

Restoring Biodiversity and Ecosystem Functions through Nature Based Solutions

R VijayKumar*^{ID} and Kokanti Mallikarjuna^{ID}

Faculty of Forestry, Dept, of Botany and Microbiology, (M.Sc. Forestry Course) Acharya Nagarjuna University Guntur, 522510 A.P, India

Received 10 October 2025 | Revised 08 November 2025 | Accepted 15 December 2025 | Available Online January 06, 2026

*Corresponding Author: R VijayKumar | Email Address: vijaykumarrathod7@gmail.com

Citation: R VijayKumar and Kokanti Mallikarjuna (2026). Restoring Biodiversity and Ecosystem Functions through Nature Based Solutions. *Biodiversity Reports An International Journal*. DOI: <https://doi.org/10.51470/BDR.2026.05.01.17>

Abstract

Biodiversity loss and ecosystem degradation are accelerating worldwide, threatening the capacity of ecosystems to sustain essential functions and services that underpin human well-being. Drivers such as land-use change, climate change, pollution, overexploitation, and biological invasions have reduced ecosystem resilience across terrestrial, freshwater, coastal, and marine systems. In response, Nature-Based Solutions (NbS) have gained prominence as an integrative approach that works with natural processes to address societal challenges while simultaneously enhancing biodiversity and ecosystem functioning. This review synthesizes current scientific understanding of how NbS contribute to the restoration of biodiversity and ecosystem functions. We examine the conceptual foundations of NbS, major categories of interventions across different ecosystems, and the ecological mechanisms through which NbS improve habitat quality, connectivity, and key ecosystem processes. Evidence from global case studies is assessed to highlight ecological outcomes, co-benefits for climate adaptation and mitigation, and implications for human well-being. The review also critically discusses trade-offs, social and governance dimensions, and challenges related to scaling, monitoring, and long-term effectiveness. We conclude by identifying key research gaps and policy priorities, emphasizing the role of well-designed and inclusive NbS in reversing biodiversity loss and supporting resilient ecosystems under global environmental change.

Keywords: Nature-Based Solutions, biodiversity restoration, ecosystem functions, ecosystem services, climate resilience, sustainability.

1. Introduction

Biodiversity forms the foundation of ecosystem functioning and underpins the delivery of ecosystem services that sustain human societies, including food production, climate regulation, water purification, and cultural values. Despite its fundamental importance, global biodiversity is experiencing unprecedented decline. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) estimates that up to one million species are currently threatened with extinction, with rates of loss occurring at tens to hundreds of times above natural background levels. This crisis is driven primarily by anthropogenic pressures such as land-use change, habitat fragmentation, overexploitation of natural resources, pollution, invasive species, and climate change [1]. The degradation of ecosystems has far-reaching consequences beyond species loss. Simplified or degraded ecosystems often exhibit reduced productivity, weakened nutrient cycling, diminished carbon sequestration capacity, and lower resilience to environmental disturbances such as floods, droughts, and extreme climatic events. As ecosystem integrity declines, so too does the capacity of nature to buffer societies against climate risks and to support sustainable development [2]. These intertwined ecological and social challenges underscore the urgent need for approaches that address biodiversity loss while simultaneously enhancing ecosystem functions and human well-being, conservation strategies and environmental management have relied heavily

on protected areas, species-specific interventions, or engineered infrastructure solutions. While these approaches have delivered important successes, they have frequently been implemented in isolation from broader socio-ecological contexts or designed to meet single objectives, such as flood control or carbon storage. In some cases, such narrowly focused interventions have resulted in unintended ecological trade-offs or social inequities, highlighting the limitations of sectoral and technocratic approaches. Nature-Based Solutions (NbS) have emerged as an integrative and holistic framework that leverages natural processes to address societal challenges while delivering co-benefits for biodiversity, ecosystem services, and human livelihoods [3]. Broadly defined, NbS encompass actions that protect, sustainably manage, and restore natural or modified ecosystems in ways that are effective, adaptive, and equitable. Unlike conventional gray infrastructure or isolated conservation measures, NbS explicitly recognize the interdependence of ecological integrity and social systems, emphasizing multifunctionality and long-term sustainability. The relevance of NbS has been increasingly acknowledged in international policy and governance frameworks. NbS are prominently featured in the Convention on Biological Diversity (CBD) as a means to achieve ecosystem restoration and biodiversity targets, in the Paris Agreement as a strategy for climate mitigation and adaptation, and in the UN Decade on Ecosystem Restoration (2021–2030).

© 2026 by the authors. This is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author(s) and source are credited. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>.

Moreover, NbS contribute directly to multiple Sustainable Development Goals (SDGs), including those related to climate action, clean water, food security, disaster risk reduction, and human well-being. This growing policy recognition reflects an expanding body of scientific evidence demonstrating that well-designed NbS can enhance biodiversity, restore ecosystem functions, and provide cost-effective and socially inclusive solutions to environmental challenges. Despite their growing prominence, NbS vary widely in their ecological mechanisms, spatial scales, governance arrangements, and outcomes across different ecosystems [4]. Questions remain regarding their effectiveness under different environmental and socio-economic contexts, potential trade-offs among objectives, and the conditions required to ensure long-term success and equity. A synthesis of current knowledge is therefore essential to clarify how NbS contribute to biodiversity restoration and ecosystem functioning, and to identify gaps that warrant further research. This review aims to provide a comprehensive overview of the role of Nature-Based Solutions in restoring biodiversity and ecosystem functions. Specifically, it (i) outlines the conceptual foundations and defining principles of NbS, (ii) reviews major categories of NbS and their underlying ecological mechanisms, (iii) synthesizes evidence from key ecosystems and representative case studies, and (iv) discusses current challenges, opportunities, and future directions for research, policy, and practice. By integrating ecological and social perspectives, this review seeks to contribute to a more nuanced understanding of how NbS can support resilient ecosystems and sustainable societies in the face of global environmental change.

2. Conceptual Framework of Nature-Based Solutions

Nature-Based Solutions (NbS) are defined by the International Union for Conservation of Nature (IUCN) as “actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits.” This definition underscores the multifunctional character of NbS and positions them at the interface of ecology, sustainability science, and socio-economic development. Central to this framework are three interrelated principles: the maintenance of ecosystem integrity, the delivery of societal benefits, and the application of adaptive, inclusive management approaches.

Ecosystem integrity refers to the preservation or recovery of key ecological structures, processes, and functions that sustain biodiversity and resilience.

NbS are therefore grounded in ecological theory, including concepts such as functional diversity, trophic interactions, connectivity, and feedback mechanisms. By working with, rather than against, natural processes, NbS aim to enhance self-regulating capacities of ecosystems, reducing long-term dependence on external inputs or intensive engineering interventions. The second principle emphasizes the explicit targeting of societal challenges, such as climate change mitigation and adaptation, disaster risk reduction, food and water security, and public health. Unlike traditional conservation approaches that may prioritize biodiversity outcomes alone, NbS are intentionally designed to generate tangible benefits for people [5]. These benefits may be material (e.g., increased crop yields, reduced flood damage), regulating (e.g., climate moderation, water purification), or non-material (e.g., cultural identity, recreation, and mental well-being). Importantly, equitable benefit-sharing and social inclusion are increasingly recognized as essential components of effective NbS. Adaptive management constitutes the third pillar of the NbS framework. Ecosystems and social systems are dynamic and subject to uncertainty, particularly under accelerating climate change. NbS therefore require flexible governance structures, continuous monitoring, and iterative learning processes that allow interventions to be adjusted over time. Stakeholder participation—including local communities, Indigenous peoples, policymakers, and practitioners—is critical in this context, as it enhances legitimacy, incorporates local knowledge, and improves long-term sustainability.

NbS encompass a broad spectrum of practices, ranging from strict ecosystem protection and ecological restoration to sustainable land and water management and the integration of green infrastructure into built environments. Conceptually, NbS overlap with related approaches such as ecosystem-based adaptation (EbA), ecosystem-based disaster risk reduction (Eco-DRR), and green-blue infrastructure. However, NbS are distinguished by their overarching emphasis on multiple co-benefits, cross-sectoral integration, and the explicit linkage between biodiversity conservation and human well-being [6]. A defining feature of NbS is their systems perspective. Rather than framing biodiversity conservation and economic development as competing objectives, NbS seek to identify and enhance synergies between ecological processes and socio-economic needs. This perspective is particularly relevant in human-dominated landscapes, where complete ecosystem protection is often neither feasible nor socially acceptable. In such contexts, NbS offer pathways to reconcile land-use demands with ecological sustainability by embedding biodiversity within productive and urban systems.

Table 1: Overview of Nature-Based Solutions, their ecological mechanisms, and associated biodiversity, ecosystem function, and societal outcomes

Ecosystem Type	Nature-Based Solution Type	Key Ecological Mechanisms	Biodiversity Outcomes	Ecosystem Functions Enhanced	Societal Co-Benefits
Terrestrial	Forest restoration, afforestation with native species	Increased structural complexity, habitat expansion, improved connectivity	Higher species richness, recovery of native flora and fauna	Carbon sequestration, soil stabilization, nutrient cycling	Climate mitigation, livelihoods, erosion control
Terrestrial (Agricultural)	Agroforestry, sustainable land management	Landscape heterogeneity, functional diversity, soil-plant-microbe interactions	Increased pollinators, birds, soil biota	Soil fertility, productivity, pest regulation	Food security, income diversification, resilience
Freshwater	River re-naturalization, wetland restoration	Hydrological connectivity, sediment retention, nutrient filtering	Recovery of fish, amphibians, aquatic invertebrates	Water purification, flood regulation, carbon storage	Reduced flood risk, water security
Coastal & Marine	Mangrove, salt marsh, seagrass, coral reef restoration	Wave attenuation, habitat provision, blue carbon sequestration	Increased fish and invertebrate diversity	Shoreline stabilization, nutrient cycling, carbon storage	Coastal protection, fisheries support
Urban	Green roofs, urban forests, parks, wetlands	Microhabitat creation, green corridors, evapotranspiration	Increased urban flora, insects, birds	Temperature regulation, stormwater management, air purification	Heat reduction, recreation, mental health
Cross-cutting	Ecological corridors, landscape-scale restoration	Enhanced connectivity, gene flow, dispersal	Improved population viability, resilience	Ecosystem stability, adaptive capacity	Climate adaptation, reduced disaster

3. Types of Nature-Based Solutions Across Ecosystems

Nature-Based Solutions are implemented across diverse ecosystems, each characterized by distinct ecological processes, stressors, and opportunities for intervention. While the specific design and outcomes of NbS vary by context, their unifying feature is the enhancement of ecosystem functions that support biodiversity and societal goals.

3.1 Terrestrial Ecosystems

In terrestrial ecosystems, NbS encompass a wide range of interventions, including forest conservation and restoration, afforestation and reforestation using native species, agroforestry systems, sustainable agriculture, and improved grassland management. These practices contribute to biodiversity restoration by increasing habitat availability, enhancing landscape connectivity, and supporting species interactions across trophic levels [7]. Forest restoration and reforestation initiatives can recover structural complexity and functional diversity, leading to improvements in carbon sequestration, hydrological regulation, and microclimate stabilization. When designed with native and diverse species assemblages, such interventions support higher levels of plant and animal diversity compared to monoculture plantations. Similarly, grassland management practices such as controlled grazing and the restoration of native vegetation can enhance soil organic matter, microbial diversity, and pollinator populations. Agroforestry represents a particularly prominent NbS in agricultural landscapes. By integrating trees with crops and/or livestock, agroforestry systems increase spatial and functional heterogeneity, which in turn supports pollinators, birds, natural enemies of pests, and soil biota. These systems often improve soil fertility, reduce erosion, and enhance resilience to climate variability, demonstrating how NbS can reconcile biodiversity conservation with food production.

3.2 Freshwater Ecosystems

NbS in freshwater ecosystems focus on restoring the structure and function of rivers, wetlands, floodplains, lakes, and riparian zones. Key interventions include river re-naturalization, reconnection of rivers to floodplains, removal or modification of obsolete dams, and the protection and restoration of wetlands [8]. Such measures enhance hydrological connectivity, which is essential for nutrient cycling, sediment transport, and the life cycles of aquatic organisms. Wetland restoration, in particular, has been shown to support high levels of biodiversity while delivering critical ecosystem services, including water purification, flood attenuation, and carbon storage. Riparian vegetation buffers further contribute to regulating water temperature, reducing nutrient runoff, and providing habitat corridors for terrestrial and aquatic species. By restoring natural flow regimes and ecological processes, freshwater NbS can increase the resilience of aquatic ecosystems to climate change, including altered precipitation patterns and increased frequency of extreme events. These benefits often translate into improved water security and reduced disaster risks for downstream communities.

3.3 Coastal and Marine Ecosystems

In coastal and marine environments, NbS target ecosystems such as mangroves, salt marshes, seagrass meadows, coral reefs, and oyster reefs. These systems are among the most productive and biodiverse on Earth, yet they are also highly vulnerable to human pressures and climate change.

Restoration and conservation of coastal habitats enhance biodiversity by providing breeding, nursery, and feeding grounds for a wide range of marine species. Mangroves and salt marshes stabilize shorelines, attenuate wave energy, and reduce coastal erosion and storm surge impacts. Seagrass meadows and coral reefs support complex food webs while contributing to carbon sequestration and nutrient cycling [9]. Mangrove restoration, for example, has been widely documented to increase fish and invertebrate diversity, improve local fisheries productivity, and sequester significant amounts of “blue carbon.” Similarly, oyster reef restoration enhances water quality through filtration while creating structurally complex habitats that support diverse marine communities.

3.4 Urban Ecosystems

Urban ecosystems present unique challenges and opportunities for the implementation of NbS. Urban NbS include green roofs and walls, urban forests, parks, constructed wetlands, permeable surfaces, and green corridors that connect fragmented habitats. These interventions enhance urban biodiversity by providing refugia and movement pathways for plants, insects, birds, and other wildlife. From a functional perspective, urban NbS mitigate heat island effects, regulate stormwater runoff, improve air and water quality, and reduce noise pollution [10]. They also deliver important social and health benefits, including opportunities for recreation, physical activity, and psychological well-being. By increasing everyday interactions with nature, urban NbS can foster environmental awareness, stewardship, and public support for broader biodiversity conservation efforts. Moreover, urban NbS demonstrate how biodiversity-enhancing solutions can be embedded within densely populated and highly modified environments, highlighting the potential of NbS to contribute to sustainability transitions across multiple spatial scales.

4. Mechanisms Linking NbS to Biodiversity and Ecosystem Functions

Nature-Based Solutions restore biodiversity and ecosystem functions through multiple, interrelated ecological mechanisms that operate across spatial and temporal scales. One of the most fundamental mechanisms is habitat restoration and enhancement. By increasing habitat area, structural complexity, and resource heterogeneity, NbS create conditions that support diverse species assemblages. Structural elements such as multilayered vegetation, coarse woody debris, wetlands, and reef-forming organisms provide niches for species with different functional traits, thereby increasing local and landscape-scale biodiversity. Connectivity is another critical mechanism underpinning the effectiveness of NbS. Habitat fragmentation is a major driver of biodiversity loss, limiting species movement, gene flow, and recolonization following disturbances [11]. NbS interventions such as ecological corridors, riparian buffers, and green urban networks reconnect fragmented habitats, facilitating dispersal and migration. Improved connectivity is particularly important under climate change, as it allows species to track shifting climatic conditions and enhances the adaptive capacity of ecosystems.

NbS also enhance key ecosystem processes that are closely linked to biodiversity. Restored vegetation increases primary productivity and stabilizes energy flows within ecosystems. Improvements in soil structure and organic matter content enhance nutrient cycling, water infiltration, and root

development. For example, restoration of native plant communities often leads to increased microbial and fungal diversity, which accelerates nutrient turnover and improves plant nutrient uptake. In freshwater and coastal systems, restored wetlands, floodplains, and vegetated shorelines regulate hydrological flows, trap sediments, and filter pollutants, thereby improving water quality and downstream ecosystem health. Importantly, biodiversity itself plays a central role in sustaining ecosystem functioning through mechanisms such as functional complementarity and redundancy. Communities composed of species with diverse traits tend to use resources more efficiently and maintain ecosystem processes under a wider range of environmental conditions. Functional redundancy—where multiple species perform similar ecological roles—provides insurance against species loss, ensuring that ecosystem functions persist even when individual species decline. As a result, NbS that explicitly promote biodiversity can enhance ecosystem resilience to disturbances such as droughts, floods, heatwaves, pests, and diseases, reinforcing their long-term effectiveness.

5. Evidence from Case Studies

A growing body of empirical evidence demonstrates that Nature-Based Solutions can effectively restore biodiversity and ecosystem functions across a range of biomes and socio-economic contexts. In Europe, large-scale river restoration initiatives, including dam removal and floodplain reconnection, have resulted in increased fish species richness, improved macroinvertebrate communities, and enhanced natural flood regulation. These projects illustrate how restoring natural hydrological processes can simultaneously deliver biodiversity gains and reduce disaster risks. In Latin America, forest landscape restoration programs have shown positive outcomes for both biodiversity and ecosystem services. Restoration of degraded tropical and subtropical forests has increased carbon sequestration, improved soil fertility, and supported wildlife recovery, while also providing livelihoods through non-timber forest products, agroforestry, and ecotourism [12]. Such integrated approaches highlight the potential of NbS to reconcile conservation objectives with rural development. Coastal NbS in Asia and Africa provide further compelling evidence. Mangrove restoration projects have been associated with increased fish and crustacean diversity, improved coastal fisheries productivity, and enhanced protection against storm surges and erosion. In regions highly exposed to extreme weather events, these interventions have reduced vulnerability of coastal communities while restoring ecologically valuable habitats. Urban case studies also underscore the multifunctionality of NbS. Cities such as Singapore, Copenhagen, and Medellín have integrated green infrastructure, urban forests, and restored waterways into urban planning. These initiatives have increased urban biodiversity, moderated urban heat island effects, improved stormwater management, and enhanced quality of life for residents. While outcomes vary depending on ecological context, governance arrangements, and design quality, these examples collectively demonstrate that NbS can deliver meaningful biodiversity and ecosystem function benefits when grounded in sound ecological principles and participatory processes.

6. Co-Benefits, Trade-Offs, and Social Dimensions

A defining strength of Nature-Based Solutions is their capacity to generate multiple co-benefits beyond biodiversity conservation.

NbS contribute to climate change mitigation through carbon sequestration in forests, wetlands, and coastal ecosystems, and to climate adaptation by buffering societies against floods, droughts, heatwaves, and sea-level rise. They also support food and water security, enhance public health, and provide cultural, recreational, and spiritual values [13]. However, NbS are not inherently free of trade-offs. Poorly designed or narrowly implemented interventions may prioritize one objective at the expense of others. For example, afforestation using fast-growing non-native monocultures can increase short-term carbon storage but reduce native biodiversity, alter hydrological regimes, and increase vulnerability to pests and fires. Similarly, restoration projects that restrict access to land or resources without adequate consultation may undermine local livelihoods and generate social conflict. Social dimensions are therefore central to the success of NbS. Inclusive governance, equitable benefit-sharing, and recognition of Indigenous and local knowledge are critical for ensuring legitimacy, effectiveness, and long-term sustainability. When local communities are actively involved in planning and implementation, NbS are more likely to align with local needs, reduce conflicts, and deliver durable outcomes for both people and nature.

7. Policy, Governance, and Implementation Challenges

Despite increasing recognition in global and national policy frameworks, scaling up Nature-Based Solutions faces several persistent challenges. Financial constraints remain a major barrier, particularly for long-term maintenance and monitoring. NbS often compete with conventional gray infrastructure for funding, despite evidence that they can be more cost-effective and provide broader benefits over time. Another challenge lies in monitoring and evaluation. Biodiversity and ecosystem functions are complex, context-dependent, and often slow to respond, making them difficult to measure using standardized indicators. The lack of harmonized frameworks for assessing NbS outcomes limits comparability across projects and hinders evidence-based decision-making.

Governance complexity further complicates implementation. NbS typically cut across administrative boundaries and policy sectors, requiring coordination among environmental, agricultural, urban, and infrastructure authorities. Weak legal frameworks, unclear land tenure, and limited institutional capacity can undermine implementation, particularly in regions with high social and ecological vulnerability [14]. Addressing these challenges requires strong governance arrangements, policy coherence, and integration of NbS into national development strategies, climate policies, and biodiversity action plans. Meaningful participation of Indigenous Peoples and local communities is especially important, as their stewardship and knowledge systems are often critical to successful NbS outcomes.

8. Future Directions and Research Needs

Future research should focus on strengthening the evidence base for the effectiveness of Nature-Based Solutions across different ecosystems, spatial scales, and socio-economic contexts. Long-term and large-scale studies are particularly needed to assess biodiversity recovery, ecosystem resilience, and sustained delivery of ecosystem services under changing climatic conditions. Advances in remote sensing, ecological modeling, and environmental DNA offer new opportunities to monitor biodiversity and ecosystem functions more efficiently and consistently.

Participatory and community-based monitoring approaches can complement these technologies by incorporating local knowledge and enhancing stakeholder engagement. There is also a need for deeper analysis of trade-offs and synergies among biodiversity conservation, climate action, and development goals. Integrating NbS with technological innovations, policy instruments, and economic incentives can further enhance their effectiveness. Ultimately, mainstreaming NbS into planning, finance, and decision-making processes will be critical for achieving global biodiversity, climate, and sustainability targets.

9. Conclusion

Nature-Based Solutions offer a powerful, flexible, and integrative approach to restoring biodiversity and ecosystem functions while addressing pressing societal challenges. By working with natural processes rather than relying solely on engineered solutions, NbS enhance ecosystem resilience, support human well-being, and contribute to sustainable development across terrestrial, freshwater, coastal, and urban systems. Although challenges related to design, governance, financing, and monitoring remain, a growing body of empirical evidence demonstrates that well-planned and inclusively governed NbS can deliver substantial ecological and social benefits. As global environmental change accelerates, NbS provide an essential pathway for reconciling biodiversity conservation with human development needs. Strengthening the scientific foundation, improving governance frameworks, and embedding NbS into policy and practice will be critical to realizing their full potential in the coming decades.

References

1. Keesstra, S., Nunes, J., Novara, A., Finger, D., Avelar, D., Kalantari, Z., & Cerdà, A. (2018). The superior effect of nature based solutions in land management for enhancing ecosystem services. *Science of the Total Environment*, 610, 997-1009.
2. Xie, L., & Bulkeley, H. (2020). Nature-based solutions for urban biodiversity governance. *Environmental Science & Policy*, 110, 77-87.
3. Cheng, C., & Li, F. (2024). Ecosystem restoration and management based on nature-based solutions in China: Research progress and representative practices. *Nature-Based Solutions*, 6, 100176.
4. Key, I. B., Smith, A. C., Turner, B., Chausson, A., Girardin, C. A., Macgillivray, M., & Seddon, N. (2022). Biodiversity outcomes of nature-based solutions for climate change adaptation: Characterising the evidence base. *Frontiers in Environmental Science*, 10, 905767.
5. Aerts, R., & Honnay, O. (2011). Forest restoration, biodiversity and ecosystem functioning. *BMC Ecology*, 11(1), 29.
6. Rey, F. (2021). Harmonizing erosion control and flood prevention with restoration of biodiversity through ecological engineering used for co-benefits nature-based solutions. *Sustainability*, 13(20), 11150.
7. Buckley, Y. M., Austin, A., Bardgett, R., Catford, J. A., Hector, A., Iler, A., & Mariotte, P. (2024). The plant ecology of nature-based solutions for people, biodiversity and climate. *Journal of Ecology*, 112(11), 2424-2431.
8. Clement, S. (2021). Nature-based solutions for urban biodiversity. In *Nature-based solutions for more sustainable cities—a framework approach for planning and evaluation* (pp. 33-45). Emerald Publishing Limited.
9. Standish, R. J., & Parkhurst, T. (2024). Interventions for resilient nature-based solutions: An ecological perspective. *Journal of Ecology*, 112(11), 2502-2509.
10. Penning, E., Burgos, R. P., Mens, M., Dahm, R., & de Bruijn, K. (2023). Nature-based solutions for floods AND droughts AND biodiversity: Do we have sufficient proof of their functioning?. *Cambridge Prisms: Water*, 1, e11.
11. Cohen-Shacham, Emmanuelle, Angela Andrade, James Dalton, Nigel Dudley, Mike Jones, Chetan Kumar, Stewart Maginnis et al. "Core principles for successfully implementing and upscaling Nature-based Solutions." *Environmental Science & Policy* 98 (2019): 20-29.
12. Waylen, K. A., Wilkinson, M. E., Blackstock, K. L., & Bourke, M. (2024). Nature-based solutions and restoration are intertwined but not identical: Highlighting implications for societies and ecosystems. *Nature-Based Solutions*, 5, 100116.
13. Mori, Akira S., Laura E. Dee, Andrew Gonzalez, Haruka Ohashi, Jane Cowles, Alexandra J. Wright, Michel Loreau et al. "Biodiversity-productivity relationships are key to nature-based climate solutions." *Nature Climate Change* 11, no. 6 (2021): 543-550.
14. van Rees, C. B., Jumani, S., Abera, L., Rack, L., McKay, S. K., & Wenger, S. J. (2023). The potential for nature-based solutions to combat the freshwater biodiversity crisis. *PLoS Water*, 2(6), e0000126.