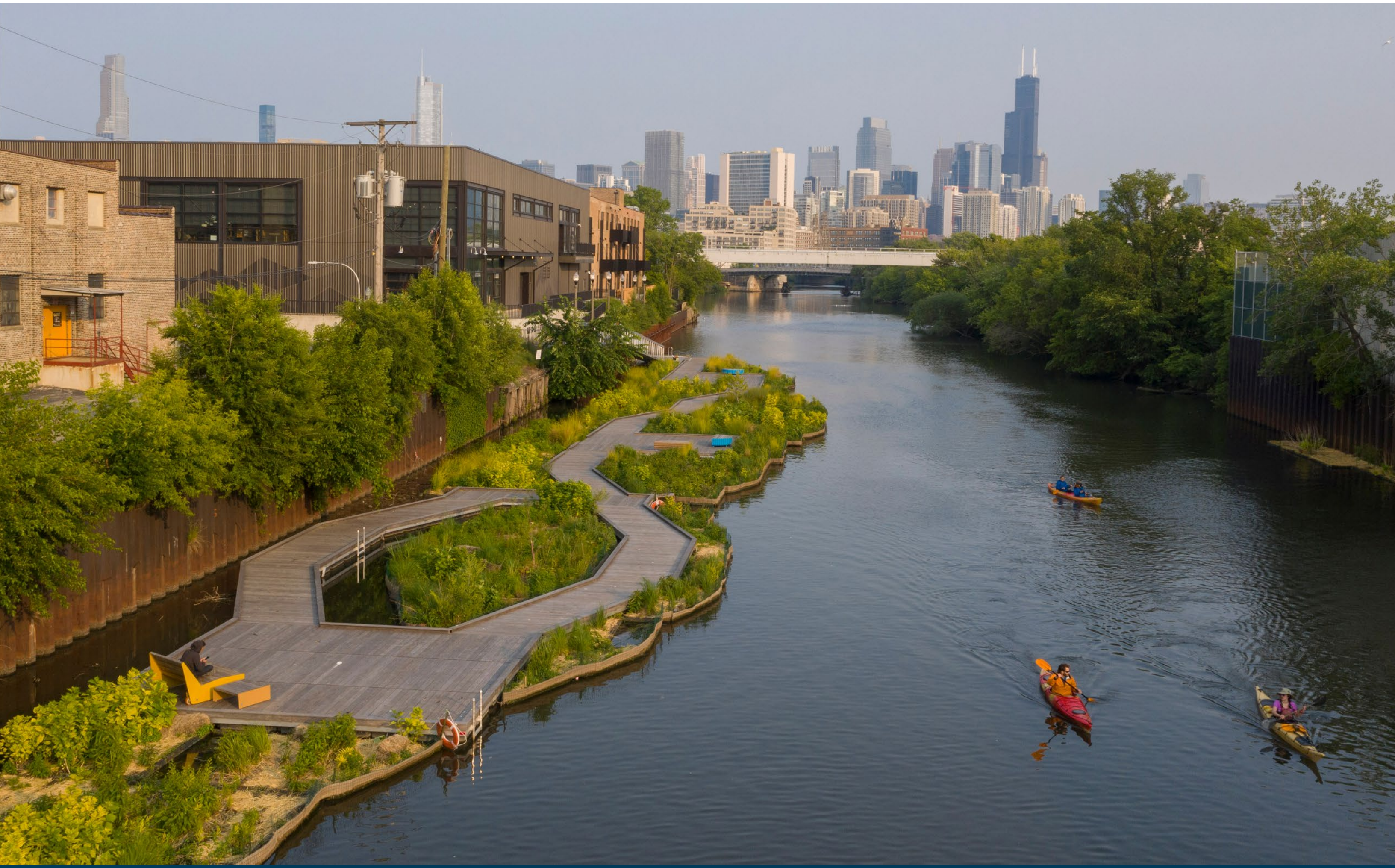
American Society of Landscape Architects

The American Society of Landscape Architects Fund



Biodiversity Primer for Landscape Architects:

Essential Knowledge to Inform Meaningful Action

Version 1
September 2025

About ASLA

Founded in 1899, the American Society of Landscape Architects (ASLA) is the professional association for landscape architects in the United States, representing more than 15,000 members. The Society's mission is to advance landscape architecture through advocacy, communication, education, and fellowship.

About the ASLA Climate and Biodiversity Action Committee

The ASLA Climate and Biodiversity Action Committee leads the implementation of the ASLA Climate Action Plan.

The committee:

- Provides input to ASLA leadership on strategies for advancing the role of landscape architecture in biodiversity and ecological restoration and mitigating and adapting to climate change.
- Develops educational resources and research for landscape architects and educators.

Editor

Betsy Peterson Sanford, ASLA, August Design Collaborative

Contributors & Reviewers

Keith Bowers, FASLA, PLA, Biohabitats
Lisa Casey, ASLA, StudioOutside
David Cutter, FASLA, PLA, Cornell University
Jennifer Dowdell, ASLA, Biohabitats
MaFe Gonzalez, Assoc. ASLA, BASE Landscape Architecture
Weston Henry, ASLA, SWA
Maria Landoni, ASLA, Sur Landscape Architecture
Meghan Mick, ASLA, PLA, Florida State University
Christian Runge, ASLA, Mithun
Grant Thompson, ASLA, Ph. D., PLA, RDG Planning & Design

ASLA Team

Jared Green, Hon. ASLA
Katie Riddle, ASLA, PLA

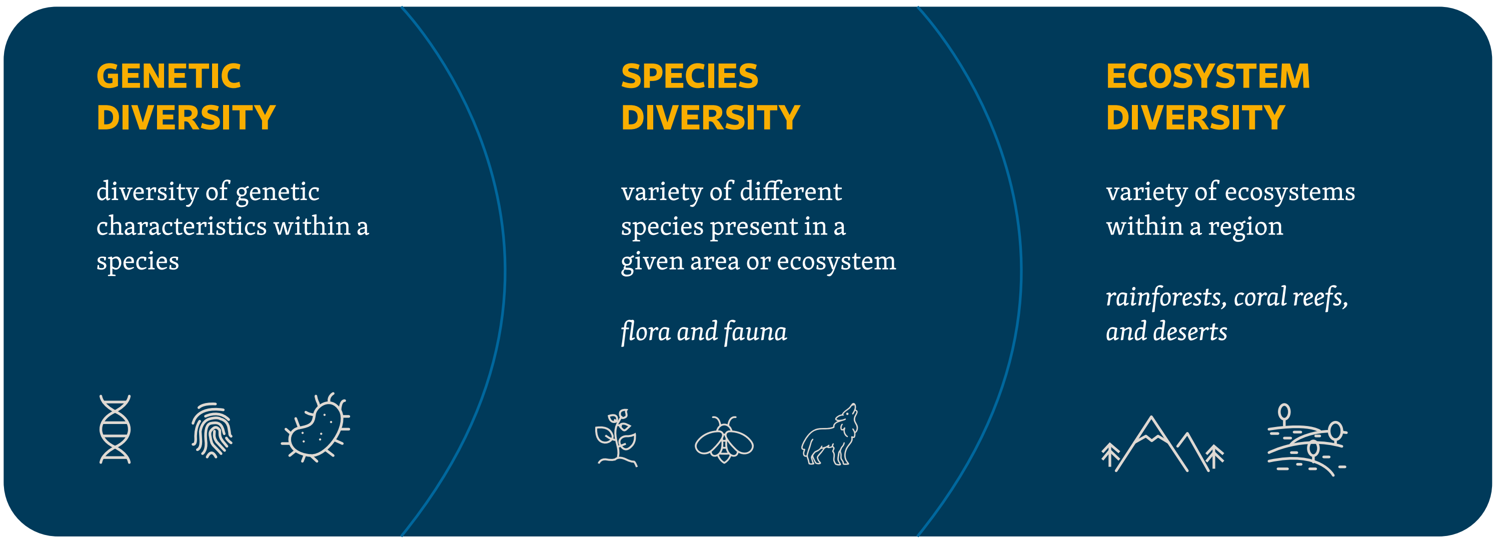
Cover Image: ASLA 2024 Professional Urban Design Honor Award. Wild Mile: Transforming an Urban River into a Floating Eco-Park. Chicago, Illinois.
Omni Workshop, Skidmore, Owings & Merrill/Scott Shigley

Table of Contents

What is Biodiversity?

Biological **Diversity** (or **biodiversity**) is the "variability among living organisms from all sources including, inter alia, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems" (United Nations, 1993).

The three levels of biodiversity



Species (along with their genes) and ecosystems do not adhere to political or property boundaries and as such designing to support biodiversity must acknowledge the more expansive and interconnected nature of ecosysems. Image Credit: Betsy Peterson Sanford

Biodiversity is more than just plants. It is about:

- A complex system of interrelated conditions and living organisms.
- Protecting and restoring ecological processes and functions.
- Preventing harm and protecting critical habitat.
- Minimizing fragmentation and reconnecting habitat.
- Supporting native plant communities and native fauna & fungi habitat.
- Understanding how history, culture, and context intersect with biodiversity
- Protecting and restoring soil health and function.
- Recognizing habitat occurs at multiple spatial and temporal scales.
- Supporting landscape management practices that protect biodiversity.
- Enhancing the food web and trophic levels of species.

The Push to 2030

Despite a renewed global effort to protect biodiversity, we still see a decline in global species.[1] There is a need to act by 2030, the year scientists say counts most in the fight to avert climate change and the continued loss of millions of species as we approach tipping points in the biosphere. This means a paradigm shift from business as usual to pursuing climate and biodiversity-positive solutions in all aspects of our work.

Relevant international frameworks for benchmarking progress toward protecting, conserving, enhancing, and restoring biodiversity:

Kunming-Montreal Global Biodiversity Framework (GBF) Targets

- Known for 30x30 global Convention for Biodiversity (CBD) goal
- Lists 23 action-oriented global targets that are milestones toward the 2050 goals

UN Sustainable Development Goals (SDG) associated with biodiversity

- Sets goals, targets and indicators and tracks progress via nations
- Supported by the UN Decade on Ecosystem Restoration (2021-2030), which is a movement to generate momentum towards the SDGS.

Society for Ecological Restoration Standards

- Supports this work by providing standards & guidelines for implementing restoration

Applicable Goals and Targets

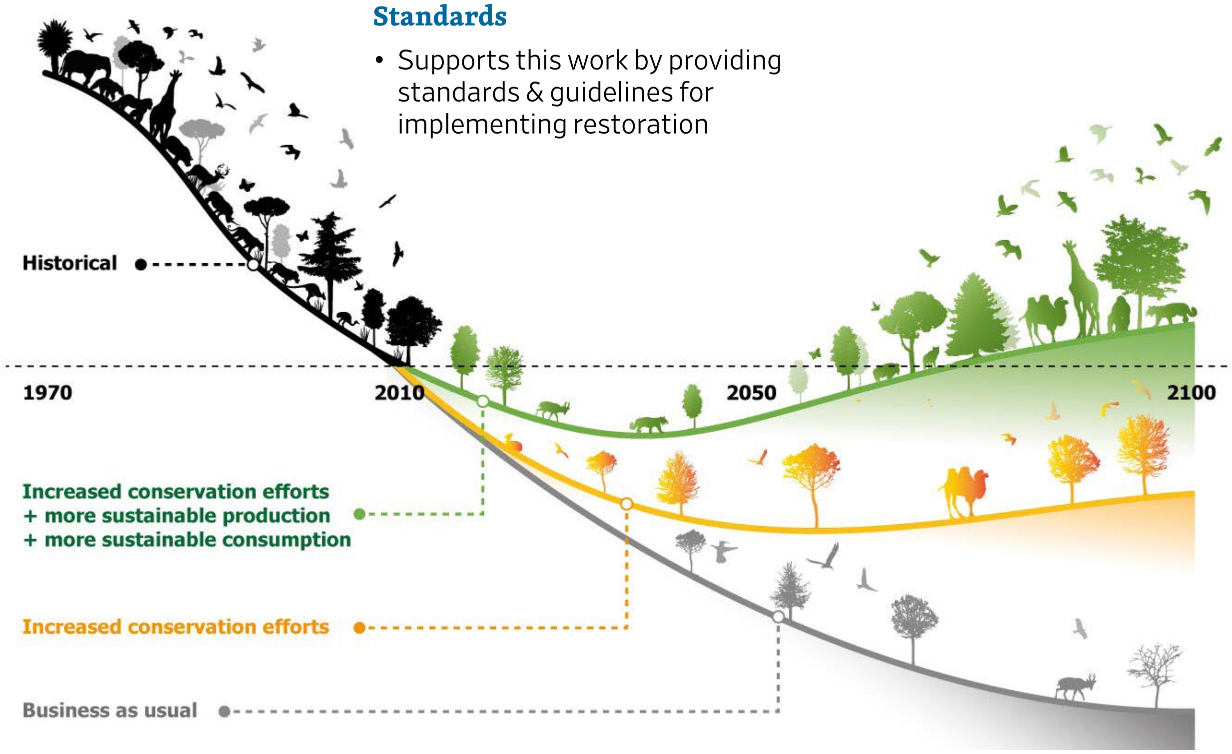
GBF Targets

- 1, 2, 3, 6, 7, 8, 11, 12, 21

Sustainable Development Goals

- 3, 6, 9, 11, 12, 13, 15

See the Appendix for more information on the goals and targets listed above.



Studies show conservation alone cannot solve this crisis. We must look at all facets that our profession influences, from land use and development to materials. Image Credit: © Adam Islaam / International Institute for Applied Systems Analysis

1 This mismatch points not to a lack of goals and agreements, but to a need for better implementation of the visions and existing global plan - a granular look at how these big visions apply to the every day. This primer, the ASLA Climate & Biodiversity Action Plan, and ASLA documents produced by the ASLA Climate & Biodiversity Action Committee translate how these global efforts are linked to landscape architects' role in the work.

A Call to Action

Landscape architects impact biodiversity in every project we touch, as professionals focused on landscapes and the web of life found within. Our capacity to shape the land offers a unique opportunity to reverse the decline in biodiversity that few other design professions have. It's a big responsibility, but one that we are positioned well to perform.

Our design palette impacts the web of life

Plants, soil, and water are the building blocks of habitat for biodiversity. This palette directly impacts biodiversity and the materials we specify and use.

We work across all scales

Any time we shape the land, we impact biodiversity. Landscape architecture and biodiversity intersect at multiple scales, from regional land-use planning to an urban streetscape. Landscape architects have the agency to protect, conserve, enhance, restore, and steward landscapes at all scales to provide a net positive effect on biodiversity.

We bring nature to the public

From master planning to site specific design, we facilitate connections between communities and nature. People are increasingly experiencing nature through encounters in the urban environment. As landscape architects, we have an opportunity and responsibility to increase awareness and dialogue through our work.

We bridge knowledge and action

We interpret a wide swath of data and information from a variety of sources, including scientists, cultural and community-based knowledge bearers, and stakeholders. We are uniquely positioned to apply this knowledge to the landscape in ways that benefit species and the ecosystems they depend upon.

We have opportunities to affect change not only in the physical landscape, but through stewardship practices and policies that affect the environment and the way we practice.

Around the world, landscape architects have heard this rallying cry and responded, identifying biodiversity as a priority for the profession. Now, we have the opportunity to lend our voices and our skills to this global design movement.

Decision making hierarchy

When prioritizing actions and making decisions, follow a hierarchy of preservation, conservation, and regeneration. With all projects, consider how you can:

1st — Protect
guard and defend against any impacts to the existing ecosystem or natural area

2nd — Conserve
manage to prevent exploitation of the ecosystems in question

3rd — Enhance
improve conditions of ecosystems that have been degraded to provide improved ecological function

4th — Restore
assist in the recovery of an ecosystem that has been degraded, damaged, or destroyed

Why Make a Biodiversity Primer?

Global biodiversity goals and commitments are in place, yet few resources show how landscape architects can directly respond to the crisis and apply their expertise. This document positions landscape architects within the context of the global biodiversity challenge, offering essential knowledge to guide ecologically-rich design, foster strategic partnerships, and drive meaningful action.

This document answers the questions :

How can I address the biodiversity crisis?

How can I make a positive impact on biodiversity through my work?

This primer introduces landscape architects to foundational information and context needed to protect and enhance biodiversity. It summarizes key concepts to ground designers in the ecological science and context of the biodiversity crisis. It gives landscape architects direction on how to mitigate the biodiversity crisis through design and planning work.

International strategies and actions on biodiversity within the field of landscape architecture:

- IFLA Europe, *The Role of Landscape Architects in Promoting Biodiversity*, 2023
- The Landscape Institute, Climate and Biodiversity Action Plan, 2020
- *New Zealand Biodiversity Strategy and Implementation Plan, 2020*
- *AILA Biodiversity Positive Design Statement*

Filling resource gaps

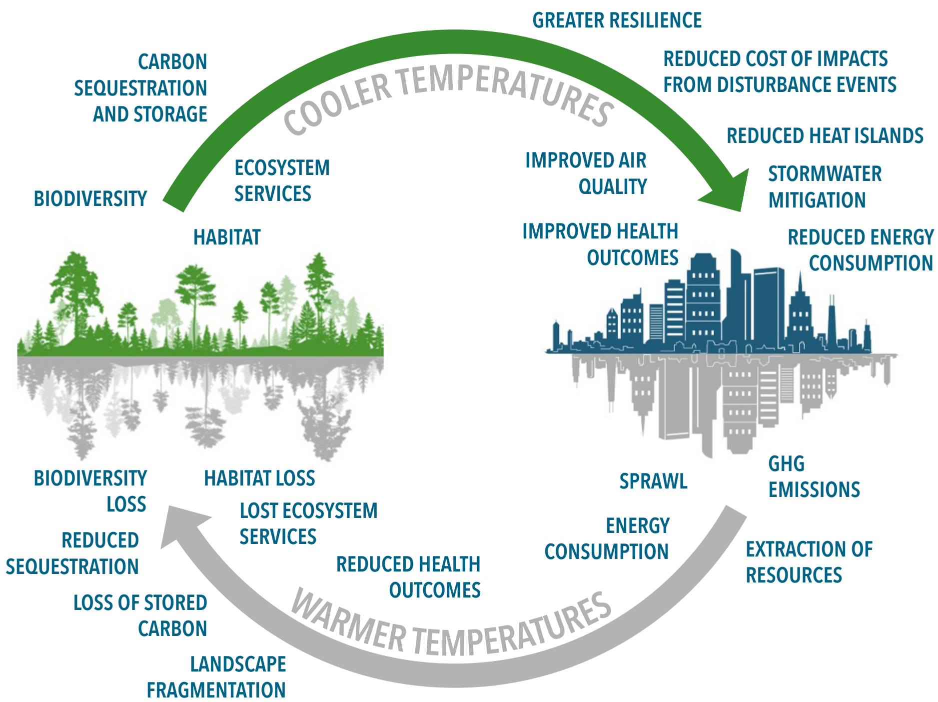
This resource is the first of several to support the implementation of the ASLA Climate & Biodiversity Action Plan (2026-2030). It will be updated periodically to reflect the shifting state of nature and global priorities and the latest research.

The authors welcome feedback. Please send comments to climate@asla.org.

Visitors walk on an elevated boardwalk to ensure undisturbed movement for animals and insects, one of many sensitively designed features of the restoration project by Z'scape that contributes to this self-sustaining ecosystem. ASLA 2024 Professional General Design Honor Award. Alpine Garden and Amphitheater. Lijiang, Yunnan. Z'scape / Bing Lu

Parallel and Intertwined Crises

Today, the globe faces two environmental emergencies: the climate and biodiversity crises. Biodiversity loss is closely intertwined with climate change, creating a feedback loop that exacerbates environmental and human health impacts.



Biodiversity is connected to the climate, creating a circular relationship feedback loop that both exacerbates and improves environmental and human health impacts. The top half of the circle illustrates the positive impacts that biodiversity has on the builturbanized environment, while the bottom half illustrates the negative impacts that urbanization and industry have on biodiversity.
Image credit : Meg Calkins

Equally important

Though intrinsically linked, the progress to addressing global biodiversity decline lags behind the focus and attention given to solving the climate crisis. In recent years, that has begun to shift.

ASLA recognizes the importance of the biodiversity crisis. Across the organization— in committees, chapters, and resources—ASLA has begun elevating biodiversity to a position commensurate with, yet separate from, that of the climate crisis. This underscores that the weight of the biodiversity crisis is equal to that of the climate crisis and demands equal attention.

The relationship between climate change and biodiversity

Rising Temperatures

- Shifts species' climate envelopes—the range of environmental conditions where they can survive.
- Alters the timing of seasons that govern mating, flowering, and migration patterns, disrupting life cycles.
- Create challenging environments for native plants, leading to reduced growth, greater competition from invasive species, and loss of native plant communities.

Extreme Weather Events

- Intensifies storms, floods, droughts, and heat waves that damage habitats and reduce food and water availability.
- Sudden events can cause population collapses in vulnerable species.

Warming Oceans

- Causes sea level rise, inundating coastal habitats such as mangroves, tidal flats, and salt marshes.
- Triggers ocean acidification, weakening coral reefs and other sensitive marine ecosystems.

Carbon Sink Degradation

- Healthy landscapes—peatlands, forests, wetlands—absorb carbon and slow climate change. The challenges listed above reduce their capacity to sequester carbon.
- Loss or degradation (e.g., Amazon Rainforest or peat bogs shifting from sink to source due to deforestation and climate stress) not only releases stored carbon but also destroys biodiversity-rich habitats.

Biodiversity Loss is Accelerating

Scientists have raised the alarm that we are now experiencing the sixth mass species extinction event in the history of our planet; the first since the fall of the dinosaurs and the first caused by humanity.

Notable statistics

The latest WWF Living Planet Report from 2024 reports staggering statistics that translate to a host of impacts on our communities and economies. Action must be taken to protect biodiversity on Earth.

73%
average wildlife population decline 1970 to 2020

2/3
land plants threatened with extinction

11x
livestock outweigh wild mammals and birds

38%
tree species at risk
Source: Global Tree Assessment

Causes

There are five areas identified by the UN's Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) as priorities for addressing global biodiversity risks. Just one of these factors would be a challenge for biodiversity; combined, they are rapidly depleting the Earth's biodiversity.

The main threats to biodiversity, in order of impact, are:

Habitat Loss / Degradation

Overexploitation

Climate Change

Pollution

Invasive Species

Habitat Loss / Degradation: Largest impact on terrestrial and freshwater ecosystems from agriculture, timber harvesting, energy production, mining, urbanization, and fragmentation.

Overexploitation: Largest relative impact on the oceans from unsustainable hunting and poaching or harvesting.

Climate Change: Moved up two spaces since 2022. If global warming exceeds 1.5 ° C, then climate change will continue moving up this list as it becomes a main driver of species loss.

Pollution: Largely due to pesticides and insecticides.

Invasive Species: A majority of invasive plants in the US—82 percent—are introduced as ornamentals through the horticultural trade.

Responsible for *more than 50% of biodiversity loss*

How Can Landscape Architects Help?

Five Biodiversity Priorities

Our work as landscape architects supports the global response to addressing the five main threats to biodiversity.

In Order of Importance	*Landscape Architecture Response*	
Threat	**Strategies**	**Actions**
Habitat Loss / Degradation	Protect habitat and ecosystems Design for ecological connectivity	• Enhance remnant ecosystems through restoration and conservation strategies to provide stepping stones or habitat corridors that reconnect habitat fragments. • Avoid impacts to existing ecosystems and fragile natural features. • Respond to regional and systemic impacts at the site scale. • Promote and protect ecosystem and landscape connectivity, especially in fragmented landscapes.
Overexploitation	Limit the harvesting, extraction, and overuse of species and their habitat	• Eliminate the use of materials and products extracted from sensitive ecosystems by responsibly sourcing and understanding Embodied Biodiversity Impacts of materials.
Climate Change	Scale up climate positive approaches and climate adaptation approaches	• Employ nature-based solutions for climate adaptation. • Mitigate greenhouse gas emmisions in site design and community planning. • Design for climate corridors to facilitate the movement of species across the landscape.
Pollution	Address and treat air and water quality Avoid the use of Red Listed materials Avoid the use of inorganic chemicals and amendments Consider noise and light pollution's impact on biodiversity	• Specify a diverse native plant palette to reduce the need for fertilizers and pesticides. • Incorporate green infrastructure to address water quality. • Incorporate night-sky lighting. • Minimize noise impacts to natural habitats. • Limit the use of polluting materials and chemicals in materials specifications and management plans.
Invasive Species	Implement an invasive species management program Support the use of native species and native plant communities	• Prioritize native plant species and communities; avoid specifying non-native species that could become invasive in the future. • Implement invasive species management plans that encompass pre-during and post contruction. • Advocate with suppliers and local municipal staff. • Enlist citizen science to assist in the tracking and management of invasive species.

Make the Case for Biodiversity

Biodiversity is vital to life as we know it. There are four key benefits to highlight in making the case for biodiversity, whether you are seeking funding, pitching to clients, or are in conversation with collaborators.

Environmental importance

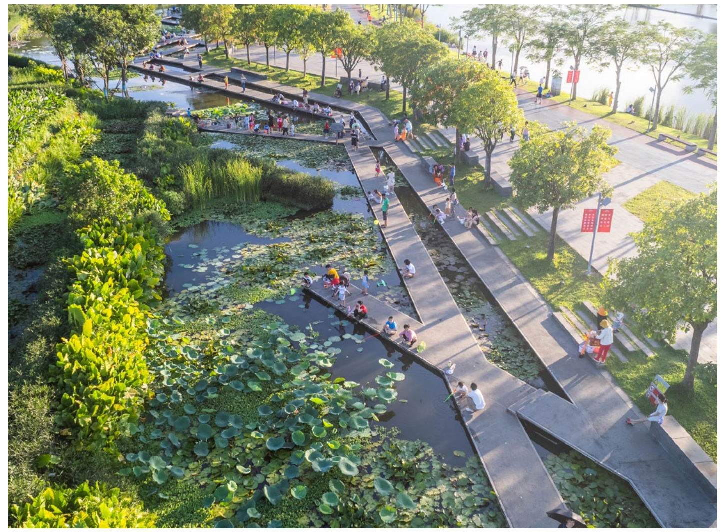
Planetary Resilience & Sustainability

Biodiversity provides ecosystems with the **resilience** to continue functioning despite environmental shocks and fluctuations; this has been termed the "biological insurance theory" of biodiversity.

Biodiversity increases an ecosystem's **adaptive capacity** to evolve and adjust to changing conditions.

Biodiversity **increases the efficiency** with which ecological communities capture essential resources (nutrients, water, sunlight, prey), produce biomass, and decompose and recycle biologically.

Key Takeaway: Landscape architecture projects protect, conserve, restore, and enhance biodiversity.



The Meishe River Greenway and Fengxiang Park showcases the transformative power of ecological infrastructure. Terraced wetlands, such as the one shown above, capture runoff, purify water, and provide habitat in this urban context. ASLA 2025 Urban Design Honor Award. Turning Gray into Green: Meishe River Greenway and Fengxiang Park. Haikou, Hainian Province, China. Turenscape

Economic importance

The World Economic Forum lists biodiversity loss and ecosystem collapse as the second highest economic threat over the long term (10 years) in their Global Risks Report of 2025.[1] One example of biodiversity's impact on the economy is that pollinators are essential for our global food production, and insects (the majority of pollinators) are globally declining.

The economic significance of natural systems is staggering— more than half (55%) of the global GDP depends on high-functioning biodiversity and ecosystem services. Yet this dependency is systemically undervalued in economic models, creating a dangerous disconnect between prosperity and ecological health, according to the WWF Living Planet Report 2024.

Key Takeaway: Landscape architecture projects focused on biodiversity are an economic investment in our collective futures.

See ASLA's resources on the economic benefits of nature-based solutions

The Atlanta BeltLine showcases the rippling economic impacts a people- and nature-focused project can have on surrounding neighborhoods. The reclaimed rail-trail touts a linear arboretum, native plantings, and pedestrian-focused design. The BeltLine has inspired adaptive reuse of structures along the trail and has catalyzed $700 million in public investment and more than $8.2 billion in private investment along the corridor. ASLA 2024 Professional Urban Design Award of Excellence. Atlanta BeltLine. Perkins&Will / Randy Maxwell

1 5 out of the 10 top risks were environmental. Global risks, ranked by severity, are: 1. Extreme Weather events 2. Biodiversity loss and ecosystem collapse 3. Critical change to Earth systems 4. Natural resource shortages 5. Misinformation and disinformation 6. Adverse outcomes of AI technologies 7. Inequality 8. Societal polarization 9. Cyber espionage and warfare 10. Pollution. Source: World Economic Forum Global Risks Report 2025

Community health

Research studies cite a wide array of **mental and physical health** benefits from engaging with nature:

- tree cover correlates to decreased anxiety and rumination.
- views of nature through windows—particularly in urban spaces—improve psychological health.
- time in nature decreases cortisol levels (stress).
- patients recover more quickly with views of nature and prolonged access to green space.
- Researchers in the UK found that biodiversity, not facilities, is the key variable of more restorative parks.

Key Takeaway: Landscape architecture projects that focus on biodiversity connect people to nature.

Continued reading: *Last Child in the Woods* by Richard Louv (2008) and *The Well-Gardened Mind by Sue Stuart-Smith* (2020) capture many of the studies listed above.

La Fénix at 1950 is a 100% affordable community with a variety of outdoor spaces for residents, including the Jardin de la Familias, or family garden (shown above) that uses native drought-tolerant plant species to enhance urban biodiversity. ASLA 2024 Professional Residential Honor Award. La Fénix at 1950, San Francisco, California. GLS Landscape | Architecture / Patrik Argast

Cultural importance

There are fundamental interconnections between humans and nature which can serve as inspiration for art, inform education and recreation, offer a sense of place, create cultural diversity, and take on religious or spiritual values.

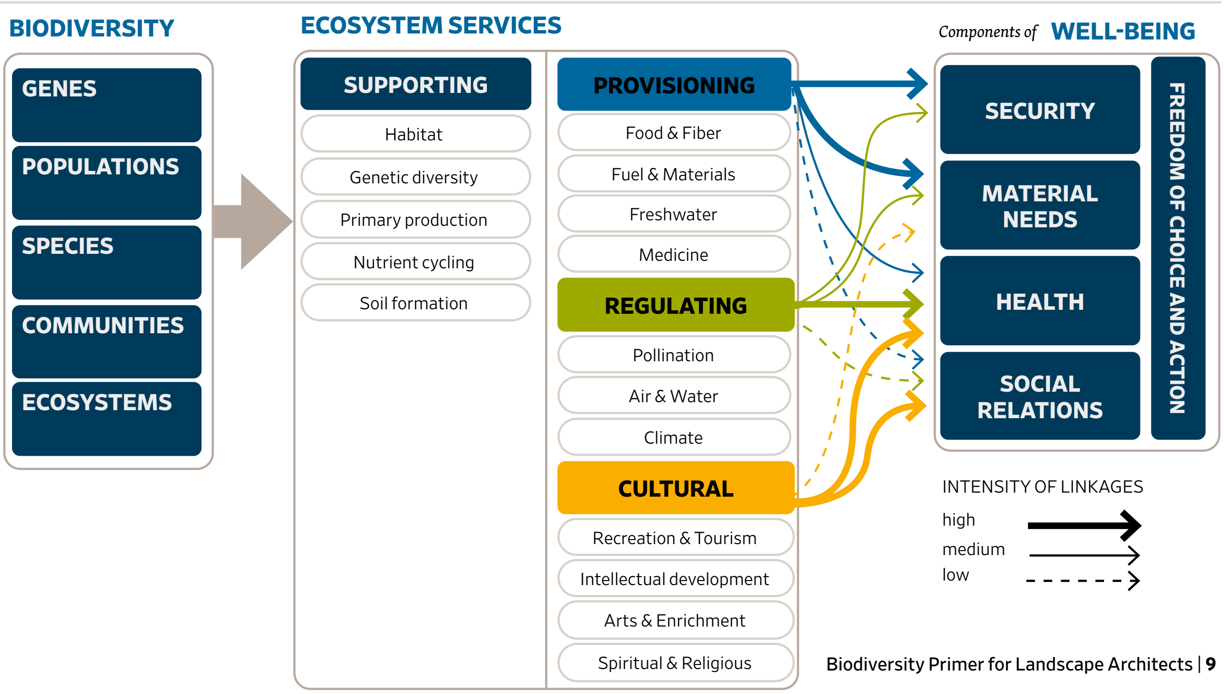
According to IPBES, "shifting dominant societal views and values to recognize and prioritize human-nature interconnetedness" is a key strategy to reverse biodiversity loss. This can be achieved by integrating connectedness to nature into spatial planning, promoting world views and values that emphasize care, reciprocity and harmony with nature, and co-creating spaces with local communities.

Key Takeaway: Landscape architecture projects that address ecological health, cultural heritage and the human sense of belonging contribute to a biologically diverse world.

An embedded timeline recalling events from Algonquian history is one of many features across Machicomoco, a new state park in Virginia, that reveals and honors Indigenous histories. ASLA 2024 Professional Communications Honor Award. *Connecting to Our Indigenous Histories at Machicomoco State Park*. Gloucester Point, Virginia. Nelson Byrd Woltz Landscape Architects / Nick Hubbard

Ecosystem Services

are the direct and indirect benefits that people and the more-than-human world receive from nature. Impacts to biodiversity directly effect the integrity of ecosystem services.



Design for Parallel and Intertwined Crises

The relationships between biodiversity loss and climate change require integrated efforts to address both issues at the same time. Focusing strictly on designing for one of these crises will not necessarily benefit the other, but many of the same design strategies can conserve or enhance biodiversity *and* mitigate climate impacts when properly implemented. Nature-based solutions are the way to address the climate and biodiversity crises together.

Key actions:

- **Prioritize Protection** – Prioritize protecting and conserving existing habitats before considering removal or alteration, as they play a dual role in carbon sequestration, habitat connectivity, and species survival.
- **Design Imperative** – Projects should integrate design strategies that enhance biodiversity while also reducing project carbon footprints (mitigation) and responding to climate change impacts (adaptation). *See "Biodiversity Co-Benefits" below.*
- **Risk Management** – Design needs to anticipate shifting species ranges, invasive species threats, and increased extreme weather events.
- **Policy Alignment** – Work needs to increasingly align with global goals that link climate action and biodiversity protection.
- **Strategic Partnerships** - Landscape architects do not have to be the experts in ecology, but should understand enough to engage the right set of experts in informing design. Collaborators could include ecologists, natural resource scientists, geologists, biologists, fluvial geomorphologists and soil scientists.
- **Environmental Justice** - Acknowledging that climate impacts and environmental degradation are most often felt in disadvantaged communities, landscape architects should ask not only who gets what, but how decisions are made, whose voices are included and how past harm can be acknowledged and repaired. Consider how decisions today shape equity for future generations.

  See ASLA's Climate Justice 101 resource for details on what this looks like in practice.

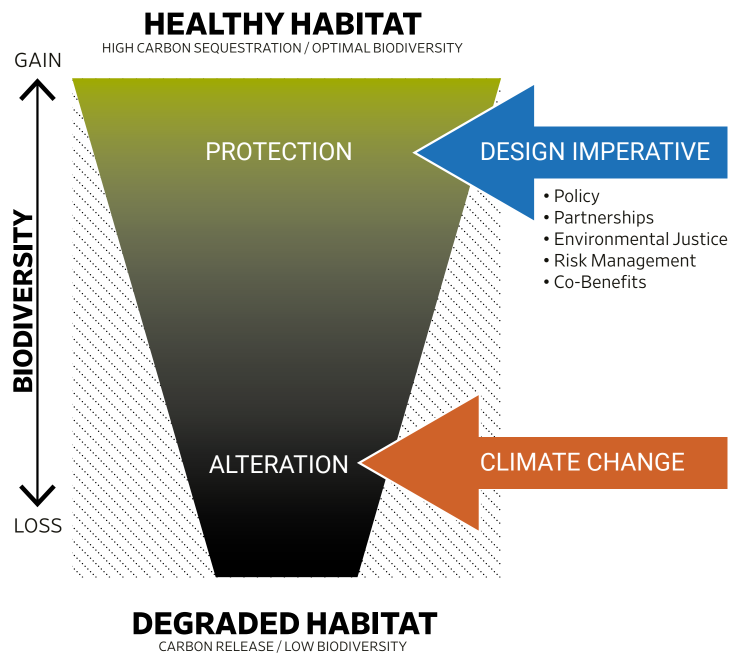


Image Credit: Maria Landoni

Biodiversity co-benefits for climate mitigation and adaptation

As practitioners working at the nexus of design, art, ecology, environmental justice, and cultural understanding, landscape architects are uniquely poised to integrate natural systems with the built environment and catalyze co-benefits for climate and biodiversity.

This living shoreline project marries design, ecology, and engineering to responded to the habitat destruction left in the wake of Superstorm Sandy. More than 14 acres of restored freshwater wetland habitat provide critical habitat that serves 70% of migratory birds along the Atlantic Flyway. Designed by Dirtworks Landscape Architecture P.C. for the Jamaica Bay Rockaway Parks Conservancy and National Park Service. ASLA 2022 Professional General Design Honor Award. West Pond: Living Shoreline, Brooklyn and Queens, New York. Dirtworks Landscape Architecture P.C. / Jean Schwarzwalder

Mitigation co-benefits

Protect biodiversity and reduce the carbon footprint of projects

Mitigation co-benefits arise from designs that protect biodiversity and reduce the carbon footprint of projects. As an example, it's important to consider impacts to biodiversity from materials and construction processes. Choose sustainably sourced, local materials instead of those derived from distant, sensitive ecosystems.

- Integrating native planted green roofs with photovoltaic (PV) arrays generates renewable energy, provides the typical benefits of green roofs (e.g. building cooling) and creates habitat.
- Choosing sustainably sourced, local materials (rock, wood, soil products) results in better carbon and biodiversity outcomes than products derived from sensitive ecosystems (sphagnum peat, Ipe wood).
- Using native meadows in place of sod lawn can reduce carbon emissions over time and support significantly more biodiversity.

Adaptation co-benefits

Protect biodiversity and respond to the effects of climate change

Adaptation co-benefits arise from designs that protect biodiversity and respond to the effects of climate change. An example is native, adapted street canopies that protect communities from urban heat island effect and extreme temperatures while reducing pollution and providing habitat for local species.

- Designing native, adapted street tree canopies can protect communities from urban heat island effect and extreme temperatures while reducing pollution and providing habitat for local species.
- Green infrastructure elements can reduce the impacts of destructive extreme weather events and support native wetland species. For example, swales to retain and treat stormwater.

Design with Landscape Ecology Principles

Foundational to biodiversity-positive landscape planning and design are the principles of landscape ecology—of seeing the landscape as a part of larger interconnected system of patterns and processes. Landscape architects have the opportunity to address biodiversity by drawing these linkages between a site and its broader context—with the end goal being to avoid habitat loss or fragmentation, protecting existing areas of habitat and designing spaces that support connectivity.

Landscape ecology: the science of interactions between spatial patterns and ecological processes across scales.

Key landscape ecology concepts for designers:

Landscapes as mosaics

Landscapes are made up of patches, corridors, and matrix—the fundamental building blocks of landscape structure.

Patch: A distinct area differing from its surroundings (e.g. forest stand, wetland). Patches can have core (interior) and edge habitat.

Corridor: A linear feature distinct from adjacent land on both sides (e.g. river, hedgerow, greenway) that connects patches and facilitates movement.

Matrix: The dominant land cover in a landscape—either supportive or hostile to ecological processes.

Mosaics are the pattern of patches, corridors, and matrices that form a landscape.

>> Design Implication: Consider how your site is part of a larger mosaic. Can your landforms, planting, soils, hydrology provide a connective tissue or a patch of habitat that supports native species movement across the broader landscape?

Scale: composition, structure, and function

In ecology, scale refers to the spatial and temporal levels at which patterns and processes occur. Ecological processes operate across multiple scales:

Composition: The variety and abundance of habitat types (e.g. wetlands, forest edge length, road density).

Structure: The spatial arrangement of patches (e.g. clustered, fragmented, edge-to-core ratio).

Function: The ecological roles and interactions (e.g. nesting, feeding, migration).

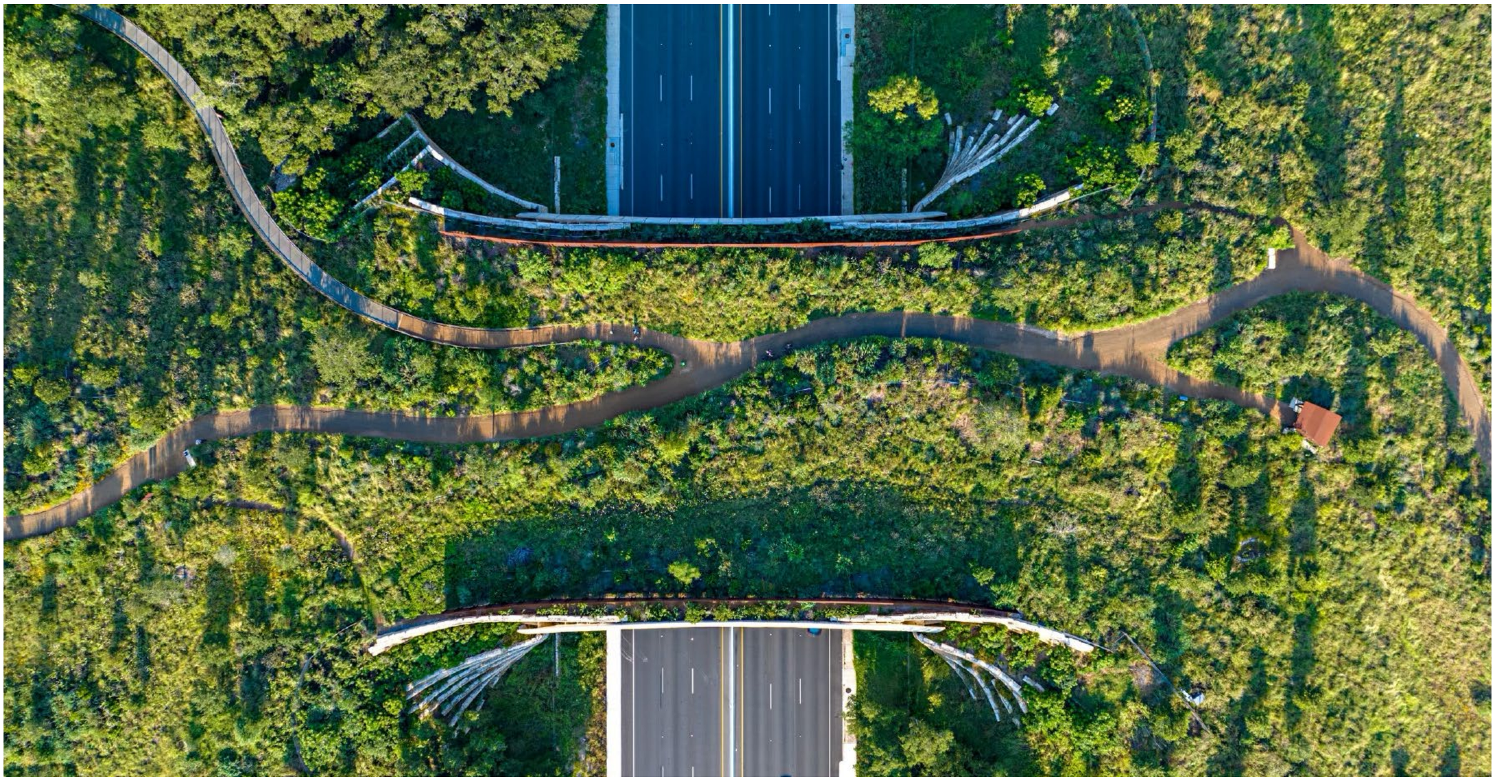
>> Design Implication: Consider how your design can have an meaningful impact at the scale of your site. What might your site be able to contribute to patch dynamics with expanding the area of available habitat for local native wildlife species? What is the capacity of your site to impact watershed health?

Habitat quality and heterogeneity

Habitat quality isn't just about land cover—it's about **context, structure, adjacencies**, and **how species use the space.**

Heterogeneity (diversity in structure and pattern) supports resilience and higher biodiversity.

>> Design Implication: Go beyond planting lists. Consider how a design can address the multiple aspects of ecological function. Beyond the plants that are specified, consider the way spaces are being shaped to impact microclimate, soil condition, hydrology, and patterns and processes found in reference ecosystems.



A new land bridge in San Antonio reconnects habitat, offering a sensitively designed wildlife corridor across a landscape previously fragmented by a six-lane parkway. ASLA 2025 Professional General Design Honor Award. More than Human: A Land Bridge for Cultural and Wildlife Connections. San Antonio, Texas. STIMSON and Rialto Studio / Phil Hardberger Park Conservancy

Habitat connectivity

Connectivity: The degree to which species can move through a landscape. Depends on **proximity** and **permeability** of patches and corridors.

Fragmentation: The breaking up of habitat into smaller, isolated patches—often a result of development. It reduces core habitat and increases edge effects.

>> Design Implication: Consider how your design can have an meaningful impact at the scale of your site. What might your site be able to contribute to patch dynamics with expanding the area of available habitat for local native wildlife species? What is the capacity of your site to impact watershed health?

Disturbance and succession

Disturbance (e.g. fire, flood, drought) is a natural process that shapes landscapes.

Design must accommodate **change over time**—ecological succession, seasonal dynamics, and adaptation.

>> Design Implication: Plan for change. Consider how a landscape may change over time, and how plants may self organize, how soils will continue to build and be nourished through the seasonal cycles of new growth and die-off, how landscapes may be impacted by natural disturbance processes and rebound in their aftermath.

Conservation Biology and the SLOSS Debate

The field of conservation biology focuses on maintaining and restoring natural ecosystems (biological communities) and the species within them. It uses landscape ecology principles to address real-world conservation challenges.

The SLOSS Debate: whether "single large or several small" patches of habitat are better at conserving or supporting biodiversity is a debate that continues within the scientific community. There is no consensus on which approach is more successful.

Both larger contiguous areas of intact habitat and smaller dispersed habitat patches may provide different value in supporting species, depending on habitat needs.

>> Design Implication: In dialogue with local ecologists or biologists, consider what potential impact your site might have in providing optimized habitat for native wildlife, or optimized ecological function for larger systemic connectivity.

Over 3.5 acres of space—or two city blocks—of space in downtown Chicago was reclaimed for biodiversity on this adaptive reuse project by Hoerr Schaudt. ASLA 2023 Professional General Design Honor Award. The Meadow at the Old Chicago Post Office, Chicago, Illinois. Hoerr Schaudt / Dave Berk

In practice: Applying these concepts

Landscape architects have a unique opportunity to consider how every project has a role in addressing ecological impacts, of avoiding loss of ecosystem function, of avoiding habitat loss and further fragmentation and of reconnecting and restoring function in support of net positive biodiversity impact.

When designing for biodiversity, consider:

1. **Total habitat area** protected, enhanced or restored.
2. **Quality** of habitat—reflecting appropriate reference ecosystems in complexity and form.
3. **Connectivity**— how the habitat connects to broader systems and how easily native wildlife species can access habitat on the site and move through the site safely.

Even small-scale projects can make meaningful contributions when aligned with landscape ecological principles.

Landscape ecology teaches us that a site is always part of a larger system, not a space isolated from its surroundings. By designing with ecological patterns and processes in mind, landscape architects and planners can create places that are inviting and beautiful, and part of a much broader connected ecological network.

Design for Biodiversity Across Scales

Landscape architects can enhance biodiversity on their projects by increasing habitat size and quality and maximizing connectivity at three scales: the landscape scale, the site scale, and the species scale.

In collaboration with ecologists and state wildlife officials, the landscape architect analyzed wildlife patterns to inform site design—this led to the protection of the creek shown above as a critical migration corridor and informed restoration strategies for over 100,000 square feet of disturbed landscape to Indigenous habitat. ASLA 2021 Professional Residential Design Honor Award. Charlie Mountain Ranch: The Renewal of a Rural Landscape. Pitkin County, Colorado. Design Workshop, Inc. / Brandon Huttenlocher

Landscape scale

How does it fit into the bigger picture of biodiversity?

The broader landscape scale plays a vital role in biodiversity and is key to achieving ecological connectivity at a regional, continental and global scale. It captures key ecological processes like species migration, disturbance regimes, hydrologic cycles, and energy flows that occur across broader areas, helping to maintain functional and ecological diversity. This scale also supports spatial planning by identifying critical habitats, corridors, and land-use patterns, making conservation efforts more strategic and effective. Importantly, it integrates human influences and promotes sustainable development, acting as a bridge between ecological and social priorities.

Why is it important to landscape architects?

The regional landscape scale is important to landscape architects because it allows us to design with a broader ecological and social context in mind. By considering how ecosystems, species movement, and land-use patterns interact across regions, we can design landscapes that support biodiversity, enhance connectivity, and build resilience to climate change. This scale also helps integrate natural systems with human development, guiding sustainable design solutions that balance ecological integrity with community well-being. It empowers landscape architects to contribute meaningfully to regional planning, conservation, and long-term environmental sustainability.

Objectives

- Protect intact habitats and corridors
- (Re)connect fragmented habitats and corridors
- Restore landscape processes that provide critical ecological functions for biodiversity and people.
- Build climate resilience
- Align with wider conservation initatives

Considerations

- Conservation status of flora, fauna, and fungi.
- Habitat patches, corridors, and stepping stones.
- Ecological relationship between site and the surrounding landscape.
- Degree of intactness and fragmentation of habitat
- Species movement and migration patterns with climate change

LaGuardia Design Group restored a degraded landscape into a functioning habitat. The team replaced miles of asphalt, mowed lawns and invasive species with 50,000 native perennials, a revitalized oak forest, and rain gardens. These improvements work together to ensure the site has a positive impact on surrounding landscapes, including the adjacent Gardiners Bay seen in the distance, above. ASLA 2025 Professional Residential Design Honor Award. Springy Banks, East Hampton, New York. LaGuardia Design Group / Anthony Crisafulli

Site scale

How does it fit into the bigger picture of biodiversity?

Individual sites play a critical role in biodiversity conservation by providing refuges where species can persist, reproduce, and adapt. Even relatively small patches of well-managed habitat can serve as stepping stones or anchor points within a larger ecological network. When these sites are strategically connected—through habitat corridors, green infrastructure, or proximity to other natural areas—they help counteract fragmentation, which supports the recovery of species populations and the long-term stability of ecosystems.

Why is it important to landscape architecture?

Shifting between site and landscape scale is key to achieving functional biodiversity. Ecosystems do not adhere to site, political, or property boundaries and as such designing to support biodiversity must acknowledge the more expansive and interconnected nature of ecosystems.

Objectives:

- Protect existing habitats and corridors
- Strengthen ecological connectivity
- Enhance and restore habitat quality
- Protect intact and healthy soils

Considerations:

- Conservation status
- Ecological connectivity
- Habitat quality (vegetation, structural diversity, spatial configuration, etc.)
- Soil health
- Water cycle and nutrient exchanges
- Disturbance regimes
- Cultural importance

The diverse understory plantings at The Beach at Elliot Bay offer habitat for the insects that salmon feast on, qualifying as certified salmon safe to support the larger waterfront ecosystem. The site's woodland is based off regional reference ecosystems, facilitating habitat connection, and reclaimed materials offer microhabitats while linking the site to the regional context. ASLA 2025 Professional General Design Honor Award. The Beach at Elliot Bay, Seattle Washington. Surface Design, Inc. / Marion Brenner

Species scale

On a species level, landscape architects should be aiming to amplify species diversity within the natural carrying capacity of the ecosystem to support ecosystem functions and integrity. This may include enhancing habitat with native plantings, restoring the biological and chemical health of soils, restoring natural hydrological regimes and employing adaptive management strategies. These actions will provide food sources, shelter, and habitat for native species.

How does it fit into the bigger picture of biodiversity?

Plants, animals, and fungi all play vital roles in weaving the fabric of life. Plants provide food and shelter, fungi form hidden networks that nourish and connect, and animals sustain ecosystems through pollination, dispersal, and balance. When one of these threads unravels, the whole system can begin to weaken. Supporting biodiversity means not only planting diverse species above ground, but also nurturing the soil life and hidden connections that keep ecosystems thriving.

Why is it important to landscape architecture?

Recognizing the roles of plants, animals, fungi, and soil life is essential to creating resilient and regenerative designs. These interconnected systems drive critical functions such as pollination, nutrient cycling, and habitat provision, while also supporting climate adaptation and reducing long-term maintenance needs. By designing for native species, landscapes become not only visually compelling but also ecologically functional and enduring.

Objectives:

- Protect and conserve native species
- Restore or enhance habitat for native species
- Design for species diversity and ecological integrity
- Promote soil and fungi health

Considerations:

- Existing species abundance and richness
- Habitat diversity and quality
- Soil and microbial diversity
- Landscape connectivity
- Cultural significance
- Species threats and opportunities

Metrics: An Overview

Biodiversity metrics help landscape architects understand how a landscape intervention is impacting a site and consequently an ecosystem. Metrics provide tools to assess the impacts of design interventions, enabling teams to refine approaches, make science-based decisions, and take measurable actions that both reduce harm and strengthen biodiversity.

An imperfect science

Putting numbers to a living system is inherently complex, imperfect, and counter to nature's inherent value. Landscape architecture is among the few professions that challenge conventional thinking, viewing biodiversity in a relational—not merely transactional—way. It is vital to hold two truths at once, that: 1. biodiversity cannot be perfectly measured and 2. metrics are useful in inspiring action, funding, and reflecting on change.

Challenges with Metrics:

- **Oversimplifies a complex process**
- **Transactional, not relational**
- **Differing opinions on global standards, which are an evolving science**
- **Often focuses on quantity over quality**
- **Ignores nuance of ecological function**
- **Measures a snapshot in time**
  - Landscapes and biodiversity evolve over time.
  - Species inhabit a space and then move on. They do not adhere to site, state, or jurisdictional lines.
  - There are real limitations due to project scope and involvement—landscape architects often are not involved with a site through the four seasons.
  - Temporality will be increasingly important as we experience and work within a changing climate.

The Value of Metrics:

- **Monitoring is the only way to assess efficacy**. It tracks design changes, assesses impact, and guides future action.
- **Better measurement is increasingly key to raising capital.** Data on impacts to the triple bottom line help make the case for biodiverse designs to clients, partners, and stakeholders. It shows how our profession makes a positive impact on biodiversity.
- **One cannot value what one does not see.** Measuring floral and faunal species helps raise awareness of species that may be otherwise overlooked in development, design, and decision-making processes.

A Cyclical Process

Measuring impact on biodiversity begins at the start of a project and is repeated after project construction and beyond, throughout the management and monitoring of a site.

The steps to monitoring biodiversity are the following:

1. **Define the Scope and Scale** - Decide what level of biodiversity you are measuring.
2. **Collect Data** - Define sampling methods and conduct field studies, (Quadrat sampling, transects, camera traps, mist nets, pitfall traps, eDNA sampling, etc.), and remote sensing.
3. **Assess Data** - Identify, classify, measure and compare.
4. **Interpret and Report** - Compare results to conservation priorities, ecosystem health, or human impact. Identify hot spots, endangered species, or declining populations.

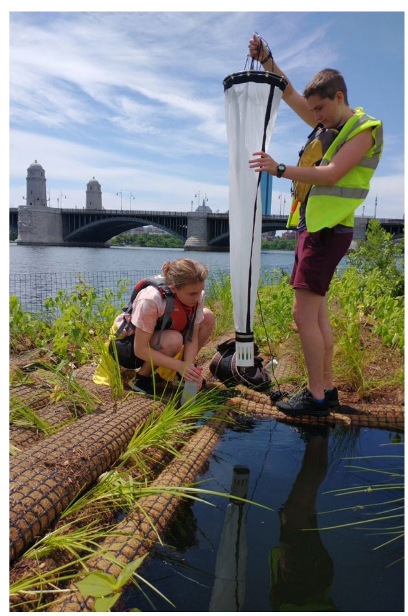


Image Right: Multi-year monitoring of this floating treatment wetland on Boston's Charles River help track plant success and ecological changes in and around the wetland installation. ASLA 2025 Professional Research Honor Award. Charles River Floating Wetland Pilot Project: Multi-Year Findings. Boston, Massachusetts. Sasaki Associates, Inc. + The Hideo Sasaki Foundation + Dr. McNamara Rome / Charles River Conservancy

Measuring Impact

A Spectrum of Approaches

There is no simple, granular, or universal biodiversity metric because biodiversity is incredibly complex. With hundreds of metrics to choose from and no global consensus, it can be difficult to know where to start. This page introduces a spectrum of approaches and highlights those that align with our expertise as landscape architects.

Collecting data and lessons learned on projects takes funding, client buy-in, and strategy. It is often seen as an add-on or extra, but it is vital to the success of landscape architecture moving forward.

Before starting a project, consider your plan for measuring impact on biodiversity:

1. **Assess Opportunities.** Analyze potential impacts to biodiversity at all scales and determine the best opportunities for protecting, conserving, enhancing or restoring on your site.
2. **Determine Feasibility.** Client buy-in, budget, management capacity, and expertise all drive decisions around what can be monitored over the long term.
3. **Area- or Species-Based Approach?** Determine which measurement approach is more appropriate for your project.
4. **Set your Biodiversity Baseline** collect data early to inform design and benchmark progress.
5. **Data Informed Design**. Use data from biodiversity baseline measurements to inform your design strategy.
6. **Establish a Monitoring Plan** with your client team for repeated measurements and monitoring.

A place to start

This chart details two biodiversity metrics approaches—with examples of tools and methods—landscape architects can consider applying in their work.

Key
- ● Methods
- ○ Tools

- ● Citizen Science Inventories
  - ○ iNaturalist
  - ○ eBird
  - ○ iTree
- ● Soil Testing
- ● Species Counts
- ● Wildlife Cameras
- ● Acoustic Monitoring

- ● Calculate Habitat Improvement
  - ○ UK's Biodiversity Net Gain
  - ○ Pathfinder
- ● GIS Map Analysis
  - ○ ArcGIS Online

- ● Quantify Habitat Value
  - ○ Ramboll's America Biodiversity Metric
- ● Functional Connectivity Analysis
- ● Fragmentation Analysis

Species-based methods

Measures quality and quantity

apply to both approaches

Focuses on counting how many distinct species are present in a defined location, often representative plots or transects within an ecosystem. This work is typically completed by partnering with biologists.

Area-based methods

Measures quality and size

Uses a geographically defined space to quantify biodiversity. Rather than counting every organism, which is often impractical for design teams, practitioners use observational methods to estimate the area's biodiversity based on the structure and condition of the ecosystem. This approach can be done by landscape architects or in partnership with biologists.

Stewarding a Site

A variety of approaches are available to support biodiversity goals over time on a given project site. Many require long term engagement with the site, often relying on the owner or caretaker. Landscape architects will not be the responsible parties in most cases, but we do have the opportunity to lay the groundwork for longterm holistic care and engagement with the landscape in a way that supports biodiversity.

Landscape architects can address the need for long-term site engagement in two ways:

1. Expanded scope

Landscape architects increasingly extend their involvement beyond project completion, evolving from designers to stewards. For many landscape architects, this requires expanding defined roles and contracts to cover longer-term engagement with the project site. Practically, this can look like:

- Including scope and fee for adaptive management plan development.
- Designing for self organization and succession in the landscape and staying engaged with client or owner to advise on adaptive management approaches.
- Including scope and fee for quarterly site visits for a defined period of time to monitor landscape changes and advise on adaptive approaches with appointed caretakers.

2. Strategic partnerships

Continued involvement is not always feasible for many landscape architects because of their capacity (time, funding, expertise, etc.), so instead of assuming the role of steward, the landscape architect orchestrates a thoughtful handoff. This requires developing an adaptive management framework in collaboration with partners.

- It requires a clear management vision that is not an afterthought but embedded early in the design process and is specific about the relationship with ecology and nature, the aesthetic expectations, and dedication to an iterative process.
- It requires an understanding of the management resources, including client knowledge and capacity, and the local experts to pull in for long-term care of the site. Engaging relevant experts—to learn from, involve in the design, and ultimately entrust with site stewardship—is an essential part of due diligence in supporting biodiversity.

Terminology matters

Thinking about the site in terms of stewardship is an important paradigm shift. Stewardship can be seen as an overarching term for a variety of approaches to caring for a site in a more holistic manner. It implies a moral responsibility to care for the land and nature - to which humans are inextricably linked.

Maintenance

implies a more **static state** approach focused on conditions like appearance and viability, with repetitive tasks

Adaptive Management

a **cyclical approach** that incorporates learning and adapting techniques needed to support goals

Engagement and storytelling

implies a **moral responsibility** to care for the land and nature, to which humans are inextricably linked

→ paradigm shift

Promising a ***process not a product*** helps to calibrate expectations and serve as a reminder that landscape architects, unlike other AEC disciplines, design with living medium—soil, water, fauna, flora —where change is constant and natural.

Adaptive Management In Practice

One tool for stewardship that landscape architects can use and support is adaptive management. Landscape architects can employ an adaptive management framework that encompasses maintenance, monitoring, evaluation, decision making, and interventions to achieve biodiversity goals.

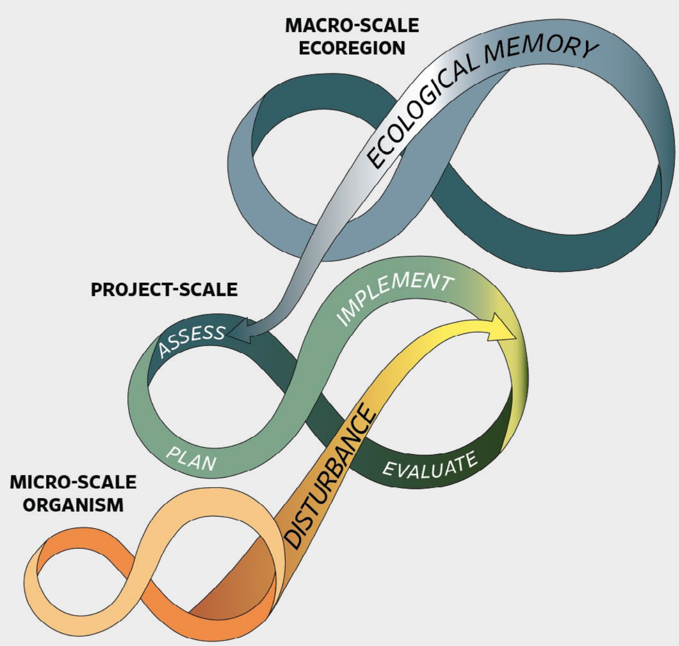
Adaptive Management is an approach to natural systems management that focuses on learning a system where a degree of uncertainty is accepted, and management action is needed (Walters 1986). It emphasizes learning and iterative adaptation of management based on that learning, and thus reduces uncertainty with increased understanding of the system (Allen & Garmestani, 2013).

The adaptive management approach

- explicitly acknowledges uncertainty
- requires long-term site engagement
- incorporates new knowledge
- operates through iterative cycles of planning, evaluating, implementing, assessing, and adapting management plans based on what's observed.
- is often misunderstood to be a trial-and-error approach to improve management outcomes rather than a structured approach focused on learning.
- includes carefully stated goals, objectives, and hypotheses of causation, as well as procedures for data collection followed by analysis, decision making, and reiteration of the process (Allen & Garmestani, 2013).

Adaptive management aims not to preserve a fixed state, but to guide a responsive, evolving process informed by metrics.

Adaptive management responds to biodiversity's needs, where natural processes of growth, disturbance, and succession demand ongoing observation, assessment, and adjustment.



Adaptive Management

- Promise a process not a product
- Structured approach focused on learning from the site (micro-macro scales)
- Design with living medium and shifting baseline

Image Credit: Maria Landoni, adapted from Panarchy: Understanding Transformations in Human and Natural Systems by Lance H. Gunderson and C. S. Holling

I. A biodiversity-positive planning and design process

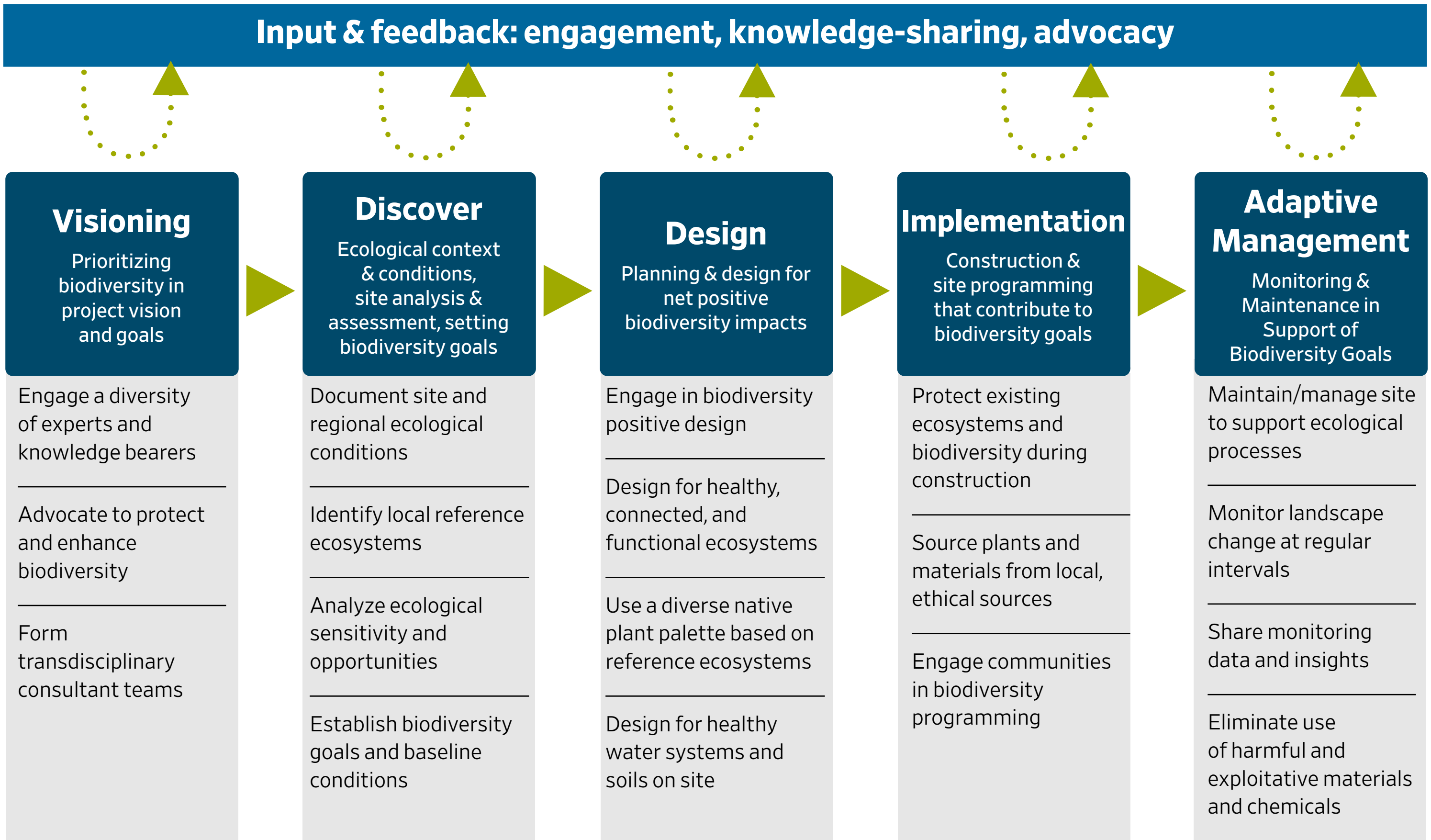


Image Credit: Jennifer Dowdell, Biohabitats, and Meg Calkins

Landscape architects can consider supporting biodiversity by:

- **(Re)building functional ecosystems.**
- Making educated decisions about **what restoration looks like on your site**, with context, history, culture, and species in mind.
- **Supporting ecological processes through design:** water percolation, carbon fixation, ground water recharge, nutrient cycling in soils, energy flow, succession.
- **Recognizing habitat occurs at multiple scales**: plants are habitats unto themselves for microbiota, insects, and animals.
- Understanding that **damage to plants** by feeding organisms **is part of creating a functioning habitat**.
- **Supporting biodiversity through landscape management practices and values**, not suppressing it.
- **Planting native species**, not just for better hardiness and reduced irrigation demands, but **because they are foundational to supporting insect life** in a way that adapted plants do not.

II. Digging deeper into global biodiversity goals and targets

Kunming-Montreal Global Biodiversity Framework (GBF) Targets

The following icons represent 10 of the 23 GBF Targets, selected because of their relevance to landscape architecture, whether diretly or indirectly. Click the Target icons to open a link for more information on each.

UN Sustainable Development Goals (SDG)

Click the linked icons below for more information about the goals most directly impacted by the profession.

IFLA developed *A Landscape Architectue Guide to the 17 Sustainable Development Goals* showcasing precedent projects that offer concrete examples of landscape architecture work that ties to all 17 SDG's.

III. Landscape architecture's impacts on ecosystem services

Over the past 50 years, more than 75% of globally analyzed ecosystem services have declined, partially driven by biodiversity loss. This chart, adapted from the IBPES Global assessment report on Biodiversity and Ecosystems, has been clipped to include 14 of the 18 ecosystem services landscapes architects and planners can impact, both directly and indirectly, through our work.

Ecosytem Service	Indicator(s)	50 Year Trend	Direct Impact	Indirect Impact
Habitat restoration and maintenance	• Extent of suitable habitat • Biodiversity in habitat	↓ (Well Established) ↓ (Well Established)	Prioritize habitat protection, design native plant communities, wildlife corridors, and restoration projects	Influence municipal policies; promote biodiversity awareness and habitat protection
Pollination and dispersal of seeds and other propagules	• Pollinator diversity • Extent of natural habitat in agricultural areas	↓ (Well Established) ↓ (Well Established)	Create pollinator pathways and specify diverse flowering plants with sequential blooms	Advocate for reduced pesticide use and promote pollinator-friendly practices
Regulation of air quality	• Retention and prevented emissions of air pollutants by ecosystems	↘ (Established but incomplete)	Position vegetation strategically to filter pollutants and create windbreaks around emission sources	Promote car-free zones and walkable/cycling communities to reduce emissions
Regulation of climate	• Prevented emissions and update of greenhouse gases by ecosystems	↘ (Established but incomplete)	Design carbon-sequestering/conserving landscapes and implement urban cooling strategies to regulate temperature	Advocate for green building codes and influence climate-resilient urban planning
Regulation of freshwater quantity, location, and timing	• Ecosystem impact on air-surface-ground water partitioning	↘ (Established but incomplete)	Design water storage and retention systems to manage flood/drought cycles	Influence watershed-scale planning and advocate for water conservation policies
Regulation of freshwater and coastal water quality	• Extent of ecosystems that filter or add constituent components to water	↘ (Unresolved)	Create filtration and treatment systems using constructed wetlands and buffer zones	Advocate for pollution source controls and collaborate with water quality monitoring agencies
Formation, protection, and decontamination of soils	• Soil organic carbon	↘ (Well Established)	Design soil restoration projects and erosion control using plants (phytoremediation)	Advocate for soil protection ordinances and influence sustainable construction practices
Regulation of hazards and extreme events	• Ability of ecosystems to absorb and buffer hazards	↘ (Unresolved)	Design regional landscape patterns that buffer hazards like floodplains, forest corridors, and coastal systems	Influence regional planning policies and collaborate with emergency management agencies
Regulation of detrimental organisms and biological processes	• Extent of natural habitat in agricultural areas • Diversity of competent hosts of vector-borne diseases	↓ (Well Established) ↘ (Well Established)	Design landscape patterns that break disease/pest cycles and reduce disease/pest breeding sites	Collaborate with public health agencies on landscape-based disease prevention strategies
Energy	• Extent of agricultural land: potential land for bioenergy production • Extent of forested land	↗ (Well Established) ↘ (Well Established)	Design landscapes that support renewable energy infrastructure while maintaining ecological function	Advocate for renewable energy policies and promote ecological integration standards
Learning and inspiration	• Number of people in close proximity to nature • Diversity of life from which to learn	↓ (Established but incomplete) ↓ (Established but incomplete)	Design interpretive landscapes and demonstration projects that teach ecological principles	Collaborate with educators and promote nature-based learning programs
Physical and psychological experiences	• Area of natural and traditional landscapes and seascapes	↘ (Well Established)	Design therapeutic and recreational spaces that provide mental health and wellness benefits	Advocate for healthcare integration of nature-based therapies and green space access
Supporting identities	• Stability of land use and land cover	↘ (Well Established)	Design cultural landscape preservation and spaces that celebrate local heritage and reflect their values	Advocate for historic landscape protection policies and collaborate with cultural communities
Maintenance of options	• Species' survival probability • Phylogenetic diversity	↓ (Well Established) ↓ (Established but incomplete)	Design & manage flexible landscapes that preserve options for future conservation and adaptation needs	Advocate for protecting undeveloped lands and collaborate with conservation researchers

Global trends

- ↗ Increasing
- ↘ Declining
- ↓ Declining Sharply

Levels of certainty

- Well Established
- Established but incomplete
- Unresolved