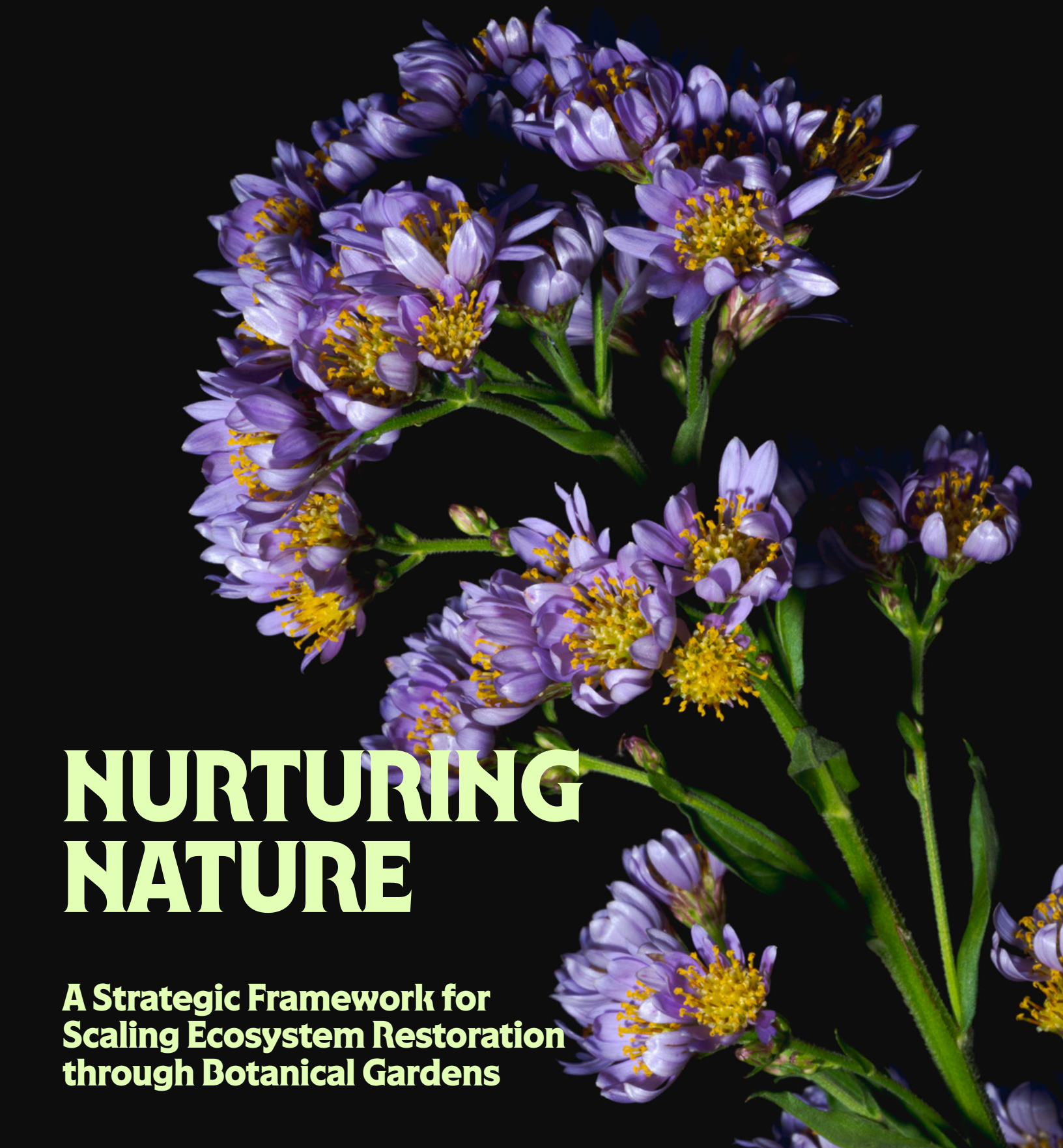
NYBG

BOTANIC GARDENS CONSERVATION INTERNATIONAL



NURTURING NATURE

A Strategic Framework for Scaling Ecosystem Restoration through Botanical Gardens

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1. Executive Summary

Biodiversity loss, ecosystem degradation, and climate change are converging crises with profound consequences for people and nature. Ecosystem restoration has become central to the global response: countries have pledged to restore close to one billion hectares of degraded land (UNEP, 2021), and the Kunming-Montreal Global Biodiversity Framework commits the world to bring at least 30 percent of degraded ecosystems under effective restoration by 2030 (CBD, 2022). Yet restoration has not delivered the quality or the quantity of restored ecosystems needed. Persistent technical and ecological challenges compound shortages of diverse plant material, limited and short-term funding, institutional constraints, and inadequate support for long-term monitoring and adaptive management (IPBES, 2019; Hardwick et al., 2011).

Botanical gardens represent a largely underutilized global resource for addressing many of these gaps, with more than 3,600 botanical gardens and related institutions operating worldwide (Botanic Gardens Conservation International, n.d.). Collectively, they hold deep expertise in plant taxonomy, conservation science, seed banking, propagation, horticulture, ecological research, education, and community engagement (Mounce et al., 2017). Many already contribute to restoration, but largely as individual institutions—with only limited coordination through existing networks such as the Ecological Restoration Alliance of Botanic Gardens (ERA), and without the connectivity and collective infrastructure needed to match the scale of the challenge.

This Nurturing Nature Strategic Framework sets out how botanical gardens can work collectively as a network, collaborating with Indigenous Peoples and local communities, practitioners, governments, researchers, and other partners to strengthen restoration outcomes. It provides an umbrella for future partnerships, proposals, funding mechanisms, regional programs, and collaborative initiatives. Its aim is not to prescribe one model, but to focus collective effort where botanical gardens can add distinctive value. In doing so, it builds directly on the Ecological Restoration Alliance of Botanic Gardens, connecting that foundation to the broader partnerships, standards, and commitments the current moment demands (Miller et al., 2016; Aronson et al., 2014). The framework draws on the first phase of the Nurturing Nature Initiative (2024–2026), including a global survey of 73 botanical gardens and arboreta and sustained consultation with botanical garden and restoration professionals worldwide.

The framework is organized around three strategic pillars:

(1) enhancing restoration quality, including ecological integrity and climate resilience, by strengthening species selection, ecological design, and attention to ecosystem processes and climate adaptation that determine whether restored ecosystems can recover and persist, building on the existing strengths of botanical gardens;
(2) expanding seed and plant supply systems and the genetic resources needed for restoration by addressing the biological supply constraints that limit the diversity and resilience of restoration in practice; and

(3) connecting research, practice, monitoring, and learning by developing the evidence base, monitoring design, and knowledge-sharing mechanisms that allow botanical gardens and their partners to improve over time.

Across all three, the framework is guided by a set of cross-cutting themes that shape how the work is pursued: communities, Indigenous Peoples, and local leadership; education, capacity strengthening, and reciprocal learning; communication, outreach, and public engagement; policy alignment and enabling conditions; and urban and peri-urban restoration.

The next step is to put the framework into practice. In the near term, that means translating these priorities into regional and thematic collaborations, proposals, and partnerships that help position botanical gardens as recognized, connected, and appropriately resourced core restoration infrastructure within wider restoration systems. Through coordination among NYBG, BGCI, ERA, the Nurturing Nature Advisory Group, and other partners, the next phase will create pathways for botanical gardens and collaborators to contribute according to their strengths and contexts, beginning with an open Expression of Interest to join the initiative's growing restoration network.

2. Introduction

2.1. Global Context: Restoration, Biodiversity, Climate Resilience, and People

Ecosystem degradation and biodiversity loss are among the most pressing challenges facing the global community, with profound implications for environmental stability, human well-being, sustainable livelihoods, and cultural relationships with nature. Climate change is intensifying these pressures by altering ecological processes, shifting species distributions, and increasing the frequency and severity of disturbances such as droughts, floods, and wildfires (IPBES, 2019). Together, these dynamics undermine the health and resilience of social-ecological systems and increase vulnerability across natural and human landscapes.

Ecosystem restoration has emerged as a central strategy for addressing these interconnected challenges. Restoring ecosystems can support biodiversity and ecological integrity, contribute to climate mitigation through carbon sequestration, strengthen adaptation by stabilizing soils and regulating water systems, and sustain benefits valued by communities. As recognized by the United Nations Decade on Ecosystem Restoration and the Kunming-Montreal Global Biodiversity Framework, effective restoration is essential to global biodiversity, climate, and sustainable-development goals (UNEP, 2020; CBD, 2022).

Ecosystem restoration encompasses a broad continuum of activities that prevent, halt, and reverse degradation. Such activities stretch from cities through working landscapes to the most remote parts of the planet. Within that continuum, ecological restoration specifically assists the recovery of native ecosystems and places biodiversity, ecological integrity, ecosystem function, and recovery relative to an appropriate reference model at its core. As restoration commitments expand, success must be measured not only by area treated, but by whether ecosystems recover biodiversity and ecological processes, remain resilient as conditions change, and provide durable and equitable benefits for people—outcomes that standards-based frameworks developed by the Society for Ecological Restoration and its partners are designed to track (Gann et al., 2026; Nelson et al., 2024).

Plants are the structural and functional foundation of terrestrial ecosystems, which places their recovery at the heart of the quality outcomes described above. Yet restoration requires far more than selecting, propagating, and planting species. It must also address soils, hydrology, fauna, disturbance regimes, ecological interactions, local priorities, and long-term stewardship, drawing on botany, restoration science, horticulture, and other disciplines in combination. Few institutions bring these strands together as readily as botanical gardens, which live at the intersection of biodiversity, climate, and people—and whose distinctive capabilities the next section considers.

2.2. The Opportunity: Botanical Gardens as Restoration Infrastructure

Botanical gardens are well positioned to contribute to the growing global movement to restore ecosystems at scale. As institutions that integrate scientific research, conservation practice, horticulture, education, and public engagement, they bring together a distinctive combination of capabilities that can support restoration

planning, implementation, monitoring, data management, and long-term stewardship (Mounce et al., 2017; Hardwick et al., 2011).

Globally, botanical gardens maintain extensive living collections and preserved plant resources, including seed banks, herbaria, and tissue collections, that together safeguard a substantial share of plant diversity and provide important genetic resources for restoration and conservation, particularly for rare and threatened species. The world's botanical gardens hold living collections representing roughly 30 percent of known plant species and more than 40 percent of those classified as threatened (Mounce et al., 2017). They also hold specialized expertise in areas such as plant taxonomy, systematics, propagation, ecology, and horticulture—fields that restoration programs have often been slow to draw upon, despite their potential to improve outcomes (Miller et al., 2016).

Beyond their scientific and technical contributions, botanical gardens serve as trusted institutions embedded within their local contexts. They maintain long-standing relationships with communities, governments, educational institutions, practitioners, and other partners, positioning them as effective bridges between technical knowledge and on-the-ground action. Through these relationships, botanical gardens can help strengthen restoration efforts not only through implementation, but also through capacity sharing, knowledge exchange, community-led monitoring, communication, and coordination.

As a result, botanical gardens contribute to restoration in a variety of complementary ways. They function as practitioners, implementing restoration on their own lands and in surrounding landscapes; as enablers, providing plant material, expertise, and training to external partners; and as conveners, bringing together diverse stakeholders to coordinate action and share knowledge (Hardwick et al., 2011). Increasingly, they also function as boundary organizations, linking science, policy, and practice in ways that support more integrated and adaptive restoration approaches.

Their greatest value often lies not in acting alone but in strengthening wider restoration systems through complementary expertise, infrastructure, relationships, and long-term institutional presence. The companion Nurturing Nature Technical Review, Scaling ecosystem restoration through botanical garden networks, provides an evidence base and illustrative examples that underpin this framework (Grover et al., 2026).

2.3. The Gap: Underutilized Capacity and Systemic Barriers

Evidence synthesized through the Nurturing Nature Initiative highlights a consistent pattern: botanical gardens possess substantial expertise and are already making important contributions to ecosystem restoration, yet their impact often remains constrained by a range of systemic challenges.

A global survey of 73 botanical gardens and arboreta conducted through the initiative demonstrates that botanical gardens are actively engaged in restoration across diverse ecosystems and regions, contributing expertise in plant identification, propagation, ecological monitoring, conservation, and project leadership. At

the same time, respondents consistently identified the barriers that most limit their ability to expand and sustain these contributions: funding (74%), limited staff capacity (51%), and insufficient support for long-term monitoring (48%), alongside challenges related to the availability and quality of plant material and limited opportunities for collaboration and knowledge exchange across institutions (Grover et al., 2026).

Notably, a lack of technical expertise was cited by only 12 percent of respondents (Grover et al., 2026), indicating that the sector's core scientific and horticultural capacity is strong but undersupported. Technical capacity nonetheless remains essential to successful restoration. Recovering diverse, self-sustaining ecosystems requires knowledge and methods for re-establishing ecological processes; securing appropriate and genetically diverse plant material; managing weeds, pests, disease, and altered soils; restoring hydrological and faunal interactions; and responding to uncertain future climates. Building and maintaining this capacity requires sustained investment, access to specialized knowledge, and opportunities for practitioners to learn from one another and adapt approaches to local conditions.

The evidence therefore points to two connected priorities: advancing the technical and ecological knowledge needed for high-quality restoration, and strengthening the conditions that allow this knowledge to be applied, tested, shared, and sustained. Botanical gardens can help bridge these priorities, connecting knowledge, practice, and the resources needed to turn restoration ambition into lasting ecological outcomes.

2.4. The Nurturing Nature Initiative

The Nurturing Nature Initiative was established by the New York Botanical Garden (NYBG) and Botanic Gardens Conservation International (BGCI) to strengthen the contributions of botanical gardens and their partners to ecosystem restoration. It builds on earlier botanical-garden restoration efforts, including the Ecological Restoration Alliance of Botanic Gardens (ERA), a consortium of botanic gardens established in 2012 and coordinated by BGCI, which pioneered collaborative, science-based approaches to restoration across the botanical-garden community (Aronson et al., 2014; Abu Taleb et al., 2016). Nurturing Nature connects these foundations with current restoration standards, policy frameworks, and a broader network of global partners.

Nurturing Nature does not promote a single model of restoration. Botanical gardens vary widely in capacity, context, and priorities. Some lead research and conservation; others focus on plant supply, training, public engagement, policy support, implementation, or community-based stewardship. The framework recognizes this diversity while identifying shared priorities through which gardens can contribute more effectively with partners. Collectively, these contributions represent a significant and largely underutilized resource for advancing biodiversity conservation, ecosystem recovery, climate resilience, and human well-being.

This Strategic Framework builds on the first phase of the initiative, which synthesized evidence from a global survey of botanical gardens, commissioned expert reports, literature and policy reviews, and sustained engagement with practitioners, researchers, policymakers, and advisors worldwide. The resulting priorities are presented in the sections that follow.

2.5. Purpose and Scope of the Strategic Framework

This Strategic Framework articulates a shared vision for how botanical gardens can contribute to restoration that supports biodiversity, ecosystem integrity, climate resilience, and community well-being. Such work is inherently collaborative with Indigenous Peoples and local communities, restoration practitioners, researchers, governments, funders, and other partners. This framework identifies priority areas where botanical-garden expertise, infrastructure, relationships, and networks can add distinctive value within these partnerships, and it is intended to clarify the role of botanical gardens as collaborators within larger restoration systems. It is written primarily for botanical-garden leaders, restoration practitioners and organizations, researchers, funders, and policymakers, though its vision depends on the engagement of a much wider set of actors.

Overall, this is an adaptive framework for guiding future proposals, partnerships, funding mechanisms, regional programs, training, collaborative initiatives, and place-based projects. Activities will vary by context; the framework provides the shared priorities and principles needed to align effort and increase collective impact. In practice, implementation may take many forms: regional or thematic working groups organized around the strategic pillars; proposals and initiatives developed by individual gardens or networks; integration with existing BGCI, ERA, SER, and partner programs; or bilateral and multilateral partnerships among botanical gardens, restoration practitioners, and other actors. These pathways will be shaped by opportunity, capacity, and context—what the framework offers is a common orientation to inform them.

3. Development of the Strategic Framework

3.1. Evidence Base and Sources

This Strategic Framework draws on four primary sources of evidence:

- **Global survey of botanical gardens and arboreta**
  A survey conducted by NYBG and BGCI gathered responses from 73 institutions spanning all geographic regions where botanical gardens operate, including Africa, Asia, Europe, Latin America and the Caribbean, North America, and Oceania. The survey documented current restoration activities, roles, priorities, and constraints, providing an empirical foundation for understanding the capacity, contributions, and needs of the botanical garden community across diverse ecological and institutional contexts. Because participation was voluntary, these 73 respondents—roughly two percent of the more than 3,600 botanical gardens worldwide, and weighted toward North American and European institutions—likely over-represent gardens already engaged in restoration; the findings are therefore best read as a detailed picture of actively engaged institutions rather than a statistically representative sample of the sector as a whole.
- **Commissioned thematic reports and expert contributions**
  A series of expert-authored reports and case studies—compiled in the companion Nurturing Nature Technical Review, *Scaling ecosystem restoration through botanical garden networks* (Grover et al., 2026)—synthesized current scientific and practitioner knowledge across key domains relevant to plant-based approaches to ecological restoration. These reports addressed topics including plant collection and propagation, ex situ conservation, climate-adaptive variation, invasive species management, integrative biotic processes, community engagement, policy integration, capacity building and training, and sustainable financing.
- **Targeted literature and policy review**
  Supporting scientific literature and relevant policy frameworks were reviewed to contextualize findings and align recommendations with established restoration principles, emerging best practices, and international biodiversity and climate commitments. Sources included the Society for Ecological Restoration (SER) standards, the Kunming-Montreal Global Biodiversity Framework, and the United Nations Decade on Ecosystem Restoration, among others (Gann et al., 2026; CBD, 2022; UNEP, 2020).
- **Advisory and Expert Engagement**
  The development of the Strategic Framework was informed through ongoing consultation with the Nurturing Nature Advisory Group and additional experts representing restoration science, horticulture, conservation, policy, implementation, and related disciplines. Feedback from workshops, discussions, and targeted consultations helped refine priorities and ensure that the framework reflects both current evidence and practical experience.

3.2. Analytical Approach and Priority-Setting

Drawing on these sources, the team examined recurring patterns of constraint, opportunity, and impact to identify areas where botanical gardens and their partners can contribute most distinctively to ecosystem restoration.

Technical and systemic constraints were considered together. Technical constraints include gaps in ecological knowledge, restoration design, propagation, plant sourcing, and methods for recovering ecosystem processes. Systemic constraints include shortages of funding and staff, weak coordination, policy barriers, and limited long-term support for monitoring and stewardship. Both determine whether expertise can be applied effectively and at meaningful scales.

The resulting priorities are organized into three pillars — moving from restoration quality and ecological design to the biological resources required for implementation, to the evidence and learning needed for continuous improvement. Cross-cutting themes establish how the pillars should be pursued: collaboratively, equitably, with respect for diverse knowledge systems, and in alignment with existing standards, networks, and policy processes.

4. Nurturing Nature Strategic Framework for Ecosystem Restoration

4.1. The Many Roles of Botanical Gardens in Restoration

Botanical gardens engage with restoration in many ways, but four interconnected areas of contribution emerged consistently across the evidence as particularly important:

- **Scientific and technical expertise** — in plant taxonomy, propagation, ecology, horticulture, and conservation science, supporting the planning, design, implementation, and monitoring of high-quality restoration
- **Knowledge exchange and capacity strengthening** — through training, demonstration sites, practitioner networks, and reciprocal learning that bridges scientific, Indigenous, and local knowledge systems
- **Convening and partnership-building** — as trusted, often neutral institutions well positioned to bring together diverse actors across sectors, disciplines, and geographies
- **Long-term stewardship and learning** — through sustained institutional presence, living collections, monitoring and data management programs, and adaptive management that extend beyond individual project cycles

These capabilities reflect the combination of scientific depth, botanical and horticultural knowledge, long-term institutional presence, and public trust that characterizes botanical gardens across diverse contexts. The three strategic pillars that follow draw on these capabilities and direct them toward the most persistent gaps in current restoration systems. The subsequent section (Section 5) then describes the partnerships and collaborative relationships through which the framework's priorities become practical action — identifying who botanical gardens need to work with and why.

4.2. Three Strategic Pillars for Scaling Ecosystem Restoration through the Efforts of Botanical Gardens

In this section we describe the three strategic pillars that emerged from the evidence base and consultations described in Section 3, and break each pillar down into priority areas and potential contributions.

Strategic Pillar 1: Enhance Restoration Quality, Ecological Integrity, and Climate Resilience

Strategic Objective: To improve the quality, ecological integrity, and long-term effectiveness of restoration by strengthening ecological design, biodiversity outcomes, climate adaptation, ecosystem processes, and lasting benefits for people. *Progress toward this objective would be reflected in restoration efforts that are designed around ecological recovery rather than planting alone, better integrated across landscapes, and more resilient to current and future environmental change.*

As restoration commitments expand globally, attention is shifting from the scale of restoration alone to the quality of its outcomes. Planting is necessary but insufficient. Successful restoration must re-establish ecological processes, support biodiversity, maintain function under changing conditions, and generate durable benefits for people and ecosystems alike. Botanical gardens are one of many actors implementing

restoration; their distinctive value lies in acting as catalysts of better restoration, drawing on their botanical, ecological, and horticultural capacities.

Priority Area 1. Strengthen Ecological and Horticultural Design

The long-term success of restoration is shaped by decisions made at the outset of a project and revised through adaptive management over time. Species selection, ecological context, genetic diversity, and the recovery of ecological processes all determine whether ecosystems can regain function, sustain biodiversity, and remain resilient as conditions change.

Botanical gardens can strengthen ecological and horticultural design through expertise in botany, taxonomy, propagation, cultivation, and conservation horticulture. These capabilities can inform reference models, species assemblages, propagation and establishment approaches, and the appropriate use of native, rare, and threatened species. Critically, effective design must extend beyond plant selection to address the processes that sustain recovery, such as soils and nutrient cycling, hydrology, pollination, mycorrhizal associations, faunal interactions, and disturbance regimes.

Potential contributions of botanical gardens and their partners include:

- Bring plant science, taxonomy, and horticultural expertise to bear on species selection, ensuring assemblages are ecologically appropriate, locally relevant, and genetically diverse.
- Strengthen ecological and horticultural design by integrating knowledge of ecosystem processes — soils, hydrology, pollination, faunal interactions, and disturbance regimes — alongside plant community composition and establishment.
- Support the conservation and appropriate deployment of rare, threatened, and genetically diverse species through living collections, seed banks, and propagation programs.
- Apply horticultural knowledge to improve plant establishment, persistence, and long-term health, including managing pests, diseases, and invasive species that can undermine recovery.
- Develop and share guidebooks, protocols, and tools for ecological design, species selection, provenance, propagation, and long-term management.

Priority Area 2. Advance Integrative Restoration Approaches Across Landscapes

The ecological, social, and economic conditions that shape a restoration site extend well beyond its boundaries. Restoration outcomes are often determined as much by landscape context as by site-level decisions. Integrating restoration within broader landscape planning can improve ecological connectivity, support biodiversity conservation, and strengthen the resilience of outcomes over time.

Through collaboration across sectors and scales, botanical gardens can help link site-level recovery with wider ecological and social outcomes and align restoration efforts with conservation and community objectives. Potential contributions include:

- Contribute botanical, ecological, and conservation expertise to landscape-scale planning and decision-making, including efforts to understand and restore the ecological processes that sustain biodiversity over time, such as habitat connectivity, hydrological function, and species interactions.
- Help define restoration objectives and approaches that are ecologically realistic, socially relevant, and responsive to local conditions, while supporting broader conservation, climate adaptation, and land-management goals, consistent with the standards and processes established by The Global Biodiversity Standard and the Society for Ecological Restoration.
- Foster collaboration among Indigenous Peoples and local communities, practitioners, researchers, governments, and other stakeholders working within shared landscapes.
- Facilitate knowledge exchange, coordination, and collective learning across institutions, initiatives, and bioregional partnerships to increase long-term effectiveness.

Priority Area 3. Integrate Climate Adaptation into Restoration Design and Implementation

Climate change is altering environmental conditions at an unprecedented pace, creating new challenges for restoration planning and practice. Shifts in temperature, precipitation, disturbance regimes, and species distributions may affect whether ecosystems undergoing restoration can persist and function over time. Restoration efforts must therefore account not only for current site conditions but for the conditions that ecosystems are likely to face in the future.

Botanical gardens contribute to climate-adaptive restoration through living collections, long-term ecological observations, and knowledge of plant distributions, environmental tolerances, and adaptive variation. These resources can inform decisions about species selection, provenance, and sourcing strategies that build resilience under future climate scenarios.

Climate adaptation should be mainstreamed within restoration rather than treated as a separate objective. Botanical gardens and their partners can help increase adaptive capacity by combining diverse plant material, ecological knowledge, scenario planning, monitoring, and adaptive management while recognizing uncertainty and avoiding simplistic assumptions about future conditions. Potential contributions include:

- Support the selection and sourcing of plant material that is suited to both current conditions and future environmental and climatic scenarios.
- Contribute knowledge of species distributions, ecological tolerances, and climate adaptation strategies that increase ecosystem resilience to disturbance, extreme weather events, and environmental change.
- Inform restoration planning through long-term ecological observations, research, and collections-based knowledge.
- Promote adaptive management approaches that incorporate monitoring, learning, and changing climatic conditions.

Strategic Pillar 2: Expand Plant Supply Systems and Genetic Resources for Restoration

Strategic Objective: To expand and strengthen the seed and plant resources, supply and demand systems, and genetic diversity within taxa needed to support biodiverse, climate-resilient, and ecologically effective restoration. *Progress would be reflected in greater availability of diverse, locally appropriate, and genetically informed plant material for restoration practitioners, and in stronger institutional networks connecting seed banks, botanical gardens, nurseries, and restoration programs.*

Successful restoration depends on access to diverse, appropriate, and high-quality plant material. Yet across many regions, restoration efforts remain constrained by limited availability of native species, insufficient seed and nursery capacity, gaps in propagation knowledge, and challenges associated with producing and sourcing plant material at the scale required to meet restoration goals (Ladouceur et al., 2018; NASEM, 2023). These constraints can limit biodiversity outcomes, reduce restoration effectiveness, and undermine long-term ecosystem resilience.

Botanical gardens can make distinctive contributions to this challenge through their living collections, seed banks, and herbaria, which hold biological material that commercial nurseries rarely prioritize — rare, locally adapted, and difficult-to-propagate species that are often critical to restoration outcomes but absent from existing supply chains. Combined with propagation expertise, nursery infrastructure, and established partnerships with seed collectors, practitioners, and conservation networks, this positions botanical gardens as key contributors to more diverse, resilient, and locally appropriate supply systems.

This pillar focuses on two priorities: strengthening seed and plant supply chains and advancing provenance-informed, climate-adaptive sourcing and genetic diversity.

Priority Area 1. Strengthen Seed and Plant Supply Chains

Seed and plant supply chains are most effective when they function as coherent networks, connecting collection, conservation, propagation, distribution, and deployment in ways that maintain quality, provenance integrity, and biological diversity from beginning to end. Many current systems fall short: fragmented, under-resourced, and unable to provide the volume and diversity that restoration goals demand. Strengthening them requires building institutional capacity and establishing relationships that can sustain supply over the long term. Supply also expands only as fast as demand allows: without predictable, well-specified orders, producers cannot justify investing in the diversity and volume that restoration requires, so strengthening supply and coordinating demand need to advance together (Pedrini & Dixon, 2020).

Botanical gardens can play a catalytic role within these systems given their technical depth in propagation, their established collections, and their experience working with species that are difficult to cultivate. Their contribution is strongest when they integrate their capacities into wider networks, working alongside seed collectors, community nurseries, restoration practitioners, public agencies, and other partners to build locally appropriate and financially sustainable supply chains. Potential contributions include:

- Support the production and use of plant material that is diverse, healthy, and suitable for restoration objectives.

- Strengthen seed collection, storage, and distribution systems that support restoration at multiple scales.
- Support collaboration among seed banks, nurseries, botanical gardens, and restoration practitioners to strengthen restoration supply chains.
- Expand the representation of native, rare, threatened, and underutilized species within restoration supply systems.
- Develop propagation and cultivation approaches for species that are difficult to produce, establish, or source through conventional restoration supply chains.
- Strengthen demand-side coordination, such as demand aggregation, forward contracts, and clear procurement specifications for provenance and quality, that reduces risk for seed producers and supports sustained investment in native seed production.

Priority Area 2. Advance Climate-Adaptive Sourcing and Genetic Diversity

Genetic diversity is an underrecognized dimension of restoration quality. Plant material sourced only from historically proximate populations may lack the adaptive capacity needed as climates shift, resulting in restoration plantings that establish well but fail to persist, or that cannot maintain function under increasingly frequent disturbances.

Botanical gardens can address this challenge, though the value of their collections for climate-adaptive sourcing depends on how those collections are assembled and documented. Many living collections have relatively narrow genetic bases or incomplete provenance data and may capture only a portion of the genetic variation found in wild populations (Wei & Jiang, 2021). Well-documented, wild-collected accessions and seed-bank collections spanning environmental and geographic gradients are therefore particularly valuable for informing provenance-based sourcing, documenting adaptive variation, and developing climate-responsive planting guidance. Drawing on these resources alongside their seed-conservation programs, propagation expertise, and research partnerships, botanical gardens and their partners can contribute in several ways. Potential contributions include:

- Support the collection and conservation of genetically diverse plant material across environmental and geographic gradients.
- Generate and apply evidence on how genetic diversity influences restoration outcomes, adaptive capacity, and long-term resilience.
- Develop guidance and best practices related to provenance, seed transfer, and climate-adaptive sourcing.
- Facilitate collaboration and knowledge exchange on genetic resources and climate adaptation across institutions and regions, consistent with access and benefit-sharing obligations under the Nagoya Protocol and national regulations.

Strategic Pillar 3: Connect Research, Practice, Monitoring, and Learning

Strategic Objective: To strengthen the generation, exchange, application, and coordination of knowledge needed to improve restoration outcomes, support adaptive management, and accelerate collective learning across institutions and regions. *Progress toward this objective would be reflected in stronger links between research and practice, more effective monitoring and adaptive management, and greater exchange of knowledge across projects, institutions, and regions.*

Restoration is a long-term, iterative process. Progress depends on connecting research and practical experience, designing monitoring that can answer meaningful questions, and sharing evidence across projects and regions. Botanical gardens can contribute through their scientific expertise, collections, demonstration sites, networks, and capacity for long-term stewardship, while working with the many existing organizations and platforms already active in these areas.

This pillar identifies three linked priorities: bridging research and practice; strengthening monitoring, evaluation, and adaptive management; and fostering comparative learning and coordinated knowledge exchange.

Priority Area 1. Bridge Research and Practice

Restoration science continues to generate insight into ecosystem recovery, biodiversity, climate adaptation, plant propagation, and restoration effectiveness. Yet evidence does not always reach practitioners, and practical experience does not always shape research. Botanical gardens can help close this gap when they connect their research, sites, staff, collections, and partners around questions that emerge from restoration implementation.

Where land-management and compliance constraints allow, botanical gardens may also be able to design restoration projects experimentally or quasi-experimentally, directly comparing methods at scales relevant to practice. Such work should be developed with researchers, practitioners, Indigenous Peoples, and local communities so that the questions, methods, interpretation, and use of findings reflect practical needs and multiple knowledge systems.

Potential contributions of botanical gardens include:

- Identify restoration questions emerging from implementation challenges and connect them with applied research agendas.
- Compare and evaluate restoration approaches through pilot projects, restoration experiments, and demonstration sites that serve as living laboratories.
- Synthesize scientific findings into practical guidance tailored to restoration practitioners.
- Support co-production of knowledge among researchers, practitioners, local communities, and Indigenous Peoples.
- Share results and lessons across botanical-garden and partner networks to build evidence on how restoration approaches perform across different ecological and social contexts.

Priority Area 2. Strengthen Monitoring, Evaluation, and Adaptive Management

Assessing the ecological, social, biodiversity, and climate-related outcomes of restoration efforts requires appropriate baselines; meaningful contrasts or controls where feasible; consistency across sites; adequate replication; and plans for data management, analysis, and interpretation.

Botanical gardens can contribute within wider standards and monitoring networks, including efforts aligned with the Society for Ecological Restoration, the UN Decade on Ecosystem Restoration, The Global Biodiversity Standard, FAO, Restor, and other relevant initiatives. Their long-term institutional presence can support sustained observation, stewardship of datasets, and comparison of outcomes against agreed goals and indicators.

Well-designed monitoring supports adaptive management by showing what is working, where challenges persist, and how outcomes change. It also makes evidence more credible to communities, practitioners, funders, and policymakers. Potential contributions include:

- Encourage partners to apply recognized standards, reference models, and indicators aligned with SER, The Global Biodiversity Standard, and related monitoring frameworks in their restoration systems.
- Work with partners to develop long-term monitoring programs that track biodiversity, ecosystem processes, climate resilience, and community-defined outcomes, using baselines, comparisons, and replication where appropriate.
- Maintain and responsibly share long-term datasets, guided by the FAIR and CARE data principles, that support adaptive management, evaluation, and connection with global databases.
- Contribute evidence needed to demonstrate restoration outcomes to funders, policymakers, and practitioners.

Priority Area 3. Foster Comparative Learning and Coordinated Knowledge Exchange

Restoration is generating valuable experience and lessons across diverse ecological, social, and institutional contexts, yet much of this knowledge remains confined to individual projects or institutions. Systematic efforts to document, compare, and share what is being learned can substantially improve practice across the restoration community. Through exchanges, case studies, communities of practice, and shared methods, botanical gardens can identify transferable lessons while respecting ecological, social, and institutional differences among places.

Potential contributions include:

- Compare restoration approaches across networks of gardens and partner sites to identify transferable lessons and context-specific differences.
- Establish learning networks that connect practitioners working in similar restoration contexts.
- Document and disseminate restoration case studies that highlight practical applications and outcomes.

- Create opportunities for reciprocal learning among scientific, practitioner, Indigenous, and local knowledge systems through communities of practice.
- Convene partners around shared restoration questions, learning priorities, and opportunities for coordinated action.

4.3. Cross-Cutting Themes

The three pillars above describe high-impact areas where botanical gardens can contribute to ecosystem restoration. But as noted above, botanical gardens are interdisciplinary organizations with capacities beyond the botanical and horticultural. The cross-cutting themes below describe how work can proceed in a collaborative and open way. These are not separate workstreams; rather, they shape decisions and relationships across every pillar.

Communities, Indigenous Peoples, and Local Leadership

Restoration cannot be sustained without local leadership, meaningful participation, and long-term stewardship. Across all pillars of this framework, botanical gardens should work alongside Indigenous Peoples, local communities, and other stakeholders as partners in restoration planning, implementation, monitoring, and stewardship. Restoration efforts are strengthened when they reflect local priorities, support local leadership, and create opportunities for reciprocal learning among diverse knowledge systems.

Education, Capacity Strengthening, and Reciprocal Learning

Building restoration capacity requires more than technical training. Education, professional development, peer exchange, and reciprocal learning strengthen practice while fostering dialogue among scientific, practitioner, Indigenous, and local knowledge systems. Botanical gardens are well positioned to host, support, and connect these learning processes — building the skills, relationships, and networks that restoration requires over the long term.

Communication, Outreach, and Public Engagement

Communication plays an essential role in building awareness, fostering participation, and demonstrating the value of restoration. Botanical gardens can engage diverse audiences — from local communities to national policymakers — to communicate restoration goals and outcomes, promote ecological literacy, and connect public support with on-the-ground stewardship.

Policy Alignment and Enabling Conditions

Restoration outcomes are strongly influenced by the policy, institutional, and financial environments in which projects operate. While this framework focuses on actions that botanical gardens and their partners can undertake directly, long-term success will also depend on supportive policies, sustained investment, institutional capacity, and governance structures that enable restoration at scale. Many of the barriers identified through the Nurturing Nature Initiative — including funding limitations, fragmented coordination, and insufficient support for long-term monitoring and learning — are shaped by these broader enabling conditions and should be considered throughout implementation of the framework. Among these barriers,

funding was cited most consistently, making the development of sustainable financing mechanisms a particularly important enabling condition—both for botanical gardens seeking to expand their contributions and for the broader restoration systems they participate in. Beyond diversified public and philanthropic funding, long-term institutional investment, and payment-for-restoration approaches, this includes more targeted mechanisms such as multi-year or core funding for long-term monitoring, restoration finance linked to credible standards like The Global Biodiversity Standard, and cost-recovery models for seed and plant supply.

Urban and Peri-Urban Restoration

Urban and peri-urban landscapes present distinctive opportunities and challenges for restoration. Botanical gardens often play important roles in these contexts through biodiversity conservation, climate adaptation, education, public engagement, and the delivery of ecosystem services. As urban populations continue to grow, restoration in urban and peri-urban environments will become increasingly important for connecting people with nature and strengthening ecological resilience. Consideration of these contexts should therefore be integrated across all pillars of this framework.

5. Partnerships and the Wider Restoration Network

5.1. A Collaborative Model for Restoration

Botanical gardens cannot achieve restoration goals alone. Restoration requires diverse expertise, authority, resources, and lived experience. The priorities in this framework are only achievable through genuine collaboration, built on shared purpose, mutual respect, and recognition of what different partners bring.

Organizing collaboration around shared ecological regions or bioregions that cross institutional and political boundaries can offer a useful level of coordination between site-level work and national or global frameworks. Existing ecological classifications, such as the IUCN Global Ecosystem Typology, can provide a common reference for identifying comparable ecosystems and organizing collaboration across regions. Botanical gardens working in shared biomes, watersheds, or landscapes may find bioregional alliances an effective way to align priorities, pool plant material, and generate comparative evidence.

5.2. Involved Parties

The mix of restoration partners will vary by place and purpose. Across contexts, effective restoration may involve:

- Botanical gardens and arboreta
- Indigenous Peoples and local communities
- Non-governmental organizations (NGOs)
- Universities and research institutions
- Governments and policymakers
- Restoration practitioners
- Private-sector partners
- Funders and philanthropic organizations
- Restoration networks and collaborative initiatives (e.g., ERA, UN Decade on Ecosystem Restoration partners, and networks and initiatives supporting implementation of KMGBF Target 2)
- Standards bodies and frameworks (e.g., SER, The Global Biodiversity Standard)

These groups bring different knowledge, authority, resources, and responsibilities. Effective partnerships make those roles explicit and create the conditions for shared decisions, reciprocal learning, and long-term stewardship.

5.3. Principles for Effective Partnership

Nurturing Nature promotes partnerships grounded in co-design, reciprocity, transparency, and respect for diverse rights, responsibilities, and knowledge systems. Effective partnerships recognize what different actors bring, support shared decision-making and meaningful participation, and invest in relationships that endure beyond individual projects and funding cycles. Botanical gardens can play a particularly useful role in these partnerships as boundary organizations, institutions whose combination of scientific, horticultural,

and community-facing capabilities positions them to bridge research, practice, and policy. This is not a role botanical gardens hold exclusively, but one that their institutional character makes them well suited to play.

6. Connecting Local Action with Regional, National, and Global Policy

6.1. Alignment with Global Frameworks

Nurturing Nature is designed to support and complement existing commitments, standards, and networks rather than create parallel structures. The framework aligns botanical-garden contributions with the UN Decade on Ecosystem Restoration, the Kunming-Montreal Global Biodiversity Framework (KMGBF), and other global conventions. Standards set by the Society for Ecological Restoration and The Global Biodiversity Standard are key mechanisms for achieving these ambitious global goals.

Framework	Alignment with the Nurturing Nature Strategic Framework
UN Decade on Ecosystem Restoration (2021–2030)	Nurturing Nature is a direct contributor to the Decade's mission, mobilizing the botanical garden community around the ecological quality, social inclusion, coordination, and long-term monitoring that the Decade identifies as central to making restoration commitments count.
KMGBF – Target 2	Target 2 requires not just restoring area but restoring ecological integrity and biodiversity. All three pillars contribute: Pillar 1 addresses restoration quality and ecological processes; Pillar 2 provides the diverse, genetically appropriate plant material that effective restoration demands; and Pillar 3 builds the monitoring and evidence systems needed to demonstrate genuine recovery.
KMGBF – Target 3 ("30x30")	Effective conservation of 30% of land requires restoration within and around protected areas and ecological connectivity at landscape scale. Botanical gardens' seed banks, propagation programs, and rare species expertise provide critical plant resources for restoration that supports protected area effectiveness.
KMGBF – Target 4	Target 4 calls for urgent action to halt species extinctions, recover threatened species, and safeguard the genetic diversity of native species through both in situ and ex situ conservation. Pillar 2's focus on diverse, genetically appropriate plant material, seed banking, and the propagation of rare and threatened species directly supports species recovery and the maintenance of genetic diversity that resilient restoration depends on.
KMGBF – Target 8	Target 8 addresses the need to reduce climate risks to biodiversity through ecosystem-based approaches. The framework's focus on climate-adaptive species selection, provenance-informed sourcing, and restoration designed for future conditions positions botanical gardens as direct contributors to this agenda.

KMGBF – Target 12	Target 12 calls for biodiverse, accessible, and well-connected urban green spaces. Many botanical gardens operate in urban and peri-urban contexts, making them particularly well placed to contribute to this target through ecological restoration, biodiversity programming, and public engagement.
KMGBF – Target 21	Target 21 emphasizes access to the data, information, and knowledge needed for effective biodiversity action, while respecting requirements for traditional knowledge. The framework supports this through stronger monitoring, knowledge exchange, reciprocal learning, and responsible data sharing across restoration networks.
KMGBF – Target 22	Local leadership, meaningful participation, and equitable partnerships are central to the framework and directly support Target 22, which calls for the full, equitable, inclusive, and effective participation of Indigenous Peoples and local communities in biodiversity decision-making and respect for their rights and knowledge.
Global Strategy for Plant Conservation (GSPC)	The current implementation phase of the GSPC for the 2024–2030 period, whose Voluntary Complementary Actions are aligned with the KMGBF, calls for plant diversity to be integrated into restoration and for that work to engage local communities and build capacity across regions. Nurturing Nature addresses both: through seed conservation and propagation of underutilized native species, and through reciprocal learning and training that strengthen local and practitioner capacity for plant-based restoration.
Sustainable Development Goals (SDGs)	Nurturing Nature's cross-cutting themes on community well-being, local leadership, and urban restoration align with SDG 11 (Sustainable Cities); Pillar 1's climate-adaptive design and Pillar 3's evidence generation contribute to SDG 13 (Climate Action) and SDG 15 (Life on Land); and the framework's collaborative, multi-partner model reflects SDG 17's emphasis on effective partnerships for sustainable development.
United Nations Framework Convention on Climate Change	The framework's emphasis on climate-adaptive design, long-term monitoring, and evidence generation supports the credibility of ecosystem-based approaches within climate policy.
United Nations Convention to Combat Desertification	Land degradation neutrality requires restoration that is technically sound and embedded in the livelihoods and land management systems of dryland communities. Botanical gardens can contribute through locally adapted plant material for dryland restoration and through convening and training that build restoration capacity with and for the communities most affected by desertification.

Ramsar Convention on Wetlands	Wetland restoration requires specialist ecological knowledge and access to appropriate plant material, but also the long-term community stewardship that sustains it. Where botanical gardens work in or near wetland ecosystems, their ecological design expertise, collections, and relationships with local communities and practitioners are all relevant.
Bonn Challenge	Achieving Bonn Challenge targets requires plant material, ecological knowledge, and implementation capacity at a scale that current systems struggle to provide. Nurturing Nature addresses these bottlenecks by strengthening seed and plant supply systems and building the shared evidence base that landscape-scale programs depend on.
New York Declaration on Forests	Forest and landscape restoration at scale requires diverse native tree seed, propagation expertise, and institutional networks to move plant material from conservation to implementation. Botanical gardens' seed bank collections and cross-institutional partnerships are directly relevant to meeting these needs.
Regional Restoration Initiatives (Initiative 20x20, African Forest Landscape Restoration Initiative, G20 Global Land Initiative)	Regional restoration networks succeed when institutions share knowledge, align priorities, and build capacity together across political and institutional boundaries. Botanical gardens are well placed to contribute as conveners, knowledge hubs, and long-term partners within these networks — connecting local restoration experience with regional coordination and shared learning.

6.2. Connecting Evidence, Practice, and Policy

International agreements establish goals and targets, but progress depends on implementation at local, bioregional, national, and regional scales. Botanical gardens can help connect policy and practice through restoration and demonstration sites, plant-conservation programs, capacity strengthening, standards-based monitoring, and partnerships that bring practical evidence and community priorities into decision-making.

Their influence may come from contributing directly to policy processes, demonstrating how commitments can be implemented, and generating credible evidence about what works, under what conditions, and why. Restoration activities are most effective and sustainable when aligned with relevant national biodiversity strategies, restoration commitments, protected-area plans, and community-defined goals. Such alignment strengthens relevance, accountability, and long-term support.

7. Implementation Pathways and Next Steps

The next phase of Nurturing Nature will focus on turning the priorities in this framework into collaborative action. This will involve bringing botanical gardens and partners together around shared priorities, identifying opportunities for regional and thematic collaboration, and developing initiatives that respond to different ecological and institutional contexts. The pathways below outline the initial steps for moving this work forward.

7.1. Coordination and Governance

Moving the framework forward will require coordination across the institutions and networks already involved in Nurturing Nature. NYBG and BGCI will co-convene this work in collaboration with ERA, the Nurturing Nature Advisory Group, participating botanical gardens, and other partners.

As new collaborations develop, roles and responsibilities can be defined based on the needs of each initiative and the strengths of participating organizations. Regional and thematic groups may take different forms depending on their goals, partners, and local context, while remaining connected through shared priorities, learning, and coordination across the wider Nurturing Nature network.

7.2. Priorities for the Next 12–36 Months

Over the next one to three years, the focus will be on building the partnerships, resources, and practical initiatives needed to begin applying the framework. Priorities include:

- **Engage botanical gardens and partners** through an open Expression of Interest to identify institutions interested in contributing to the next phase of Nurturing Nature and the areas where they would most like to collaborate.
- **Develop regional and thematic collaborations** around shared restoration challenges, ecosystems, and areas of expertise aligned with the three strategic pillars.
- **Co-develop proposals and mobilize resources** for collaborative activities, connecting botanical gardens with restoration practitioners, Indigenous Peoples and local communities, researchers, governments, funders, and other partners.
- **Put the framework into practice** through place-based and networked initiatives that apply its priorities in different ecological, geographic, and institutional contexts.
- **Share evidence and learning across the network** so that experience from individual projects can strengthen restoration practice and inform future collaborations.

These activities may develop at different speeds and in different combinations depending on existing partnerships, capacity, funding, and opportunities. The intention is to create multiple ways for botanical gardens and partners to participate rather than require every institution to follow the same pathway.

7.3. Tracking Progress and Learning

A small set of shared indicators can help show whether the framework is leading to stronger collaboration and restoration practice. These should be refined with participating partners as the next phase develops rather than treated as fixed targets from the outset. Potential indicators include:

- the number and diversity of botanical gardens and partners participating in Nurturing Nature;
- regional or thematic collaborations established around framework priorities;
- use of standards-based approaches that strengthen restoration quality, ecological integrity, and climate resilience;
- strengthened seed and plant supply capacity and access to diverse, appropriate plant material;
- participation in shared monitoring, knowledge exchange, and learning; and
- resources mobilized to support collaborative restoration activities.

Together, these indicators can provide a practical picture of where the framework is gaining traction, where additional support is needed, and what the network is learning as implementation progresses.

7.4. Joining the Next Phase

Botanical gardens and partners will contribute to Nurturing Nature in different ways depending on their expertise, capacity, and local context. Some may lead or participate in restoration projects; others may contribute through plant conservation and supply, research and monitoring, training, community partnerships, policy engagement, or knowledge exchange.

The immediate next step is an **open Expression of Interest** for botanical gardens, arboreta, and partners interested in contributing to the next phase of Nurturing Nature. Responses will help identify shared priorities, potential collaborators, and opportunities for regional and thematic partnerships, providing a starting point for the collaborations, proposals, and initiatives that will carry the framework forward.

8. Conclusion and Call to Collaboration

Botanical gardens have much more to contribute to ecosystem restoration, particularly when their expertise, collections, infrastructure, and long-term presence are connected with the knowledge and work of others. The three pillars in this framework reflect that opportunity. High-quality restoration depends on access to diverse and appropriate plant material, while research, monitoring, and shared learning help determine what works and how restoration can improve over time.

Making that contribution meaningful will depend on partnership. Botanical gardens are part of much larger restoration systems that include Indigenous Peoples and local communities, practitioners, researchers, governments, conservation organizations, funders, and many others. Working together creates opportunities to combine complementary strengths, address persistent gaps, and support restoration that is responsive to both ecological and community priorities.

Nurturing Nature provides a shared direction for this work, but the framework will continue to develop through the experience of the institutions and partners that use it. As collaborations grow and lessons emerge, they can help refine priorities, strengthen practice, and identify where botanical gardens can make their most useful contributions.

The longer-term vision is for botanical gardens to become more recognized, connected, and appropriately resourced as core restoration infrastructure within wider restoration systems. Achieving that vision will depend on what comes next: building partnerships, developing and funding collaborative initiatives, learning from implementation, and sharing that knowledge across the network. The Expression of Interest provides the first opportunity for botanical gardens and partners to help shape that next phase and turn the priorities in this framework into action.

9. Glossary

This glossary is adapted and expanded from existing glossaries in the Society for Ecological Restoration (SER) Principles and standards for the practice of ecological restoration (SER Standards; Gann et al., 2026) and The Global Biodiversity Standard: Manual for assessment and best practices (Bartholomew and Mosyaftiani et al., 2024).

Adaptive management – the incorporation of deliberate learning into professional practice to reduce uncertainty in decision-making in complex or unpredictable systems such as ecosystems. Specifically, it is the integration of design, management, and monitoring to enable practitioners to systematically and efficiently test key assumptions, evaluate results, and adjust management decisions, generate learning, and ultimately, improve outcomes.

Arboretum – a managed and documented collection of living woody plants, maintained for research, conservation, education, and/or display. An arboretum is generally considered a specialized type of botanical garden focused primarily on woody plants.

Biodiversity – the variability among living organisms from terrestrial, marine, and other aquatic systems, and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems. In global environmental agreements and guidance documents, this term is most often used to refer to the earth's native organisms and the native ecosystems of which they are part.

Bioregion – a geographic area defined by natural features, such as shared landforms, watersheds, climate, soils, and plant and animal communities, rather than by political or administrative boundaries.

Botanical (also "botanic") **garden** – a managed collection of living plants, documented according to scientific standards and maintained for research, conservation, education, and display.

Boundary organization – an institution that works across different communities—such as science, policy, and practice—serving as a convener, translator, and facilitator that enables knowledge exchange and collaboration while remaining accountable to each.

Climate resilience – the capacity of ecosystems, institutions, communities, and livelihoods to anticipate, prepare for, respond to, and adapt to climate-related stresses and disturbances (e.g., rising temperatures, flooding, drought) while maintaining or recovering essential functions, relationships, and benefits.

Community well-being – the combination of social, economic, environmental, cultural and political conditions identified by individuals and their communities as essential for them to flourish and fulfill their potential.

Conservation (of nature, ecosystems, or resources) – the practice of protecting and maintaining nature and natural resources, including native biodiversity, natural habitats, and ecosystems. In the broad sense,

ecological restoration is part of conservation focused on recovering degraded ecosystem values. Effective conservation is collaborative, evidence-informed, and applies principles of adaptive management.

Degradation (of an ecosystem) – a level of deleterious human impact on an ecosystem that results in the loss of biodiversity and simplification or disruption in its composition, structure and functioning, and generally leads to a reduction in the flow of ecosystem services.

Ecological restoration – the process of assisting the recovery of a native ecosystem that has been degraded, damaged, or destroyed. It differs from other ecosystem restoration activities along the Restorative Continuum in that it aims to recover a native ecosystem to the state it would exhibit in the absence of degradation, while accounting for environmental change. See also **ecosystem restoration**.

Ecosystem – a dynamic complex of plant, animal, fungal, and microorganism communities and their non-living environment interacting as a functional unit. The term ecosystem can be used to describe a functional ecological assemblage, native or nonnative, of any size or scale.

Ecosystem integrity – the degree to which an ecosystem's physical condition, composition, structure, and function are intact.

Ecosystem restoration – the full spectrum of practices and activities along the **Restorative Continuum** (Gann et al., 2026), depending on local conditions and societal choice. These activities contribute collectively to halting and reversing degradation, resulting in improved biodiversity, ecosystem integrity, and ecosystem functions and services (modified from UNEP 2021; Nelson et al. 2024).

Effective restoration – standards-based restoration underpinned by agreed principles that results in appropriately balanced sustainable net gain (project level) (i.e. that benefits and enhances biodiversity, ecosystem integrity, and human well-being). The concept of effective restoration applies to ecosystem restoration broadly and ecological restoration specifically.

Ex-situ conservation – the conservation of components of biological diversity outside their natural habitats through approaches such as seed banking, tissue culture, cryopreservation, and the maintenance of living plant collections.

Genetic diversity – the variety of alleles and genotypes present in a population, which is reflected in morphological, physiological, and behavioral differences between individuals and populations.

Herbarium – a curated collection of preserved plant, fungal, and algal specimens and associated data used for long-term scientific study, research, and conservation.

Indigenous Knowledge (IK) – knowledge and practices learned from experience and observation and passed from generation to generation informed by strong cultural memories, sensitivity to change, and values that

include reciprocity. While IK is the preferred term, it is often used interchangeably with Traditional Ecological Knowledge (TEK), which specifically focuses on ecological and environmental knowledge but may convey the perception of an outdated or static knowledge system.

In-situ conservation – the protection of ecosystems and natural habitats, and the maintenance and recovery of viable populations of species in their natural surroundings.

Interested and affected parties – any individual, group, or institution that has a vested interest in or can influence a project and/or that potentially will be affected by the project and has something to gain or lose if conditions change or stay the same. Interested parties are all those who need to be considered in achieving project goals and whose participation and support are crucial to its success.

Invasive species – a species whose presence in an ecosystem disrupts and degrades the composition, structure, functions, or physical conditions of that ecosystem. Invasive species often accomplish this by outcompeting other species or by preventing their recruitment or establishment. These species are often, but not always, nonnative species. However, not all nonnative species are invasive.

Local community – a group of people who live in or near a project area, who share a set of institutions that order all aspects of social life and could be affected by a conservation or restoration project.

Local Ecological Knowledge (LEK) – knowledge, practices, and beliefs regarding place-based ecological relationships that are gained through extensive personal observation of and interaction with local ecosystems and shared among local resource users.

Monitoring – the periodic collection and assessment of data to answer specific questions about a project's context, strategies, and effectiveness. Some people term the assessment of data as the “evaluation” component of M&E or monitoring, evaluation, and learning (MEL).

Native species – taxa considered to have their origins in a given region or that have arrived there without recent (direct or indirect) transport by humans. Among ecologists, debate exists over how precisely to define this concept.

Nature-based solutions – actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits.

Partner – any individual, group, or institution including governments and donors whose active participation and support are essential for the successful implementation of a project or program. See also **interested and affected parties** and **stakeholders**.

Propagation – the process of creating new plants from existing ones through natural or artificial means, encompassing sexual (seeds) and asexual/vegetative (cuttings, cloning) techniques.

Provenance – the geographic origin of a seed, propagule, or other plant material, together with the environmental conditions of its source population, which shape the material's adaptive traits.

Provenancing – the strategy for selecting from where propagules are sourced to support genetic diversity, climate resilience, and long-term project success.

Recovery (of species) – the state attained by a species when it regains its presence and functionality (in part or in full) after release from a stress or disturbance. Return to functionality is measured in terms of such indicators as abundance, distribution, reproductive capacity, genetic diversity, and resilience compared to a reference state. In ecological restoration, the aim is to attain this state for a site's component species through the process of removing or managing threats and applying appropriate restoration interventions, followed by the appropriate ongoing management to protect species and their habitats on an ongoing basis.

Recovery (of native ecosystems from degradation) – describes the outcome of restoration where an ecosystem regains its integrity, including its composition, structure, and function, through the return of biota and interactions between them and their abiotic environments (as biota grow, breed, recruit, and ultimately build ecosystem complexity). In ecological restoration, recovery, relative to the levels identified for the reference model, is assisted by restoration activities and can be described as partial or full. A key indicator of recovery includes demonstrated or predicted capacity for self-perpetuation of the focal biota.

Reference model – a model that indicates the expected state (in its highest integrity condition) that the restoration site would exhibit in the absence of degradation (with respect to flora, fauna and other biota, abiotic elements, functions, processes, and successional states), reflecting background and predicted changes in environmental conditions. It is not the historical state, nor the baseline condition, but represents a benchmark against which the condition of the site is measured prior to, during, and after restoration.

Rehabilitation – management actions that reinstate attributes of some physical properties (e.g. soils and water) and a level of ecosystem functioning on degraded or converted sites, along with a renewed or improved and ongoing provision of high quality and diverse ecosystem goods and services. Native biodiversity and ecosystem integrity are supported but actions do not achieve substantive recovery of a native ecosystem.

Reintroduction – the intentional return of biota, usually individuals of a given population or species, to an area where they previously occurred. This is carried out by restoration practitioners and can be done through a range of techniques suited to whether the organisms are plants, animals, or belong to other biological groupings.

Restoration ecology – the branch of science that provides concepts, models, methodologies, and tools for the practice of ecological restoration, often in collaboration with other scientific and professional disciplines and cultural practices. It benefits from direct observation of and participation in restoration practice.

Restoration practitioner – an individual who applies practical skills, as well as knowledge from a range of sources, to engage in ecological restoration tasks at project sites. Practitioners may be adept at different aspects of restoration practice, whether planning, implementation, or monitoring, depending on training and experience.

Restorative Continuum – a spectrum of activities (including ecological restoration) that directly or indirectly support or attain at least some recovery of ecosystem attributes that have been lost or impaired.

Seed bank – technical facilities that collect, process, and store seeds at low temperatures and low humidity to preserve genetic diversity and support their potential use in future planting.

Seed transfer zone – a defined geographic area, usually derived from relationships between traits of a species and environmental factors (with or without genetic analysis) to guide where seed may be transferred with minimal adverse effects on fitness.

Stakeholders – see **interested and affected parties**.

Taxonomic group – a taxon or set of taxa at any rank in the biological classification system (e.g., family, genus, species), grouping organisms on the basis of shared characteristics and evolutionary relationships.

Threatened species – a species at high risk of extinction in the wild. Species in the Vulnerable, Endangered and Critically Endangered categories in the IUCN Red List are collectively described as 'threatened.'

Well-being – a positive state experienced by individuals and societies, encompassing such factors as health, the basic material needs for a good life, good social relations, and personal security. Similar to health, it is a resource for daily life, is determined by social, economic, and environmental conditions, and has a strong relationship to the equitable distribution of resources and sustainability (adapted from Millennium Ecosystem Assessment 2005; WHO 2021).

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