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# Landscape Architecture Solutions to Biodiversity Loss

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## Executive Summary



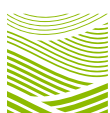
**Sohyun Park**, ASLA, PhD, Assistant Professor,  
Department of Plant Science and Landscape Architecture,  
University of Connecticut

**Zahra S. Ali**, PhD Student, Department of Plant Science  
and Landscape Architecture, University of Connecticut

**Pan Zhang**, PhD Candidate ABD, Department of Plant  
Science and Landscape Architecture, University of Connecticut

**In the New York Botanical Garden's Native Plant Meadow, wetland aquatic plants cleanse stormwater at the promenade's edge. Beyond, the Wet Meadow transitions to the Mesic Meadow, where species such as *Asclepias tuberosa* attract pollinators, insects, and birds. The Education Pavilion is seen in the background.**

ASLA 2020 Professional General Design Honor Award. [The Native Plant Garden at The New York Botanical Garden](#). New York, USA. OEHME, VAN SWEDEN | OvS / Ivo Vermeulen.



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**L**andscape architects play a significant role in designing and preserving green spaces that enhance and restore biodiversity and promote human well-being. Their work demonstrates the essential connection between the environment and our health and well-being.

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▶ **1,000,000** out of **8,000,000**  
estimated species on the planet are under threat of extinction

According to the Intergovernmental Science-Policy Platform  
on Biodiversity and Ecosystem Services (IPBES)  
Global Assessment on Biodiversity and Ecosystem Services

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▶ **157,190** | **44,016**  
species on the Red List | species threatened  
with extinction

According to the International Union for Conservation  
of Nature (IUCN) assessment

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▶ **30 x 2030**

**We need to protect  
at least 30% of ecosystems by 2030**



Heterogeneity and diversity are critical components of healthy ecosystems. This goes beyond the diversity of animal and plant species to include built forms, landscapes, and water bodies. Landscape architects can design diverse landscapes and restore plant communities that mimic nature in both functional diversity and complexity of structure. These design strategies enhance insect, bird, reptile, and mammal biodiversity and improve the water retention capabilities of soils and green infrastructure.

It is critical that stakeholders appreciate how everything connects within a socio-ecological system. Landscape architects must design spaces with this system in mind. And planners and policymakers should take a holistic view when setting biodiversity objectives and planning local or national initiatives.



**The size and degree of heterogeneity of urban green spaces contribute to the amount of biodiversity it can sustain. The Chulalongkorn University Centenary Park has distinct biomes, including a wetland, forest patches, and grassland integrated with the built form and multiple levels and gradients. These features create unique habitats that attract 59 bird species.**

ASLA 2019 Professional General Design Honor Award. [Chulalongkorn University Centenary Park](#), Bangkok, Thailand. LANDPROCESS

## How it all Connects

Biodiversity loss is a significant global crisis, on par with the severity of the climate crisis. Alarming rates of species extinction, habitat loss, and ecosystem degradation are jeopardizing biodiversity on our planet, posing a direct threat to human existence.

## Health & Wellbeing

Healthy ecosystems provide clean air, water, food, and recreational opportunities. Biodiversity plays a crucial role in promoting mental health and quality of life. Public awareness of these connections are steadily growing.

## Education & Public Awareness

When designed with the intent to enhance and restore biodiversity, native landscapes provide a unique opportunity to incorporate place-based outdoor and experiential learning that educates the public.

## Ecosystem Services

Biodiversity supports vital sectors such as agriculture, fisheries, and tourism industries, contributing to economic stability and growth. The ecosystem services provided by biodiversity hold substantial economic value, with their wide-ranging benefits immeasurable.

# Biodiversity

## Community & Research Partners

Participatory design processes can engage indigenous groups and other community stakeholders in the design, biodiversity monitoring and stewardship, and decision-making process. These processes should focus on socio-ecological communities, with consideration for bio-cultural heritage, integrating both biodiversity and cultural inclusion. Researchers can also contribute.

## Policy Making

Land-use planning, urban design, and infrastructure development policies and regulations can advance biodiversity priorities. The cumulative impact of local biodiversity focused policies benefit both the environment and communities while helping to achieve global biodiversity goals. Landscape architects offer policymakers expertise in planning, design, and implementation.

## Site Design & Planning

Landscape architects are experts specializing in planning and design for biodiversity conservation. With interdisciplinary knowledge, commitment to land stewardship, and comprehensive toolkits, landscape architects play a pivotal role in enhancing biodiversity and ecosystem resilience across various scales.



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Research and case studies show that these landscape architecture strategies are the most effective at increasing biodiversity:

## ► **Planting Design**

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### ► **Incorporating Native Plants**

Native plants are important but so are structural and functional diversity that complement each other. The goal should be reaching 80–100% endemic heterogeneous plantings that translate into a diversity of ecosystem services from stormwater retention, phytoremediation, and soil-nutrient restoration to serving as a food source for a larger variety of insect and animal species.

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### ► **Supporting Pollinators**

Landscape architects can consider the timing of when plants flower, types of flowers produced, pollination mechanisms, and other characteristics, traits, or behaviors related to the flowering process. They can stagger flowering phases by using different individuals or populations of the same flower species at different times. These strategies also support faunal diversity. The landscape architects that designed the South Eveleigh Community Rooftop Garden intentionally curated native plant communities to address functional diversity and flowering timing and colors to attract pollinators.

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### ► **Enabling Integrated Pest Management**

Landscape architects can design plant communities that facilitate integrated pest management, such as planting certain plant species that attract beneficial species and keep destructive species in check. The High Line in New York City is an example of a successful integrated pest management scheme.

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### ► **Allelopathic & Companion Plants**

When the objective is to minimize maintenance and the use of synthetic herbicides, landscape architects should determine if aggressive plant species that present challenges on a site are known to secrete allelopathic compounds, such as juglone, and consider planting dense native species that have a higher tolerance to these natural biochemical compounds and can outcompete the

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“weeds.” Moreover, certain plants are inherently beneficial to one another, and this should be a consideration when designing plant communities. The South Eveleigh Community Rooftop Garden demonstrates the use of plants to inhibit weeds while enhancing the garden. The team planted Warrigal greens (*Tetragonia tetragonioides*) to serve as a food source and control invasive weeds.

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► **Protected Areas**

Landscape architects can include designated areas to be left undisturbed by humans and pets in projects, creating space for species that thrive when there is no human disturbance. The Dune Peninsula at Defiance Point Park is an example where signage was used to keep people on paths and out of meadows and minimize disturbance in order to allow the meadow to establish itself. Research studies in Berlin, Germany and Chongqing, China demonstrated a spontaneous return of endangered native plants, as well as animal species, in undisturbed areas.

► **Transforming Grey to Green**

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► **Retrofitting**

Urban greening initiatives should consider how existing buildings and walls can be retrofitted with green roofs and green facades. For instance, vegetation can be allowed to naturally overtake walls without compromising their structure, or walls and roofs can be retrofitted with appropriate technology. Green roofs and walls improve energy efficiency, enhance air quality, mitigate the urban heat island effect, manage stormwater, and promote biodiversity.

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► **Slope and Pitch**

Planting design should be specific to place and slope. Pitch roofs might benefit from moss plantings while flat roofs can accommodate plants with deeper roots that can provide stormwater retention capabilities.

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► **Building Height and Architecture**

Landscape architects should consider building height and architectural details when installing green roofs to enhance insect or

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bird diversity or provide nesting habitats. For instance, research indicates that high buildings are potentially less likely to be conducive to pollinator nesting, but high buildings with architectural details could possibly be more conducive for birds prone to cavity nesting.

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► **Bio-solar Roofs**

Landscape architects can explore integrating photovoltaics into planting design. Bio-solar roofs may deliver co-benefits in terms of energy efficiency and supporting vegetation and invertebrate communities. An important factor to plan for it is the density of photovoltaic arrays, which can affect certain invertebrates, as well as high density plantings that can lead to increased parasitism.

► **Tracking Performance**

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► **Data Collection**

Landscape architects can integrate pre- and post-project data collection and internalize rigorous and systematic monitoring of the projects post-completion for five years to obtain longitudinal data for researchers to work with. This may be done through engaging citizen science, public-private partnerships, and academic research collaborations.

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► **Assessment**

Consider using the IUCN Global Standard for Nature-based Solutions Self-Assessment tool or the Sustainable Sites Initiative (SITES) monitoring framework.

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**The following strategies, demonstrated in the research and cases, are key to building strong community coalitions to protect and increase biodiversity:**

- ▶ Create community partnerships that build trust with stakeholders.
- ▶ Use participatory design processes to build social-ecological communities defined by a shared sense of bio-cultural heritage.
- ▶ It is integral that Indigenous groups and other community stakeholders are involved in the design, biodiversity monitoring and stewardship, and decision-making processes.
- ▶ Expand collaboration between practitioners and researchers.
- ▶ Team up to conduct more quasi-experimental pre- and post-project research to evaluate the real-world impacts of large-scale projects. While experimental research with controls is useful in narrowing variables, the research conducted in undisturbed experimental plots lacks key variables, such as societal interaction and disturbances. Researchers partnering with indigenous Māori tribes to conduct a longitudinal experimental [AUT Living Laboratories in Aotearoa New Zealand](#) could be a precedent.
- ▶ Expand public awareness campaigns.

In the U.S., there is growing awareness about the value of meadows and pollinators. But it is time to expand awareness beyond bees and butterflies to other life forms that might not be as endearing or obviously important.

What about the salamanders, frogs, snakes, moths, beetles, flies, and ants that our ecosystems rely on?

Through their projects, landscape architects can teach the public about how integral other species are to planetary systems we all rely on, such as the decomposition of organic matter, or predator and prey roles in food chains.





**The High Line in NYC integrates the cityscape of an old rail line with native grasses, pollinator meadows, and trees. The public space is also used for education and workshops to raise awareness about biodiversity.**

ASLA 2010 Professional Award. [The High Line, Section 1](#). New York City, New York, USA. Field Operations / Iwan Bann



**This rooftop at Sonoma Academy High School incorporates photovoltaic panels and a meadow creating a bio-solar roof. Buildings at this school are designed to teach students to engage their environments, be critical thinkers, and observe and collect data, including on this green roof.**

ASLA 2021 Professional Research Honor Award. [Ecoregional Green Roofs: Theory and Application in the Western USA and Canada](#). Bruce Dvorak, ASLA. Sonoma Academy High School, Sonoma, California. Janet Durgan Guild & Commons. WRNS Studio / Bruce Dvorak



## CASE STUDY

# Cortex Commons, St. Louis, Missouri



**A corten ribbon frames a rain garden. Bioretention areas such as these capture stormwater and improve water quality.**

LAF 2023 Landscape Performance Series Case Study Investigations. [Cortex Commons](#). St. Louis, Missouri. SWT Design, Inc. / Jim Diaz

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Cortex Commons is an open space in the Cortex Innovation Community, a hub for entrepreneurs and startup businesses. The 8-acre Commons serves as a gathering and recreation space for the business community and public. A remediated brownfield in a blighted community, the project improved water quality and soil health and increased biodiversity and access to green space.

SWT Design led the project, incorporating green infrastructure enhanced with structurally and functionally diverse native plant communities. This infrastructure improves stormwater retention and biofiltration and provides bird and pollinator habitats. The site also educates the public through signage about the plants and biodiversity.

In 2023, University of Minnesota researchers conducted a Case Study Investigation (CSI) on Cortex Commons for the Landscape Architecture Foundation's *Landscape Performance Series*.

**The research team found a plant species richness of 52 and a “high” urban pollinator score of 85 within the green infrastructure and prairie plantings.**

Notably, of the 52 plant species found, 43 were considered native species and approximately 83% are endemic.

The project also provided economic benefits to the community in the form of maintenance jobs.



**Educational signage about the function of the rain garden and bioretention areas that capture stormwater and improve water quality.**

LAF 2023 Landscape Performance Series Case Study Investigations. Cortex Commons. St. Louis, Missouri, USA. SWT Design, Inc./ Jim Diaz



## CASE STUDY

# Dune Peninsula at Defiance Point Park, Tacoma, Washington, USA



**Native prairies established on slopes are low maintenance public landscapes that control erosion, provide valuable urban habitat, and educational opportunities to support conservation.**

LAF 2023 Landscape Performance Series Case Study Investigations. [Dune Peninsula at Defiance Point Park](#). Tacoma, Washington, USA. Site Workshop/Stuart Isett.



The Dune Peninsula at Defiance Point Park is an 11-acre park built on top of a remediated brownfield Superfund site on the Puget Sound. For nearly a century, it had been home to the American Smelting and Refining Company (ASARCO). The peninsula itself is man-made, built up over time through dumping toxic slag—the residues from smelting of metallic ore, which are loaded with heavy metals such as arsenic, lead, cadmium and copper. The slag and effluent from the factories had leached into the sediments and water and created one of the most toxic environments in the U.S. Remediation involved containing the site through multi-layer capping and shoreline armoring. Clean topsoil was then brought in to cover the site.

Designed by Site Workshop, the Dune Peninsula was completed in cooperation with the Environmental Protection Agency, Washington State Department of Ecology, and other stakeholders.

**The team amended uncontaminated soils excavated on site where possible and opted for the establishment of a native prairie ecosystem to promote biodiversity, rather than a lawn.**

This resulted in water savings related to irrigation and habitat creation for native bird populations.

In 2022, researchers from the University of Washington completed a Case Study Investigation on Dune Peninsula, using a transect-quadrat methodology to identify plant diversity. Given the prairie was an area the public was asked to keep out of, the transect-quadrat method for biodiversity observation was an appropriate alternative to citizen science methods. From the prairie sample, the researchers found the site has a plant species richness score of 29 and a moderate level of plant species diversity (a score 2.42 out of a maximum of 3.63). There were approximately 67 plant species and fairly stable functional diversity.



**Before**



**After**

**The toxic slag peninsula was poisoning the local water and was unsafe to occupy. This peninsula was transformed from barren slag to an ecosystem burgeoning with life.**

LAF 2023 Landscape Performance Series Case Study Investigations. Dune Peninsula at Defiance Point Park. Tacoma, Washington, USA. Site Workshop/Stuart Isett.



## CASE STUDY

# South Eveleigh Community Rooftop Garden, New South Wales, Australia



**The South Eveleigh Community Rooftop edible pollinator garden in bloom during Australian spring.**

LAF Landscape Performance Series.  
South Eveleigh Community Rooftop Garden. Eveleigh, New South Wales, Australia. Jiwah/Sara Padgett Kjaersgaard

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The South Eveleigh Native Rooftop is a 1,640 square foot (500 square meter) office rooftop in New South Wales, Australia, and claims to be the first Indigenous rooftop farm in Australia.

**The 2,000 native, edible plants grown on the rooftop have ethnomedicinal and biocultural significance for the Aboriginal community.**

The plant community initially comprised 30 species when completed in 2019, but increased to 65 species within two years.

This roofscape project was led by Indigenous design firm Yerrabingin, co-founded by Christian Hampson and Clarence Slockee, who is now director of Jiwah, an Indigenous company specializing in cultural landscape design. While the team focused on ensuring 100% native plants, they also recognized the importance of structural and functional diversity, so consideration was given to the diversity of flower shapes, colors, and forms to attract a greater diversity of pollinators. Given the harsh environment, the designers and permaculturist focused on edible bush plants that would require little irrigation but still produce sufficient quantities of produce for local chefs.

In 2020, researchers from the University of New South Wales carried out a Case Study Investigation on the South Eveleigh Native Rooftop. Notably, this rooftop is near a park and creates a patch habitat supporting a wildlife corridor. It is also frequented by a number of bird species.

South Eveleigh is an example of how to partner with Indigenous communities in the planning, design, and management of a site. Further, it showcases how partnerships can be enhanced by regular on-site educational workshops.



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Learn more at [asla.org/evidence](https://www.asla.org/evidence)

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Research Grant Selection and Review Panel**

**Dr. James A. LaGro Jr., PhD**

Professor, Department of Planning and Landscape Architecture,  
College of Letters & Sciences, University of Wisconsin -  
Madison and Editor-in-Chief, *Landscape Journal*, the flagship  
academic journal of the Council of Educators in Landscape  
Architecture (CELA)

**Nina-Marie Lister, MCIP, RPP, Hon. ASLA**

Professor, Director, Ecological Design Lab, School of  
Urban and Regional Planning, Toronto Metropolitan University;  
Founding Principal, PLANDFORM.

**Ebru Özer, ASLA**

Associate Professor, Landscape Architecture + Environmental and  
Urban Design, Florida International University, and Vice President  
of Education, American Society of Landscape Architects

**Dr. Susan Sherrod, PhD**

Senior Ecologist, Professional Wetland Scientist, and  
Certified Ecological Restoration Practitioner at Biohabitats.

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