using stable isotope analysis of $d^{13}C$, $d^{15}N$, and d^2H , we found the proportion of diet that is aquatically derived increased for some functional feeding groups (e.g., spiders, non-spider predators) after treatments were installed. These changes in diet altered isotopic niches, indicating treatments affected riparian food webs. Our results demonstrate that BDAs and plug-and-ponds can rapidly shift environmental conditions, recover riparian plant communities, reestablish links between aquatic and terrestrial environments, and alter trophic dynamics. Our study offers robust evidence that these treatments are effective tools for achieving management goals related to restoring degraded streams and reestablishing lost or extensively altered riparian ecosystems.

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Urban Smart Farm n garden, Makerspace, Lab, Recycling Center as components of a thriving, resilient, sustainable holistic community

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Abstract

The intent is to thoroughly understand the inter-relatedness of the Urban Food-Water-Energy Nexus in the practical application of an HTown SOUND Urban SmartAg vision and initiative. The mission is to become a global leader in implementing advanced, regenerative & sustainable urban farming practices that can solve food desert and water scarcity issues in an environmentally challenged world.

The objective is to create a blueprint for an urban farming initiative along Houston's Bayou Trails, starting with a precision irrigation and soil biome project at either POST HTX Blackwood SkyFarm, Goal Park, or another stakeholder. The initiative intends to strategically partner with the University of Houston Downtown - Center for Urban Agriculture & Sustainability, Blackwood Educational Land Institute, the Danforth Plant Science Center, Prairie View A&M as well as other Institutions to bring regenerative, sustainable, SmartAg practices to Houston. It also envisions incorporating modular greenhouses, containerized farms, aeroponics, hydroponics, and aquaculture.

The document also details the HTown SOUND NextGen entrepreneurial ecosystem, / makerspace which will support the initiative and create a space for innovation in plant science and agricultural technology. The vision includes an entertainment complex -- featuring a music studio, sound stage, nightclub, and farm-to-table restaurant to further market and promote what is unfolding on the ground pertaining to Urban farming in Houston.

Overall, the HTown SOUND initiative aims to transform Houston's urban landscape by creating a sustainable food system, fostering innovation, and celebrating the city's diverse culture.

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Cattle grazing as a conservation tool to enhance plant diversity and habitat conditions in replanted grasslands

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Abstract

An important part of the Conservation Reserve Program (CRP) in the United States is to replant native grassland species on former row-crop fields to combat soil erosion and create habitat in agriculturally dominated regions. Over the past several decades, these efforts have “restored” millions of hectares providing an excellent opportunity to evaluate the success of restoration approaches on private lands. One shortcoming of this program is that most fields are dominated by a few grass species and exhibit low habitat heterogeneity, limiting opportunities for wildlife. We tested whether cattle can be used as a conservation tool to reduce grass dominance, increase plant diversity, and improve habitat heterogeneity in over 100 fields located along a steep precipitation gradient (460-1090 mm/yr) from the grassland biome of North America. After two years of conservative cattle grazing, plant structural heterogeneity increased with few negative effects on bird nesting or increases in non-native plants. Trampling of bird nests by cattle was extremely low. In comparison to untilled reference sites, plant diversity was lower on CRP sites, particularly in higher precipitation regions; these differences were primarily due to the absence of legumes. We are currently extending this work using interannual grazing rotations to increase temporal heterogeneity and increase plant diversity through overseeding with a focus on increasing legume richness and abundance.

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From a Tea Monoculture to a Biodiversity Refuge: The Story of the Endane Biodiversity Corridor in Southwestern Sri Lanka

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Abstract

Sri Lanka, the land of Ceylon Tea, boasts a tea planting legacy spanning over 150 years in its lowland wet zone, which was once home to lush rainforests. Many remaining rainforests are fragmented and being encroached for tea, further hampering endemic biodiversity. In response, we initiated the Endane Biodiversity Corridor project, converting a century-old tea garden to connect the peripheral Iharakanda Forest Reserve with the Sinharaja Rainforest through human-dominated agricultural landscapes. We have partnered with Dilmah Ceylon Tea (Pvt) Ltd, Seethawaka Botanical Garden, local and minority communities to restore over 60 ha of degraded agricultural fields, planting over 54 globally threatened rainforest tree species including rediscovered *Shorea ovalifolia*, that once thought extinct in the wild. Our threatened plant nursery has nurtured over 13,000 seedlings from over 545 geo-referenced mother tree populations in adjacent Sinharaja Forest. Using drone surveys aided by GNSS technology, we monitor 5 ha of restoration monitoring plots and community-owned agroforests. A payment for ecosystem services scheme is in place after valuing the whole landscape alongside a community beekeeping program empowering the local livelihoods. Hosting many hands-on training sessions and research projects on restoring threatened biodiversity, we are scaling our field station to Endane One Earth Rainforest Observatory, a Center for Excellence in Tropical Rainforest Biodiversity Research, Conservation, and Outreach this year. Looking ahead, we aim to showcase our lessons-learned at SER2025 as we strive to ensure a sustainable future where Sri Lanka's lowland rainforest biodiversity and ecological integrity are safeguarded for the future of nature and humanity.

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Leveraging Technology and Mega-Project Expertise for Scalable Restoration of South African Subtropical Thicket

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Abstract

Restoring degraded subtropical thicket ecosystems requires innovative approaches that ensure both ecological impact and scalability. The Spekboom Restoration Project is an ambitious initiative to restore 100,000 hectares of degraded land in South Africa's Eastern and Western Cape provinces by reintroducing *Portulacaria afra* (spekboom), a dominant species in intact thicket. This restoration effort aims to enhance carbon sequestration, improve soil structure and hydrology, and support biodiversity recovery in a semi-arid landscape increasingly vulnerable to climate change.

A key factor in the project's success is the integration of interdisciplinary expertise, including ecology, conservation, engineering, and large-scale project management. Lessons learned from implementing mega-projects are being applied to optimize efficiency, while cutting-edge technologies enable quality assurance and scalability. Advanced tools include UAVs with AI-driven analysis for landscape-scale monitoring, digital project management platforms to streamline logistics, and Ellepot technology for large-scale spekboom propagation. Additionally, AI-powered ecosystem monitoring—using camera traps, autonomous audio recorders, and near-infrared spectrometry—allows for comprehensive assessments of ecosystem recovery.

This presentation highlights how integrating emerging technologies with large-scale operational experience can significantly improve restoration outcomes. By embracing cross-sector innovations, applying adaptive management strategies, and fostering continuous learning, we can raise the bar on ecological restoration. Ensuring both the quality and scalability of interventions is critical for addressing land degradation, biodiversity loss, and climate change mitigation at meaningful scales.

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Silt Trapping, a Nature based solution proved effective in flood mitigation in the refugee camps in Bangladesh with many co-benefits

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Abstract

Large scale refugee influx in 2017 caused new built areas which unfortunately blocked the last corridor for the migratory Asian Elephant in the region. IUCN and UNHCR later explored the possibilities of opening the corridor and concluded that for the duration of the refugees stay in Bangladesh, the biophysical nature of the corridor needs to be maintained and once refugees find durable solutions, corridor could be opened. Due to large scale degradation, hydrological characteristics of the area have changed and resulted into more frequent and intense flooding. UNHCR and IUCN (2021) ran Climate Change model with SSP245 scenario and revealed that annual mean and maximum monthly rainfall will be increased with high likelihood of flash flood in the camps. UNHCR and CNRS (2020) produced a watershed management plan and identified 'silt trapping as one of the options to mitigate flood in the downstream. Silt trap using design modification and by using of grass, conceptually offered accelerated silt deposition. After one year of operation, more than 20,000 cubic feet of silt has been deposited and are ready to be used for site development purpose. It ensured the silts are not clogging the waterways in the downstream and reduced water velocity did not cause stream bank erosion. Use of this Nature based Solutions provided co-benefits by not affecting biodiversity, and multiple use of surface water e.g. irrigation. Silt trap could be scaled a NbS against structural options to flood mitigation and not affecting the bio-physical characteristics of the Elephant Corridor.

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The CLIMAREST project: A scalable approach to improving marine restoration and coastal resilience in the Arctic-Atlantic basin.

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Abstract

Climate change is impacting coastal regions all along the European coastline, which is home to over 40% of the continent's population. Therefore, ecosystem restoration and initiatives to enhance climate resilience in these regions are a top priority. CLIMAREST (2022-2025) is an EU project that works to upscale the restoration of coastal areas through a unique set of innovative tools and methodologies, with collaboration across five demonstration sites from Svalbard and the High Arctic (79°N) in the north to the Madeira archipelago (33°N) in the south.

The project takes a transdisciplinary approach towards developing technological, logistical, social, and economic innovations for the restoration of marine ecosystems and increased climate resilience in the Arctic-Atlantic basin.

CLIMAREST focuses on upscaling, making the knowledge and tools available for local, regional and national policymakers and restoration practitioners so they can be further integrated into management practices.

The project is developing and delivering a holistic toolbox for ecosystem restoration and coastal climate resilience (to be hosted by SER). Once implemented, this modular toolbox will include tools for multilevel stakeholder and community involvement and co-production of knowledge, ecosystem-service improvement analysis, cost-benefit analysis, priority of actions and protocols for restoration and monitoring of the restored systems in a broadly applicable framework.

The tools are currently being developed for demonstration sites with different restoration scenarios and particular specificities in terms of biodiversity, pressures and threats, ecosystems services and stakeholders, and will be further be tested for replication and upscaling in comparable ecosystems and similar communities.

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How Could a Blue Economy Framework Support the Great Lakes?

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Abstract

The blue economy promotes the sustainable use of ocean or freshwater resources for economic growth, improved livelihoods, and ecosystem health. While traditionally focused on marine environments, this presentation examines its application to The Great Lakes Region, emphasizing opportunities and needs unique to its freshwater ecosystem. Challenges such as invasive species, habitat degradation, and climate change demand innovative solutions. Integrating blue economy principles like sustainable fisheries and resilient green infrastructure can drive ecological and economic revitalization. Understanding how land management decisions directly impact freshwater environments are crucial for restoration efforts, as these decisions influence industrial, ecological, and economic development. By integrating blue economy principles, such as sustainable fishery management and environmentally conscious economic growth, restoration efforts can help promote sustainable development, enhance community resilience and protect The Great Lakes' unique natural resources. Lessons from a Gulf Coast case study of an emerging blue carbon economy—where wetland restoration efforts work toward carbon credit development—highlights potential strategies and caveats for The Great Lakes. However, the distinct economic uses and environmental dynamics of freshwater ecosystems require tailored approaches. This presentation compares the traditional blue economy's challenges with the freshwater blue economy's opportunities, proposing innovative frameworks for sustainable resource management, community-driven restoration, and climate adaptation in The Great Lakes.

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Preparing for effective landscape-scale restoration: The role of botanic gardens in native seed supply

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Abstract

Botanic gardens are uniquely poised to support increasing the native seed supply and the use of nature-based solutions through their integrated expertise in horticulture, education, conservation, and research. The landscape-scale impacts of global climate change, ranging from sea-level rise, urban heat effect, increasing storm intensity, flooding, and droughts, have highlighted the urgent need for a supply of native, locally sourced plant material for ecosystem restoration and nature-based solutions. As trusted scientific organizations, educators, and neutral conveners, gardens of all sizes and capacities are well positioned to lead efforts in increasing the native seed supply to address the social, economic, and environmental challenges we face due to climate change. We identify challenges, potential solutions, partnership opportunities and share efforts to engage the public and decision-makers in better understanding the vital role that nature-based solutions can play in tackling some of society's most pressing issues. All gardens, large or small, have an important opportunity to leverage plant collections, programming, and broad organizational expertise to support increasing the native seed supply and the use of nature-based solutions. We will share real-world case studies of gardens working to meet seed supply needs and identify achievable recommendations for gardens to support increasing the native seed supply and engaging in ecosystem restoration and nature-based solutions in their communities and regions.

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The New Nearshore: Planning for Sea Level Rise, Shifting Coastlines, and Marine Ecosystems Developing on the Ruins of Flooded Cities

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Abstract

In the coming decades, sea level rise and increased riparian flooding are expected to inundate low-lying urban landscapes along the world's coastlines. As the shoreline moves inland over urbanized areas, the materials and forms of the flooded built environment will become the substrate for the subsequent realigned nearshore marine and estuarine ecosystems. This presentation will consider how we might plan for and facilitate the inevitable un-building of the coastal built environment to help establish healthy, functioning new habitats and mitigate the compounding impacts of climate change.

We need to think about the post-flood coastal environment when these landscapes can no longer be occupied by humans. How can we facilitate rather than fight this transformation? Might these flooded cities become a new type of coastal infrastructure, an armature to be shaped by natural forces and colonized by non-human life? How will the materials and methods used in the construction of our urban landscapes influence the development of these ecosystems? How do the sand and gravel, asphalt, concrete, and rebar of our streets, sidewalks, and building foundations get redistributed by floodwaters and tidal currents to form new shoals, gravel bars, and coastal banks? What kind of mineral base does this substrate of heterogeneous materials provide and how does that differ from the local geology? There are not enough public or private financial resources available to preserve, protect, and rebuild every inundated urban landscape for human occupancy, but we may have enough resources to support the development of a new shared coastal environment.

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Community Gardens and Mini Forests for Ecosystem-Based Adaptation: Addressing Land Degradation and Climate Change in the Pastoral Himba Community of Kunene, Namibia

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Abstract

In African drylands, where agriculture is climate-sensitive and ecosystems face rapid degradation, innovative and cost-effective adaptation strategies are urgently needed. This study evaluates ecosystem-based adaptation (EbA) approaches within a pastoral Himba community in Kunene, Namibia, through the establishment of community gardens and mini forests. Three community gardens, each spanning 5 hectares and supporting approximately 40 families, have been successfully implemented. These gardens not only bolster food security by providing staple crops such as maize but also enhance livestock nutrition, as surplus harvests serve as animal feed. Continuous feedback from the community indicates high levels of satisfaction and significant socio-economic benefits, demonstrating the value of locally led initiatives.

In parallel, the project introduced mini forests—an experimental yet highly successful intervention. Within a year, these mini forests developed forest-like vegetation structures with trees surpassing 3.5 meters in height, while several species began fruiting within six months. Moreover, the rapid recruitment of local species underscores the ecological viability and resilience of this approach. The mini forests have quickly become a local attraction, serving as a living demonstration of effective, community-driven restoration efforts.

By integrating socio-economic, cultural, governance, and ecological criteria, this study holistically assesses the potential of EbA strategies to enhance adaptive capacity and mitigate climate-related risks. The outcomes provide compelling evidence that community gardens and mini forests can serve as robust tools for addressing the dual challenges of land degradation and climate change, offering a replicable model for similar dryland regions.

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Collaboration opportunities and challenges to connect agroecology and ecological restoration, experiences from several major experiments in the Netherlands

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Abstract

Attempts are being made in various places around the world to align ecological restoration and agroecology, or agroecological restoration. This is a challenge due to their different social and scientific backgrounds. Notwithstanding the highly productive agriculture, several large agroecological restoration projects have been started in the Netherlands, in which nature conservationists, farmers, government ecologists and others work together.

Despite their differences, these projects have the following in common.

1. The impact of agroecology on ecosystem functioning and biodiversity is often indirect, variable and unknown. However, some projects produced interesting results, for example the importance of ground beetles as indicators for agricultural and nature quality.
2. Collaboration has different faces, but success factors are scale, experience, coaching and learning, financial mechanisms, common goals, perspectives, appealing key persons and a sense of urgency.
3. New ways of knowledge development were needed, such as Living Labs. This, for example, resulted in new and applicable knowledge about relationships between soil fertility, vegetation, farm management, population dynamics of birds and insects, and social coalitions.
4. Initially, vagueness about nature objectives simplifies cooperation, but later articulation is inevitable.
5. Existing government instruments, organization, capacity and skills are hardly tailored to these projects.
6. Markets and market parties are an obstacle. However, new business models, including paying for ecosystem services, niche markets for organic products, and biodiversity KPIs, may be a way out.

Despite these challenges, these projects resulted in new transdisciplinary knowledge and policy arrangements, and development of research and policy agenda's for agroecological restoration.

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How to use both carbon credits and biodiversity certificates to maximize the biodiversity impact of nature restoration projects?

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Abstract

if nature restoration projects can effectively contribute to achieving the Kunming objectives, developers today have little incentive to maximize the biodiversity impacts:

- The most widespread financing tool for this type of projects is carbon credit, for which the biodiversity impact is only a co-benefit. Moreover, maximizing biodiversity impacts often implies a short-term reduction in carbon profitability.
- There is not yet a market for biodiversity credits/certificates, which would make it possible to finance large-scale nature-based projects.

How then can we use the various “credits/certificates” to maximize biodiversity impacts? A triple-dual approach may be recommended.

- Systematically contract a duration of at least 50 years for all projects,
 - o With Public Authorities (ex.: PPP) for public forest restoration projects. Increasing biodiversity is therefore necessary to guarantee permanence. It can be assessed using the SER methodology.
 - o Via the use of innovative financial mechanisms mixing, for instance, the creation of a foundation coupled with that of a dedicated fund for projects carried out on private land (ex. : in Brazil).
- Use carbon credits to finance the initial capex of restoration, and biodiversity certificates to ensure the transition from a planted forest to a natural forest.
- Deploy biodiversity certificates in conservation areas close to the ones to be restored. Apart from preventing leakages, it also facilitates the generation of biodiversity certificates across the entire project once the replanted forest has reached its maturity stage.

aDryada’s feedback on this triple approach shows its effectiveness.

aDryada’s feedback on this triple approach shows its effectiveness.

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Bet-hedging and invasion resistance in seed-based wetland restoration

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Abstract

Developing robust seeding approaches for wetlands has lagged behind other ecosystems due to erroneous assumptions that revegetation is often unnecessary in wetland restoration. However, given the intense invasion pressure that wetlands experience, active revegetation is almost always warranted. As part of an EPA Wetland Program Development Grant, we implemented multiple large-scale seed-based restoration experiments in Great Salt Lake wetlands. We asked various questions about optimal seed densities, species diversity, and the timing of seeding for invasion resistance. However, the region experienced extreme weather during this time, resulting in enormous hydrologic variability and unpredictable restoration conditions. Given the sensitivity of seeds and seedlings to abiotic extremes and the inability to predict when or if those extremes might occur, we also adapted our experiments to assess “bet-hedging” approaches that might lead to better plant establishment. We did so by (1) broadening the suite of plant species used, (2) selectively delaying seed germination, (3) performing multi-year sowing, and (4) modifying sowing timing. Synthesizing across multiple experiments, we detail when some of these bet-hedging strategies showed promising results and when they led to undesirable outcomes. We discuss how this bet-hedging approach must simultaneously be balanced with the need to restore invasion-resistant wetlands. Finally, we conclude with recommendations for how to weigh different seed-based restoration approaches and when alternative (planting) methods may be required.

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Soil nutrient and organic matter response to compost amendment in a California annual grass-dominated rangeland

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Abstract

Compost amendments have been proposed as a tool to restore degraded annual grass-dominated rangelands, potentially increasing carbon sequestration and improving soil health, including plant-available soil nutrients and structure. Restoration outcomes following compost application have been understudied in rangelands relative to croplands and pasturelands, and long-term ramifications of these applications on nutrient cycling in such ecosystems remain uncertain. To investigate soil nutrient dynamics following compost amendment, we selected a degraded annual grass-dominated rangeland site in Yuba County, California, USA. Compost was applied to plots at 0-, 8-, or 15-tons acre⁻¹ (no compost (NC) control, C+, or C++ treatments, respectively). We measured changes in soil organic matter (SOM), bulk density (BD), soil carbon (C), soil nitrogen (N), nitrate, and ammonium following compost application in Fall 2023 and one-year post-treatment, with soil cores collected at 0-5 cm and 5-10 cm. SOM, C, and N increased one-year post-treatment, with the greatest response in the C++ soils at 0-5 cm (average increases of 54%, 46%, and 70%, respectively). BD also increased in all plots, but less so for 0-5 cm C++ treatment soils. Nitrate and ammonium decreased after compost application, possibly due to greater microbial nitrogen immobilization, though decreases in ammonium were less severe. Nitrate concentrations were slightly higher in the C++ treatment compared to both NC and C+ treatments. These results suggest that compost application may improve some important metrics of soil health in degraded annual grass-dominated rangelands.

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From Sand to Soil: Restoring Soil Quality in Post-Mining Riparian Reserves on Bangka Island, Indonesia

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Abstract

Tin mining has existed on Bangka Island, Indonesia, for almost two centuries, with enormous expansion at the beginning of millennium. Today, Indonesia remains the world's second-largest tin producer, with Bangka Island as its primary production area. Whereas industry benefits the local economy, it has resulted in thousands of hectares of degraded landscapes, replacing lush tropical rainforests into sandy wastelands. Previous research indicates that sandy soils exhibit low fertility due to nutrient leaching, following low water-holding capacity. This study focuses on restoration of a 0.3-hectare post-mining riparian reserve within MP Evans Plantation. This site represents similar widespread wastelands across Bangka Island, offers an opportunity to test and refine nature-based restoration practices.

Five trial plots were established to assess soil fertility with different treatments that mixed topsoil with forest leaf litter, palm oil wastes, empty fruit bunches compost and sediment from palm oil mill effluent. Cover crops, *Paspalum conjugatum* and *Chrysopogon zizanioides*, were planted to stabilize soil and reduce erosion, while native tree species were planted to recreate the original forest composition. At time T₀, we established baseline data on soil physical and chemical composition (bulk density, moisture, soil texture, pH, soil nutrient, organic matter) and biological indicators (invertebrates, microbial and decomposer activity). At T₁, we outplanted 24 tree seedlings per test-plot, representing six native species, monitored seedling survival rate and growth parameters (height, stem diameter, and number of leaf). Biodiversity recovery was tracked through vegetation cover and faunal presence. Data were analyzed to assess temporal changes of all variables over time.

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A River Runs Through It; Restoration of Four Highly Degraded Sites in New Jersey

William Young

Reforestation Solutions Inc., Point Pleasant, NJ, USA

Abstract

A RIVER RUNS THROUGH IT; RESTORATION OF HIGHLY CONTAMINATED SITES IN NEW JERSEY

By William Young, PWS, CERP

Reforestation Solutions Inc.

New Jersey has the most Superfund sites in the nation, despite being the fourth smallest state. The EPA has embarked on an ambitious program to remediate these sites for public health and safety. In the last twenty years there has been an added push to restore these sites, often of large size, to open space and native wildlife habitat.

Early on, Bob Swain of the Dawson Corporation (now SumCo Eco Contracting) decided to pursue these projects. He obtained all the hazardous waste credentials and invested in equipment and workforce to comply with strict EPA and Army Corps of Engineers requirements for work of this nature.

Bill Young, working for Dawson, was project manager on no less than forty of these hazmat sites in NY/NJ/PA and DE. On this talk, Bill will provide details, insights, and results from four high profile projects in New Jersey. Because these sites can never be built on, it is a rare opportunity to provide critical habitat and bring wildlife back. And many of these cleaned up sites provide a measure of environmental justice to underserved communities.

https://us02web.zoom.us/webinar/register/WN_FQRBI_IDQUmyTlu_LW4LDg

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An assessment of riparian conditions in the Greater Yellowstone Ecosystem: Tools for prioritizing restoration actions across a large landscape

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Abstract

Riparian areas have been identified as “the most important ecosystems on the landscape” for protecting threatened and endangered species, increasing biodiversity, providing clean water, and addressing climate change. Widespread degradation of riparian zones has reduced their capacity to provide valuable ecosystem services. This pattern has alarmed scientists, land managers, and policy makers, resulting in billions of dollars of investment in riparian restoration. To improve effectiveness, ecologists suggest completing restoration at landscape-scales rather than isolated projects. Opportunities exist in landscapes like the Greater Yellowstone Ecosystem (GYE) to complete coordinated restoration, but this approach requires objective tools to prioritize restoration actions. We used nationally available data to evaluate current and projected riparian conditions in the GYE. This assessment provides input data for a decision-support tool to aid managers in identifying riparian ecosystems for long-term conservation or high-priority restoration. Output from the Riparian Condition Assessment Tool show that most GYE riparian areas are in good condition, however, many streams are expected to see substantial shifts in key hydrological variables that influence riparian condition including summer stream temperature, summer stream flow, and runoff timing. Beaver-based restoration may increase the resilience of riparian ecosystems to climate-induced stressors. According to the Beaver Restoration Assessment Tool, more than a third of streams in the GYE require low effort to reestablish beaver dams on the landscape. These results will help managers more effectively use limited resources and improve riparian condition across the GYE by highlighting riparian ecosystems that are strong candidates for long-term conservation and/or high-priority restoration.

700

The Evolution of Floodplain Connection Restoration Concepts in the Middle Rio Grande over Three Decades

Ondrea C Hummel

USA

Abstract

Like many arid southwestern riverine systems, the Rio Grande in New Mexico has had many anthropogenic influences over the past 100 years that have changed both the physical form as well as the related function of the system.

Within the central portion of the Rio Grande in New Mexico (call the Middle Rio Grande) various agencies, partners, stakeholders and other interested parties have worked individually and together to implement restoration and enhancement projects with the goal of sustaining existing quality habitat and increasing a 'mosaic' of habitat types similar to those that historically occurred. One of the main factors needed to support these habitats is floodplain connection with the riverine system which no longer provides overbank flooding. Restoration efforts focus on 'bringing the bosque to the river' to allow connection at higher flows.

The presentation will review a number of floodplain connection restoration efforts implemented throughout the Middle Rio Grande, and past and ongoing coordination efforts to increase efficiency and effectiveness of features by continually sharing lessons learned and monitoring results.

701

A global spatial review of constraints to natural climate solutions

Hilary Brumberg¹, Margaret Hegwood², Waverly Eichhorst², Anna LoPresti², James T. Erbaugh^{3,4}, Timm Kroeger³

¹Stanford University, Palo Alto, CA, USA. ²University of Colorado Boulder, Boulder, CO, USA. ³The Nature Conservancy, Arlington, VA, USA. ⁴Dartmouth College, Hanover, NH, USA

Abstract

Natural Climate Solutions (NCS) could provide over one-third of the climate mitigation needed between now and 2030 to limit warming below 2°C and support the Sustainable Development Goals. Despite this potential, large disparities exist between the estimated biophysical Climate Mitigation Potential (CMP) of NCS and their actual implementation. Social, informational, political, and economic factors contribute to this gap, but the spatial distribution of these constraints and their impact on different NCS remains poorly understood. Understanding these constraints is especially important given the growing research on spatial prioritization of NCS, which is often based on biophysical criteria. We identified and mapped non-biophysical constraints to NCS implementation by conducting a systematic review of recent peer-reviewed literature across ten high-CMP NCS. Our search yielded 1,821 papers, 350 of which provided relevant data on NCS constraints, revealing 2,477 instances across 39 unique constraint types. We mapped the spatial distribution of these constraints and analyzed their similarity across NCS pathways and geographic classifications. Lack of funding, lack of information on how to manage NCS, and ineffective policies were the most widely-observed constraints globally. Constraints to NCS varied within and across each categorization; each geography and NCS pathway faced a unique suite of constraints that span multiple categories. These findings highlight the need for context-specific solutions that address the interrelated constraints unique to each geography, often requiring interdisciplinary approaches; such strategies are likely to be more effective than generic approaches or those targeting single constraints. We also discuss solutions to the most widely-observed constraints.

706

Tree Value Index: A Score-based matrix for selection of tree species and monitoring restoration success

Shalini Dhyan

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Abstract

One of the pressing challenges we observe in fast-expanding urban areas, especially in the Global South, is linked to the retreat of nature and infrastructure development negatively impacting urban green spaces (UGS). There is evidence that a very large proportion of the birds, bats, and butterflies can be conserved if the urban green spaces are restored. Restoration efforts for improving ecological services and biodiversity co-benefits are often undervalued in fast-growing urban areas of the Global South. This undervaluation enhances insufficient attention to restoration efforts, demand-supply gaps, disparity of access, and reduces incentives for urban planners to prioritize restoration. A promising approach is to assist restoration as well as post-restoration monitoring efforts in fast-spreading cities. This study showcases insights from India that can improve the understanding of urban planners to understand larger biodiversity and diverse co-benefits from a wise selection of species.

To improve restoration outcomes, a score-based matrix, viz., the Total Value Index (TVI) index, was developed to assess the choice of tree selected for restoration and the expected benefits. With wider applicability potential, TVI can assess and compare diverse benefits of individual trees that include provisioning (direct use values), cultural (aesthetic/spiritual), supporting (tree-based microhabitats), and regulating ecosystem services (carbon stocks). We showcase a TVI matrix for 80 potential tree species from India that can guide restoration practitioners. TVI for trees and restoration sites is also a guiding indicator of ecological health. The potential of the matrix to be implemented in diverse geographical and context-specific settings is an asset.

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Restoring Buried Wetlands: Lessons from Colorado and MichiganRod Chimner¹, Jake Kurzweil², Lenka Dosekocil², Angela Lafuente¹¹Michigan Tech, Houghton, MI, USA. ²Mountain Studies Institute, Durango, CO, USA**Abstract**

Wetlands provide many important ecosystem functions and values that make them a priority for restoration. Wetlands are degraded by many factors, including burial by sediment from mines, mills, roads, slope erosion, or intentionally filled for development. This presentation will provide an overview and lessons learned from two wetland restoration projects affected by burial. Site 1 is a small high-elevation fen in the mountains of Colorado that was buried by slope erosion from historic mining activities and has been bare for >50 years. Site 2 is a large wetland in Michigan that had many sections buried and heavily modified by construction. At each site, we conducted pre-restoration monitoring, including quantifying the amount of spoil (<0.5 m in Colorado to >8 m in Michigan), determining if hydrologic conditions have changed, identifying underlying soils, assessing reference vegetation communities, and determining what to do with the spoil once it was removed. The restoration process included removing fill with heavy equipment, grading the site to design specifications, and revegetating the wetlands with appropriate native plants. Post-restoration monitoring shows that both sites have appropriate wetland hydrologic conditions and plant recovery is on target.

712

Monitoring shifts in plant-fungal interactions after restoration interventions to inform future management

Grace Rose Gutiérrez, Mandy Slate, Stephen Hovick

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Abstract

Herbicide application is the most used approach to remove invasive species. Although herbicide can be effective at reducing invasive plant cover, potential negative consequences for other ecosystem communities are seldom monitored. Herbicide can affect soil fungal communities in ways that favor performance of invasive and/or native plant species, and these dynamics are poorly understood in wetlands. We surveyed plant roots in ten *Phragmites australis*-invaded freshwater marshes in Northeast Ohio, USA (Morgan Swamp Nature Preserve) that varied in number of years since glyphosate application. Roots of samples collected from these restoration sites were scored for colonization of dark septate endophyte fungi (DSE) and arbuscular mycorrhizal fungi (AMF). To characterize variation in fine root AMF and DSE community composition, we used Illumina amplicon sequencing. We could not detect an effect of herbicide history on DSE nor AMF colonization intensity for any host species. However, across the dataset, DSE colonization was higher in the common native sedge *Carex lurida* than other native sedges and *Phragmites*. For *Phragmites*, 93% of plants in recently sprayed sites were colonized by DSE and 87% by AMF, whereas in sites never sprayed, likelihoods were reduced to 70% DSE and 60% AMF (AMF effect marginal, DSE effect non-significant). Interestingly, AMF colonization did not differ between species, suggesting that *Phragmites* and co-occurring native sedges may interact with AMF to a similar extent. Results on fungal community composition using sequence data are forthcoming and will be presented. Restoration ecologists should consider assessing plant-fungal interactions when constructing post-management monitoring plans.

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Quantifying Wetland Outcomes for a Valley Bottom Restoration Project

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Abstract

Large-scale floodplain reconnection projects must meet multi-faceted objectives of the client and often broad stakeholder teams consisting of regulatory agencies, landowners, and other partners. Demonstrating anticipated project outcomes in a way that is clear and results in stakeholder support can be critical to moving a project forward.

This presentation will describe a method for providing a tangible prediction of project outcomes to the broad co-manager/stakeholder group of the Tucannon River 5-15 project, a 10-mile floodplain reconnection project in Washington. In addition to the client's interests, the success of the project relies on demonstrating how the interests and requirements of funders, tribal organizations, resource agencies, landowners, and recreationists will be met.

The project team developed a method to scale anticipated wetland outcomes of various restoration design options, and present stakeholders with a 'lens' through which to view those options in an easily understandable way. Wetland distribution, condition, and complexity within the Tucannon 5-15 project area were compared to those of a nearby restored floodplain, demonstrating how ecological processes that are environmentally and socially/culturally important could be increased within the project area. Metrics representative of the multiple perspectives of the broad stakeholder group were developed to illustrate how important environmental services such as salmonid habitat, shading potential, and erosion and flood control may be expected to change. As a result, the project team developed a shared understanding of how anticipated outcomes could achieve balanced ecosystem restoration with interests of the co-managers/stakeholders of the river system.

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From long-term restoration research (ILTER) to actionable knowledge in support of commitments

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Abstract

Conservation alone cannot handle the level of degradation; restoration of ecosystems must accelerate regeneration processes. Research results can provide support to plan the details of implementation, but short-term project outcomes might mislead the process. The International Long Term Ecological Research Network (ILTER) consists of a network of 39 members that operate over 750 sites. Beside basic ecological research, several of these sites carry out long-term restoration research. The added value of the network is the long-term, site based, complex nature of research with diverse background data and analyses. The Whole System approach can best be demonstrated within the European regional network (<https://elter-ri.eu/>). Five spheres will be studied in parallel: geosphere, hydrosphere, biosphere and the sociosphere by standard observations that, analysed with restoration intervention outcomes, will provide an invaluable contribution to actionable knowledge. Four workshops have already been organized to enhance collaboration among sites and develop a dedicated topic centre (TC). The main aim of this TC would be to foster knowledge exchange and synthesis, and promote activities to scale-up restoration efforts. By becoming a European Research Infrastructure, eILTER Europe will help understand the complex interactions between people and nature by providing empirical evidence needed to identify and mitigate human impacts on ecosystems. Key functionalities of the TC include identification of knowledge and best practices; restoration approaches for different ecosystems; barriers to restoration including legislation; collaboration with other initiatives that plan to support nature restoration; to exchange ideas, methodologies and resources, with SERE being the main partner.

715

A multicriteria model to prioritize forest restoration in Spain

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³Regional Forest Directorate, Tetouan, Morocco

Abstract

The UN Decade on Ecosystem Restoration (2021–2030) and the EU Regulation on Nature Restoration highlight the strong political commitment to ecological restoration as a key strategy for addressing the global environmental crisis. The EU Regulation challenges Member States to develop National Restoration Plans by June 2026. To translate legal obligations into effective action, a robust prioritization strategy is essential—one that bases restoration efforts on objective and transparent socio-ecological criteria. We developed a multi-criteria model for prioritizing forest habitat restoration, aligning with the EU Regulation while incorporating criteria specific to Spain's forest ecosystems. Our analysis identified forest habitats in unfavorable conservation status, where restoration could enhance connectivity and reduce drought risk. Currently, 7.2 million hectares (43%) of forest habitats are in poor condition, with 60% of these areas at high risk of drought. Restoring these habitats could revitalize 17,693 km of wildlife corridors. This study is a pioneering effort to quantify the forest areas needing restoration under EU regulations. More importantly, it provides a methodological framework for analyzing available data and developing guidelines at both the national and subnational levels—offering a strategic foundation for future restoration planning. This research was funded by Conselleria d'Educació, Cultura, Universitats i Ocupació, Generalitat Valenciana (PROMETEO program, Project R2D, CIPROM/2021/001).

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An experimental test of trait-based ecological restoration to achieve drought tolerance and invasion resistance in two distinct grasslands

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Abstract

Drought and invasive species are two key threats to grassland primary productivity worldwide and ecological restoration seeks to establish resilient plant communities that withstand these stressors. A functional trait-based framework may improve management outcomes by helping design restoration projects that allow managers to meet goals in restored communities including drought tolerance, invasion resistance, and the long-term sustainability of ecosystem services. We established experimental restoration projects in a perennial mixed-grass prairie in Wyoming and an annual grassland in California with three seeding treatments (drought tolerant, functionally diverse, and random) in two experimental treatments (extreme drought and invasion by non-native annual grasses). We asked: (1) did seeding treatments succeed in establishing and maintaining plant communities that satisfied trait-based restoration targets? (2) How did different communities respond to drought and invasion treatments?

Overall, the Euclidean distance from our trait-targets was significantly lower in Wyoming, suggesting trait-based restoration targets may be easier to achieve in perennial grasslands than the annual-dominated grasslands. Restoration targets that included multiple traits were more difficult to meet than functionally diverse targets. At both sites, we found that communities with drought-tolerant traits did maintain higher growth rates in a drought, but not during recovery or prolonged drought. We find that while perennials may tolerate extreme drought, including annuals with other drought response strategies in seed mixes will enhance drought resiliency in rangelands with variable precipitation. These results improve our ability to predict community-level responses to drought events and provide a strong test of trait-based restoration in rangeland communities.

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Targeted Nature-based Infrastructure Improvements on FEMA-Qualified Buyout Properties to Improve Climate Resilience, Green Space and Human Health in vulnerable areas of Greater Houston, TX

Camilla Smith, [Phillip Bevers](#)

Houston Wilderness, Houston, TX, USA

Abstract

With the assistance of local, regional and federal partners in the coastal region of Gulf-Houston, Texas, Houston Wilderness (HW) created the *Riverine Targeted-Use-of-Buyouts* (TUBs) Program to meet a regional need for large-scale nature-based infrastructure (NBI) on contiguous FEMA-qualified public buyout properties bordering numerous riparian corridors. Through collaboration with public landowners, HW implements targeted native large-scale tree plantings, wetland restoration and native grass bioswale installations with the assistance of a corporate volunteer network, and funding from private and public sources. There are currently 26 TUBs sites with thousands of targeted native tree species and multiple native grass bioswales being planted in Houston/Harris County and Galveston County, all of which replace non-native turf grass that was present after the non-pervious surfaces were removed from the buyout properties. The native wetlands restoration and bioswale installations are critical to the region's NBI efforts, and HW partnered with NRCS and Texas A&M Galveston to create a BMP Manual and informational video to provide education and awareness to local communities along riparian corridors, the region and the state. Annual analysis of these climate change adaptations show that large-scale NBI on contiguous buyout properties bordering riparian corridors are providing flood mitigation, air and water quality enhancements, increasing riverine erosion control, providing healthy and productive green spaces in highly urbanized areas, and serving as a low-cost, effective tool for reducing social disparities in high flood-prone communities. These types of NBI can be replicated in other parts of the U.S. – particularly along riparian corridors in urban areas.

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Effects of rehabilitation practices on ecosystem dynamics in a utilized high Andean landscape

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⁶Archaeology and History Department, University of Exeter. ⁷Department of Geography and the Environment, University of Texas at Austin

Abstract

High-elevation ecosystems provide important hydrological services such as flow regulation and water supply to millions of people. In the Peruvian highlands, reduced water availability linked to glacial recession is increasing the vulnerability of local livelihoods, who rely on glacial-irrigated wetlands for subsistence farming and to obtain palatable grasses that support pastoralism. One such case is the Huancavelica department in Peru, which is amongst the highest alpaca fiber producing regions in the country whilst remaining one of the poorest. In recent years, alpaca weight and fiber quality have decreased, presumably due to the low availability of palatable species for alpacas. To address these issues, governmental, non-governmental, and international agencies developed and established a rehabilitation program in 2011. The rehabilitation targeted possible overgrazing associated with a decline in water availability and included the following treatments: exclusion from alpacas, exclusion with irrigation ditches, and exclusions with active irrigation pumps. In 2019, our team published the findings from our first sampling performed in 2015, which showed that the aboveground biomass (AGB) of palatable species increased with the treatments. Now, we present data from two additional sampling periods, 2017 and 2018. We found that excluded plots increased in AGB over time but decreased in species richness. We also found that *Calamagrostis vicunarum*, a palatable species, was the dominant species in the excluded plots. These results help provide recommendations for policymakers in Peru to improve climate mitigation strategies and foster the adaptability of vulnerable populations.

721

Restoring Complexity: Integrating Self-Organization into Forest Restoration

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Abstract

Current restoration practices often treat forests as mere assemblages of plants. However, forests are complex, dynamic, self-organized systems and their natural regeneration is shaped by ecological memory. Forest ecological memory is embodied in available seed sources distributed by various vectors. It is also reflected in existing physical structures, like coarse woody debris, as well as legacy communities, such as common mycorrhizal networks and overstory trees. When reforestation strategies disregard ecological memory, they impede forest self-organizing processes, particularly in relation to spatial arrangement, species composition and legacy effects. This issue is especially salient given the sessile nature of plants, which limits their capacity for spatial adjustment, a process naturally mediated by early competition amongst seedlings of many species. While some aspects of ecological memory, such as physical structures and legacy communities, may be difficult to reestablish, I argue that two common restoration strategies could be improved to more closely mimic natural regeneration and support spatial adjustment: single-seedling grid-pattern planting and the use of only one or few species. Both not only prevent the natural clustering and competitive interactions that drive selection of the most suitable seedlings but also inhibit cooperative dynamics like inosculation amongst conspecifics later in life. Thus, these practices should be replaced with strategies that mimic natural regeneration, such as more natural planting layouts like multi-species group plantings. By aligning reforestation efforts with ecological processes interventions can support rather than suppress forest self-organization, ultimately improving forest resilience and health, ensuring long-term sustainability of reforestation efforts.

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Application of Drones Imagery and Artificial Intelligence in Ecological Restoration Assessment and Monitoring

Sami Almaliki¹, Ahmed Mohamed¹, Hassan Boukcim², Youssef Lebrini², Yassine Fendane², Shauna Rees¹, Benjamin Y-H Lee¹, Abdalsamad Aldabaa¹

¹The Royal Commission for AlUla, AlUla, Medina, Saudi Arabia. ²Valorhiz, France

Abstract

Ecological restoration is a key tool in tackling the biodiversity loss crisis and aid natural recovery. Understanding the distribution and conditions of habitats is needed for implementing ecological restoration initiatives. The use of Drone Imagery for monitoring purposes is a promising technology for assessing ecosystem restoration strategies. The ecological restoration 100 ha pilot site at Sharaan National Park, Saudi Arabia, started at October 2021 served as the study area. This study leveraged the advantages of short revisit times, applied multi-source remote sensing imagery. The aim of this research is to provide a synthesis on what is currently feasible in terms of detection and monitoring of natural and semi-natural habitats with remote sensing data. Direct mapping of distinct habitat types were employed. After obtaining and processing drone images, a holistic approach to the expansion of ecological surveys, mapping, restoration, and monitoring was developed with the help of artificial intelligence (AI) Cassia® -technologies, a powerful instrument for tying together disconnected datasets. Results reveal that drone imagery is a potential tool to enhance the comprehension of habitat distribution and conservation status evaluation. Vegetation coverage increased to 33.5%, 82% of pillar species were identified, and eight soil units were delineated using Cassia®. This study validates the feasibility of using drone imagery as an evaluation method, offering a scientific reference for understanding habitat distribution and assessing their conservation status prior to implementation. This could serve as a valuable reference for evaluating the effectiveness of ecological restoration using drones and AI technology.

723

Predicting Soil Physical and Chemical Properties Using XRF Spectroscopy and Locally Weighted PLSR in Hyper-Arid Environment

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Abstract

Effective soil characterization is important for a better understanding of ecosystems and ecological restoration strategies in degraded areas. This study explores the prediction of soil physical and chemical properties in the hyper-arid environment of AlUla, Saudi Arabia, using X-Ray Fluorescence (XRF) spectroscopy combined with innovative statistical modeling. Soil samples, predominantly sandy with low clay and nutrient content, were collected between 2019 and 2023 as part of ecological restoration and biodiversity projects. The study employed centered log-ratio (CLR) transformation to address the compositional nature of XRF data and locally weighted partial least squares regression (LWPLSR) for predictive modeling. The findings demonstrate that the combination of CLR transformation and LWPLSR significantly improved model accuracy for key soil properties. Reliable predictions were achieved for soil texture and chemical properties such as pH (KCl), total calcium carbonate (CaCO₃), exchangeable calcium (Ca) and magnesium (Mg), and cation exchange capacity (CEC). Sand content predictions, in particular, showed excellent performance with high coefficients of determination ($R^2 = 0.94$). However, poor prediction accuracy was observed for soil organic matter, extractable micro-elements, water pH, and salinity, likely due to the complexity of these properties and the inability of XRF to detect elements lighter than magnesium (e.g., carbon and nitrogen). The study highlights the potential of XRF spectroscopy as a cost-effective and rapid method for soil property characterization. This research provides a valuable reference for improving soil property monitoring in arid environments. The methodologies developed offer significant potential for large-scale, low-cost soil characterization and management in similar contexts.

730

Scared Strong: Using Predator Cues to Bolster Oyster Restoration

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Abstract

Many prey species alter their morphology to reduce predation risk, which can improve survivability but also incur costs in growth and fecundity. Using predator cues to enhance prey defenses may improve survival of cultivated species and enhance species restoration efforts, but assessment of such benefits across relevant scales is needed. Oysters, *Crassostrea virginica*, develop stronger shells in response to exudates from predators and injured conspecifics. We investigated if oyster morphology could be manipulated to improve survival and bolster restoration, and we tested the costs and benefits of this approach to improve oyster survival in the field. Exposing oyster spat to predator cues increased shell strength by 20-100% and boosted their survival by >50% after one year. Although oysters exposed to predator cues, initially developed less soft tissue, after one year, they had similar sizes and tissue masses to controls. Concurrently, we ran bioassays to identify the chemical cues predators release that stimulate oysters to grow stronger shells with a goal of developing a synthetic cue to harden oysters and improve their survivorship. From these experiments we have identified 3 molecules in predator urine from which a synthetic cue may be created. These findings demonstrate the utility of using predator cues to enhance the survival of target species, and highlight an opportunity to employ nontoxic methods to control pest-based mortality.

733

Rights of Nature in Wetlands: Recognizing and Operationalizing Wetlands' Right to Restoration and Regeneration

Gillian Davies

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Abstract

A Rights of Wetlands (and of Nature) perspective shifts our thinking as well as governance and legal structures, thereby enhancing our capacity to achieve a stable and livable climate, reverse the current biodiversity crash, and restore ecosystems. Through a Rights of Wetlands/Nature lens, humans are understood to be part of Nature, not separate or superior to Nature. Often the Rights of Nature movement has been led by Indigenous Peoples who, for millennia, have viewed Nature as kin. With this in mind, communities and governments around the world are embracing Rights of Nature, including for wetlands. A key right for wetlands and other elements of Nature is the right to restoration and regeneration. This presentation will examine what the right to restoration and regeneration means, and how to operationalize, or implement, this right in a wetland context, and in the context of the broader Rights of Nature movement that is spreading around the world. Key considerations for how to operationalize Rights of Wetlands will be addressed, and an ongoing project to operationalize Rights of Wetlands in five countries (Bolivia, Ecuador, Guyana, Kenya, and Sri Lanka) will be discussed. Links to materials that can assist in increasing wetland preservation and restoration through a ROW approach will be shared including: Rights of Wetlands infographics/Quick Guides; *Transforming Our Relationship with Wetlands: A Guide to the Rights of Wetlands*; the *Universal Declaration of the Rights of Wetlands*; links to peer-reviewed journal articles on ROW; and a link to the Rights of Wetlands website.

734

College campuses as conservation space: A case study in connecting undergraduate students to restoration practice at Rice University.Cassidy Johnson

Rice University, Houston, Texas, USA

Abstract

The green spaces of university and college campuses are by default “protected” in that they are not under external threat of development. These natural areas can play a valuable role in urban conservation through the protection of local biodiversity and the education of the campus community. The campus of Rice University is a named arboretum and a member of Tree Campus USA. The Harris Gully Natural Area (HGNA), a detention basin that is a part of the arboretum, serves as a living laboratory where students explore the challenges and benefits of urban habitat restoration. Over the past seven years, students in Conservation Biology lab have monitored, collected data, and proposed a range of restoration activity in the basin. This past academic year the university approved moving forward with a student-proposed prairie and wetland reconstruction that will recapitulate the historic ecosystems that once dominated our campus. This talk will explore how engaging students in authentic, conservation and restoration activities through their coursework can provide a mechanism for a university to “lead by example” in protecting local biodiversity and supporting urban sustainability initiatives.

736

Improving the Efficacy of Pollinator Habitat Establishment Practices

Jody Thompson, Kristin Conrad, Kasia Bradley, Renata Rodriguez, Jeremy Sandifer

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Abstract

Pollinator habitat establishment is one of the most common and important practices implemented across various land uses to benefit pollinator populations, diversify biotic communities, and meet sustainable agricultural goals. Weed competition control is widely regarded as the most important step because weed competition prevents native seed germination and establishment, resulting in failed installations, wasted funds and time, and discourages efforts for reinstallation and continuation of the practice. Unfortunately, inadequate competition control is common in the professional and landowner communities and recommendations vary among sources. Previous studies about competition control have been limited in scope and do not provide adequate information to address the suite of practices, questions, and needs that are regularly associated with realistic scenarios. This project assesses the relative efficacies of six common pollinator habitat establishment systems using a shortgrass meadow wildflower mix. These systems were designed in collaboration with Roundstone Native Seed, Upton, KY to account for common practices observed in the commercial and non-commercial conservation communities. Treatments include four common practices incorporating various numbers of conventional herbicide applications using 2% glyphosate+1% 2,4-D, one organic method using 8% pelargonic acid, and one no-spray practice. Treatments were inventoried for 2 years to determine diversity and abundance of native and non-native plants. Results demonstrate an efficacy range for seed-based habitat establishment that can aid conservation practitioners in making better decisions to prevent future practice failures and encourage increased conservation.

739

Protecting, Restoring and Connecting Endangered Species Habitat with a Community of Volunteers

Jim ODonnell

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Abstract

The Balcones Canyonlands ecoregion in Central Texas is a biodiversity hotspot with many endemic and imperiled species, including rare plants, cave and spring invertebrates, aquatic salamanders, and the endangered Golden-cheeked Warbler (*Setophaga chrysoparia*). The 13,350-hectare Balcones Canyonlands Preserve west of Austin, Texas, was established under a U.S. Endangered Species Act permit to protect the Golden-cheeked Warbler and 34 other at-risk species from habitat loss due to accelerating urban expansion. All of these species depend on Ashe juniper-oak ecosystems, which cover a highly dissected limestone karst terrane. Land management within the Balcones Canyonlands Preserve focuses on protecting prime habitat, enhancing recovering systems, and restoring degraded sites. We use historic documents, aerial photographs, and reconnaissance to identify these sites. Using regenerative techniques and designs, we are working to repair the degraded sites and promote healthy, resilient ecosystems. Starting from the ground up, we begin with earthworks that stabilize erosion and promote water infiltration to rehydrate and rebuild the soil “sponge”. Restoration is designed within an adaptive management framework to connect and expand forest patches, promote carbon sequestration, provide pollinator habitat, increase native plant diversity, and recycle invasive woody material back into the ecosystem. We have received an award from the U.S. Environmental Protection Agency with top honors for Low Impact Green Infrastructure Improvement. This work is being implemented thanks to the dedication and engagement of a community of volunteers and non-profit organizations who are also teaching others how to regenerate their own land using these nature-based restoration techniques.

741

MULTI-STAKEHOLDER RESTORATION OF DEGRADED MANGROVE SHORELINES IMPACTED BY PETROLEUM HYDROCARBON USING MULTIPLE MANGROVE SPECIES IN Ogoniland, NIGERIA.

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Abstract

Thousands of hectares of mangroves in Ogoniland, Nigeria, have suffered degradation due to decades of oil spills compounded by a poor history of restorative efforts. However, the Hydrocarbon Pollution Remediation Project (HYPREP) has initiated a large-scale shoreline cleanup and mangrove restoration project in the region. The initial cleanup covers 3000 hectares, and the pilot mangrove restoration spans 560 hectares. Multiple stakeholders drive both initiatives. The process is guided by the Shoreline Cleanup Assessment Technique (SCAT). SCAT includes representatives from the host communities, credible civil society organizations, HYPREP, and government regulators. The SCAT stakeholders are involved in different aspects of the projects, such as defining the objectives, field execution, verification, monitoring the effectiveness of the shoreline cleanup, and validating planted mangrove grids. The restoration process involves planting multiple species native to the region. Two thousand five hundred (2,500) community workers were trained in oil spill response and sustainable mangrove restoration techniques. Additionally, 90 women and youths were trained and provided grants to establish multispecies mangrove nurseries. The trainees, in turn, utilized the HYPREP user-friendly mangrove restoration manual to train over 200 of their family members in nursery establishments, resulting in surplus seedlings. The sale of the seedlings and the direct jobs created are significant livelihood outcomes of the cleanup and mangrove restoration. Indirect jobs, such as food vending, waste hauling, and boat transportation, improved local livelihoods. To date, 1,262,947 seedlings of five species of woody mangroves have been planted, and over 450 hectares of oil-degraded mangrove shorelines have been restored.

742

Approaches to restoration and co-management of lakes in rapidly urbanising catchments

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Abstract

Several lakes in Bangalore are undergoing restoration through funding from government initiatives and private enterprises under corporate social responsibility (CSR) programs. However, despite these efforts, restored lakes continue to face persistent challenges, including eutrophication, fish kills, and bird deaths. To identify gaps in current lake restoration approaches, we conducted action research on five lakes at various stages of restoration. Our study examined multiple dimensions of lake health, such as water quality, biodiversity, and socio-economic factors, to develop a comprehensive understanding of the challenges. Findings indicate that: (a) the lack of clear expectations among stakeholders often results in a perceived sense of project failure and diminished stewardship, (b) integrating stakeholder perspectives and setting short-term restoration targets based on their inputs can significantly enhance project outcomes, and (c) addressing stakeholder concerns and incorporating local ecological knowledge fosters long-term community engagement. Additionally, transforming these lakes into living laboratories and equipping citizens to monitor simple water quality parameters, such as Secchi depth, can provide multiple benefits. These include (i) establishing benchmarks for future restoration projects, (ii) generating long-term data to evaluate the effectiveness of interventions, and (iii) detecting illegal wastewater discharge. Our study highlights the need for an inclusive, participatory approach to lake restoration, where citizen science plays a central role in ensuring sustainable management. By fostering co-management practices, engaging local communities, and setting realistic expectations, restoration initiatives can achieve improved ecological and social outcomes, ultimately leading to healthier urban lakes.

743

Our grandchildren's grandchildren: A collaborative approach to mine rehabilitation for generational impact.

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Abstract

The Banjima Land Rehabilitation Partnership (BLRP) is a collaborative initiative between the Banjima Native Title Aboriginal Corporation (BNTAC) and BHP, designed to restore mining areas on Banjima traditional lands while prioritising intergenerational benefits and a sustainable future.

This partnership emphasises a holistic approach to mine rehabilitation, recognising it as a complex, integrated process requiring a long-term commitment, skilled workforce, and deep understanding of site-specific conditions. A key element is the shift from a purely rehabilitation-driven approach to one that is people-centred, prioritising the training and empowerment of Traditional Owners (TOs). This approach fosters a sustainable program and better outcomes for all stakeholders seeks to develop a diversified Indigenous-led restoration economy.

The presentation will detail three key principles behind the partnership's emerging solutions:

The initiative highlights the importance of prioritising long-term relationship building over quick technical fixes and offers insights for those working at the interface of Indigenous knowledge systems and ecological restoration, on how embracing Aboriginal wisdom and TEK transforms stakeholder engagement from token consultation to meaningful collaboration, delivering better ecological outcomes.

In summary, the BLRP serves as a model for how partnerships focused on people, particularly those with barriers to employment, can create holistic benefits, driving both ecological restoration and community development. It demonstrates that prioritising long-term relationships, cultural knowledge, and economic opportunities leads to more sustainable and successful outcomes.

745

Assessing forest restoration and naturalness using airborne laser scanning: advancing monitoring for ecological recovery

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Abstract

Intensive forest management has led to a significant decline in forest biodiversity by degrading habitats and altering ecosystem structure. The European Union Nature Restoration Law mandates the restoration of degraded ecosystems, including forests, while the EU Biodiversity Strategy requires the protection of all remaining primary and old-growth forests. Achieving these targets necessitates a reliable method to assess forest naturalness and monitor restoration outcomes over time.

This study explores the potential of airborne laser scanning (ALS) for identifying both forests with a high level naturalness in managed forests and degraded forests within protected areas, as well as tracking changes in naturalness following restoration. By combining ground-based ecological assessments with nationwide ALS data, the study evaluates how structural forest attributes can serve as indicators of restoration success or ongoing degradation.

Preliminary analyses suggest that ALS-based models can effectively predict forest naturalness, providing a scalable tool to assess restoration needs and measure post-restoration changes. These changes can be both positive, indicating successful ecological recovery, or negative, revealing unintended consequences of restoration interventions. However, model selection must be tailored to specific forest types and tree species to ensure accurate interpretation.

By integrating remote sensing technology into forest monitoring, this research enhances our ability to prioritize restoration efforts, evaluate ecological recovery more efficiently, and inform adaptive forest management strategies. These results contribute to improving large-scale restoration planning, supporting evidence-based conservation policies and advancing the role of remote sensing in ecological restoration science.

751

Empowering Women in arid and semi-arid areas to grow vibrant regenerative organic Kitchen gardens for ameliorated health, soils, and livelihoods.

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Boma Ikolojia Regeneration, Kanyerus, West Pokot, Kenya

Abstract

I am the co-founder of Boma Ikolojia regeneration Kanyerus, a community-based organisation based in Kanyerus West Pokot County Kenya. Boma Ikolojia is geared towards bringing communities together to improve their livelihoods through rehabilitation and management of degraded natural resources and to build resilience. The project has taken a community-based approach centered around the BOMA (***Swahili for homestead***), the project intends to inspire, educate, and enlighten the local rural community for common good. In pastoral communities, women are regarded as commodities whereby girls and young women, between the ages of 9 and 15, are sold off by their parents to older men, in exchange for cows. This project is helping mothers and women married at a young age to start generating income and ameliorate livelihoods for their families. The community of Kanyerus have started embracing regeneration and Kanyerus Peace Boader Primary School, a school developed in a conflict prone area to foster cohesion is the main beneficiary of this project. We anticipate for better lives healthy ecosystems, healthier community, vibrant livelihoods, and happiness! *In Africa we say, “a full stomach brings happiness and peace”, that is what we would love to achieve in every household now and in future.*

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Productive Participatory Restoration: Lessons learned from five years of Community-Engaged restoration in Colombia, Ethiopia, Ghana, Indonesia, and Vietnam.

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Abstract

Restoration efforts are most effective when they integrate the efforts with tangible benefits for local communities. Over the past five years, members of the Tropenbos Network in Colombia, Ethiopia, Ghana, Indonesia, and Vietnam have implemented the **Productive Participatory Restoration (PPR)** approach aligned with the landscape approach. PPR is a holistic approach co-developed with local communities to restore degraded soils and impoverished forests while strengthening cultural ties, social cohesion, and sustainable livelihoods. Rooted in local knowledge and enriched by scientific and technical expertise, PPR fosters intercultural dialogue to promote environmental stewardship and unlock the economic potential of forest-based economies. By prioritizing community-led governance and integrating diverse native species, PPR enhances ecosystem resilience, reinforces local environmental knowledge, and ensures the long-term sustainability of restoration efforts.

We have consolidated comprehensive evidence on the impacts of PPR, as well as identifying barriers to broader adoption, replication and scale-up. Through case studies and field data, we will present key lessons learned, focusing on the effectiveness of PPR in restoring biodiversity and ecosystem services, the role of restoration in enhancing local livelihood and reducing the dependency on extractive activities, and the key barriers to implementation and scaling up PPR in diverse socio-ecological contexts.

This presentation will showcase how **PPR** enhances the long-term effectiveness of restoration efforts. PPR moves beyond conventional area-based metrics to emphasize the quality and sustainability of restoration outcomes. We will highlight key success factors, challenges, and pathways for scaling up high-quality, community-driven restoration efforts that ensure lasting environmental and social benefits.

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Biological Soil Crust as a Nature-Based Solution for Radionuclide Immobilization and Reclamation of Abandoned Uranium Mines on the Navajo Nation.

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Abstract

Abandoned uranium mines (AMU) on the Navajo Nation present an ongoing environmental and public health hazard due to persistent heavy metal contamination such as uranium and arsenic. Conventional remediation methods can be expensive and ecologically disruptive demonstrating the need for alternative solutions. Biological soil crusts (biocrusts) produce extracellular polymeric substances (EPS) that immobilize metals through cell surface adsorption, binding interactions, and biomineralization posing a possible remediation technique. This study explores the potential of biocrusts to remediate heavy metal-contaminated soils in a secure greenhouse environment. Soil with three distinct uranium and arsenic concentrations was collected from an AUM in Cameron, AZ. We conducted a full factorial experiment with biocrust inoculation, crossed with soil origin, and high or low watering treatment (72 units, n=6). Surface and subsurface extraction will be completed and analyzed through EPS quantification analysis, and ICP-MS/MS for metal concentration. Though still a work in progress, anticipated results include metal immobilization and trapped effect caused by the EPS. Higher uranium concentrations may lead to a decreased sequestration rate due to higher contaminant toxicity. Higher water treatment may enhance biocrust growth but decrease EPS binding metal ability due to the higher movement of soluble metals. Increased soil stability and reduction in water and wind erosion can contribute to the decrease of metal mobilization in soil and increase ecosystem restoration. Ongoing observations of the plots will be completed with further analysis to ultimately assess biocrust effectiveness as a nature-based solution for metal reclamation.

760

The Ecologist in the War Room: The Fight to bring Regeneration to the Engineering Table

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Abstract

With the rise of sustainability, biomimicry, and regenerative design, the role of the ecologist is evolving. No longer confined to taxonomy and field research, biological experts are becoming key contributors to engineering teams striving to build for the future. Yet, this integration presents a delicate balancing act—leveraging nature’s genius without allowing the engineering space to become another vehicle for ecological exploitation. Navigating an industry often driven by the pursuit of economic growth, ecologists embedded in engineering fields—systems, materials, architecture, and robotics—encounter unique challenges. Regeneration has historically not been a default goal in these sectors, requiring ecologists to bridge disciplinary gaps, challenge entrenched paradigms, and advocate for nature-centric design. Scientific frameworks such as systems ecology, ecological resilience theory, and circular economy principles provide a foundation for integrating regenerative approaches. However, applying these concepts in engineering contexts asks the ecologists to be more than a scientist, but a translator, liaison, and constant advocate for the ecological world. This study explores the experiences of ecologists working within engineering, drawing from interviews with professionals at the forefront of this transition. It uncovers the barriers they face, the strategies they employ, and the tensions between success and compromise. Through their insights, this research offers practical approaches for influencing regenerative initiatives beyond conservation-focused spaces. Ultimately, it asks: *Can ecosystems be regenerated from within traditionally extractive industries?*

761

Restoration targets, trajectories, and shrub establishment in the sagebrush steppe of Grand Teton National Park

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Abstract

The sagebrush steppe ecosystem extends over millions of hectares of land in the western United States, but its geographic extent has declined by 45%. Grand Teton National Park (GRTE) is actively restoring sagebrush steppe ecosystems across 4,500 acres of degraded smooth brome (*Bromus inermis*) hayfields. We used intact sagebrush steppe communities as restoration targets. Here we summarize restoration trajectories over 11 years and report on the results of a field experiment that tested the effects of tilling and seed mix design on native shrub establishment. Some old restoration sites contained native shrubs and forbs and were moving toward reference conditions, but another type was dominated by native grasses. Native grasses established well yet native grass cover overshot the reference targets. Restored communities were dominated by conservative and drought tolerant species with high leaf dry matter content and low turgor loss point. In the field experiment, we detected a trade-off in shrub establishment rates across different restoration methods, where *Artemisia tridentata* established best in no-till plots using drill seeding, while *Purshia tridentata* established best in tilled plots with broadcast seeding. This management trade-off precludes a one-size fits all approach to restoration, but offers opportunities to increase *Purshia* establishment in targeted sites. Full recovery may require several decades, but practitioners may be able to hasten success and increase control over outcomes via "precision restoration" techniques that target ideal establishment conditions, use different seed mixes, or use different tilling treatments to target specific species responses.

762

Parks, Pollinators, People, and Perceptions: A science driven exploration into the relationship between public space, pollinator habitat, and the perceptions of humans that visit them.

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Abstract

Pollinator decline is a global phenomenon that is the result of many factors, with habitat loss being one of the most impactful. Urban sprawl generally results in a loss of habitat for pollinating species, but this does not always need to be the case. Good urban planning and management can help to expand pollinator habitat so that urban spaces can become biodiverse epicenters for pollinator species. Implementation of ecologically centric management can run into challenges as it relates to the selection of proper plants and the perception of the public of these spaces. As a public agency, departments like Denver Parks and Recreation, Federal agencies, and State, Provincial, City and Municipal are highly receptive to public feedback and must strike a balance between sound ecological management and public need/will, as they are not always in alignment.

To help identify the best confluence of ecology and public will Denver Parks and Recreation, Denver Colorado, USA partnered with Colorado State University to study the species richness of bees in park spaces, what flowering species supported the most pollinators and then how the public responded to the landscapes that supported pollinators. Preliminary data found that park spaces supported 15% of the total bee species within the state of Colorado. Overall, public perceptions of pollinator habitat were split with a slight majority favoring 'traditional' park spaces that supported less biodiversity and less pollinators that a more native landscape type.

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Restoration of gully erosion-degraded farm-forest landscapes in Anambra State, Nigeria by integrating Nature-based Solutions with the implementation of alternative livelihoods

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Abstract

Gully erosion is the major ecological problem endangering the lives of the people of Anambra State, Nigeria, leading to the degradation of farm-forest landscapes, loss of arable land, and the destruction of vital ecosystems. This study evaluates the success of the restoration of gully erosion-degraded landscapes through the integration of Nature-based Solutions (NbS) alongside the implementation of alternative livelihood strategies. The NbS such as gully sites reclamation, reforestation, agroforestry, and soil conservation techniques were employed to restore soil stability and enhance vegetation cover, thereby mitigating further erosion and land degradation in selected communities. Complementary to these ecological interventions, the promotion of alternative livelihoods—including fish farming, piggyery, and palm oil-processing —provided local communities with alternative income sources, reducing their dependence on harmful land-use practices. This study evaluates the success of this dual strategy in meeting the goals of the project. The goals of this integrated approach include to foster ecological restoration while creating socio-economic opportunities, enhancing resilience to climate change, and improving the well-being of affected populations. Data from field studies, community feedback, and environmental monitoring highlight the effectiveness of NbS in restoring degraded landscapes and the positive impact of livelihood diversification on community engagement and sustainability. The findings suggest that combining ecological restoration with economic empowerment offers a holistic solution to the long-term recovery of gully erosion-devastated areas in Anambra State, providing a scalable model for other regions facing similar challenges in Nigeria and beyond.

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Mentoring local capacity at global scales to bolster standards-based ecological restoration initiatives

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Abstract

Knowledge to support the practice of ecological restoration remains unevenly distributed worldwide, creating challenges for widespread implementation. Local capacity is needed to address a wide range of ecosystem types and conditions, making the representative distribution of expertise imperative. SER has made significant steps in bridging the gap between knowledge and practice through the publication of SER standards. However, barriers remain, including limited localized dissemination of standards-based restoration practices and scarcity of local experts in many regions. To tackle these challenges, SER, in collaboration with partners such as Microsoft, the Union for Ethical BioTrade (UEBT), and The Global Biodiversity Standard (TGBS), has initiated programs to promote standards-based restoration, including practices and certification intended to improve restoration outcomes. To effectively support this, a mentoring program has been developed by SER and Botanic Gardens Conservation International (BGCI) as part of TGBS. Through restoration mentoring, this program engages a diverse range of stakeholders and other restoration experts to build capacity in planning, implementation, and adaptive management. This program connects technical experts with local practitioners to build capacity in restoration planning, implementation, and adaptive management. By fostering the mentoring program, it facilitates tailored knowledge transfer, enhances restoration quality, creates employment opportunities, and extends knowledge-sharing to local communities, governments, policymakers, funders, and global agencies. Additionally, it provides pathways for local practitioners to become certified through SER's Certified Ecological Restoration Practitioner (CERP/CERPIT) program. This mentorship is transformative by advancing local capacity to deliver standards-based ecological restoration at a global scale.

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Seed treatments and focalized soil sourcing to improve the establishment of winterfat (*Krascheninnikovia lanata*) in semi-arid degraded pastures

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Abstract

Increased drought occurrences and severity are expected to worsen for parts of the Great Northern Plains, specifically the Canadian prairies. Restoring the productivity of marginal lands and degraded pastures should consider drought-tolerant native perennial species such as winterfat (*Krascheninnikovia lanata*). Winterfat has long attracted interest from cattle and bison producers, but seeding it in wildlands or pastures presents logistical challenges due to the seed's physiology, which restricts its compatibility with standard farm machinery. Collaboration between Utah and Saskatchewan researchers aims to optimize seed treatments and identify the role that beneficial rhizosphere microbes can play in improving the establishment of winterfat. Initial studies on the establishment of winterfat in semi-arid pastures have shown seeding with other native forage species can bolster survival rates. We also found that winterfat conditions the soil around itself in a potentially beneficial way to favor seedling survival. The rhizosphere of winterfat roots has a relatively high soil pH and greater soil microbial biomass compared to common native grasses growing in the same swards. Our results on the impact of whole soil community inoculum point to a positive plant-soil feedback mechanism potentially characteristic of winterfat. We are currently setting up field trials to determine the impact of growing Indian ricegrass (*Achnatherum hymenoides*) and purple prairie-clover (*Dalea purpurea*) along with winterfat. As such, investigating the role of beneficial soil microbes (*Rhizobium* and mycorrhizal fungi), while reducing soil-borne pathogens in winterfat's rhizosphere will be explored. Some of our initial results and trials will be presented and discussed.

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"Using Urban Food Waste to Fight Droughts and Climate Change - Activities and Challenges in Choma, Zambia"

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Abstract

In 2024, Zambia experienced one of the worst droughts in its recent history. Even the famous Victoria Fall reduced its water flow to merely one tenth of its norm. The local communities are in desperate need for countermeasures. In our project called Organic Circulation Project, we are focusing on urban food waste as a tool to help build resilience among local communities.

According to UN, by 2030, over 60% of the World population will be living in urban setting. Without proper management for the accumulating food wastes, it's a quick formula for a local public health issue, and a global climate issue as more Greenhouse gas are released. On the other hand, farmlands are ever in need of organic fertilizer. When crops are shipped to the cities, so are the soil nutrients never to be replaced. Soil scientists now know that applying chemical fertilizer will not reverse the damage but lead to a further degradation in the long term.

Can we not tackle these two problems as one?

Our project aims to do just that. We are designing and implementing a system which feeds urban food waste to the pigs and insects to produce organic fertilizer. Ultimately our goal is to build a waste system to support regenerative agriculture in Zambia. We are in partners with University of Zambia, Zambia Agriculture Research Institute, Choma Municipal Council, youth groups and a local agricultural school. In our presentation, we will show some insights to our activities and also the challenges.

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First Nations led collaboration to assess the response of fish communities to habitat restoration in three estuaries on Vancouver Island

Elmar Plate

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Abstract

On the west coast of Vancouver Island, Canada, in the Treaty Settlement Lands of the Huu-ay-aht, Kyuquot-Cheklesah and Toquaht First Nations, causeways were breached and new channels were constructed in three estuaries of salmon bearing rivers between 2018 and 2021. These restoration measures were carried out in collaboration with the three First Nations, informed by their traditional ecological knowledge and carried out by First Nations based fisheries biologists and technicians. Following the successful field work, re-connected or restored estuary habitats were immediately colonized by juvenile salmon in all three estuaries and led to the re-activation of other ecologically beneficial processes such as increases in eel grass cover and the establishment of intermediate salinity values. The intermediate and tidally changing salinity values of estuaries create a unique ecosystem that represents a crucial habitat to ensure the growth, health and survival of juvenile salmon during the physiologically challenging phase of freshwater to saltwater migration. Through the collaboration of three First Nations and a consulting company > 1.4 km² of Chinook and Chum Salmon habitat was created and immediately used. These measures were part of a larger decade long watershed restoration initiative driven by First Nations using a holistic restoration approach addressing all aspects of watershed health such as, upslope stability, road deactivation, logging practices, riparian vegetation planting, enumeration of incoming and outgoing salmon populations, salmon enhancement as well as fish habitat assessments in freshwater, estuaries and the marine foreshore. Also innovative, logging stumpage fees were used to provide ongoing funding for restoration measures.

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Bringing the Science and Practice of River Restoration into Alignment to Improve Restoration Outcomes

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Abstract

We are in a watershed moment in the river restoration community. The science and the practice of river restoration are aligning at last and present an opportunity to improve restoration outcomes.

The history of river restoration practice has reflected a persistent disconnect between what the research community has been illuminating and what the community of practitioners and resource agencies have been practicing. The research community has at times offered standards and principles; the industry of practice has at times drawn from revelations from the research community. More commonly, trends of practice have been based largely on popular and formulaic design approaches without regard to the science and often with limited benefit to the river. The advent of “process-based restoration” in the early 2000s provided a promising framework but has had imperfect application to the practice.

Current trends in science and practice are again emphasizing process but now with more effective communications from the research community and a new generation of practitioners benefitting from advancements in interdisciplinary science. Among practitioners and resource organizations, rivers are increasingly understood as systems and restoration goals increasingly strive for dynamic and messy rather than stability.

In this time of emerging alignment between science and practice, how are we as a restoration community going to rise up to meet the opportunity? Will we be able to see the blind spots and redirect? Will we be able to foster the collaboration between science and practice critical to improving restoration outcomes?

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Soil surface modifications can improve drylands restoration following energy development

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Abstract

The Colorado Plateau, a high elevation dryland in the southwestern US, has a long history of energy and mineral exploration and development. After extraction is complete reclamation practitioners are charged with restoring desirable plant communities and preventing excessive erosion, yet they face challenges including the unfavorable conditions of arid landscapes and extreme impacts from development. We aimed to identify novel reclamation methods that could address these challenges, testing different seed mixes, surface modifications, and soil amendments. Eight study sites with a common small-scale study design were established from 2018-2023 on abandoned oil or gas well pads. Treatments were comprised of combinations of seed mixes with surface modifications, including soil pits, cedar mulch, connectivity modifiers, fertilizer, local mycorrhizae, and over 30 additional site-specific methods of interest to reclamation practitioners. We monitored plant community and soil surface cover for two years after establishment in 2x2 m plots. Large variation in climate between sites and reclamation years resulted in inconsistent results. Precipitation had dramatic effects on establishment of seeded species, with very dry seasons resulting in lower seeded species cover and density across all treatments. Soil pits and cedar mulch generally improved seeded and native species establishment. Other methods increased total plant establishment and lowered bare soil exposure, though this was primarily through increased cover of invasive species. Overall, this study provides guidance to restoration practitioners and demonstrates several novel restoration methods that show promise in establishing desirable plant communities and decreasing potential soil erosion under a variety of climatic conditions.

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Evaluating the potential of the soil seed bank as a nature-based restoration tool across a gradient of annual grass invasion

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Abstract

Anthropogenic disturbances are increasing plant species invasions in drylands globally, often resulting in habitat degradation and reductions in native plant diversity. Invasive species removal followed by revegetation using seeds or transplants is a common restoration tool, yet this practice is typically expensive, difficult to implement across large spatial extents, and often unsuccessful. Could the soil seed bank be used as a nature-based solution in dryland restoration? We assessed the effects of increasing aboveground cover of an invasive grass (*Bromus tectorum*) on the seed bank and its restoration potential. We established 40 plots with a range of *B. tectorum* cover (2-58%) in degraded shrublands in the Sawtooth National Forest, Idaho, U.S.A. We measured aboveground species cover and collected soil cores for a greenhouse emergence study to evaluate seed bank species composition.

Bromus tectorum was abundant in the seed bank and highly correlated with aboveground *B. tectorum* cover. However, density of important native species in the seed bank was not correlated with their aboveground cover, and they emerged across the full range of invasive grass cover, suggesting that it will be challenging to use aboveground species cover as the sole indicator of native species viability in the seed bank. Nonetheless, several perennial species commonly used in restoration (e.g., *Poa secunda*, *Artemisia tridentata*) emerged in over 20% of the plots, indicating that these species are capable of natural regeneration following invasive grass removal, and that the seed bank could therefore be an economically practical strategy for aiding restoration of some drylands.

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Establishing a Model for the Ecological Restoration of Tropical Forest in Hong Kong

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Abstract

Despite the importance of subtropical Asia's evergreen forests for species conservation and ecosystem services, the ecoregion has suffered extensive degradation. To address this trend, there is urgent need to upscale forest restoration through the establishment of evidence-based frameworks that emphasise species diversity and the need for long-term monitoring, whilst offering practical means of overcoming arrested succession and associated barriers to seed dispersal, natural recruitment and soil rehabilitation. We review the experience of Hong Kong in generating applied understanding of landscape history, identification of reference sites, nursery management, silvicultural approaches and working with a diverse and threatened flora to piece together a model that can be upscaled for effective landscape restoration.

Since 2013, KFBG's forest restoration programme has synthesised science, horticulture and learning-by-doing to select, plant and nurture thousands of native tree seedlings towards the restoration of >30 hectares of forest. This programme supports the cultivation and reintroduction of >300 native tree species, as well as shrubs, lianas, epiphytes and understorey herbs, many of them endangered in the wild. Seeds are locally collected and accessioned with provenance records, allowing analyses of species performance and the impact of genetic diversity, as well as other biotic and abiotic factors, on community recovery. Adaptive management has led to practical advances, including the use of tree guards to protect young seedlings and selective thinning to control over-dominant species. Long-term after-care has proved essential. The knowledge gained is being used to formulate an implementation plan for expanding onto degraded hillsides outside KFBG.

790

Lessons Learned and Common Pitfalls in Auditing Ecosystem Restoration Projects

Mateo Cariño Fraisse

Preferred by Nature, Madrid, Spain

Abstract

Preferred by Nature, an NGO with over 30 years of experience auditing land-use projects such as forestry and agriculture, launched its Ecosystem Restoration Standard in 2019 (latest version: <https://www.preferredbynature.org/library/document/preferred-nature-ecosystem-restoration-standard-v31>). Developed with input from SER and key organizations including WWF, IUCN, FAO, HCVRN, WRI, FSC, Climate Focus, and ITTO, the standard provides a framework for comprehensive project evaluation, continuous improvement, and independent verification. Initial field tests were funded by TNC.

Over the last six years, we have assessed restoration projects across Africa, the Americas, Asia, and Europe, spanning diverse ecosystems such as forests, mangroves, rangelands, agricultural lands, peatlands, and wetlands. These field evaluations aim to help projects demonstrate their impacts, secure funding, and improve practices. Our ground-based findings reveal crucial lessons, many of which are shared through publicly available project summaries (<https://cs.preferredbynature.org/s/>). While some findings remain unpublished as projects work to meet minimum requirements, all contribute valuable practical knowledge for advancing restoration science and policy in real-world contexts.

This presentation will highlight key insights from these assessments, including the importance of traditionally overlooked areas, such as addressing social issues, which are critical to project success.

This connects with the subtheme: Implementation, effectiveness, and effects monitoring

801

Relevance of Stakeholder in Implementing Restoration Activities: A case Comparison between Costa Rica and Ethiopia Restoration Projects.

Hernán Zaldívar

Preferred by Nature, Lima, Lima, Peru

Abstract

Preferred by Nature, an NGO with over 30 years of experience auditing land-use projects such as forestry and agriculture, launched its Ecosystem Restoration Standard in 2019 (latest version: <https://www.preferredbynature.org/library/document/preferred-nature-ecosystem-restoration-standard-v31>). Developed with input from SER and key organisations including WWF, IUCN, FAO, HCVRN, WRI, FSC, Climate Focus, and ITTO, the standard provides a framework for comprehensive project evaluation, continuous improvement, and independent verification.

Our ground-based findings reveal crucial lessons in the social arena, which is often disregarded, or at least not looked at in its whole dimension, weighing as much as the environmental side, sometimes due to a lack of understanding, knowledge, or references from other ecosystem restoration projects. This presentation will compare the successful approaches to stakeholder engagement used by two different forest restoration projects. Stakeholder engagement is a crucial step in creating viable restoration initiatives. Although the projects focus on two distinct fragile and degraded ecosystems —a tropical rainforest and a montane dry forest—this comparison will highlight how stakeholders' engagement strategies can enhance project outcomes such as the delivery of provision ecosystem services -such as water, firewood or cattle food- and supporting services as Biodiversity enhance, all this in the challenging context of external pressures like the production of commodities or massive arms conflicts, where success was due precisely to that engagement despite conditions.

802

From Wasteland to Wildflowers: Collaborative Habitat Restoration in the Tri-State Mining District, USA

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Abstract

The historic Tri-State Mining District located in Missouri, Kansas and Oklahoma, USA, was one of the largest lead and zinc mining districts in the world in the late 1800s and early 1900s. Efforts to remediate widespread contamination left behind thousands of acres of denuded soils and residual metals across the landscape. Since 2014, a partnership of federal, state, and municipal agencies, aided by local volunteers, has restored approximately 1000 acres of prairie, woodland and wetlands. Known as the Cardinal Valley Habitat Restoration Project, this is a collaborative effort to reconstruct and restore native habitat on former mine lands owned and managed by the City of Webb City, Missouri. Placing the community itself at the forefront of project implementation has been a key to its success. However, as a small municipality with minimal staff and a limited budget, Webb City relies on assistance from its partner agencies, university students, and volunteers to help conduct restoration monitoring. These efforts have documented increases in vegetation density, native plant richness, and migratory bird species in the restored lands. Ongoing studies by multiple government agencies, university students, and citizen scientists seek to quantify changes in soil health and microbial communities, metal bioavailability, and wildlife populations. Results of these studies will be used to inform adaptive management of this project, as well as mine land remediation and restoration best practices throughout the larger mining district and may have application to mine lands throughout the world.

806

How corporate nature reporting are driving delivery of key GBF ambitions

Ida Elizabeth Bailey

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Abstract

We are experiencing increasing demand from clients for support with corporate nature reporting (e.g. TNFD and CSRD) as well as associated services such as target-setting for biodiversity and nature/ biodiversity baselining and monitoring.

This trend has been amplified and driven by the historic agreement reached in December 2022 at COP15, particularly via the Global Biodiversity Framework in relation to:

Greater emphasis on natural capital and biodiversity enhancement in development projects and national strategies (Target 1);

Business operations and supply chains in response to Target 15 (e.g. the Taskforce on Nature-related Financial Disclosures; and

Development of the biodiversity off-setting markets and biodiversity/ nature credits markets.

This has implications both for the types of nature related projects that we undertake and the requirements for measurement and monitoring of biodiversity in line with various standards and guidance.

This increase in demand, at a time when associated nature/biodiversity reporting and monitoring requirements, standards and guidance are in flux, presents multiple challenges and opportunities. A holistic approach including consideration of other aspects of natural capital will be key to achieving robust outcomes for the environment and society.

I will discuss the challenges and opportunities for nature restoration associates with corporate nature reporting including prioritising sites, understanding supply chains and quantifying nature to achieve material impact at different scales.

812

Upscaling restoration and conservation efforts in Central-European oak forests: insights from the LIFE 4 Oak Forests project

Réka Aszalós¹, Pál Bódis², János Bölöni¹, József Fidlóczky³, Tamás Frank¹, Mariann Komlós¹, Péter Koncz¹, Serena Petroncini⁴, Katalin Veres¹

¹HUN-REN Centre for Ecological Research, Vácrátót, Pest, Hungary. ²WWF Hungary, Budapest, Pest, Hungary. ³FENCON Consulting Ltd, Budapest, Pest, Hungary. ⁴Ente di gestione per i Parchi e la Biodiversità Romagna, Riolo Terme, Emilia Romagna, Italy

Abstract

In Central Europe, deciduous oak woodlands represent vital forest habitats. However, their structure and composition have been significantly homogenized over recent centuries. As part of the ongoing LIFE 4 Oak Forests project, we initiated the restoration of five formerly managed and now abandoned oak forest habitats in 2017. This effort aims to enhance structural and compositional complexity of the selected forest stands and increase biodiversity. Active management is being implemented across 24 pilot sites located in protected areas of Hungary and Italy, covering approximately 2,000 hectares of *Quercus*-dominated stands.

The management actions include girdling and felling trees to create deadwood and canopy gaps. Microhabitats are enhanced through bark shelters, bird nest boxes, wetland restoration, and native shrub hedges. The effect of these actions on stands and biodiversity are monitored in a Before-After-Control-Impact design.

The LIFE project's conservation-oriented management is the region's first comprehensive oak habitat restoration. Our key upscaling activities are being implemented across educational, communication, and policy levels. We are developing a forest management guideline for Central-European oak forests with expert input, which will serve as a management tool for forests managed by national park authorities in Hungary, supporting close-to-nature forestry actions in integrated forest management. Based on the guideline, several field demonstrations were held in both countries, engaging hundreds of forest practitioners, scientists, and conservationists. In Italy, seminars and excursions were organized in the intervention areas, along with workshops for various MSc courses at the University of Bologna and Florence.

814

Using common garden arrays to model trait-climate associations for restoration forb species in the Great Basin, USA

Francis Kilkenny¹, Robert Heckman², Sarah Barga², Jeffrey Ott¹, Kimberly Rizkowsky¹, Jessica Irwin³, Nyika Campbell⁴, Tessa Bartz⁴, Elizabeth Leger⁵, Andrew Kulmatiski⁶, Owen Baughman⁷, Bryce Richardson⁸

¹USDA Forest Service, Rocky Mountain Research Station, Boise, ID, USA. ²USDA Forest Service, Rocky Mountain Research Station, Cedar City, UT, USA. ³USDA Forest Service, Boise National Forest, Boise, ID, USA. ⁴. ⁵University of Nevada, Reno, Reno, NV, USA.

⁶Utah State University, Logan, UT, USA. ⁷The Nature Conservancy, Burns, OR, USA.

⁸USDA Forest Service, Rocky Mountain Research Station, Moscow, ID, USA

Abstract

The Great Basin is a ~540,000 km² region in the western United States that is topographically and climatically heterogeneous, with cold desert as the most common habitat. It is under increasing threat from annual grass invasions, wildfire, climate change and other anthropogenic disturbances. Federal and state agencies spend tens of millions of dollars each year on seed purchases for post-fire restoration and rehabilitation projects in the Great Basin. However, the availability of locally and climatically adapted native seeds and other plant materials remains limited, especially for forb species. Here, we describe a project to test trait-climate associations and develop seed transfer zones in a set of high priority native forb species using a common garden array, where garden sites are located across a range of representative geographies and environments. As of fall 2024, data collections for four taxa have been completed (*Machaeranthera canescens*, *Chaenactis douglasii*, *Erigeron pumilus*, *Phacelia hastata*), with three other taxa in progress (*Balsamorhiza sagittata*, *Crepis acuminata*, *Sphaeralcea spp.*). We will present seed transfer zone models for the four species with complete data sets, as well as discuss the role that common garden arrays can play in defining best practices for restoration seed sourcing.

817

Adjusting to a constantly changing landscape: Adaptive design as a restoration strategy for fish bearing tributaries to the Klamath River

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¹Stantec. ²RES. ³Stantec, USA

Abstract

On January 26, 2024, a loud blast echoed down the Klamath River; following a century of damming, dismantling of J.C. Boyle Dam, one of four dams slated for demolition, began, kicking off active construction of the largest dam removal project in the world. As reservoirs behind the dams drained, they exposed previously submerged floodplains and once again free-flowing waterways. Work to restore the reemerging tributaries had begun.

This project presents unique challenges from unknown existing conditions of tributaries that are constantly changing in response to long dormant fluvial processes. Accommodating (and accelerating) these processes requires the design team to perpetually adapt in real-time. We are working with the Yurok Tribe and other project partners to restore these previously submerged tributaries to improve the habitat and health of fisheries to allow salmon, steelhead, and lamprey access to historic upstream spawning habitat. We will discuss how design for the post-dam removal tributaries adapted over time to reflect knowledge of boundary conditions and ongoing channel responses to free-flowing water. We will talk about uncertainty of pre-reservoir channel alignments and profiles and the concomitant assumptions associated with design. We will then provide an overview of the channel response to assisted sediment evacuation and strategies to accelerate geomorphic processes during the first year following dam removal. Lastly, we will present the current state of the restoration design for the fish bearing tributaries along with expectations as we anticipate construction of the tributaries commencing in the summer of 2025.

819

Adapting the SER Restoration Wheel to align projects in blue carbon ecosystems with the High-Quality Blue Carbon Principles and Mangrove Breakthrough Guiding Principles.

Mark Beeston

Conservation International, Arlington, Virginia, USA

Abstract

Lessons learned and invitation for member feedback on a new application of the SER Recovery Wheel: dual use as both a project management and reporting tool, and also in support of due diligence processes, project financing, or the trading of blue carbon credits.

We incorporated several hundred performance indicators aligned with best practice in restoration, inclusivity, impact measurement and finance into a multiple choice matrix to support standardized scoring on the recovery wheel, and mapped each section of the wheel to accompanying written guidance, case studies and best available resources for conservation practitioners in a full length manual.

The visual output of the wheel and ease of understanding by non-experts, including philanthropic and corporate financiers interested in supporting projects in blue carbon ecosystems, has generated further interest in versions which can be applied to other nature-based solutions.

The **High-Quality Blue Carbon (HQBC) Principles and Guidance**, released in 2022, provide a comprehensive framework to ensure that projects in blue carbon ecosystems (currently defined as mangroves, seagrass and saltmarshes) are designed and managed in a credible, equitable, and environmentally sustainable way. To support the practical application of these principles Conservation International, ORRAA and partners developed the **High-Quality Blue Carbon Practitioners Guide**, released for testing in 2024-25, adapting the **Society for Ecological Restoration (SER) Recovery Wheel**, a self-assessment tool for project managers, for tracking project alignment against the HQBC Principles and Mangrove Breakthrough Guiding Principles.

824

Putting numbers to nature: quantifying biodiversity value and return on investment in urban settings with biodiversity metrics

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¹Ramboll, Binghamton, NY, USA. ²Ramboll, Denver, CO, USA

Abstract

Urban habitats offer unique opportunities for biodiversity restoration, conservation, and enhancement. However, measuring and comparing biodiversity outcomes remains a challenge. To meet this challenge, Ramboll developed the America's Biodiversity Metric 1.0 (ABM1.0), a habitat-based biodiversity quantification tool adapted from the extensively tested and regulator-supported Natural England Biodiversity Metric used to deliver the biodiversity net gain policy in the UK.

The ABM1.0 strikes a balance between complexity, simplicity, and practicality, creating a robust tool that quantifies biodiversity value through the product of habitat area, condition, conservation priority, and local significance, expressed as Biodiversity Units (BUs). Designed to operate within the mitigation hierarchy, ABM1.0 supports decision-making, and land use planning at local scales, and is applicable to both rural and urban settings, the latter of which are often overlooked.

To effectively address the biodiversity crisis, urban systems must be part of the equation. City greenspaces and brownfields present significant opportunities for conserving, restoring, or enhancing biodiversity. The value of greenspaces in urban areas extends beyond biodiversity restoration; they have the potential to provide essential ecosystem services and improve the quality of life for communities.

Tools like the ABM1.0 can assist municipalities in strategically managing their natural resources and landscapes. When paired with tools that estimate the monetary benefits associated with biodiversity enhancements based on the potential ecosystem services provided, we can begin to understand the return on investment. Here, we present two case studies that leveraged the ABM1.0 and Ramboll's ROI tool to highlight the value of biodiversity in urban settings.

827

Riparian Restoration: Lessons Learned from the North Platte River in Casper, Wyoming, USA

Randy Walsh

Tetra Tech Inc., Lander, Wyoming, USA

Abstract

High-functioning, well-vegetated riparian zones protect riverbanks from erosion, provide floodplain stability, create shading and thermal refugia, enhance riverine aesthetics, and create diverse habitat for a host of lifeforms, among other benefits. The creation of healthy and vibrant riparian vegetation is thus a fundamental component of river restoration projects. The City of Casper, Wyoming has been actively completing channel and riparian restoration projects on the North Platte River for the past decade, and the re-establishment of native vegetation is one of several key objectives driving this work. While the river restoration projects implemented to-date have met many success metrics, some goals have not been fully achieved. Specifically, the restoration of native, functional, self-sustaining riparian vegetation communities has fallen short of expectations. Given the functional and aesthetic needs for robust riparian vegetation along the North Platte River, the City of Casper sought to quantify the performance of vegetation in the completed reaches, and to identify factors potentially causing suboptimal results. This paper presents the findings of the quantitative riparian vegetation assessment conducted for three (3) restored reaches of the North Platte River, discusses the expected (and unexpected) results of the assessments, and identifies best practices for vegetation design and implementation that may improve the establishment and performance of riparian vegetation on future projects.

828

Kankakee Sands Mosaic – Climate Resilience and Community Connections

Trevor Edmonson, Melissa Moran

The Nature Conservancy, Indiana, USA

Abstract

East of the Mississippi, it is rare to find a large-scale restoration complex that was designed for climate resiliency, adjacent natural area connectivity and community engagement. The Efroymsen Prairie Restoration at Kankakee Sands is such a place. Situated in northwest Indiana in the easternmost reach of the tallgrass prairie ecoregion, this 8,400-acre prairie, wetland and savanna project was undertaken by The Nature Conservancy in 1996. The then barren farm fields and degraded savannas were tended and planted and today are home to over 600 native plant species, 250 bird species, and a conservation bison herd. The Efroymsen Prairie Restoration is a vital anchor point and connector for a much larger 30,000-acre macrosite that crosses state boundaries. The project continues to evolve today as we look for innovative ways to collaborate on species reintroductions, community engagement and public access. Twenty-five years after the restoration began, The Nature Conservancy undertook the largest visitor infrastructure improvements project in its history to enhance community participation and conservation engagement that has now captured the attention of local economic development. We will share our lessons learned over the years and how we think these ideas are not only scalable but critical for restoration practices and planning into the future.

829

Working the ecological restoration with local communities to amplify knowledges and solutions, a study case in Rio de Janeiro, Brazil.Bruna Debastiani, Luiz Gomes, Geraldo Rios

OceanPact Serviços Marítimos S.A., Rio de Janeiro, Rio de Janeiro, Brazil

Abstract

Mangroves are vital ecosystems that support biodiversity, human wellbeing, and climate change mitigation. Despite this, large areas have been degraded by human activities. Many initiatives are trying to restore mangrove areas, but large-scale projects remain underexplored due to methodological uncertainties and a lack of connection between local communities and fundings. OceanPact acting as a connection between both, is helping to close this gap alongside local NGOs. In Guanabara Bay (Rio de Janeiro State), we have restored mangrove areas and are working to identify the best methods for measuring restoration outcomes by testing technologies as LiDAR, soil quality sensors and eDNA, in areas restored in 2013, 2017, and 2021, alongside the local fishing community. Additionally, in a nearby 14 hectares belonging to a quilombo, different restoration techniques are being tested to optimize the processes while reducing the costs of restoration. This includes for example semi-automated approaches using drones and robots and the use of probiotics. Within these projects, the local community is bringing valuable traditional knowledge and receiving resources and technical training to act with us. Furthermore, we are going to launch a native bee meliponiculture project with the local community to boost their incomes and ecological awareness. So far, results include 12 hectares of restored mangroves, a forest inventory of restored areas (2013, 2017, and 2021) with their mangrove forest growth model, as well the development of new equipment that seek to optimize the restoration process while exchanging knowledge and promoting a regenerative blue economy together with traditional communities.

833

The Challenges of Largescale Invasive Running Bamboo Management in an Urban Context

John Burke, Patricia Greenberg

Fairfax County Park Authority, Fairfax County, Virginia, USA

Abstract

In 2023, Fairfax County, a county in the Commonwealth of Virginia with a population of 1.1 million residents and the most populous county in Virginia, enacted an ordinance mandating landowners to control the spread of running bamboo across property lines. The ordinance presents a challenge and opportunity for Fairfax County Park Authority (FCPA), the largest landowner in Fairfax County, to prevent the spread of running bamboo from parkland to private property. With over 250 acres of bamboo mapped on FCPA property, project site selection and prioritization became imperative. We will discuss FCPA's prioritization protocol for bamboo project site selection which accounts for ecological, social, and administrative elements of bamboo management as well as the challenges of managing bamboo on a countywide scale. We will also discuss case studies of FCPA's bamboo management to date including efficacy of restoration techniques and experiences with stakeholder and landowner engagement.

835

Monitoring for high-quality restoration: Lessons learned from localized restoration

Tamara Coger

World Resources Institute, Washington, DC, USA

Abstract

This presentation will share practical learnings from the development and implementation of a monitoring, reporting and verification (MRV) framework for small- and medium-scale tree-based restoration projects in Africa. It will provide learnings and insights from restoration projects related to delivery of high-quality restoration, covering social, environmental, climate, and operational dimensions. It will also discuss how this framework can be adapted and replicated in other contexts.

World Resources Institute and partners developed this MRV framework in the context of the Restore Local program, which aims to scale high-quality, localized restoration in target landscapes in Africa through innovative financing mechanisms, supportive policies, capacity strengthening and knowledge sharing, and practical, comprehensive monitoring. The framework integrated user feedback and aimed to be accessible to small- and medium-scale projects and inclusive of biophysical, social, and institutional indicators of progress.

Utilizing this MRV framework, 200+ restoration projects are providing data and insights about their work, the challenges they face and the benefits they are seeing. Analysis of quantitative and qualitative data from these projects provides a range of lessons learned that can refine our understanding of high-quality restoration and opportunities and barriers to delivering high-quality restoration.

The process of developing the framework also provided a range of learnings on improving data collection methods, defining terminology, and monitoring hard-to-measure outcomes related to community engagement and social equity.

836

Scaling Impact and Resilience Through Collaboration: How the 2-3-2 Partnership Advances Landscape Restoration Across Boundaries

Lily Bruce¹, Cody Dems²

¹Forest Stewards Guild, Santa Fe, NM, USA. ²

Abstract

Collaboration is our tool; restoration is our goal. The 2 Watersheds – 3 Rivers – 2 States Cohesive Strategy Partnership (2-3-2 Partnership) is a diverse network of individuals and organizations working in northern New Mexico and southern Colorado to integrate forest and watershed restoration across 5 million acres. The 2-3-2 Partnership is working across multiple boundaries (state borders, regional lines, agency silos, personal biases, cultural legacies, fire regimes, etc.), scales (forest stands, subwatersheds, neighborhoods, counties, etc.), and project stages (mapping/modeling, community meetings, bundled funding, implementation efficiency, monitoring, workforce development, etc.) to increase the pace and scale of upland vegetation and in-stream restoration treatments.

Relationships are at the core of the 2-3-2 Partnership. As we enter our 10th year of committed collaboration, we face new challenges and opportunities at various points in the restoration process. This talk will explore how the 2-3-2 Partnership, or more explicitly the relationships between the partners, is improving the whole restoration process. From pre-planning through to post-restoration monitoring and adaptation, the 2-3-2 Partnership is strategically able to scale up and scale down interactions to accomplish landscape-scale impacts by designing locally relevant projects with site-specific community benefits.

Site-specific restoration is complex and stacking projects for landscape-scale impacts compounds this. However, in the face of increasingly severe wildfires, expanding insect and disease outbreaks, extended droughts, and water scarcity, we know that coming together, working together, and learning together is the solution.

837

Improving outcomes of seed-based dryland restoration on tribal lands through collaborative science

Caroline Havrilla¹, David Stoner², Ember Bradbury¹, Emily Swartz^{3,4}, Retta Bruegger¹, Emily Lockard¹

¹Colorado State University, Fort Collins, CO, USA. ²Ute Mountain Ute Tribe, Towaoc, CO, USA. ³Colorado State University Extension, Dolores, CO, USA. ⁴

Abstract

Seed-based restoration in drylands often fails to result in desired revegetation. Locally specific strategies are often needed to overcome barriers to native plant establishment. A history of oppression and underinvestment presents additional challenges on tribal lands. To meet these challenges, we convened a collaborative team that emphasizes relationship building at the request of Ute Mountain Ute Chairman Heart to bring restoration research to Tribal lands in southwestern Colorado, USA. Our team has continued to focus on restoring ecosystem structure and function, improving productivity for grazing, and ensuring access to cultural resources. To meet these goals, two experimental sites were established: a networked RestoreNet site and a culturally important location for hyperlocal seed-based restoration questions and treatments rooted in indigenous and traditional ecological knowledge systems. Within sites, we tested climate-adaptive restoration treatments in small plots, including ground modifications, seeding vs. outplanting seedlings, herbicide treatments to suppress invasive species, and others to inform larger-scale restoration projects. Results show effective restoration strategies include imprinting the landscape with pits, outplanted restoration islands, and the importance of integrated invasive species management. Equally importantly, we have built relationships and met tribal needs through education and outreach. Since 2020, we have gained insight into the challenges and successes of working collaboratively across a land-grant university, Tribal government, governmental institutions, and other community groups. By honoring different perspectives and expertise, we are creating actionable science and building relationships essential to the restoration, future grazing, and long-term health of dryland systems on tribal lands.

838

Drone-based herbicide dye detectors are effective when trained on real or synthetic imagesKyle Doherty, Charles Casper, Erik Samsøe, Beau Larkin, Philip Ramsey

MPG Ranch, Missoula, MT, USA

Abstract

Increasingly, automated systems are paired with drone surveys to map weed extents and are used as a basis for treatment prescriptions. Close alignment of treatment and prescription is an important management objective as it can reduce chemical costs and environmental impacts. This is particularly relevant for the task of assessing performance of automated spray systems, which are under development for agricultural applications, and might one day be adapted to wildlands. We tested a drone-based system to map herbicide dyes across a breadth of conditions, including: season of application, application rate, spray patch size, and patch color in a grassland in western Montana, USA. Additionally, we incorporated synthetic data during model training in which colored squares were overlaid on unsprayed areas to simulate dye application, and assess if synthetic data can enhance dye detection performance. We found that overall performance was excellent for both dye colors (F1-score 0.979 for red trained on a mixture of real and synthetic data; 0.929 for blue trained on real only), but blue dyes were more difficult to detect during the summer. Additionally, we found that models trained only on synthetic data performed well for the task of detecting real-world treatments; again red dye (F1 0.962) out-performed blue (0.86). This suggests that effective dye detectors may be trained from visible light imagery without the need for gathering real example images of sprayed areas, thus dramatically reducing the costs to train these systems in new areas that may differ in underlying vegetation.

839

Wet and Wild: A decade-long push for instream flow restoration on the Cache la Poudre River

Bernadette Kuhn

City of Fort Collins, Fort Collins, CO, USA

Abstract

The Poudre Flows Plan is a watershed-scale flow restoration project with big implications for the State of Colorado. The goal of the plan is to increase and protect flows in the Cache la Poudre River so that future generations inherit a more resilient river. Presently, the river regularly experiences regular dry-ups in fall and winter, which can degrade water quality, temperature, and aquatic habitat. If implemented, the Plan would alleviate dry-ups and improve river health while avoiding injury to existing water rights. Moreover, it would be the first Instream Flow Augmentation Plan in the state and could be a model for streamflow restoration in other river basins. The Plan is a collaboration between the City of Fort Collins, City of Greeley, City of Thornton, and the Colorado Water Trust.

To operate the Plan, diversion structures must be upgraded along the Poudre River to bypass and measure flows. The City of Fort Collins is working with partners to identify win-win infrastructure upgrades to allow measurement, bypass flow, and river health upgrades where possible. These are necessary to operate the Plan in compliance with Colorado water regulations. A decade in the making, the Plan's trial date in Colorado Water Court is set for October 2025. If approved, it will allow additional water rights owners like water conservancy districts and agricultural producers to strategically pool their water rights to restore flows during low-flow or dry-up conditions.

840

Rising Tide: Finding a Niche for RestorationChrista Russell^{1,2}, Benjamin Belgrad¹, Carter Lin³, Jessica Lunt¹, Lee Smee^{1,2}¹Dauphin Island Sea Lab, Dauphin Island, AL, USA. ²University of South Alabama, Mobile, AL, USA. ³Virginia Institute of Marine Science, Gloucester Point, VA, USA**Abstract**

Shellfish restoration and aquaculture are often impeded by predation losses, and predators can restrict locations where restoration is viable. Shellfish can modify their morphology to reduce predation risk. Artificially stimulating these defensive responses has the potential to improve the survival of cultivated species and enhance restoration efforts. However, these defensive strategies come with tradeoffs in terms of energetic costs, which may affect individuals' tolerance to environmental stress and alter the breadth of conditions over which induced defenses are beneficial. We manipulated oyster shell morphology using predator odor cues at a hatchery scale. We used the resultant spat to seed restored reefs to examine the effects of induced defenses across a gradient of abiotic and biotic stressors associated with tidal depth. Predator exposure increased the survival of oysters on both subtidal and intertidal reef structures by >50%, though the extent to which predator exposure improved survival was variable by both site and tidal position. Notably, predator exposure had no detrimental effect on oyster survival at any site or tidal position. Our results suggest that providing chemical predator cues can be used as a technique to improve restoration outcomes for oyster reefs, and that the efficacy of such a technique is context dependent. Survival benefits vary spatially over a gradient of predation pressure and abiotic stress associated with tides.

848

Empowering Communities Through Process-Based Restoration: A Model for Resilience and Engagement

David Fulton-Beale

Wildlands Restoration Volunteers, Longmont, CO, USA

Abstract

While low-tech, process-based restoration (LTPBR) techniques have emerged as a key strategy for ecological restoration, offering promise to scale restoration, they also offer opportunities for community engagement. Engaging volunteers in implementing LTPBR projects offers many benefits to communities and ecosystems.

LTPBR structures are often installed with heavy machinery and paid work crews. As an alternative, I will present a model of offering leadership and technical training to volunteers to guide teams to install post-and-log structures and a variety of rock structures that can serve similar functions.

While volunteer-based restoration projects require an investment of time and resources for training and coordination, they can be more cost-effective than relying on paid work crews. By leveraging the enthusiasm and dedication of volunteers, land managers can accomplish more with limited financial resources. Engaging volunteers also empowers people to take action, build connections with each other and with land managers; and fosters a sense of ownership and stewardship over the restored areas.

In Colorado, we have installed structures reducing the risk of flooding and landslides after wildfires and restored sage steppe habitat that has been trampled and overgrazed by cattle. On return visits to project sites, we have seen dramatic impacts on the hydrology and vegetation of treated areas. This presentation aims to inspire the audience to engage volunteers in implementing LTPBR techniques as a route to a more engaged and educated community and more resilient ecosystems in the face of a changing world.

850

Local government successes in ecological restoration in wetland and forest ecosystems in Santa Fe County, New Mexico

Adeline Murthy

Santa Fe County, Santa Fe, New Mexico, USA

Abstract

Local governments can play a significant role in implementing and leading innovations in ecological restoration in the United States considering shifting federal priorities. Santa Fe County owns and manages nearly 7,000 acres of protected areas across various ecosystems. We present two case studies of successful County-led restoration outcomes in wetland and forest ecosystems. Both projects serve as demonstration sites for successful resource management approaches that can be replicated elsewhere in the Southwest. In the wetland ecosystem, beavers arrived to a County property at the confluence of two streams within a traditional agricultural community. Santa Fe County has worked to enhance human-beaver coexistence, which has resulted in increased water availability for downstream farmers. Biodiversity has increased significantly, including the recent discovery of an undescribed species of firefly in the *Photuris* genus on the property. The beavers have re-wetted the former pasture, and the County is now partnering with Defenders of Wildlife and World Wildlife Fund to increase the volumetric water storage of the wet meadow. In the forest ecosystem, Santa Fe County is partnering with Defenders of Wildlife and the Rocky Mountain Youth Corps to implement a forest thinning prescription designed to reduce the potential for catastrophic fire while improving wildlife habitat, using Grace's warbler (*Setophaga graciae*) as an indicator species, by selectively thinning trees in a phased approach to retain historic canopy cover, rather than historic tree density. Bird survey results show that Grace's warbler density and occupancy is increasing as a result of the wildlife-friendly forest management prescription.

854

Mechanisms underlying secondary plant invasion during drought

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Abstract

Removal of invasive plants are often followed by 'secondary invaders', species that opportunistically take advantage of the disturbance and open space freed up by invasive control. Traits related to plant function can help explain which native species will best perform as a secondary invader. We found that certain species were more sensitive to drought, which was compounded by competition for some, but not all species. Invasive annual grasses and forbs were resistant to drought, and native grasses typically had higher survival during drought compared to native forbs. Native plant survival was dependent on the cohabiting invasive species and was lower when in competition with forbs compared to grasses and was higher when there was reduced competition. During drought we found that key trait combinations related to plant strategies helped explain differences in productivity and survival. Plants that simultaneously had acquisitive leaf traits like high leaf area but adaptations for drought resistance such as low specific leaf area and leaf lobedness were associated with higher productivity with reduced competition. These trait combinations were expressed by aggressive invasive species: *Briza maxima*, *Centaurea solstitialis* and *Holcus lanatus*. Although they were not as productive as invasives, native species that were functionally distinct from invaders and fast growing were more successful during reduced competition. Results suggest that multiple removal events are likely needed to allow for effective plant restoration when competing with fast growing, drought-resistant invasives. Our findings indicate that selecting native species that differ from the dominant invasive species could improve plant establishment.

860

Vascular plant diversity underscores importance of flooding to quality restoration and resilience of riparian floodplainsSara Sweet

The Nature Conservancy, Galt, CA, USA

Abstract

In low-gradient river reaches, hydrologic connectivity between the channel and the floodplain supports biodiversity and offers dispersal pathways for range adaptations. However, this connectivity – also called flooding – has been greatly reduced by dams and levees in many watersheds, such as those in northern California, U.S.A. Of rivers draining the western slope of the Sierra Nevada mountains, only the Cosumnes River remains without a flow-regulating dam, although there are myriad earthen embankments that inhibit lateral flooding from small and medium-sized storms. To restore riparian floodplain habitat, The Nature Conservancy implemented engineered breaches of certain embankments. In contrast to the many studies focusing only on woody plants, our monitoring documented the establishment and development of the entire vascular plant community. We found that herbaceous plants comprised 87% of the native species richness, and that the number of native species colonizing the site naturally (116) vastly exceeded the number of species present only where planted by people (5). These results, combined with other studies of geomorphology, emphasize the essential role of natural processes like flooding to maintain biotic and abiotic diversity through time. Flooding simultaneously serves as a determining dispersal agent to assist range adaptations. We believe both diversity and dispersal contribute to ecosystem resilience in a changing climate.

861

How to Monitor, Report and Verify High Quality Restoration: A Scalable Approach to Verifying Trees

Darby Levin, Dow Martin

World Resources Institute, Washington, DC, USA

Abstract

Ensuring the credibility of restoration efforts through rigorous Monitoring, Reporting, and Verification (MRV) systems is essential to attracting investment and scaling high-quality restoration. This presentation illustrates how WRI's innovative tree verification approach, as part of a robust MRV framework, demonstrates restoration impact and helps implementers scale their work.

A key component of this MRV system is WRI's innovative approach to tree verification. In 2024, WRI and Meta released a groundbreaking AI foundation model and the world's first 1-meter resolution global tree canopy height map, enabling the detection of individual trees at a global scale. The release demonstrated the power of foundation models to pave a new path toward AI-driven earth monitoring. The data and model are freely and publicly available to users, with the goal of facilitating accountability and transparency for restoration projects.

WRI is applying this foundation model as part of a robust and scalable MRV system for high-quality, local restoration projects. This presentation highlights key steps, including collecting precise project boundary polygons, incorporating self-reported data, and independently verifying progress through remote sensing. This early-stage tree detection method for verification is a crucial piece of an MRV system that is applicable across varied ecosystems and geographies. This method uses the canopy height model backbone in a downstream object detection task to identify individual trees and independently verify projects' progress. This presentation highlights the use of innovative remote sensing and AI-based methods to inform the restoration field by bringing cost effective, transparent, and accurate information to decision-makers.

863

Vegetation characterization and determination of potential ecosystem services of the parks of Conjunto de Las Damas, San José, Costa Rica

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Abstract

The world's population is concentrated in cities with deep anthropocentric rationality, causing ecosystem degradation and biodiversity loss. The UN Decade on Ecosystem Restoration and Sustainable Development Goals promotes actions in cities. We use a social-scientific approach to analyze vegetation and potential services in four parks (Nacional, Morazán, España, and Jardín de Paz) in San José, Costa Rica. We registered plant species, consulted the eBird database, and applied surveys to pedestrians. We registered 55 botanical families with 130 species. Introduced and native species ratios were: all species 61% and 39%, trees 48% and 52%, shrubs 70% and 30%, and herbs 81% and 19%. We recorded 504 trees with diameter: $X=33.6\pm2.3\text{cm}$, $\text{max}=170\text{cm}$, and height: $X=8.85\pm0.49\text{m}$, $\text{max}=30\text{m}$. The Nacional Park is the largest, where we recorded 213 trees with 56% of crown occupation. eBird reported 64 bird species, 49 native. Temperature reduction, carbon capture, recreation, and wildlife refuge are the most significant potential services, but vandalism, tree disease, and tree mechanical damage put them at risk. Restoration actions such as replacing introduced plants with native ones to create a reservoir of the country's flora and promote fauna attraction, using permeable materials in sidewalks to improve infiltration, and training garden keepers to enhance their skills can improve the services. Public space users create deep meaning in their connection, appropriation, and care of nature. Still, public policies are required to enhance the ecosystem services' cultural dimension and its importance in resisting the effects of environmental degradation and performing the right to the city.

868

Space Lasers for Conservation: Using LiDAR to Map Woodland Biodiversity

Caitlin Dagg, Michael Franklin, Uffe Nielsen, Elise Pendall, Paul Rymer

Hawkesbury Institute for the Environment, Richmond, NSW, Australia

Abstract

Accurate knowledge of the distribution of biodiversity across landscapes is necessary to enable effective conservation efforts. Standardised field surveys provide comprehensive insight but are often prohibitively slow and resource intensive. The advent of remote sensing approaches to quantify vegetation structure allows the possibility of efficient, cost-effective, and accurate biodiversity assessment at landscape scales. We integrate LiDAR sensing of vegetation structure with a novel database of standardised plot-based floral survey data to characterise the structure and biodiversity of highly fragmented, peri-urban woodland communities in south-east Australia.

Using only LiDAR-derived metrics of vegetation structure, we predicted species richness across the surveyed plots with an R^2 of 0.2 to 0.7, with a median of 0.3. The species richness of trees had the lowest prediction accuracy, and shrubs the highest. The amount of open ground, density of the shrub layer (1-2m) and density of the lower canopy (10-20m) were important predictors.

This work demonstrates the feasibility and utility of evaluating biodiversity at a landscape-scale using LiDAR-derived vegetation structure, and lays the foundation for future work integrating additional climatic and environmental metrics and expanding the assessment from plot-level to landscape-wide.

880

Scaling and leveraging finance for equitable and effective ecosystem restoration

Sara Löfqvist

ETH Zurich, Zurich, Switzerland

Abstract

Scaling ecosystem restoration that is just and ecologically sound depends on understanding the underlying financial forces that drive ecosystem change. Current regulatory systems largely allow financial flows to degrade nature and enhance social injustices. Understanding how to shift these financial flows towards investments that promote equitable ecosystem recovery is imperative if global restoration targets are to be met. Based on ongoing research this talk will discuss current trends in high-level restoration finance policy dialogues, and lay out barriers and challenges with both macro-economic interventions such as debt-for-nature swaps and financial mechanisms such as blended finance and carbon- and biodiversity credits. The way governance and regulations around finance is set up will have large impacts on both the scale and type of finance that can be leveraged, and what the associated social and ecological may be This talk will explore what such governance mechanisms may look like within monetary systems (primarily in the Global North), on landscape level (primarily in the Global South) and related to different specific funding mechanisms. Finally, the talk will explore the potential synergies and trade-offs between financial objectives, ecosystem health and local and global social justice and explore how inequitable trade-offs can be minimised in efforts to shift financial flows from those that drive climate change and nature destruction towards those that promote ecosystem restoration.

893

Hands on the land: calling for a paradigm shift toward inclusivity and continued intervention in restoration

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Abstract

Restoration serves as a powerful tool to combat global change but inconsistent outcomes and unreach goals cast doubt on its efficacy. Many have called to re-examine the field of restoration; we are not the first. Here, we collaborate with land managers to demonstrate a paradigm shift toward continued restoration intervention and increased inclusivity. One exemplary success is the restoration of serpentine meadows through a yearly “remove and release” approach favoring native species. We also pose two ways to promote inclusivity in restoration: socio-ecological thinking and bridging the knowledge-action-community gaps. The authors founded Hands on the Land in 2021 to give all people frequent, repeated restoration experience through free weekend restoration trips, reflecting these values in action. The trips foster community, centered around land based work, learning, and joy. The benefits of combining long term restoration with inclusivity are multiplicative and go beyond standard outcomes of restoration.

897

Improving the reliability of monitoring programs: lessons learned from assessing the efficacy and effects of whitebark pine ecosystem restoration

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Abstract

A central challenge in ecological restoration is developing monitoring programs that have the power to reliably detect treatment responses. Despite substantial investments, all too often monitoring efforts do not improve understanding or allow for adaptive management. Developing effective monitoring programs is especially challenging for ecosystems with high spatial and temporal heterogeneity and threatened and endangered species. One such ecosystem is whitebark pine (*Pinus albicaulis*) forests, a high-elevation ecosystem of North America, which is declining due to an invasive pathogen that causes white pine blister rust (*Cronartium ribicola*), epidemic-level outbreaks of a native insect, mountain pine beetle (*Dendroctonus ponderosae*) and altered fire regimes. Understanding the response of whitebark pine forests to restoration is of utmost importance, given whitebark's federally protected status. We evaluated the precision of estimation of past monitoring of whitebark pine forest restoration, implemented by the US Forest Service. We then used results of that analysis to develop a framework for monitoring the effects of restoration on whitebark pine and Clark's nutcrackers (*Nucifraga columbiana*) – the species' primary seed disperser. This presentation covers the nuts and bolts of assessing reliability of monitoring results as well as our framework for effective monitoring of restoration treatments in whitebark pine ecosystems. Specifically, we will show easy-to-calculate methods for determining appropriate sample sizes for vegetation composition and structural variables, as well as for vocalizations detected by acoustic recorder units (ARUs). Although we focus on whitebark pine ecosystems, the framework applies globally to forests where practitioners are implementing silvicultural and prescribed fire as restoration treatments.

899

The Third River Wetland Floodplain Wetland Creation Project - An Urban Restoration Story

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Abstract

The Third River Urban Floodplain Wetland Creation Project is part of the Bloomfield's Lions Gate Park. This project involved the conversion of an urbanized, flood-prone former industrial site to a 10.6-acre municipal park and a 4.2-acre wetland floodplain creation area.

Historically, much of the property was filled during the late -19th century to construct the yarn mill and was redeveloped following World War II by Scientific Glass Company which manufactured and tested laboratory instruments including thermometers for nearly forty years. By the 1980s the site was abandoned, contaminated, and cleaned up pursuant to CERCLA. Following the partial cleanup of the site, it was the target of several private developers seeking to construct a townhouse community atop a capped 8.5-acre area of historic fill. After the developer received approval from the NJDEP and Bloomfield, the municipality acquired the property in 2015 during ongoing construction of 104 townhouses. Bloomfield received a \$1.75m grant from NJDEP's Wetland Mitigation Council to construct a 2.2-acre freshwater wetland. Bloomfield committed to a \$500,000 match. Subsequently additional funds were received from ONRR to create another 2 acres of wetland. The establishment of the 4.2 acres of flood prone wetland required the removal of approximately 50,000 cubic yards of historic fill. The wetland was designed as a topographically complex hummock hollow system that would retain storm and flood water. Flood storage increased by 20.32 ac ft or 6,621,927.45 gallons. The site just completed its fifth and final year of monitoring and is a well-established species rich wetland.

900

Microsites matter: small-scale environmental variation plays a role in the community assembly of a rangeland restoration

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Abstract

There is strong evidence for the benefits of managing for multiple ecosystem services in rangelands, but this is often challenging if there are trade-offs in the conditions that support different services. Here, in a semi-arid grassland restoration, we investigate whether actions to increase microsite heterogeneity (e.g., the small-scale biotic and abiotic variation in a plot, from centimeters to a meter) can be combined with high functional plant diversity seeding to maximize both forage production and native grass cover, or whether there are tradeoffs where homogenous conditions (in this case, high soil moisture pits) maximize production while heterogeneity in soil moisture (a mixture of pits and surface) maximize native cover. We draw on results from an ongoing rangeland restoration experiment that test for the effect of plot level microsite heterogeneity on the assembly of forage grass communities with different resource use strategies. We measured community composition using grided line-point intercept (LPI) and production using the non-differentiated vegetation index (NDVI) across three years of growth. Our 1m² plot treatments included unaltered surface plots, pit plots that were 10cm deep, and mixed plots composed of mixed surface and pit subplots. Our seeded forage grass communities were combinations of native grasses to reflect conservative drought tolerant growth strategies, acquisitive fast-growing growth strategies, or diverse growth strategies. After the first year of growth, preliminary findings suggest that pit microsites can boost native cover but that diversity in either microsites or seeding might not have the tradeoffs expected to affect forage production.

902

Exploring native lawn alternatives as a way to meet conservation goals in Chicago

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Abstract

Lawns are important landscapes in cities, but not all are actively used. Converting non-recreational lawns to native landscapes can help cities meet conservation and sustainability goals. Transforming lawns into ecological restorations targeting reference conditions is not always feasible, appropriate or accepted in all urban contexts. In Chicago, we're exploring native lawn alternatives, landscape installations that are short, and lawn-like in appearance, but include native plants that are hypothesized to deliver ecosystem services greater than those provided by turfgrass. We'll present on different types of public urban grasslands – turf grass lawns, prairies, as well as a range of several combinations of short-stature native grasses, sedges, rushes, and forbs and how those installations compare in terms of stormwater infiltration, soil carbon, pollinator support, and plant diversity in installations across the city. We'll also share feedback received by park visitors, and lessons learned in installing, maintaining, and communicating these unique landscape installations

that are a form of ecological restoration in a highly urbanized context.

903

Uncovering spatial patterns of native shrub recovery after wildfire using drone imagery and replicated point pattern analysis

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Abstract

The spatial arrangement of plant communities plays a critical role in post-disturbance recovery and informs key restoration decisions, such as optimal spacing for outplanting. Clustering in native plant populations can either enhance resilience by reducing abiotic stress or hinder recovery by increasing competition in dense stands. However, few studies have quantified how clustering changes over time following disturbances.

Novel remote sensing technologies, such as unoccupied aerial systems (UAS), provide a scalable approach to mapping individual plants and analyzing spatial patterns across disturbance gradients. In this study, we used ultra-high-resolution UAS imagery (<1 cm pixels) to map six shrub species in post-fire sagebrush steppe of southern Idaho. We conducted drone surveys across fourteen wildfire boundaries, capturing data from both burned and unburned areas. Machine learning algorithms classified shrubs to species, and we used replicated point pattern analysis to assess how burn status and time-since-fire influenced plant clustering.

We found that burned areas exhibited greater clustering across all spatial scales compared to unburned areas, suggesting that processes such as limited seed dispersal and facilitation shape post-fire recovery. Within burned areas, older sites showed less clustering at short distances, indicating a shift in spatial patterns over time. These findings provide new insights into how spatial structure influences ecosystem recovery and highlight the potential of drone technology for improving restoration planning and monitoring.

905

Tracking wetland restoration success with remote sensing: Vegetation recovery and hydrological trends in restored commercial-scale cranberry bogs

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Abstract

Wetlands deliver vital ecosystem services, yet agricultural conversion often compromises their ecological integrity, necessitating evidence-based restoration. We assessed vegetation and hydrological recovery in two retired cranberry farms in southeastern Massachusetts, USA, restored in 2016 and 2020, using Sentinel-2-derived spectral indices: Enhanced Vegetation Index (EVI) and Normalized Difference Water Index (NDWI). Time-series analysis (2016–2023) compared restored sites to reference wetlands, evaluating progress toward ecological equivalence. EVI revealed distinct recovery trajectories: 2016 restorations achieved 85–92% of reference EVI values by 2023, with synchronized June–July productivity peaks ($p < 0.05$), indicating stable wetland plant communities. In contrast, 2020 restorations showed lower EVI (62–75% of reference) and greater variability, reflecting early-successional dynamics. NDWI highlighted hydrological disparities: restored sites had 15–20% lower median water coverage than reference wetlands ($p < 0.01$), though 2020 restorations exhibited higher initial surface-water retention (35% coverage) compared to 2016 sites (22%), likely due to design improvements targeting hydrological reconnection. Older restorations demonstrated significant vegetation recovery, nearing reference conditions, while hydrological recovery lagged, underscoring legacy impacts of agricultural drainage. The emergence of wetland plant assemblages and productivity gains ($p < 0.001$) validate restoration success, yet incomplete hydrological recovery emphasizes the need for adaptive management. This study highlights the utility of open-source remote sensing for scalable, cost-effective monitoring of restoration outcomes. By integrating spectral indices with ecological benchmarks, we establish a replicable framework for tracking recovery, informing resource allocation, and refining techniques to accelerate functional equivalence. Our findings advocate for policy shifts prioritizing long-term monitoring and adaptive strategies to enhance wetland restoration efficacy.

909

Improving Restoration Outcomes for Infrastructure Projects Through a Collaborative Project Approach

Kim MacKenzie

Canada

Abstract

Infrastructure empowers the human experience by providing facilities and services to enhance our day-to-day lives. However, the design of these projects is not always considered in an ecological context to identify opportunities for habitat restoration improvements. Additionally, environmental or regulatory constraints can pose a fatal flaw to the proposed design, approach, or schedule for the project. The early identification of potential impediments to successful project development and potential ecological restoration opportunities can provide key information for accurate financial and logistical planning and allow for the implementation of new techniques and technologies (i.e., creative solutions). Employing a collaborative approach provides the opportunity for ecologically sustainable outcomes that are more desirable to stakeholders but far too often, these opportunities are considered after a design has been progressed far past the conceptual stage. The most successful integration of restoration opportunities in infrastructure projects start early in the project schedule. Input from a diverse team of specialists and stakeholders biologists, engineers, geoscientists, designers, and construction professionals is often required. Innovations, project successes, missed opportunities, and lessons learned through multi-disciplinary and stakeholder collaboration will be presented based on examples of projects that have involved bioengineering, wetland creation, watercourse re-establishment, bank stabilization, wildlife habitat creation, and erosion mitigation.

916

Nature Notes, Ralston Creek: A Community-Driven Public Mural Connecting Ecological Awareness, Public Engagement, and a Restored Habitat

Catie Michel

Independent Artist, Denver, CO, USA

Abstract

Public fosters deeper connections between people and places. The *Nature Notes* mural, located along a restored riparian corridor in Arvada, Colorado, celebrates this revitalized ecosystem while engaging the community in both artistic and ecological exploration.

The mural was shaped by guided nature walks, where community members observed species thriving in the restored creek. Birds, insects, plants, and aquatic life documented during these walks became central elements in the artwork, giving participants an active role and fostering a sense of ownership. Community painting days further reinforced public engagement, allowing people to contribute directly to the mural's creation.

An augmented reality (AR) “field guide” offers interactive educational content about the species depicted and the creek’s restoration history. Public art gains depth when it reflects real-life stories, and the *Nature Notes* mural incorporates several such moments. During a walk, a child excitedly revealed the five-pointed star inside a snapped cottonwood twig, which a later visitor expanded upon by sharing an Indigenous story about the Wind-Spirit shaking cottonwoods to release stars into the night sky. Another unexpected event: a small cottonwood tree near the trail, once a familiar landmark, disappeared—revealed to have been felled by a resident American beaver. These moments are now immortalized in the mural, illustrating the evolving nature of restoration sites—not just as managed spaces but as places of ongoing ecological and cultural narratives.

This presentation will explore how public art can amplify ecological storytelling, create meaningful public spaces, and encourage long-term engagement with the natural world.

920

Extreme fires and management for restoring biodiversity – the need for flexibility in prescribed burning thresholdsMark Ooi

University of New South Wales, Sydney, NSW, Australia

Abstract

Fire regimes are changing and recent megafires around the world are examples of the extremes that fire events can reach. Ecosystems and their component species are adapted to historic fire regimes, persisting within thresholds of fire frequency, seasonality, severity and extent. Developing an understanding of how shifting fire regime elements can impact persistence and recovery of plant species is therefore essential for conserving biodiversity. Management for conservation in fire-prone regions includes implementing prescribed fires, maintaining a balance between hazard reduction and positive ecological outcomes. However, as fire events reach new extremes in severity and intensity, the fire regime (particularly fire interval) thresholds implemented, may need to account for differences in recovery trajectories under different antecedent fires. This is to ensure the recovery and restoration of systems impacted by fires beyond the persistence thresholds of some species. Drawing on the results from recent research, I report on the different recovery trajectories of plant functional groups after extreme fires, and discuss the need for a more nuanced and flexible approach to setting thresholds for managed burns to ensure restoration of biodiversity and minimise negative impacts for those species most at risk.

924

Unlocking the Potential of eDNA Sampling for Monitoring Biodiversity in Restoration Projects Using AI and Modelling Approaches

Vere Ross-Gillespie

NatureMetrics, Guildford, Surrey, United Kingdom

Abstract

Environmental DNA (eDNA) is revolutionizing biodiversity monitoring by enabling the detection of species from minute traces of genetic material in water, soil, and air. In restoration projects, particularly in mining and conservation contexts, eDNA provides a powerful, non-invasive tool to assess ecosystem recovery and biodiversity trends over time. However, maximizing its potential requires advanced analytical techniques to interpret complex datasets effectively.

This presentation explores how AI and predictive modelling enhance the application of eDNA for monitoring biodiversity in restored landscapes. By integrating machine learning with eDNA data, we can refine species detection, reduce false positives, and generate more reliable biodiversity insights. Modelling approaches further allow for forecasting ecosystem responses to restoration interventions, supporting adaptive management strategies.

We present case studies from mining restoration and conservation projects, demonstrating how AI-powered eDNA analytics improve species monitoring, track ecosystem resilience, and inform sustainable land-use practices. These examples highlight the role of cutting-edge technologies in bridging the gap between biodiversity assessment and actionable environmental management.

By unlocking the full potential of eDNA through AI and modelling, we can transform how restoration success is measured—ensuring data-driven decision-making for biodiversity conservation and responsible resource development.

926

Biodiversity, Climate Change, and Ecological Restoration in the Arabian Arid Region

Samira Omar Asem

Kuwait Institute for Scientific Research (KISR), Kuwait, Kuwait, Kuwait

Abstract

Among the biggest environmental threats that the earth faces today are biodiversity loss and climate change. Land degradation with climate change phenomena altered habitats causing losses in biodiversity. Greenhouse gases (GHG) increase the earth's surface temperature, and many species must either adapt or migrate to more favorable areas to survive. Losses in biodiversity include degradation of ecosystems, and species migration or extinction. This has been exacerbated in the Arabian arid regions due to harsh climatic conditions that increase extreme weather events, dust storms, and sand encroachment into vulnerable areas. The United Nations declared the decade from 2020-2030 for Ecological Restoration. Ecological restoration measures can halt and reduce land degradation and species losses. At a regional level and to fulfill the global agreements and initiatives, strategic thinking for long-term biodiversity conservation, ecological restoration, and GHG emissions control are appropriate integrated approaches. A strategic plan for climate mitigation and adaptation in the Arab region including vulnerable ecosystem restoration/rehabilitation and remediating contaminated soils is recommended. Research on forecast modeling for climate change, key species monitoring, adaptation and mitigation measures, long-term impacts on climate change, and pollution-related issues in soils and water need to be applied in the region with support.

929

Restoring Nahalel Stream: A Holistic Approach

Roey Egozi

Soil Erosion Station, Bet-Dagan, Israel

Abstract

The Nahalel Stream restoration project demonstrates the interconnectedness of stream corridors and adjacent agricultural lands in Israel. Unlike the widespread degradation of streams within Israeli agricultural landscapes, this project showcases a successful approach to integrated restoration. Our three-year study focused on improving two key physical aspects: water availability and riparian buffer zones. Through stakeholder engagement and data-driven evidence from field surveys and modeling, we facilitated the release of irrigation water previously diverted from the stream, restoring its natural flow. This increased water availability and the implementation of large woody structures to harness stream power accelerated restoration. Simultaneously, establishing a 15-meter average riparian buffer zone by relocating nearby cultivation significantly enhanced riparian biodiversity. This low-tech, process-based approach, avoiding extensive earthworks, demonstrates the potential for effective stream restoration by strategically managing both land and water resources. The project highlights the synergistic relationship between different stakeholders active in the watershed area, leading to improved stream ecosystem services.

Sustainable Solutions: Accelerating Recovery of Kenya's Tropical Montane Forests Through Collaborative Governance Approach in Landscape Restoration

David Langat¹, Nereoh Leley^{1,2}, Abdalla Kisiwa¹, Geoffrey Maina², Beatah Nzove³, Langat Kipkirui³, Anthony Kitema³

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Abstract

Mau Forest Complex in Kenya, East Africa's largest montane forest (416,542 hectares) supports key sectors and communities with ecosystem services valued at \$1.97 billion annually. However, it faces degradation from unabated deforestation, illegal logging, and overstocking. Restoration efforts are hindered by weak and uncoordinated governance and inadequate scientific support. In 2015, a model restoration program was initiated employing an integrated action approach by establishing a conservation trust uniting the state, private sector, non-profit organizations, and the community to co-develop sustainable solutions towards forest conservation and livelihood improvement. To assess its effectiveness, we conducted impact research through quasi-experiment and difference-in-difference analysis on 60,000 hectares project area by evaluating intervention effects on the focal landscape compared to a matched comparison within Mau Forest. We present impact findings on forest conditions assessed through forest cover transitions during pre and post-program interventions and complemented by biophysical measurements. Results showed that net forest regeneration increased by 49%, degradation declined by 48%, while CO₂ emissions reduced by 59% in the focal landscape of which 73%, 51%, and 27% respectively were attributed to the program interventions, compared to 61% lower regeneration, 22% degradation decline and 22% emissions reductions in the matched comparison. Additionally, active restoration improved species diversity (63%) and stem density threefold. The improvement is due to collaborative approaches in forest protection, surveillance, science-based restoration, and innovative business models for livelihood support, compared to conditions in the landscape under disconnected governance. Policy and strategic framework are recommended for the sustainability of the model and benefits.

938

Ecological restoration of a coastal dune system on the Portuguese Atlantic coast - long-term monitoring of the ReDuna project

Alice Nunes¹, Ana Júlia Pereira¹, Maria Alexandra Oliveira¹, Inês Domingues¹, Pedro Pinho¹, Teresa Mexia¹, Raquel Mendes¹, Patrícia Silva², Duarte Mata², Margarida Santos-Reis¹, Otília Correia¹, Cristina Branquinho¹

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Abstract

Coastal dune systems are globally under great anthropogenic pressure, leading to disruption of their ecological and physical integrity. They are among the most threatened habitats in Europe. The destruction of its protective effect against coastal erosion and ocean flooding puts many structures and human activities at risk and is expected to worsen with more frequent storms and rising sea levels caused by climate change. Portugal has an extensive coastline, with many areas facing severe degradation. Frequent efforts to artificially replenish sand levels on beaches are an expensive solution with short-lived results, while ecological restoration of dune habitats aimed at recovering their natural dynamics is less frequent and poorly documented. The ReDuna project in S. João da Caparica aimed to associate artificial sand nourishment with the ecological restoration of dunes, to reinforce their resilience. It was promoted by the Almada City Council and began in 2014, to combat the effects of increasingly frequent storms, which caused the frontal dune to break and flood urban areas. Restoration actions included installation of sand traps, plantation of 10 native species from local origin, conditioning against trampling, and strong communication and community engagement. Scientific assistance and continuous monitoring (>10 years) were essential to plan restoration, assess its success over time and guide adaptive management strategies. It showed that the establishment of vegetation and faunal communities, and the geomorphology evolution of the dune system were highly successful. Dune ecological restoration has proven to be a cost-effective solution for restoring dune habitats and protecting human activities.

Ecological Restoration Project of Historic Abandoned Mines in China and its Resilience Monitoring

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Abstract

In 2021, the Chinese Government implemented a demonstration project for the ecological restoration of historical abandoned mines, supporting 49 projects nationwide for three consecutive years, with a total investment of no less than 500 million yuan per project and a treatment area of no less than 10 square kilometers.

This presentation, taking Key Ecological Zone (Linfen) Historical Legacy Abandoned Mine Ecological Restoration Demonstration Project along Yellow River within Shanxi (the Linfen Project) as an example, introduces the Project' restoration objects, objectives, contents and new technology of the project. Also, the presentation puts forward the project resilience monitoring program.

The Linfen Project covers 11 counties in Linfen City, with 374 comprehensive patches covering an area of 10.71 square kilometers. The Project, integrating topography, ecosystem types and other ecological elements, highlights comprehensive, systematic and source management in order to realize the rebalancing of damaged ecosystems and positive succession in the restoration area. Based on the degree of damage and resilience of the ecosystems, the Project applies new technologies such as disaster elimination, ecological restoration, and monitoring, and systematically carries out protection and restoration. A total of 28 sub-projects have been organized and 6 major types of tasks have been implemented.

A monitoring system has been established for vegetation resilience, with a total of 15 monitoring items in 4 monitoring indicators, such as vegetation, soil, topography and meteorology, adopted AUV, remote sensing and wireless remote automatic monitoring equipment to realize intelligent monitoring. A vegetation resilience model has been built for evaluating the Project.

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Arrested succession in the Brazilian Atlantic Forest: fire, soil, and landscape effects

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Abstract

Although secondary tropical forests may reach similar species richness and vegetation structure as old-growth forests in 50 years, there are situations in which they remain arrested for decades. In the present study, we evaluated the effect of these factors in the establishment and maintenance of monodominant secondary forests of *Moquiniastrium polymorphum* (Less.) G. Sancho in abandoned farmlands in the Atlantic Forest. We tested whether fire history was the most significant factor associated with the occurrence of *M. polymorphum* forests (MPF) in the landscape; and the role of soil conditions and fire history on the vegetation structure, richness, and species composition of MPF. At the landscape scale, we assessed if the occurrence of MPF, comprising land cover changes between 1985 and 2020, was associated with fire events and other biophysical factors. At the local scale, we evaluated the role of soil properties, fire events, and landscape context on the species richness, structure, and floristic composition. MPF was observed further from the drainage and on slopes that were more affected by fires. Their coverage increased by 54% on abandoned farmlands further from cities, where fire events were significantly more frequent. Fire history and soil properties were the factors that best explained the structure, diversity, and floristic composition of MPF, while landscape showed relevance only to the floristic composition. Our findings indicate that fire-soil-vegetation feedback mechanisms can sustain this alternative stable state, and ecological restoration efforts are crucial to promote ecosystem recovery.

945

Weaving Ecological and Social Fabric: Traditional Cotton Craft as a Foundation for Holistic Community Restoration in Post-Mining Thailand

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Abstract

In gold mining-impacted communities of Loei, Thailand, "The Weaving School for Revitalizing Lives and Community Nature" demonstrates how cultural revival can catalyze comprehensive ecosystem restoration by rebuilding social and economic foundations. This presentation examines how traditional cotton weaving, reintroduced through intergenerational education, creates the socioeconomic stability necessary for environmental healing. Led by women human rights defenders of Khon Rak Ban Kerd (KRBK), the initiative addresses mining-related trauma by strengthening community bonds through shared cultural practice. The school teaches organic cotton cultivation, natural dyeing, and traditional weaving, simultaneously developing sustainable livelihoods and restoring native plant species to contaminated lands. Initial results show improved relationships between youth and grandma-teachers and increased connection to previously mining-devastated land. After successfully closing the gold mine, the community is using the Weaving School to repair social wounds and create opportunities for youth to build futures in their home community. This case study provides critical insights for practitioners on how cultural revitalization can establish the foundational conditions – restored social ties, sustainable livelihoods, and community healing – required for successful ecological restoration in post-mining contexts.

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Community Driven Social Ecological System Health and Human Dignity Restoration

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Abstract

In Thailand's Loei province, community resistance to gold mining contamination has transformed into pioneering approaches for stakeholder collaboration in ecological restoration. After a landmark 2018 court ruling mandating community participation in restoration, affected communities developed the innovative "Social Ecological Systems Health and Human Dignity Restoration" framework. This presentation analyzes how local communities transformed environmental conflict into opportunities for multi-stakeholder restoration innovation. Moving beyond traditional technical approaches to contamination remediation, the framework pioneers trust-based processes that integrate ecosystem health, community wellbeing, and economic sustainability. Local communities' persistent advocacy has created new dialogue spaces and social innovations that bridge diverse stakeholder interests - from government agencies to environmental researchers. Their holistic approach demonstrates how community leadership can align technical restoration needs with social healing and economic revitalization. This case study offers valuable insights for practitioners on transforming environmental conflicts into collaborative restoration opportunities, emphasizing how community-led processes can create the trust necessary for successful multi-stakeholder restoration outcomes.

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Healthy Ecosystems, Healthy Minds: Mapping the Psychosocial Impact of Mining in Thailand

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Abstract

This research reveals the intricate connection between environmental harm and psychosocial trauma in mining-affected communities in Loei, Thailand. Using participatory mapping, we explored how a gold mine's operation (2006-2014) transformed both landscapes and mental wellbeing of local residents.

Our findings demonstrate that ecosystem integrity and human mental wellbeing are inextricably linked. When landscapes are damaged, communities experience depression, anxiety, fear, and hopelessness. Negative emotions directly correlated with environmental degradation, while positive emotions emerged from community cohesion, resistance efforts, and self-sufficient livelihoods.

This research contributes to the "One Health" framework, which recognizes the interdependence of human, animal, and environmental health. By documenting how environmental degradation creates measurable psychological harm, we establish that ecological restoration must be viewed as a mental health intervention as well.

The participatory mapping approach serves dual purposes: capturing complex data while supporting community-led healing initiatives. As communities document their experiences, they reclaim agency and develop pathways toward both environmental and psychological restoration.

This work demonstrates that healthy ecosystems are essential for healthy minds, making environmental restoration a crucial component of holistic community wellbeing. Our approach emphasizes storytelling both for capturing complex data and supporting communities as they organize activities to promote wellbeing through environmental healing.

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Applying functional trait-based approaches to improve restoration seed mix design in dryland pollinator plantings of the US Conservation Reserve Program (CRP)

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Abstract

The Conservation Reserve Program (CRP), administered by the US Farm Service Agency (FSA), encourages landowners to convert environmentally sensitive land to improve ecosystem health, including water quality, erosion control, and native habitat. The CRP Pollinator Habitat Initiative (CP-42) supports landowners in converting land into diverse meadows of native wildflowers and grasses to benefit pollinators. However, CRP pollinator plantings in Eastern Colorado have largely been unsuccessful, primarily due to drought and competition from invasive plant species. Trait-based restoration strategies, which focus on plant traits that increase restoration success, offer a potential solution, but their effectiveness in drylands remains underexplored. Eastern Colorado CRP sites present an ideal system for testing such approaches.

Using a list of 23 candidate restoration species and common invasive species in Eastern Colorado, we conducted a trait screening and developed two seed mixes: a drought-resistant mix and a competitive mix. The screening revealed striking ontogenetic differences in plant traits and strategies between both desirable and invasive species, and grasses and forbs. The drought-resistant mix emphasizes a diversity of traits that enhance drought tolerance, while the competitive mix targets traits that overlap with those of invasive species. These mixes aim to address two key barriers to restoration: water scarcity and invasive competition.

This research aims to improve CRP restoration in Eastern Colorado by testing trait-based seed mixes tailored to local environmental challenges, providing a potential model for more successful pollinator plantings.

959

YIMBY: Yes (so Much Stream Restoration) in My (Urban) Backyard

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Abstract

Over the past decade, Kitchener, a city of 250,000 in southwestern Ontario, Canada, has undertaken many urban stream restoration projects. These projects have helped to position Kitchener as a restoration leader since large-scale stream restoration was relatively rare across Canada until recently. This presentation will explore the economic drivers and management strategies that are building a long-term restoration success story in Kitchener from the perspective of consulting engineers – who are also residents working in our backyard – involved in designing and constructing restoration. As practitioners, we view these projects as transformative, proactively enhancing habitat, water quality, and public green spaces, and representing true restoration rather than mere rehabilitation or stabilization.

In 2011, the City of Kitchener introduced a stormwater utility fee paid by property owners. This fee provides a steady and predictable funding source for stormwater initiatives. Reliable funding, combined with a modern management approach that recognizes natural, well-functioning watercourses as valuable assets integral to the wider stormwater network, has resulted in the consistent implementation of stream restoration projects.

The City is reaffirming its commitment to urban stream restoration. In its 2025 budget, stormwater utility revenues over the next five years are projected at \$180M (CAD). Approximately 65% of these revenues are allocated to the City's capital budget, which includes eight new stream restoration projects implemented over 5 years.

This presentation will provide valuable insights into the strategies and successes of Kitchener's urban stream restoration projects, offering a model for other municipalities aiming to achieve similar economic, environmental, and social benefits.

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Managing for post-disturbance recovery. Lessons from active and passive restoration approaches in mountain forests.

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Abstract

When large and severe disturbances affect mountain forests, their ability to provide fundamental ecosystem services may be impaired for a long time. Indeed, in the Alps, forested slopes exert a crucial protective function and rapidly restoring the forest cover after a stand-replacing event is key to prevent the occurrence and mitigate the impact of subsequent natural hazards. Post-disturbance intervention can make or break forest recovery and should thus be tailored to meet management requirements and ecological needs. Widespread salvage logging removing all deadwood and other biological legacies in harsh environments where natural regeneration relies on facilitation mechanisms is a classical example of human intervention leading to undesired consequences. Quite often, when time is not a constraint, passive restoration can be the best option. Whenever active restoration is deemed necessary, particularly when large areas are affected, several challenges and limitations have to be addressed. Lack of saplings supply from tree nurseries, specialized workers and funding availability can hamper restoration activities.

Some lessons learnt from mountain forests of the Italian Alps will be presented, considering restoration interventions after forest fires, windthrows and bark beetle outbreaks. Taking advantage of biological legacies, assisted regeneration and applied nucleation provided encouraging results, with nature-based solutions proving to be effective in promptly restoring the ecosystem services provided by forests, especially in protective stands.

The reported results, considering ongoing climate change and its repercussion on disturbance regimes, highlight the urgent need to implement new methods in defining intervention priorities and new approaches in active and passive restoration.

Collaborative Ecosystem Restoration Planning in Community Forests: A Multi-Stakeholder Strategy in West Java, Indonesia

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Abstract

The limited jurisdiction of the West Java Provincial Forestry Service in managing community forest ecosystems has driven social innovation in restoration. To address these constraints and mitigate social tensions, the Forestry Service has implemented a multi-stakeholder collaborative strategy. This explores such an approach in two landscape planning initiatives responding to local stakeholder efforts in West Java, Indonesia: the forest farmer group in Talaga Sunda, Subang, and Jalatrang Village. The Forestry Service collaborated with landscape architects to facilitate coplanning through biophysical assessments—including analyses of potential rehabilitation areas—alongside socio-cultural and economic evaluations, as well as ecotourism and educational opportunities assessed using a SWOT. The collaborative effort in Talaga Sunda has implemented tree planting and rehabilitation since the landscape plan was established in 2022, increasing vegetated land cover from 8.25 hectares in 2020 to 14.42 hectares in 2024, as indicated by GIS analysis. In Jalatrang Village, planning initiated in 2024 has identified a 33.68-hectare opportunity for community forest management, with an additional 52.16 hectares designated as a potential buffer zone. SWOT analyses indicate that Talaga Sunda falls in Quadrant III (x: -0.50; y: 0.09), requiring strategies to address internal weaknesses, whereas Jalatrang Village is in Quadrant I (x: 0.77; y: 0.39), supporting a growth-oriented strategy that capitalizes on strengths and opportunities. These findings highlight the critical role of local governments as catalysts and expert teams as enablers in embedding ecosystem restoration into landscape planning. Sustaining partnerships among government agencies, local communities, private sectors, and academic institutions is essential for long-term success.

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Advancing Ecological Restoration in Europe through the Biodiversa+ BiodivRestore Knowledge Hub: Empowering Collaboration and Innovation

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Abstract

The adoption of the Nature Restoration Law (NRL) in 2024 marks a pivotal step in reversing biodiversity loss and ecosystem degradation in the EU. With binding restoration targets, the law mandates the development of National Restoration Plans (NRPs), requiring scientific support, cross-sectoral collaboration, and stakeholder engagement to restore 20% of EU land and sea by 2030 and all ecosystems in need by 2050.

Launched in 2024, the BiodivRestore Knowledge Hub supports these efforts by integrating 52 interdisciplinary experts to bridge the gap between science, policy, and practice. The Hub fosters knowledge exchange, conflict resolution, and evidence-based restoration strategies, leveraging synergies with initiatives like the Society for Ecological Restoration Europe (SERE). It provides technical guidance, disseminates best practices, and ensures alignment with environmental policy and law.

A key innovation is the establishment of National Hubs, linking existing restoration networks and facilitating cross-border cooperation and stakeholder engagement. These hubs translate high-level strategies into locally adapted actions, promoting institutional collaboration and public-private synergies.

This presentation will showcase the Hub's contributions, including stakeholder mapping, capacity building, monitoring for adaptive management, and conflict resolution. It will also outline the 2025 roadmap, emphasizing workshops, technical guidance, and best-practice dissemination. By enhancing the effectiveness of restoration initiatives, the Hub plays a crucial role in supporting Member States and local practitioners in achieving ambitious restoration targets and addressing the triple planetary crisis of biodiversity loss, climate change, and pollution.

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Community-oriented and collaborative approaches to floodplain wetland restoration along the highly developed West Branch of the Little Calumet River floodplain corridor in northwest Indiana

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Abstract

The Calumet Region, spanning Southeast Chicago and Northwest Indiana, once rivalled the Everglades as one of the largest, most biodiverse wetland systems in the United States. Following decades of development and industrial pollution, the region is now a patchwork of highly altered remnant floodplain wetlands. Yet, these sites still hold significant potential for supporting rich biodiversity. Since 2016, The Wetlands Initiative (TWI) has built collaborative partnerships and played a catalytic role in reestablishing healthy hemi-marsh in this urban, industrialized area. Once fully restored, these sites will support rare wildlife and provide quality green spaces for residents of the surrounding underserved communities.

As a leading member of the Little Calumet River Conservation Collaborative in Northwest Indiana—a coalition of peer conservation groups, local public agencies, and the City of Gary—TWI has expanded habitat restoration and community engagement efforts along the 2,000-acre floodplain corridor of the West Branch of the Little Calumet River. Along this corridor, TWI has begun facilitating its first-ever community-driven planning process, focused on Northwest Indiana's first stream re-meandering project and developing a community vision for access and recreation on the 400-acre 'Marshalltown Marsh Complex' and the 800-acre 'Chase Street Complex.'

Community-based organizations, local stakeholders, and a 'Community Advisory Board' are guiding the development of 60% designs for stream re-meandering, habitat restoration, and improved public access. TWI and its partners anticipate these projects will have significant ecological and social benefits for both native wildlife and underserved communities on a local and regional scale.

An interdisciplinary monitoring effort raises the bar for assessing restoration outcomes in wet prairies of the Florida panhandle

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Abstract

Loss of species-rich wet prairies in the Florida panhandle is caused by an increase in coastal development and fire suppression leading to hardwood encroachment. Research related to reliable and efficient restoration strategies to return these systems to their herbaceous state is essential for biological diversity and community resilience. Often, practitioners fail to broadly disseminate restoration attempts, failures and successes. Also, data obtained from restoration monitoring often lacks a broad ecosystem perspective that includes biotic and abiotic ecosystem attributes. Both hinder the widespread implementation of sound restoration.

Over the past decade, Atlanta Botanical Garden and Florida State Parks have removed over 300 acres of woody vegetation at Deer Lake State Park in Walton County, FL. In 2019, University of Florida researchers joined this effort to assist with a controlled experimental assessment of novel restoration approaches and the evaluation of vegetation and seed bank dynamics, changes in groundwater nutrients, soil parameters, and abundance of wetland-dependent herpetofauna species. This interdisciplinary collaboration allows for communication of restoration outcomes between practitioners, land managers, botanists, horticulturalists, hydrologists, plant ecologists, soil scientists, and herpetologists. To date, results show, of restoration treatments tested, there are additive positive effects on plant diversity and soil and groundwater chemistry. Treatments that included a combination of woody vegetation removal and litter duff scraping yield the greatest benefits. However, scraping had short-term negative impacts on herpetofauna diversity. These findings underscore the need for interdisciplinary, multi-trophic monitoring to evaluate restoration success and refine best practices for shrub-encroached wetlands.

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A Catalyst for Change: Expanding the Impact of Flood Mitigation projects

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Abstract

Niver Creek's Tributary M (Tributary) was a constrained stream disconnected from its floodplain, no longer functioning as a healthy, natural system and exposing the adjacent community and utilities to hazardous safety concerns. Situated within a highly trafficked regional open space park in Thornton, CO, Tributary M's channel migration and bank erosion threatened nearby infrastructure, continued to degrade the regional watershed and limited the public's ability to access the surrounding open space safely. A project team of stormwater engineers, landscape architects and restoration ecologists determined to restore the Tributary to its original function, found a way to realign the channel around critical utility infrastructure and reconnect it to its historical floodplain. The team of design engineers, along with strategic project partners, thought more broadly about the Tributary as a regional resource and considered how creating a more resilient floodplain could benefit both natural systems and the people who inhabit them. The City of Thornton saw an opportunity to integrate other functional and programmatic elements along the stream corridor to establish a comprehensive open space plan that supports visitor engagement with the restored channel. Newly designed stream crossings, trails, and play and gathering nodes allow visitors of the park to safely access the creek and explore new spaces along its sinuous banks. The improvements along Tributary M are an example of how a flood mitigation project can leverage its surrounding context to provide natural based solutions that manage flood risks and foster safe, recreational opportunities for the regional community.

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A Biogeographic Approach to Assessing Biotic and Abiotic Factors Contributing to Cheatgrass Invasion

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Abstract

When successful, biological invasions can degrade ecosystem functioning and lead to other harmful outcomes, a trend that is observed worldwide. Annual invasive grasses are particularly problematic in rangeland systems across the western United States, with *Bromus tectorum* (cheatgrass) - native to Eurasia- causing significant ecological and economic harm. An important step in improving cheatgrass restoration efforts is investigating, and understanding, the ecological processes that drive its invasion. One method that can be employed is to use a biographical approach to assess invasion mechanisms in both native (home) and invaded ranges. Through mirrored field experiments that compare cheatgrass native and invaded ranges we examine how biotic and abiotic factors may contribute to invasion success. Our study spans six sites -three native and three invaded ranges- in a fully factorial design where we manipulate key biotic (plant-fungal interactions, insect herbivory, cattle grazing) and abiotic (fire, mechanical soil damage) factors. Our results demonstrate that in the invaded range with higher native plant diversity, cheatgrass abundance is reduced. We also found that, although the response varied by treatment type, cheatgrass abundance generally increased when disturbance occurred in both native and invaded ranges. These findings, along with additional treatment level insights, underscore the importance of prioritizing native plant biodiversity and ecosystem stability when restoring invaded sites, or working to prevent further cheatgrass invasion.

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Native Prairie Restoration as a Nature-Based Solution for Ground-Mounted Photovoltaic Solar Landscapes: Insights from a Single-Axis Tracking Solar Array in Semi-Arid California

Yudi Li, Leroy Walston, Heidi Hartmann, Alona Armstrong, Rebecca Hernandez

Abstract

Utility-scale ground-mounted photovoltaic solar utilities (GPVs) present an opportunity to integrate ecological restoration with renewable energy production, such as solar-pollinator habitats, promoting multifunctional land use and sustainable development. However, botanical diversity on GPVs is often impoverished due to a lack of management schemes and understanding of microclimatic impacts imposed by solar panels. In this two-year study (2022–2023), we designed and tested two native seed mixtures — wildflowers and grasses — on a single-axis GPV in California’s Central Valley, where intensive weed pressure posed a challenge to establishment.

Many sown perennials thrived by the second year with minimal irrigation and maintenance, particularly cost-effective species. In contrast, annuals gradually declined in density, frequency, and coverage due to limited self-regeneration. While PV-induced shading generally favored shade-tolerant species, it also enhanced the survival of sun-loving wildflowers in the summer by reducing heat and drought stress. Additionally, it delayed phenological transitions, such as germination, blooming, and senescence, thereby extending resource availability for late-season wildlife and beneficial insects.

These findings offer valuable insights for scalable prairie restoration on GPVs in semiarid regions, highlighting their potential as a nature-based solution to enhance habitat quality, support biodiversity, and mitigate climate impacts. Despite challenges like limited availability of locally sourced seeds, implementing adaptive management strategies, such as tailored planting, reseeding, and strip mowing, is essential for ensuring success and optimizing vegetation diversity, cost-effectiveness, and compatibility with PV infrastructure. By prioritizing quality over quantity in restoration efforts, this research demonstrates how GPV projects can actively contribute to responsible land stewardship.

973

Organic carbon stocks in aboveground biomass and soils in hyper-arid ecosystems - a case study of AlUla County, Saudi Arabia

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Abstract

Dryland ecosystems, covering 47% of Earth's terrestrial surface, play a vital role in carbon sequestration despite their relatively low carbon densities. Restoration of drylands, particularly through the re-establishment of native vegetation, offers significant opportunities for reversing ecosystem degradation and increasing global carbon stocks. Within the framework of Saudi Vision 2030 and the UN Decade on Ecosystem Restoration, Saudi Arabia has committed to ambitious restoration targets. This study provides the first empirical assessment of organic carbon stocks in the hyper-arid protected areas of AlUla, spanning eight distinct habitat types. Using stratified random sampling and species-specific allometric equations, aboveground biomass (AGB) and soil organic carbon (SOC) stocks were quantified across 172 plots. Results highlight the heterogeneity in carbon storage across habitats, with arid thorn woodlands exhibiting the highest AGB carbon stocks ($1.82 \pm 0.55 \text{ t.ha}^{-1}$), while abandoned agricultural lands displayed the highest SOC stocks ($12.83 \pm 1.92 \text{ t.ha}^{-1}$). Total organic carbon (TOC) stocks varied, with abandoned agricultural lands holding the highest mean TOC ($13.36 \pm 2 \text{ t.ha}^{-1}$) and Harrat Uwayrid Biosphere Reserve contributing the largest cumulative TOC due to its extensive area. The results highlight the critical role of restoration in enhancing carbon storage, stabilizing soils, and promoting ecosystem resilience in hyper-arid environments. This research establishes a baseline for monitoring carbon stocks and guiding restoration efforts. By quantifying the contributions of drylands to global carbon dynamics, this study supports sustainable land management and climate change mitigation goals, emphasizing the ecological and climatic importance of restoring degraded dryland ecosystems.

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Safeguarding Florida Keys Coral Genotypes through Proactive Genebanking Strategies

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Abstract

Coral Restoration Foundation (CRF) has dedicated over two decades to large-scale coral restoration in the Florida Keys, USA. During this period, CRF has propagated and outplanted over 250,000 corals across essential reef sites from Key Largo to Key West. Despite CRF's large restoration footprint, the severe bleaching disturbance in 2023 considerably impacted corals both in natural reefs and within CRF's in-water nurseries. Mass coral bleaching is one of the most significant threats to coral survival around the world. Recent NOAA estimates show that total stony coral cover throughout Florida's Coral Reef declined to less than 2% after the 2023 bleaching event. Consequently, restoration practitioners in Florida now maintain the largest populations of Florida's Acroporids within coral nurseries, causing a clear need for innovative, adaptive solutions to safeguard coral stock and genetic diversity in response to the rising frequency and severity of high sea surface temperatures. Here we discuss proactive strategies CRF has implemented through genebanking, building redundancy of unique coral genotypes through replication and collaboration. By including collaborative, proactive restoration practices at multiple levels into daily operations, CRF and other practitioners intend to improve upon routine best practices that can most effectively safeguard the remaining coral genotypes in Florida's Coral Reef, and may potentially be adapted or scaled globally.

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Denver Water and Jefferson County Open Space, A collaborative approach to achieve multiple goals with the South Platte Watershed Sediment Mitigation Pilot Project

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Abstract

Denver Water has undertaken a pilot study to evaluate the use of natural process-based restoration techniques that can be implemented across the water supply catchment of the Strontia Springs Reservoir. Several large wildfires have occurred in the Middle Fork of the South Platte River which feeds into the Strontia Reservoir. The accumulation of sediment compromises the function of the reservoir and significantly increases the cost of water treatment and delivery. Addressing the problem at its source by stabilizing and capturing sediment higher in the watershed is seen as a potentially cost-effective solution.

In partnership with the Jefferson County Open Space Program, Denver Water has recently undertaken a pilot study to evaluate sediment capture and stream restoration options on Casto Creek. Utilizing process-based restoration techniques such as PALS and log-jam features, the goals are to stabilize of an eroding stream reach and restore the natural sediment detention function of a healthy riparian floodplain.

Early results suggest that sediment capture will not be cost effective until the channel is returned to a stage 0 condition in which high flows can access the floodplain and deposit sediment. The need for maintenance and adaptive management add to the cost and risk of the sediment mitigation which must be considered with the benefit-cost analysis. Other ecological parameters are also being tracked by Jefferson County Open Space, such as effects on the floodplain groundwater, vegetation, and wildlife communities to understand the full suite of ecological benefits that may be possible with a process-based restoration approach.

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Promoting agroforestry for biodiversity restoration in human dominated landscapes: potential of Biodiversity Credits

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Abstract

Agroforestry systems (AFS) are important Nature Based Solutions confronting global environmental degradation as they harmonize land productivity with landscape restoration functions. AFS' heterogeneous design, species and management strongly influence their restoration and productive functions. Complex multistrata AFS hold higher conservation values than more simplified AFS and may constitute biodiversity islands (BI) in human-dominated landscapes. Other less complex AFS may be part of a BI, or form part of buffer zones of protected areas. The inclusion of AFS in human-dominated landscapes provides greater biodiversity than conventional agriculture, however this should not justify land use change from natural forest.

Payments for Ecosystem Services (PES), government incentives, organic certification, and niche marketing can serve to promote AFS. Biodiversity credits (BC) can become an additional incentive to favor biodiversity-friendly land use options such as AFS. Despite difficulties in monitoring biodiversity in heterogeneous systems such as AFS, appropriate metrics can be found, as it has been done successfully in Latin America. Our research responds to the gap that most BC developed so far overlook AFS. However, many AFS are complex multistrata comprised of perennial crops such as cacao, coffee, yerba mate, for which standards to consider them organic, biodiversity-friendly or other seals are generally in place. In these cases assigning biodiversity credit values reaching proper markets can become more feasible. We present examples from perennial AFS promoted by PES and their potential to access BCs. In all cases BCs need to cater to each specific context, considering prevalent environmental conditions as well as farmer preferences.

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Linking differentiation of plant functional and floral traits to source climate and pollinator visitation in key native southwestern US restoration species

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Abstract

Identification of intraspecific variation in plant functional traits in relation to source climate can be used to guide modern-day restoration decisions such as seed sourcing, which may be especially critical for forbs that are both important for pollinators and an historically understudied functional group of plants in this arena. We implemented a common garden study to examine intraspecific variation in a series of plant traits and floral phenology across 10 native forb and shrub species that are commonly used in restoration in the southwestern US, and measured the following plant functional traits over a growing season: height, specific leaf area (SLA), leaf nitrogen (N), leaf dry-matter content (LDMC), and seed mass. We also coupled climate-based variation in population mean traits to pollinator observations over a growing season to determine whether pollinator visitation corresponded to climate-responsive flowering phenology. We found that plant height consistently showed a pattern of climate adaptiveness for the majority of species we studied; but leaf N, SLA, LDMC and seed mass showed climate adaptiveness for a subset of the species. We found that all ten target species demonstrated some degree of phenotypic variation in phenological floral traits associated with climate source, with later-flowering populations having greater visitation. Beyond practical applications to seed sourcing, this research demonstrates a step toward understanding how population variation in floral and functional traits has evolved in response to climate, and how trait-community interactions may shift during climate change.

991

Jabez Branch Stream-Wetland Complex Restoration: Goals, Methods, and Preliminary Monitoring Results of a Restored Coldwater Trout Stream on the Atlantic Coastal Plain

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Abstract

Jabez Branch is unique as it is the only stream within the Coastal Plain of Maryland, USA that historically supported a native Brook Trout population. Rapid development of the Jabez Branch watershed including the construction of state and inter-state highways over the stream caused ecological degradation through intensified runoff, thermal pollution, and excessive sediment – all of which have caused a decline of the Brook Trout population. In 2024, the most degraded tributary was restored using Regenerative Stream Conveyance (RSC).

Project goals are multifaceted and were determined through extensive collaboration with relevant stakeholders including local and state government agencies and multiple local environmental groups including the Severn River Keeper. The primary goal of the project is to reduce in-stream temperatures through hyporheic exchange to benefit Brook Trout. Secondary goals include stream & wetland complex, sphagnum bog, and forest habitat creation for a variety of rare and threatened species, improvement of local and downstream water quality, environmental education, and ecological restoration research.

The restoration is the subject of ongoing monitoring efforts in order to characterize what effects RSC may have on the ecosystem. The monitoring effort is a collaboration between state, county, non-profit, and private parties. Metrics like structural stability, groundwater level, water quality and temperature, vegetation, and biota are being tracked as the restoration continues to mature; this data is being evaluated for trends and qualitative results.

We will present our restoration objectives, methods, and research, and discuss the implications of the preliminary findings which indicate improved ecosystem health.

993

Growing moss: Using moss and soil fungi to enhance reforestation of *Pinus ponderosa* after wildfire

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Abstract

Wildfire are increasing in size and severity in the southwestern United States due to above average fuel loads and more extreme climatic conditions. After wildfires, drought stress tends to limit tree regeneration of desired tree species, such as *Pinus ponderosa* and thus leaves forests vulnerable to type conversion, creating a need to artificial reforestation. Many artificial reforestation plantings are unsuccessful in the long term due to drought stress or lack of site-specific seed. Despite this, studies have shown that symbiotic organisms, including mycorrhizal fungi, can alleviate drought stress in plantings. Further, early seral post fire species including non-vascular plants, known as fire mosses, tend to have traits that make them successful in these dry nutrient limited sites. These same traits, high water absorption capacity, nutrient fixation, and desiccation tolerance, may also be useful to alleviate drought stress and enhance the survival of seedlings. In this study, we conduct a nursery operations style greenhouse project to produce stock types of *Pinus ponderosa* seedlings grown with moss, mycorrhizae, or moss and mycorrhizae compared to a sterile background nursery mix to better understand how this biota influence nursery production. We grew seedlings under drought or well-watered conditions and out planted seedlings during summer monsoons. We tracked and measure seedling growth, moss growth, and fungal growth to better understand how these organisms interact and to better understand whether moss and mycorrhizae can be used as biotic amendments that could enhance seedling survival in out planting settings.

995

Breaking down barriers to restoration for grizzly bear movement in the Yellowstone to Yukon Corridor of North America

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Abstract

The Yellowstone to Yukon Corridor (Y2Y) falls within the world's most intact mountain system spanning 3400 kilometers/2100 miles-in length and is often referred to as the "spine" of the Rocky Mountains. The Y2Y Corridor is under pressure from resource development, residential expansion, recreation and transportation development representing a threat to wildlife and their habitats. Fragmented landscapes impose barriers to movement, restrict migration routes, result in increased wildlife-vehicle collisions, human wildlife interactions and loss of habitat. Some solutions are being studied, and local Indigenous communities are actively working to overcome obstacles to facilitate effective habitat management.

The *Grizzly Cultural Study of Kananaskis Project* is a community-led initiative of the Stoney Nakoda Nations (SNN), focused on the Kananaskis County area, and supported by funding from Environment and Climate Change Canada. To address barriers and implement cohesive and inclusive management strategies, grizzly bear behaviour and habitat management must draw from modern science and traditional knowledge to provide innovative and sustainable solutions.

The Project started in 2016 and completed in 2024 resulted in recommendations for grizzly bear management that included SSN cultural and traditional knowledge. The study informs where, how, and when National Parks implement grizzly bear management, priority areas for habitat enhancement and visitor management. This model can be used and applied to other jurisdictions where cumulative effects on habitat disturbance and wildlife movement need to be addressed.

Spatiotemporal trends of vegetation recovery in burned areas of the Americas

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Abstract

Fire is an essential component of species, ecosystem and atmospheric dynamics. However, human activity has caused changes in fire regimes during the last two decades. In many cases, post-fire recovery processes at the landscape scale are unknown. The main objective of this study was to evaluate the spatial trends of the increase and decrease in vegetation affected by wildfires and burns for the whole American continent, for the period 2001–2024, using non-parametric tests, through the analysis of Normalized Difference Vegetation Index (NDVI) remote sensing products. The results showed that between 2001 and 2024, fires affected an absolute area of 429.7 Mha of the Americas and the Caribbean, mainly in Brazil (154.1 Mha), United States (57.5 Mha), Canada (57.1 Mha), Argentina (43.2 Mha) and Bolivia (29 Mha). The NDVI values evidenced diverse spatial variations, with a slightly higher proportion of increasing trends (33%, $p < 0.05$; 19.1%, $p > 0.05$) relative to decreasing trends (23.2%, $p < 0.05$; 24.7%, $p > 0.05$). The ecosystems with the largest areas with increasing trends (149 Mha, $p < 0.05$) were Cerrado (33.8 Mha), Llanos (13.3 Mha) and Humid Chaco (7 Mha), while the areas with decreasing trends (91.8 Mha, $p < 0.05$) were Dry Chaco (9.2 Mha), Cerrado (8.6 Mha) and Boreal Shield (8.3 Mha). Spatial identification of natural vegetation change trends post-fires is a fundamental step to implement strategies and public policies to ensure ecological restoration. Moreover, given that the costs of restoration actions are high, governments must work together to prevent these ecosystems from burning again.

1003

SER standards put into practice to raise the bar on tallgrass prairie restoration using organic methods to enhance and preserve biodiversity

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Abstract

Tallgrass prairies are among the most threatened ecosystems in North America. Their restoration provides critical habitat to address our biodiversity crisis including habitat for declining pollinator populations, carbon storage to mitigate climate change, and sources for indigenous foods and medicines. Adoption of herbicide-free or organic management practices may offer opportunities to conserve existing biodiversity while enhancing restoration success in tallgrass prairie restoration projects. This project details restoration practices and lessons learned by a CERP professional utilizing practical infield applications of SER standards of practice. The project spans over a 26-year period on a 160-acre non-native agricultural pasture site in southeastern Iowa. The site was originally comprised mainly of smooth brome (*Bromus inermis*) tall fescue (*Schedonorus arundinaceus*), and Kentucky blue grass (*Poa pratensis*), a variety of agricultural weeds, and a variety of native upland sedge species. Organic practices were used to preserve the existing native species and included prescribed burning, mechanical removal of non-native species, mowing, and inter-seeding of site appropriate native species.

Monitoring results showed frequent prescribed burning lessened the density and vigor of non-native grasses and strategically timed inter-seeding of diverse native species including a diversity of native legumes were pivotal aspects of the plant community restoration dynamics. Results indicate not only was the existing biodiversity preserved, but the non-native species were nearly eliminated and plant diversity increased to 280+ native prairie species.

Outcomes of this project indicate organic management practices may raise the bar for tallgrass prairie restoration by preserving existing biodiversity and building resilience to weed invasion.

1004

Leveraging Geospatial Intelligence for Effective Forest Restoration in the Brazilian Atlantic Forest

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Abstract

Restoring the Brazilian Atlantic Forest (AF) is essential for biodiversity, carbon sequestration, and sustainability targets. This study explores the use of geospatial intelligence to improve restoration efforts through three strategies. First, it evaluates natural forest regeneration as a cost-effective method for meeting legal requirements. Using data layers and Random Forest regression models, we predicted regeneration potential and carbon sequestration, finding higher regeneration in areas with steeper slopes, native vegetation, and proximity to water. Second, the study identifies priority areas for creating and restoring Protected Areas (PA) by analyzing land use changes in PA buffer zones and carbon stocks. Findings highlight underrepresented vegetation types and the need for new protected areas to boost biodiversity and resilience. Third, the study explores voluntary mechanisms for forest restoration to improve carbon offset scenarios, integrating degradation and stagnation rates into carbon credit methodologies. We identified areas where secondary forests are stagnating, suggesting Assisted Natural Regeneration as a solution. These findings emphasize the role of advanced geospatial intelligence in prioritizing restoration, optimizing legal compliance, and enhancing ecosystem resilience in the AF.

1012

Brazilian Network Women and Girls on Ecological Restoration: building gender equality, governance and transformation

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Abstract

Brazil is one of the global leaders in ecosystem restoration, with extensive experience and efforts, as reflected in the large body of publications, initiatives and network governance. Evidence shows that collaborative governance in restoration networks is essential to scaling up restoration efforts while delivering environmental and social benefits. However, one issue that is rarely considered is how the outcomes of restoration initiatives affect different social groups, particularly women, in terms such as job opportunities and leadership positions. To discuss the gender equity gap in ecological restoration, the Nativas' Network was founded in July 2024, during a national event that gathered more than 1000 key professionals. The network has already undertaken its first action, which involved applying a questionnaire to gather insights on how gender issues are perceived by the women in the network. A total of 231 women answered the survey. Among the results, women reported having experienced moral (64%) and sexual (26%) harassment, while 40% reported suffering gender barriers on career development. These results highlight the importance of strengthening the network, to shed light on these issues and push for public policies that promote greater gender equality. The network is composed of 982 women working on restoration, representing all five Brazilian biomes. It has a structured governance, organised into a Board of Directors and Coordination Groups, discussing governance and opportunities, with the potential to expand to Latin America. However, there is an urgent need to strengthen the women's movement and create a program that encourages gender debate in organizations.

1016

Increasing the success of CRP pollinator restoration plantings in drylands

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Abstract

The Conservation Reserve Program (CRP) is a Department of Agriculture (USDA) initiative which pays to temporarily take private agricultural land out of production to improve environmental quality including creating pollinator habitat. In drylands, efficiently transitioning agricultural areas into high-quality native pollinator habitat via seed-based restoration (SBR) has been difficult and has grown more challenging with increasing frequency and severity of drought and non-native plant invasion. SBR efforts regularly fail and result in fields of invasives which provide few pollinator resources and increase wildfire risk, highlighting a clear need for innovative strategies to boost success of CRP plantings. As part of a transdisciplinary research team spanning Utah, Montana, and Colorado, we conducted coordinated research projects to identify key barriers and opportunities to support CRP SBR success. We established four treatments: a control, compost addition, strip planting of grasses and forbs, and a more diverse seed mix, with half the plots seeded in 2017 and half in 2018. Using meta-regression, we explored how the four treatments as well as climate variables and soil characteristics affected the success of seeded and invasive species establishment and survival. Results show that seeding year, monitoring year precipitation and temperature, soil type, and treatment interact to have differing effects on desired grass and forb density. The results indicate that planting multiple years to access preferred climatic conditions and with diverse species mixes may be important steps to improving success of pollinator habitat goals on CRP land in drylands of the western US.

1017

Seed source and insect herbivores interact to influence early stages of grassland plant community assemblyJayne Jonas

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Abstract

Locally adapted seed is often used in grassland restoration as these propagules are likely to be best adapted to the biotic and abiotic conditions of the site. However, the “local is best” paradigm may not be adequate with continuing shifts in climate and increasing scale at which native seed for restoration is needed. If source populations (local vs non-local) differ in their match to abiotic conditions or interactions with local insect herbivores, then seed sourcing decisions may directly or indirectly affect patterns of plant establishment and lead to alternative trajectories of assembly over time. A pilot greenhouse study examined the effects of local (Nebraska) grasshopper herbivores on early plant community development in mesocosms established using seed from local (Nebraska) and non-local (Texas) populations of the same six native plant species. An admixture using seed from both local and non-local plant populations was also tested. Primary production in admixtures was higher than local-only mesocosms when protected from herbivory. Grasshoppers decreased plant production in both non-local and admixed mesocosms, but not in local plant mesocosms. Similarly, grasshoppers led to large shifts in plant community composition in non-local and admixed mesocosms with little impact on mesocosms established using only local seed. These results suggest that seed sourced from areas within a species range representative of anticipated future climate may have the potential to perform better than locally adapted seed, but grassland restoration outcomes may be affected in novel ways due to local biotic interactions, such as those associated with insect herbivory.

1021

Using Nature Based Solutions to Safeguard Critical Infrastructure in San Francisco Bay; Successes and Challenges

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Abstract

The 400-mile shoreline of San Francisco Bay is highly vulnerable to sea level rise. Critical infrastructure, vulnerable populations, and ecosystems are already experiencing significant impacts throughout California. We will discuss successes and challenges to using nature-based solutions to safeguard critical infrastructure at the West Bay Sanitary District's Ecotone Slope/Living Shoreline Project. The District's flow equalization and resource recovery facility built in the 1950s is surrounded by levees lower than the FEMA floodplain elevation, failing to protect the facility from high tides or sea level rise. The District's levee project design has incorporated nature-based solutions including an ecotone slope/living shoreline and tidal salt marsh restoration. Additionally, innovative Oyster Catcher reef structures are being used for the first time in San Francisco Bay. Robust monitoring of all natural systems incorporated into the design will occur for 10 years through collaboration with Bay Area regulators and NFWF and will incorporate innovative drone technology, hydrology data loggers, and other monitoring efficiencies. Our nature-based approach aims to reinforce regional, national, and global climate change resiliency and biodiversity goals by mitigating the impact of coastal flooding and risk to key infrastructure while preserving and enhancing the habitat functions and values of coastal marsh habitat through decades of sea level rise. Our discussion will focus on successes and challenges of building this project, including navigating regulatory challenges in permitting nature-based solution, seasonal constraints, and scheduling issues associated with grant funding and permit requirements.

1023

Preparing for urgent and effective landscape-scale restoration of Southwest Florida's coastline in the face of global climate change.Chad Washburn

The Center for Nature-Based Solutions at Naples Botanical Garden, Naples, FL, USA

Abstract

Coastal resilience is one of Southwest Florida's greatest challenges in the face of rapid urbanization and increasing intensity of storms and hurricanes. Most recently, Hurricane Ian (2022) brought as much as 4.2 meters of storm surge to the region, nearly completely decimating beach dunes across multiple counties. These beaches and their dunes act as both the protective barrier for most of the region's urban areas and the primary driver of the region's tourism-based society and economy. A resilient coast is vital to the region's social and economic resiliency in the face of climate change.

With more than 160 kilometers of coastline devastated by storm and ebb surge, the region faces the challenging task of restoring dunes on a landscape scale. Current regional restoration practices are ineffective and limited to beach renourishment, building unvegetated dunes, or planting monocultures of grasses and trees. In addition, the region lacks a supply of the native plants necessary to restore resiliency to coastal ecosystems.

In 2018, Naples Botanical Garden (Florida) began preparing to face the challenges of restoring Southwest Florida's coastline. The goal of this work is to change ineffective restoration practices and develop the pipeline of native local plant species necessary to bring resiliency to a restored coastline. These efforts have resulted in positive changes to restoration practices across the region and a greater availability of native plant species. This work requires collaborative partnerships across research disciplines, developing relationships with native plant nurseries, and communicating openly with regional municipalities to effect change in practices.

1026

Prioritizing Restoration Areas in Malawi: A Nature-Based Solutions Approach to Address Land Degradation

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Abstract

Malawi, a least developed country, faces significant challenges from land degradation and climate change, threatening agricultural productivity, biodiversity, and community resilience. To support effective restoration planning and implementation, an update of the degradation and restoration opportunity maps within Malawi's National Landscape Restoration Strategy was conducted.

The methodology included a national stocktaking exercise to locate and quantify ongoing restoration projects, a multi-criteria geospatial analysis to assess degradation trends compared to 2017, and ground-truthing via drones in 42 priority areas. Restoration priority areas were identified using GIS overlay analysis and participatory mapping with district forest and land officers, restoration practitioners, and development partners.

The resulting maps provide critical insights into current restoration project locations, degradation hotspots, and priority areas for intervention. This analysis enhances the targeting of restoration investments for greater efficiency and impact. A key finding is that many projects operate within the same areas, underscoring the need for better coordination to optimize resources, reduce community fatigue, and expand restoration to highly degraded regions.

By integrating spatial data with local expertise, this approach strengthens decision-making for landscape restoration, fostering collaborative, data-driven planning. Findings emphasize the importance of coordinated action among government agencies, financiers, NGOs, and other restoration stakeholders to maximize investments, restoration impact on ecosystem services, and build community resilience. This study offers a replicable model for other countries seeking to align national restoration efforts with global commitments to reduce land degradation and increase restoration and biodiversity conservation and climate resilience.

1028

Multi-stakeholder collaboration for a restored and resilient public parkJessica Cañizares, Timothy Clark, Eli Terris

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Abstract

The Nature Conservancy in Connecticut (TNC) has secured a \$4M grant through NOAA's Transformational Habitat and Coastal Resilience Grant to design improvements at Rocky Neck State Park (RNSP) in East Lyme, CT. RNSP is home to exemplary recreational features and ecological systems. Running the length of the park is Bride Brook, a tidally influenced watercourse that supports the largest run of anadromous alewife in Connecticut, dozens of other important fish species, and 82 acres of tidal marsh. The planning goals of the project are to 1) re-establish full tidal connectivity between Bride Brook and Long Island Sound, 2) implement large-scale, climate-resilient marsh restoration, and 3) improve public access and enhance recreational opportunities. Although the restoration of the Bride Brook estuary has been a high priority for decades, the funding available in the past only supported disparate efforts and not the holistic estuary-scale vision of the current project. The development of the proposal was – and the project continues to be – significantly shaped by the support and recommendations of a range of stakeholders. The project team is comprised of leaders from TNC, the State of Connecticut, and NOAA staff as well as many NGO, federal agency, and municipal partners, and Amtrak. A series of public workshops over the life of the project will ensure co-development of the project design, with a focus on community needs and priorities. The project's innovative approaches to multi-stakeholder collaboration encourages creative solutions and a shared vision for the future of this important public resource.

1032

Restoration Efforts That Improve Bank Stability for the Alligator Snapping Turtle

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Abstract

The Alligator Snapping Turtle (*Macrochelys temminckii*), currently proposed for listing under the Endangered Species Act, depends on stable riparian habitats for nesting and foraging. However, urbanization along Buffalo Bayou in Houston, Texas, has led to significant habitat degradation, including steep, eroded banks (50°–90° angles) and invasive species encroachment. These conditions limit access to suitable nesting areas, potentially impacting population viability. To address these challenges, we applied adaptive management strategies focusing on invasive species removal and bank stabilization. Targeted mechanical and chemical treatments were used to control dominant invasive species, including *Megathyrsus maximus*, *Ambrosia trifida*, *Melia azedarach*, and *Arundo donax*. In March 2022, we established 64 permanent plots (100 m²) to monitor habitat recovery in an 11-acre riparian restoration area adjacent to Buffalo Bayou. Over a two-year study period, native willow stakes (*Salix spp.*) and native grasses were planted to improve bank stability, enhance vegetative cover, and restore ecosystem function. Results indicate a significant reduction of invasive species by over 60%, leading to improved habitat conditions for nesting turtles. These findings provide valuable data for land management agencies at the local, state, and federal levels working to conserve *M. temminckii* in urban riparian systems. Restoring native vegetation and stabilizing banks are crucial steps in ensuring the long-term viability of this species, highlighting the role of ecological restoration in mitigating urban habitat degradation.

1034

Working together for resilient cities: Woody seedlings are facilitated by surrounding herbaceous cover in an urban restoration site

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Abstract

In urban restoration sites, planted woody seedlings suffer from browsing by high densities of mammalian herbivores, including urbanized deer. While herbaceous cover competes with woody seedlings for light and nutrients, it also shelters seedlings from browsing, thus facilitating the establishment of planted trees. Here, we present four years of monitoring a cohort of native tree seedlings planted by SER Student Association members as part of an urban riparian forest restoration project along the Olentangy River in Columbus, Ohio.

We mapped 648 seedlings of twelve native tree species planted in 2019 within a 0.5ha region of floodplain forest. Each subsequent autumn, for each seedling, we measured occurrence of mammalian herbivory, percent cover of herbaceous vegetation at the height of the plant, and performance (end-of-growing-season height + within-season growth).

Higher herbaceous cover reduced the probability of mammalian herbivory on planted seedlings, which also correlated with significantly increased annual growth and probability of survival. Seedling survival in the first year and growth in all years were positively associated with increased herbaceous cover. The effect sizes of increases in growth associated with herbaceous cover increased over subsequent years.

Taken together, these results demonstrate sustained and increasing benefits of herbaceous cover for native tree plantings, potentially through improved resistance to first-year transplant shock and subsequent reduction in herbivory pressure.

1036

Mossy medics: employing fire-moss pill capsules as first responders in post-fire soil restorationBenjamin Covington, Matthew Bowker, Anita Antoninka, Peter Fule

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Abstract

Forest management practices and climate change have resulted in more frequent fire and higher intensity fires in southwestern North America. Damage to the soil microbial community and decreased resistance to erosion associated with high severity burns often results in low vascular plant establishment success. Conversely, some moss species, often referred to as 'fire mosses', are often identified as high abundance early colonizers of severely burned soils. Naturally occurring fire mosses have been shown to improve characteristics of topsoil stability and the microbial community of soils affected by high intensity wildfire. We aim to leverage this phenomenon to improve soil quality immediately post fire by developing low-cost technologies that reestablish native fire mosses post fire using greenhouse cultivated inoculum. Currently, we are monitoring a recently installed experiment to quantify establishment of the three fire moss species, *Bryum argenteum*, *Funaria hygrometrica*, and *Ceratodon purpureus* via inoculum filled pill capsules in plots in two nearby but micro-climatically distinct sites within the Preacher Fire burn scar in the Tonto National Forest near Payson, Arizona. We will identify effects of topography and climate on encapsulated inoculum establishment and, in turn, the effect of moss establishment on characteristics of soil health, microbial community, and erosion.

1040

IT Rolls Downhill along Big Dry Creek... How a massive sanitary project became the catalyst for restoration of over a mile of creek corridor

Derek Updegrove

USA

Abstract

When the Big Dry Creek Interceptor Sewer (BDCIS) project required an enormous construction effort to expand and move the piping system in Westminster City Park, the City and the Mile High Flood District (MHFD) saw the time to combined funding and address long-standing stream bank erosion and protect this new infrastructure. But as the project developed and new stakeholders and experts were added to the team, it evolved into a precedent for resilient corridor planning.

From its headwaters tucked behind the Flat Irons, Big Dry Creek travels through front-range towns, serving as a vital corridor for recreation and the natural community. It serves as important waypoints for migrating birds, and links local ecosystems in an urbanizing region. Along the corridor, rampant suburban development has led to increased runoff, large-scale erosion, sediment-filled water, and ecological degradation.

The BDCIS team was tasked with expanding the pipes and shifting the new system out of harm's way. The creek restoration team was tasked with stabilizing the channel and optimizing natural systems to accommodate additional stream length and sinuosity. Why not leverage the efforts of both teams and maximize the projects' full potential? Through a collaborative effort between the city and the MHFD, the design team set forth acting deliberately and adding experts throughout the design process; landscape architects and engineers maximize preservation and long-term stability, an insect zoo nonprofit assists in a pollinator highway design, and ecologists, present even through construction, adapt seed mixes and consult on transplants. Collaboration runs along Big Dry Creek.

1042

Embracing Adaptive Management to Enhance Resilience in Reef Restoration Programs

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Abstract

Coral Restoration Foundation (CRF) has been actively restoring Florida's Coral Reef for over 17 years and has continuously evolved its approach to different aspects of restoration by adapting to predictable and unforeseen challenge. Adaptive management for ever-changing situations is vital in coral reef restoration, further enhancing resilience against disturbances while also ensuring a continuum in reef restoration efforts. Here we discuss multiple situations where CRF has implemented adaptive management techniques through various stages of the restoration process.

Within in-situ nursery settings, CRF has used multiple iterations of adaptations to the original Coral Tree to increase coral capacity within the structure without increasing the number of structures in the nursery and limit biofouling. Most recently, CRF has incorporated ex-situ genetic banking in addition to housing genetic diversity within in-situ nurseries to build redundancy in preparation for future disturbance events. To remain a leader for coral restoration outplanting techniques, CRF has trialed many techniques and has recently adapted outplanting efforts to use an applied nucleation approach using many coral species in the same restoration area.

CRF has embraced new knowledge from other practitioners, gained information from firsthand experience, and altered initial planning to achieve our goals. CRF has found that adaptive management characterized by flexibility, ongoing learning, and the integration of scientific research, is important in reef restoration. In addition, we have seen successful recovery in coral nurseries following significant disturbance events that offers hope for continued reef restoration.

1046

Integrating Nature in Agriculture: Habitat Restoration for Resilient Agrosilvopastoral Ecosystems

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²

Abstract

Traditional Mediterranean agroecosystems once supported a diverse landscape with multiple land uses. However, the expansion of monocultures and land-use changes, such as intensification and abandonment, have led to habitat loss, fragmentation, and landscape homogenization. The Montado, a characteristic agrosilvopastoral system in Southern Europe, dominated by cork and holm oak trees.

This study explores the ecological restoration of small natural habitat patches and corridors within the Montado to enhance biodiversity and improve landscape connectivity. By restoring remnant habitats—such as Mediterranean woodlands, riparian galleries, ponds, and rocky outcrops—we aimed to create stepping stones for species movement and ecosystem functionality. The project, implemented in two pilot areas, focused on three key actions: (1) improving soil quality through direct seeding of resilient perennial pastures, mulching trials, and runoff stabilization; (2) restoring and conserving natural habitats within the Natura 2000 Network; and (3) enhancing connectivity by restoring ecological corridors and planting multifunctional native hedgerows.

Our results indicate that small-scale habitat restoration significantly contributes to biodiversity conservation, ecosystem services, and long-term agricultural sustainability. Furthermore, to ensure financial viability and scalability, we are piloting a results-based payment scheme. This integrated approach demonstrates how habitat restoration can promote both ecological resilience and economic sustainability, offering a model for biodiversity-friendly agricultural landscapes.

1049

Revisiting alternative states and positive feedbacks in restoration

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Abstract

Understanding the temporal trajectory of recovery in natural systems is important in a variety of contexts, from identifying constraints on community assembly, to informing what to expect if a system is allowed to recover unassisted, to understanding how species invasion or past landuse may make a system stuck in an undesirable state. In a review published in *Trends in Ecology and Evolution* over two decades ago, we (KNS, KG) presented a framework based on models of alternative ecosystem states that incorporated system thresholds and feedbacks, asserting that they can be applied to the dynamics of recovery in degraded systems and assist to identify, prioritize and address constraints in restoration. This assertion has a rich history in the literature, both preceding and following that publication.

Nevertheless, restoration research and practice in this area has grown considerably: there is much more work comparing long-term recovery in actively restored sites to those where passive recovery was allowed to run its course, and there is greater awareness of the need to incorporate current environmental threats, such as climate change, repeated or compound disturbance, and extreme events, into restoration. Here, by utilizing studies that document temporal recovery in a comparative framework, we examine alternative states and feedbacks in this new light, arguing that taking internal controls into account remains very important to identify and address feedbacks but also that environmental change can shift these internal controls and change threshold dynamics. We end by suggesting ways interventions aimed to break feedbacks can incorporate these additional considerations.

1053

The significant naturalization of invasive fanwort and it's possible implication for ecological restoration

Nicholas Weissflog, Eric Sager, Thomas Whillans

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Abstract

Invasive species management is a common component of ecological restoration. Species naturalization, or ecological integration of a new species into an ecosystem previously unknown to it, is a phenomenon that is rarely considered in invasive species management planning. We conducted a study of the introduced aquatic plant species fanwort (*Cabomba caroliniana*) populations in Katchewanog Lake, Ontario in 2022 to assess the degree to which fanwort had integrated into the lake ecosystem. Vegetation and benthic macroinvertebrate communities were sampled in six bays previously sampled in 2008 to assess the impact of fanwort on the lake ecosystem (Reid et al., 2009). Of the six bays, three had fanwort in 2008 and three did not. We found that macrophyte species diversity had returned to near pre-invasion reference levels in the bays that had fanwort in 2008 despite fanwort remaining widespread within those bays. In those same bays, fanwort biomass had declined by 67.8% on average and fanwort proportion of macrophyte community biomass had declined by 44.2% on average. Benthic macroinvertebrate community composition was not observably changed by the presence of fanwort based on the metrics used in this study. These results suggest that fanwort has significantly naturalized in Katchewanog lake within ~15-20 years of ecosystem residency time to the extent that it no longer appears to be causing significant ecological impacts. These results are not well explained by the most cited frameworks for the process of invasion and, consequently, this phenomenon goes completely unconsidered in ecological restoration planning and unstudied in restoration ecology.

1054

Art as Catalyst: Evoking Emotion & Empathy through Creativity to Inspire Restoration & Stewardship

Dawn "Cricket" Desmarais

Key West, Florida, USA

Abstract

Facts and figures inform, but emotion moves people to act. By evoking empathy, wonder, and urgency—feelings often missing from scientific data alone, art can make the invisible visible, transforming abstract threats like coral bleaching, overfishing, and habitat loss into vivid, visceral experiences that resonate deeply with the public.

This presentation explores how art serves as a catalyst for marine restoration. By highlighting global examples—from haunting underwater sculptures that become artificial reefs to community-driven murals illustrating marine biodiversity—this presentation demonstrates how creative expression can galvanize stewardship. I will also share my own work, which merges art and advocacy to inspire connection, responsibility, and hope for ocean conservation.

Through carefully curated video clips, attendees will witness how artistic interventions have not only captured attention but also sparked grassroots movements, influenced policy, and supported marine restoration initiatives.

It will also offer suggestions on how communities can scale these creative communication efforts locally.

Ultimately, this presentation underscores that while science provides the knowledge, art touches the heart and is where lasting change can begin.

1061

The removal of invasive woodland leads to the recovery of riparian communities and their mycorrhizal counterparts

David Banuelas

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Abstract

The Brazilian pepper tree (*Schinus terebinthifolius*) is an invasive species that requires significant disturbance to eradicate. Previous studies have identified associations between the Brazilian pepper tree and ectomycorrhizal fungi (EMF). However, limited research has explored the connection between disturbance from removal and the effect on EMF. This study investigated the sensitivity of EMF and the broader fungal community to the full and selective removal of the Brazilian pepper tree. During the selective removal of Brazilian pepper tree, we examined the mycorrhizal community of the Arroyo willow (*Salix lasiolepis*) to assess the influence of the restoration disturbance on native species. We used ITS2 sequencing to identify the EMF present during the restoration. Our expectation was that both removal efforts would reduce the presence of EMF. Contrary to our predictions, full removal increased EMF richness and relative abundance in the soil. As anticipated, selective removal reduced the richness and relative abundance of EMF associated with soil. Selective removal led to a decrease in the richness of EMF in arroyo willow roots with no effect on relative abundance. Moreover, fungal community composition in soil and roots shifted significantly during selective and full removal. However, the community composition of EMF, specifically, remained constant across treatment types. During full removal efforts, the application of organic soil amendments may have contributed to the increase in the diversity and relative abundance of EMF. Selective removal will require additional measures, such as soil amendments, to curtail the loss of EMF.

1066

Assessing hydrologic and pollutant load reduction benefits of peatland restoration in Minnesota, USAChristian Lenhart

University of Minnesota, Department of Bioproducts & Biosystems Engineering, St. Paul, MN, USA. The Nature Conservancy, Minneapolis, MN, USA

Abstract

Peatland restoration provides many ecological benefits including restoration of pre-drainage water levels, mitigation of carbon dioxide emissions and support for rare wildlife species. However, formation of methyl mercury (MeHg) and potential increased load downstream are key problems in Minnesota's restored peatlands. Since 2023 we have been investigating the impacts of hydrologic restoration of drained peatlands at restored, ditched and "natural" sites to better understand changes to hydrology, MeHg concentrations and total downstream load. The restoration of Sax-Zim bog raised water levels, retaining water behind the blocked ditches. Our research is addressing two main questions 1) How does restoration affect mercury concentrations? 2) How does restoration affect the water balance and total load of MeHg? We collected biweekly water samples and some stormwater events and monitored streamflow at fixed outlet points. We found that total mercury levels were similar at all sites. However, MeHg was significantly higher at the restored site, at 5 times the control (natural site). Streamflow from the outlets were different with the restored site having a more perennial flow and total loading of MeHg 6-8 times the control site. The channels are not filled so the presence of a channelized flow continues at the restored site, accelerating stream velocity and discharge, as well as the ditched site. This suggests that flow paths and the characteristics of channel flow need to be considered in peatland restoration, as well as water level. Research will continue through the end of 2026 and continue to inform peatland restoration and management practices.

1072

Prioritizing Placement Locations for Nature-Based Solutions in Dryland Watershed Restoration: A GIS Analysis in the Rio Grande Basin of New Mexico

Kaustuv Raj Neupane^{1,2}, Connie M. Maxwell¹, Robert P. Sabie¹, Alexander G. Fernald^{1,2,3}

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Abstract

Nature-based structures (NbS) such as water harvesting practices of one-rock dams and brush weirs address the coupled water and vegetation dynamics of drylands, where vegetation patches act as sinks for infiltration, and bareground as sources of runoff. However, effective installation of these structures requires analysis and expertise in identifying placement locations, and widespread adoption is hindered by limited technical capacity. Remote sensing (RS) and GIS are powerful tools for identifying restoration sites, and their use for NbS placement is now feasible due to more widely-available fine-scale DEM resolution. We propose a spatial model to prioritize NbS installation locations in a watershed using a 0.6 m Digital Elevation Model (DEM). We hypothesize that a GIS-based Analytical Hierarchy Process (AHP) can effectively prioritize sites for NbS placement as ground-truthed by restoration practitioners. In the 0.12 sq. km Rincon Arroyo watershed, which contributes to New Mexico's Rio Grande subbasin, we categorized parameters into areas of sources (slope, stream power index, sediment transport index) and sinks (topographic wetness index, NDVI, surface roughness). We classified data into five suitability classes, ranking sites from most to least suitable, and assigned pairwise comparison values and weights using AHP. Preliminary results identified key locations with 80% accuracy in a validation test as compared to practitioner-identified locations. 7 % of the land is highly suitable, typically before water forms the channel, while 23% is ideal, closer to the stream. This approach will improve watershed restoration planning in drylands by reducing field workload, enhancing replicability, and incorporating key ecohydrological characteristics.

1073

Identifying Landscape-Level Goals and Indicators to Assess Restoration Outcomes

Ella Samuel¹, Claudia Mengelt², Lief Wiechman³, Ashley Leavell⁴, Sarah Carter¹, Cameron Aldridge¹, Alisa Wade⁵

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Abstract

How can restoration programs be designed to ensure that individual projects collectively contribute to meeting landscape-level restoration goals, like improving ecological resilience? Examining outcomes across projects and scales can inform restoration program design and help maximize returns on future ecological restoration investments. The U.S. Department of the Interior (DOI) designed a restoration program that facilitates collaboration across DOI bureaus responsible for land management. This program resulted in hundreds of restoration projects being implemented across the United States. To assess outcomes of this historic restoration initiative, we are developing a framework to synthesize landscape-level restoration goals across jurisdictional boundaries and to pair those goals with associated indicators, metrics, and measures. We are gathering information on landscape-level goals in the sagebrush and grassland biomes through analyzing existing resource management documents, like conservation plans and strategies. We are using the Society for Ecological Restoration's Five-Star System and Ecological Recovery Wheel to identify relevant indicators for assessing progress towards those landscape-level goals. This presentation will report on progress to date and lessons learned from this multi-agency, highly collaborative effort. We hope that the resulting framework, developed using objective, repeatable methods for identifying landscape-level goals and indicators, can help inform the design of future broadscale restoration programs. This project supports two key goals of the UN Decade on Ecosystem Restoration – to showcase economic returns from restoration and to synthesize lessons learned from ecosystem restoration initiatives.

1083

Engaging the offshore wind industry in restoration: Integrating oyster reef restoration into offshore wind construction in Europe

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Abstract

At its simplest restoring an oyster reef is the reverse of overfishing. First a reef base is required. If the system is larvae limited oysters are then added to build the breeding population to provide future recruitment. Building the reef base is increasingly using rock, and is the most expensive component of large-scale oyster reef restoration. In the North Sea there is a unique set of circumstances. Recent work has demonstrated that oyster reefs were a major structuring habitat throughout the system. The construction of offshore wind is occurring throughout the region and has accelerated in recent years. In a relatively shallow and high energy system like the North Sea infrastructure that connects with the sea floor needs to be protected using rock 'scour protection'. Hence the offshore wind industry is installing the most expensive component of oyster reef restoration, in areas historically occupied by oyster reef, at a scale that is unprecedented in the history of marine habitat restoration.

Remote setting is a technique that has been used in oyster reef restoration in the US for decades, however, it is relatively new to other geographies. Recently, The Nature Conservancy and partners have been demonstrating this technique in oyster reef restoration beyond the US. In the North Sea we are now adapting remote setting techniques to using 20-foot shipping containers as the setting unit to facilitate the use of rock with oysters 'pre-loaded' during offshore wind construction. The process and potential of this work will be described.

1154

Identifying dust sources and dust transport mechanisms contributing to dust-on-snow events in the Rocky Mountains: implications for management and restoration

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Abstract

Every year dust transported from regionally active dust sources in the US Southwest results in multiple dust-on-snow events in the Rocky Mountains. Dust-on-snow is a growing concern for resource managers because it significantly changes the life cycle of snow, accelerates snowmelt, and alters the hydrologic cycle of the Colorado River and Rio Grande Basins, affecting regional agriculture, ecosystems, and more than 40 million people living in the Southwest. Studies have shown that dust-on-snow radiative forcing influences snowmelt more than increasing air temperatures. As a result, identifying regionally active dust sources and mechanisms of dust transport to snowpack are important to mitigate negative impacts and support water resource management across the Southwest where communities and agriculture face critical water shortages. However, most research has focused on impacts to snowmelt timing and down-basin effects, and models are yet to capture the complete life cycle of dust on snow, including dust emissions and transport. This is a critical knowledge gap the scientific community needs to address to provide early warnings to water resource managers. Here, we present highlights of our ongoing research seeking to understand dust source dynamics and dust transport mechanisms—critical components for dust-on-snow modeling. We show how available datasets and tools, including the Rangeland Analysis Platform, Weather Research and Forecasting with Chemistry Model, and the Aeolian EROsion (AERO) model can be used to identify dust sources contributing to dust-on-snow and provide critical information to support restoration efforts to mitigate dust emissions and dust impacts on regional hydrology and agriculture.

1210

Assisted coral propagation in developing circular economy to support sustainable coral reef rehabilitation

Rita Rachmawati¹, Leigh Peters², Mark Funnell³, Ofri Johan¹, Michael Sweet²

¹Research Center for Conservation of Marine and Inland Water Resources, National Research and Innovation Agency, Cibinong, West Java, Indonesia. ²University of Derby, Derby, United Kingdom. ³University of Leicester, Leicester, United Kingdom

Abstract

Coral reefs, critical to marine biodiversity and economic stability in countries like Indonesia, are experiencing unprecedented declines due to anthropogenic pressures and climate change. This concept introduces a circular economy model for coral restoration, aiming to transform reef conservation into a self-sustaining system that integrates ecological restoration with economic development. By applying circular economy principles, the model proposes revenue-generating activities, such as sustainable coral aquaculture, that fund ongoing restoration efforts. The framework involves community engagement, advanced coral propagation techniques, and partnerships with local and global stakeholders to create a regenerative economy for coral ecosystems. Preliminary financial models suggest that such initiatives could restore ecological integrity and enhance economic opportunities for local communities, ensuring long-term sustainability. This study examines the potential of the circular economy approach to mitigate coral reef degradation while fostering economic resilience, offering a scalable and replicable model for global reef conservation efforts. An initial 3-year circular economy regeneration model will be implemented at three different sites in Indonesia in 2025, providing key data and information to assess the effectiveness of the coral reef circular economy framework.

1227

The Revegetation Playbook: A Producer's Guide for Ecologically Viable & Economically Capable Dryland RestorationMadeline Wilson

CSU SLV Area Extension, Monte Vista, CO, USA

Abstract

The San Luis Valley (SLV) contributes 40% to Colorado's agricultural GDP and is heavily dependent on groundwater for cash crop production. The SLV is facing a state mandated deadline to replenish its overdrawn unconfined aquifer by 2031, or risk significant well curtailment and retirement of between 40,000 and 100,000 irrigated acres. The Revegetation Playbook offers if-this-then-that strategies for landowners navigating the transition from irrigated, annual systems to dryland, perennial systems with emphasis on ecologically viable, economically capable outcomes. The Playbook offers scenarios for plant species selection, soil preparation, planting methods, and long-term maintenance, alongside enterprise analyses for various dryland uses that allow for alternative production.

Acceptance type: Poster

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Applying Nature-Based Solutions (NBS) to restore mountain biodiversity and ecosystems in AfricaMohammed Sghir TALEB

Institut Scientifique, Rabat, Morocco

Abstract

Africa mountains cover an estimated 3 million Km². Approximately half of African countries have mountains higher than 2000 m.

Africa mountains are home to significant richness in biodiversity and ecosystems (8 of the world's 34 biodiversity hotspots are in Africa (including Morocco)).

This richness is currently subject to many natural (climate change, erosion etc.) and anthropogenic (deforestation, overgrazing etc.) pressures. To overcome this problem of degradation and loss of biodiversity, many actions have been carried out in Africa taking into account Nature-based Solutions approach. Thus, Africa is applying Nature-Based Solutions (NbS) tools in mountain biodiversity and ecosystems for restoring ecosystem, conserving biodiversity and ecosystem services and for combating desertification and mitigating the effects of climate change.

This work will be focused on how Africa draw inspiration from nature to implement transformative change through restauration actions for the conservation and sustainable management and use of mountain biodiversity and ecosystem services for human well-being and to achieve the 2050 vision "Living in harmony with nature".

Key words: Mountain, biodiversity, ecosystem, Nature based Solutions, restauration, Africa

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Charge what you are worth and what is needed. Deliver healthy native ecosystems.Jack Pizzo

Pizzo Group, Leland, Illinois, USA

Abstract

Healthy native ecosystems are the cornerstone of ecological balance and biodiversity. However, many restoration projects are constrained by budgets that prioritize cost over quality, leading to compromised outcomes. In an effort to meet financial goals or cater entirely to customer demands, some practitioners in the ecological restoration industry cut corners, resulting in ineffective or unsustainable results.

This trend undermines the integrity of restoration efforts and fails to deliver the robust, thriving ecosystems needed to combat environmental challenges. As professionals, we have a responsibility to prioritize quality and advocate for adequate resources to ensure meaningful, lasting impacts. By committing to higher standards and pushing back against insufficient budgets, the industry can elevate its practices and fulfill its mission of restoring ecosystems to health and resilience.

Now is the time to do better—because the health of our ecosystems, and the future they sustain, depends on it.

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Conservation Implications of the Resource Matrix of Maya Forest at the Ancient Maya City of El Pilar

Anabel Ford

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Exploring Solutions Past, Exploring Solutions Past, CA, USA

Abstract

The traditional Maya milpa forest garden is an asynchronous c.20-year field to regenerative forest cycle that is based on the opening of a “milpa” field to cultivate annual plants for approximately four years to manage the regeneration towards a useful mature forest of 16-year succession. The mosaic of horizontal and vertical habitats offers the continual availability of household products focused on food, yet providing all needs including construction materials, household items, medicine, and animal habitat. The maligned slashing and burning is a highly managed asynchronous strategy for opening fields that simultaneously reduce fuel load and fire hazards.

Practiced over millennia by Maya peoples, a wide range of vital resources in both shaded and sunny environments have been identified in archaeological contexts and in contemporary use. Employing Lidar at the Maya civic center of El Pilar, we have been able to model the milpa forest garden cycle to visualize the landscape that provided the plants and animals that sustained the ancient and contemporary Maya. In collaboration with Master forest gardeners and informed by their vast Traditional Ecological Knowledge, our spatial and temporal approximation pictures the resources in terms of cultivated open, regenerating, and mature spaces that provisioned the Maya with their daily needs of food and housing. This poster explores sustainability and demonstrates the enduring cultivated capital of the natural resources of the Maya Forest.

Promoting Ecosystem Restoration in Bangladesh: A Vision for Sustainable Development and Climate Action

Bidhan Chandra Pal

Probha Aurora, Dhaka, Dhaka, Bangladesh

Abstract

Bangladesh, with its unique geography, faces significant challenges in ecosystem restoration. As the seventh most vulnerable country to climate change, there is a pressing need to integrate restoration into daily practices and policies. The combined effects of natural factors and unsustainable human activities have led to severe environmental degradation, making restoration essential.

Probha Aurora has pioneered restoration initiatives in Bangladesh through collaborations with organizations like FEE, implementing programs such as Eco-Schools, YRE, and Green Key. Programs like UNEP's Tide Turners Plastic Challenge and KOICA-supported Guardians of Dhaka further support these efforts.

Under the leadership of Probha Aurora's Founder and Managing Director, work is underway to establish a Restoration School cum Museum. This innovative institution will serve as both a Restoration Knowledge Hub and a museum, showcasing global restoration practices and inspiring future generations.

This extraordinary initiative is a crucial step toward addressing climate change and promoting sustainable development, with significant implications for both Bangladesh and South Asia.

Leaf morphology and stable isotope ratios of carbon/nitrogen in *Acacia senegal* (L.) Wild trees vary with climate at the geographic origin and ploidy level

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Abstract

Leaf morphology and ploidy level can influence plants' ability to adapt to climatic conditions. Here we study *Acacia senegal* that has multiple ploidy levels and grows across a geographic range of mainly dry environments. We test if and how ploidy level and climate at the site of origin influence leaf shape and ratios of stable carbon and nitrogen isotopes of *A. senegal*. The study is based on leaves collected from 225 *A. senegal* trees representing 16 populations across the species range, grown in a common garden trial in Senegal. Leaf morphological parameters were measured, and ploidy level, total leaf nitrogen (N), carbon isotope ratios ($\delta^{13}\text{C}$) and nitrogen isotope ratios ($\delta^{15}\text{N}$) were determined. Three levels of ploidy were found, namely diploid, triploid and tetraploid, but at highly different frequencies among the 16 origins. Leaf morphology varied significantly among both geographic origins and ploidy levels, with especially triploid trees having distinct leaf shapes. Tetraploids displayed high $\delta^{13}\text{C}$ and low $\delta^{15}\text{N}$ values compared to diploids. For diploids, leaf length and number of leaflets were correlated with precipitation and latitude, respectively. Leaf morphology and isotopic discrimination in *A. senegal* vary according to ploidy level and geographic origin. Our analysis suggests that the differences likely reflect adaptation to different environments, but the patterns tend to differ between diploids and tetraploids.

The restoration of forest landscapes and degraded lands, biodiversity conservation, combating climate change and desertification with the planting of caterpillar host trees in the BOMBWANZA.

Fidèle MBILIZI MUTIMANWA

GOMA

Abstract

The country's current state of play on climate change is fundamentally based on the results of work in which we have played a very active part, both with the general public in the field, and as a scholar in this field at several specialized scientific meetings.

We are therefore convinced that the national self-assessment of the capacities to be strengthened in this field will be all the more significantly credible. The community forests of the BATWA indigenous peoples are irrationally exploited firstly for agricultural purposes, with forest wastelands that do not last more than three years, and secondly for timber production by the local communities in the villages targeted by the project.

The project's mission was to build the capacity of indigenous Pygmy peoples and local communities in the fields of reforestation and restoration of forest landscapes, degraded lands and biodiversity conservation through edible caterpillar host trees in these degraded areas, so that after a record 2 years they can reap the multiple benefits linked to climate improvement and soil fertility, on the one hand; and biodiversity restoration and conservation, on the other.

As mentioned in the summary above, there are currently a number of environmental problems linked to climate change, deforestation and degradation of forests and land, and the loss of biodiversity in the Ingende site, all of which are having a negative impact on people's daily lives.

Implementing marine nearshore restoration on residential waterfronts through social marketing: A Shore Friendly success story connecting communities, process-based restoration, novel funding sources, and strategic partnerships

Mary Krauszer

Pierce Conservation District, Puyallup, Washington, USA

Abstract

Hardening shorelines are a threat to critical nearshore fish habitat in our shared marine waters. But most of the shorelines of Puget Sound, Washington, USA are in private ownership. Puget Sound is the second largest estuary in the contiguous United States and over 57% of its shoreline is in residential ownership. With shorelines *and* tidelands under private ownership in Washington, waterfront homeowners must be part of the conversation to restore for our imperiled nearshore habitats.

Our poster tells the story of a shoreline armor removal and habitat restoration project that originated through a social marketing campaign and capitalized on partnerships and strategic funding to restore high-priority nearshore fish habitat by connecting with private waterfront homeowners with process-based restoration.

The project will restore 700 feet of shoreline to a natural state, allowing full restoration of nearshore processes. As sea levels rise, the shoreline will be able to migrate landward and continue to provide upper beach fish habitat as nearby armored beaches are lost to coastal squeeze.

Strategic partnerships with the Washington Department of Fish and Wildlife's Shore Friendly Program and Great Peninsula Conservancy land trust – as well as the private landowners – have made this restoration effort possible.

The project is receiving a mix of local, state, and federal funding. We are using non-traditional sources, such as state oil spill fees, federal coastal eelgrass funding, and local flood control dollars to support this multi-benefit project. From floods, to eelgrass, to fish, funding priorities intersect to move this nearshore restoration forward.

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Stewardship Legacies and the Maintenance of Ecosystem Services and Biodiversity in Threatened Prairie-Oak Landscapes

Emily Hamant¹, Amanda Rodewald¹, Peter Arcese²

¹Cornell University, Ithaca, New York, USA. ²University of British Columbia, Vancouver, BC, Canada

Abstract

Historically maintained by Indigenous stewardship, prairie oak ecosystems of the Pacific Northwest are now among the most threatened ecosystems in North America, with <5% of their original extent remaining due to development, agriculture, invasive species, and altered fire regimes. Among the species negatively impacted by these changes is the iconic tree, *Arbutus* (*Arbutus menziesii*), which is an important source of nectar, pollen, and fruit for and may attract pollinators and seed dispersers that maintain culturally-significant plants. We evaluated how resources provided by *Arbutus*, along with and the species utilizing them, vary across environmental, landscape, and stewardship gradients throughout the Gulf Islands of British Columbia, Canada. We also quantified the spillover pollination benefits of *Arbutus* to other species and examined the extent to which the abundance, dominance, and health of *Arbutus* predicts the richness and abundance of bird and wildflower communities. These results are expected to guide agency, NGO, and community-led efforts to restore prairie-oak systems and conserve species-at-risk and will help to integrate Indigenous Ecological Knowledge and collaborative management with Indigenous Peoples.

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Nature's Comeback: Habitat Creation and Stormwater Infrastructure in Urban Renewal

Lindsey Carle, Casey-Lee Bastien

Worcester, MA

Abstract

In the heart of Athol, MA is 6-acres of undifferentiated parking and cut-through access framed by commercial, residential, industrial, and institutional buildings. This former industrial mill town is a vulnerable environmental justice community and is trying to reinvent itself. Converting the Plaza from a blight into a community center was identified as an essential step for the Town to achieve their social, economic, and environmental resilience goals. The hidden truth of the Plaza is Mill Brook flowing beneath it.

By daylighting Mill Brook we can efficiently organize existing infrastructure around the new pedestrian centric space. By applying nature-based solutions we will effectively address the heat island effect, improve traffic safety, and create new community gathering space while also enhancing watershed connectivity, stormwater quality, bird and pollinator habitat, and reduce inland flooding.

Changes include centering community gathering spaces on a riparian conservation area with space for events, performances, and community gardening. This newly established open space will provide users with a way to connect with nature in the urban context.

Achieving these ideals require changing the perspectives of a skeptical majority, by illustrating that proposed changes will provide an overall benefit to their community. This included convincing truckers that new traffic patterns are practical, convincing DPW staff that maintaining habitat is less work than maintaining pavement, and convincing business owners that the way customers reach them has changed, and yes there will be plenty of parking.

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Planning for a successful ecological restoration within the constraints of safeguarding critical cultural resources.

Bryan Coppede

Fairfax County Park Authority

Abstract

Fairfax County has a long anthropogenic history spanning several centuries. This has led to many sites on land managed by the Fairfax County Park Authority (FCPA) to be declared archaeologically significant. This declaration substantially limits ground disturbance on certain potential ecological restoration sites. One such restoration site sits atop the remains of an 18th century human settlement in Lorton, VA. The site, most recently an abandoned cattle pasture, has become severely degraded and is dominated by non-native invasive trees, shrubs and vines. As such, the site was chosen for an ecological restoration with the goal of an active forest restoration to an oak-hickory community type.

It was determined that ground disturbance would not be permitted due to the archeological resources, resulting in the original plan of active restoration via oak seedling planting having to be abandoned. With close collaboration between the FCPA cultural resource and natural resource branches, an alternative restoration community was chosen that will satisfy the needs and goals of both branches, protecting critical cultural resources while restoring the native vegetative community.

Significant scoping and schedule changes were required for this project due to the constraints. The original reference site and the definition of project success needed to be redefined. In this case, creative thinking and flexibility of restoration techniques has positioned the project to succeed. This collaborative effort recognizes the constraints on an ecological restoration project due to cultural resources at a site and the need for creative and adaptive planning and project development.

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Managing Legacy Effects in an Urban Forest Restoration.

Bryan Coppede

Fairfax County Park Authority, Fairfax, USA

Abstract

Fairfax County is a heavily populated region adjacent to Washington, DC, and due to intensive anthropogenic development, there are limited natural areas over 50 acres in size. Fairfax County Park Authority (FCPA) manages most of the existing intact forest in the county and is tasked with ecological restorations of degraded habitats for the benefit of both ecosystems and the surrounding community, as the public depends on these places for local access to natural areas.

One such restoration is occurring at Oakmont Park, which has a long and complex history of land use. While the goal of the site is to restore it to a high-quality oak/hickory forest, the project's starting point is comprised of at least three different existing conditions in terms of vegetative composition, all of which are heavily degraded. Prior to the site's current state, it was an open pasture, likely planted with non-native grasses and forbs. Once the pasture was abandoned, multiple invasive species colonized and flourished. Managing the project from three different degraded starting points to achieve one cohesive natural vegetation community goal will require adaptive management and multiple active ecological restoration techniques occurring concurrently.

Complex landscape legacy effects must be considered when developing scopes, schedules and budgets for projects, and in some cases, legacy effects may be constraints on a project. It is important to carefully plan restorations in urbanized areas, as community expectations must be considered in addition to ecological goals when defining project success.

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Impact of Forestry Management and Interannual Variability on Ectomycorrhizal Fungal Communities in Northern Hungarian Oak-Hornbeam Forests

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Abstract

This study aimed to investigate how various forestry practices influence the diversity and composition of ectomycorrhizal (ECM) fungal communities in an oak-hornbeam forest in northern Hungary. Soil samples were collected from 30 plots at the Pilis Forestry Systems Experiment, six and seven years after implementing different treatments including clear-cutting, gap-cutting, preparation-cutting, tree retention, and control. High-throughput sequencing of ITS2 rDNA was used to analyze fungal communities. Out of 1035 detected fungal genotypes, 267 were ECM fungi, with notable diversity within phylogenetic clades such as */tomentella-thelephora*, */inocybe*, */russula-lactarius*, */sebacina*, and */cortinarius*.

Results revealed significant variations in ECM fungal richness among different forestry treatments, with clear-cutting plots showing lower richness compared to control, preparation cutting, and retention tree groups. Notably, certain fungal clades exhibited stronger responses to treatments, while others were less affected. Compositional differences between years were significant, alongside treatment effects. Environmental factors like soil water content, microclimate, understory vegetation, and distance to ECM host trees partly explained treatment variances. Interannual variations may be attributed to differing weather conditions, with 2021 being notably drier than 2020.

In conclusion, forestry practices exert significant influences on ECM fungal communities in the studied forest, impacting both richness and composition. Understanding these effects is crucial for sustainable forest management and ecosystem conservation.

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Summer and fall fires during dry conditions can often control invasive bluestems: a meta-analysis

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Abstract

Afro-Eurasian and Australian bluestems have invaded many grasslands outside their native ranges, including many grasslands dominated by similar species (warm-season bunch/tussock grasses). We conducted a global meta-analysis of fire effects on six invasive bluestems (Caucasian bluestem/*Bothriochloa bladhii*, King Ranch bluestem/*B. ischaemum*, pitted bluestem/*B. pertusa*, Kleberg bluestem/*Dichanthium annulatum*, Angleston bluestem/*D. aristatum*, and silky bluestem/*D. sericeum*) to identify patterns in fire effects. Specifically, we focused on fire season, drought, and fuel load to explain why some fires are more successful than others at controlling these invasive species. Most of the studies that we found were for King Ranch bluestem so we can draw only limited conclusions about the other species. We found that fires in summer, fall, and early winter tended to have negative effects on the invasive bluestems and did not find consistent positive effects in any month. Native grasses in the same studies, including other warm-season grasses, did not have significant negative effects from fire. Fires during dry conditions, especially when conditions were dry before the fires, tended to have more negative effects on the invasive grasses. Fuel loads did not influence fire outcomes at all. While we identified strong trends based on rainfall and fire timing, the effects of individual fires varied among the studies, so there are other important factors that we don't understand yet. Other invasive species may have similar vulnerabilities to specific fire seasons and rainfall conditions that increase the effectiveness of prescribed fires.

Improving legal requirements for seed-base restoration in Brazil: a international comparative approach

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Abstract

The Decade of Ecosystem Restoration spotlighted the global relevance of restoration but also highlighted the challenges of achieving ambitious goals necessary to halt biodiversity collapse and mitigate climate change. In Brazil, part of native seed legislation has stringent requirements, such as mandatory accreditation of laboratories for seed quality assessment. This study analyzes Brazilian legislation and compares it with that of six other countries (Germany, the United States, Australia, Argentina, Uruguay, and Chile) across four themes. Brazil lacks regulations for seed collection in the wild, unlike the guidelines established by SER and European countries. Laboratory accreditation standards vary globally, but most align with international agricultural market norms, making Brazil's stringent requirements appear overly restrictive. Simplifying these rules seems crucial. It should be noted that countries like Australia and Chile do not mandate quality tests, but this has not led to more structured production chains as well. In Europe, regulations for directly harvested seed mixtures are well established; adopting similar practices could advance restoration efforts in Brazil and neighboring countries of the Río de la Plata grasslands. Lastly, Seed Transfer Zones (STZs), vital for genetic quality in restoration, are rare across the studied countries. They are mandatory only in Germany and, although stipulated in Brazilian legislation, have not been implemented. Considering these insights, both Brazilian and international standards can benefit from adopting best practices. We emphasize the importance of adapting policies to local contexts, with stakeholder engagement, while also taking global experiences into account to improve the supply chain for ecosystem restoration.

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Recognising indigenous and local community conservation territories and areas (ICCAs): Cornerstone for bio-cultural conservation and ecosystem restoration in Zambia.

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Abstract

Indigenous local community conserved territories and areas hold unique restoration knowledge of production systems, which if recognised, protected, promoted and valued can become real assets to national economies, as well as addressing global restoration challenges. Indigenous communities manage at least a quarter of the world's land surface. Despite many restoration interventions undertaken in Zambia, there has been insufficient recognition of ICCAs. It is evident that only about 10% of land is legally owned by them and the wisdom and knowledge of these communities is still not fully incorporated into conservation and restoration agendas despite the greater part of Zambia includes a myriad of territories and areas customarily governed, managed and conserved by its indigenous communities. Threats such as reduced rainfall caused by climate change, land grabbing for mining, unsustainable natural resources harvesting and limited information on the need to conserve and restore ecosystems, are leading to increased biodiversity loss and degradation of ecosystems. Therefore, at the heart of the recent conservation and restoration efforts, this case study discusses collaborative landscape design efforts in an attempt to promote the national level recognition of the ICCAs. Through appreciative inquiry and self-strengthening processes, the study findings highlight on the existing national policy environment, lessons learned and opportunities to advance recognition of these territories for bio-cultural conservation and ecosystem restoration. The case further shares key emerging indigenous perspectives for supporting restoration science, practice and policy framework in Zambia and across borders.

Key words: Indigenous, peoples, territories, bio-cultural conservation, restoration, lessons learned, policy, opportunities, perspectives.

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The Use of Successional-Based Seed Mixes & Herbicide Pretreatments in a Tallgrass Prairie Reconstruction

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Abstract

In the past few decades, an emphasis has emerged to reconstruct the critically endangered tallgrass prairie. However, reconstruction efforts have had limited success, being less diverse than the prairie remnants they intend to emulate. Invasive species play a major role in this, since these species can establish early in plant community development and reduce the emergence of seeded species, often squandering valuable conservation dollars. In this experiment, we reconstructed six hectares of invaded tallgrass prairie to test the ability of five herbicides to reduce invasive species, followed by planting a novel succession-based seed mix. This seed mix incorporates a high density of native fast-establishing forbs to a standard diverse reconstruction mix, which we theorize should block the reemergence of invasive species and facilitate the establishment of a diverse plant community. In the first growing season, we found that glyphosate was the most effective herbicide pretreatment at controlling invasive species, reducing their cover to only 2%. The succession-based seed mix, compared to the standard seed mix, did not initially reduce the cover of invasive species, but increased seeded species cover by over 20%. This increase was due to the establishment of the fast-establishing forbs, and we suspect the increase in seeded species cover will hinder the ability of invasive species to emerge in the next growing season. We will continue to monitor the plant communities that emerge in the upcoming years to understand if mimicking the prairie's natural successional processes will aid in the quality of our tallgrass prairie reconstructions.

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Identification and assessment of best practice in nature-based solutions for climate action and ecosystem restoration in Ireland

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Abstract

Climate change presents significant challenges globally, with Ireland experiencing its impacts through altered weather patterns and extreme events. Habitat restoration, a key nature-based solution (NBS), has emerged as a vital strategy for climate adaptation and mitigation. Restoring ecosystems such as woodlands and wetlands enhances carbon sequestration, reduces greenhouse gas emissions, and builds resilience while delivering co-benefits for biodiversity, human well-being, and economic sustainability.

This study explores habitat restoration practices in Ireland, analysing 81 NBS projects, including peatland restoration, native woodland strategies, and river rehabilitation. Initiatives like the Active Blanket Bog Restoration LIFE Project and the Strategy for Native Woodlands illustrate how habitat restoration mitigates climate impacts and delivers critical ecosystem services such as carbon sequestration, water attenuation and infiltration, and pollination. Across eight system types—agroecosystems, constructed wetlands, urban greening, rivers, peatlands, woodlands, wetlands, and marine—case studies revealed seven ecosystem services. Carbon sequestration was provided by 48% of projects, water attenuation by 40%, infiltration by 25%, pollination by 21%, pest control by 10%, coastal protection by 7%, and nitrogen fixation by 7%.

Agroecosystems and peatland/wetland restoration showed significant potential for climate mitigation. Agroecosystem projects covered 3,476 km² and provided six ecosystem services, while peatland/wetland projects spanned 425 km² and delivered three.

This research highlights the critical role of habitat restoration in addressing climate challenges, protecting biodiversity, and promoting sustainable development. Integrating habitat restoration into policy and practice can enhance Ireland's climate resilience and advance its transition to a carbon-neutral future.

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Beyond vegetation: how stream morphology drives current beaver activity in Rocky Mountain National Park

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Abstract

As ecosystem engineers, beavers play a pivotal role in riparian restoration by enhancing habitat complexity, water retention, and biodiversity. Restoration efforts often focus on improving vegetation conditions to support beaver activity. However, emerging evidence suggests that stream geomorphology may play an equally—if not more—important role in determining beaver site selection and activity.

This study investigates the relationship between beaver activity, stream morphology, and riparian vegetation across a gradient of historic, recent, and active beaver sites in Rocky Mountain National Park. Data were collected on key geomorphic variables, including stream width, depth, sinuosity, incision, and substrate type, alongside vegetation metrics such as shrub canopy cover, willow height, and species diversity. Results indicate that beavers preferentially occupy sites with more favorable stream geomorphology—characterized by wider, deeper streams with lower gradients and higher complexity—even when vegetation conditions are suboptimal.

These findings highlight the critical role of geomorphic suitability in restoration success, challenging the traditional focus on vegetation alone. This poster will explore how incorporating stream geomorphology into restoration planning can enhance habitat quality, increase beaver occupancy, and improve restoration outcomes. By prioritizing the interplay between physical and biological processes, this research raises the bar on restoration success, offering insights for integrated, science-driven management strategies in degraded riparian systems.

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Effects of Surface Coal Mining and Habitat Structure on Avian Abundance in Central Appalachia

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Abstract

Surface coal mining is a large-scale human disturbance that modifies landscape structure leading to habitat loss and, consequently, an ongoing decline of biodiversity in the Appalachian deciduous forests. Mining techniques include mountaintop removal in lower watershed ridges to extract coal (causing large-scale deforestation) and releasing leftover sedimentary material in the streams. This extensive removal of vegetation and soil makes it difficult to achieve full ecological restoration, despite many efforts to minimize the adverse environmental consequences. These consequences remain unclear, in part because the effects of changes in habitat structure and the scale at which they impact biodiversity are still under debate, mainly because of species' different responses to habitat structural complexity. To fill this gap, this study investigates how and to what extent surface mine operations affect forest structure (canopy openness and shrub cover) and breeding bird communities in Central Appalachia. We combined remote sensing techniques to characterize fragmentation and landscape/patch features and species occupancy modeling to examine how different avian species respond to similar habitat structural changes in post-mining sites over time. We expect forest specialist birds to decline and disturbance-dependent bird species benefit from the increase in habitat heterogeneity. Findings from this study aim to enhance our current understanding of how habitat fragmentation and changes in structural complexity impact biodiversity in post-mining landscapes. Results are also discussed in the context of global coal mining and restoration practices.

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Turning Back Ecological Time: Reversing Mesophication in a Historic Dry-Mesic Oak Forest Community through Forest Thinning and the Reintroduction of Prescribed Fire

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Abstract

Historic fire regimes in Eastern North America have been disrupted or halted since the onset of European settlement through the exclusion of forest fire. This is particularly evident in the densely populated suburban settings of the Mid-Atlantic region. Many vegetation communities and habitats across the United States evolved with and were driven by periodic disturbance from low and high intensity fires. Without these fires, we are losing fire adapted vegetation and forest communities through the process of mesophication. Simultaneously, research has highlighted the importance of oak communities to support ecological function.

Mt. Cuba Center is a native plant focused botanic garden with a large land holding in the mid-Atlantic region. We have the unique opportunity to both conduct intensive land management techniques and demonstrate their value to others. Our goal is to reverse the mesophication process in a Dry- Mesic Oak Forest site by implementing intensive forest thinning and reintroducing prescribed fire at historic fire regime intervals, informed by site specific historic vegetation analyses and regional fire scar and dendrochronology records. Our talk will highlight our first year of management activities including initial mechanical and chemical removal of unwanted plant species and the reintroduction of prescribed fire. Pre- and post-burn vegetation monitoring in the understory and overstory shows future species composition without intervention and the initial response to our management techniques. The transformation of the oak forest community guides adaptive management, informing the efficacy of management techniques, and projecting the trajectory of the future forest.

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Examining Social-Ecological Resilience of Native Seed Systems for Restoration: Insights from the Northern Great Plains

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Abstract

Demand for native seeds has surged in response to climate change, habitat loss, and biodiversity declines. However, native seed systems struggle with inefficiencies that range from economic barriers to regulatory inconsistencies and unpredictable demand schedules, resulting in native seed scarcity that hinders ecological restoration efforts. Specifically, the Northern Great Plains (NGP) Native Seed System has immense potential to restore endangered grasslands and prairies, yet it remains underdeveloped and poorly understood. Critical gaps include a lack of understanding of system dynamics, stakeholder values and needs, and mechanisms for creating flexible governance systems that can scale up production effectively. Most notable, there is a significant void in understanding and integrating Tribal perspectives on seed management despite their crucial ecological knowledge and traditional resource management practices. This project will address these knowledge gaps through the co-production of research with Tribal leaders to develop strategies that enhance system collaboration and promote inclusive governance. By utilizing interviews and participant observation, we will identify and address primary challenges that hinder system growth and offer actionable recommendations to boost production, resilience, and collaboration. By integrating Tribal leadership and knowledge, this research aims to create a more adaptive and socially just seed system. Through collaborative partnerships, learning, innovation, and enhanced social diversity, we seek to foster a more robust and resilient seed system to better support restoration efforts.

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Advancing montane fen restoration: the role of baseline monitoring data

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Abstract

Changing precipitation regimes and rising temperatures are threatening ecosystems around the globe, and fens (i.e., carbon-rich, groundwater-fed wetlands) in the Uinta Mountains of Utah are no exception. Montane fens are a relatively uncommon and understudied ecosystem that play a critical role in supporting water quality, carbon storage, and vegetation diversity. However, baseline monitoring data are needed to inform restoration. We documented the characteristics and current condition of 50 fens in the Uinta mountains to establish baseline conditions and inform future restoration. The Colorado Natural Heritage Program previously mapped potential fen sites in the Uintas using remote sensing. We visited these potential fens to assess wetland vegetation, soils, water chemistry, and disturbance. Across all sites, we observed 108 vascular plant species with an average of 23 species at each site. Peat depth in sampled sites ranged from 22 to 96 cm, and soil carbon stored at each site was between 185 and 450 MgC ha⁻¹. Groundwater pH at each site ranged from 4.5 to 7.5, and electric conductivity remained very low, ranging from 0.01 to 1.23 mS cm⁻¹. The most common disturbances were grazed vegetation and soil rutting due to grazing, and soil erosion and peat drying due to channelized groundwater discharge. Many sites lacked significant disturbances and had intact soils, hydrology, and vegetation communities. These data will be used to aid in the prioritization of sites for future restoration, provide comparison data to post-restoration monitoring, and for high quality sites, guide future restoration targets.

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Identification of Ecologically Significant Coastal Wetlands and Wetlands Under Pressure Along the Coastal Margin of Lake Ontario

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Abstract

The Laurentian Great Lakes coastal wetlands provide a number of economic, environmental, cultural, and social benefits. Despite their importance, wetlands continue to be degraded, fragmented, and lost due to the multiple and ongoing pressures from agricultural, industrial, and urban development, altered tributary hydrology, invasive species, pollution, shoreline alteration, and climate change (e.g. reductions in lake-ice cover, increased frequency and intensity of storm events, and extreme fluctuations in lake water levels). Given the number of wetlands and the competing land use needs occurring along the Great Lakes coastal margin, it is not possible to try to protect, restore, and increase the resilience of all wetlands. It is, therefore, necessary to identify the wetlands in the greatest need of conservation, protection, and restoration. Using spatial data from the Canadian Baseline Coastal Habitat Survey and monitoring data from the Great Lakes Coastal Wetland Monitoring Program (CWMP), the ecological significance and pressure of 81 wetlands along the Canadian portion of the Lake Ontario coastal margin were assessed and ranked. Wetlands with both higher ecological significance and higher pressure were also identified as these wetlands may benefit the most from protection and restoration. This information can be used to help wetland conservation practitioners to determine where to strategically focus their efforts and resources.

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Restoring Oak Savannas: The Role of Fire and Mechanical Thinning for Recovering Ecosystem Structure

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Abstract

Oak savannas have been reduced to less than 0.02% of their historic range in central North America due to fire suppression and other land-use changes. With fire suppression, these ecosystems, defined by open canopies, low oak (*Quercus*) tree densities, and herbaceous understories, have transitioned into closed-canopy woodlands and forests dominated by fire-sensitive species. This study evaluated 15 years of experimental restoration in southern Michigan, comparing three replicated treatments: unmanaged control, burn-only with repeated prescribed fire, and thin-and-burn with mechanical canopy thinning combined with prescribed fire (n = 5/treatment, 0.2 – 1.6 ha each). We collected vegetation and structure data annually, including measurements of canopy openness, ground-layer plants, shrubs, saplings, and trees. This allowed us to ask if returning fire alone recovers fire-suppressed oak savannas to their historical ecosystem structure characterized by scattered trees, partly open canopies and dense ground layers, or is mechanical thinning also required to restore a savanna ecosystem state?

Prior to treatments, canopy openness ranged from 6-9%, which remained unchanged for the burn-only and unmanaged areas but increased by >12% in the thin-and-burn treatment. Burning alone has resulted in mortality of most sapling sized trees but has only started to kill smaller overstory trees of fire-sensitive species during the most recent years of the study. These findings suggest that thinning is critical to the restoration of open-canopy savannas over 15 years of management, though future research is needed to determine whether fire alone can achieve similar outcomes over longer timescales as fire-sensitive species mortality and community dynamics evolve.

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Shore Friendly: A social marketing approach to achieving climate resilience, restoration, and protection across private shorelines of Puget Sound.

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Abstract

The shorelines of Washington state are complex, geomorphically varied, and rich with life. They are also subject to pressures from human development and the impacts of sea level rise and climate change. These pressures can be challenging to address, as approximately one-third of the Puget Sound's marine shorelines contain hard armor, which reduces available spawning habitat for forage fish (a key food source for salmon), impedes natural sediment dynamics, and prevents marine shorelines from equilibrating in response to rising sea levels. Most of this armor is found on privately-owned properties and was erected decades ago, before the risks and ecological impact were well understood. Scientists now know that bulkheads are unnecessary on most Puget Sound shorelines and can actually worsen overall erosion. They also damage delicate habitat that is crucial to the survival of our coastal species, from insects and seabirds to salmon and orcas.

Nearly 1,400 miles (about 57 percent) of the Puget Sound shoreline is identified as residential, leaving shoreline landowners responsible for Washington's beaches. The Shore Friendly program incentivizes willing landowners to avoid and remove bulkheads, providing the triple benefit of protecting property, reducing shoreline armor and restoring shoreline habitat for fish, wildlife, and communities.

Providing services to shoreline landowners is a win for everyone. Social science research has shown that helping landowners overcome key barriers in property management decisions can lead to voluntary stewardship behaviors that recover and sustain critical beach habitats.

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The relevance of including local and traditional knowledge in the process of species monitoring and its benefits for ecological restoration efforts.

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Abstract

Non-scientific knowledge, e.g. from Indigenous and local communities, experienced individuals or traditional stories, is often overlooked or dismissed in scientific studies. This, however, ignores the benefits local knowledge can provide for science, like supplying culturally relevant information and important baselines, which might be missed by conventional monitoring methods and can, therefore, enhance monitoring efforts. Furthermore, successful and ecologically meaningful habitat restoration is reliant on nuanced information, like the small-scale habitat use of a species or its reaction to changes in the ecosystem, which is often first noticed by local communities.

My work at Snowchange, focused on wild forest reindeer and their status and trend in Finland, demonstrates how local knowledge can complement scientific monitoring and aid targeted habitat restoration. This was done by interviewing knowledgeable individuals to gain a more comprehensive understanding of the species' broader context, including the influence of factors beyond the monitored parameters.

This example highlights that incorporating local knowledge into species monitoring and habitat restoration can fill monitoring gaps, improve understanding of hard-to-track behaviours, help uphold traditional knowledge from past generations and provide enriched knowledge beyond measurable values. Additionally, it underlines how more contextualised information can improve ecological restoration efforts.

Finally, I advocate for the increased inclusion of non-scientific local and community knowledge in research. This approach can help build a more holistic view of ecosystems, foster greater public awareness, support restoration actions by strengthening community involvement and commitment to species protection and promote increased acceptance of necessary restoration actions within local communities.

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Unveiling Sacred Landscapes: Indigenous Wisdom and Spiritual Commons as Pillars of Ecological Restoration in the Himalayas

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Abstract

The concept of "spiritual commons" offers an innovative lens to integrate cultural heritage and ecological restoration, emphasizing the deep-rooted sacred interconnections between humans and high-conservation-value landscapes. Sacred landscapes serve as a vital reservoir of bio-cultural diversity and ecological resilience. However, their role in restoration remains underexplored. This study examines the spiritual commons within the Great Himalayan National Park Conservation Area (GHNPCA) in Himachal Pradesh, India, through the lived experiences of the Saraji community. Using a detailed interview-based approach, the study identifies four sacred water bodies, twelve cultural festivals, and numerous sacred taboos, symbols, forests, and historical landmarks that define the community's spiritual relationship with the landscape. These findings reveal an intrinsic sense of place-based attachment and nature-connectedness, critical for fostering long-term ecological stewardship. The research demonstrates how local communities, such as protecting sacred water bodies and observing cultural taboos, contribute to the conservation and restoration of pristine ecosystems. By integrating these practices with contemporary restoration strategies, sacred landscapes can serve as models for achieving ecological integrity while preserving cultural heritage. Recognizing the customary rights and spiritual values of local communities is essential for intergenerational knowledge transmission and the sustainable management of these landscapes. This study highlights the untapped potential of sacred landscapes as networks of restoration, proposing a future where the wisdom of local peoples forms the foundation of restoration science. By bridging traditional knowledge and modern ecological practices, this work offers insights to address global challenges of biodiversity loss and ecosystem degradation, fostering harmonious coexistence of culture and nature.

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Putting Numbers on Nature: A New Approach to Biodiversity Measurement in the Americas

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Abstract

Biodiversity is in crisis. Since COP15 and the adoption of the Kunming-Montreal Global Biodiversity Framework by nearly 200 nations, the call to “take urgent action to halt and reverse biodiversity loss” has echoed globally. Measuring biodiversity is crucial but complex, requiring consistent and scientifically robust approaches. This discussion introduces the Americas Biodiversity Metric (ABM) 1.0, exploring biodiversity basics, measurement methods, and real-world benefits for natural and human communities.

The ABM 1.0 is a habitat-focused tool built on principles of ecological integrity and conservation priority. It quantifies biodiversity value using habitat size, condition, conservation priority (global status ranks from NatureServe), and strategic significance (regional or local importance), expressed as Biodiversity Units (BU). Larger, higher-quality habitats typically support a broader range of species, offering greater biodiversity value. The ABM 1.0 can evaluate baseline biodiversity, quantify development impacts, assess restoration alternatives, and track changes over time consistently.

Derived from Natural England’s extensively tested metric, the ABM 1.0 uses the International Vegetation Classification System and conservation measures to assess habitats effectively. It aligns with global frameworks like Corporate Sustainability Reporting, Science-Based Targets, and TNFD to achieve positive outcomes for nature and communities.

The Americas Biodiversity Metric is set to become a leading tool for biodiversity assessment in the Americas, addressing the growing need to measure and improve biodiversity in development and land-use planning.

Evaluation of the suitability of an urban technosol as a substrate for *Aporrectodea caliginosa* Sav. and its potential benefit on *Lolium perenne* L

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Abstract

Technosols are a solution for maximizing ecosystem services in urban environments. The inoculation of earthworms, such as *Aporrectodea caliginosa*, improves the physicochemical and microbiological quality of these substrates, especially when associated with compost. However, the use of crushed concrete (RCD) as a potential substitute for natural gravel in green infrastructure technosols remains underexplored. This study evaluated the optimal proportion of RCD for technosols compatible with *A. caliginosa* and the effect of earthworm inoculation on *Lolium perenne*. Mixtures with different RCD percentages (low (L), medium-low (ML), medium-high (MH), and high (H)) were used, maintaining a constant proportion of compost and variable sand content. Earthworm survival and weight, as well as the growth of *L. perenne*, were analyzed. Results showed that substrates L and ML significantly favored earthworm survival (**H = 13; p < 0.01**) and reduced biomass loss (**H = 15; p < 0.05**) compared to substrates with higher RCD concentrations. This was attributed to the increase in electrical conductivity (EC) associated with higher RCD content, as described by the model: **Survival = 111 - 29EC (R² = 0.57; F = 26; p < 0.01)**. The growth of *L. perenne* was superior in technosols with lower RCD concentrations (**F = 211; p < 0.05**), with a positive effect observed in ML substrates with earthworms, similar to L substrates with and without earthworms (**F = 2.740; p < 0.05**). It is concluded that concrete is a viable material for urban technosols, but its mixture must be optimized to balance properties and organisms

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Rewilding a Floodplain in Carmel, California

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Abstract

Applied River Sciences and SWCA Environmental Consultants performed restoration design and hydraulic modeling on the Rancho Cañada Floodplain Restoration Project on the Carmel River, located at the Palo Corona Regional Park, California. Goals of this project include rewilding a former golf course to a fully functional river ecosystem with greatly increased floodplain connectivity and improving riparian and salmonid habitat. The existing Carmel River is approximately 15 feet below adjacent floodplain surfaces. A process-based restoration approach was adopted for the design, which will allow for future channel and floodplain dynamism. The project will create roughly 25 acres of winter and spring juvenile salmonid rearing habitat and will reconnect nearly 40 acres of floodplain to the Carmel River. This presentation will provide an overview of the design approach and engineering analyses, as well as provide insight into the stakeholder engagement process.

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Examining The Global Biodiversity Standard – a reflection from the India Hub

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Abstract

The Global Biodiversity Standard (TGBS) is a novel site-based certification and mentoring program that assesses the impact on biodiversity from baseline to current conditions of a site. The methodology, developed over the course of three years with international organizations and local partners in biodiversity hotspots across the globe, has been published, with its official launch taking place at the CBD COP 16 in Cali, Colombia, in October 2024.

The assessment methodology criteria of TGBS are based on the "10 Golden Rules for Reforestation" paper. The assessment is conducted using field surveys organized by a local hub of TGBS with Certified Assessors as well as advanced remote sensing technology.

The process for assessing the biodiversity impact of a site is broken into four sections:

Ecosystem Integrity – examines 21 sub-attributes of an ecosystem using an adapted version of the Ecological Recovery Wheel from the Society for Ecological Restoration.

Level of Protection – focuses on legal tenure and management activities aimed at minimizing threats to the ecosystem.

Social Engagement and Benefits Distribution – assesses the involvement and support of stakeholders, knowledge-sharing practices, benefits distribution, and the impact on the local economy.

Monitoring, Evaluation, and Adaptive Management – evaluates data gathering, progress reporting, and how adaptive management is used to ensure long-term success.

This session is a reflection on the journey of the standard's development over the last three years from the India hub. It showcases an example of exceptional collaboration and knowledge-sharing on a global level with intergenerational outputs.

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Improving tropical forest restorations by leveraging pest control services provided by birds.

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Abstract

Forest restoration is widely recognized as a key strategy for mitigating climate change, conserving biodiversity, and enhancing ecosystem services, such as pest control and carbon sequestration. However, restoration outcomes are often variable, and wildlife responses are not fully understood especially across multiple spatial scales. Our research aims to address this gap by investigating how within-site attributes, such as habitat structure and microclimate, and landscape context influence birds and the pest control services they deliver to restored forest systems in Costa Rica's AmistOsa biological corridor. Factors governing activity patterns and habitat use by birds were studied by surveying birds, local vegetation, and microclimate along transects, characterizing the landscapes that surrounded the study sites. By using nets to exclude foraging birds from tree seedlings and saplings, we also evaluated the influence of habitat structure, microclimate, and landscape position on avian pest control services. By elucidating multi-scale habitat processes that operate within restored systems, this study provides insight for the development of land-management recommendations that improve the likelihood of achieving a wide range of forest restoration goals amid a rapidly changing climate.

Sustainable native timber production in restoration plantations: A pathway to Scale up tropical forest Restoration

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Abstract

Sustainable native timber production in restoration plantations offers a transformative approach for scaling up tropical forest restoration. This study investigates the growth potential of three Brazilian native timber species—*Cariniana legalis* (Mart.) Kuntze (Lecythidaceae), *Dalbergia nigra* (Vell.) Allemão ex Benth. (Fabaceae), and *Zeyheria tuberculosa* (Vell.) Bureau ex Verl. (Bignoniaceae)—for sustainable timber production in restoration plantations. Growth data were collected from 14 plantations in the Brazilian Atlantic Forest. Using predictive models, we have analyzed growth trends, identified species growth rates, and estimated commercial rotation ages based on a diameter threshold of 35 cm. Our results showed that *Z. tuberculosa* had the slowest growth rate (0.90 cm/year) and did not reach the target diameter, making it more suitable for low-value products such as pallets. In contrast, *D. nigra* had the highest growth rate (1.33 cm/year) and reached harvest size within 22 years, making it ideal for high-value applications such as furniture and construction. *C. legalis* showed a moderate growth rate (1.16 cm/year) and reached harvest age at 31 years, also suitable for high-value applications. The native timber species growth potential proves promising, particularly compared to exotic timber species already established in the Brazilian market. Our results underscore the potential of native timber production to replace illegal logging, protect natural forests and support to global restoration goals. By aligning ecological restoration with economic purposes can engage multiple stakeholders, including local landowners, government, investors, and policymakers, to promote long-term sustainability and large-scale adoption of restoration initiatives.

Mangrove Restoration in the Niger Delta: A Carbon Offset Mechanism for Climate Change Mitigation and Community Development

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Abstract

The Niger Delta, a vital ecosystem in West Africa, faces severe environmental degradation due to oil exploitation, deforestation, and coastal erosion. Mangrove restoration has been recognized as a viable strategy for climate change mitigation due to their exceptional carbon sink capacity. This study evaluates the potential of mangrove restoration as a carbon offset mechanism in the Niger Delta. Using remote sensing, GIS, and field observations, the carbon sequestration potential of restored mangroves was estimated to be approximately 1.3 million tons of CO₂ equivalent annually. Stakeholder surveys and interviews were conducted to explore the benefits and challenges of carbon trading schemes for local communities. The findings indicate that mangrove restoration can deliver significant carbon offset benefits while creating income and employment opportunities for communities. However, barriers such as limited awareness, restricted access to finance, and inadequate institutional capacity hinder the full realization of these benefits. The study highlights the importance of integrating mangrove restoration into climate change mitigation strategies and emphasizes the role of community-led conservation efforts. Policymakers and practitioners are urged to prioritize mangrove restoration, address social and economic needs, improve institutional capacity, and enhance financial access to maximize the effectiveness of restoration initiatives. This research provides valuable insights into the carbon sequestration potential of mangrove restoration in the Niger Delta and underscores its dual role in climate mitigation and sustainable development for local communities.

Seven years after nucleation planting: can it promote successional processes for other species?

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Abstract

Forests are dynamic systems that often require intervention to maintain their structure. Disturbances like wildfires, deforestation, and land-use changes cause significant ecosystem alterations. Mediterranean forests in Chile are severely affected by climate change, necessitating urgent restoration strategies. Facilitation, a process of positive interactions among organisms, has proven effective in enhancing plant establishment, increasing diversity, and supporting conservation efforts. The objective of this research was to evaluate the positive effect of a nucleation planting established 7 years ago on its capacity to promote the establishment of other species or novel life forms for the ecosystem in successional stages, such as geophytes. To this end, an experiment was conducted using seeds of *Alstroemeria garaventa* subsp. *longaviensis* (Alstroemeriaceae), under three conditions: (1) natural nuclei, (2) artificial nuclei created through cluster planting, and (3) open areas. The results showed that the average germination rate was significantly higher under natural nuclei (39.06%) and artificial nuclei (38.09%) compared to open areas (1.43%), underscoring the importance of the nucleation effect in high-stress environments. This research provides key tools for implementing innovative techniques in the ecological restoration of degraded environments. Adapting these methodologies to the conditions generated by climate change and wildfires in the Mediterranean zone of Chile will enable a more effective response to the challenges of conservation and ecosystem recovery.

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Impact of water table depth and soil temperature on annual methane rate estimates in rewetted forested boreal peatlands

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Abstract

Peatland restoration starts with rewetting by blocking or filling ditches and aims to restore the hydrological and ecological conditions of pristine peatlands. A critical aspect of this process involves getting the water table (WT) back to its natural state. Drainage lowers the WT, promoting oxic soil conditions, while rewetting raises the WT, restoring anoxic conditions that favor methanogenesis by methanogenic Archaea. CH₄ fluxes in peatlands are therefore influenced by the interplay of methane production under anaerobic conditions and methane oxidation in aerobic layers and are also affected by factors such as soil temperature and plant communities.

We measured CH₄ fluxes in 27 rewetted and 6 pristine forested peatland sites across southern and central Finland between 2021 - 2023. Rewetting age varied between 3–30 years. We conducted biweekly to monthly flux measurements using the closed chamber method. WT and soil temperatures were monitored hourly with dataloggers. Vegetation mapping was conducted in 2023. These new measurements, combined with existing data from Finnish peatlands, enable a comparative analysis of methane fluxes across drained, rewetted, and pristine sites.

We hypothesize that methane emissions increase post-rewetting, approaching levels observed in pristine sites, and that seasonal CH₄ flux variability is greater in rewetted sites due to more dynamic WT compared to pristine sites. Therefore, we also hypothesize that annual methane rates can be estimated with WT and soil temperature. This study increases the understanding of methane flux responses to rewetting and contributes valuable insights into the effectiveness of peatland restoration strategies.

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Restoration of springs monitoring - retention of water in the landscape directly at the source

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Abstract

The mountains and highlands in central Europe are important spring areas that generate most of the watercourses in our territory. Springs are an extremely important hydrological structure with a significant impact on the water regime of the landscape. At the same time, these are distinct biotopes inhabited by specific species and their communities, which significantly enrich the biodiversity of the area. A large number of springs were in the second half of the 20th century were meliorated, the incipient streams were straightened, deepened and converted into a network of drainage ditches. In NP and PLA Sumava (Czech Republic), restoration of drained springs has taken place or is underway as part of the finishing Life project. Our project follows it by comparing degraded, restored and preserved springs, analyzing their vegetation (higher plants and bryophytes), occurrence of macromycetes and some groups of aquatic invertebrates. The main aim of the project is to develop a methodology how to identify the main features of spring degradation caused by drainage and the impact of restoration measures (elimination of drainage channels and pipe drainage, restoration of natural capillary outflows from springs) on restoration of biota.

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Optimizing soil amendments for forest restoration on degraded tropical lands

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Abstract

Scaling up forest restoration is essential to tackle climate and biodiversity crises. Several innovative low-cost amendments to accelerate tree growth on degraded tropical lands lack field-testing and cost-effectiveness data. Soil microbiome amendments rewild native microbial communities, while locally sourced effective microorganisms (LEM) are widely used in agriculture but remain untested in restoration. Nutrient-rich biowastes, such as composted coffee pulp, have potential to enhance soil nutrients and tree growth. We individually tested these amendments alongside conventional methods (fertilizer, control “no amendments”), evaluating effects on soil and foliar nutrients, survival, growth and cost-effectiveness for early-successional (*Croton tenuicaudatus*) and late-successional (*Persea caerulea*) tree seedlings. We report first-year results from 1440 seedlings planted across 6 replicate plots in southern Costa Rica.

Coffee pulp and fertilizer significantly elevated soil P and N relative to other treatments. Coffee pulp also significantly elevated soil OM, K, Mg, and lowered pH. *Croton* foliar nutrients had significantly elevated N and P in fertilizer and coffee pulp treatments, while *Persea* had only elevated N in response to coffee pulp. *Croton* had similarly high survival across all treatments, while *Persea* survival was highest in coffee pulp ($F = 4.9$, $p < 0.014$). *Croton* had significantly greater growth in coffee pulp and fertilizer treatments and greater growth in soil microbiome compared to control treatments ($F = 42.4$, $p < 0.001$); *Persea* growth did not differ across treatments. Cost-effectiveness analysis showed biowaste (coffee pulp) as the most economical for carbon (C) gain, particularly for *Croton* that had 3-fold lower cost /kg C/ha compared to control treatments.

Small forest landowners play a crucial role in restoration and climate mitigation: Insights from Chile

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Abstract

International commitments to forest restoration, along with global efforts in this field, have created an urgent need to innovate planting strategies that effectively involve local communities. It is essential that areas selected for these projects not only meet ecological and technical criteria but also address the priority needs of communities, landowners, and local development in areas with high environmental and social vulnerability.

In Chile, particularly in the Maule region in the south-central zone, priority areas for restoration have been identified. However, many of these areas are not available for projects, highlighting the need for more inclusive and practical approaches that incorporate social, economic, and environmental dimensions into restoration strategies.

This study analyzes the areas involved in restoration projects in the Maule region, exploring their relationship with landowners and assessing whether they align with the regional planning of priority sites for forest restoration. Results show that, out of 1,863 hectares of restoration projects executed in the region, only 235 ha (12.6%) are within the regional priority strategy, while 1,610 ha (86%) belong to small landowners. These findings underscore the critical role of small landowners in achieving restoration goals and advancing climate change mitigation actions. These findings emphasize the vital role of small landowners in achieving restoration goals and climate change mitigation. However, they reveal a concerning gap: many priority restoration areas are impractical to implement. This highlights the need to refine analyses, integrating landowners' needs to ensure their participation in restoration projects and align efforts with practical realities.

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‘They’re like King Kong and Godzilla’ Understanding the relationship between rewilding and cultural heritage management in the UK and the potential benefit of increased engagement

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Abstract

Rewilding is fast becoming a key component of landscape management strategy in the UK, increasingly part of mainstream dialogues and influencing landscape policy. The British landscape is rich with cultural heritage, tangible and intangible, that holds great significance for rural communities who live and work within it. Consequently, rewilding-style projects are often met with suspicion and hostility by local stakeholders who fear the loss of this cultural heritage, particularly intangible heritage that plays a key role in building identity and community, through alterations in land use. Despite this, there is still little engagement in cultural heritage from rewilding projects and relationships with heritage management bodies are often regarded as oppositionary. Furthermore, academic research on this relationship is scarce and often focuses on prior negative outcomes without proposing alternative solutions.

Working with five case study rewilding sites in northern England and southern Scotland, a series of in-depth interviews with rewilding practitioners and heritage management professionals have provided the first detailed understanding of this relationship. Projects understand the significance of heritage to local stakeholders and are keen to engage but lack the tools and knowledge to do so. This presentation will present these findings and discuss how innovative engagement in cultural heritage with local stakeholders has the potential to develop adaptive co-management relationships that can mitigate conflict over management decisions. Heritage must play a greater role in nature restoration to ensure constructive progress. Although UK centred, these findings are applicable to anywhere that people and nature co-exist within the same landscape.

Measuring post-fire forest regeneration using the greenness index on UAS point clouds to guide restoration in arid forests

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Abstract

With the ongoing climate change, wildfires in arid climates may alter the forest species composition, or even threaten the permanence of forest cover. Land managers face these issues with post-fire forest restoration, often in the form of planting seedlings. Various techniques are available to foster seedlings survival, but monitoring of forest regeneration still relies greatly on field sampling. Regeneration monitoring is necessary to intervene with successive plantation in case of failure, but it is often omitted due to the high costs of field data acquisition. Any method reducing the amount of fieldwork required to estimate post-fire forest regeneration would ease the work of land managers in burnt areas.

In this case study we tested a methodology to monitor the status of a reforestation in a burnt ponderosa pine forest in Arizona with the use of Uncrewed Aircraft Systems (UAS). A 3D representation of the landscape with point clouds was obtained through Structure From Motion on RGB images. Then, leveraging the colour difference between green pine seedlings and cured vegetation, and the apical dominance of pine seedlings, we were able to identify the individual seedlings in the point clouds and to measure their height. We compared the remote sensing results with actual field monitoring on permanent plots, showing moderate to high accuracy depending on the variable considered. Compared to most monitoring goals, remote sensing offers a highly efficient advantage.

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Native Willow Bar Community Established in Lower Saranac River to Support Terrestrial and Aquatic Life Use Following Environmental Remediation

Jason Vogel

Syracuse

Abstract

Design team and contractors worked together to address stakeholder concerns to implement and restore more climate-friendly vegetative cover within the active wetted channel. The primary goals were to help offset heat buildup from exposed river cobbles and to provide more shade tolerances for aquatic and wildlife species use. This effort dovetailed with stakeholder's efforts to restore the seasonal run of inland Atlantic salmon from Lake Champlain through swift water and holding habitat to upstream spawning grounds. Site walks with stakeholders provided collaborative input and refinement of design and implementation methods. Key challenges were river flows in dormancy period and installation of vegetation within large river cobble to achieve rooting success. Implementation methods used live willow whip bundles trenched into bank toes and bundled live stakes directly installed into inundated river cobble shoreline areas. A track-hoe with mounted ram hydraulic pick and chained steel cylinder driven into the river cobble created a planting hole for live stakes and growing media. Through construction innovation and design modifications with stakeholder input, creation of the willow bar and bench community was successful. Post-restoration monitoring is ongoing and vegetative growth and cover has shown improvement.

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The effects of cheatgrass management with indaziflam on live fuel moisture content in rangeland plant communities along the Colorado Front Range

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Abstract

Invasive annual grasses like cheatgrass (*Bromus tectorum* L.) are a major concern for restoration ecologists in the United States. Along with resource competition, diminishing biodiversity, and loss of wildlife and livestock forage, live fuel moisture content (LFMC) is often reduced in rangelands dominated by invasive annual grasses because they dry out earlier in the season compared to native plants, resulting in fine fuel build-up across the landscape. Reductions in LFMC after cheatgrass invasion typically increase the likelihood of uncharacteristically frequent, large, and fast-growing wildfires that pose risks to human health, property, and native plants. Further, forage nutritional quality in plant communities infested with cheatgrass has been known to decline, negatively impacting the quality of wildlife habitat and grazing lands for livestock. While the impacts of cheatgrass invasion on fire regimes in sagebrush shrublands are well understood, it is necessary to evaluate the impacts of cheatgrass invasion and management in different rangeland plant communities, including grasslands. The herbicide indaziflam (Rejuvra®, Envu) is widely used to manage cheatgrass in grasslands and several studies have verified its effectiveness for reducing cheatgrass abundance. We evaluated the effects of indaziflam treatment on LFMC and plant community composition (cover) at six grassland study sites in Boulder and Jefferson County, Colorado during the summer of 2024. Final results are forthcoming, but preliminary analysis suggests that indaziflam treatment increased fuel moisture content in treated areas. This is largely due to increased perennial forb abundance and little to no cheatgrass present in treatment plots.

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Restoring spring ephemeral herbaceous populations after removing invasive shrubsKristy Hopfensperger, Denice Roberbton, Zoe Robles

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Abstract

Establishing a diverse plant community is a key component of successful urban forest restoration. Spring ephemerals provide important resources for pollinators before most plants flower in summer. Understanding the optimal growth conditions of these species is essential for effective restoration. This study examined the growth and survival of five spring ephemeral species using three life forms—seed, plug, and bare root—at sites where invasive bush honeysuckle had been recently removed. We studied 30 restoration patches, each with three replicate plots, to evaluate how biological and environmental factors influence the re-establishment of different life forms. We analyzed differences in plant height across different life forms and looked at how life form success changed among patch locations due to environmental variables including soil metrics and light variables. As we learn that different species can re-establish faster than others, this will provide insights into best practices for restoring spring ephemeral communities in urban forest landscapes.

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A Seed of Meanings: Multiple Senses of Seed Collecting in the Xingu Seeds Network

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Abstract

The Xingu Seeds Network (XSN) is Brazil's largest and most diverse seed network, comprising approximately 700 seed collectors organized into 25 groups: 2 urban extractivist groups (6.5%), 11 family farming groups (25.7%), and 12 Indigenous groups (67.8%). Diversity is central to XSN, evident in the seeds, technical team, participants, production chain agents, and the biomes it encompasses: the Brazilian Cerrado and Amazon.

This diversity also reflects in the multiple meanings that seed collection holds for different groups. For all, it represents work and income generation, creation of affective bonds, well-being, creativity stimulation, maintenance of lifestyle, and territorial protection. However, the significance of each aspect varies by group.

Data from 2023 indicate that, although urban collectors constitute only 6.5% of the total, they collected 8.8 tons of seeds, accounting for 32% of the annual income. Family farmers collected 14.3 tons, generating 49% of the income, while Indigenous groups collected 5 tons, corresponding to 19% of the income.

These differences suggest that each group dedicates varying time and resources to the activity, resulting in different volumes and incomes. Additionally, they stand out for different reasons: family farmers are creative in developing processing techniques and machines, while Indigenous groups compose songs about collection and prefer manual processing, ensuring high seed quality.

A possible explanation for these differences is each group's exposure to the productive logic. While some urban collectors dedicate themselves entirely to seed collection, in Indigenous communities, this activity is more integrated into daily life, the collective, lifestyle, and territorial protection.

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Exploring aquatic and terrestrial plants' remediation potential from wetlands impacted by illegal mining.

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Abstract

Wetlands, considered amongst the most productive and ecologically vital ecosystems on Earth, are under severe threat in Ghana due to illegal mining, known colloquially as “galamsey”. This unsustainable practice releases toxic heavy metals into wetland ecosystems, degrading water quality, threatening biodiversity, and compromising ecosystem services. Current remediation approaches are often prohibitively expensive and environmentally intrusive, particularly for resource-limited regions. Phytoremediation, a nature-based solution using plants to detoxify pollutants, offers a cost-effective and sustainable alternative.

This study investigates the phytoremediation potential of aquatic and terrestrial plant species in highly impacted galamsey sites, close to wetlands in Ghana. By integrating laboratory and field assessments, the research seeks to identify plant species capable of absorbing and accumulating high concentrations of heavy metals. Bioaccumulation and translocation factors will be used to analyze and quantify their remediation efficiency. Further mapping of pollutants and effective species distribution across selected wetlands will be done using geographic information systems (GIS), providing actionable insights for restoration planning.

Preliminary findings from some studies, highlight several plant species with exceptional heavy metal uptake capacity, offering hope for restoring degraded wetlands. Beyond remediation, these findings will support the dual goals of ecosystem restoration and biodiversity conservation, offering a pathway to sustainable management of wetland resources in Ghana. This research will address a critical environmental challenge and provide scalable, context-specific solutions for tropical regions. It contributes to the broader goal of sustainable development and global wetland conservation by blending ecological restoration with socio-economic benefits.

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Exploring Public Perception of Forest Restoration: Insights from Social Media Analysis

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Abstract

Forest Landscape Restoration (FLR) extends beyond restoring forests to rehabilitate and ensure the long-term sustainability of the broader landscape, emphasizing not only ecological recovery but also the integration of social and economic dimensions. However, there is a need to take a more comprehensive approach to forest restoration that includes human dimensions and understanding public perception of forest restoration is crucial for advancing initiatives like FLR. This study examines how forest restoration is represented on social media through the perspectives of online users who commented on YouTube videos. Keywords related to “forest restoration” and its synonyms were employed as search terms to identify relevant YouTube videos, and their associated comments were analyzed. Topic modeling was applied to identify clusters related to forest restoration, and these topics were analyzed by a qualitative content analysis. The results reveal themes and trends in public sentiment, motivations, and concerns, providing actionable perspectives for aligning restoration efforts with diverse stakeholder expectations. These findings highlight opportunities to bridge communication gaps, foster inclusive decision-making, and enhance engagement through data-driven strategies. Ultimately, this study aims to strengthen multi-stakeholder collaboration in forest restoration initiatives.

What are we losing regarding belowground structure richness when converting native areas into pastures in the Brazilian savanna?

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Abstract

Tropical open ecosystems are characterized by slow-growing herbaceous-shrub vegetation that has been suffering a loss of area due to various land uses, primarily for agricultural conversion. Typical native species possess massive belowground storage organs that protect buds and enable rapid resprouting, increasing resilience to disturbances. In this study we investigated the richness of belowground structures contrasting a conserved *cerrado* area with a degraded area dominated by exotic species, both located in a protected area at Alto Paraíso de Goiás, GO, Brazil. In each area, we randomly distributed five plots where we excavated 1m² to a depth of 1.20 m, collecting belowground structures every 20 cm, resulting in five sampling points per soil profile. We identified six types of belowground structures: common roots, taproots, tuberous roots, rhizomes, woody rhizomes, and xylopodia. We found higher richness of structures and heterogeneous distribution across the 1.20 m profile in the conserved area (4 ± 0.20) compared to the degraded one (3 ± 0.16). The greatest difference between the areas occurred within the top 40 cm, where the conserved area presented all types of underground structures (6 types) compared to degraded Cerrado (3 types). These results suggest that converting native Cerrado areas leads to a loss of belowground structure richness, particularly in the upper soil layers, where degradation is most intense during land conversion to pasture. The diversity of belowground structures is likely linked to the greater resilience of tropical open ecosystems to disturbances and may also influence the higher stability of belowground carbon storage.

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Structure and performance of restoration planting using trait-based species selection across tropical forest ecosystems

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Abstract

Trait-based frameworks can guide species selection for assisted restoration, overcoming recovery barriers and meeting targeted goals. However, implementation remains limited, especially in the megadiverse tropics, due to scarce field trials. To assess functional assemblages, we established five large-scale trials in tropical forest ecosystems in Mexico and Costa Rica (2021-2022). We planted five tree species mixes along a gradient of increasing functional diversity, beginning with two local species (N-fixer and carbohydrate-rich fruit) and adding species to maximize trait diversity. Each site includes six replicates of six treatments: (1) N-fixer monoculture, (2) fruit monoculture, (3) 50/50 mix of N-fixer and fruit species, (4) six-species, (5) 12-species, and (6) natural regeneration. Treatments were planted in 15×15m plots (48 trees). We report survival, growth, and structural characteristics over three years.

Seedling survival varied across species, but was highest for fast-growing pioneers and N-fixers. Overall survival was highest in wet lowland forest, lowest in dry forest, and intermediate in premontane and montane forest. Plot-level heterogeneity of tree height increased one to three-fold from monocultures to the highest functional diversity treatment ($p > 0.05$). Cover of ruderal herbs and introduced grasses declined most quickly in N-fixer monocultures. Mean basal area of N-fixing species increased by ~25% along the functional diversity gradient ($p > 0.05$), suggesting a facilitative effect of the higher functional diversity mixtures over the monocultures. Overall, a trait-driven approach to species selection led to increased vegetation heterogeneity, better mimicking natural recovery processes and providing a promising way forward for designing species mixes for assisted tropical forest recovery.

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High- resolution temporal dynamics of carbon and water in restored and control ponderosa pine forests, Arizona

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Abstract

In the southwestern US, ponderosa pine (*Pinus ponderosa*) trees primarily use winter precipitation stored in deep soil layers as their main water source, particularly during the summer dry season. However, climate change is altering precipitation patterns, potentially limiting access to this water. Tree water-use is also impacted by forest stand density. Land-use changes circa 1880 interrupted fire regimes, removed Indigenous stewardship practices, and introduced grazing and logging, changing forests from meadow-like, open canopy structures to dense, closed canopy forests, exacerbating competition for below-ground resources like nutrients and soil water. A key question in the region is how forest restoration can increase overall forest health and ecosystem resilience to climate change, such as increased drought.

Here, we present high-resolution temporal data from the G.A. Pearson Natural Area (GPNA) in the Fort Valley Experimental Forest near Flagstaff, AZ. Experimental restoration began at the site in 1992, when low-severity fire and pre-1880 tree densities were reintroduced. In fall 2024, we installed automated point dendrometers and soil moisture sensors in both the restored and control forest types within the GPNA to monitor ponderosa pine responses to climate and soil moisture. Our study aims to understand how environmental differences affect (1) tree growth rates and (2) how trees respond to precipitation and drought. We hypothesize that the full restoration will show continually higher soil moisture levels, which corresponds to higher growth rates. We aim to provide concise, impactful data for future management and monitoring programs by Tribes, national forests, and others in building climate resilience.

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Restoring degraded marine habitats by leveraging the microbiome: a new frontier in nature-based solutions

Cinzia Corinaldesi, Francesca Marcellini, Marco Lo Martire, Domenico Sacco, Pierfrancesco Cardinale, Federica Carducci, Roberto Danovaro

Ancona

Abstract

Microorganisms are essential for sustaining all life forms, facilitating their adaptation and enhancing their resilience after human-induced impacts. The microbiota of seagrasses, macroalgae, mangroves, and tropical corals benefits its hosts by increasing fitness, abating toxic compounds, providing protection against pathogens, and supporting nutrient sequestration. Alterations in microbiomes may negatively affect the health and survival of key species, and compromise the overall ecosystem functioning. Despite its key ecological role, the potential of the microbiome as a tool to restore degraded macroalgae forests and improve their success remains largely unexplored. In the present study, we investigated the role of the microbiome in the success of ecological restoration of the brown alga *Gongolaria barbata* (formerly *Cystoseira barbata*). This species creates macroalgal forests and is a key species in the Mediterranean Sea. The macroalgal forests have declined in recent decades due to climate change and anthropogenic impacts, making their restoration essential for the conservation of biodiversity and ecosystem services. We analyzed the *G. barbata* microbiome using meta-barcoding and meta-transcriptomics in a time-course restoration experiment conducted in a coastal area of the Adriatic Sea (Mediterranean). Six experimental sites were selected, including donor sites (characterized by extensive and dense macroalgal canopies), fragmented sites (where the macroalgal canopy was patchy), and receiving sites, where macroalgal forests were absent. Our results provide new insights into microbe-based nature restoration, which could help expand the spatial scale and improve the success of future blue restoration plans.

412

Restoring coastal prairies with fire: vegetation and soil carbon responses to prescribed burns

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Abstract

Practitioners have been trying to restore California coastal prairies for decades using management techniques like grazing, mowing, and revegetation. One technique that has been largely absent is prescribed burning due to fire suppression policies. Recent policy changes have expanded prescribed fire in California to reduce fine ladder fuels that contribute to wildfires. With a resurgence in fire management, it is crucial to understand how burning affects vegetation and soil in coastal prairies. While Indigenous burning historically maintained grassland diversity, invasive species and soil carbon loss pose challenges with increased fire frequency. Few studies assess prescribed fire across multiple burns or large spatial scales to evaluate its effectiveness for restoration. To address this gap, we are evaluating nine paired prescribed burn and unburned prairies across three counties in the Central Coast Region of California. We measured pre-burn vegetation composition in spring 2024, pre-burn aboveground biomass in fall 2024, and pre- and post-burn soil carbon during fall 2024 along five 50-m transects in each burned and unburned site. In spring 2025, we will assess post-burn vegetation and aboveground biomass. We will present comparisons of soil carbon, above-ground biomass, and vegetation composition pre- and post-burn and in unburned sites. Because fire behavior varies, monitoring multiple sites across a region improves scalability and interpretation of environmental patterns.

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Avian response to a decade of riparian habitat restoration in the Colorado River delta, Mexico

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Abstract

Riparian habitat restoration in the Colorado River Delta (CRD) in northwestern Mexico has been ongoing since 2010 as part of a binational agreement between the U.S. and Mexico. Restoration actions include active vegetation management since 2010 and environmental water deliveries since 2014. The CRD is of hemispheric importance for migratory birds, supporting between 14 and 17 million birds during spring and fall migrations and providing critical habitat for sensitive and protected species. Monitoring avian responses to restoration has been a key component of the binational agreement. Bird surveys have been conducted annually since 2002, a decade before restoration began, along both restored and unrestored reaches of the CRD. We analyzed the response of the entire bird community to restoration through 2021, with a focus on 53 breeding species of interest. Our findings show that avian communities respond predictably to plant composition and habitat types (e.g., riparian forests, shrublands, wetlands), but different bird guilds (based on habitat preferences – e.g., riparian forest specialists, waterfowl, synanthropic birds) exhibited differential responses to local environmental factors. We also observed high variability in responses within the same guild, suggesting the need for finer-scale analyses in future studies. Overall, our results demonstrate that restoration has significant potential to help recover declining bird communities after decades of degradation. However, scaling up restoration efforts and improving efficiency is crucial in the context of potentially decreasing water supply and increasing water demand.

415

Evaluating the Impacts of Riparian Restoration on Climate Resilience, Biodiversity, and Productivity

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Abstract

Temperate grassland ecosystems are the most threatened ecosystem type in the world, and 62% of North American temperate grasslands have been lost. Within grasslands, mesic and riparian areas serve as critical habitat for many resident and migratory species, however, many of these systems are highly degraded. Low-tech process-based restoration (LTPBR), which includes construction of beaver dam analogs (BDAs), is a method to restore degraded stream ecosystems by slowing water flow. While LTPBR has been effective in wet climates and montane ecosystems, it is unknown how this restoration strategy changes biodiversity value, productivity, and climate resilience of riparian areas embedded within arid grassland ecosystems. Further, established methods to evaluate the impacts of ecological restoration are labor intensive, often qualitative, and discontinuous. To address these questions, we leverage a suite of low-cost automated continuous monitoring tools, including microclimate and soil moisture sensors to assess climate resilience and productivity, and autonomous recording units (sound) to assess biodiversity at restoration and control sites in the Northern Great Plains. To implement this monitoring evaluation, we are collaborating with a diverse set of partners to select sites and implement LTPBR, including World Wildlife Fund, The Nature Conservancy, National Wildlife Federation, Montana Conservation Corps, the Bureau of Land Management, and a variety of private landowners. Given that this is the early stages of a multi-year study, will present findings on climate resilience and productivity. The results of these monitoring efforts will help inform future restoration strategies and help conservation practitioners to allocate resources towards riparian restoration.

425

Mapping Agroforestry Systems and Natural Regeneration Areas: Case Study of an Agrarian Reform Settlement in the Brazilian Amazon

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Abstract

Assisted natural regeneration (ANR) is a set of techniques to scaling up ecological as well as productive restoration through agroforestry systems (AFS), contributing to income generation and food security (ALLIANCE FOR THE RESTORATION OF THE AMAZON, 2020) within agrarian reform settlements. These areas have a significant presence in the Amazon and emerge as central to the challenges and solutions of restoration efforts.

The project “Promoting and Implementing ANR in Mato Grosso and Pará” aims to restore degraded forests in the Amazon by promoting the implementation of AFS and ANR in five land reform settlements. This study focuses on Abril Vermelho: one of the largest food producers in the Belém metropolitan region.

To quantify and qualify the AFS and ANR areas in the long term, land use and cover mapping was carried out. The Geographic Object-Based Image Analysis (GEOBIA) technique was used to segment satellite images and carry out a supervised classification using the Random Forest machine learning algorithm.

Field data was collected from the AFS and ANR areas to train and assess the model's accuracy. Data was collected by young settlers, promoting community engagement in the mapping process.

A total of 445 hectares of AFS and 4,957 hectares of ANR were mapped in the Abril Vermelho settlement, which has a total area of 6,548 hectares. Access to the data provides a broader view of the territory and a solid basis for territorial planning in the settlements. Furthermore, when qualified, the mapped areas can contribute to restoration goals in the Amazon.

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Relationships between soil properties and vegetation composition in peri-urban grassy woodlands

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Abstract

The Cumberland Plain Woodlands (CPWs), critically endangered grassy woodlands in peri-urban Sydney, Australia, face significant degradation from urban expansion and exotic species dominance. With less than 10% of their original extent remaining, restoring CPWs is critical to enhance biodiversity and ecological integrity in a metropolitan region. However, exotic species dominance and soil properties vary widely across remnants due to historical land use, influencing restoration outcomes. This study investigates how physicochemical and biological soil parameters at different depths relate to the relative dominance of native and exotic species across CPW degradation gradients. Field plots were established across metropolitan Sydney, capturing a degradation gradient based on native and exotic species cover and canopy and bare ground presence. We assessed native and exotic vegetation, alongside 15 soil attributes across shallow (5cm), medium (10cm), and deep (20cm) layers. Early results for physicochemical attributes show that soil pH correlated with vegetation degradation conditions, with more acidic soils correlating with higher native cover in understory and canopy. Soil texture also distinguished degraded from non-degraded plots. Soil moisture and nutrient availability, particularly phosphorus, was positively associated with exotic cover and abundance and negatively with native cover and abundance, while ammonia exhibited the opposite trend. These patterns were generally consistent across depths. The next phase will integrate biological soil attributes to improve understanding of plant-soil relationships across degradation gradients and soil depths. These results will offer insights for developing strategies to promote native vegetation and suppress exotics, ultimately supporting biodiversity restoration in peri-urban ecosystems.

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The effects of Piñon-Juniper mastication debris on understory assemblage.

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³Pueblo

Abstract

The United States' historical policy of fire suppression has dictated silvicultural practices for over a century, leading to dramatic changes in plant community composition in multiple biomes and drastically increasing the burn severity of wildfires. Mastication treatments are frequently utilized in Piñon-Juniper landscapes to reduce fuel loads for fire mitigation, producing woody debris akin to mulch. Previous studies have shown that Piñon-Juniper habitats respond positively to slash-mulch treatments with dramatic increases in understory cover. Straw mulch has been demonstrated to have beneficial restorative effects on native forb and graminoid recruitment in other ecosystems, such as mixed grass prairies. However, there is little known about the effects of mastication debris within Piñon-Juniper ecosystems on understory plant assemblages. We hypothesize that mastication debris will promote increased forb and graminoid recruitment. Our study will utilize a paired plot design with treated and untreated Piñon-Juniper sites along the Arkansas River. Spatially balanced random sample points will be dropped throughout treatments. Point-line intercept surveys paired with modified Whittaker plots will be employed to ascertain herbaceous cover within treated and untreated Piñon-Juniper sites, along with mastication debris metrics, such as mulch depth and overall site coverage. By displaying the effects of mastication within Piñon-Juniper ecosystems, our research aims to highlight how management actions can positively influence plant communities and the impacts they may have on bottom-up trophic cascades, particularly for imperiled pollinator species.

458

Monitoring and evaluating watershed restoration structures on private lands in drainage areas recovering from the 2022 Calf Canyon/Hermits Peak Fire in northern New Mexico.

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Abstract

The Calf Canyon Hermits Peak (CCHP) Fire in 2022 was the largest and most destructive wildfire in New Mexico (NM). Increased downstream erosion and sedimentation are issues in watersheds after wildfires and have impacted catchments affected by the CCHP fire.

Non-profit organizations including the Hermits Peak Watershed Alliance (HPWA), built watershed restoration structures in 2023 in drainages on private lands in the CCHP burn scar at high elevation locations. These structures were built using natural building materials, and include Zuni Bowls, Trash Racks, and One Rock Dams. Each structure is different in design but have similarly intended functions.

Several of these structures have been monitored and evaluated since fall 2024. This research effort is to document whether these structures are fulfilling the functions they were designed to do, to reduce erosion, slow flow rates, and maintain sediment in upper drainage areas. Field verification will document any signs of poor design, placement, and/or configuration, and highlight any regrowth vegetation on or around these structures. New vegetation can help to reinforce these structures into upper drainage areas damaged by fires. In addition, sharing results with other interested practitioners is a key component of this research.

This project also aims to determine whether drainages with these structures have less erosion and sedimentation issues, than drainages without these structures. In addition, the amount of sediment trapped behind these structures will also be documented. Photo documentation using GPS locational data at fixed location sites will be monitored over various seasons and major precipitation events.

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Leveraging species traits of disturbance-resilient ecosystems to make them available for restoration

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Abstract

In open ecosystems such as grasslands and savannas, perennial species are well-known for their ability to resprout after disturbances like herbivory, drought, and fire. These species are crucial for maintaining ecosystem resilience due to their ability to resprout and spread from woody rhizomes, yet they are often overlooked in restoration efforts due to low seed production. The resprouting ability is linked to specialized underground organs, such as rhizomes, roots with adventitious buds, and tubers. However, new methods for propagating and including these species in restoration efforts are needed. To this end, we collected 309 individuals, averaging 25.61 cm (± 10.81) in height and 20.24 cm (± 11.80) in underground length. The woody rhizomes were cut into segments averaging 4 cm (± 2.38) and then placed in a tray with commercial substrate. After 70 days in nursery conditions, we assessed the sprouting and rooting success. We found an average sprout of 25.21% (± 20.71), with 5.77% (± 11.05) rooting among those that sprouted. The finding that one in four segments sprouted indicates that the 4 cm woody rhizome cuttings contain sufficient reserves to develop shoots. However, rooting remains challenging, and additional steps must be taken, e.g., auxin hormones. This study highlights directions for incorporating a neglected key functional group essential to recover resilience in restored open ecosystems, especially in a climate change world.

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Natural Infrastructure for Water: A Strategy for Hydric, Social, and Economic Resilience

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Abstract

Natural infrastructure has become a strategic solution for strengthening hydric and climate resilience, reducing social vulnerabilities, and promoting sustainable economic benefits. Forest restoration and other nature-based solutions play a crucial role in regulating water flow, improving water quality, and mitigating environmental impacts such as erosion and extreme climate events.

Methodologies like the Green-Gray Assessment (GGA/WRI) and the Restoration Opportunities Assessment Methodology (ROAM) enable the identification of priority areas and the quantification of social and environmental benefits. In the Metropolitan Region of Belo Horizonte (RMBH), where WRI Brazil applied these methodologies under the Cities4Forests initiative, it was found that restoring 900 hectares of degraded pasture could prevent annual water treatment costs of R\$ 2 million while generating income and opportunities for small-scale farmers through the implementation of Agroforestry Systems (SAF). These practices not only reduce sediment loads in water sources but also enhance food security and improve local communities' living conditions.

Water governance plays a central role in the effectiveness of these initiatives. Cooperation between governments, businesses, and civil society fosters better integration of public policies, access to financing, and the strengthening of programs such as Payment for Environmental Services (PES). Thus, natural infrastructure emerges as a viable pathway to ensuring water quality, promoting social equity, and driving sustainable development.

502

Great Basin Research Center and Seed Warehouse: Operational Overview

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Ephraim

Abstract

The Utah Division of Wildlife Resources, Great Basin Research Center and Seed Warehouse (GBRC) is the operational hub for much of the restoration work performed on rangelands throughout Utah. While it is most well-known for its role as a seed warehouse—providing the majority of seed for restoration projects through Utah’s Watershed Restoration Initiative (WRI)—the GBRC also houses multiple additional projects including: restoration equipment development and delivery, native plant material development, habitat restoration methods research, long-term range trend monitoring, and heavy equipment operation for restoration projects. The GBRC’s location in Central Utah makes it ideal for collaborating and contributing to work being done in both the Colorado Plateau and the Great Basin throughout Utah. This poster gives an update on the projects and resources available through the Great Basin Research Center.

515

Co-production of Socio-Ecological Indicators for Restoration Monitoring between government institutions and academy in Southern Chile

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Abstract

The National Forest Corporation (CONAF) in Chile implements the “Large-Scale Native Forest Restoration” program, which supports small and medium landowners in initiating restoration processes. However, the program lacks a monitoring tool to assess the current state and future actions of these processes. Through participatory workshops with CONAF professionals, this study co-developed 14 ecological and 2 socio-ecological indicators, distributed across six key attributes, to monitor restoration efforts in 28 properties in southern Chile. The indicators were compared against values from two reference ecosystems, constructing a Socio-Ecological Recovery Wheel adapted from Gann et al. (2019). The application of these indicators revealed an average plant survival rate of 57%, primarily affected by water scarcity. A GLMM model showed that facilitation by nurse plants providing shade significantly enhances survival ($P < 0.001$). Sites exhibit high invasive species coverage but also natural arboreal regeneration, which could help determine whether additional planting is necessary. A high level of landowner engagement was also identified. The process involved not only knowledge transfer to CONAF through training sessions and practical tools for data collection but also a critical reflection on how monitoring is integrated into the program. This approach questioned the absence of a monitoring framework from the program’s inception and emphasized the need for adaptive management strategies that ensure ecological recovery. Planting under nurse plants and controlling invasive species are recommended to enhance restoration success. This study highlights the importance of collaborations between the scientific community and governmental institutions to improve decision-making, resource efficiency, and transparency.

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How Flooding and Drying Events Impact Sediment-Surface Water Nitrogen Exchange in a Restored Wetland

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¹Kent. ²Columbus

Abstract

Climate change-driven drying and re-wetting events are becoming more common stressors of wetland ecosystems and can impact nutrient biogeochemistry, in particular nitrogen cycling processes. Understanding how changing inundation regimes may impact sediment-surface water nitrogen exchange in restored wetlands can inform improved wetland management for nitrogen removal. We hypothesized that surface water ammonium and nitrate concentrations would increase after drying and re-flooding events, and that concentrations would increase significantly more in previously inundated sediments (pools). We collected 16 intact sediment cores from a restored wetland (Trumbull Creek, Ashtabula County, Ohio) in inundated and dry areas. We incubated intact cores in a flow-through system to measure response to experimental drying and re-flooding. Each core was flooded for 3 days, drained and dried for three days and then flooded again for three days. When inundated, water samples were collected each day to measure nitrogen concentrations, dissolved oxygen, conductivity, and pH. Initial results demonstrate an overall release of ammonium into the water column at all sampling locations. Results also demonstrated that previously wet soils released more ammonium over time than the dry soils. This knowledge will help us to further understand the nutrient exchanges that are paramount to ecosystem function, future management and conservation of these sites.

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Stinknet: A New Invasive in ArizonaCameron Crowder, Rachel Mitchell

Tucson

Abstract

Globe Chamomile also known as Stinknet (*Oncosiphon piluliferum*) is a relatively new invasive in California, and more recently, Arizona that has been introduced from South Africa. Stinknet, has been continuously creeping across the Southwestern United States, invading arid ecosystems and degrading the landscape. Previous research has shown that it contributes to wildfires, habitat loss, is unpalatable to livestock, crowds out native species, contributes to breathing and dermatological problems, and produces seed banks that can survive up to 5 years. There is a significant lack of research on the characteristics of this species, how it spreads, human health impacts, genetic characteristics, impact on other species, and mitigation techniques. With this research we will conduct two separate studies. For the first part, we will conduct an experiment on stinknet seeds. The focus will be on their ability to germinate at various temperatures with differing water availability. The goal is to understand the limits of what conditions stinknet seeds are able to survive and germinate in. The second part will be to conduct a survey asking managers dealing with stinknet to explain the scope of the issue. The plan is to understand what land managers are doing to remediate the spread and severity of stinknet in Arizona (and possibly California) and to what extent. This work will contribute to the growing volume of research on this new invasive. Our findings will serve to enrich experts' understanding on the limits of stinknet and inform future research to come.

531

Modeling the Presence and Distribution of Invasive Plants in Connecticut's Forests

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Abstract

Non-native invasive plants are becoming one of the most significant threats to our global terrestrial ecosystems. Once they colonize a new ecosystem, these plants can negatively impact their new surroundings through altering disturbance and successional patterns, reducing local biodiversity, and affecting the functional traits of the native flora. Currently, there are models that track the distribution of invasive plants globally and nationally, such as the United States Geological Survey's Invasive Species Habitat Tool (INHABIT). For the summer of 2025, the objective of this study will be to assess and refine the INHABIT models at a higher resolution (30 meters, as compared to the model's 90-meter resolution) in the state of Connecticut by examining species presence in sites determined to be most susceptible to future or current invasions. Through in-situ observations, we will ground-truth the distribution of non-native invasive plants currently in the early stages of invasion and compare their presence and abundance to the model's data. Once we can determine the accuracy of the current invasion models, we can provide researchers and land managers with improved models and proactive recommendations for preventing further invasive plant dispersal. Improved management practices will work toward restoring Connecticut's forest ecosystems from the presence and damage of non-native plants. Using nature and science-based solutions, we can prevent further invasions into vulnerable sites, which will build the resiliency of our natural environments.

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Salvaging Partners: accessing salvaged plants improves both restoration outcomes and the capacity of a small, non-profit stewardship society in Calgary, Alberta's Fish Creek Provincial Park.

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Abstract

As housing demand increases in the Calgary region, losses of high-biodiversity pastureland and remnant native Foothills Fescue grassland (FFG) are inevitable. With less than 17% of FFG remaining intact, the unique genetics of its native plants are also at risk. To mitigate these impacts, a novel partnership is emerging between land development corporations, restoration practitioners and a plant salvage volunteer organization. The Alberta Native Plant Rescue Foundation (ANPR) has brokered pre-stripping access to 160 hectares of land slated for development with over 100 native grasses, forbs and woody species represented. Interim outcomes of a FFG restoration, led by the Friends of Fish Creek Provincial Park Society (FFCP), demonstrate that the value of salvaged mature plants (SMPs) in restoration extends beyond preservation of the plant material itself.

To date, the FFCP has restored 7000m² of degraded agronomics to FFG, 28.5% of which incorporated SMPs, exclusively. Since installation in 2021, all transplanted SMPs have survived, weed pressure is low, and micro-site margins are expanding. The in-kind value of 15,000 SMPs received through ANPR has enabled the FFCP to reallocate its budget supporting retention of trained staff, a GIS-based invasives monitoring program, and enhancements to maintenance regimens. SMPs facilitated improved programming including an expanded on-site nursery and robust community-based seed collection initiative ("Grow With Us"), further securing future supply of plant material.

Providing small, non-profit restoration organizations with large quantities of SMPs is uniquely impactful and suggests a replicable model that fosters partnerships, preserves plant heritage and transforms what stewardship organizations can accomplish.

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Secondary seed dispersal by ants in tropical forest restorationChristina Blebea, Stacy Philpott, Karen Holl

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Abstract

Successfully establishing late-successional tree species in secondary forests can take centuries. Active restoration can introduce some late-successional species, yet practitioners cannot reestablish the species composition of diverse ecosystems solely by installing plants. Thus it is important to restore plant-animal interactions that can aid in ecosystem recovery. One fundamental interaction that is vital to restoring forests is seed dispersal. Ants are key secondary dispersers in tropical forests. Ants markedly impact plant spatial patterns and in turn forest recovery through directed dispersal. In this forest restoration study, we identified ant dispersers, the number of seeds they removed and the distance the seeds were carried for three species of mid- to late-successional trees. We conducted this experiment in six forests that were restored using active tree planting (plantations) and natural regeneration methods ≥ 15 years prior, as well as four remnant forests, in southern Costa Rica. Ants removed significantly fewer seeds in natural regeneration than plantation plots, likely due to a clearer understory and greater woody debris. Seeds were also dispersed significantly shorter distances in natural regeneration compared to plantation and reference forest plots, potentially due to the differences in the ant disperser communities. Our study demonstrates that different restoration methods result in distinct vegetative structures and ant communities that impact late-successional tree dispersal. Shade from dense tree planting often creates more open understory conditions that may maximize the benefits of ant-mediated seed dispersal in a secondary tropical forest.

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Effects of pinyon-juniper mastication treatments on bumble bee communities and floral preferences

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Abstract

Mastication is a management tool often implemented to restore degraded pinyon-juniper woodlands by decreasing tree cover and density. These treatments may increase understory plant cover and diversity, reinvigorate decadent shrubs, improve soil stability, and increase landscape scale heterogeneity, all of which may improve wildlife habitat. Maintaining and improving wildlife habitat in pinyon-juniper ecosystems supports biodiversity throughout much of the western United States. However, due to the varied nature of pinyon-juniper ecosystems and a limited understanding of their disturbance regimes, it is unclear if mastication treatments restore the appropriate structure and function. Bumble bees and their habitats on public lands have become a greater conservation priority in the face of global population declines. Bumble bees provide essential ecosystem services, namely increasing plant genetic diversity and productivity by transmitting pollen as they forage. The association between bumble bees and pinyon juniper habitat, both masticated and untreated, is relatively unknown. Our objective is to determine the effects of pinyon-juniper mastication treatments on bumble bee communities and habitat use. We will monitor bumble bee abundance, species richness, and diversity and their floral preferences on public land throughout Fremont County, Colorado. Surveys will be conducted on masticated and untreated sites using a paired plot design to determine treatment effects over multiple decades. We will recommend best practices for pinyon-juniper mastication treatments to improve their efficacy in maintaining and restoring bumble bee habitat.

554

RestoreNet 2.0: Using seedballs, microbes, pits, and livestock for dryland restoration in the Southwestern U.S.

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Abstract

The degradation of dryland ecosystems presents a complex challenge for restoration practitioners due to low and variable water availability, slow vegetation recovery rates, soil degradation, and a high level of environmental heterogeneity. RestoreNet is a restoration field trial network co-created in 2018 by scientists, land managers, and landowners in the southwestern U.S., that provides a standardized cross-site experiment to test ecological restoration strategies across a broad gradient of environmental conditions. Our goal as a network is to provide guidance for improving restoration and seeding techniques, and to increase communication about effective restoration strategies. Starting in 2022, we implemented RestoreNet 2.0 treatments: site-specific soil microbial inoculation, seedballs, and soil pits, at 13 sites across the southwest with a goal of increasing restoration success through enhancing soil health. In 2024, we worked with ranchers to implement short-duration, high-intensity livestock treatments at a subset of sites to improve seeding outcomes in addition to our 2.0 treatments. As the network advances, we are co-developing new research directions with stakeholders through site visits, workshops and stakeholder meetings, and outreach materials to communicate results and elicit feedback, and we invite additional participants to contribute to the network.

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Exploring microclimatic condition for propagating *Sphagnum palustre* for wetland restoration in Japan

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Abstract

Since the area of *Sphagnum*-growing wetland, including peatlands, continues to decrease, the effective restoration techniques are increasingly required. In Canada, moss layer transfer technique is widely employed for peatland restoration, resulting in the successful establishment of *Sphagnum* community. However, in Japan, because the availability of donor sites for *Sphagnum* collection is limited, preparation of *Sphagnum* diaspore is difficult. To reduce the extraction of donor *Sphagnum* from natural wetlands, it is essential to develop efficient propagation techniques for harvested *Sphagnum*. Since Japan experiences hot summers compared to Europe and North America, it is crucial to investigate microclimatic factors -specifically thermal and solar radiation conditions- that enhances *Sphagnum* production. However, research on this topic remains limited. This study aims to elucidate the effects of microclimate on *Sphagnum* production and capitulum propagation. To achieve this, we cultivated *Sphagnum* in a floating culture system under four different shading conditions (0%, 39%, 66%, and 78% shadings) at three sites from northern to southwestern Japan across two years. From the results, the effects of microclimate condition on *Sphagnum* production and capitulum (side shoot) propagation were assessed to understand the optimal environmental conditions for *Sphagnum* propagation.

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Soil Restoration of lead (Pb) Contaminated Soil Using Phytoextraction by Switchgrass (*Panicum virgatum* L)

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Abstract

The accumulation of Pb deposits in soil is a growing global concern. Soil restoration options include phytoextraction that involves the use of plants and associated soil microorganism. Switchgrass (*Panicum virgatum* L.), a second-generation bioenergy crop was used in this study due to its ability to produce high biomass and grow in metal polluted soils. Plants were grown in Pb-contaminated soil (5,802.5 mg kg⁻¹) in an environmentally controlled greenhouse. Plants were treated with exogenous application of the plant growth regulator (PGR) benzylaminopurine (BAP) or complete foliar nutrient solution (Triple-12®) twice a week until harvested. Plants also received the soil fungicide propiconazole (Infuse™) that was followed by the soil chelate nitrilotriacetic acid (NTA). Two concentrations of NTA were compared (5 mM and 10 mM) and combined application of NTA (10 mM) + APG (alkyl polyglucoside). Soil fungicide (propiconazole) was used to arrest arbuscular mycorrhizal fungi (AMF) activities in the roots. Lead (Pb) was measured in dry plant materials using an ICP-OES. Phytoextraction by switchgrass was significantly improved by dual soil applications of 10 mM NTA, APG and foliar applications of BAP which resulted in the greatest average Pb concentration of 5,942 mg kg⁻¹. The average dry mass of plants and the average value for total phytoextracted Pb (mg) per pot were significantly greatest for plants treated with 10 mM NTA, APG and BAP. The results suggested that chemically enhanced phytoextraction significantly improved biomass production of switchgrass and at the same time increased phytoextracted Pb which is important for soil restoration.

579

Rewilding CSU: creating habitat for birds, bees and butterflies on a Colorado campus

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Abstract

Have you ever noticed that many college and university campuses have lovely trees and grassy lawns, but lack habitat for native biodiversity? Restoration on urban college campuses offers opportunities for experiential learning, social cohesion, greater access to nature, reduced water use, heat island mitigation, and benefits to human-sensitive plants and animals. To explore pathways for restoration on the campus of Colorado State University (CSU), we (a group of faculty, graduate students, and undergraduate students) developed and participated in a semester-long seminar. Specifically, our goal was to develop a spatially explicit plan, and build capacity, for converting some of the turf grass on campus to native grass, wildflower, and shrub habitat for birds, bees and butterflies. We formed three sub-groups (mapping, design, and fundraising), and collaborated closely with campus staff (e.g., facilities, landscaping, planning) to propose projects that could be feasible and sustainable. In doing so, we established partnerships with student organizations to explore options for long-term maintenance and monitoring and worked with campus development offices to raise funds. Finally, we presented our plan, which included a map of areas on campus most suitable for conversion, a proposed assemblage of plants for each area, and a funding plan to cover short and longer-term costs, to campus leadership. In addition to these products, the students in this course gained greater knowledge of and appreciation for the challenges and opportunities associated with urban habitat restoration through their participation in a process that will ultimately benefit nature and people on CSU's campus.

580

Advances in Remote Sensing and Machine Learning for Wetland and Stream Mapping Across Geographies and Ecosystems

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Abstract

Understanding baseline conditions and accurately monitoring post-construction success are crucial for ecosystem restoration. High-quality data and assessment methods are essential for guiding adaptive management and providing rapid feedback to refine restoration strategies for future projects. Traditional non-machine learning methods for evaluating wetlands often require extensive field efforts or desktop analysis based on outdated, low-resolution data, making the process subjective and laborious. While existing machine learning models can identify and map wetlands at regional scales, their accuracy may falter for smaller restoration projects.

CDM Smith is revolutionizing wetland delineation with an innovative machine learning model that leverages high-resolution LiDAR and publicly available multispectral NAIP imagery across diverse geographies. By employing various approaches to train the model on site-specific data, CDM Smith has significantly enhanced accuracy while saving time in the field. Multiple model iterations, incorporating different sites and data combinations, have been developed. This innovative approach combines high-resolution spatial datasets with machine learning, enabling rapid, repeatable wetland identification and quantification, and facilitating the tracking of changes over time. Impressively, the model's accuracy ranges from 70 to 90%.

This machine learning model, grounded in high-quality digital data, offers numerous benefits for restoration monitoring. The abundance of quality data greatly reduces uncertainties about baseline conditions. The digital data used in the machine learning model can support H&H design, map vegetative communities, and identify sensitive habitats. Adaptable to specific regions and ecosystem types, the model can be optimized with additional site-specific data and reapplied over time, eliminating the subjectivity inherent in human-based assessments.

587

Improving native plant selection: Phenotypic variability in *Shepherdia argentea* and *Phacelia hastata* across different seed sources

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Abstract

Native shrubs and forbs are critical for supporting wildlife habitats, sustaining pollinator communities, enhancing biodiversity and maintaining overall ecosystem integrity. However, successfully establishing shrubs and forbs in harsh environments, such as mine reclamation sites and degraded rangelands throughout the Great Basin, remains a significant challenge. This research examines seedling establishment of two native species, *Shepherdia argentea* and *Phacelia hastata*, by comparing seeds sourced from plants that have successfully established at a Superfund site in Montana to commercially available seed. The study will evaluate how seed source may influence advantageous phenotypic traits that contribute to plant survival and establishment under varying moisture conditions. Following a period of cold-moist stratification, seeds from both species will be planted in 50:50 mixture of native topsoil and inert material in cone-tainers (3.8 cm x 21 cm) using a randomized block design with 10 replicates. Upon seedling emergence, seedlings will be subjected to either a normal water regime (field capacity of the soil mixture) or a moderate drought water regime (50% of field capacity). Plants will be harvested 20-25 days after emergence, and seedling morphological traits measured, including root length, number of root tips, seedling height, leaf number, and shoot and root biomass. Determining phenotypic variation between seed lots under different water regimes may provide valuable insights for selecting seeds best suited for restoration and reclamation efforts, which is particularly important as climate change introduces greater variability and uncertainty to restoration success.

594

Understanding the effect of introducing a novel facilitator plant on soil microbial communities and ecosystem function

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Abstract

Land use changes, specifically agriculture expansion, in tropical montane regions have contributed largely to high rates of deforestation and can have critical consequences on ecosystems processes and services. A common restoration approach is to use facilitator species that can harness positive species interactions to promote survivorship of surrounding species through stress amelioration or soil improvement. However, the effect of introducing a novel facilitator organism, possessing unique microbial communities and root structures on belowground processes, remains largely unexplored and an essential part in elucidating the relative importance of incorporating soil dynamics into restoration. In this project, I will explore the 'belowground black box' in restoration and community ecology by examining the indirect and direct changes to the structure and function of the soil microbial community in the edaphic environment following the introduction of *Oreocallis grandiflora*, which is a facilitator plant in the Proteaceae family. Many species in this family display a unique "proteoid root" adaptation where plants possess cluster root formations that exude organic acids that could mobilize nutrients. Exudation of organic acids may lower the pH of the rhizosphere (acidification), introducing new selective pressures on the soil microbial communities. I plan to examine how introduction of a facilitator plant species with a novel root adaptation affects ecosystem processes & soil microbial community assembly processes. Ultimately, this research could elucidate belowground mechanisms underpinning facilitative restoration treatments.

596

INFLUENCE OF SMALL-MAMMAL HERBIVORY ON RANGELAND RESTORATION SUCCESS IN WESTERN TEXAS.

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Abstract

Rangeland Restoration can improve biodiversity, ecological integrity, and ecosystem resilience. Restoration success can be hindered by overgrazing from herbivores, climate change, desertification, and invasive species. A factor that has received little attention in past studies is the herbivory of small mammals on rangeland restoration. The purpose of this study was to evaluate the influence of small-mammals herbivory on rangeland restoration success in western Texas. As part of a larger rangeland restoration project, we assigned various treatments, our objectives were 1) to quantify the relative abundance of small mammals in restored rangelands in western Texas, and 2) to evaluate the influence of small mammal herbivory on plant species composition, richness and biomass. We established 40 small mammal exclosures (n = 40) on 2 restoration sites located within Ector (Goldsmith site) and Gaines (Seminole site) counties of western Texas, USA. Small mammal exclosures were established within subplots that received a restoration treatment consisting of a high diversity + cover crop mix. We collected plant species composition and biomass within small herbivore exclosures and matching control plots to quantify evidence of small mammals' herbivory at the restoration sites. We also conducted small mammal trapping using Sherman live traps to identify rodent species composition and estimated burrow density using distance sampling within restoration sites. Our preliminary findings suggest that small mammals influence plant species richness and biomass thus may be a hinderance to rangeland restoration success in western Texas. Herbivory by small mammals should be considered when planning rangeland restoration projects.

609

High medusahead (*Elymus elymoides*) cover buffers soil against temperature variation

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Abstract

Thatch producing non-native annual grasses are common in the western United States. These grasses have a mixed, but usually negative effect on native plant cover, as well as native animal and insect populations. A prime example of these grasses is medusahead (*Elymus caput-medusae*), a common and problematic non-native annual grass in northern and central California, Oregon and northern Nevada.

Thatch, senesced above-ground plant matter, from these grasses can alter the soil and ground level environment including soil temperature. Soil temperature plays a central role in many processes including seed dormancy and survival, soil microbial and faunal activity, root growth, and nutrient cycling and availability. Evans & Young (1970) measured the temperature on the soil surface and at 1.5 cm depth for a four-week period on introduced thatch (various species) during the springtime near Reno, NV. They found that thatch lowered the maximum and raised the minimum diurnal soil temperatures.

Our study builds off Evans & Young (1970) to measure and compare soil and ground level conditions in monoculture medusahead stands, medusahead thatch, bare ground, and native cover throughout the year for two calendar years at a grassland site highly invaded by medusahead. Thus far, we have found that thatch significantly decreases soil temperature variation during both the day and the year. The increased measuring time period, treatment types, replication, and more natural setting will hopefully shed light on the filters in medusahead and other non-native annual grass dominated landscapes advancing the science and practice of restoration ecology.

610

A Symphony of Sound: Examining Ecological Resilience in the Florida Everglades Using Bioacoustics

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Abstract

The effects of climate change place increased strain on the Florida Everglades and the biodiversity within. Severe deviations in the frequency and intensity of wildfires and hurricanes outside of historical norms challenges the resilience of the Everglades as a system. To better protect these systems and inform future restoration, it is crucial to develop methods that can rapidly observe species responses and resilience to disturbance. The Acoustic Monitoring Project (AMP) is a large-scale resilience study that uses bioacoustics to measure wildlife activity in response to fires, droughts, and hurricanes in the Florida Everglades. AMP's objectives are to establish a baseline of pre-disturbed biophonic activity, investigate differences in soundscapes between habitats varying in restoration progress, and to discern the resilience of the biophonic community via the recovery time of sound to pre-disturbed levels. Eight stations are currently installed in the northern Everglades across restored and unrestored habitats. A baseline for biophonic activity was established in May of 2024. Stations have continuously documented biophonic responses to wildfire, seasonal shifts, and the Atlantic hurricane season. Initial results suggest discernable differences in wildlife soundscape saturation between sites affected or unaffected by disturbances, primarily driven by frog and insect communities. Results also indicate increases in biophonic activity in parallel with the wet season shift, and within restored habitats. This study is ongoing and will continue in other Everglades subsystems. AMP is on the cutting-edge of resilience science and may be extremely informative for questions surrounding the adaptability of the Everglades to future stress.

611

Cats at the Critical Connections: Investigating Spatiotemporal Behavior of Apex and Mesopredators within Critical Connection Points in the Greater Everglades Ecosystems

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Abstract

The effects of climate change and anthropogenic stressors are reducing habitat connectivity for South Florida wildlife. The resulting fragmentation between urban, natural, and restored habitats adversely affects the range and activity patterns of predators such as the Florida Panther (*Puma concolor coryi*) and Florida bobcat (*Lynx rufus*). Significant changes to community composition, trophic organization, and ecosystem functions resulting from behavioral adaptation or avoidance in predators presents a growing issue for the future of wildlife conservation. The behavioral plasticity of predator species to human-induced rapid environmental change is now considered a leading indicator of anthropogenic disturbance and restoration success on a landscape. This project explores an understudied area of research by examining the behavioral variation of indigenous felids along habitat frontiers and critical connection points of the Florida Wildlife Corridor. This research utilizes low-impact camera trap surveys to compare the range, activity, and behavioral expression of panthers and bobcats in a Northern Everglades restoration site that is crucial for wildlife movement throughout the corridor. Initial surveying began in the Fall of 2024, documenting the photographic rate of detection, identifying behaviors, and analyzing activity patterns within connection boundaries and surrounding continuums. This study is ongoing but initial research suggests a variation between panther and bobcat diel activity and preferences for distinct landscape morphology. As this study continues, the data will be instrumental for developing wildlife conservation goals, adaptive management strategies, and nature-based solutions in South Florida.

617

Evaluating the effects of ectomycorrhizal fungi inoculation of *Quercus* on tree establishment in a forested wetland restoration

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Abstract

Wetland restoration projects often transform disused agricultural fields with hydric soil into forested wetlands utilizing hydrologic manipulation. However, the presence of hydric soil and wetland hydrology does not always result in a biodiverse, functional wetland. Struggling wetland restorations experience stunted tree growth and tree mortality, likely resulting from impacts to soil health and microbiome from intensive agriculture. Previous studies have shown positive effects of associations between arbuscular mycorrhizae and herbaceous vegetation in emergent wetlands and prairie restorations, but less is known about the effects of inoculating oak trees in wetland restorations with ectomycorrhizal fungi. To evaluate the effectiveness of inoculums in forming viable symbioses with oak saplings, and to determine their effectiveness in increasing the survival of oaks in wetland restorations, four commercially available inoculums containing ectomycorrhizal fungi and beneficial bacteria species and one soil transfer treatment of humus, soil, and fine root material from an on-site reference forested wetland were applied to containerized oak trees prior to planting in a wetland restoration project. Treatments were applied to five oak trees each, and 25 oak trees were planted without treatment. Tree height and diameter were measured at the time of planting and plant survival and growth were recorded during the first growing season. Roots were harvested, stained, and examined for ectomycorrhizal associations. Comparisons were made between inoculated and uninoculated saplings. Saplings differed in survival, growth, and ectomycorrhizal associations, indicating a potential role for mycorrhizal inoculation in the establishment of oak trees in wetland restorations.

626

Waldo Canyon Post-Fire Stabilization & Restoration Case Study: 12-Years Later

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Abstract

The Waldo Canyon Fire burned 18,247 acres in the foothills above Colorado Springs in 2012 and was the most destructive fire in Colorado history at the time. Three weeks later, a storm event caused further damage due to flooding and erosion. Colorado Springs Utilities (Springs Utilities) had water detention and treatment facilities within the burn scar that were damaged by sediment. Springs Utilities and the US Forest Service (USFS) collaborated to repair roads and sediment basins. However, ephemeral drainages and steep slopes not accessible with heavy equipment had to be stabilized by hand. Habitat Management, Inc. was contracted to design and build slope and drainage stabilization structures throughout the burn area during the summers of 2013 and 2014. All work was completed by hand primarily using felled trees and on-site rocks with designs approved by Springs Utilities and USFS. Each drop structure, check dam, and log erosion barrier was field-fitted to each unique location. A total of 7,857 linear feet (1.5 miles) of ephemeral (first order) drainages were stabilized, 54.4 acres of steep slopes were stabilized, and 163.8 acres were hand-seeded. Habitat Management also facilitated eight volunteer project days to involve the community. In 2023 and 2025, Habitat Management project managers returned to the project area to evaluate the long-term success of the project. Most drop structures were still in place although some were so overgrown with vegetation that they were hard to find. Photographs were taken to qualitatively assess efficacy and vegetation and ground cover data were collected.

650

Challenges and Opportunities Implementing Nature-based Solutions for Climate Resilience: Warren, RI

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Abstract

With increased projections for future importance of Nature-based Solutions (NbS), identifying challenges and opportunities for communities to implement NbS for successful results is needed. Rhode Island, particularly Warren, RI, serves as an applicable case study for examining challenges and opportunities for NbS implementation in the face of climate change for coastal communities in the US, an area understudied in extant literature. While global models have been constructed, their efficacy on identifying community-level challenges and opportunities is unknown. Using a global NbS challenges and opportunities model produced by Shahryar Sarabi in 2019, my work aims to collect responses from “decision-makers” in Warren on their perceptions of challenges and opportunities for implementing NbS in Warren. I find that Warren’s respondents did identify all of the Sarabi model’s synthesized categories (100% coverage), with *at least* two respondents identifying each category as relevant to their community without being prompted to do so. Further, findings suggest the addition of 4 new categories to the model: Facilitation and Reasoning, Decision-Making Power, Accessibility, and *Lack of Relevance*. Participants most commonly identified the following opportunities, challenges, and new findings as relevant to NbS implementation in Warren: Inadequate Financial Resources, Partnership Among Stakeholders, Appropriate Planning and Design, and *Education and Training*. Financial concerns and particular socio-political conflicts caused the largest challenges for NbS, as identified by respondents. However, respondents also noted the opportunity for community partnership and community identity to propel NbS action. Thus, this model proves useful for understanding opportunities and challenges for NbS implementation in Warren.

651

Identifying areas with higher chance of natural regeneration and higher value to biodiversity in a tropical biodiversity hotspot

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Abstract

The increase in forest cover through the ecological restoration of terrestrial ecosystems has been the most promising strategy for achieving global goals aimed at restoring the various ecosystem services provided by forests. The feasibility of restoring large forest areas will only be possible with the adoption of relatively low cost methods, such as passive restoration through natural regeneration promoted by ecological processes, as seed dispersal. Identification of areas with areas with higher potential of natural regeneration and higher value for biodiversity are crucial to guide public policies aimed at promoting the restoration of degraded areas. In this study our aim is to identify the potential of natural forest regeneration in the restoration of areas with deficits of native vegetation in a tropical biodiversity hotspot, the Brazilian Atlantic Forest. We built a model based on the effect of landscape on the abundance and movement of frugivorous fauna to identify regions with higher chance of natural regeneration and its role on the restoration of degraded land. Regions with higher value to biodiversity (based on the occurrence of primates and forest birds) were also identified. Our results show areas with higher chance of natural forest regeneration and areas with higher importance to biodiversity. As expected, areas around large forest remnants have higher chance of natural forest regeneration and higher value to biodiversity. These layers can be used on the prioritization of forest restoration in private properties with a deficit of native vegetation according to the Brazilian Law on Native Vegetation Protection

658

Advancing equity in coastal restoration: Sharing your insightsRebecca Vidra, David Gill, Sara Mason

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Abstract

Despite an increasing focus on equity in conservation, little evidence exists on how (in)equitable processes affect outcomes of restoration projects and how practitioners engage and define equity. Restoration activities situated as “nature-based solutions” or “blue carbon” are of particular interest because of the rapid increase in external funding and policies and the resulting impacts on Indigenous People and local communities. Over the last few years, the [Ocean Evidence Gap Map](#) project developed a comprehensive literature database on marine conservation, including equity outcomes. Current Duke Nicholas Institute projects are examining socio-economic considerations in restoration projects across several ecosystem types and throughout the restoration project cycle. As part of a student-centered collaboration with global researchers and practitioners, we are using these frameworks to inform a broad literature review of equity in restoration, both in terms of processes and outcomes. We will share our preliminary findings and also ask SER 2025 attendees for their insights into how equity is defined, measured, and operationalized in their work during this interactive poster session.

661

Assessing Microbial Inoculum as a Tool to Improve Sagebrush Steppe Restoration in Grand Teton National Park

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Abstract

The "Kelly Hayfields" in the Antelope Flats area of Grand Teton National Park have been the subject of a 15-year restoration effort seeking to restore sagebrush (*Artemisia tridentata*) steppe and mixed sagebrush-bitterbrush (*Purshia tridentata*) plant communities that were removed in favor of smooth brome (*Bromus inermis*), a non-native perennial grass. The success of these efforts in returning restoration sites to their target native plant communities has been mixed, and more work is needed to understand controls on restoration success in this system.

The soil microbial community plays a pivotal role in supporting plants through mediation of nutrient cycling and facilitation of mutualistic relationships. Non-native plants can select for a soil microbial community which may inhibit native plant re-establishment through the alteration of nutrient cycling and disruption of beneficial plant-microbe interactions. There is compelling evidence demonstrating that microbial inoculum from reference sites can promote the growth of native plants, thus improving restoration outcomes. We are currently analyzing field samples to investigate potential linkages between the plant and soil microbial community recovery at sites of varying restoration age and success. We are also conducting a greenhouse experiment with sagebrush and bitterbrush using bulk soil inoculum from restoration sites to determine whether inoculum can promote shrub re-establishment. We will transplant seedlings to a prepared restoration site in Antelope Flats in summer 2025 to test the survival and plant fitness of inoculated and uninoculated seedlings in the field. Preliminary results from field and greenhouse experiments will be presented.

662

Rodents and cheatgrass impact mountain shrub habitat restoration in the Colorado Rocky Mountains

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Abstract

Shrublands are essential for maintaining biodiversity and providing resources for numerous wildlife species. However, increasing habitat degradation in mountain shrublands has created a pressing need to restore shrub populations in the western US. This includes developing effective methods for shrub establishment. In this study we aimed to identify factors limiting the seedling establishment of two key mountain shrub species in western North America: antelope bitterbrush (*Purshia tridentata*) and mountain mahogany (*Cercocarpus montanus*). Specifically, we assessed the relative importance of three potential limiting factors: competition from non-native cheatgrass (*Bromus tectorum*), rodent presence, and insect herbivory. Using a factorial design, we conducted replicated experiments at four sites in Colorado mountain shrub habitats. Treatments included rodent exclusion cages, insecticide application, and cheatgrass addition/removal. Shrub seeds were planted in fall 2023, with data collection occurring in spring and summer of 2024. Our results indicate that rodent presence strongly affects the early establishment of bitterbrush. Additionally, interactions between rodent exclusion and cheatgrass treatments suggest that both rodents and cheatgrass presence limit bitterbrush seedling survival. These findings highlight the potential need for land managers to control cheatgrass and mitigate rodent impacts in order to improve mountain shrub establishment in restoration projects.

665

Restoring Natural Flood Control Infrastructure in the Southern Lake Superior Basin

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Abstract

Recurrent and catastrophic flooding events in the southern Lake Superior basin have impacted human communities and ecosystems since early 20th Century regional deforestation and subsequent agricultural landscape conversion. The region's geology-characterized by glacial outwash sand deposits overlying ancient lakebed clays and steep stream gradients-exacerbates erosion and flooding risks. Historic and more recent catastrophic flood events (1946, 2012, 2016, and 2018) and projected climate change-driven increases in heavy precipitation events underscore urgency for development and application of natural flood management (NFM) strategies to restore the landscape's capacity to capture, store, infiltrate, and slowly release seasonal snow melt and heavy rainfall. This presentation explores preliminary work focused on identification and ranking of fluvial erosion hazards (FEH), application of these vulnerability assessment metrics and strategies to an existing USEPA-approved nine key element watershed management plan, pilot-scale floodplain reconnection projects, and upcoming collaborative NFM projects planned by regional stakeholder partners. Project work is funded through the National Oceanic and Atmospheric Administration's (NOAA) Climate Resilience Regional Challenge (CRR). Restoration of flood-controlling natural infrastructure in the southern Lake Superior basin is explored in the context of existing and planned activities including hydraulic reconnection of wetlands to streams and streams to historic floodplains, and re-establishment of native upland, riparian, and wetland vegetation communities.

673

Foxhole Forests 2.0: The Next Generation of Fire-Protected Muvuca-Hybrid NucleationChristopher Duke, Cullen Anderson

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Abstract

Our organization developed a novel restoration technique, dubbed "Foxhole Forests", for cost-efficient, rapid rainforest restoration in fire prone mountains in Madagascar. This hybrid restoration technique dovetails elements of nucleation, muvuca, bunding, and wildlands firefighting, and has continued to show promise as a tool for landscape scale restoration. Additional and novel elements have been incorporated into the next generation of Foxhole Forests, as we work to consistently improve restoration outcomes in response to feedback from monitoring data. Here, we present the next iteration of the Foxhole Forest technique, share initial results and lessons learned, and seek to provide an improved tool for restoration practitioners facing similar conditions.

685

Assessment of opportunities for restoration of the degraded landscape of the Bamboutos Mountains, West Cameroon

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Abstract

The current knowledge of the biophysical situation and human activity in the Bamboutos Mountains in Cameroon does not sufficiently highlight the socio-economic and ecological opportunities essential for a successful restoration initiative. A study on the assessment of restoration opportunities was conducted to analyze these opportunities in line with local, national, and international development objectives and to minimize the negative effects of land-use decisions.

Five participatory reflection workshops, following the ROAM approach, were organized in the five target clusters for data collection. The results led to the development of a restoration map presenting five interventions: grassland management on 4,720 ha of shrub savannahs; fruit-based agroforestry on 3,221 ha of agricultural fields; planting of riparian forests on 451 ha of degraded watercourses; revegetation and conservation of the Bamboutos Mountains forest reserve, sacred forests, and relics of degraded forests on 435 ha; and revegetation of 6 ha of degraded water sources. The carbon content varies from 2.66 to 345.15 tC/ha depending on the type of intervention, totaling 247,367.45 tC/ha on the 8,834 ha to be restored. For an investment of 6,131,432 USD, a gain of 102,789,244 USD could be achieved after 25 years, resulting in an estimated revenue of 96,657,812 USD.

These results are scientifically significant as they provide a comprehensive understanding of potential restoration interventions. Practically, they offer a solid basis for planning and implementing restoration initiatives. Politically, they guide decision-makers on prioritizing areas for restoration from social, economic, and ecological perspectives.

691

Beaver dam analogs and plug-and-pond treatments affect alluvial groundwater levels and riparian habitat at stream restoration sites in northern New Mexico

Katelyn Driscoll, Max Smith, Alexander Krichels

USFS Rocky Mountain Research Station, Albuquerque, NM, USA

Abstract

Riparian areas are dynamic ecotones that offer disproportionately large ecosystem services in relation to their size. Included in these valuable services are recharging and storing groundwater and providing habitat that increases regional biodiversity. Multiple stressors that degrade streams and alter riparian areas have diminished the capacity of these ecosystems to provide these and other ecosystem services. For this reason, every year considerable attention and financial resources are invested in restoring streams and riparian areas, often with the intent of raising water tables and recovering habitat. New process-based restoration treatments aim to aggrade channels, slow runoff, raise water tables, and increase overbank flooding. If successful, these treatments may significantly change riparian habitat structure. We studied the effects of two treatments—beaver dam analogs (BDAs) and plug-and-ponds—on depth to groundwater and the composition and structure of riparian vegetation at restoration sites in northern New Mexico. Preliminary data suggests treatments maintained higher water tables farther from the stream and throughout the growing season compared to untreated control sites. Additionally, habitat structure differed between treated and control sites, with treated sites having greater measurements of graminoid cover and vertical plant cover. These vegetation characteristics are important components of habitat quality for imperiled species such as Rio Grande cutthroat trout (*Oncorhynchus clarkii virginalis*) and New Mexico jumping mouse (*Zapus hudsonius luteus*). As BDAs and plug-and-ponds are rapidly and widely implemented throughout the western U.S., often without field validation, our data provide evidence that these treatments may effectively raise water tables and recover riparian habitat.

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Creating Resilience in an Urban Floodplain through Beaver-led Restoration

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Abstract

The Rock Creek Floodplain Enhancement Project in the upper Tualatin River Basin west of Portland, Oregon was initiated to improve hydrological functions of a 120-acre floodplain-wetland complex and providing resiliency to the site for anticipated hydromodification effects from nearby urban growth. The project's overall goal is to support natural processes that benefit flora and fauna by increasing floodplain inundation through prolonging residence time of surface-water and groundwater storage. Rather than implementing a costly, earth-moving construction project, a multi-disciplinary project team incorporated the lessons learned from a five-year monitoring study and implemented a natural design that encouraged the highly effective ecosystem engineering abilities of the site's resident beaver.

Promoting beaver-led restoration is shown to be a cost-effective method that requires reduced management to restore wetland and floodplain functions and provide complex, structurally diverse aquatic and terrestrial habitat. Enhancement activities included the strategic installation of large wood that serve as anchor points for dams and increasing water storage across the floodplain. Diverse wetland plantings provide hydraulic roughness and structural complexity while providing food and building material for beaver. Piezometer data documented the increase in groundwater storage and enhancement of wetland hydrology. Today, it is a beautiful and diverse ecosystem managed by beaver.

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Improving Pollinator Habitat through Manipulation of Priority Effects

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Abstract

Pollinators around the world are declining as a result of habitat loss and conversion, climate change, and associated disturbances. We are exploring a novel approach to restoring biodiversity in grassland systems using a combination of grass-selective herbicide treatments and revegetation techniques that manipulate priority effects for the purpose of improving pollinator habitat by increasing floral resources. The poster will present preliminary (Year 1) results of ongoing research that aims to increase forb and shrub abundance in a degraded northeastern Colorado rangeland by controlling non-native pasture grasses, primarily crested wheatgrass (*Agropyron cristatum*) and smooth brome (*Bromis inermis*), that have created a near monoculture at the site. During the autumn of 2024 we used grass-selective herbicides to control the non-native pasture grasses at the site followed by seeding of a forb and shrub seed mix. While many studies have looked at the efficacy of controlling non-native pasture grasses with herbicide treatments, few have used grass-selective herbicides in combination with a forb and shrub seeding treatment. If successful, this strategy will support land managers in restoring plant diversity to existing stands of non-native pasture grasses or within new restoration plantings that have seed banks dominated by non-native pasture grasses.

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Perspectives on Habitat Restoration for Boreal Toad in Colorado

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Abstract

The boreal toad (*Anaxyrus boreas boreas*) is a state endangered species and U.S. Forest Service - Region 2 sensitive species. Boreal toad populations in Colorado and other areas of the American West have exhibited sharp declines in abundance over the past several decades. These declines are due to chytridiomycosis ("chytrid") caused by a fungus known as Bd, short for *Batrachochytrium dendrobatidis*, which has been documented to cause similar declines to amphibian populations at different locations worldwide. The boreal toad is also Colorado's only alpine species of toad. Preferred habitat is typically in the vicinity of mountain lakes, ponds, meadows, and wetlands in subalpine forest. The distribution of the toad is typically centered around riparian areas near suitable breeding habitat in spruce-fir forests and alpine meadows. The requirements of suitable boreal toad breeding habitat include retention of still water with warm shallow areas from spring thaw to September, which is a period sufficient for egg laying and tadpole development to metamorphosis. Maintaining, creating, and restoring habitats suitable to support breeding for toads is critical to survival of the species in Colorado. This presentation will include two case studies. The first monitoring site presented will highlight key elements of high-quality, functioning habitat. The second site presented is targeted for restoration activities to support reestablishment of breeding populations of boreal toad. Key features of both study areas will be discussed as well as monitoring methods with draft designs presented for the restoration site.

702

Spatial prioritization of forest restoration in the Brazilian Atlantic Forest to maximize ecosystem services

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Abstract

The Brazilian Atlantic Forest (AF) is a global biodiversity hotspot and one of the most fragmented tropical forests, with only 12.6% of its native vegetation remaining. As a global priority for restoration, the AF holds potential for climate mitigation, biodiversity conservation, and sustainable livelihoods. Given limited resources, restoration efforts must be strategically targeted to maximize ecological and social benefits.

This study integrates InVEST ecosystem service modeling and multi-criteria optimization to identify high-priority areas for reforestation near São Paulo and Rio de Janeiro, focusing on legally protected Permanent Preservation Areas (APPs) along rivers. We assess how targeted restoration could enhance water quality (via sediment and nutrient retention), carbon sequestration, biodiversity habitat, and equitable access to benefits under a changing climate.

By identifying priority sites, our framework guides where restoration can deliver the greatest returns, particularly in intensively managed lands with water security concerns. Additionally, we map how these ecosystem service gains align with vulnerable communities and biodiversity habitat.

The methods and insights from this work can be adapted to other regions, assisting practitioners and policymakers in optimizing restoration investments, enhancing climate resilience, and meeting global goals for ecosystem recovery.

703

Exploring drone technology's potential in planning ecologically valuable semi-natural grassland restoration and management

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Abstract

Representing a LivingLab, a collaborative research project between two actors: academics in the environmental protection and landscape management remote sensing team and grass-fed beef farmers in Latvia and Estonia, who have a goal to improve local environmental conditions, wildlife and agricultural land biodiversity, and landscape aesthetics and recreational value. The project aims to investigate remote sensing applications and increase farmer digital literacy to reach a common goal. Focal action: understanding drone technology for ecologically valuable grassland management and European semi-natural grassland restoration planning. We identified drone tech's versatility in farm green infrastructure management, regenerative pasture planning and as a communication aid, the need for individualized on-farm vocational training in how to personalize drone tech for farmers who have nature restoration as part of their business model.

As part of LivingLab we had experimented with various drone sensors (RGB, thermal, multispectral, laser) and created numerous map layers for eco-friendly farmers with one goal: to understand how farmers could use this technology to ease and improve their work and also create communication materials to spread knowledge to other farmers farming for biodiversity and communicate with public actors.

We nominated a demo farm and created a virtual tour to popularize regenerative agriculture and inform the public about pastoral agriculture for semi-natural grassland restoration.

709

Data-driven Paths to Scale Agroforestry: Insights from Land Use Planning in the Brazilian Amazon

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Abstract

The National Program for Productive Forests (*Programa Nacional de Florestas Produtivas*, PNFP) is a government initiative to increase the production capacity of healthy food and sociobiodiversity products, promoting the integrated and sustainable economic development of family farming. The Program's first project began in the State of Pará, involving 1,680 families in 21 agrarian reform settlements in the state.

These communities face several challenges, including inadequate infrastructure, limited transportation, and increasing vulnerability to extreme climatic events. To address these challenges, the main PNFP's strategy is the promotion of agroforestry systems (AFS), recognized as a key approach for integrating production, conservation and restoration efforts (Aliança Pela Restauração da Amazônia, 2020).

A spatial analysis was conducted to determine which of the 21 settlements in the state offered the greatest long-term viability for AFS implementation and efficient product transportation. Territorial planning included criteria such as the biophysical potential for natural regeneration, agricultural suitability, compliance with the Brazilian Forest Code, and distance to markets and supplies.

The analysis showed that only three settlements – PA 17 de Abril, PA Abril Vermelho and PA Praia Alta Piranhiera – fully meet the established criteria. However, the study also provided actionable insights for improving conditions in other settlements and outlined specific strategies for overcoming limitations and expanding the Program's reach.

The methodology is adaptable to other regions, making it a valuable tool for informing public policies focused on food security, income generation, and sustainable land use.

711

An educational program to train professionals in dryland restoration

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Abstract

Ecosystem restoration is critical for addressing global environmental challenges and combating desertification. However, the shortage of skilled professionals and the limited availability of education and training opportunities may hinder progress in this field. As part of the Erasmus+ TEAM#UP project, we have developed an open educational program tailored to emerging professionals and practitioners in dryland restoration. The program integrates the latest innovations in the field and incorporates an entrepreneurial perspective to foster new business opportunities. In collaboration with AGRESTA, a cooperative consultancy, IES Palmeral, a vocational education and training school, and digital innovation experts from the Regional Government of Valencia (CIDA), we have developed structured educational content to enhance existing vocational education and training curricula. This content will serve as the foundation for an expert course and micro-credential program at the University of Alicante. Educational materials will be freely accessible through the Society for Ecological Restoration (SER) portal. Key outcomes of this initiative include the development of tutorials on basic and applied topics in ecological restoration, compiling educational resources and programs, assessing business opportunities in the restoration sector, and designing training strategies based on the analysis of practitioners' networks. By bridging the gap in specialized education and training, this initiative contributes to building a skilled workforce capable of tackling the challenges of dryland restoration, fostering innovation, and promoting sustainable entrepreneurship in the sector.

725

Democratizing best practices in the marine restoration virtual toolboxLara Veylit

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Abstract

The recent passage of the Nature Restoration Law by the European Union presents an opportunity for the growth of the marine restoration community. The marine restoration toolbox developed in the Climate Restoration Actions in Arctic and Atlantic Coastal Ecosystems (CLIMAREST) project aims to bring science-backed best practices to current and future marine restoration practitioners to maximize the effectiveness of restoration actions through connecting users to established networks, experts, and tools. The toolbox provides tools through the lifespan of projects (i.e., assessment, planning and design, implantation, ongoing management, and through monitoring and evaluation) as well as case studies where these studies have been used with openly accessible data and code for users to experiment with and adapt to their case. Furthermore, the toolbox brings together information on best stakeholder engagement from guidelines through to material for developing ocean literacy campaigns. The toolbox leverages existing communities to further its impact; the toolbox website is included in the Society for Ecological Restoration's Restoration Resource Centre and the marine restoration virtual lab where users can experiment with tools on an open cloud computing platform being hosted by Blue-Cloud, part of the European Open Science Cloud. This initiative aims to democratize best practices and bring the necessary tools and resources to the marine restoration community for the development of effective restoration actions for communities and nature.

732

In-field invasive species biomass management through biochar up-cycling.Devin Wegner

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Abstract

In order to avoid spreading seeds, many restoration projects generate large quantities of waste biomass of invasive plant species that necessitate manual removal and disposal. This material is often burned, landfilled, or simply left in place to rot, releasing large amounts of methane and carbon dioxide in the process. Alternatively, this waste can be used as feedstock to produce biochar, an agricultural commodity that can sequester carbon for centuries. This end product can be used as a soil ameliorant for future sites that suffer from high soil acidity, low permeability, low water retention, excessive leeching, and contamination. There are a number of advantages to working with biochar, most notably low barrier to entry: biochar can be made anywhere with only ground space, the feedstock, and a method of extinguishment. These principles can be adapted to convert waste biomass into biochar even on remote sites, steep slopes, or sites without access to water. Here, we share field methods and strategies for converting invasive species biomass into biochar at remote sites and on difficult terrain, based on our work restoring the endangered Palouse Prairie in Washington, USA.

752

Farming native plants: A comparison of seeds and seedlings from wild and farmed *Elymus elymoides* and *Elymus multisetus*

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Abstract

Native seed-based restoration is common in the western United States, especially for post-fire restoration. Seed can be sourced from wildlands, but is increasingly farmed to meet growing demands. However, one concern is that farm environments may alter wild collections, leading to genetic and phenotypic changes. Using seed mass as an indicator of plant establishment for *Elymus* sp., a common restoration plant, we weighed 2400 seeds from three different populations of *Elymus elymoides*, two which also contained *E. multisetus*. Half the seeds were wild-collected and half were farmed and harvested as Generation 1 seed. We hypothesized more abundant resources on farms would increase overall seed mass, and mixed species populations would have the largest increase in seed mass from overrepresentation of the larger *E. multisetus*. In contrast, seed mass did not vastly differ between wild-collected and farmed seed for the two mixed species populations (average 6.8% and 10.6% larger), but increased significantly (31.4%) for the smaller-seeded *E. elymoides* dominated population. This provides preliminary support for the idea that native plants can be grown in farm settings without large phenotypic trait shifts, though these changes could be due to genetic shifts or phenotypic plasticity. Further research quantifying genetic differences as well as other phenotypic traits such as germination phenology, seedling vigor, and root allocation will determine the effect seed farming has on intraspecific variation and its implications for restoration success of this species.

753

ANALYSIS OF ECOLOGICAL RESTORATION IN THE BOM FUTURO NATIONAL FOREST: SPECIES DIVERSITY AND DOMINANCE

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Abstract

This study presents ecological restoration indicators in the Brazilian Amazon Rainforest, specifically in the Bom Futuro National Forest, a Federal Sustainable Use Conservation Unit located in the state of Rondônia. The direct seeding technique was employed in December 2022 by the NGO Ação Ecológica do Guaporé – Ecoporé. The objective was to restore 85 hectares of degraded land, divided into three areas: 3A (9.8 ha), 5B (10.3 ha), and 5A (65.25 ha). Monitoring has been conducted through data analysis from 48 permanent plots randomly distributed across these areas. The seeds used were sourced from members of the Amazon Bioeconomy Seed Network (RESEBA), which connects Indigenous communities to the ecological restoration market and promotes sustainable income generation. Monitoring conducted between 2023 and 2024 revealed a progressive increase in diversity, as indicated by the Shannon Index. Area 5A showed an increase from 1.30 to 2.51, area 3A from 1.68 to 2.70, and area 5B from 1.47 to 2.36. The Berger-Parker Index initially indicated a dominance of 50% by *Canavalia ensiformis* and *Crotalaria* spp., which decreased to 30% in subsequent samples, with a greater presence of *Apeiba tibourbou*, *Cecropia hololeuca*, and *Colubrina glandulosa*. Pielou's Evenness Index and the Simpson Index also indicated greater uniformity in floristic composition. The results suggest an expected pattern of ecological succession, characterized by the gradual replacement of pioneer species with late-successional tree species. Increased diversity and reduced dominance indicate progress in ecological restoration.

757

Building Native Food Forests that Support Wildlife & People

Sarah Roth

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Abstract

In 2023, we planted a “Miyawaki food forest” at George Mason University in suburban Northern Virginia. Our mission is to grow food in a way that supports wildlife, fosters outdoor recreation, and advances climate resilience. To our knowledge, this is the first project to adapt the Miyawaki method of reforestation to create a 100% native food forest. This presentation will provide a case study of our project and guidance on replicating this project in other contexts.

The project covers 5,300 square feet and is planted with 2,000 native trees, shrubs, grasses and wildflowers. Over 57 plant species are represented at the site, including 26 edible and food-producing plants such as blueberries, plums, hazelnuts, and American chestnuts.

As a university, we also use our native food forest to facilitate education, research, and service learning. GMU students are currently tracking individual trees to record changes in plant phenology due to climate change; tracking changes in soil health after a soil improvement project at the site; and getting hands-on experience managing natural lands in and around the food forest.

Because native food forests support wildlife and people, they are a valuable tool in the urban restoration toolbox. Native food forests are ideal for schools, universities, community centers, houses of worship, HOAs, and even residential backyards. By creating safe foraging spaces, these projects help communities to rediscover the value of their native ecosystems.

769

A Biodiversity–Ecosystem Functioning (BEF) experiment to support the restoration of the grassy layer of the Cerrado, the Brazilian savanna

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Abstract

Tropical grassy biomes support outstanding biodiversity and provide key ecosystem services. However, the restoration of their grassy component remains a challenge, particularly in the Cerrado where the herbaceous plants are poorly studied and invasion by African grasses is a major issue. Our goal is to understand the functional mechanisms promoting the establishment of native graminoids in Cerrado communities that are invasion-resistant, self-sustaining, fire-resilient and able to provide crucial ecosystem functions. The poster aims at presenting the experimental setup of this BEF field experiment. We manipulated both species richness and the functional diversity of herbaceous plants using 15 Poaceae and 1 Cyperaceae from four functional groups based on the plant propagation strategies of the Cerrado: caespitosus with large leaves, caespitosus with thin leaves, faster growers or rhizomatous. During the rainy season of early 2025, we marked 165 plots, arranged in five blocks, within a 1.5-ha former pasture at the Chapada dos Veadeiros National Park, after removing 30-cm of topsoil containing invasive propagules. Eighty plots were planted with monocultures (1 replicate/block/species) and twenty plots were planted with the 16 species (4 replicates/block). We also created communities with intermediate species richness (4 species or 8 species) with various functional groups (1, 2 or 4 functional groups). We are monitoring vegetation establishment and different ecosystem functions namely erosion control, productivity, and carbon and water cycles. We will perform regular vegetation surveys and assess above and belowground plant functional traits associated with species establishment, competition with invasive species and flammability.

783

Applied Nucleation as a Coral Reef Restoration Approach in the Florida Keys

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Abstract

Active coral restoration has emerged as the primary strategy to accelerate the recovery of declining coral reef ecosystems. Despite the existence of multiple coral restoration techniques, they are still relatively new, under-studied, and require focused efforts to combat biodiversity loss. One emerging approach is applied nucleation, adapted from forest restoration. This method involves outplanting small, species-rich, genetically diverse, and densely clustered coral assemblages that act as focal points for natural reef recovery. These patches are designed to enhance ecosystem resilience by facilitating biological, chemical, and physical cues that promote coral survival, growth, and reproduction. The onset of the 4th global bleaching event and its detrimental impacts on large-scale restoration efforts prompted the need to field-test this approach. Here, we describe the implementation of applied nucleation in coral reef restoration, emphasizing the importance of strategic outplanting efforts to strengthen long-term ecosystem resilience.

This study details the application of applied nucleation within regional restoration efforts in the Florida Keys National Marine Sanctuary. Between 2024 and January 2025, 11,160 corals have been outplanted across multiple reefs over extended periods to simulate natural recruitment processes. By improving population demographics and ecosystem function through strategic coral placement in small patches, applied nucleation represents a promising nature-based solution for coral reef restoration. Monitoring is conducted using photogrammetry-based photomosaics, allowing for comprehensive, high-resolution tracking of coral cohorts across different time points. This strategy underscores the importance of refining restoration methodologies to maximize ecological impact and long-term success in the face of climate change and biodiversity loss.

794

Introducing SeedPOD - the Seed Portal for Online Data

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Abstract

SeedPOD (Seed Portal for Online Data) is a new digital resource designed to facilitate native seed-based ecological restoration and research, due for open release in 2026. SeedPOD will aggregate detailed data on seed collections from wild populations throughout each plant's global distribution range, including their availability for use, and will help facilitate the transformation of native seed stocks back into thriving plant communities.

SeedPOD will:

- 1) Aggregate detailed data on seed collections from wild populations throughout each plant's global distribution range.
- 2) Aggregate detailed viability test data. These data will inform germination and propagation protocols.
- 3) Be an open access, robust, user-friendly digital resource, designed to work with limited bandwidth and intermittent data connection. Downloadable resources will be available to use offline.
- 4) Offer native seed custodians a means to have a digital presence, in particular small-scale community seed custodians.
- 5) Provide a facility to connect seed supply requests with native seed custodians.
- 6) Link to complimentary digital resources and information sources.
- 7) Engage a wide user group through existing Seed Science and Ecological Restoration networks through targeted information sharing and training.

The needs of restoration practitioners are at the forefront of SeedPOD design, and we are continually looking to use your knowledge and experience to make the best resource we possibly can. Please come and talk with us and tell us how we can help you and contribute to ecological restoration success.

832

Improving floral resources and pollinator visitation in Conservation Reserve Program Easements with diverse seed mix composition and strip planting

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Abstract

Pollinator populations are declining in drylands due to climate change, land use, and habitat loss. The United States Department of Agriculture-Farm Service Agency Conservation Reserve Program (CRP), covering 1.8 million acres in Colorado, aims to re-establish native vegetation on retired agricultural lands. Particularly, CRP pollinator-focused plantings (CP-42) aim to increase pollinator-friendly forb density but often struggle in drylands due to arid conditions and weed pressure. Therefore, innovative strategies are needed to meet NRCS goals for CRP success.

Using a field study, we tested four restoration treatments: the standard NRCS seed mix and planting methods ("Business as Usual," BAU); composted manure + BAU to enhance soil organic matter; strip planting + BAU for targeted weed control; and a more diverse, forb-heavy seed mix for improved floral resources. We compared the total number of open inflorescences, density and diversity of flowering plants, and pollinator visitation.

Our preliminary results revealed that composted manure and strip planting significantly increased flowering plant density compared to BAU. However, the diverse seed mix showed no substantial improvement in floral density or open inflorescences. Our composted manure, strip planting, and diverse treatments attracted significantly more bee pollinators later in the season than BAU, while non-bee visitors remained unaffected.

Our findings highlight the potential of compost and strip planting to enhance floral resources and pollinator activity in CRP plantings. This study increases understanding of the capacity of alternative CRP restoration treatments to improve floral resource availability to pollinators across CP-42 plantings and supports restoration decision support in CRP projects.

842

Prescribed fire timing alters re-emergence phenology and growth rate of plants in a restored tallgrass prairie

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Abstract

Fire is a key driver of community assembly in grassland ecosystems worldwide. Due to human-induced changes to disturbance regimes, fire regimes often must be reinstated for effective grassland management and restoration. In tallgrass prairies, prescribed fires are most often conducted during the dormant season, in either spring or fall. Fire timing can alter prairie plant community composition, which may be, in part, due to microclimate dynamics at the start of the growing season. Burning in the fall removes insulative litter cover prior to winter, potentially exposing perennating plant parts to colder and more variable winter temperatures but also expediting soil warming in the spring. Alternatively, burning in spring leaves the litter intact from senescence through winter, but early-emerging species can be damaged by spring prescribed burns. We hypothesized that plants treated with spring prescribed burns would experience delayed establishment and subsequent trade-offs in growth rate and reproduction when compared to plants treated with fall prescribed burns. To test our hypotheses, we collected data regarding emergence phenology, growth rate, and flowering from 12 plant species in a restored tallgrass prairie treated with annual spring burns, fall burns, or left undisturbed. We found that emergence phenology differed with fire timing, and growth rate in spring burn treatments was greater than in other treatments. Plants in undisturbed plots were more likely to flower, but fewer individuals were present. These findings lend insight to the potential drivers behind long-term changes in plant community composition in response to fire.

845

Assessing which functional traits improve population performance under different soil textures and drought

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Abstract

Drought complicates restoration projects throughout dryland ecosystems. Drought severity is influenced not just by precipitation but also by soil texture. Understanding how plant functional traits, or morphological, physiological, and phenological characteristics of plants, interact with drought and soil texture to influence plant performance can improve dryland restoration efforts.

Using 15 different populations of *Bouteloua curtipendula* (Sideoats grama), we aim to determine: (1) how leaf and root functional traits vary among *B. curtipendula* populations, (2) how traits respond to different soil textures and drought conditions, and (3) how traits influence plant performance in these different conditions. To answer these questions, we will grow individuals from these 15 populations in a soil texture gradient of 5%-45% clay under control and drought conditions. After a six-week treatment period, we will measure leaf and root traits as well as above- and below-ground biomass.

We expect populations from drier southern NM regions to invest more in roots and dense tissues (e.g., higher root tissue density, higher root mass fraction) than northern populations. Similarly, we expect to see increases in tissue density and root investment with drought and increases in clay content. We predict plants with high root biomass and conservative traits will perform best under both drought and high clay conditions.

Understanding how *B. curtipendula* will adapt to these conditions will help us determine which populations should be grown for the highest success rate in dryland restoration projects.

849

Restoration of the Colorado River Delta: A Binational Effort

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Abstract

Water Treaty agreements between Mexico and the United States have enabled the restoration of the Colorado River Delta riparian corridor, a 136 km stretch from the border to the Gulf of California. Since 2000, scientists from government agencies, universities, and non-government organizations on both sides of the border have collaborated to define the best approach for ecological restoration. Restoration actions began in 2008. In 2014, through the landmark agreement Minute 319, a two-month "pulse flow," was delivered to the main channel and followed by active restoration along the river margins and community outreach programs. These initiatives have restored 547 hectares of marsh, cottonwood-willow, mesquite bosque, and adjacent upland vegetation, increasing the abundance and diversity of priority bird species and attracting other wildlife, including beavers.

Following Minute 319, a new agreement, Minute 323, between both countries, has provided water for in-channel flows, recharging local groundwater, reducing salinity in the upper estuary, and offering recreational benefits to local communities. However, the benefits to vegetation and birds have been modest. The current treaty agreement extends through 2026, with the continuation and expansion of restoration efforts dependent on funding, water availability, and a new binational agreement.

851

Remediating a Formerly Used Defense Site within a proposed mitigation bank: Lessons learned from the Otay River Restoration Program in San Diego, California

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Abstract

Brownfields (i.e., abandoned, underutilized, possibly hazardous lands) provide a unique opportunity for restoration practitioners to collaborate with entities to remediate the land and transform it into restored public space, including parks and native habitats for wildlife. Brownfields in the United States are remediated through a standardized process outlined in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLA is the most comprehensive environmental remediation program globally, and the environmental laws of many countries are adopting CERCLA as a model. In this presentation, we highlight the Otay River Restoration Project as a case study demonstrating the challenges and opportunities associated with remediating brownfields for habitat restoration. The Otay River Restoration Project is located in south San Diego County, California, United States. It includes over 300 acres of riparian and upland habitat restoration providing compensatory mitigation for nearby impacts to aquatic resources and sensitive species. One component of the project is a proposed mitigation bank which overlaps with a Formerly Used Defense Site (FUDS). The restoration team from SWCA Environmental Consultants has partnered with the California Department of Toxic Substances Control, and several entities providing technical survey support, to implement the CERCLA process for the investigation and remediation of the FUDS site to facilitate the approval and implementation of the proposed mitigation bank. This presentation will provide a general overview of the CERCLA process for restoration practitioners and highlight the challenges and lessons learned from this remediation effort.

856

Soil Health and Carbon Dynamics in Nebraska's Rainwater Basin: Evaluating Resilience in U.S. Fish and Wildlife Service Waterfowl Production Areas

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Abstract

The U.S. Fish and Wildlife Service Waterfowl Production Areas (WPAs) are vital ecosystems that support biodiversity, enhance water quality, and sequester carbon. The Rainwater Basin in south-central Nebraska is a critical wetland complex, requiring soil health assessments to ensure its long-term resilience. Key indicators such as organic matter content, nutrient availability, and moisture retention provide insights into habitat stability, while soil respiration and carbon sequestration inform ecosystem functionality. This study assessed soil health across seven WPAs in the Rainwater Basin during Summer 2023. Within each WPA, three ecological sites (upland, wet meadow, and transitional habitats) were sampled to evaluate seasonal influences on soil properties. Results revealed variability in soil respiration and carbon sequestration across WPAs, though ecological sites within each WPA exhibited similar trends. Ritterbush, the driest WPA, had the lowest soil respiration, carbon sequestration, and carbon stock, whereas Lindau exhibited the highest nitrogen and carbon content. Low carbon sequestration rates may be linked to increased microbial activity and organic matter decomposition during dry periods. Findings underscore the interplay between hydrology, soil properties, and carbon dynamics in WPAs. The variability in soil carbon stocks and sequestration suggests that periodic drying influences microbial activity and decomposition rates, potentially limiting long-term carbon storage. Understanding these dynamics is crucial for adaptive management strategies aimed at enhancing wetland resilience and ecosystem services in the Rainwater Basin.

858

Water table and humification effects on carbon dioxide and methane gas flux in a peatland mesocosm experiment.Jackson Brady¹, Christian Lenhart^{1,2}, Emily Deering¹¹University of Minnesota, St. Paul, MN, USA. ²The Nature Conservancy, Minneapolis, MN, USA**Abstract**

Natural peatlands operate as effective carbon sinks due to their unique ecology, hydrology, and biogeochemistry. However, drained peatlands transition from carbon sinks to carbon sources through aerobic decomposition of stored soil organic carbon into carbon dioxide (CO₂). Vegetation and bacterial community shifts can exacerbate the release of methane (CH₄) and tip the balance of carbon cycles in drained peatlands. The purpose of this study was to measure gas flux of CO₂ and CH₄ in peat soil across a gradient of water table and peat humification. We constructed a peatland mesocosm experiment in St. Paul, Minnesota using peat soil at three distinct humification levels on the Von Post scale (H2, H4, H8) and three water levels (+/-10 cm below soil surface and at soil surface). We measured CH₄ and CO₂ gas emissions using a Li-COR gas flux analyzer chamber, surface water pH, and soil temperature from May to October 2024. We found that water table elevation and humification were significant factors in predicting CH₄ flux, while water table elevation was a significant factor predicting CO₂ flux. Mesocosms with the -10cm below surface water table and H8 treatments had the lowest mean CH₄ flux (33.81 nmol m⁻² s⁻¹). Mesocosms with the surface water table and H2 treatments had the lowest median CO₂ flux (1.849 μmol m⁻² s⁻¹). This study provides valuable insight to land managers and scientists seeking guidance for peatland restorations in the United States.

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How Does Tree Planting Affect Dryland Biodiversity? Lessons from the African Great Green Wall in Senegal

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Abstract

Dryland ecosystems are highly vulnerable to land degradation due to their intrinsically low resilience. Restoring vegetation communities is often considered a critical step in promoting ecosystem recovery, but restoration activities such as tree planting can abruptly alter habitat structure and negatively impact faunal communities. The African Great Green Wall (GGW) is a large-scale restoration initiative that aims to improve ecosystem and community resilience. In northern Senegal, GGW interventions include various restoration activities, including tree planting. We conducted repeated count surveys of two arid-adapted amphibian species (*Tomopterna milleti* and *Sclerophrys pentoni*) across eight reforestation plots and surrounding areas, and applied *N*-mixture models to assess how increased woody plant density affected their abundance. Our results showed that woody plant density was significantly higher in the afforested plots than in the surrounding areas. Furthermore, high woody plant density had species-specific negative effects on amphibian abundance. Populations of *T. milleti* and *S. pentoni* decreased by 74% and 29.8%, respectively, within reforested plots. We highlight the importance of woody plant density as a key structuring factor for Sahelian amphibian communities. These can be preserved by maintaining a mosaic of open-habitat patches and reforestation plots with moderate planting densities. Our study underscores the importance of considering species-specific responses to restoration activities when developing management plans.

881

Reviving Peatlands: The Role of the Private Sector in Canada's Restoration Efforts

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Abstract

The Canadian horticultural peat industry, despite its small footprint (36,000 hectares, or 0.03% of Canada's peatlands), plays a crucial role in advancing peatland ecological restoration. For over 30 years, it has supported academic research, leading to the development of restoration techniques and a long-term monitoring program to evaluate successional trajectories and indicators. Monitoring across 125+ restoration sites over 27 years has resulted in a valuable database for meta-analyses in ecosystem restoration. Unlike the United States' Long-Term Ecological Research program, Canada lacks similar initiatives, making this academia-industry partnership unique to assess long-term restoration success. The industry has proactively managed peat resources based on scientific findings and has restored or reclaimed 72% of its post-extracted footprint (10,300 hectares) since 1930. The industry aims for 100% restoration through a National Peatland Restoration Initiative. Notably, active restoration with moss reintroduction has demonstrated carbon sequestration recovery to an average of 75 g C m⁻² per hectare within 9 to 12 years, contributing to climate mitigation within 20 years. However, this life-cycle analysis does not account for carbon emissions from extracted peat or carbon uptake by plants grown in peat-based media. Aware of the need to reduce its peatland impact, the industry continues to invest in research for improved practices such as Sphagnum farming or new less impactful harvesting methods.

885

Rooting for success: How functional traits and soil texture shape seedling survival under drought

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Abstract

Soil texture plays a vital role in plant establishment, influencing root development and shaping water availability. Plant traits- morphological, physiological, and phenological characteristics- determine how species interact with their environment, yet few studies examine how these traits interact with soil texture to influence seedling performance.

This study examines how varied soil textures (different proportions of clay and sand) influence root traits and early growth of grasses commonly used in restoration across the arid southwestern United States. We completed a greenhouse study, growing nine different grass species in three distinct soil types (10% clay / 90% sand, 25% clay / 75% sand, 40% clay / 60% sand). Seedlings were watered for 14 days, after which irrigation ceased, and seedling mortality was monitored. Additionally, we measured seedling traits, assessing how functional characteristics relate to survival time.

We expect grass seedlings with finer roots (i.e., low root diameter and high specific root length) to perform best in clay-rich soils and those with thicker roots to thrive in sandier soils. Root traits influence a plant's ability to access resources- fine roots may better penetrate the small pores in clay-rich soils, while thicker roots may be advantageous in sandier environments.

The findings of this study will provide valuable insights into how soil texture affects plant establishment, enabling restoration ecologists to make more informed species selections based on soil conditions. This knowledge will strengthen ecological restoration efforts in arid regions, fostering healthier, more resilient ecosystems.

886

Restoration after fire devastation for species at risk, food sovereignty, forest productivity and fire resiliency.

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Abstract

This project is in the traditional *sm̓əlq̓m̓íx* territory. There was a wildfire in 2023 that spanned 44,000 hectares in the Ashnola, located in the Similkameen, British Columbia. This area is part of an Indigenous and Protected and Conserved Area (IPCA). The intention of the IPCA is to protect water, restore habitat and safeguard species through active management and law.

The overall goal of this project is to enhance ecosystem health and resiliency to benefit species at risk, and the well-being of *sm̓əlq̓m̓íx*. Without restoration work to stabilize vulnerable ecosystems, there was a high risk of landslides, flooding and invasive species infestations. Our restoration is ongoing, starting in the fall of 2023. Specifics include:

Bioengineering of water draws with live stakes of willow (*Salix bebbiana*), red osier dogwood (*Cornus sericea*), and cottonwood (*Populus balsamifera*). Providing three day workshops on bioengineering. Bioengineering stabilization on several draws in the burnt areas.

Planting rare species and species that provide habitat for wildlife at risk in the area. A total of 800,000 plants planted to date, and planting more each year. Each species targeting one (or more) of the following attributes: traditional plant use, food and shelter for wildlife, shade for fish bearing watercourses, erosion protection, competition to invasive species, increased absorption for flood mitigation, and diversity on the landscape for fire resiliency and protection of the newly planted cash crop (Ponderosa pine and Douglas fir).

In addition, creating a snake hibernaculum for the Western Rattlesnake (*Crotalus oreganus*) (two completed to date).

890

Finding the Value and Restraints of Native Tree Protection and Restoration Within Degraded and Productive Agricultural Lands of Misiones, Argentina

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Abstract

Misiones is a sub-tropical province in Northeastern Argentina, containing portions of the heavily deforested Alto Parana and Araucaria forests. Misiones experienced significant economic and sociographic changes throughout the previous four decades, significantly affecting environmental and social sustainability. The primary drivers of these regional transitions are the globalization and consolidation of central agricultural products such as yerba mate, timber/pulp products, and cattle. These shifts carry negative externalities, including the growing popularity of high-yield agricultural methods, leading to soil degradation, increased agrochemical use, and decreased native tree cover and habitat continuity. Consequently, ecosystem resilience has diminished, leading to greater crop susceptibility to climate change and pest outbreaks. Moreover, the recent abandonment of productive agricultural land has allowed for greater centralization and accumulation of land and resources by larger agribusiness producers. Still, there is a strong presence of local land stewardship by smallholder and medium-sized farmers to conserve and restore native tree stands. However, their motivations and challenges have yet to be examined. This study has four core components, which are: to characterize the socioeconomic profile of the smallholder farmers (i.e., income, education level, land tenure, and social networks); conduct a qualitative assessment of the motivation and barriers that underpin land use change and the abandonment of productive land; evaluate the valuation and efficacy of extant conservation and environmental restoration practices by smallholder farmers, focusing on native trees; and understand how these linkages and relevant empirical information can improve public policy and sustainable rural development projects that incorporate conservation and ecosystem restoration.

892

Effects of wildfire on grazed semi-arid grasslandsMegan tenBensel, Bryan Drew, Jayne Jonas

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Abstract

Grassland ecosystems are adapted to and maintained by periodic fire and grazing. However, management efforts in working lands often focus on cattle grazing despite the potential benefits of occasional prescribed burning for restoration of native plant species. In late April 2022, the Road 702 Wildfire burned an estimated 18,000 hectares of privately owned semi-arid grasslands in northwestern Kansas and southwestern Nebraska. Although characteristics of wildfire can differ from those of prescribed fire, this study was initiated in fall 2022 to monitor impacts of the Road 702 wildfire on plant recovery over time in a system subject to long-term fire suppression. Specifically, this study compares three sites: an overgrazed burned pasture, an ungrazed burned pasture, and a control pasture that was not burned and has not been grazed in at least 20 years. Twenty permanent 1-m² sampling plots were randomly located on each site and plant species cover monitored annually through 2024. The site that was both burned and grazed tended to have higher species richness than ungrazed sites (both burned and unburned) by 2024. In addition, the proportion of native species in the burned-grazed site also tended to be higher than in the ungrazed sites. This study demonstrates the possible benefit of fire for increasing native plant diversity in a semi-arid rangeland where fire is not widely used as a management or restoration tool.

894

Impacts of Residual Indaziflam on Emergence of Native Species from Seed

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Abstract

Indaziflam, a pre-emergent herbicide used for the control of invasive annual grasses, particularly *Bromus tectorum* (cheatgrass or downy brome) is becoming widely used by land managers in the western United States. Little is known about indaziflam's impacts on the germination and emergence of native species used for seed-based restoration. Furthermore, while indaziflam is known to have residual persistence in the soil, it is unknown how this residue may impact the germination and emergence of seedlings of native species. We conducted a greenhouse study to assess the seedling emergence of 14 species in response to ten rates of indaziflam from 0 to approx. 500 g/ha (0 to 95 g/ha active ingredient) in a sand mix and topsoil. Liquid chromatography/mass spectrometer analysis indicated that residue of indaziflam was higher in topsoil than sand mix. Emergence of the native grasses *Bouteloua gracilis* and *Elymus elymoides* and the invasive grasses *Bromus tectorum*, *Arrhenatherum elatius*, and *Secale cereale* decreased with increasing indaziflam application rate. Native forb species *Linum pratense*, *Ratibida columnifera*, and *Rayjacksonia annua* also showed a negative relationship between increasing application rate and emergence. Native forb species *Artemisia frigida*, *Grindelia subalpina*, and *Machaeranthera tanacetifolia* showed a weak to no relationship between application rate and emergence, which may indicate a degree of tolerance. More research is needed to explore these findings.

896

Survey of growth-reproduction strategies of California grassland plants: consequences of migration of native and non-native species

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Abstract

Globally, grasslands are economically, ecologically, and culturally important. They are often rain-fed systems and thus dependent on precipitation regimes. In California, grasslands are dominated by annual native and non-native species. This can lead to intense spread of highly invasive species that are economically and ecologically costly. The spread of native, non-native, and invasive species is linked to the allocation of resources to propagules production versus growth, stress tolerance and defense mechanisms. Here I ask, how do California grassland plants trade-off their limited resources between growth and reproduction and how does this vary across native, non-native, and invasive species? Additionally, how does this relationship vary across a species' range of precipitation regimes? I constructed a common garden experiment in Davis, California with five representative grassland communities from along California's cis-montane grassland precipitation gradient (300 mm – 1140 mm mean annual precipitation). In spring 2023, I measured twelve species from each community for growth and reproductive investment. Preliminarily, I found that species identity was a significant factor in the allometric relationship between vegetative and reproductive biomass ($p < 0.005$). Most notably, I found a more aggressive growth-reproduction strategy of non-native species compared to native species ($p < 0.005$); that is, non-native species invested in more reproductive biomass for every unit of vegetative biomass compared to native species. Finally, many species found in multiple communities had significantly different growth-reproductive relationships depending on their home site precipitation regime, lending insight into the positive and negative consequences of unintended and intended assisted migration in a restoration context.

898

Addressing Impacts of Heavy Metal Pollutants on Groundwater in E-waste Locations: A Case Study of Alaba International Market and Olusosun Communities in Lagos State, Nigeria

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Abstract

Abstract

In the study, we examined the complex, interconnected and interdependent nature of social, economic, health and environmental dimensions of the Sustainable Development Goals (SDGs) and offer pathways for policy intervention to address the impacts of heavy metal pollutants in the environment. Heavy metal contamination in groundwater poses a significant threat to public health and environmental sustainability, particularly in urban areas like Alaba International Market and Olusosun communities in Lagos State, Nigeria. This issue highlights the paradoxical nature of sustainable development, where economic activities such as e-waste processing can compromise environmental and social pillars. The Equilibrium Perspectives Paradox Framework suggests that achieving sustainable development requires balancing these interconnected pillars.

To address this challenge, a strategic action plan has been proposed:

- 1.) Establishment of a Stakeholder Committee: Comprising government representatives, scientific organizations, community associations, and NGOs to implement effective management strategies.
- 2.) Regulatory Enforcement: Strict regulations for e-waste handling and disposal.
- 3.) Groundwater Monitoring: Continuous quality checks to ensure public health safety.
- 4.) Health Risk Assessments: Regular evaluations focusing on vulnerable populations like children.
- 5.) Public Awareness Campaigns: Educating the public about health risks associated with heavy metal contamination.

Implementing these measures will help mitigate the negative impacts of heavy metal pollutants on groundwater while aligning with Sustainable Development Goals (SDGs) related to health (SDG 3), water quality (SDG 6), and environmental protection (SDGs 11, 12, 14 and 15). This approach underscores the need for integrated policies that balance economic growth with social equity and environmental sustainability.

907

Above and Belowground Understory Response to Repeat Fire within Colorado's Front Range

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Abstract

Within the western United States, fire is increasingly returning to the landscape. In dry-mixed coniferous forests, wildfires today are burning at higher severities in comparison to historic fire regimes as the result of a century of fire exclusion and climate change. Certain forested areas are experiencing short interval (10-30 years) repeat fire leading to delayed forest recovery and in some cases, ecosystem type conversion. The understory plant community plays a crucial role in quickly revegetating the landscape after fire. Understory plants aid in soil stabilization, provide crucial habitat, cycle nutrients, and comprise most of the plant diversity in dry coniferous forests. The soil seed bank is particularly important in post-fire conditions, as many early successional plants recruit from the seed reserves stored in the soil. My research aims to answer the question of how does repeat fire, stratified by fire severity, impact above and belowground understory composition within the intersection of two fires in Colorado's Front Range. To assess current and future community composition across the burn scars I will I) document aboveground plant richness and abundance across sites that burned twice under different severities and II) assess the species composition of the soil seed bank to compare above and belowground similarity across sites that burned twice under different fire severities. My research will contribute to regional knowledge of understory resilience in western forests and can inform post-fire restoration efforts, such as species and site selection for aerial seedings.

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Targeting restoration in medium and large rural properties can increase vegetation gains in a buffer zone in the Brazilian Atlantic Forest

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Abstract

Legal compliance is a key mechanism for Brazil to fulfill its international restoration commitments. In Brazil, degraded Permanent Preservation Areas (PPAs) must be restored to reestablish their ecological functions. Prioritizing areas for restoration should account for relevant areas for biodiversity conservation in the landscape. Buffer zones (BZs) play a critical role in reducing pressure on Protected Areas (PAs) and are strategic targets for restoration efforts. We analyzed a scenario of riparian PPA restoration in the BZ of Serra do Mar State Park (Atlantic Forest, Brazil), considering different rural property sizes. Using data from the National Rural Environmental Registry System, we assumed non-adherence to the Environmental Regularization Program, requiring full restoration of PPAs. In the BZ, 3% (209) of rural properties exceed 15 fiscal modules and account for 56% (158,823 ha) of the area of the analyzed properties, while 90% (6,930) of properties are smaller than 4 fiscal modules, covering only 27% (77,572 ha) of this area. Riparian PPAs (121,254 ha) represent 23% of the BZ, with 74% covered by native vegetation and 23% used for agriculture or forestry. Registered rural properties contain 57% (15,500 ha) of the restorable PPAs. Restoration of PPAs within medium-sized properties (4–15 fiscal modules) and large properties (>15 fiscal modules) could raise vegetation cover in PPAs to 77% and 80%, respectively. While restoration in medium and large properties could enhance vegetation cover and optimize efforts in the BZ, supporting restoration in small properties is equally important and may require additional incentives.

923

Do regenerative farming practices improve soil health and plant diversity on small farms around southeast Tennessee's Cumberland Plateau?

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Abstract

Research suggests that regenerative agricultural practices that enhance soil carbon sequestration may mitigate climate change, improve soil health and promote biodiversity. Small farmers around the world are adopting these practices out of a sense of stewardship. Methods to assess the effectiveness of these practices, however, are often designed for large operations. We sampled small (≤ 200 acres) regenerative and conventional farms around the southeastern Cumberland Plateau in Tennessee to examine whether regenerative agriculture has positive impacts in this context. A 2022 pilot study of small farms comparing soil carbon between farmland managed with regenerative practices and adjacent unmanaged plots had inconclusive results, in part, due to the stratified random sampling method that had been developed for large farming operations. We shared the results of the pilot study, including soil carbon maps, with the farmers. Based upon these conversations, we modified our sampling strategy to include conventional farms and measured new variables, including plant species richness and soil aggregate stability, in addition to soil organic carbon. We directed our sampling to where farmers have implemented regenerative practices most intensively and for the longest period. In contrast to the pilot study, data collected using methods modified to focus on farmer practices demonstrated significant results on some farms. One farm regenerating from strip mining showed considerable improvement, while others showed less dramatic results, depending on practices and soil type. This study shows that a collaborative adaptive study design integrating farmers' insights may better reflect the positive effects of regenerative practices on small farms.

934

Collaborative Ecosystem Restoration Planning in Community Forests: A Multi-Stakeholder Strategy in West Java, Indonesia

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Abstract

Bamboo plays a crucial role in ecosystems due to its multifunctionality and environmental sustainability benefits. In Sumatra, where numerous endemic bamboo species thrive, conservation efforts are urgently needed as habitat loss accelerates due to agricultural expansion and urbanization. Ex situ conservation within managed botanical gardens offers a strategic solution by integrating ecological preservation with educational and ecotourism functions. The ITERA Botanical Garden in Lampung presents a significant opportunity to become a center for bamboo conservation, particularly for Sumatra's native species facing habitat degradation and insufficient protection.

Bamboo forests have substantial carbon sequestration potential, contributing to climate change mitigation by absorbing over 12 tons of CO₂ per hectare annually. Additionally, bamboo's extensive rhizome system enhances soil stability and water absorption, with the capacity to retain up to 90% of rainfall. These attributes make bamboo an essential resource for sustainable environmental management. The proposed Bamboo Garden at ITERA aims to preserve local bamboo species while promoting environmental education and eco-friendly tourism. Its design integrates ecological, aesthetic, and educational functions to raise public awareness and support conservation efforts. The success of this initiative requires collaboration among government bodies, academia, and local communities to ensure effective management. Through sustainable landscape design and community engagement, the ITERA Bamboo Garden can serve as a national model for green space conservation. This initiative will not only safeguard Sumatra's bamboo species but also enhance ecotourism potential, reinforcing long-term ecological and social benefits. The master plan for the Bamboo Garden is designed based on ecoregion groups in Sumatra Island.

965

“Wetlands Belong All Over”: Celebrating Three Decades of Successful Large-Scale Wetland Design, Restoration, and Creation with the Wetlands Initiative

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Abstract

Founded in 1994, the Wetlands Initiative (TWI) envisions a world with plentiful healthy wetlands that sustain biodiversity and human well-being. Our innovative and collaborative projects employ sound science to improve water quality, habitat for plants and wildlife, and climate resilience. As the only nonprofit organization in Illinois dedicated to bringing back wetland ecosystems, we combine two basic strategies: on-the-ground restoration of high-quality wetland landscapes, and innovation in ways to promote and finance large-scale wetland restoration by others. Our long-term projects include native habitat restoration at the Sue and Wes Dixon Waterfowl Refuge, Midewin National Tallgrass Prairie, the Calumet region of Chicago and northwest Indiana, and within working farms across Illinois. These projects illustrate successful outcomes in challenging sites heavily degraded by agriculture, industry, and urbanization. From techniques to restore natural water patterns and habitat in urban wetlands to integrating “Smart Wetlands” into working farmland to improve water quality, we demonstrate practicable methods for addressing some of the Midwest’s most critical environmental problems across both urban and rural landscapes. Over three decades, we’ve developed design processes that address both immediate restoration needs and long-term sustainability, and in total, we’ve restored nearly 10,000 acres. Through creative funding approaches and public-private partnerships, we’ve pioneered sustainable models for scaling up wetland restoration across the Midwest region. Our experience shows that successful large-scale wetland restoration requires not just technical expertise, but also innovative financing mechanisms, strong partnerships, and adaptive management approaches that respond to changing environmental conditions.

977

Evaluating annual grass control with indaziflam at US National Parks in the desert southwest.

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Abstract

Invasive annual grasses are a major restoration challenge for land managers in the western United States, where they invade rangeland plant communities and promote destructive wildfire regimes that reduce the likelihood of native plant persistence. Mitigating wildfire risks associated with annual grass invasion is particularly important in desert plant communities that feature iconic slow-growing plants like Joshua trees (*Yucca brevifolia*) and saguaro cacti (*Carnegiea gigantea*). Numerous trials have demonstrated the effectiveness of the herbicide indaziflam for reducing annual grass abundance, but few studies have occurred in the arid deserts of the US southwest. We are evaluating annual grass control at five study sites spread across Tonto National Monument in Arizona and Joshua Tree National Park in California. All study sites are infested with red brome (*Bromus rubens*), Mediterranean grass (*Schismus* spp.), cheatgrass (*Bromus tectorum*), or a mix of these species. Initial treatments were applied in December 2023, and replicated in December 2024 to account for interannual variability in environmental conditions. Treatments varied slightly across the different sites, but all trials feature several rates of indaziflam. We will report initial results from these trials, with data collected 4 and 16 months after treatment, depending on the timing of the initial applications. Preliminary results indicate that indaziflam is effectively controlling invasive annual grasses at our study sites, but effective application rates may vary by target species. Our results suggest that indaziflam may be a powerful tool for land managers tasked with mitigating wildfire risk in the US desert southwest.

979

Transition in managing forests and other natural areas through rewilding - in Denmark, one of the most cultivated countries in the World

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Abstract

The Danish Nature Agency manages 5% of the Danish land area, appr. 200,000 hectares of forests and natural areas, to create the greatest possible value for society in terms of good conditions for nature protection and outdoor recreation.

Since 2016 the Nature Agency has carried out major efforts to change the concrete management of the 60% of the public owned forests with the aim to restore important parts of Danish biodiversity. This change consists of transition from traditional near-nature forestry to set-aside forests, also called untouched forests. The Agency uses different tools such as removal of non-native conifers (formerly planted as a part of intensively forestry), grazing, restoration of the natural hydrology etc.

Besides this transition the Agency also works with genuine rewilding - a total different management scheme in 21 Nature National Parcs placed all over Denmark. A Nature National Parc is a delimited area with the size of 300-5000 hectares where natural dynamics and rewilding is the goal. Reintroduction of the elk, European bison (visent) and beaver together with populations of feral horses and cattle plus wildlife such as red deers is important tools together with wetland restoration etc.

The poster will show some examples of concrete management together with some of the dilemmas regarding continued public access to these areas, political demands for animal welfare, scientific monitoring etc.

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Conserving and preserving Biodiversity Hotspots on privately-owned lands to support species and genetic sources for regeneration/reforestation

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Abstract

Reforestation and regeneration are intimately tied to intact biomes. Without biodiverse systems from which to preserve and source flora and fauna species, regeneration and reforestation efforts will lack the genetic diversity to mimic natural systems and adapt to future challenges. Most of the land in the world's 36 biodiversity hotspots are privately-owned. Hotspot Patrons serves as a liaison between private landowners in biodiversity hotspots and those with resources to enhance their conservation impact- addressing a gap in conservation financing by supporting private-lands conservation.

Hotspots Patrons will include results from a needs assessment from the Cerrado and Atlantic Forest in Brazil. Currently, we are forming a partnership with the GEF (Global Environment Facility) and Funatura in Brazil to use Hotspot Patrons' privately-owned nature reserve's (RPPN) needs-assessment to evaluate the 51 RPPNs that surround a UNESCO World Heritage Site- Chapada das Veadeiros National Park situated in the biodiversity hotspot biome, the Cerrado. Hotspot Patrons is developing a second pilot project in the Atlantic Forests, working with private landowners and bridging research, private, governmental, and public sectors to enhance biodiversity (and therefore restoration/regeneration) efforts.

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Slowing degradation feedbacks: restoring bare ground patches in rangeland systems

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Abstract

Rangelands occupy approximately 31% of terrestrial ecosystems, and support tens of millions of people in both rural and urban communities with goods and services including food, clean water, and recreational space in the U.S. However, water deficits are predicted for much of these rangelands, due to increases in temperature and more frequent droughts. These changes in already water-limited systems could result in degradation, meaning substantial loss of biodiversity, forage productivity, worsening erosion, and altered nutrient cycling. Degradation often starts with a trigger such as grazing causing a loss of vegetation, leading to the formation of bare patches. In warm, dry conditions, a feedback can form causing bare patches to expand from the edges of vegetation and merge to form large and persistent denuded areas. Restoration efforts could potentially reverse this runaway degradation process by identifying plant species that have traits that allow them to establish on the edges of patches, where conditions can favor new vegetation growth and leads to vegetation recovery. In the Summer of 2025, this study will explore the mechanisms behind bare patch formation and whether targeted species can reverse degradation through edge facilitation. We will assess how microsite conditions (e.g., soil moisture, temperature) and functional traits (e.g., seed mass, emergence timing) affect seedling emergence and establishment. The results will help guide rangeland restoration efforts worldwide and contribute to the conservation of rangelands facing increasing degradation by identifying traits and species suited to different microsites, enhancing seedling survival, and informing seeding strategies.

999

Mentoring young ecologists through Student Associations: an open discussion on strategies for long-term success

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Abstract

Student and young professional mentoring are critical to support future generations of restoration ecologists. Through its Student Association Program, SER encourages the formation of groups which foster such intergenerational mentoring opportunities at academic institutions. Forming an association is the first step, yet building long-term organizational continuity can be challenging due to high student turnover rates and short funding cycles. Since 2018, the SER at The Ohio State University Student Association (SER-OSU) has faced these challenges and tested strategies to improve long-term institutional memory for its 60+ members across eight student cohorts. We also spoke with members of other Student Associations for their insights into key pillars of success and spoke with prospective Student Associations to understand knowledge gaps that may limit Association development. In collaboration and with funding from the *SER members through the Partnership Fund*, the SER Midwest-Great Lakes Chapter has begun an initiative to support Association development and use these insights to create a framework for organization longevity. Such a framework would teach new Associations worldwide to leverage their resources and form long-term restoration partnerships while mentoring future leaders.

This presentation seeks to foster discussion among SER2025 attendees about their experiences forming partnerships in restoration and mentoring young ecologists. As a springboard for conversation, we present SER-OSU's story of collaboration with nonprofits, university faculty and staff, and the public to manage riparian forest restorations along the Olentangy and Scioto Rivers in Columbus, Ohio, USA. Insights from attendees could generate additional broadly applicable advice for groups training future ecologists.

1008

Assessing Pollen Limitation of Four Native Wildflowers to Improve Prairie Restoration Success in Eastern Washington

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USA

Abstract

Prairie ecosystems in eastern Washington are among the most endangered in the U.S., with less than 0.1% of native prairie remaining due to habitat fragmentation, agriculture, and urbanization. The Eastern Washington University (EWU) prairie restoration site provides an opportunity to study how these disturbances impact plant-pollinator interactions and early ecosystem recovery. Native bees are essential for plant reproduction, yet their populations have declined due to habitat loss. While restoration efforts focus on reintroducing native plants, the extent of pollen limitation remains unclear. This study examines pollen limitation in native wildflowers at restored and intact prairie sites, hypothesizing that restored sites will experience greater pollen limitation, that pollinator communities will differ between sites, and that higher non-native plant cover will increase pollen limitation and reduce native plant reproductive success.

Pollination treatments, including open pollination, pollinator exclusion, and hand pollination, will be applied to four focal species to assess seed set differences. Bee communities and vegetation composition will also be monitored to determine their effects on pollination success. In 2023, our surveys at EWU documented 839 bees from 48 species, revealing a high yet understudied diversity of pollinators in the region. Pollination is a key driver of ecosystem resilience, influencing plant population stability and genetic diversity. Findings from this study will inform restoration strategies by identifying key plant-pollinator relationships that enhance reproductive success in native species. This research will contribute to broader conservation efforts, offering insights that may aid in the restoration and management of fragmented prairie habitats across the Pacific Northwest.

1009

Assessing the Impacts of Freight Channel Exposure in a Fetch-Limited Environment on Coastal Wetland Distribution

Spencer Dzyacky

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Abstract

Great Lakes Coastal Wetlands are ecologically important ecosystems that are highly susceptible to wave action. The St. Marys River is the site of heavy shipping traffic, exposing wetland communities to significant wave action. With the proposal of a new lock in Sault St. Marie and the likely increase in freighter use, it is important to understand if this wave action is affecting the distribution of wetlands. This study uses the distance across a body of water (fetch), bottom slope, water depth, and exposure to the shipping channel to predict the presence and absence of bullrush and cattail. The two study species are common and have a high wave tolerance, allowing them to be used as a proxy for wetland establishment. A Maxent model confirmed the assumption that the distribution of wetlands across the Great Lakes is largely determined by fetch. I then created a random forest model in R to assess the hypothesis that exposure to the freighter is the most impactful factor to distribution in fetch-limited environments. The model accuracy lies between 85-92%, with the most important variable being the exposure to the shipping channel. In the summer of 2024, I ground-truthed model predictions throughout the study area. During the 2024-2025 academic year I will incorporate the ground-truthed data to test and improve the model's accuracy. I will use the refined model to predict wetland distributions under future predicted water levels to understand how climate change may impact the future of St. Marys river coastal wetlands.

1014

Who benefits from fungal friendships? An assessment of dryland restoration species dependance on mycorrhizal inoculation.

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Abstract

Restoration efforts in dryland ecosystems are successful less than 20% of the time largely due to low and variable precipitation. One action researchers take to combat this low success rate is by adding inoculum (mycorrhizal fungi) to restoration plantings. However, which restoration species benefit most from mycorrhizae is not well understood. Theory suggests that species with larger root diameters rely more on mycorrhizae because their roots are less efficient at independent resources acquisition. Yet, assessments of the interacting effects of root diameter and mycorrhizae on plant performance are limited. To address this knowledge gap, we are growing 24 grass and forb species used in dryland restoration throughout the western United States. We are growing each species in sterile and living soils (added mycorrhizal inoculum) for a 10-week period. After this, we will stop watering a subset of each species in each soil treatment and will monitor plant mortality. With this study we aim to determine if inoculation improves plant survival time under drought and if survival duration differs among species with different root diameters. We expect species with large root diameters to survive longer with mycorrhizae under drought. We also expect survival of small diameter species under drought to be unaffected by mycorrhizal inoculation. The results of this experiment will clarify which restoration species benefit most from mycorrhizal inoculation in dryland restoration. We hope this research will improve outcomes of dryland restoration across the western United States by elucidating when mycorrhizal inoculation ought to be integrated into restoration plantings.

1019

Enhancing Ecological and Economic Benefits through Restoration of Tropical Grassy Biomes

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Abstract

Restoration in tropical grassy biomes must assess outcomes related to essential ecosystem services and their economic implications, thereby enhancing the potential ecological and economic benefits offered by these initiatives. In response, we outline an experimental framework designed to establish plant communities that support both ecosystem and socioeconomic functions. Our approach aims to design models for ecological restoration and agro-savanna systems by carefully selecting plant species from key functional groups to replicate the typical structure of open ecosystems of the Cerrado biome, which comprises roughly 70% herbaceous species (herbs and graminoids) and 30% woody species (shrubs and subshrubs, often disregarded in restoration projects). Within this framework, we identified seven target species with the potential to provide critical ecosystem services specifically related to (1) carbon sequestration, (2) pollination support, and (3) economic viability. To maximize diversity, we incorporate a treatment with 13 species, ensuring representation for all targeted services. Recognizing the challenges of restoring grass layers, we also established a five-species grass-only treatment, considering the resilience of woody species to resprout from budbanks after prolonged land degradation. In early 2025, we set up plots across 10 blocks in a former pasture area in central Cerrado during the rainy season. Continuous monitoring of plant establishment in all treatments will allow us to compare targeted ecosystem services to a Cerrado reference site, thereby evaluating the effectiveness of our selected species. Ultimately, we expect to promote the restoration of biodiversity, ecosystem structure, function, and the sustainable use of natural resources in the Cerrado.

1022

The effects of storage conditions on two common forb species of the North American Great Plains, *Echinacea angustifolia* and *Solidago rigida*.

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Abstract

Northern Great Plains prairies exist as some of the most endangered ecosystems on earth today. In recent decades, this knowledge has pushed stakeholders of South Dakota and surrounding states to begin placing an increasing amount of time and money into large-scale restoration and management projects to expand, increase, and strengthen the functionality of affected grassland ecosystems. These projects require considerable time and labor costs due to the hands-on nature of seed collection, storage, and broadcasting of seeds, and often yield disappointing results due to poor seed germination and plant establishment. As many concepts associated with native seed restoration are somewhat new, most native seeds possess storage and germination behaviors that are unknown. General assumptions based off research from similar species, or just general standard practices are used when information about a species is unavailable, although research has shown that there is large species variability in storage capacity. This research project aims to find the relationship between two storage condition factors (temperature and relative humidity) and seed longevity. Inter- and intraspecific responses will be evaluated using five populations of two common forb species of the Northern Great Plains, *Echinacea angustifolia* and *Solidago rigida*, collected across South Dakota. Seeds will be stored in 9 separate experimental units, each with different relative humidity and temperature conditions. Seed viability and germination are examined at 1, 3, 6, 12 weeks.

1025

Gender Equality in Higher Education and Leadership in Ecological Restoration: Analyzing Policies, Initiatives and Governance in Brazil and Chile.

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Abstract

Achieving gender equality in higher education is essential for fostering equity academic environments and driving social progress. Recently, institutions such as the University of São Paulo (USP) in Brazil and the University of Concepción (UdeC) in Chile have implemented initiatives to address gender gaps and promoting diversity in research and leadership. However, persistent challenges remain in ensuring equal representation across disciplines and leadership roles. This study aimed to analyze whether current institutional policies and initiatives are gender-blind, gender-sensitive, or gender-transformative, using documentary research and interviews with key actors. The research seeks to provide critical insights into governance structures and their effectiveness in promoting gender equity within universities and ecological restoration programs. In Chile, ecological restoration courses are predominantly led by men, reflecting positive strides in female leadership within this specific field. At USP, while gender equity policies have advanced, similar challenges persist in achieving equal opportunities for women in research and leadership. Funding agencies play a pivotal role in addressing gender disparities by prioritizing financial support for projects led by women and those addressing gender-related gaps. The integration of robust institutional policies with targeted funding incentives can drive transformative changes. We analyzed the institutional structure of the two institutions by looking at research networks, leadership and access to grants and resources. The results aim to point out weaknesses in the institutions that need to be resolved to guarantee gender equality in educational institutions and provide critical insights into governance structures and their effectiveness in promoting gender equity within universities.

1035

Effects of vegetation restoration on soil fungi community structure and assembly process in a semiarid alpine mining region

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Abstract

Understanding the response of soil fungal community characteristics to vegetation restoration is crucial for improving the effectiveness of artificial restoration in alpine mining areas. However, the comprehension of the structural composition and assembly mechanisms of soil fungal communities following vegetation restoration in these areas remains limited. Here, we determined variations and drivers of soil fungal community structures and assembly processes along restoration years in a semiarid alpine coal mining region. Results indicated that artificial vegetation restoration significantly increased diversity indices of soil fungal communities while significantly decreasing β diversity. As the restoration period extended, the α diversity of soil fungal communities significantly decreased, while β diversity significantly increased. Furthermore, the null model analysis indicated that dispersal limitation and homogeneous selection were main mechanisms governing assembly processes of soil fungal communities. In natural plant and unrestored sites, the structure of soil fungal communities were mainly influenced by dispersal limitation rather than homogeneous selection. In 2-year restoration sites, homogeneous selection was considered the main contributor to the assembly of soil fungal communities, with the structure being mainly affected by soil sand, TP, TK and BGB. As restoration period increased, the importance of homogeneous selection decreased, while the relative importance of dispersal limitation notably increased, with community structure being mainly influenced by soil clay, SMC and TP. Overall, our findings highlighted the importance of soil texture and TP in regulating soil fungal community during the vegetation restoration process in semiarid alpine mining regions.

1037

Is the Soil Seed Bank Sufficient for Restoring Tropical Dry Forests?Viviana Londoño-Lemos, Jennifer Powers

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Abstract

Tropical dry forests (TDFs) are among the most threatened tropical ecosystems globally. Urban expansion, cattle ranching, and extensive monocultures threaten the few TDF remaining fragments in the Americas. Additionally, TDFs are considered one of the most challenging ecosystems to restore, as active restoration requires intensive management, and their natural regeneration process is understudied. Passive restoration relies on soil seed banks (the storage of viable seeds on the forest floor). Plants have two main strategies for the soil seed bank; some are transient (seeds remain viable for less than a year) and persistent (seeds remain viable for more than a year). Studies of soil seed banks in TDF have shown that their soil seed bank is often dominated by herbaceous plants and few woody species; the latter are the main structural components of TDFs. To assess the viability of passive restoration in TDF, we designed a manipulative experiment and buried seeds of 43 different TDF species in Costa Rica and Colombia to directly test their soil seed bank strategy. Each experiment was harvested every three months for 12 months. I found that species with thicker seed coats and physical dormancy tended to stay longer in the soil seed bank. This approach allowed me to establish which TDF species had a persistent or transient strategy for the soil seed bank. My results show that for some TDF species, an effective restoration should be complemented with revegetation or direct seeding to ensure the typical diversity of TDFs.

1043

Evaluating the Impact of Educational Initiatives on Student Awareness and Engagement in Sustainable Development Goals: A Case Study of SER UNILAG Student Chapter Annual Conference

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Abstract

The Sustainable Development Goals (SDGs) are a global initiative established by the United Nations in 2015 to tackle urgent social, economic, and environmental issues by 2030. As hubs of knowledge and innovation, universities are pivotal in promoting these goals. This study, conducted at the University of Lagos, assesses the impact of the second Annual Conference of the SER UNILAG student chapter, which focused on the role of youth in advancing the UN's agenda for ecological restoration through SDG actions. The conference addressed youth empowerment, community engagement, and education for sustainable development, policy advocacy, biodiversity conservation, sustainable agriculture, and climate change. A survey of 150 participants revealed that student awareness of SDGs rose dramatically from 38.2% before the event to 85% afterward. Student participation in SDG initiatives increased from 15% to 65%.

The survey highlighted familiarity with specific SDGs, with the highest awareness for clean water and sanitation (55%), quality education (51.5%), and good health and well-being (45%). However, there was less awareness regarding economic and infrastructure goals, such as decent work (13.2%) and peace and justice (10.3%). The low participation of students in SDGs within the university reflects either a lack of opportunities for students to engage with SDG-related initiatives or insufficient awareness of the activities available to them. The conference fostered networking opportunities, enhancing students' commitment to sustainability initiatives.

This research reveals the effectiveness of targeted awareness campaigns in boosting student engagement in global goals, suggesting that ongoing educational efforts can significantly increase participation in sustainable practices within academic settings.

1056

Community-initiated enhancement of US Forest Service prescribed burn through volunteer weed management

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Abstract

Community involvement in restoration projects can provide volunteer labor that may permit otherwise economically infeasible restoration activities. Such an approach can enhance large-scale land management initiatives. This case-study highlights one such example where the community initiated a manual weed management project following a US Forest Service funded and executed prescribed burn in the Colorado Front Range on a south-facing meadow at approximately 8,000 ft elevation. The US Forest Service prescribed burn successfully restored this fire-adapted landscape and significantly reduced the prevalence of cheatgrass in the area. The community proposed and received US Forest Service approval to enhance the restoration effort by addressing the patches of cheatgrass that did survive the prescribed burn. Volunteers cut and collected seed heads of senesced cheatgrass plants in areas where cheatgrass persisted following the prescribed burn, thereby preventing the cheatgrass from spreading and progressively depleting the cheatgrass seed bank, which had already been reduced by the prescribed burn. Cutting of seed heads minimized disturbance to the soil by leaving root systems intact, thus preventing reproduction of this annual plant while maintaining good soil conditions for native plant regrowth. Annual repetition of this control method is expected to lead to elimination of cheatgrass in targeted areas over three years, based on results already achieved in similar, nearby ecosystems. Such an ad hoc community-driven approach to proactive long-term management may be favorable in other settings where land management agencies lack resources for labor-intensive manual interventions following large-scale restoration efforts.

1057

The Role of Soil Microbial Communities in Mediating Plant-Soil Feedbacks

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Abstract

Plant-soil feedbacks are driven by host-associated changes in the soil microbial community, though the relative influence and relationship of soil pathogens and plant-associated mutualists in dictating strength and direction of feedback is unclear. Plant phylogenetic diversity also shapes microbial community composition, potentially altering feedback outcomes. We conducted a greenhouse feedback experiment to assess how soil inoculation treatments and plant diversity influence biomass-based feedback responses and microbial community composition (arbuscular mycorrhizal fungi (AMF), pathogenic fungi, oomycetes, and bacteria). We used soil conditioned for five years in a long-term field experiment and tested 12 species from *Asteraceae*, *Poaceae*, and *Fabaceae* families. Plants were grown in conspecific, same-family, and different-family trained soils replicated across three field microbial amendments: unamended, amended with a diverse community of native prairie AMF, and prairie whole soil community. Results show that AMF amendment generally promotes more positive feedback and reduced pathogenic fungi dissimilarity. The lowest AMF dissimilarity was observed in AMF-inoculated soils and in treatments with *Asteraceae* species. Fungal pathogen dissimilarity was generally greater in treatments grown with *Fabaceae* species except when inoculated with AMF; which then had the lowest. Additionally, in AMF-inoculated soils, greater pathogenic fungi dissimilarity was associated with more negative feedback, whereas in uninoculated and prairie whole soil treatments, it was linked to more positive feedback. This work affirms that soil pathogens are important drivers of negative feedback and therefore plant species coexistence. Moreover, we find that native AM fungi can suppress soil pathogens, as evidenced by reduced soil pathogen dissimilarity.

1063

Using remote sensing to assess the influence of thermal properties and vegetation structure on arthropod biodiversity in agricultural landscapes

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Abstract

Restoration of riparian vegetation within complex agricultural landscapes has shown to enhance ecosystem services, such as pest control and pollination. Yet, we lack an understanding of how specific vegetation characteristics drive these benefits. Vegetation structure modifies local temperature conditions through solar radiation reflection and microclimate creation, which is important for temperature-sensitive arthropod communities that provide essential ecosystem services. However, the combined effects of thermal properties and vegetation structure on biodiversity remains understudied in agricultural and riparian systems. Here we employed ground-based measurements and remote sensing techniques, including aerial LiDAR and thermal infrared imaging (UAV, Landsat 9), to measure vegetation structure and thermal characteristics in orchards and natural areas along riparian corridors in the Santa Clara River Valley. Our aims were to 1) assess how 3D vegetation and thermal metrics differ as a function of management types (lemon and avocado orchards, riparian area) and distance from natural riparian habitat (near (<0.3 km), far (>1 km)); 2) determine whether 3D vegetation structural metrics are related to thermal properties; and 3) examine relationships between vegetation and thermal metrics and measures of arthropod biodiversity, including abundance of pests and beneficial arthropods. Preliminary results showed that natural areas with more complex vegetation structures exhibited greater thermal heterogeneity and subsequently, arthropod biodiversity, compared to orchards. In addition, both proximity to riparian habitats and total percent vegetation cover positively influenced arthropod species abundance and diversity. Results from this study suggest that restoring structurally diverse vegetation can promote more sustainable agricultural practices, by enhancing ecosystem services.

1069

Ruminant: Visualizing Bison Carcass Decomposition Through the Art and Science of Soil

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Abstract

“Ruminant” provides viewers with the opportunity to visualize changes in soil chemistry around bison carcasses at the City and County of Denver’s Genesee Park—a public park in the foothills west of Denver. Genesee Park holds historic significance as the site of Colorado’s first recorded animal reintroduction. In 1914, Denver Mountain Parks collaborated with Denver Zoo Conservation Alliance to reintroduce bison to the park, marking a pivotal moment in conserving this ecologically and culturally important species. Since then, their collaboration on bison management and research has persisted.

Research highlights bison’s keystone role during their life; however, few studies have reviewed their ecological significance in death, and even fewer have explored this process through art. To address this, we combined science and art to document changes in soil nutrients around two bison carcasses at the park.

We took soil samples the week after each bison died and once a month for 10 months. We collected soil samples at the carcass and 5, 10, and 15 meters away in each cardinal direction (n = 26 samples). We analyzed soil samples using inductively coupled plasma mass spectrometry (ICPMS) to test for elemental concentrations of magnesium, potassium, sodium, sulfur, nitrogen, and phosphorus. After each carcass had mostly decomposed, we buried undyed cloth at each soil collection point. We left the cloth for 49 days before exhuming it to reveal chemical and microbial activity that inspired a series of paintings. Overall, our art-science partnerships seeks to build public interest and affinity around scientific phenomena.

1070

The Intersection of Art and Science: A Living Artwork of Colorado's Native Plants

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Abstract

The historic interconnection between art and science has long served as a catalyst for discovery and inspiration, yet modern disciplinary divides have led to a loss of beauty, intuition, and connection to the natural world. This research project seeks to bridge that gap by creating a living artwork composed of Colorado's native plants. Designed collaboratively by ecologists, botanists, and classically trained artists, the statue will evolve with the seasons, displaying different images and narratives based on the time of year. This dynamic, living artwork will be shown in schools across the Denver Metro area, engaging students in the interplay of ecological cycles, artistic expression, and scientific observation. The selection of native plants ensures the piece is both ecologically rooted and regionally significant, fostering discussions about native biodiversity, ecosystem loss, and restoration of unassuming spaces in the built environment. By merging ecological expertise with artistic vision, this project rekindles an ancient dialogue between disciplines, demonstrating that scientific inquiry and artistic creativity are not only compatible but intertwined. The goal is for the living artwork to serve as a tangible representation of the interconnectedness of humanity and the natural world.

1071

Teaching Human-Environment Interactions - Exploring how past land use affects current plant diversity in an ecosystem

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Abstract

Presenting real-world challenges in the classroom enhances student engagement, motivation, and academic performance. The Four Dimensional Ecology Education (4DEE) Framework provides a comprehensive guide for developing teaching materials that integrate human-environment interactions, core ecological concepts, ecological practices, and crosscutting themes, making ecology more relevant and engaging for students. We applied the 4DEE framework to create a teaching module for undergraduate courses in introductory ecology, restoration ecology, and environmental sciences. The module investigates how past land use changes continue to influence present-day species assemblages, providing students with an opportunity to apply ecological theory to current environmental challenges. We worked with a secondary forest that developed after agricultural activities ceased on a former plantation. Although the study was conducted in this specific location, the approach can be applied to any land area.

Students analyzed aerial images using Google Earth Pro to create land history data covering the past 60 years and mapped 15 x 15 m plots. Then, students recorded species diversity of woody vegetation in each of those plots. Depending on interests and faculty expertise a variety of ecosystem services or functions could be measured. Preliminary results showed that the number of non-native woody species increased as disturbance intensity (changes in land-use) increased. In a final discussion, students then consider other common post-abandonment land use transitions with varying degrees of human intervention.

We will provide lesson plans, share student experiences, and highlight the potential for this module to be adapted to other ecological contexts.

1074

Restoring Colorado's forests: How collaborative public-private partnerships are driving impact in ecological restoration

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Abstract

Land Life, a global nature restoration company, is pioneering a public-private reforestation model that integrates state agencies, private sector innovators, and ecological practitioners to scale impact. In partnership with the Colorado State Land Board, Land Life has established the first-ever state land forest carbon lease, which will restore up to 1,000 acres of wildfire-affected land while generating revenue for public education.

This afforestation, reforestation, and revegetation (ARR) project focuses on state trust lands across Grand, Huerfano, and Larimer counties. Land Life will fund and implement the restoration in consultation with the Colorado State Forest Service, planting native tree species to improve watershed health, enhance wildlife habitat, and increase landscape resilience to climate-induced stressors such as wildfires.

Stakeholder collaboration has been fundamental to this project. Land Life has actively engaged with the Colorado State Forest Service, which manages State Land Board lands, ensuring alignment with regional forest management goals. The project also involves State Land Board lessees, particularly grazing leaseholders, fostering a cooperative approach that balances conservation and land use needs. The Nature Conservancy also played a key role and the Colorado Native Plant Society submitted public comments during the approval process.

This initiative highlights stakeholder mapping, participatory planning, and transparent impact measurement as essential components of successful restoration. The two-stage review and approval process provided multiple opportunities for public input, reinforcing transparency and community involvement.

This presentation will provide insights into the opportunities and challenges of multi-stakeholder ecological restoration, offering practical strategies for leveraging collaborative engagement for large-scale restoration.

1086

A Collaborative Approach to Restoring Bison, Grasslands, and Cultural Connections Across Daniels Park and Highlands Ranch Backcountry Wilderness Area (Colorado, USA)

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Abstract

Colorado's open spaces face countless restoration challenges, including introduced species, erosion, woody overgrowth, and encroaching development. These issues can become magnified across jurisdictional boundaries where land management goals and strategies may differ. Underpinning all of this is a complex socio-cultural history—around fifty Native American tribes once cared for these lands before being forcefully removed. Thus, fully restoring open spaces requires cross-jurisdictional, ecologically minded, and culturally conscious approaches that reconnect people to land and heritage.

Focusing on Daniels Park and Highlands Ranch Backcountry Wilderness Area (HRBWA)—adjacent open spaces in Metro Denver managed by different landowners—this poster examines how land managers, conservationists, and Native communities are working together to heal these landscapes. The Tall Bull Memorial Grounds, located within Daniels Park, provides a space to honor Native American traditions and connections to land. As part of these efforts, a medicine wheel garden was created at Daniels Park to highlight traditional ecological knowledge and Colorado's grassland plant species—both of which were shaped by bison herds that once freely roamed across the Great Plains. Despite bison's important cultural and ecological role, restoring bison populations in fragmented, semi-urban landscapes presents significant challenges. Across Daniels Park and HRBWA, Denver Mountain Parks, Highlands Ranch Community Association, and Denver Zoo Conservation Alliance address these challenges through a collaborative approach to bison reintroduction, grassland restoration, and community engagement. Overall, this poster emphasizes the importance of collaboration in restoring grasslands and bison to ensure a more resilient and culturally connected future for Metro Denver's open spaces.

1129

Soil seed bank resilience in passively restored endangered Sand Fynbos following a century of pine plantations

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Abstract

Soil-stored seed banks are a critical evolutionary strategy for plants as they can stabilize population dynamics in response to environmental fluctuations such as droughts and natural disturbances such as fires, thus improving ecosystem resilience. This study aimed to assess resilience during the first restoration cycle of endangered Sand Fynbos following pine harvesting and a prescribed burn in South Africa. We compared above ground populations and soil-stored seed bank composition and focused on six perennial fynbos focal species in five 1 m² plots. All six species are obligate reseeders with soil-stored seed banks but represent a variety of important fynbos growth forms and seed types. We found that native soil-seed bank density following over a century of plantation forestry and ten years after the first fynbos restoration burn was comparable to, or exceeded, densities measured in other fynbos studies, especially seed banks of alien-invaded fynbos ecosystems. The early years following pine harvesting and a restoration burn likely provide a pest- and predator-free window of opportunity in which plants may re-establish and flourish. Our results show that even for old forestry plantation areas, ecological restoration to the historic vegetation community is feasible, where there is retained seed bank resilience, through a combination of passive and active restoration methods. Ecological restoration in cases where soil seed banks persist is therefore a viable and critically important method to attain 30% conservation of terrestrial land in ecosystems with less than 30% remaining, as part of the Kunming-Montreal Global Biodiversity Framework.

1204

Pelletizing cyanobacteria with organic amendments: a strategy for enhancing dryland restoration

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Abstract

Biocrusts, communities of microorganisms closely associated with soil, play a vital role in stabilizing soils, enhancing water availability, and supporting nutrient cycling in drylands. Cyanobacteria-based biocrust restoration has gained attention as a nature-based solution due to their resilience in extreme conditions and ability to improve soil fertility and stability. However, large-scale application faces challenges in production, storage, transport, and soil establishment. This study investigated pelletizing cyanobacteria with organic amendments (paper residues, biochar, and vermicompost) to enhance inoculum delivery and performance.

Pellets were assessed for physical stability, cyanobacterial viability over four months of storage, and effectiveness in facilitating inoculum establishment in soil. Pellet composition significantly influenced these factors. Paper-based amendments (shredded paper and paper pulp) provided strong structural integrity, resisting disintegration, and created a favourable microenvironment that fostered cyanobacterial growth. However, inoculum transfer from the pellet to the soil was limited and greater cyanobacteria growth was not translated into effective soil colonization. Conversely, biochar-vermicompost pellets, though structurally weaker and less effective in preserving cyanobacterial viability during storage, successfully facilitated inoculum transfer and soil colonization. The nutrient-rich vermicompost and biochar's disaggregation properties likely contributed to better cyanobacterial establishment, especially at lower amendment concentrations.

This study underscores the need for a balance between stability and nutrient availability in pellet formulation to overcome logistical barriers in dryland restoration. Tailoring amendments could optimize cyanobacterial inoculation, improving restoration efforts in degraded drylands.

1268

Restoring Tidal Wetlands and Ponds in HOA Communities

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Abstract

Did you know that there are over 370,000 homeowner associations (HOA) in the United States (homeowner associations of the USA (HOA-USA) hoa-usa.com)? HOAs are responsible for maintaining all private properties within their jurisdiction. Many HOA residents own waterfront properties around tidal waterways or manmade ponds. Often these shorelines and ponds require management strategies to reduce erosion, increase aesthetic value, prevent algae blooms and much more. Such strategies include invasive species management, pond management and restoration along shorelines and pond edges. This poster will discuss different restoration projects, pond management and approaches GEI ecologists delivered for a local HOA on Long Island, New York.

Project #1-Tidal wetland restoration project at HOA waterways where houses are surrounded by tidal creeks. Objectives include 1. invasive species management which involves invasive species survey, application of chemical herbicides (specifically, GEI applied herbicide to the new re-growth of Common reed and Japanese knotweed). 2. Tidal restoration plan where GEI was responsible for obtaining tidal wetland restoration plants and overseeing proper installation, including mark out of the proper planting zones, field layout of plant materials, and overall management.

This poster will include;

1. Pond erosion and restoration project. Objectives incorporate; Restoration planning and design, plantings of native wetland plants along the edge of a HOA pond to reduce erosion along the pond liner and goose fencing to prevent birds from eating new plants.
2. Restoring ponds along HOA property. Objectives involve; Invasive species treatment and chemical treatment of algae blooms.
3. Pond treatment with dye and bacteria packets.

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