renaturing for resilience

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Stewart Monti was awarded the Byera Hadley Travelling Scholarship in 2019

the author acknowledges the traditional custodians of Country throughout Australia and the world, and recognises their continuing connection to land, waters, and community.

i pay my respects to them and their culture, and to Elders past and present.

foreword

The way we shape our cities has a profound impact not only on our daily lives but also on the resilience of our communities and the ecosystems that support us. In an era of rapid urbanisation and escalating climate challenges, rethinking the relationship between nature and the built environment is no longer optional—it is essential.

Renaturing for Resilience explores this critical intersection, offering a compelling examination of how urban landscapes can be designed to work with, rather than against, natural systems. Through case studies, expert insights, and on-the-ground research, this work highlights innovative approaches that restore ecological function, enhance biodiversity, and create more liveable, adaptive cities.

The examples presented here—from green corridors that reconnect fragmented habitats to policies that incentivise urban biodiversity—demonstrate that resilience is not just about withstanding shocks but about fostering environments where both people and nature can thrive. By drawing from global best practices and local applications, this work offers not just inspiration but also tangible strategies for designers, planners, and policymakers committed to a more sustainable future.

This is an invitation to rethink our cities as dynamic, living systems—where architecture and infrastructure are integrated with ecological processes, and where nature is not an afterthought but a fundamental building block of urban resilience. As the challenges of climate change intensify, the need for such approaches will only become more urgent.

Byera Hadley Travelling Scholarships Journal Series

This report is a timely and necessary contribution to that conversation, reminding us that renaturing our cities is not just a possibility, but a responsibility.

renaturing for resilience

1

introduction

Background

Australia currently has one of the largest extinction rates in the world (IUCN 2017); the greatest cause of that extinction is habitat loss (Woinarski, Burbidgec & Harrisond 2015, p. 4535); while the causes of this are diverse and nuanced many of them relate directly to humans' intervention in the environment (Woinarski, Burbidgec & Harrisond 2015). This means that built environment design professionals are complicit in one of the greatest losses of plant and animal species in human history. Concurrently, climate change, or more specifically the anthropogenically induced modifications to the earth's natural processes are already apparent and will continue to have an impact on the environment, the economy and society (IPCC 2007, pp. 31-3). In order to respond to climate change effectively we must mitigate the unmanageable impacts whilst adapting to the unavoidable impacts (Laukkonen et al. 2009, p. 288).

The use of the term 'resilience' in reference to cities was not used explicitly until the middle of the 20th century (Allan & Bryant 2011, p. 39) however the concept of cities as complex 'metasystems' (Godschalk 2003, p. 136) has been around for a lot longer epitomised by the work of Ian McHarg (1969) and John T. Lyle (1994, 1999). The use of the term has not been clearly defined and is such an everyday word that it often comes with a set of implicit assumptions (Allan & Bryant 2011, p. 39) which must be clarified. Pickett and Ostfeld's (1995, p. 262) definition of resilience articulates continual or periodic evolution or shifts of ecological systems rather than permanence and emphasises the importance of the science of ecology (Brand & Jax 2007; Holling 1996; Wu & Wu 2013). Therefore, more focus on the science of ecology, and by extension biodiversity should inherently lead to more resilient cities.

The International Convention on Biological Diversity (United Nations 1992, p. 3), defines 'biodiversity' as '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'. This definition indicates that designing for biodiversity has to be more than just the inclusion of a collection of plant species even if these are native to the locality (Wells & Yeang 2010, p. 130). It must include the interactions of these components (West 1993, p. 3), their structural and functional attributes (Forman & Collinge 1997, p. 129; Noss 1992, p. 355), and spatial and temporal scales (Fernández-Juricic & Jokimäki 2001, p. 2033; Scott et al. 2002) to create an interlocked hierarchy of elements (Noss 1992, p. 360), a concept known as 'nested hierarchy' (Sweeney, Engindeniz & Gündüz 2007, p. 59).

Traditionally the discipline has been concerned with the effect of urbanisation on biodiversity (Sweeney, Engindeniz & Gündüz 2007, p. 63), however we now know that ecologically sustainable urban settlements must be integrated with the landscape structure itself (Opdam, Steingröver & Rooij 2006, p. 322). The rehabilitation of lost or degraded ecosystems can aid in the adaptation response to climate change (Baron et al. 2008, pp. 1-3) and also tend to stay healthier than monocultures (Wells & Yeang 2010, p. 130). Additional 'regulating services' such as climate regulation, water purification and flood protection are provided by semi-natural vegetation (Wentworth 2006, p. 1).

In addition to these 'regulating services' there are several 'cultural services' (Wentworth 2006, p. 1) to humans that can be measured. It has been proven by various authors (De Vries et al. 2003; Groenewegen et al. 2006; Maas et al. 2006) that proximity to green space in an otherwise dense urban area has: a positive impact on perception of health and wellbeing (Charlesworth & Booth 2012, p. 171); reduces stress (Ulrich et al. 1991, p. 208); and children's abilities to manage impulses, delay gratification and pay attention (Faber Taylor et al. 1998, p. 3; Kuo 2001, p. 33). Principally however is the moral argument regarding the fundamental right to exist of all non-human biodiversity (Wells & Yeang 2010, p. 130).

Relevance

It is becoming increasingly clear that our current modes of city making are not only unsustainable but in many cases are actually detrimental to our own health. In fact, most of the top ten causes of death (2015) are directly or indirectly influenced by faulty urban design and planning policies (WHO 2015). Fossil fuel-powered car-centric suburbs has led to decreases in air quality (Ayres, Maynard & Richards 1999). While the roll-out of impervious roads intensifies already rising temperatures causing urban heat island (UHI) effects (Mohajerani, Bakaric & Jeffrey-Bailey 2017). The warmer more polluted waters which flow from these cities decreases water quality and puts stress on surrounding ecosystems as well as the traditional grey infrastructure we have constructed to deal with it (Chadwick et al. 2006).

Aims and objectives

There is no limit to how biologically diverse our cities can be (Yeang 2008, p. 93). Humans and wildlife can thrive alongside one another assuming the potential for conflict is managed effectively (Trueman & Young 2012, p. 101). Designing for biodiversity can lead to diverse habitats right in the heart of the city (Wells & Yeang 2010, p. 130) and indeed almost any habitat can be recreated on the roof of a building (Charlesworth & Booth 2012, p. 169). Biodiversity should be nested within a hierarchy of local, regional and national areas (Bryant 2006, p. 24; Fábos & Ryan 2004, p. 146) linked by the landscape in which the city is the central figure (Sweeney, Engindeniz & Gündüz 2007).

Presently biodiversity targets are not widely incorporated into architectural projects (Wells & Yeang 2010, p. 132) so this project will provide a method for the systematic inclusion in advance of design, targets that are 'SMART': specific, measurable, achievable, realistic and time-scaled. The predominant view of cities as static architectural products (Pickett et al. 2014, p. 144) is antiquated (Hart 1991, p. 50) and though goals may be articulated renaturing is best thought of as a trajectory (Childers et al. 2014, p. 323) to be achieved over the life of the development (Wells & Yeang 2010, p. 133).

While the concept of 'resilience' in architecture and urban design tends to deal broadly with manmade responses to acute shocks and chronic stresses there are more emergent theories which seek a more natural response.

‘Ecological urbanism’ seeks to achieve these goals with ‘design that provides the synthetic key to connect ecology with an urbanism that is not in contradiction with its environment’ (Mostafavi & Doherty 2016, p. 12). Concurrently, the notion of ‘urban ecology’ attempts to ‘move beyond familiar and increasingly outmoded ways of thinking about environmental, urban, and social issues as separate domains; and advocating for the synthesis of practice’ (Orff 2016, p. 10). Both of these theories should be seen as the next logical step on the path to a more sustainable urban environment, but a transitional step on the way to a true union of the built and natural environments.

Approach

This project approaches learning about renaturing for resilience and documenting in several different ways:

- **People |** interviews with professionals championing urban ecology and ecological urbanism as a means to achieve resilience
- **Projects |** visiting projects that demonstrate best practice approaches to renaturing in the urban context
- **Policies |** exploring statutory policies and other planning strategies that facilitate excellence in renaturing projects
- **Places |** people, projects, and policies are inherently products of, and catalysed by the places they inhabit and these form the basis of the itinerary
- **Podcast |** interviews will be recorded and distributed in and audio podcast format

Contribution to profession

The benefits of ecosystem services in our cities, direct and indirect, economic and social, are huge and the body of knowledge which supports them equally so. However, examples of their successful integration are few and strategies to achieve them even more so. Particularly in the Australian context.

Ecology should be embedded in every facet of how we design and manage our urban environment. This project seeks to forefront the profession’s effect on the environment and instigate the discussion surrounding strategies not just to stop biodiversity loss, but actively reverse it.

Contribution to community

While the project’s contribution to the profession is designed to be immediately instructive, for the community it is intended to illicit an emotional response. People have become all too familiar with rhetoric and imagery of impending doom, so much so that at times it can be difficult to imagine any other possible future. Renaturing for Resilience aims to provide a tangible vision of hope for the future. Not just utopian visions but real-world examples and material strategies for change.

Motivation

Architectural education teaches us to continually reimagine the future and our place in it. Draw inspiration from as many sources as possible and speculate on how these may unite in a new tomorrow.

For me the greatest source of inspiration has always been nature. Aside from the direct practical design solutions an approach like biomimicry can provide to our anthropocentric problems, it is the less tangible benefits that have always inherently appealed to me. The idea that we can harness the design of termite mounds for the thermoregulation and ventilation of buildings is new to me (relatively speaking).

Intrinsically, however, it is the mental and emotional health benefits of simply being in nature that I have always known, and which are the greatest motivator for me.

Nowadays we have significant literature to evidence the myriad benefits to be gained from a ‘green prescription.’ Yet as a species our society and our profession, on the whole, ignores these. So much so that we now find ourselves on the precipice of a complete collapse of global biodiversity and subsequently us as a species along with it. I believe this need not be the case though. We as a species and a profession have created technologies that have allowed us to congregate in in such densities that we make any other species pale in comparison. We have constructed marvels of engineering and design hundreds of metres tall which can comfortably house thousands of us.

Our technology, in many cases based directly on nature, and tenacity have allowed for such a proliferation of us that I believe it can do the same for every other of the planet’s species. Now that we are truly beginning to understand the importance of biodiversity to our overall planetary health and the ramifications of not doing something to change our trajectory I believe we are in a position to make a change. We must.

Ultimately, I envision cities whose human population density is not only greater than today but which is also far outweighed by that of the innumerable other flora and fauna that shares our environment.

As a professional now within the industry I worry about two things: firstly, that I will either directly or indirectly be continuing to contribute to the loss of more species; and secondly, that one day I will have to explain to my children and/or grandchildren that I did so.

1.1

nomenclature: what's in a name

Origins

The origins of sustainable architecture and design can be traced back to the environmental movements of the late 19th and early 20th centuries, which emphasised the need to protect natural resources and promote sustainable living practices. However, it was not until the 1960s and 1970s that sustainable architecture and design emerged as a distinct field, in response to growing concerns about the environmental impacts of human activities and the need for more sustainable forms of development.

During this time, the concept of "ecological design" began to gain popularity, as architects and designers sought to create buildings and landscapes that were in harmony with nature and promoted sustainability. The term "ecological architecture" was also used during this period, which referred to the integration of environmental considerations into the design process.

In the 1980s and 1990s, the field of sustainable architecture and design continued to evolve, with a growing emphasis on energy efficiency, renewable energy, and green building technologies. The term "green architecture" began to be used to describe buildings that were designed and constructed using environmentally friendly materials and technologies. "Environmental architecture" and "earth-friendly architecture" were also terms that were used during this period.

In the late 1990s and early 2000s, there was a growing recognition of the need to address broader environmental and social issues in the built environment, including climate change, biodiversity loss, and social inequality. This led to the development of new terminologies and concepts, such as "low-impact design," "regenerative design," "biophilic design," "sustainable design," "eco-friendly architecture," "passive solar design," "net-zero energy design," "carbon-neutral design," "cradle-to-cradle design," "living buildings," "zero-energy buildings," "green buildings," "high-performance buildings," "natural buildings," and "climate-responsive design," which sought to promote more holistic and integrated approaches to sustainable architecture and design.

At the same time, there was also a growing interest in sustainable urbanism, which focused on creating more sustainable and liveable cities through the integration of green infrastructure, public transportation, and mixed-use development. The concepts of "sustainable community planning," "green infrastructure design," and "sustainable landscape architecture" emerged as a result of this movement.

Finally, the late 1990s and early 2000s also saw the emergence of new sustainability movements such as ecovillages and permaculture design, which sought to promote more sustainable and self-sufficient lifestyles through the integration of sustainable agriculture, renewable energy, and ecological design principles.

Overall, the development and evolution of terminology in sustainable architecture and design reflects a growing awareness of the interconnectedness of environmental, social, and economic issues, and the need to promote more sustainable and resilient forms of development.

Renaturing vs Rewilding

Rewilding refers to the process of restoring natural ecosystems and reintroducing native species to an area that has been degraded or lost due to human activities. It involves creating or restoring habitats, allowing natural processes to occur, and promoting the recovery of biodiversity. The focus of rewilding is on the restoration of natural systems to their original state, with minimal human intervention.

On the other hand, renaturing is a broader concept that includes the restoration of natural systems but also encompasses the integration of natural features and functions into urban and rural landscapes. Renaturing involves improving the quality of the environment by restoring natural systems, such as waterways, forests, and wetlands, and reintroducing native species. It also involves creating green infrastructure in urban areas, such as parks, green roofs, and urban forests, to improve ecosystem services, support biodiversity, and enhance human well-being.

While both rewilding and renaturing involve restoring natural systems and processes, renaturing is a more comprehensive approach that takes into account the needs of both urban and rural landscapes, including human communities. Rewilding, on the other hand, focuses more on restoring ecosystems in their natural state, with minimal human intervention.

Resilience

Resilient design refers to the concept of designing buildings, landscapes, communities, and cities to withstand and adapt to various stresses and shocks, such as natural disasters, climate change, economic downturns, and social unrest. The primary goal of resilient design is to minimise damage and disruptions caused by external forces and to facilitate a speedy recovery.

Resilient design is essential for creating sustainable, safe, and prosperous communities. It helps to reduce the human and economic costs of disasters, ensures the continuity of vital services and infrastructure, and enhances the quality of life for residents.

The concept of resilience in design has its roots in ecology and systems theory. It emerged in the 1970s as a response to the growing awareness of environmental issues and the need for sustainable development. In recent years, the focus on resilience has increased due to the rise of climate-related disasters, such as hurricanes, floods, and wildfires, as well as pandemics and other global challenges.

Today, resilient design is employed across various sectors, including architecture, urban planning, and engineering. It involves a range of strategies, such as the use of durable materials, the integration of green infrastructure, the adoption of flexible and adaptable designs, and the involvement of communities in planning and decision-making.

All together now

“Not seeing a tsunami or an economic event coming is excusable; building something fragile to them is not”
- Nassim Nicholas Taleb -

Renaturing for resilience is an approach to architecture and urban planning that focuses on designing spaces that not only support ecological sustainability, but also enhance community resilience. It involves incorporating ecological principles and practices into the design of urban spaces to create more resilient communities that can withstand and adapt to the impacts of climate change and other stressors.

One key aspect of renaturing for resilience is designing urban spaces that prioritize biodiversity and ecological connectivity. This can involve incorporating green roofs, green walls, and urban forests into the built environment, as well as creating interconnected networks of green spaces that allow for the movement of wildlife and the exchange of ecological services. By prioritizing biodiversity and ecological connectivity, we can create urban environments that are more resilient to the impacts of climate change, such as increased flooding, heatwaves, and storms.

In addition to promoting ecological sustainability, renaturing for resilience also involves designing urban spaces that enhance community resilience. This can involve creating spaces that promote social interaction and community cohesion, as well as providing access to basic services such as food, water, and energy. By designing urban spaces that are responsive to the needs and values of local communities, we can create more resilient communities that are better able to adapt to the impacts of climate change and other stressors.

Overall, renaturing for resilience represents a shift towards a more holistic and interdisciplinary approach to architecture and urban planning. It involves breaking down traditional silos between disciplines and working collaboratively to create urban environments that are not only ecologically sustainable but also socially and economically resilient. By embracing this approach, we can create urban spaces that enhance the health and well-being of both humans and non-human organisms, while also promoting the long-term resilience of our communities.

1.2

anthropocentricism: us them

Origins

The issue of human-focused development and its negative impact on ecology and biodiversity has a long history dating back to the Industrial Revolution of the 18th and 19th centuries. During this period, there was a massive increase in the production of goods, as well as a shift towards urbanisation and industrialisation. The construction of factories, mills, and other infrastructure resulted in significant environmental degradation, including air and water pollution, habitat destruction, and the loss of biodiversity.

This trend continued throughout the 20th century, as urbanisation and industrialisation accelerated around the world. The post-World War II period saw a surge in economic growth and technological innovation, leading to the construction of vast numbers of buildings, highways, and other infrastructure. The development of automobiles and other modes of transportation also led to an increase in emissions and air pollution, which further exacerbated environmental problems.

In the latter part of the 20th century, concerns about the impact of human-focused development on ecology and biodiversity began to emerge. Environmental movements, such as the Greenpeace and Friends of the Earth, emerged to raise awareness about the damage caused by human activity. These groups lobbied for changes in policy and legislation to address the issue, leading to the development of environmental regulations and protections.

Mitigation

Over the past few decades, there has been a significant shift in the architecture and design professions towards mitigating the negative impact of human development on the natural environment. This shift has been driven by a growing recognition of the importance of sustainable and ecologically sensitive design.

There are several factors that have contributed to this change in approach. One of the key drivers has been the development of new technologies and materials that enable architects and designers to create buildings and environments that are more energy-efficient, resource-efficient, and generate less waste. This has been supported by the development of green building standards such as Green Star and LEED, which provide guidelines for sustainable design and construction practices.

Anther important driver has been the growing awareness of the impact of urbanisation on the environment. As cities have expanded, the negative impact on the natural environment has become more apparent. This has led to the emergence of new approaches to urban design, such as ecological urbanism, which seek to promote sustainability, biodiversity, and social justice in the design and development of urban environments.

Furthermore, there has been a growing sense of responsibility among architects and designers to address the negative impact of their work on the natural environment. This has been driven by a growing awareness of the scale of environmental challenges we face, as well as the ethical imperative to protect the natural world for future generations.

Regeneration

While there has been a significant shift in the architecture and design professions towards mitigating the negative impact of human development on the natural environment, there is now a growing recognition that simply reducing negative impacts is not enough. It is no longer sufficient to design buildings and environments that are merely less harmful to the environment; we must also design in a way that actively supports and enhances the natural world.

This has led to the emergence of new design approaches, such as regenerative design, which seek to create buildings and environments that not only reduce harm but actively contribute to the restoration and regeneration of natural systems. Regenerative design aims to create buildings and environments that generate positive ecological, social, and economic benefits, rather than simply reducing negative impacts.

This shift towards regenerative design has been driven by a growing awareness of the scale of environmental challenges we face and the need for urgent action to address them. There is now a recognition that we cannot continue to design and build in the same way we have in the past, and that we must find new ways of working that are more in harmony with the natural world.

As a result, there has been a significant increase in the use of regenerative design principles in the architecture and design professions. This includes the use of natural materials, the incorporation of green infrastructure, and the design of buildings and environments that are more closely integrated with natural systems.

A different approach

While regenerative design represents a significant step forward in creating more sustainable and ecologically sound buildings and environments, there is still a need for a more transformative approach to architecture and city-making.

This is because even regenerative design is often still focused on reducing negative impacts or minimising harm rather than actively promoting the flourishing of the natural world. In order to truly create cities and buildings that are in harmony with nature, we need a more holistic and systemic approach that goes beyond regenerative design.

Ultimately, the key to creating more sustainable and ecologically sound cities and buildings is to take a more systemic approach that considers the interrelationships between humans, the built environment, and the natural world. This requires collaboration across disciplines and sectors, and a willingness to challenge long-held assumptions about how we design and build our cities and buildings.

1.3

temporality:
is
was
could be
should be

Temporality

Considering temporality is crucial in renaturing and ecological urbanism because it allows for a comprehensive understanding of the ecological processes and cycles that shape our natural environment. It is important to consider temporal scales that vary from seconds to centuries, including short-term processes such as daily and seasonal variations, and long-term processes such as climate change and natural succession.

By understanding the temporal dynamics of ecosystems, we can design urban spaces that support biodiversity, promote resilience, and enhance the health and well-being of both humans and non-human organisms. This requires considering the existing ecology, which may be imperceptible to us due to our unfamiliarity with it.

Furthermore, by recognising the temporal dimension of urban ecology, we can appreciate the historical context of a site and its natural processes, and incorporate this knowledge into the design process. This helps to preserve the ecological integrity of the site and can also enhance cultural and educational values.

What is

In the pursuit of renaturing and ecological urbanism, it is important to consider not only the environmental conditions of the site, but also the full ecological context in which the site exists.

Considering daily and seasonal cycles is crucial. Urban environments often prioritise human activities during the day, but neglect the importance of the nocturnal world. Ignoring the needs of nocturnal species can lead to ecological imbalances and detrimental effects on local biodiversity.

Similarly, seasonality plays a vital role in urban ecology, with summer heat and winter cold presenting unique challenges for both the built and natural environment.

Architects and designers are well-versed in site analysis and take into account factors such as topography, geology, and hydrology. However, often ecological considerations are not fully taken into account.

Taking a wider ecological perspective involves recognising the interconnectedness of different systems and how they impact each other. For example, understanding how a site's water usage affects the water cycle of the entire region, or how a site's landscaping choices affect the local wildlife population. This can also involve considering the hidden ecological communities that exist within the soil, which are often overlooked in traditional site analysis.

What was

To truly understand the ecological context of a site, it is important to consider its past and how it has evolved over time. This includes understanding the site's geological history, the pre-existing ecological communities that once inhabited the site, and the various human interventions that have shaped the site over time. For example, a site that was once a wetland ecosystem may have been drained and converted into farmland before being urbanised. In order to renature and design ecologically sustainable urban spaces, it is essential to understand how these past changes have impacted the current ecological condition of the site.

By understanding the historical context of a site and how it has evolved over time, architects and designers can make more informed decisions about how to design urban spaces that support ecological sustainability and biodiversity. For example, a site that was once a wetland ecosystem could be renatured to support wetland plant and animal species, or a site that was once heavily contaminated could be remediated to support a healthy and thriving ecosystem.

What could be

To move towards a more sustainable future, we must design urban spaces that prioritise the preservation and enhancement of biodiversity. This can involve incorporating features such as green roofs, rain gardens, and urban forests, which not only provide habitat for wildlife but also help to mitigate the impacts of climate change.

Furthermore, by prioritising the restoration and regeneration of damaged or degraded ecosystems, we can create more resilient urban environments. This involves identifying areas that have been impacted by human activity, such as brownfields or polluted waterways, and working to restore them to their natural state.

Intentional design that maximises the ecological and renaturing potential of a site is essential for creating sustainable and resilient urban environments. By intentionally designing for maximum ecological and renaturing potential, we can create urban spaces that are not only sustainable and resilient but also provide significant benefits to both human and non-human communities.

What should be

To fully embrace the importance of temporality in the design of urban environments, we must shift towards a more holistic and interdisciplinary approach. This involves breaking down silos between different disciplines, such as architecture, ecology, and urban planning, and collaborating to create truly sustainable and resilient urban spaces.

In addition, we must prioritise the education and engagement of communities in the design process. By involving local residents and stakeholders in the planning and implementation of urban design projects, we can ensure that they reflect the needs and values of the community.

Finally, we must adopt a long-term view of urban design, recognising that the decisions we make today will impact the ecological health of our cities for generations to come. This involves embracing the concept of adaptive management, which involves monitoring and adjusting designs over time to ensure they remain effective and sustainable.

1.4

disciplinarity: inter- intra- cross- multi- trans-

What is it

Disciplinarity is a concept that refers to the ways in which different fields of knowledge are organised and structured, and how knowledge is produced and communicated within and across these fields.

In the context of design and planning, disciplinarity plays a key role in shaping the way that cities are designed, built, and managed. Each of these types of disciplinarity has a distinct approach to problem-solving and knowledge production.

In architecture, urban design, and planning, a collaborative approach is already familiar to professionals. However, there are more specific ways of approaching collaboration depending on the desired outcome.

- Inter-disciplinarity: Collaboration among different disciplines to create a shared understanding of a problem and to develop a solution.
- Intra-disciplinarity: Integration of different sub-disciplines within a single discipline to create a more comprehensive approach.
- Cross-disciplinarity: Collaboration among different disciplines to generate new perspectives and develop a shared solution.
- Multi-disciplinarity: Independent efforts of multiple disciplines to contribute to a shared goal.
- Trans-disciplinarity: Integration of diverse knowledge and practices beyond traditional disciplinary boundaries to address a complex problem.

What should we do

A trans-disciplinary approach is based on the principle that a complex problem requires a holistic solution that transcends traditional disciplinary boundaries. It involves bringing together diverse perspectives, knowledge, and methods from different fields of study and practices to create a comprehensive understanding of the problem and develop a solution that is effective, equitable, and sustainable.

Compared to traditional approaches to architecture and urban design, which tend to be disciplinary and siloed, a trans-disciplinary approach involves a more collaborative and integrated process. It acknowledges that urban environments are complex and dynamic systems that require a holistic understanding of their social, ecological, and economic dimensions.

This means that a trans-disciplinary approach is better suited to addressing the systemic challenges that cities face, such as the impacts of climate change, biodiversity loss, and social inequality.

Renaturing provides resilience to urban environments by creating healthy ecosystems and increasing biodiversity. However, achieving this requires collaboration among multiple disciplines, such as ecology, landscape architecture, and social sciences, to address complex ecological and social challenges.

How do we do it

To lead an architecture or urban design project in a trans-disciplinary way, professionals should involve stakeholders and disciplines that would not typically be included, such as ecologists, sociologists, and community members.

Collaboration across disciplines can be challenging due to differences in language, methodology, and perspective. Therefore, it is crucial to establish a shared language, define clear goals, and maintain effective communication throughout the project.

Setting a common goal is necessary to ensure that everyone is working towards the same objective. Without a shared goal, the collaboration may not be as effective, and individuals may work towards their own agenda, which can create tension and conflict.

A shared goal provides a framework for decision-making and helps to guide the project towards a specific outcome. This can create a sense of purpose and meaning for all involved and can lead to a greater sense of ownership and investment in the project.

A clear set of goals can also help to communicate the project's purpose to stakeholders outside the trans-disciplinary team, such as clients, funders, and the general public.

Who's doing it that way

There are several architecture and design practices that operate in a trans-disciplinary way. One example is the firm HOK, which has a sustainability consulting group that works with their architects and engineers to incorporate sustainable design strategies into their projects. They also have a human performance group that integrates research from sociology and psychology to inform their design decisions.

Another example is the interdisciplinary design firm IDEO, which brings together designers, engineers, anthropologists, and other professionals to solve complex design problems. IDEO uses a human-centred design approach that emphasises empathy and collaboration with end-users to develop innovative and effective solutions.

The landscape architecture firm OLIN is also known for its trans-disciplinary approach. OLIN brings together landscape architects, ecologists, urban designers, and planners to create sustainable and resilient landscapes that benefit both people and the environment. Their projects often involve collaboration with local communities and stakeholders to ensure that the design solutions are tailored to meet the needs of the people who will use and care for them.

2

san francisco, california

First Nations and Traditional Ecological Knowledge

Long before San Francisco became a major metropolis, the Ohlone people lived in harmony with the land, managing forests through controlled burns and sustaining wetlands, grasslands, and coastal forests. Their stewardship supported diverse wildlife, maintaining the ecological balance of the San Francisco Bay.

Spanish colonisation in the late 18th century disrupted these systems. The establishment of Mission Dolores in 1776 forced Indigenous people from their lands, while European agricultural and pastoral practices altered the landscape. Today, Ohlone descendants continue advocating for land and cultural restoration, ensuring their traditional ecological knowledge informs modern conservation efforts.

Colonisation and the Transformation of the Bay

San Francisco's transformation began with Spanish settlement and accelerated during the California Gold Rush (1848–1855). The sudden influx of people led to widespread urbanisation, with wetlands drained, forests cleared, and hills levelled.

Hydraulic gold mining in the Sierra Nevada sent vast amounts of sediment into the bay, reshaping the coastline and suffocating estuarine habitats. Industrialisation in the late 19th and early 20th centuries further degraded the region, with shipyards, oil refineries, and factories polluting the air and water. By the mid-20th century, highways and suburban expansion displaced native ecosystems, while industrial pollution contaminated waterways. However, rising environmental awareness would soon reshape the city's approach to sustainability.

Contemporary Urbanisation and Ecological Innovation

San Francisco is now a leader in ecological restoration and sustainable urbanism. The city integrates green infrastructure, biodiversity conservation, and climate resilience into its planning policies.

One key initiative is the Green Hairstreak Corridor, a community-driven project that reconnects fragmented butterfly habitats across urban neighbourhoods. Similarly, Heron's Head Park, a former industrial wasteland, has been rehabilitated into a thriving wetland supporting migratory birds and improving water quality.

San Francisco has also pioneered green building standards, mandating green roofs, permeable pavements, and rainwater harvesting to improve stormwater management. Salesforce Park, a 5.4-acre rooftop garden, demonstrates how urban nature can enhance biodiversity and mitigate climate stressors.

Balancing conservation with ongoing urban development remains a challenge, as the demand for housing, transportation, and infrastructure continues to grow.

Ecosystems and Biodiversity: A Fragile Balance

Despite being one of the most densely populated cities in the U.S., San Francisco is home to diverse ecosystems, including coastal bluffs, tidal marshes, and oak woodlands. These habitats support migratory shorebirds, pollinators, and marine life.

Efforts to restore native plant communities have gained momentum. The restoration of Crissy Field, once a military airstrip, has successfully revived tidal marshes, providing habitat for fish and birds. India Basin Shoreline Park aims to create an ecologically rich waterfront while improving public access to green spaces.

Urban biodiversity initiatives like Nature in the City promote pollinator-friendly plantings and tree canopy expansion, but long-term management and community engagement remain critical in sustaining these efforts.

Climate Challenges and Resilience Strategies

San Francisco faces growing climate threats, including sea-level rise, extreme heat, and intensified storms. With much of the city's waterfront built on infill land, rising sea levels threaten key districts like Mission Bay and the Embarcadero.

To address this, the city has adopted nature-based solutions, integrating wetland restoration, green seawalls, and adaptive infrastructure to mitigate storm surge risks. Projects such as the Baylands Restoration Initiative aim to restore salt marshes, which act as natural buffers while improving water quality.

Urban heat is another challenge. Programs like Cool Streets and urban forestry initiatives work to expand tree canopy coverage, particularly in underserved neighbourhoods. Investments in green roofs, reflective pavements, and heat-resilient urban design help reduce temperature extremes in built-up areas.

San Francisco has also committed to carbon neutrality, investing in renewable energy, electrified public transit, and emissions reductions across industries to enhance climate resilience.

Economic and Social Considerations

While San Francisco is a leader in environmental innovation, it faces economic inequality and housing affordability challenges. The city's booming tech industry has driven rapid development, increasing real estate prices and displacing long-time residents.

Concerns over eco-gentrification, where environmental improvements contribute to rising property values, have emerged. To address this, San Francisco is integrating environmental justice into sustainability planning. Initiatives like the Bayview Hunters Point Community Revitalization Plan prioritise green infrastructure investments in historically marginalised neighbourhoods. Policies supporting affordable housing near transit hubs also aim to ensure equitable access to environmental benefits.

Community-led programs, such as the San Francisco Urban Agriculture Alliance, empower residents to engage with sustainability efforts, fostering environmental stewardship while improving food security. Preventing displacement amid green development remains a key challenge.

2.1

people

2.1.1

kirstin weeks, biostudio

“We need to design cities that don’t just sustain life but regenerate it—where buildings function like ecosystems, water is treated as a precious resource, and urban nature thrives alongside communities.”

Bio

Kirstin Weeks is a leader in regenerative design and urban ecology. She is the founder of BioStudio, a firm dedicated to nature-based solutions in the built environment. Prior to starting **BioStudio**, she spent 12 years at **Arup** as an Energy and Building Ecology Specialist. Her expertise spans ecological restoration, sustainable urban design, climate resilience, and biophilic design. She is actively involved in multiple organisations, including the **Nature in the City Advisory Council**, the **Society for Ecological Restoration**, the **Biophilic Cities Network**, the **International Living Future Institute**, and the **Urban Land Institute**.

Kirstin’s work is rooted in the three ‘Bios’ of regenerative design:

- **Biomimicry** – Designing buildings that function like natural ecosystems, eliminating waste, and closing resource loops.
- **Biodiversity** – Enhancing urban ecological restoration through projects like creek daylighting, habitat restoration, and native landscape design.
- **Biophilia** – Creating environments that connect people with nature to improve health, wellbeing, and resilience.

Her portfolio includes urban creek restoration, school and community centre projects, the **Sacramento Valley Station Living Community Challenge**, and **California’s High-Speed Rail stations**. She is passionate about the intersection of urban nature, climate action, and environmental justice, working with historically marginalised communities to create equitable and resilient spaces.

Key Themes from the Interview

From Green Buildings to Regenerative Design

Kirstin’s journey began in green building consulting but evolved towards a **deep integration of ecology in urban design**. Her early work focused on energy and resource efficiency, but over time, she became more invested in **urban ecological restoration** and creating spaces that benefit both people and biodiversity.

“At the end of the day, I wanted to see thriving people and nature thriving together in the projects I’ve worked on.”

COVID-19’s Role in Shaping Awareness

The pandemic increased public awareness of the **importance of access to nature**. Lockdowns made people more conscious of **green spaces, mental health, and community resilience,** reinforcing the need for nature-based urbanism.

“COVID really underscored how important it is for people to be in nature for stress reduction and self-care.”

Balancing Community Vision and Technical Solutions

A key part of Kirstin’s work is ensuring projects align with community aspirations before technical solutions are developed. This is especially relevant in **urban creek restoration**, where gaining buy-in from landowners and local groups is essential.

“Before we can get to the technical, we have to bring the community and landowners together to agree on the vision.”

This **facilitation-first approach** applies across all her projects, from community-led green infrastructure to equity-focused school designs.

Biophilic Innovation in Education Spaces

Kirstin is working on a **digital learning centre** that challenges traditional closed-box, screen-heavy environments. Instead, it will integrate nature and daylight to improve student **cognitive performance and well-being**.

“Students acknowledged that they learn better when they have trees, when they can see the outside. We’re asking—how light and open can this be?”

Climate Resilience and Infrastructure

She is engaged in large-scale infrastructure projects such as **California’s High-Speed Rail stations**, embedding **resilience, water reuse, and net-positive strategies**.

At Sacramento Valley Station, a Living Community Challenge Vision Plan integrates:

- Battery storage for critical loads
- Net-positive water systems
- Mixed-use sustainable development

“If we’re designing for resilience, we have to ask—who is this resilience for? Communities with strong social ties recover faster.”

Environmental Justice and Indigenous Collaboration

Kirstin is particularly interested in **partnerships with Indigenous communities**, advocating for urban nature and land-based cultural restoration.

“The world needs a reconnection to Indigenous perspectives—respect for the land and ecosystems.”

She sees **ecological restoration** not just as a technical practice but as a **tool for equity, justice, and healing** in historically marginalised communities.

Looking Ahead

Kirstin’s future vision is centred on **restoring urban nature while addressing environmental justice**. She hopes to expand collaborations with **Indigenous groups**, develop **equitable urban nature projects**, and help reshape cities to work **with** rather than **against** ecosystems.

2.1.2

richard mullane + annie ryan, hassell

“The creek isn’t just a flood risk; it’s a missing link between the community and the Bay.”

Bio

Richard Mullane is a Principal at **Hassell**, specialising in urban resilience and nature-based adaptation. With a background in architecture and urban design, he focuses on **integrating climate resilience, ecological restoration, and community-driven planning**. Richard played a leading role in the Resilient by Design Bay Area Challenge, working with global partners to develop **long-term strategies for sea level rise adaptation and green infrastructure** in the San Francisco Bay Area.

Annie Ryan is an urban strategist at **Hassell**, focusing on **environmental justice, resilience, and community engagement**. She brings expertise in navigating the complex intersection of policy, funding, and participatory design, ensuring that **urban nature and climate adaptation** projects align with **community priorities and long-term sustainability goals**.

Together, they advocate for nature-based solutions that go beyond technical interventions to address social equity, governance, and policy alignment, shaping urban adaptation strategies that are both **ecologically and socially resilient**.

Key Themes from the Interview

The Resilient by Design Bay Area Challenge

Richard and Annie’s work in San Francisco began with the **Resilient by Design Bay Area Challenge**, a global initiative addressing sea level rise and climate adaptation through nature-based solutions. Their team worked across disciplines to create a citywide resilience framework, combining ecological restoration, flood adaptation, and community engagement.

“There was a strong push for restoring the shoreline, but much of it was driven by environmental elites—without addressing the needs of low-income communities that lacked access to nature.”

Colma Creek: A Case Study in Nature-Based Resilience

Following the competition, Hassell continued working on Colma Creek, a **nature-based flood adaptation** project in South San Francisco. Their approach reimagines the creek as:

- A **restored natural waterway**, replacing outdated concrete channels.
- A public space **reconnecting the community to the waterfront**.
- A **flood protection strategy**, integrating habitat restoration and climate resilience.

“The creek isn’t just a flood risk; it’s a missing link between the community and the Bay.”

Funding Resilience Through Policy & Partnerships

Unlike traditional projects, urban resilience efforts in California are largely funded through grant programs, environmental offsets, and public policy initiatives. Richard and Annie highlighted:

- **Measure AA**, a Bay Area-wide tax funding shoreline restoration and water quality projects.
- **California’s Environmental Protection Act (CEPA),** which requires infrastructure projects to fund ecological restoration as an offset.
- **Stacked grant funding**, where small initial grants are used to leverage larger resilience investments.

“We started with a small grant, then used it to apply for a larger one, and now we’re working with over $30 million in resilience investments along Colma Creek.”

Governance Challenges in Climate Adaptation

The **fragmented governance** of the Bay Area, with over 100 separate municipalities, presents a major challenge for coordinated adaptation. Many projects compete for the same funding without aligning efforts.

“Everyone is competing for the same limited grants, but there’s no requirement to integrate efforts across the Bay. We need a system that rewards collaboration over competition.”

The Role of Long-Term Commitment in Resilience

Unlike conventional projects with fixed timelines, climate resilience requires sustained engagement. Richard and Annie emphasised the importance of:

- **Staying involved** beyond the initial design phase, ensuring long-term follow-through.
- **Building relationships** with local governments and advocacy groups to embed adaptation into policy.
- **Ensuring continuity** despite political and funding changes, so projects don’t stall over time.

“We started this project in 2017. Five years later, we’re still here—because real resilience takes long-term commitment.”

Looking Ahead

Richard and Annie see urban resilience evolving in key ways:

- **Scaling up** nature-based solutions, using funding models like carbon offsets and corporate social responsibility programs.
- **Integrating resilience** into major infrastructure projects, ensuring highways and rail developments fund ecological restoration rather than exacerbate risks.
- **Embedding climate adaptation** into mainstream urban planning, shifting from reactive disaster response to proactive resilience building.

“The big shift we need is from reacting to disasters to embedding resilience into everyday planning and infrastructure.”

2.2

projects

Byera Hadley Travelling Scholarships Journal Series

2.2.1

green hairstreak corridor

Project Overview

Location: San Francisco, California; Golden Gate Heights neighbourhood

Designer(s): Nature in the City, with contributions from local community members and volunteers

Client: Nature in the City (nonprofit) in partnership with Earth Island Institute

Physical Size: 11 habitat sites, including parks, street medians, and stairways

Context: Nestled in San Francisco's Golden Gate Heights neighbourhood, the Green Hairstreak Corridor addresses the pressing challenge of habitat fragmentation in a dense urban setting. Rediscovered in 2006, the Green Hairstreak butterfly (Callophrys viridis) was nearing local extinction due to invasive plant species and loss of native habitat, sparking a grassroots movement to reconnect its fragmented populations.

Purpose: This initiative focuses on re-establishing ecological connectivity, enhancing biodiversity, and fostering urban resilience by linking isolated butterfly habitats into a cohesive network of green spaces, all while actively involving the local community in conservation efforts.

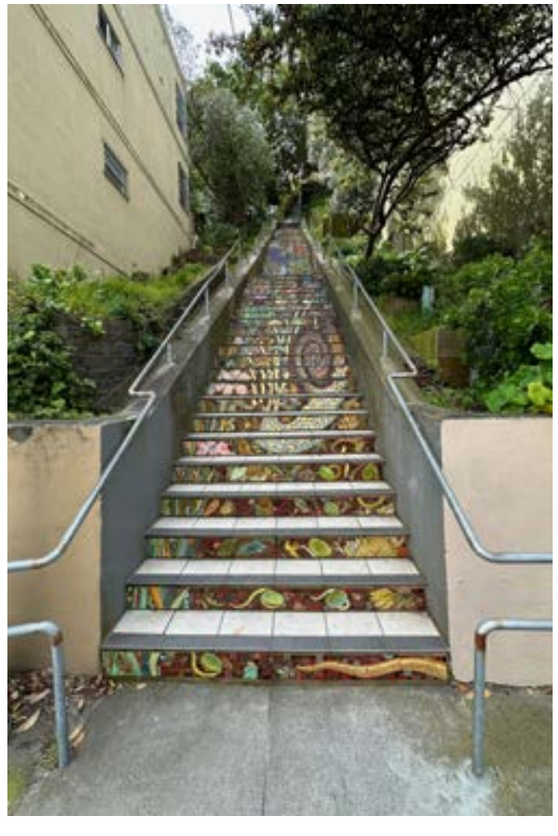
Key Design Strategies

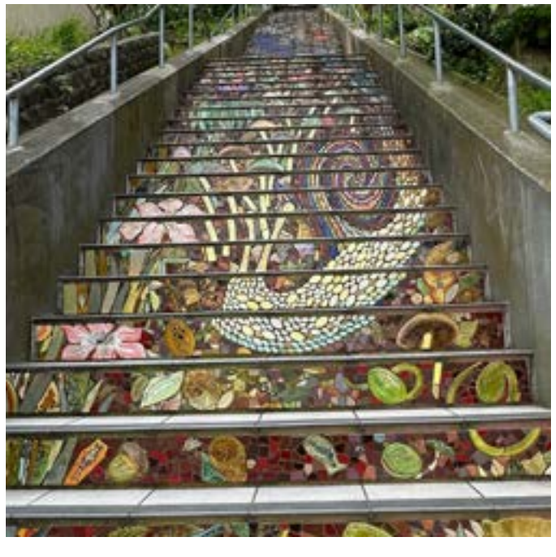
Renaturing:

- **Integration of Biodiversity Principles:** Carefully selected native plants critical to the butterfly's lifecycle, such as Coast Buckwheat (Eriogonum latifolium) and Seaside Daisy (Erigeron glaucus), were reintroduced to create sustainable habitats.
- **Habitat Creation and Expansion:** Eleven restored habitats function as "stepping stones" that enable butterfly movement, improving genetic diversity and population stability.
- **Engaging Urban-Nature Interactions:** Volunteers and residents played pivotal roles, maintaining habitats and participating in programs like the "Backyard Nursery Network," which empowers community members to grow native plants and expand the corridor's impact.

Resilience:

- **Climate Resilience:** The introduction of native plants not only supports pollinators but also strengthens ecological stability, mitigates urban heat islands, and addresses soil erosion and stormwater management by stabilising slopes and managing runoff.
- **Community Resilience:** The project fosters social cohesion by providing shared stewardship opportunities, enhancing mental well-being through nature engagement, and offering education on the importance of urban biodiversity. A standout example includes a resident's dedication to maintaining a nearby plot and advocating for its





protection, exemplifying local stewardship in action.

Outcomes and Lessons Learned

Impact:

- Increased populations and improved genetic diversity of the Green Hairstreak butterfly, safeguarding it from local extinction.
- Expanded urban green spaces that benefit a wide range of pollinators and wildlife.
- Strengthened community connections through ongoing engagement in ecological restoration activities.

Challenges and Innovations:

- **Challenges:** Urban constraints necessitated innovative solutions, such as utilising medians, stairways, and small parks as habitat sites.
- **Innovations:** Programs like the “Backyard Nursery Network” extended the project’s reach into private spaces, significantly enhancing its ecological footprint and community involvement.

Takeaways:

- Demonstrating the potential of small-scale, community-driven interventions, the Green Hairstreak Corridor highlights how urban renaturing projects can effectively address biodiversity loss.
- The initiative underscores the importance of integrating local communities into long-term ecological and social resilience efforts.
- By prioritising native species and fostering a sense of shared responsibility, this project serves as a replicable model for urban biodiversity enhancement worldwide.


116th Avenue &
Quintara Steps


What little creatures live in this Park?
Here's a clue:
Some call it Bug Park,
others refer to it as Roly-Poly Hill.
Walk about and explore.
Look under a rock, or lift a log.
Who's there?!
Roly polys, slowly polys, centipedes, millipedes,
worms, slugs, and more!
After making your observation,
with thoughtful consideration,
carefully replace the log or rock
so the creatures don't get squashed
and they can safely get back
to their business
or slowliness.
Then, maybe lift another log... who's there?


Pill Bugs are also called
Roly-Polys because they
roll up into a little
ball when disturbed. Its
hard shell helps protect
it. It is a crustacean;
related to lobsters and
crabs. It breathes
through gills on its
abdomen.
Sow Bugs are much like
pill bugs, but they don't
roll up, so they're also
called slowly-polys.
Generally found in
groups. Sow bugs and pill
bugs eat dead leaves,
bark, and fungi.
Centipedes run very
quickly. Each body
segments has one pair of
legs. The first pair are
like fangs, helping it to
catch insects to eat.
who's there?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quickly. Each body
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legs. The first pair are
like fangs, helping it to
catch insects to eat.
Millipedes have two pair
of legs under each body
segment, and move more
slowly than centipedes.
They eat plant debris.
When resting or
disturbed, they roll into
a flat coil.
Springtails hop about
frantically when the log
they're resting under is
lifted. So some people
call them "jumping bugs."
They are super tiny.
They ask mold and
decaying and decaying
plants.
Earwigs (pincher bugs)
use the pincher-like
cerci on their back-end
to grab insects to eat.
They also eat plants.
The cerci are curved on
males, and straight on
females. They have
wings, but usually don't
fly.


Black Ground Beetles are
fast runners. They catch
caterpillars and worms
and other squishy things
to eat. There are wings
under their shiny black
armor, but they seldom
fly.
Devil's Coach-Horse is a
type of Rove Beetle. It
has strong jaws and eats
snails, slugs, and soft
crawlies. When threatened
it curls up its back-end
to look scary like a
scorpion.
Termites are the only
insect that can eat the
cellulose fibers of dead
wood. They live in
colonies with a queen,
king, workers and
soldiers.

2.2.2

heron's head park and the ecocenter

Project Overview

Location: San Francisco, California; Bayview-Hunters Point neighbourhood

Designer(s): Literacy for Environmental Justice (LEJ) and partners

Client: San Francisco Recreation and Parks Department and the Port of San Francisco

Physical Size: 22-acre park with an 8-acre restored wetland and a 1,500-square-foot EcoCenter facility

Context: Located on a former industrial brownfield site, Heron's Head Park is a vibrant example of environmental restoration and education in a historically marginalised neighbourhood. The park and EcoCenter address ecological degradation while fostering community revitalisation and sustainability in Bayview-Hunters Point, an area with significant environmental justice challenges.

Purpose: To transform a polluted industrial site into a thriving public park and environmental education hub. The project focuses on habitat restoration, community engagement, and teaching sustainable practices, with an emphasis on addressing local environmental justice issues.

Key Design Strategies

Renaturing:

- **Habitat Restoration:** Heron's Head Park features 8 acres of intertidal marsh, providing vital habitat for over 100 bird species and supporting native wetland flora. Efforts include planting native vegetation to stabilise the shoreline and combat erosion.
- **EcoCenter Features:** The EcoCenter exemplifies green building principles, operating entirely off the grid with solar energy, a green roof, and rainwater harvesting systems. Constructed wetlands treat the building's wastewater on-site, reducing its environmental footprint.
- **Nature Exploration Area (NEA):** Designed with input from local children, this play space encourages unstructured outdoor play using natural materials like logs and stumps, fostering a connection to nature and creativity.

Resilience:

- **Climate Resilience:** The park's restored wetland mitigates storm surges and supports biodiversity, while the shoreline resilience project employs nature-based solutions to address erosion and prepare for sea-level rise.
- **Community Resilience:** The EcoCenter provides environmental education and workforce development opportunities, empowering residents with knowledge and skills to contribute to sustainability efforts. Programs like the Youth Stewardship Program engage K-12 students in hands-on activities such as

wetland restoration and renewable energy system maintenance.

Outcomes and Lessons Learned

Impact:

- Transformed a polluted industrial site into a thriving ecological and community space.
- Supported local biodiversity, with notable increases in bird populations and native vegetation.
- Engaged the community through educational programs, volunteer opportunities, and youth internships.
- Earned recognition, including an EPA Environmental Justice Award and UNICEF's Cities Inspire Award.

Challenges and Innovations:

- **Challenges:** Limited funding initially stalled the project, but the availability of ARRA funds allowed construction to continue. Addressing environmental justice concerns in a historically underserved neighbourhood required significant community outreach and engagement.
- **Innovations:** The EcoCenter's design integrates cutting-edge green technologies as teaching tools, such as solar panels and on-site wastewater treatment, creating a living laboratory for sustainable practices.

Takeaways:

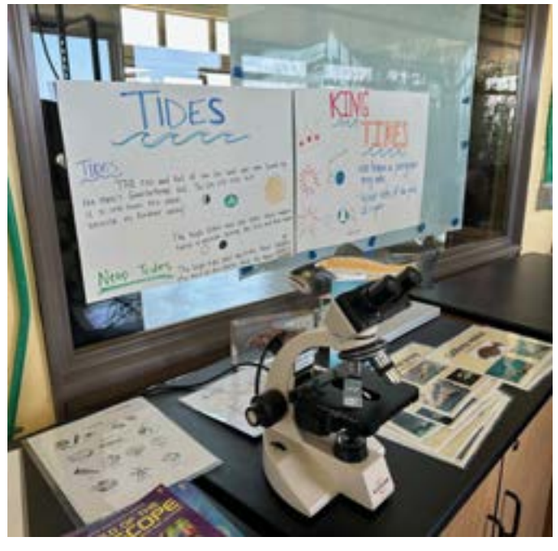
- Heron's Head Park and the EcoCenter demonstrate how environmental restoration can address social and ecological challenges in underserved communities.
- By prioritising local engagement and education, the project has fostered a sense of pride and stewardship in Bayview-Hunters Point.
- The project serves as a replicable model for sustainable redevelopment in urban areas, particularly those with environmental justice concerns.


Hunters
Point
SHORELINE


The Drilling Tank


Wastewater
Treatment


INSIDE THE ECOCENTER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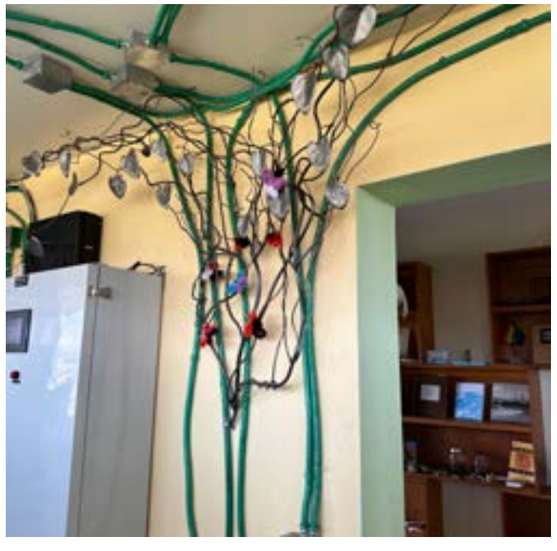
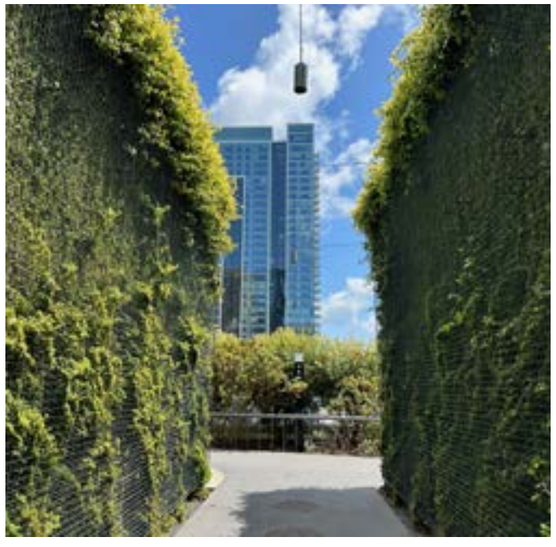


2.2.3

salesforce transit center



Project Overview

Location: San Francisco, California

Designer(s): Pelli Clarke & Partners; PWP Landscape Architecture

Client: Transbay Joint Powers Authority (TJPA)

Physical Size: 5.4-acre park atop an eight-level, multimodal transit hub spanning five blocks

Context: Situated in a dense urban environment, Salesforce Transit Center and Salesforce Park address the challenge of limited green spaces in San Francisco's East Cut neighbourhood. Replacing the outdated Transbay Terminal, the project reclaims urban infrastructure to integrate public transportation with ecological and social functions.

Purpose: To create a multifunctional space that combines sustainable transportation infrastructure with ecological restoration and community engagement. The project seeks to improve urban biodiversity, manage stormwater, and provide accessible green space to enhance the environmental and social resilience of the city.

Key Design Strategies

Renaturing:

- Rooftop Ecology: Salesforce Park provides 5.4 acres of habitat, featuring 600 trees and 16,000 plants from 13 distinct Mediterranean climate zones. These plantings attract wildlife, including 47 observed bird species, four of which are endangered or species of concern, and 17 migratory bird species.
- Feature Gardens: The park's carefully curated gardens promote biodiversity and serve as ecological stepping stones for urban wildlife.
- Habitat Creation: By incorporating native and adaptive species, the park improves urban biodiversity and supports pollinators, birds, and other wildlife.

Resilience:

- Water Management: The park captures and treats 67% of annual stormwater runoff, totalling approximately 2.3 million gallons, and recycles greywater for irrigation and non-potable uses.
- Climate Mitigation: The park mitigates urban heat islands, improves air quality, and provides shade, contributing to a cooler and healthier urban environment.
- Social Resilience: Accessible programming, such as free yoga, concerts, and educational tours, fosters a sense of community and enhances well-being. Visitor surveys indicate that 76% of attendees feel improved mental health in the park.

Outcomes and Lessons Learned

Impact:

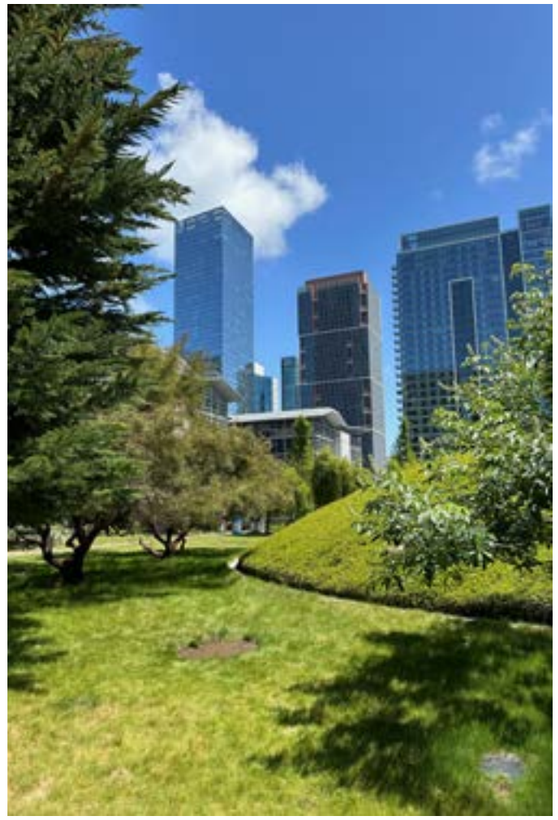
- Increased biodiversity within a dense urban context, with the park serving as a vital refuge for wildlife and an ecological corridor for migratory species.
- Enhanced stormwater management and reduced environmental impacts through innovative green infrastructure.
- Elevated property values in the surrounding area by $51,000 per unit on average, showcasing the economic benefits of integrating green spaces into urban planning.

Challenges and Innovations:

- **Challenges:** Coordinating the integration of ecological features with transit infrastructure required balancing structural, ecological, and functional priorities. Addressing early structural issues further underscored the need for innovative solutions.
- **Innovations:** Design features, such as daylighting through architectural skylights and a greywater filtration wetland, demonstrate the potential for urban infrastructure to support ecological health and sustainability.

Takeaways:

- Salesforce Transit Center and Park exemplify the potential for urban greening projects to enhance biodiversity, climate resilience, and community well-being.
- Combining ecological restoration with transit-oriented development can address multiple urban challenges simultaneously.
- Thoughtful integration of nature and infrastructure serves as a model for other cities seeking to balance urbanisation with ecological and social needs.

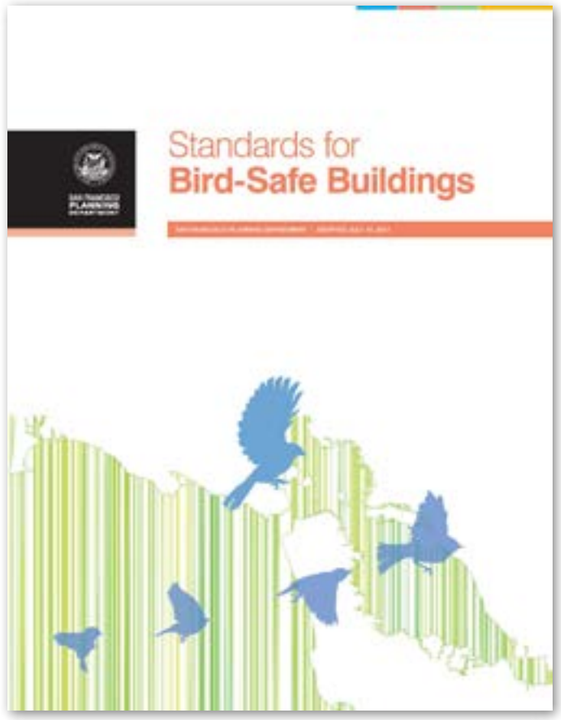


2.3

policies

2.3.1

standards for bird-safe buildings



The Standards for Bird-Safe Buildings aim to reduce bird collisions with reflective and transparent glass surfaces, addressing key hazards in urban environments. Illustrated here are examples of how reflections and transparency create risks, and how San Francisco's guidelines integrate solutions to protect avian life.

Overview

Jurisdiction: San Francisco, California, USA

Policy Type: Planning Code Amendment (Section 139)

Purpose: The Standards for Bird-Safe Buildings aim to mitigate bird mortality caused by urban structures, particularly from collisions with glass facades and disorienting lighting. The policy integrates bird conservation with sustainable urban development, setting a precedent for wildlife protection in a dense urban environment.

Key Provisions

Scope:

- **Location-Related Hazards:** Applies to new construction and renovations within 300 feet of Urban Bird Refuges, such as parks, green roofs, and wetlands (2 acres or larger).
- **Feature-Related Hazards:** Includes building elements like clear glass corners, skywalks, and free-standing glazed walls, which pose significant risks to birds.

Requirements:

- **Glazing Treatments:**
  - 90% of glazing in the "Bird Collision Zone" (up to 60 feet above ground) must be treated with bird-safe materials or patterns.
  - 100% of glazing on building features deemed hazardous (e.g., glass corners or skywalks) must be treated.
  - Compliance with the "2x4 Rule," which specifies patterns no larger than 2 inches by 4 inches, is mandatory to make surfaces visible to birds.
- **Lighting Design:**
  - Prohibits uplighting and requires shielded fixtures to minimise light pollution.
  - Encourages the use of motion-sensitive lighting and the "Lights Out" program during migration seasons.
- **Wind Generators:** Horizontal-axis turbines must be reviewed for bird safety, while vertical-axis turbines are encouraged for their lower risk.
- Incentives: Voluntary certification programs recognise buildings that exceed basic compliance, awarding designations such as "Sterling Bird-Safe Building" to encourage best practices.

Relevance to Renaturing and Resilience

Renaturing:

- Promotes the incorporation of bird-friendly features, such as green roofs, vegetated facades, and visually interrupted glass surfaces, to foster urban biodiversity.

“Each year, up to one billion birds die from collisions with glass in the United States. San Francisco’s Bird-Safe Standards aim to reduce this toll by incorporating bird-friendly design into urban planning.”

— San Francisco Planning Department, Bird-Safe Building Standards Document

- Highlights the importance of aligning architectural practices with ecological restoration and wildlife conservation.

Resilience:

- Protects bird populations, which play critical roles in pest control, seed dispersal, and pollination, ensuring long-term ecological stability.
- Reduces the environmental impact of urban lighting and glazing practices, contributing to broader sustainability goals.

Impact and Outcomes

Successes:

- The California Academy of Sciences and the Federal Building in San Francisco exemplify successful integration of bird-safe practices. The use of fritted glass and screens has significantly reduced bird collisions at these sites.
- The "Lights Out" program has garnered widespread participation, reducing light pollution and energy use during migration seasons.

Challenges:

- Retrofitting older buildings remains cost-intensive, limiting broader application across the city.
- Ensuring consistent compliance and monitoring requires additional resources and collaborative effort.

Lessons Learned:

- Education and public awareness are critical for promoting voluntary adoption of bird-safe standards.
- Partnerships with conservation organisations, such as the Golden Gate Audubon Society, have been instrumental in implementing and refining the policy.

Influence on Urban Design:

The Standards for Bird-Safe Buildings have redefined urban planning in San Francisco by embedding wildlife conservation into architectural design. These standards demonstrate the potential to harmonise urban development with ecological priorities.

Recommendations for Other Cities:

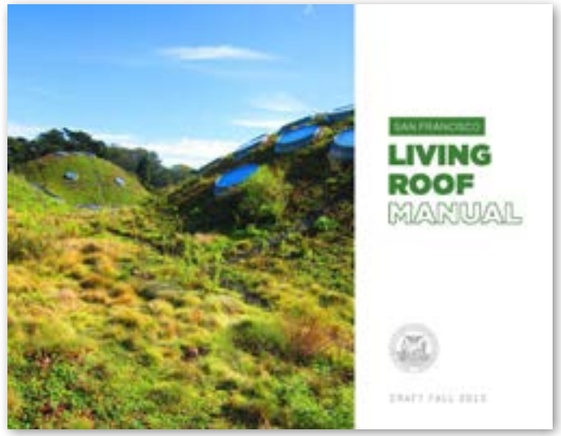
- **Adapt Standards to Local Needs:** Tailor bird-safe policies to address species-specific behaviours and regional migratory patterns.
- **Foster Collaboration:** Engage architects, developers, and conservationists in crafting and implementing guidelines.
- **Provide Incentives:** Offer tax breaks, grants, or recognition programs to encourage compliance and innovation in bird-safe practices.

The Minnesota Central Library’s atrium features angled glass, a dramatic architectural feature that reduces reflections of habitat and sky from most angles. The likelihood of fatal collisions at this angle is lessened.

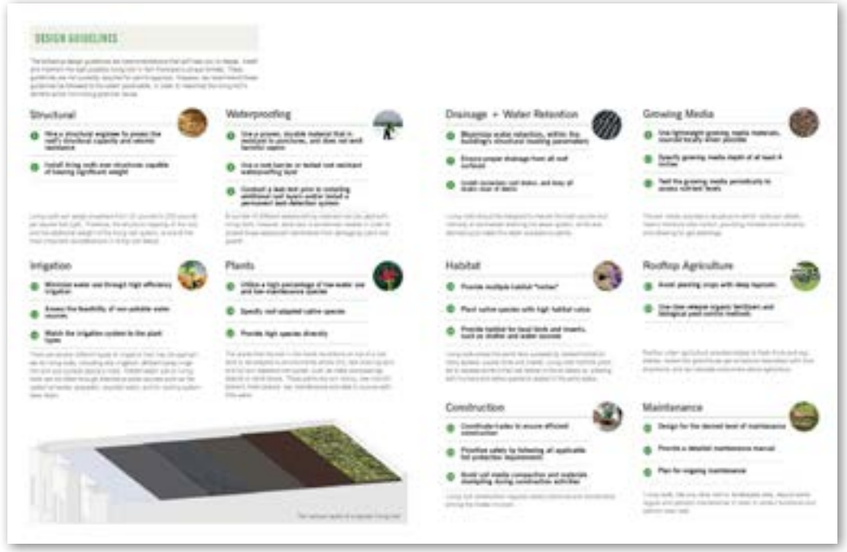
Salesforce Transit Center is wrapped with a white aluminum screen, perforated with an intricate pattern devised by mathematician Roger Penrose that protect birds from impact and allow views out for users of the building.

2.3.2

better roofs initiative



The Living Roof Manual provides comprehensive guidance for designing, constructing, and maintaining green roofs in San Francisco. It supports the 'Better Roofs' initiative by outlining best practices tailored to the city's unique climate, ensuring environmental benefits like stormwater management, biodiversity enhancement, and urban cooling.



Overview

Jurisdiction: San Francisco, California, USA

Policy Type: Planning Code Amendment (Section 149)

Effective Date: January 1, 2017

Purpose: The "Better Roofs" initiative transforms San Francisco's rooftops—comprising over 30% of the city's land area—into functional spaces that provide environmental, social, and economic benefits. The policy mandates the installation of solar energy systems, living roofs (green roofs), or a combination of both to address stormwater management, urban heat reduction, renewable energy generation, and biodiversity enhancement.

Key Provisions

Scope:

- Applies to new buildings with:
  - A gross floor area of at least 2,000 square feet.
  - Up to 10 occupied floors.

Requirements:

- Allocate at least 15% of roof area for solar energy systems or living roofs, or a combination of both.
- For photovoltaic (PV) systems:
  - Panels must genera te a minimum of 10 Watts DC per square foot.
- For solar thermal systems:
  - Installations must produce 100 kBtu per square foot annually.
- For living roofs:
  - Replace required solar zone area at a rate of 2 square feet of living roof for every 1 square foot of solar.
  - Meet standards for soil depth, plant diversity, and stormwater retention.

Implementation and Compliance:

- Developers must demonstrate compliance during the permitting process.
- Coordination is required with city ordinances, including the Stormwater Management Ordinance and Non-Potable Water Ordinance.

Relevance to Renaturing and Resilience

Renaturing:

- Creates habitats for urban wildlife, supporting biodiversity.
- Promotes the use of native and drought-tolerant plants.
- Enhances ecological connectivity across urban spaces.

"San Francisco continues to evolve as a prime example of an increasingly sustainable city, with green roofs and walls as essential contributory elements."

— John Rahaim, Planning Director

Resilience:

- Reduces urban heat island effects, lowering cooling energy demands.
- Improves stormwater management by reducing runoff volume and intensity.
- Contributes to energy independence and greenhouse gas reduction through on-site renewable energy systems.

Impact and Outcomes

Successes:

- Enhanced stormwater retention reduces reliance on infrastructure upgrades.
- Increased renewable energy generation supports San Francisco's emissions reduction goals.
- Living roofs have improved urban biodiversity, benefiting pollinators and other species.

Challenges:

- High installation and maintenance costs for living roofs pose barriers for developers.
- Varying levels of technical familiarity among stakeholders create obstacles in implementation.

Lessons Learned:

- Flexible options for combining solar and living roofs enable tailored solutions.
- Demonstration projects and clear permitting processes reduce regulatory confusion.
- Financial incentives, such as grants or fee reductions, encourage adoption.

Influence on Urban Design

The "Better Roofs" initiative has redefined San Francisco's urban development by transforming rooftops into multifunctional assets that integrate energy production, stormwater management, and biodiversity. These features are now a standard part of building design, contributing to a greener, more sustainable urban landscape while enhancing aesthetics and livability in dense urban areas.

Recommendations for Other Cities

- **Tailor policies to local contexts:** Adapt green roof mandates to fit climate, building practices, and urban planning goals.
- **Incentivise adoption:** Provide financial incentives, such as grants, stormwater fee reductions, or tax exemptions, to lower costs for developers.
- **Promote education:** Develop resources and case studies to engage stakeholders and build technical capacity.
- **Integrate broader urban goals:** Align rooftop requirements with stormwater management, renewable energy, and biodiversity objectives to maximise impact.

The California Academy of Sciences showcases the potential of living roofs in urban design. With over 1.7 million native plants, the roof provides habitat for local wildlife, improves stormwater management, and reduces energy use, setting a benchmark for sustainable architecture.

3

portland, oregon

First Nations and Traditional Ecological Knowledge

Long before Portland became a major city, the Chinook, Clackamas, and Multnomah peoples lived along the Columbia and Willamette Rivers, practicing sustainable land management. They engaged in seasonal burning, rotational agriculture, and river stewardship, ensuring the health of salmon runs and wetland ecosystems.

European settlement in the 19th century led to the forced displacement of Indigenous communities, disrupting these ecological practices. Treaties were broken, and land was seized for agriculture and development. Today, Indigenous groups, including the Confederated Tribes of Grand Ronde and Warm Springs, are reclaiming their role in conservation, integrating traditional knowledge into Portland's sustainability efforts.

Colonisation and the Transformation of the Willamette Valley

Portland's rapid urbanisation began in the mid-19th century, driven by westward expansion and the Oregon Trail migrations. The Donation Land Act of 1850 encouraged settlers to claim Indigenous lands, leading to deforestation, wetland drainage, and intensive farming. The Willamette River, once central to Indigenous life, became increasingly industrialised.

By the early 20th century, logging and shipping had reshaped the region. The Willamette River was polluted by paper mills, manufacturing waste, and sewage, while the city's expanding rail and road networks further altered the landscape. The consequences of this rapid growth—deforestation, flooding, and declining water quality—eventually led to the emergence of Portland's environmental movement.

Contemporary Urbanisation and Ecological Innovation

Portland is now recognised as a leader in sustainable urban planning, green infrastructure, and ecological restoration. The city's urban growth boundary (UGB) policy, introduced in 1973, was one of the first in the U.S. to limit sprawl and protect natural areas.

Key restoration projects include Tanner Springs Park, which reintegrates lost wetlands into the urban landscape, and the Lloyd EcoDistrict Pollinator Corridor, which enhances biodiversity by transforming ordinary streetscapes into pollinator-friendly habitats. The Green Streets Program is another notable initiative, integrating bioswales and rain gardens into roads and sidewalks to manage stormwater naturally.

Portland has also mandated green roofs on new developments, reducing the urban heat island effect and improving water retention. However, the city faces ongoing challenges in balancing urban growth with ecological preservation, as demand for housing and infrastructure continues to increase.

Ecosystems and Biodiversity: A Delicate Balance

Portland sits at the convergence of diverse ecosystems, from temperate rainforests in Forest Park to wetlands along the Columbia River. These landscapes provide habitat for salmon, beavers, owls, and pollinators essential to the region's ecological health.

However, urban expansion has led to habitat fragmentation, invasive species, and declining fish populations. The Johnson Creek Watershed Council and Friends of Trees work to restore riparian corridors, expand tree canopy cover, and reintroduce native vegetation. Initiatives like Depave, which replaces unnecessary pavement with green space, help restore soil health and mitigate runoff.

Community-led programs, such as the Backyard Habitat Certification Program, empower residents to support biodiversity through native plantings and sustainable landscaping. These efforts highlight Portland's commitment to urban ecology at multiple scales.

Climate Challenges and Resilience Strategies

Portland faces increasing climate threats, including rising temperatures, drought, wildfires, and flooding. The city's mild climate is becoming more unpredictable, with extreme heat events straining infrastructure and disproportionately affecting vulnerable communities.

Urban heat islands—caused by expanses of concrete and asphalt—have worsened temperature extremes. To combat this, Portland has expanded its tree canopy initiative, prioritising shade equity in underserved neighbourhoods. The city has also mandated cool roofs and increased green infrastructure investments to mitigate heat absorption.

Water management is another critical concern. The Willamette and Columbia Rivers face rising water temperatures, seasonal flooding, and reduced snowmelt, affecting water supply and aquatic life. Portland's Green Streets Program and floodplain restoration projects help absorb excess water and protect critical ecosystems.

Portland has committed to net-zero carbon emissions by 2050, focusing on renewable energy, transit expansion, and electrification. Investments in bike infrastructure and pedestrian-friendly urban design aim to reduce car dependency while enhancing liveability.

Economic and Social Considerations

While Portland is celebrated for its environmental policies, rapid population growth and rising housing costs have led to increased displacement, particularly in historically marginalised communities. The expansion of green spaces and transit-oriented development has at times contributed to eco-gentrification, where environmental improvements drive up real estate prices.

To address this, the city has integrated environmental justice into urban planning. The Cully Green Street Project combines affordable housing with green infrastructure, ensuring that low-income communities benefit from ecological improvements. Similarly, the Portland Clean Energy Fund supports renewable energy and climate resilience projects in communities most affected by climate change.

Grassroots initiatives like Living Cully focus on job training in green industries, community-led urban design, and equitable sustainability efforts, ensuring that Portland's environmental progress benefits all residents.

3.1

people

Byera Hadley Travelling Scholarships Journal Series

3.1.1

joshua baker, lloyd ecodistrict

“The success of a sustainable neighbourhood comes from diversity—not just biodiversity, but diversity of people, transportation, and land uses.”

Bio

Joshua Baker is the **Outreach Program Manager at Lloyd EcoDistrict**, a sustainability-driven non-profit organisation in **Portland, Oregon**, dedicated to making the Lloyd neighbourhood a model of **urban resilience, equity, and sustainability**. His work focuses on **placemaking, pollinator-friendly landscapes, energy efficiency, urban resilience planning, and community engagement**.

Lloyd EcoDistrict operates outside of formal government structures but works closely with **local businesses, residents, and public agencies** to drive sustainability initiatives across **privately and publicly owned spaces**. The organisation has achieved **EcoDistrict certification**, integrating **equity, climate action, and resilience** into its long-term strategy. Joshua plays a key role in managing programs that **foster green infrastructure, public space improvements, and climate resilience** initiatives at the district scale.

Key Themes from the Interview

The Role of Lloyd EcoDistrict in Urban Resilience

Unlike government agencies, Lloyd EcoDistrict is a **non-profit working across public and private sectors** to implement sustainability projects. It **does not own land** but collaborates with stakeholders to improve **green infrastructure, energy efficiency, and public space activation**.

“We work on everything from pollinator placemaking to energy tracking and emergency preparedness—our role is to bring together the people and resources needed to make change happen.”

Peace Memorial Park: A Case Study in Bureaucratic Challenges

One of Lloyd EcoDistrict’s key projects is **Peace Memorial Park**, a neglected green space at the entrance to the district. Originally maintained by **Veterans for Peace**, the space became overgrown and under-utilised. Lloyd EcoDistrict stepped in to **maintain and revitalise the site**, but progress has been slow due to **bureaucratic barriers and unclear jurisdiction over public right-of-way space**s.

“We’ve raised funding, secured grants, and developed a design plan, but we’ve been in limbo for two years waiting for approval to break ground.”

Overcoming Governance Barriers to Sustainability

A major challenge for Lloyd EcoDistrict is **navigating fragmented governance and liability concerns**. Since many of its projects are on **public land but not officially designated as parks**, there is often confusion about **who is responsible for maintenance and long-term stewardship**.

“Even when the city supports a project in principle, we run into roadblocks around liability, maintenance responsibilities, and permissions to modify public land.”

The Power of Voluntary Collaboration

Unlike sustainability initiatives tied to **development compliance**, Lloyd EcoDistrict’s success depends on **voluntary participation** from property owners and businesses. The organisation facilitates **forums for building managers to share best practices** and provides **incentives for energy efficiency upgrades**.

“We can’t force anyone to do anything, but many property owners understand that sustainability adds value—whether through attracting tenants or reducing long-term costs.”

The Pollinator Corridor & Road Diet: Integrating Green Infrastructure with Mobility

One of the district’s most visible projects is the **Pollinator Corridor**, which transformed a five-lane road into a **safer, pedestrian-friendly street with protected bike lanes and pollinator-friendly planters**. Instead of using plastic barriers, the EcoDistrict repurposed **retired city planters filled with native plants** to create a greener and safer corridor.

“It’s not just about transportation—it’s about layering benefits. We improved pedestrian and bike safety while also increasing urban biodiversity.”

Long-Term Planning: The 2030 Roadmap

Lloyd EcoDistrict’s **2030 Roadmap** sets out **62 initiatives** focused on **resilience, equity, and climate action**. Developed through **surveys, community events, and stakeholder meetings**, it ensures that **projects reflect local priorities** and serve as a guiding framework for future development.

“A big takeaway from community engagement was demand for more community gardens—so now we’re actively identifying locations and tracking progress on green space expansion.”

Looking Ahead

Joshua sees the future of Lloyd EcoDistrict focused on:

- **Unlocking bureaucratic barriers** to advance projects like **Peace Memorial Park**.
- **Expanding urban resilience initiatives**, including climate adaptation strategies and emergency preparedness.
- **Transforming vacant land** into temporary or permanent community gardens.
- **Advocating for policy changes** that support sustainable redevelopment and adaptive reuse of commercial spaces.

3.1.2

lori henning, oregon metro

"Conservation and equity aren't separate issues—they have to be addressed together if we want real resilience."

Bio

Lori Hennings is a **Senior Natural Resource Scientist** at **Oregon Metro**, the regional government for the Portland metropolitan area. With over **22 years at Metro**, Lori specialises in **habitat connectivity, urban ecology, and land conservation**. She played a key role in developing regional wildlife corridor mapping, ensuring that land-use planning integrates **biodiversity, ecological resilience, and climate adaptation**.

Metro oversees **land-use planning, environmental management, and public facilities**, operating within 23 cities and three counties under **Oregon's Urban Growth Boundary**—the first of its kind in the U.S. Lori's work influences **parkland acquisitions, transportation planning, and ecological restoration efforts** across the region. She is also deeply involved in **equity-focused conservation strategies**, ensuring that **historically underserved communities benefit from environmental planning**.

Key Themes from the Interview

Oregon's Urban Growth Boundary & Regional Land Use Planning

Metro plays a crucial role in **managing urban expansion** through the **Urban Growth Boundary**, a statewide policy aimed at **preserving farmland and natural areas while accommodating population growth**. Every five years, Metro assesses land needs and works with local governments to determine **where and how development should occur**.

"It's not about stopping growth—it's about planning it better."

Habitat Connectivity: Mapping & Protecting Urban Wildlife Corridors

A major focus of Lori's work is **habitat connectivity**, ensuring that wildlife can move between fragmented natural areas despite urban development. Metro has spent years mapping critical **wetland, forest, and oak habitat corridors**, identifying barriers and restoration opportunities.

"We developed models using key species—like amphibians that need wetlands and forests—to guide land conservation and urban planning."

This mapping informs **land acquisitions, transportation planning, and restoration projects**, ensuring that new infrastructure doesn't sever critical wildlife corridors.

Balancing Development with Conservation

Metro works closely with **local governments and developers** to ensure that **growth aligns with ecological priorities**. This includes:

- Using **connectivity maps** to guide new urban expansions.
- Acquiring key parcels of land to **preserve habitat corridors**.
- Encouraging developers to **integrate biodiversity into urban projects**.

"In new urban areas, it's critical to prevent barriers to wildlife movement—once a corridor is cut off, it's hard to restore."

Community Engagement & Environmental Justice

Lori emphasises that **equitable access to nature is as important as conservation itself**. Metro has integrated **equity into all land-use decisions**, ensuring that underserved communities benefit from green spaces, shade, and clean air.

"Low-income neighbourhoods often suffer from urban heat islands and air pollution—we need to invest in nature where it's needed most."

Metro also supports **Indigenous land access**, providing opportunities for First Nations communities to **manage and steward conservation lands**.

Climate Change as the Defining Challenge

For Lori, **climate change is the central issue** shaping all future planning efforts. She stresses the need to:

- **Incorporate climate resilience** into all Metro policies.
- **Enhance urban cooling** through green space expansion.
- Ensure **biodiversity conservation** as part of climate adaptation strategies.

"Everything we do from now on has to consider climate change—it's our biggest challenge, and it affects everything else."

Looking Ahead

Lori sees the future of urban resilience and conservation focused on:

- **Strengthening habitat connectivity** efforts, ensuring that wildlife corridors remain intact despite urban growth.
- **Expanding land conservation efforts** in urban and suburban areas to support biodiversity and climate adaptation.
- **Embedding equity into climate resilience strategies**, ensuring that low-income communities gain access to urban nature and cooling solutions.
- **Scaling up regional climate action**, making sure that all land-use decisions prioritise long-term ecological sustainability.

3.2

projects

Byera Hadley Travelling Scholarships Journal Series

3.2.1

tanner springs park

Project Overview

Location: Portland, Oregon – Pearl District at NW 10th Ave. and Marshall St.

Designer(s): Atelier Dreiseitl (Germany) and GreenWorks, P.C. (Portland)

Client: City of Portland

Physical Size: Approximately 0.92 acres (3,723 square meters)

Context: Tanner Springs Park is located in a historically significant area that was once part of a wetland ecosystem bisected by Tanner Creek and bordered by the Willamette River. Over time, industrial development transformed the site into rail yards and other infrastructure. Recent redevelopment efforts in the Pearl District sought to restore ecological connections and introduce green spaces to reconnect the area with its natural past.

Purpose: The project aimed to restore a fragment of the site's original wetland habitat, integrating ecological principles to enhance biodiversity, manage urban stormwater sustainably, and provide a tranquil, contemplative space for community engagement and passive recreation.

Key Design Strategies

Renaturing:

Ecological Integration: The park's design restores native habitats that reflect the pre-industrial landscape. Features include a wetland pond and an open grassy meadow planted with native species to support urban biodiversity and create a refuge for wildlife.

Habitat Creation: The park supports local biodiversity by reintroducing wetland and prairie vegetation. These habitats attract birds, insects, and aquatic species, fostering ecological connectivity within the urban fabric.

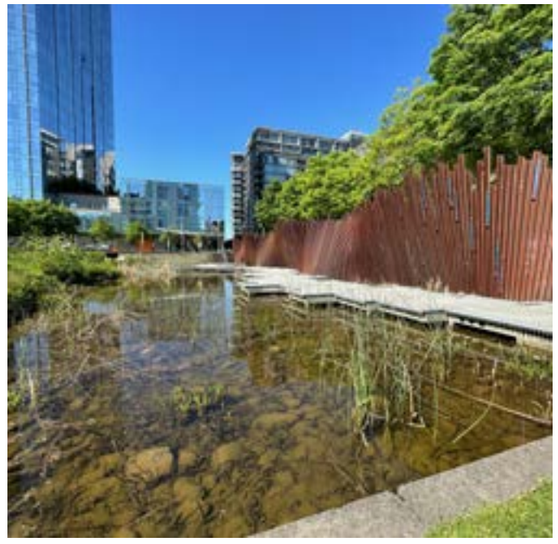
Artistic Elements: The "Artwall," constructed from 368 reclaimed railroad tracks and fused glass pieces, depicts native wildlife and symbolises the site's transformation from industrial use to ecological restoration.

Resilience:

Stormwater Management: Tanner Springs Park incorporates a natural water management system, capturing and filtering stormwater from adjacent streets and hard surfaces. The pond at the park's lowest point acts as a bioswale, reducing runoff and improving water quality.

Community Well-being: The park provides a tranquil retreat within a bustling urban neighbourhood, offering mental health benefits and opportunities for passive recreation. Its design encourages reflection and connection with nature in an urban context.

Outcomes and Lessons Learned



Impact:

Ecological Benefits: The park has reintroduced native vegetation and created habitats that support a range of species, including birds like herons and ospreys, enhancing urban biodiversity.

Urban Resilience: The integration of natural stormwater management systems demonstrates how ecological functions can address urban challenges such as water quality and flooding.

Social Enhancements: By providing a peaceful green space, the park has enriched the community's quality of life, serving as an educational and recreational resource.

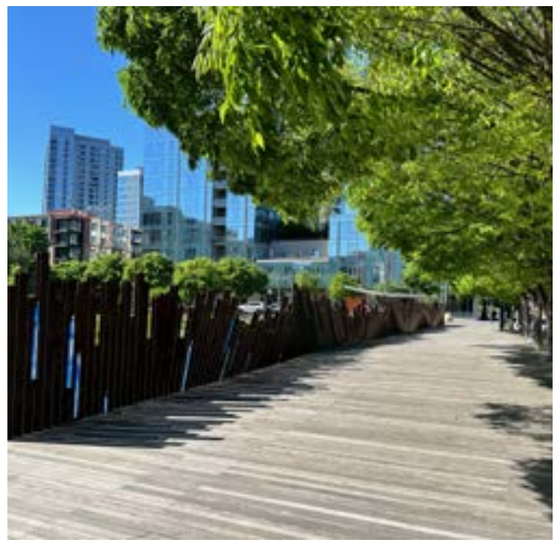
Challenges and Innovations:

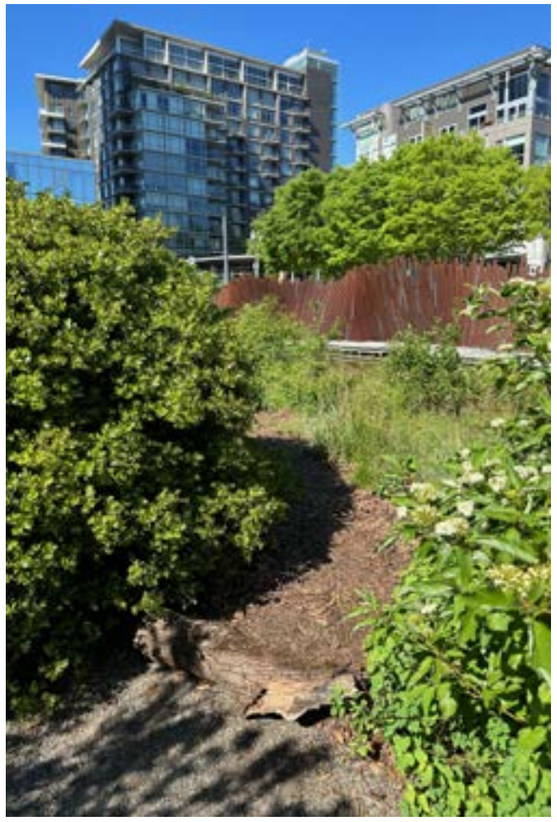
Pet Policy Enforcement: To protect its delicate ecosystems, the park prohibits dogs. Community education and enforcement have been critical to maintaining this policy.

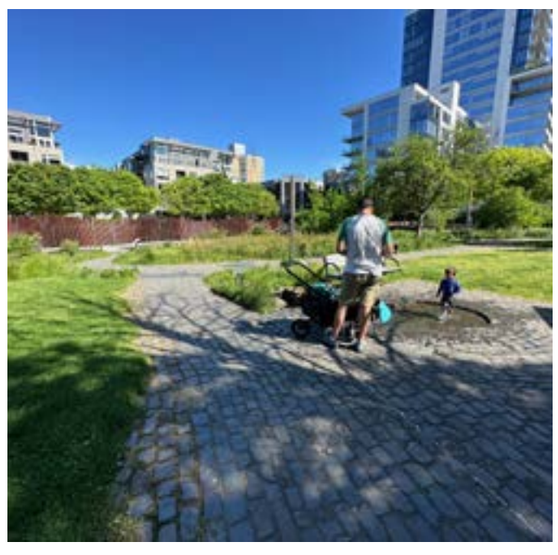
Design Reception: While the park's serene design is widely appreciated, some critiques highlight the challenges of aesthetic and functional balance in urban public spaces.

Takeaways:

- Tanner Springs Park demonstrates the potential of urban spaces to integrate ecological restoration and sustainable design.
- The focus on native habitat restoration highlights the importance of biodiversity in urban environments.
- The park showcases effective natural water management techniques that enhance urban resilience.
- Thoughtful design can reconnect cities with their natural heritage, creating spaces that benefit both people and the environment.







3.2.2

lloyd ecodistrict pollinator corridor

Project Overview

Location: Portland, Oregon – NE Multnomah Street, from NE 15th Avenue to NE 2nd Avenue

Designer(s): Lloyd EcoDistrict, in partnership with Go Lloyd, City Repair, Color Outside The Lines, and Rather Severe

Client: Lloyd EcoDistrict

Physical Size: Approximately 1 mile (1.6 km) along NE Multnomah Street

Context: The Lloyd neighbourhood, a bustling urban area in Portland, identified the need to support declining pollinator populations and enhance urban biodiversity. The initiative aimed to transform existing urban spaces into habitats conducive to pollinators, thereby fostering ecological health and community engagement.

Purpose: The project sought to create a continuous pollinator corridor by installing planters with native, pollinator-friendly plants along NE Multnomah Street. This corridor not only provides essential habitats for pollinators but also beautifies the urban landscape and raises awareness about the importance of pollinators in the ecosystem.

Key Design Strategies

Renaturing:

- **Ecological Integration:** The corridor features large concrete planters filled with native perennials such as kinnikinnick, milkweed, salal, and yarrow. These plants are specifically chosen to attract and support local pollinator species, including bees and butterflies.
- **Habitat Creation:** By converting urban streetscapes into pollinator-friendly environments, the project establishes a network of habitats that facilitate the movement and proliferation of pollinators across the city.
- **Artistic Elements:** The initiative includes pollinator-themed murals and art installations, created in collaboration with local artists and organisations, to celebrate pollinators and engage the community.

Resilience:

- **Community Engagement:** Volunteers were deeply involved in the project, from planting and maintenance to creating artistic elements. This involvement not only fostered a sense of pride and ownership but also strengthened community bonds and demonstrated care for the space.
- **Urban Greening:** Enhancing the area with greenery and art improves its visual appeal and conveys that the place is cared for, contributing to a stronger sense of community.
- **Urban Biodiversity:** By supporting habitats for pollinators, the corridor contributes to greater urban biodiversity, which in turn supports ecosystem resilience and stability.

Outcomes and Lessons Learned

Impact:

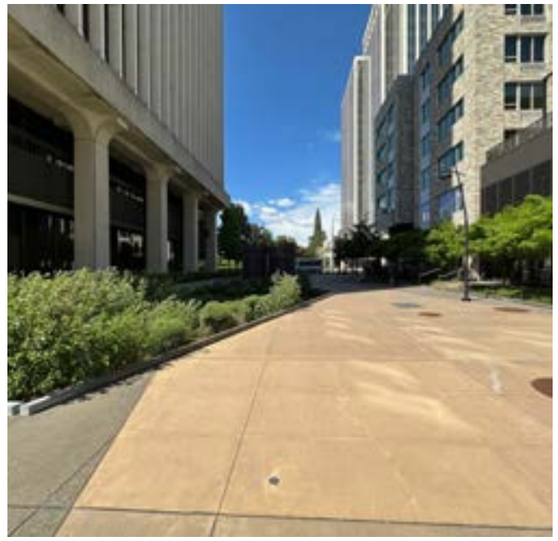
- **Ecological Benefits:** The corridor has successfully established habitats that support various pollinator species, contributing to the stabilisation and growth of local pollinator populations.
- **Community Involvement:** The project engaged community members through volunteer opportunities and educational initiatives, strengthening community bonds and environmental awareness.
- **Urban Aesthetics:** The addition of greenery and art has enhanced the visual appeal of NE Multnomah Street, creating a more inviting and vibrant urban environment.

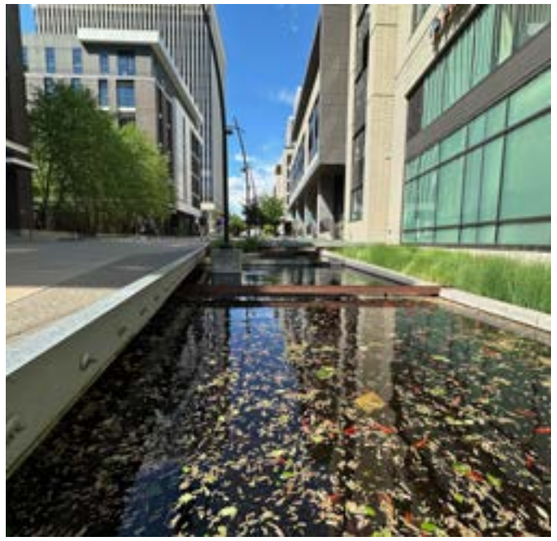
Challenges and Innovations:

- **Maintenance:** Ensuring the health of the plants requires ongoing maintenance, which is addressed through regular volunteer events and partnerships with local organisations.
- **Climate Resilience:** The project has adapted to challenges such as heatwaves by selecting drought-resistant native plants and implementing sustainable watering practices.

Takeaways:

- The Lloyd EcoDistrict Pollinator Corridor demonstrates how urban spaces can integrate ecological restoration and sustainable design.
- Engaging community members fosters pride, ownership, and a stronger sense of community, reinforcing the importance of care and collaboration.
- Thoughtful design can reconnect urban areas with nature, creating spaces that benefit both the environment and the community.
- Urban greening projects serve as powerful tools to address ecological and social resilience simultaneously.





3.3

policies

3.3.1

nature in neighborhoods grants

Overview

Jurisdiction: Portland metropolitan area, Oregon, USA

Program Type: Community Grants Initiative

Purpose: The Nature in Neighborhoods Grants Program, funded through Metro's Parks and Nature bond measures, supports projects that integrate nature into urban environments, enhance community well-being, and promote environmental stewardship. The program prioritises community-led initiatives, focusing on racial equity, climate resilience, and improved access to nature for historically marginalised communities.

Key Components

Grant Categories:

- **Capital Grants:** Fund projects such as land acquisition, ecological restoration, and urban transformations that result in publicly owned assets.
- **Community Choice Grants:** Utilise participatory budgeting, empowering residents to propose and select projects that reflect local needs and values.

Eligibility Requirements:

- Projects must be on property owned by state or local governments within Metro's jurisdiction.
- Must involve partnerships between community-based organisations and government entities.
- Matching funds must cover at least one-third of the total project cost.

Relevance to Renaturing and Resilience

Renaturing:

- **Integrating natural features into urban spaces:** Projects such as the Native Plant Gardens at Rood Bridge Park exemplify how under-utilised areas can be transformed into vibrant green spaces that enhance biodiversity and ecological connectivity.
- **Creating accessible natural environments:** The Enhancing Shute Park project added natural play areas and native vegetation buffers, making nature more accessible while improving ecological value.
- **Restoring critical habitats:** Habitat restoration at Sturgeon Lake, funded through Metro grants, reintroduced water flow and revitalised fish and wildlife ecosystems, benefiting both nature and local communities.

Resilience:

- **Mitigating urban heat islands:** Tree planting and shaded gathering spaces at projects like Restoring Nature in Hamby Park improve urban cooling and provide climate resilience during heat events.
- **Improving water quality**: Urban stream restoration initiatives, such as those funded through the Community Choice Grants, reduce stormwater runoff and restore native vegetation to improve watershed

The Nature in Neighborhoods Grants Handbook and featured case studies illustrate Metro's commitment to empowering community-led projects. These resources highlight successful initiatives that integrate nature into urban spaces, improve access to green areas, and promote equity and resilience throughout the Portland metropolitan region.

“By investing in community-led projects, the Nature in Neighborhoods Grants Program ensures equitable access to nature while addressing climate resilience and biodiversity restoration in urban spaces.”

– Metro Parks and Nature Initiative

health.

- **Enhancing flood management:** The Sandy River Delta project strengthened floodplain resilience while enhancing wildlife habitats, demonstrating how nature-based solutions address both ecological and community needs.

Impact and Outcomes

Successes:

- Increased investment in historically underserved communities, ensuring equitable access to nature and environmental benefits.
- Funded a wide range of impactful projects, including salmon habitat restoration, nature-based playgrounds, and community gardens.
- Strengthened partnerships between government agencies, non-profits, and local communities.

Challenges:

- Securing matching funds can be a barrier for smaller organisations.
- Ensuring sustained community engagement throughout project lifecycles requires ongoing support.

Lessons Learned:

- Racial equity must be embedded in all phases of the project, from planning to implementation.
- Flexible funding models and technical assistance can empower smaller organisations to participate effectively.

Influence on Urban Design

The Nature in Neighborhoods Grants Program has influenced urban design by emphasising the integration of green infrastructure and nature-based solutions into public spaces. This approach demonstrates how ecological restoration and community-driven design can enhance urban environments, creating healthier, more liveable neighbourhoods.

Recommendations for Other Cities

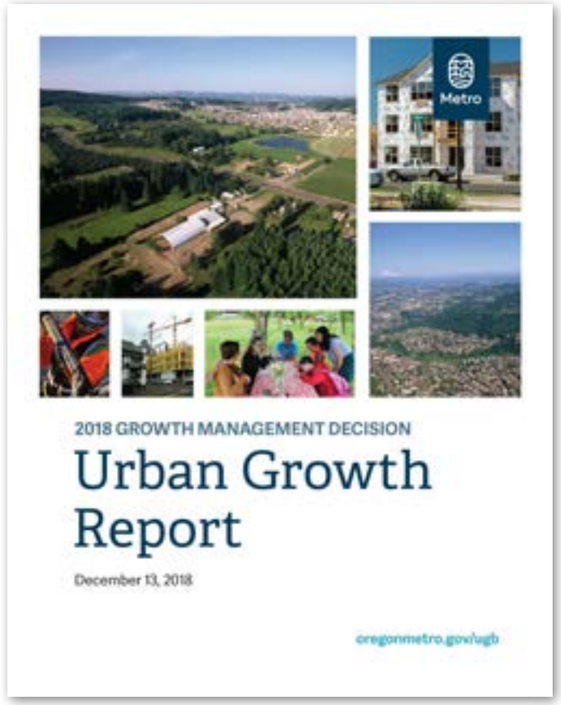
- **Prioritise Equity:** Embed racial and social equity in funding criteria and project planning to ensure historically marginalised communities benefit.
- **Foster Partnerships:** Encourage collaboration between diverse stakeholders to maximise project impact and sustainability.
- **Support Community Engagement:** Provide resources for meaningful community involvement in decision-making processes.

Hoyt Arboretum Friends was awarded $500,000 to increase connection to nature for visitors by improving accessibility while creating meaningful learning experiences in a unique global tree collection.

Friends of Tryon Creek, in partnership with Oregon State Parks, Cultural Lifeways Community was awarded $350,000 to create a new education space for the whole community within the urban forest, grounded in ancestral design.

3.3.2

urban growth boundary



The Urban Growth Report 2018 provides a comprehensive analysis of Portland's growth needs and land use strategies, while the Urban Growth Boundary map visually defines the region's commitment to balancing urban development with the protection of farmland, forests, and natural areas.

Overview

Jurisdiction: Portland metropolitan area, Oregon, USA

Policy Type: Land Use Planning Regulation

Purpose: Established in 1979, Portland's Urban Growth Boundary (UGB) is a pioneering land-use planning tool designed to curb urban sprawl, protect farmland and natural habitats, and promote efficient urban development. Managed by Metro, the UGB aligns with Oregon's state-mandated land-use goals to ensure sustainable growth and resource conservation.

Key Provisions

Scope:

- Encompasses a defined boundary around the Portland metropolitan area, separating urbanisable land from rural areas.
- Applies to all cities and counties within Metro's jurisdiction, including Beaverton, Gresham, Hillsboro, and others.

Implementation:

- **Periodic Reviews:** Metro is required to evaluate the UGB every six years to ensure sufficient land supply for housing and employment over the next 20 years.
- **Expansion Process:** UGB expansions occur only when necessary, based on demonstrated needs for additional land, and must prioritise efficiency and the protection of natural resources.
- **Urban and Rural Reserves:** The region uses reserves to designate areas for future urbanisation while protecting long-term rural lands.

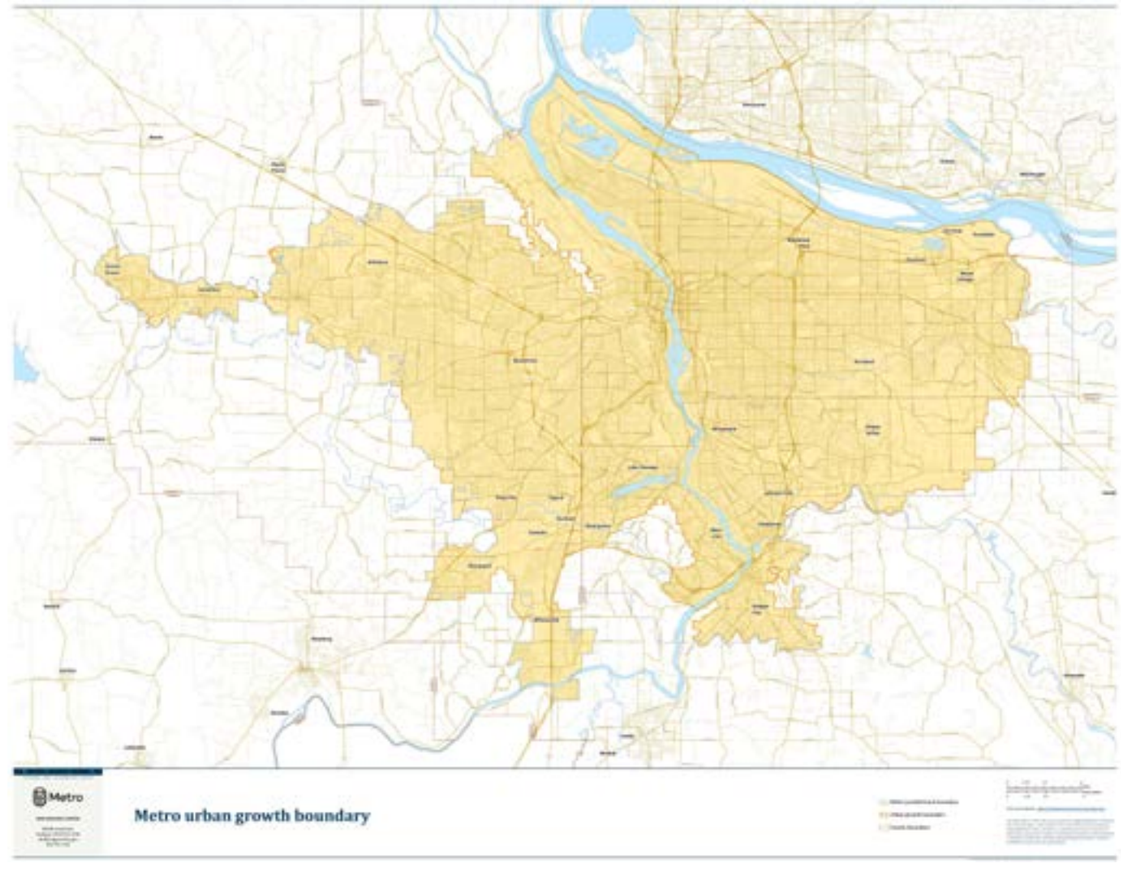
Relevance to Renaturing and Resilience

Renaturing:

- **Protecting Natural Habitats:** The UGB helps safeguard forests, wetlands, and wildlife corridors by concentrating development within a specific boundary.
- **Enhancing Green Infrastructure:** Compact urban development creates opportunities for green spaces and parks, contributing to urban biodiversity and community well-being.
- **Preserving Farmland:** By limiting urban expansion, the UGB ensures the continued viability of farmland close to urban markets.

Resilience:

- **Mitigating Climate Change:** Compact growth reduces reliance on car travel, lowering greenhouse gas emissions.
- **Reducing Infrastructure Costs:** Focused development within the UGB minimises the need for sprawling infrastructure, reducing long-term maintenance and environmental impact.



“The Urban Growth Boundary ensures that as our region grows, we do so responsibly—protecting farmland, forests, and natural areas while creating vibrant, efficient urban spaces.”

– Metro, Portland’s Regional Government

- **Adaptation to Population Growth:** By directing growth strategically, the UGB supports efficient use of resources and builds resilient urban systems.

Impact and Outcomes

Successes:

- **Farmland and Natural Area Preservation:** Protected over 25 million acres of farmland and significant natural habitats since its inception.
- **Efficient Urban Development:** Facilitated the development of compact, transit-oriented neighbourhoods such as w, which combines housing, retail, and transit access.
- **Model for Other Regions:** Inspired similar growth boundaries in cities like Vancouver, British Columbia, and Boulder, Colorado.

Challenges:

- **Housing Affordability:** Critics argue that limiting land supply can increase housing costs. Metro has addressed this through targeted expansion and urban density strategies.
- **Balancing Competing Interests:** Conflicts arise between development pressures and the need to preserve farmland and natural areas.

Lessons Learned:

- A clear, transparent process for UGB expansion is essential to balance growth needs with conservation goals.
- Integrating community input ensures equitable outcomes and fosters public trust.
- Complementary policies, such as incentives for affordable housing and green infrastructure, enhance the UGB's effectiveness.

Influence on Urban Design

Portland’s UGB has significantly shaped urban design by encouraging compact, walkable communities and efficient land use. Developments such as Orenco Station exemplify how the boundary promotes density while preserving green spaces, creating vibrant urban areas that balance liveability with sustainability.

Recommendations for Other Cities

- **Adopt a Clear Boundary Policy:** Define an urban growth boundary with periodic reviews to manage long-term growth.
- **Incorporate Reserves:** Use urban and rural reserves to plan for future growth while protecting essential resources.
- **Promote Compact Development:** Encourage transit-oriented, mixed-use development to maximise land use within the boundary.
- **Address Housing Affordability:** Pair growth boundaries with strategies for affordable housing to prevent unintended cost increases.

Tualatin Hills Nature Park (top) exemplifies accessible green spaces within urban areas, Orenco Station (middle) showcases compact, transit-oriented development with integrated greenery, and Forest Park (bottom) highlights one of the largest urban forests protected within Portland’s Urban Growth Boundary.

4

seattle, washington

First Nations and Traditional Ecological Knowledge

For thousands of years, the Duwamish, Suquamish, and Coast Salish peoples lived in harmony with the waterways, forests, and prairies of the Puget Sound region. Their sustainable practices included selective harvesting, controlled burns, and salmon habitat management, ensuring the long-term health of the environment. The Duwamish River, central to their way of life, provided food, transportation, and cultural significance.

European settlement in the mid-19th century led to widespread displacement and environmental degradation. The Duwamish Tribe, though not federally recognised, continues to advocate for the restoration of their ancestral lands and waterways. Indigenous-led conservation efforts are reintegrating traditional ecological knowledge into Seattle's sustainability strategies, particularly in river restoration projects.

Colonisation and the Transformation of Puget Sound

Seattle's urbanisation began with the arrival of settlers in 1851, who saw the region's dense forests and waterways as prime resources for economic growth. Logging became the city's first major industry, with old-growth trees harvested to fuel westward expansion. By the early 20th century, the city's topography had been significantly altered, including the Denny Regrade project, which levelled entire hills to accommodate infrastructure.

The Duwamish River was straightened and industrialised, leading to severe pollution and habitat loss. Salmon populations, once abundant, began to decline as dams, urban runoff, and deforestation disrupted their migration routes. The transformation of Elliott Bay into a shipping and industrial hub further eroded marine ecosystems.

By the mid-20th century, environmental degradation spurred new conservation efforts. The 1972 Clean Water Act and local activism helped improve water quality, laying the foundation for Seattle's modern ecological restoration efforts.

Contemporary Urbanisation and Ecological Innovation

Seattle has emerged as a leader in green infrastructure, climate resilience, and ecological urbanism. The city's Green Factor policy mandates that new developments include green roofs, stormwater gardens, or tree planting to reduce runoff and heat retention.

Projects like the Bullitt Center, one of the world's first net-zero energy office buildings, and the Seattle Green Streets Program, which integrates bioswales and permeable pavements, showcase how nature can be reintegrated into urban landscapes. The Elliott Bay Seawall Project has been redesigned to protect the waterfront from sea-level rise while restoring intertidal habitats for marine life.

Community-driven projects such as the Beacon Food Forest, a seven-acre urban permaculture site, and the Thornton Creek Restoration, which improves water quality and habitat connectivity, highlight the city's commitment to renaturing urban spaces. However, as Seattle's population grows, balancing housing demands with green space preservation remains a challenge.

Ecosystems and Biodiversity: A Changing Landscape

Seattle's location between Puget Sound and the Cascade Mountains supports diverse ecosystems, from coastal wetlands to old-growth forests. These habitats provide essential refuge for salmon, orcas, bald eagles, and pollinators.

However, urban expansion has led to habitat fragmentation, declining salmon runs, and water pollution. The Green-Duwamish Watershed Alliance is working to restore the river's health by removing barriers to fish migration and reducing industrial pollution. Similarly, Seattle's Tree Canopy Initiative aims to expand tree cover, improving air quality and climate resilience.

Efforts such as the Backyard Habitat Program and pollinator-friendly landscaping promote urban biodiversity, while the restoration of Discovery Park and the Washington Park Arboretum ensures that Seattle's ecological heritage is preserved.

Climate Challenges and Resilience Strategies

Seattle faces growing climate threats, including sea-level rise, extreme storms, and urban heat islands. The city's dense urbanisation and reliance on aging infrastructure make it particularly vulnerable to flooding and storm surges.

The aftermath of Hurricane Sandy (2012) influenced Seattle's climate adaptation planning, leading to investments in shoreline restoration, floodplain expansion, and green stormwater systems. Projects such as the Salmon Bay Estuary Restoration and the Smith Cove Habitat Project integrate ecological resilience with flood mitigation.

Extreme heat events are another concern, particularly for low-income communities with limited green space. The city has expanded tree-planting programs and cooling infrastructure, including reflective surfaces and shaded public spaces, to combat urban heat.

Seattle is also committed to achieving net-zero emissions by 2050, with major investments in offshore wind energy, electrification, and public transit expansion. Sustainable mobility efforts, such as the city's bike-friendly infrastructure and pedestrian zones, further align with climate goals.

Economic and Social Considerations

Seattle's rapid growth, fuelled by the tech industry, has led to rising housing costs and displacement, particularly in communities of colour. While green investments have improved quality of life, concerns about eco-gentrification—where environmental improvements drive up property values—persist.

To address this, the Duwamish Valley Action Plan prioritises climate adaptation and pollution reduction in historically marginalised neighbourhoods. Community-led organisations like Got Green ensure that green job training, clean energy programs, and affordable housing initiatives are accessible to all residents.

Seattle's future depends on balancing climate resilience, ecological restoration, and economic inclusivity, ensuring that environmental progress benefits the entire city.

4.1

projects

Byera Hadley Travelling Scholarships Journal Series

4.1.1

the beach at expedia group

Project Overview

Location: Seattle, Washington, along the Puget Sound waterfront at One Expedia Group Way West.

Designer(s): Surfacedesign, Inc.

Client: Expedia Group

Physical Size: Approximately 2.6 acres (1.05 hectares) within a 40-acre campus.

Context: Historically an industrial site with commercial finger piers supporting shipping, railroads, and logging industries, the area was infilled with debris and dirt during the mid-20th century. This led to contamination and a lack of ecological value. The redevelopment sought to transform this post-industrial landscape into a thriving, biodiverse public waterfront space.

Purpose

The Beach at Expedia Group serves as a central feature of Expedia's Seattle headquarters, reimagining the urban waterfront to prioritize biodiversity, climate resilience, and community connection. The project reflects the coastal landscape of the Pacific Northwest, creating ecological value, promoting urban-nature interaction, and offering inclusive public spaces that support social cohesion.

Key Design Strategies

Renaturing:

- Native Vegetation: The project exclusively uses native and climate-adapted plants to restore the site's ecological integrity. The planting palette includes grasses, perennials, and wetland species that replicate the natural character of Puget Sound.
- Habitat Creation: Layered landscapes with beach pebbles, driftwood, and dune plantings create diverse habitats for birds, insects, and other wildlife, enhancing biodiversity in the urban environment.
- Material Reclamation: The project incorporates reclaimed materials such as boulders, driftwood, and natural beach elements, serving functional and aesthetic roles while reducing construction waste. These materials are used to define pathways, act as informal seating, and support habitat creation.

Resilience:

- Stormwater Management: The site integrates subtle gradients and permeable surfaces, such as pebbled beaches and planted dunes, to manage stormwater runoff, mitigate flooding, and support coastal resilience.
- Ecological Restoration: Extensive soil remediation addressed contamination from industrial activity, creating a healthy foundation for the restored landscape.
- Community-Focused Design: The Beach connects to the Elliott Bay Trail, enhancing urban mobility and

accessibility. Terraced overlooks, informal seating, and gathering spaces promote social interaction, support mental well-being, and create a sense of place for employees and the public.

Outcomes and Lessons Learned

Impact:

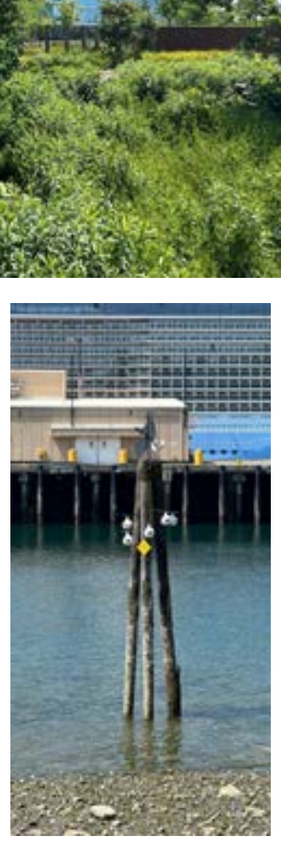
- Ecological Benefits: The integration of native plantings and habitat features has increased biodiversity, offering critical spaces for urban wildlife to thrive.
- Urban Resilience: The project's approach to stormwater management and flood mitigation has reduced environmental risks while enhancing climate adaptability.
- Social Enhancements: By transforming the waterfront into an inviting public space, the project has strengthened community ties, offering spaces for relaxation, recreation, and connection with nature. Employees and visitors alike benefit from the tranquility of this restored coastal environment.

Challenges and Innovations:

- Site Transformation: Overcoming the site's industrial legacy required innovative approaches to soil remediation, habitat creation, and sustainable design.
- Balancing Functions: Designing a landscape that balances ecological priorities with the needs of a corporate campus and public use posed unique challenges. The careful layering of spaces ensures seamless coexistence of wildlife habitats and human activities.
- Material Innovation: The reuse of natural elements such as driftwood and boulders demonstrates how reclaimed materials can create functional, aesthetically pleasing, and ecologically supportive spaces.

Takeaways

- Prioritising biodiversity through native and climate-adapted plantings can restore ecological integrity to degraded urban sites.
- Thoughtful integration of stormwater management and permeable surfaces supports climate resilience while blending into naturalistic landscapes.
- Transforming industrial sites into multifunctional spaces can balance ecological restoration with human use, creating vibrant public amenities.
- The reuse of natural and reclaimed materials can reduce construction waste while fostering ecological and aesthetic connections.
- Corporate campuses can actively contribute to urban resilience and biodiversity while fostering social and ecological benefits for employees and communities.



4.1.2

beacon food forest

Project Overview

Location: Seattle, Washington, adjacent to Jefferson Park on Beacon Hill, near 15th Avenue South and South Dakota Street.

Designer(s): Jacqueline Cramer and Glenn Herlihy.

Client: Community-led initiative supported by the City of Seattle.

Physical Size: Approximately 7 acres.

Context: Established in 2012, Beacon Food Forest is situated on land owned by Seattle Public Utilities. It is believed to be the largest food forest on public land in the United States. The project emerged from a community-driven effort to transform under-utilised urban space into a productive, educational, and ecological asset.

Purpose: The Beacon Food Forest aims to cultivate a community dedicated to building equitable food systems for all people and stewarding the environment for the benefit of all species. By integrating principles of permaculture and agroforestry, the project seeks to create a self-sustaining urban ecosystem that provides free, accessible produce to the community, fosters environmental education, and strengthens social ties among diverse populations.

Key Design Strategies

Renaturing:

- **Agroforestry Implementation:** The food forest combines trees, shrubs, and agricultural crops to create a multi-story ecosystem that mimics the self-sustaining functions of a natural forest while incorporating food plants for human consumption.
- **Biodiversity Enhancement:** By planting a diverse range of species, including fruit and nut trees, berry shrubs, and medicinal plants, the project increases habitat complexity, supporting various pollinators and wildlife.
- **Soil Restoration:** The use of organic farming practices and perennial plantings improves soil health and promotes carbon sequestration, contributing to overall ecosystem resilience.

Resilience:

- **Community Engagement:** The project is maintained by volunteers and managed by the Food Forest Collective, a 501(c)(3) tax-exempt organization, fostering a sense of ownership and stewardship among local residents.
- **Educational Programs:** Offering classes, workshops, and work parties, the food forest educates the public on sustainable agriculture, permaculture principles, and environmental stewardship, building community resilience through knowledge sharing.
- **Open Harvest Policy:** The food forest operates with an open harvest policy, allowing community

members to freely forage, thereby enhancing food security and promoting equitable access to nutritious produce.

Outcomes and Lessons Learned

Impact:

- **Ecological Benefits:** The establishment of a diverse, perennial-based ecosystem has improved local biodiversity, soil health, and urban green space, contributing to ecological stability.
- **Social Enhancements:** The food forest has become a hub for community interaction, cultural exchange, and education, strengthening social cohesion and fostering a sense of belonging among participants.
- **Food Security:** By providing free access to fresh produce, the project addresses food sovereignty and offers a local solution to food insecurity challenges.

Challenges and Innovations:

- **Funding and Resources:** As a nonprofit volunteer-organised collective, securing consistent funding has been challenging, impacting the ability to sustain staffing and operations. In 2024, the organisation faced critical financial constraints, leading to potential staffing reductions.
- **Volunteer Engagement:** Maintaining a steady volunteer base requires ongoing community outreach and engagement, as participation can fluctuate with seasons and individual availability. The project offers various volunteer opportunities, including work parties and committee involvement, to encourage participation.
- **Land Use Agreements:** Operating on public land necessitates continuous collaboration with city agencies, such as the Seattle Department of Neighbourhoods P-Patch Community Gardening Program, to align objectives and secure long-term site access.

Takeaways

- **Community-Led Initiatives:** Empowering local communities to lead urban agriculture projects fosters ownership, resilience, and sustainable stewardship of shared spaces.
- **Integration of Education:** Incorporating educational components into urban agriculture projects enhances community knowledge, engagement, and long-term success.
- **Adaptive Management:** Flexibility and adaptability in management practices are crucial to address challenges such as funding constraints and volunteer variability.
- **Partnerships:** Collaborations with municipal agencies and other organisations can provide essential support and resources, facilitating project sustainability and growth.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Why Do We Need Forests in the City?

4.2

policies

4.2.1

green seattle partnership

Overview

Jurisdiction: Seattle, Washington, USA

Policy Type: Public-Private Restoration Program

Purpose: The Green Seattle Partnership (GSP), initiated in 2005, is a collaborative effort aimed at restoring and maintaining 2,500 acres of Seattle's forested parklands by 2025. This initiative addresses environmental degradation, enhances urban biodiversity, and fosters community engagement in ecological stewardship.

Key Provisions

Scope:

- Encompasses all forested parklands within Seattle, totalling approximately 2,500 acres, including significant areas such as Discovery Park, the city's largest green space, and Seward Park, which contains one of the few remaining old-growth forests in Seattle.

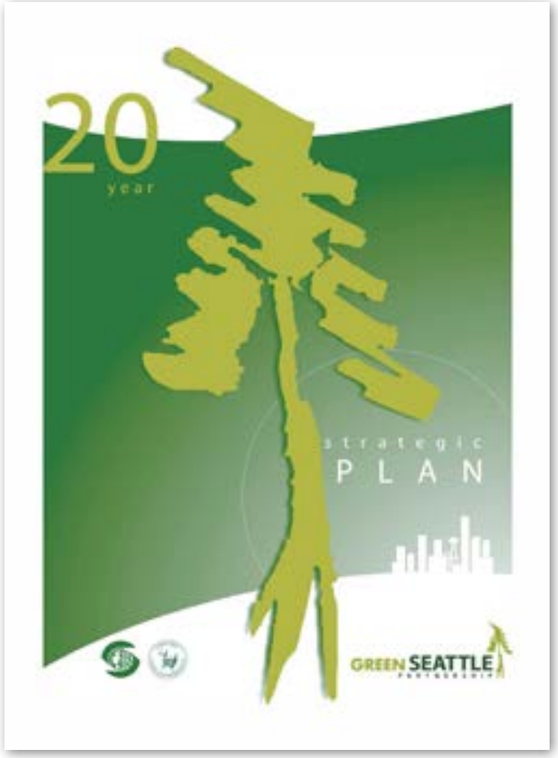
Implementation:

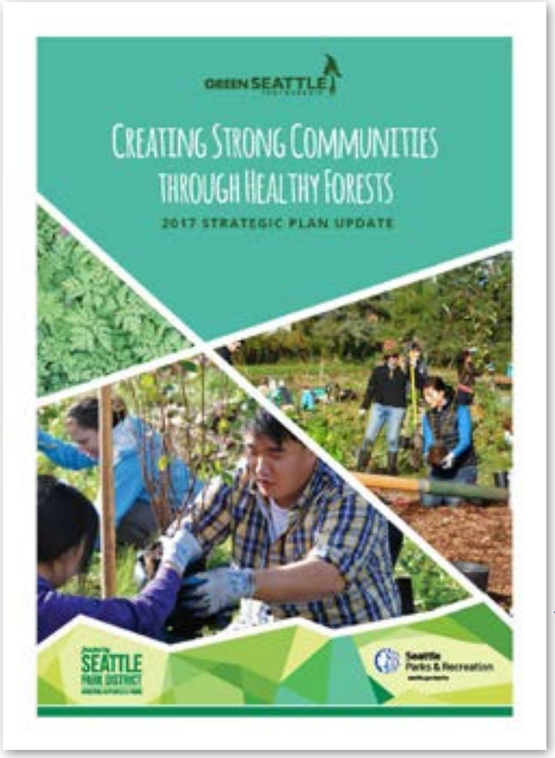
- Collaborative efforts involve the City of Seattle, volunteers, and community groups, including partnerships with Indigenous-led organisations such as the Na'ah Illahee Fund and Futures Rising. These collaborations focus on connecting plant communities to their traditional territories and engaging BIPOC youth in ecological restoration and urban forestry.
- Utilises a four-phase restoration process: invasive species removal, native planting, establishment, and long-term stewardship.
- Incorporates data collection and mapping tools, such as the Green Cities Mapper, to prioritise areas for restoration based on factors like forest health, canopy coverage, and habitat connectivity.

Relevance to Renaturing and Resilience

Renaturing:

- **Restoring Native Habitats**: Projects like the Seward Park Forest Restoration focus on removing invasive species and reintroducing native vegetation, providing critical habitat for local wildlife, including bird species and small mammals.
- **Enhancing Urban Green Spaces:** Restoration efforts in parks such as Carkeek Park not only improve ecological health but also offer educational opportunities through features like the Environmental Learning Center, which demonstrates sustainable building practices and fosters community involvement.
- **Collaborating with First Nations:** GSP acknowledges the traditional lands of the Duwamish Tribe and engages in partnerships with Indigenous-led organisations to integrate traditional ecological knowledge into restoration practices.





Key documents supporting the Green Seattle Partnership's mission. The 20-Year Strategic Plan (top left) establishes the long-term vision and framework for restoring Seattle's urban forested parklands. The 2017 Strategic Plan Update (top right) outlines progress and future goals for creating resilient, healthy forests. The Forest Steward Field Guide (bottom left) equips volunteers with knowledge and tools for on-the-ground restoration efforts.

"Our vision is a city with invasive-free, sustainable forested parklands. Seattle's urban forest will be supported by an aware and engaged community in which individuals, neighborhoods, nonprofits, businesses, and City government work together to protect and maintain this resource."

— Green Seattle Partnership 20-Year Plan

Restoration efforts in the Green-Duwamish Watershed highlight the ecological and cultural connections of the region. The Duwamish River (top) provides critical riparian habitat and restoration context, while art installations (bottom) celebrate cultural heritage and environmental stewardship.

Resilience:

- **Mitigating Climate Impacts:** Restored urban forests contribute to carbon sequestration, reduce urban heat island effects, and manage stormwater runoff, thereby enhancing the city's resilience to climate change.
- **Community Engagement:** Programs like the Forest Steward Program train volunteers to lead local restoration efforts, strengthening community bonds and promoting environmental stewardship.
- **Data-Driven Adaptation:** The use of tools like the GSP Forest Monitoring Dashboard allows for adaptive management by tracking restoration progress and informing decision-making processes.

Impact and Outcomes

Successes:

- Restored over 1,700 acres of forested parkland, including areas in Seward Park and Interlaken Park, enhancing ecological integrity and public access to natural spaces.
- Engaged over 100,000 volunteers, contributing millions of hours to restoration activities and fostering a culture of environmental stewardship within the community.
- Improved biodiversity, evidenced by increased native plant coverage and the return of various bird species to restored habitats.

Challenges:

- Ongoing management of invasive species, such as Himalayan blackberry, requires continuous effort and resources.
- Soil degradation in certain areas poses challenges for the establishment and growth of native plants.

Lessons Learned:

- Engaging with Indigenous communities and incorporating traditional ecological knowledge enhances the effectiveness and cultural relevance of restoration efforts.
- Comprehensive volunteer training programs ensure high-quality restoration outcomes and build long-term community investment in urban forests.

Influence on Urban Design

The Green Seattle Partnership integrates ecological restoration with urban design by enhancing green infrastructure and public spaces. For instance, the Carkeek Park Environmental Learning Center demonstrates sustainable building practices, serving as a model for incorporating ecological considerations into urban development.

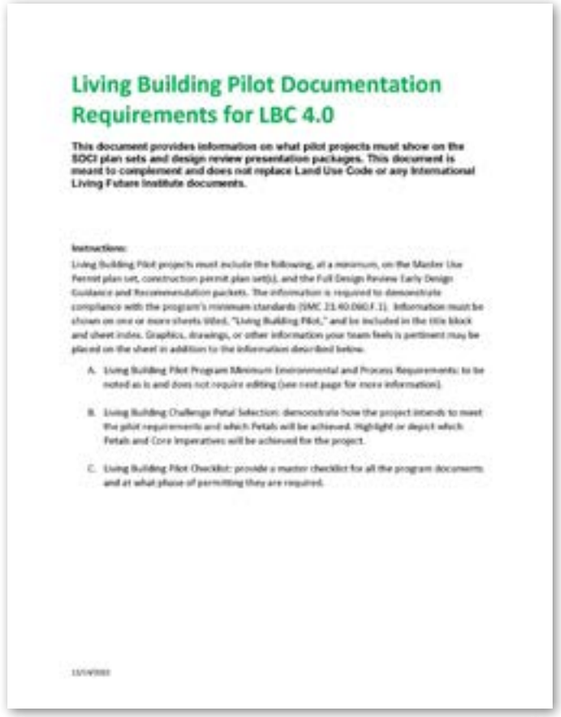
Additionally, Seattle's participation as a "Role Model City" in the United Nations Environment Program's initiatives highlights the city's commitment to integrating nature-based solutions into urban planning and development.

Recommendations for Other Cities

- **Foster Inclusive Partnerships:** Collaborate with Indigenous communities, local organisations, and residents to incorporate diverse perspectives and knowledge systems into urban restoration projects.
- **Utilise Advanced Mapping Tools:** Implement technologies like the Green Cities Mapper to effectively prioritise restoration areas and monitor ecological health.
- Develop initiatives similar to the Forest Steward Program to build local capacity for ongoing restoration and maintenance efforts.

4.2.2

living building pilot program



Living Building Pilot Documentation Requirements for LBC 4.0

This document provides information on what pilot projects must show on the SDCI plan sets and design review presentation packages. This document is meant to complement and does not replace Land Use Code or any International Living Future Institute documents.

Instructions:
Living Building Pilot projects must include the following, at a minimum, on the Master Use Permit plan set, construction permit plan set(s), and the Full Design Review Early Design Guidance and Recommendation packets. The information is required to demonstrate compliance with the program's minimum standards (SMC 23.40.060.F.1). Information must be shown on one or more sheets titled, "Living Building Pilot," and be included in the title block and sheet index. Graphics, drawings, or other information your team feels is pertinent may be placed on the sheet in addition to the information described below.

A. Living Building Pilot Program Minimum Environmental and Process Requirements: to be noted as is and does not require editing (see next page for more information).

B. Living Building Challenge Petal Selection: demonstrate how the project intends to meet the pilot requirements and which Petals will be achieved. Highlight or depict which Petals and Core Imperatives will be achieved for the project.

C. Living Building Pilot Checklist: provide a master checklist for all the program documents and at what phase of permitting they are required.

11/19/2021

Overview

Jurisdiction: Seattle, Washington, USA

Policy Type: Green Building Incentive Program

Purpose: The Living Building Pilot Program (LBPP), launched in 2009, promotes the development of environmentally regenerative buildings that meet the Living Building Challenge (LBC) standards. It encourages innovation in urban design by integrating sustainability, ecological restoration, and resilience through targeted incentives for developers.

Key Provisions

Scope:

- Applicable to new and existing buildings outside shoreline jurisdictions.
- Projects must achieve full LBC certification or Petal Recognition in at least three performance areas, including Energy, Water, or Materials.

Incentives:

- **Increased Floor Area Ratio (FAR):** Developers can access up to 25% additional FAR, or 30% for projects preserving unreinforced masonry structures, enabling greater design flexibility.
- **Height Bonuses:** Additional height allowances of 10–20 feet, depending on zoning, support dense, sustainable urban growth.
- **Design Flexibility:** Exemptions from specific land use requirements, including parking, density, and structural overhangs, allow for innovative architectural solutions.

Implementation:

- Developers submit a Master Use Permit application with a plan detailing compliance with LBC certification.
- Projects must provide a third-party compliance report based on one year of post-occupancy performance data.
- The program is capped at 20 projects and is set to expire in 2030.

Relevance to Renaturing and Resilience

Renaturing:

- **Pollinator-Friendly Habitats:** LBPP projects enhance urban biodiversity through features like honeybee apiaries, such as those found at 35 Stone, where visitors can use a rooftop periscope to view the bees in action. Native landscaping complements these efforts, supporting pollinators across the city.
- **Stormwater and Aquatic Ecosystem Health:** The Watershed Building treats over 400,000 gallons of stormwater annually through bioswales and rain gardens, reducing pollution entering Lake Union while supporting local ecosystems.
- **Green Roofs and Native Vegetation:** Projects incorporate green roofs and native plantings, fostering habitat for urban birds and insects and creating ecological continuity within dense urban environments.

Resilience:

- **Net-Positive Energy Systems:** Projects generate surplus energy through extensive solar arrays, reducing dependency on centralised grids and enhancing energy security during climate disruptions.
- **Water Independence:** Rainwater capture and filtration systems reduce reliance on municipal water while mitigating flood risks and promoting resilience against water scarcity.
- **Mental Health Benefits through Biophilic Design:** Inclusion of natural elements such as timber interiors, green walls, and rooftop terraces.

Impact and Outcomes

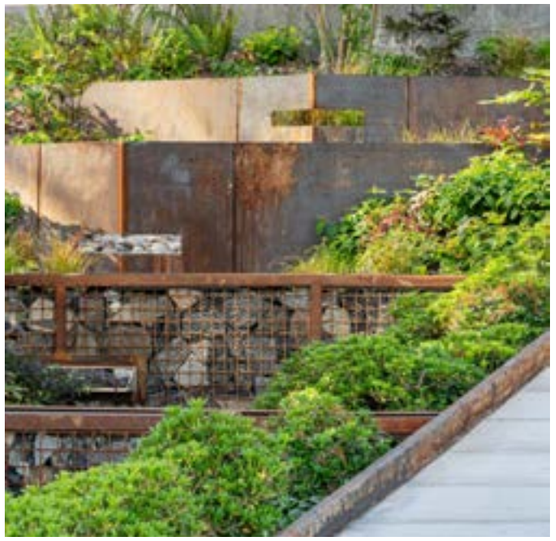
Successes:

- Enabled pioneering projects like the Bullitt Center, which achieved full LBC certification, demonstrating the feasibility of net-positive energy and water systems in commercial office buildings.
- Promoted significant reductions in resource use, such as the Watershed Building, which reduced potable water use by 88% and treats substantial stormwater runoff.

The Living Building Challenge 4.0 serves as a roadmap for regenerative design, pushing the boundaries of sustainability in urban development. Seattle's Living Building Pilot Program aligns with this vision, providing detailed documentation requirements to support developers in meeting ambitious environmental standards. At its core, the program embodies a commitment to creating harmonious, sustainable, and restorative spaces.

“The Living Building Pilot Program is an important tool to encourage developers who are transforming our City to construct to the built environment’s most rigorous performance standard – The Living Building Challenge – while meeting important implementation targets outlined in the 2013 Seattle Climate Action Plan,”

— Amanda Sturgeon, CEO of the International Living Future Institute



- Advanced urban biodiversity and occupant engagement, as seen at 35 Stone, where features like the honeybee apiary and biophilic design foster ecological stewardship and mental well-being.

Challenges:

- High upfront costs and regulatory complexities limit participation.
- A 20-project cap restricts the scalability and broader adoption of the program.

Lessons Learned:

- Streamlined permitting and clearer compliance guidelines enhance accessibility for developers.
- Cross-sector collaborations, such as partnerships with universities, architects, and developers, expand capacity for innovative, sustainable building practices.

Influence on Urban Design

The LBPP has reshaped urban design in Seattle by integrating sustainability into dense urban environments. Participating buildings balance energy efficiency, water reuse, and ecological restoration. Projects can harmonise with ecological restoration, creating a global model for regenerative urban design.

Recommendations for Other Cities

- **Flexible Incentives:** Offer zoning bonuses, such as increased FAR and height allowances, to encourage green building practices.
- **Cross-Sector Collaboration:** Partner with universities and nonprofits to advance sustainable design research and implementation.
- **Promote Public Awareness:** Showcase successful projects to inspire adoption and build community support for sustainable initiatives.

Seattle’s Living Building Pilot Program brings transformative ecological and architectural design to life: Watershed (top) emphasises innovative green stormwater infrastructure and lush urban landscaping. At 35 Stone (middle), a striking honeycomb canopy and landscaped spaces promote biodiversity and community engagement. The Bullitt Center (bottom), often called the “greenest commercial building in the world,” showcases solar PV integration and natural water treatment features in the public domain, setting a global benchmark for sustainable urban design.

5

charlottesville, virginia

First Nations and Traditional Ecological Knowledge

Long before Charlottesville became a city, the Monacan Nation thrived in the Piedmont region of Virginia. They cultivated crops using rotational agriculture, sustainably managed forests through controlled burns, and relied on the Rivanna River and James River watersheds for fishing, transportation, and spiritual practices.

The arrival of European settlers in the 18th century led to land seizures, forced removals, and the disruption of Monacan traditions. By the early 20th century, many Indigenous burial sites and settlements had been destroyed or repurposed for urban development. Today, the Monacan Indian Nation continues to fight for land recognition and ecological restoration, particularly around Rassawek, a sacred site at risk from infrastructure projects.

Colonisation and the Transformation of the Piedmont

Charlottesville's development began in 1762 as a small trading hub along the Rivanna River. The surrounding land, once rich in biodiversity, was rapidly converted into tobacco and wheat plantations, leading to deforestation, soil erosion, and wetland loss. Enslaved labor played a central role in sustaining the plantation economy, and the city's wealth grew at the cost of significant environmental degradation.

By the 19th century, industrialisation brought mills, railroads, and urban expansion, further altering the landscape. The Rivanna River, once teeming with fish and wildlife, became polluted from runoff and waste disposal. However, the early 20th century saw a shift toward conservation, particularly with the creation of Shenandoah National Park, which helped preserve portions of Virginia's natural environment.

Contemporary Urbanisation and Ecological Innovation

Charlottesville has increasingly prioritised sustainability, ecological restoration, and green infrastructure. The Rivanna River Renaissance project focuses on improving water quality, restoring riparian buffers, and enhancing public access to the riverfront. Similarly, the Ivy Creek Natural Area, once an eroded farm, has been transformed into a thriving protected forest and wetland habitat, demonstrating the city's commitment to renaturing efforts.

The city has adopted progressive urban forestry and stormwater management policies, integrating rain gardens, bioswales, and tree-planting initiatives into public spaces. Charlottesville's Tree Canopy Plan seeks to expand native tree coverage, reducing urban heat and improving air quality. However, urban growth pressures continue to compete with green space preservation, making sustainable land use an ongoing challenge.

Ecosystems and Biodiversity: A Fragile Balance

Charlottesville's location in the Blue Ridge foothills provides a mix of oak-hickory forests, wetlands, and riverine habitats. These ecosystems support diverse wildlife, including black bears, bobcats, and migratory birds. However, urbanisation has led to habitat fragmentation, invasive species, and declining water quality in local streams and rivers.

Restoration projects focus on removing invasive plants, improving stream buffers, and expanding protected natural areas. Organisations like the Piedmont Environmental Council advocate for land conservation easements, ensuring that rural landscapes and critical wildlife corridors remain undeveloped. Urban greening initiatives, such as native plant gardens and pollinator corridors, aim to support biodiversity within the city.

The Rivanna Stormwater Management Plan has introduced streambank stabilisation, permeable pavement installations, and wetland restoration projects to reduce erosion and improve flood resilience. These strategies enhance the health of local waterways, ensuring long-term sustainability for aquatic ecosystems.

Climate Challenges and Resilience Strategies

Charlottesville faces increasing climate risks, including extreme heat, intense storms, and periodic flooding. Rising summer temperatures threaten public health, particularly in neighbourhoods with limited tree canopy coverage. The city has expanded its tree-planting and shade equity programs, prioritising heat-vulnerable communities.

Flooding is another growing concern, as heavier rainfall events strain outdated drainage systems and increase runoff into the Rivanna River. Charlottesville has invested in stormwater infrastructure upgrades, floodplain restoration, and permeable pavement solutions to reduce urban flooding and protect critical ecosystems.

Charlottesville has also committed to 100% renewable electricity for municipal operations by 2030, with investments in solar energy and energy-efficient building retrofits. The city promotes green building practices and electrification to lower carbon emissions while increasing local energy resilience.

Economic and Social Considerations

While Charlottesville's environmental initiatives have improved sustainability, economic inequality and housing affordability remain major challenges. Green space access is unevenly distributed, and many lower-income communities remain vulnerable to heat stress, pollution, and flood risks.

Concerns over eco-gentrification—where sustainability efforts drive up property values and displace long-term residents—have surfaced as green developments expand. To address this, Charlottesville is integrating affordable housing policies into environmental planning. The Southwood Redevelopment project aims to combine affordable housing with green infrastructure, ensuring equitable access to sustainable urban living.

Community-driven efforts, such as the Charlottesville Food Justice Network, work to provide access to fresh, locally grown food through urban agriculture and farmers' markets. Programs like StreamWatch engage residents in water quality monitoring and conservation efforts, fostering a sense of environmental stewardship.

5.1

people

5.1.1

tim beatley, university of virginia

“We need to shift from seeing nature as secondary to making it central to how we design and live in cities.”

Bio

Tim Beatley is a **Professor of Urban Planning** at the **University of Virginia (UVA) School of Architecture** and a leading advocate for **biophilic cities, urban resilience, and nature-based urbanism**. With a career spanning multiple decades, he has authored numerous books on **biophilic design, green urbanism, and coastal resilience**, shaping global discussions on how cities can integrate nature at every scale.

Tim is the founder of the **Biophilic Cities Network**, which brings together cities committed to embedding nature into urban life. His research explores **how urban environments can support biodiversity, human wellbeing, and climate resilience** through **immersive, nature-first design approaches**. His work has influenced urban planning strategies worldwide, emphasizing that **anything that makes a city more biophilic also makes it more resilient**.

Key Themes from the Interview

The Origins of Biophilic Cities

Tim’s interest in **biophilic urbanism** was sparked by a conference on **biophilic design**, led by **Stephen Kellert** at Yale. While much of the early work focused on buildings and interiors, Tim saw the need to **expand these ideas to entire cities**.

“We need to be thinking about biophilic design beyond buildings—between buildings, across neighborhoods, and at the regional scale.”

His early writing on biophilic cities evolved into a global movement, advocating for nature-first planning and immersive urban biodiversity.

Biophilic Cities as a Path to Resilience

Tim argues that **biophilic design is a fundamental resilience strategy**. Cities that integrate green infrastructure, habitat corridors, and ecological urbanism are **better equipped to withstand climate change, support biodiversity, and enhance human wellbeing**.

“Just about anything that makes a city more natureful will also make it more resilient.”

3. Rethinking Coastal Resilience: Balancing Danger and Delight

As sea levels rise, **urban planning must shift from hard infrastructure (seawalls, levees) to nature-based solutions (living shorelines, managed retreat)**. However, cities must also **recognise the deep human connection to water** and find ways to balance climate risk with urban waterfront experiences.

“We’re drawn to water—it offers awe, relaxation, and healing. The challenge is balancing that delight with the real dangers of rising seas and stronger storms.”

4. The Role of Urban Wildlife & Coexistence with Nature

Tim highlights the importance of **embracing urban wildlife**, from coyotes in San Francisco to mountain lions in Los Angeles, as **cities become shared habitats**.

“To enjoy the benefits of wildness in a city—whether it’s coyotes, mountain lions, or birds—we need to learn how to coexist.”

This shift requires rethinking how we design urban environments to **accommodate, rather than exclude, non-human life**.

5. Equity, Social Justice, and Tree Canopy Disparities

Tim stresses that **nature-based urbanism cannot ignore social equity.** Historic redlining and systemic racism have left many low-income communities with fewer trees, hotter temperatures, and worse air quality.

“African American neighborhoods often have 10% tree canopy, while wealthier areas have 50-60%. That’s not just an environmental issue—it’s a health crisis.”

Addressing these disparities is **essential for climate resilience, public health, and environmental justice**.

6. Addressing Green Gentrification & Climate Displacement

While urban greening projects like New York’s High Line or Atlanta’s Beltline can improve quality of life, they also **risk displacing long-term residents** through rising property values. Some strategies to counteract this include:

- **Affordable housing policies** that prioritise former residents.
- **Equitable development plans** (e.g., Washington D.C.’s 11th Street Bridge Park).
- **“Just Green Enough”** approaches—where nature is added without triggering displacement.

“We need to ensure that adding nature doesn’t force out the very people who need it most.”

Looking Ahead

Tim envisions a future where:

- **Nature is at the center of urban planning**, not an afterthought.
- **Resilient cities embrace wildness**, from urban forests to wildlife corridors.
- **Equity and biophilic design go hand in hand**, ensuring access to nature for all communities.
- **Cities become places of awe**, where everyday encounters with birds, trees, and even whales shape urban life.

5.1.2

jd brown, biophilic cities network

“For biophilic cities to succeed, we need to stop seeing nature as an ‘extra’—it must be embedded into the core of how cities function.”

Bio

JD Brown is the **Program Director** for **Biophilic Cities**, leading efforts to integrate **nature-first urbanism, policy development, and equitable planning** into city initiatives worldwide. With a background in law and urban planning, JD brings a unique perspective on how **governance, policy, and legal frameworks shape biophilic urbanism**.

Biophilic Cities is both a **research initiative and a global network** of more than 50 cities working to embed **nature-based solutions, biodiversity, and green infrastructure** into planning processes. JD plays a key role in **knowledge-sharing, policy development, and turning biophilic theory into practice**, ensuring cities not only adopt nature-based strategies but also address issues of equity, funding, and community engagement.

Key Themes from the Interview

The Role of Biophilic Cities: A Global Network for Urban Nature

Biophilic Cities operates at multiple levels—**connecting cities, supporting research, and advocating for policy change**. The initiative facilitates a global exchange of ideas, enabling cities to learn from each other’s successes and challenges.

“We have more than 50 cities in the network, spanning vastly different ecosystems and cultural contexts. Planning for nature looks very different in Edmonton than it does in Costa Rica.”

From Theory to Practice: Scaling Up Biophilic Urbanism

The network is shifting focus from **knowledge-sharing to real-world implementation**. JD emphasises that successful biophilic urbanism requires three key elements:

- **Financial models** that justify investment in nature-based infrastructure.
- **Legal and regulatory frameworks** that integrate biophilia into planning.
- **Community-driven planning** that ensures nature-based solutions benefit local residents.

“It’s not just about inspiring cities with ideas—it’s about ensuring they have the funding, legal structures, and community support to make it happen.”

Finding the Right Scale: The ‘Just Green Enough’ Approach

A key challenge is determining **how much greening** a neighbourhood needs without **triggering displacement and gentrification**. JD stresses that biophilic planning must be tailored to each community’s needs.

“We need to stop thinking in blanket terms and instead focus on what scale of greening makes sense for each neighbourhood.”

This requires **deep engagement with local communities**, ensuring that green investments bring benefits without pushing out long-term residents.

Biophilic Cities & Climate Resilience: More Than Just Parks

While parks and green infrastructure are essential, JD emphasises that **biophilic cities must integrate nature across all urban systems**, including:

- **Stormwater management** (e.g., Portland’s Green Streets program).
- **Transportation planning** (e.g., integrating nature into bike lanes and transit corridors).
- **Public works and infrastructure** (e.g., Philadelphia’s stormwater retention basins under parks).

“Nature-based solutions aren’t just about beauty—they serve critical functions in making cities more resilient to climate change.”

Funding as a Barrier: Making the Economic Case for Nature-Based Solutions

One of the biggest challenges in scaling up biophilic cities is **securing funding**. Many city governments see green infrastructure as an extra cost, rather than an **investment in long-term economic and social resilience**.

JD highlights **successful value-capture models**, such as Portland’s Tabor to River project, which used distributed green infrastructure to address stormwater issues at **half the cost of traditional infrastructure**.

“The economic case for biophilic cities is strong—we just need to better document and communicate the cost savings and long-term benefits.”

The Future of Biophilic Cities: Embedding Nature in All Urban Decisions

JD envisions a future where biophilia is **embedded into every aspect of urban governance**, rather than being treated as a separate initiative.

“The ideal future for biophilic cities is one where nature is considered in every decision—whether it’s public works, transportation, or housing policy.”

Looking Ahead

JD sees the next phase of Biophilic Cities focusing on:

- **Scaling up implementation**, ensuring more cities move from ideas to action.
- **Developing new funding models**, proving the economic and social return on investment for nature-based solutions.
- **Deepening equity efforts**, ensuring green infrastructure benefits marginalised communities rather than displacing them.
- **Strengthening global collaboration**, particularly in underrepresented regions like Africa and Latin America.

5.2

projects

5.2.1

schenks branch tributary restoration

Project Overview

Location: Charlottesville, Virginia

Designers: Biohabitats, in collaboration with the City of Charlottesville and local environmental groups

Client: City of Charlottesville

Size: Approximately 1,300 linear feet of restored stream

Context: Schenks Branch is an urban stream heavily affected by pollution, erosion, and habitat degradation due to surrounding impervious surfaces and outdated infrastructure. This project was initiated to restore ecological integrity, improve water quality, and mitigate downstream impacts on the Rivanna River.

Purpose: To rehabilitate the degraded tributary by addressing erosion, restoring its ecological function, and enhancing its value as a community and environmental asset.

Key Design Strategies

Renaturing:

- **Streambank Stabilisation:** Bioengineering methods, including live stakes, coir logs, and bio-terracing, were used to stabilise streambanks and prevent further erosion. These approaches incorporated natural materials and native vegetation to create a more resilient stream corridor.
- **Native Plantings:** The riparian corridor was replanted with native trees, shrubs, and grasses to provide habitat for wildlife, filter pollutants, and create shade to lower water temperatures.
- **Floodplain Connectivity:** The stream was reconnected to its natural floodplain, enabling it to better absorb stormwater and reduce peak flow impacts during heavy rains, while restoring its natural hydrology.

Resilience:

- **Erosion and Sediment Control:** Stabilised streambanks reduced sediment transport into downstream waterways, including the Rivanna River, improving aquatic habitat.
- **Water Quality Enhancement:** The restoration enhanced the stream's ability to retain nutrients and pollutants, reducing nitrogen and phosphorus levels entering the watershed.
- **Biodiversity Improvement:** Reestablishing riparian vegetation and in-stream habitats created conditions for native fish, amphibians, and insects to return and thrive.

Community Engagement:

- **Educational Signage:** Installed along walking trails to educate residents about the project's goals, its ecological benefits, and the importance of healthy streams.
- **Public Access and Recreation:** Integrated pathways,

seating areas, and observation points for visitors to engage with and enjoy the revitalised stream.

- Volunteer Involvement: Local schools and community groups participated in planting events, fostering a sense of stewardship.

Outcomes and Lessons Learned

Impact:

- **Water Quality Benefits:** Significant reductions in sedimentation and nutrient loads have been documented, improving overall watershed health.
- **Biodiversity Gains:** Increased wildlife activity, including sightings of native bird species and aquatic organisms, reflects a healthier ecosystem.
- **Community Value:** The project created a visually appealing and educational space for local residents, blending ecological restoration with urban recreation.

Challenges and Innovations:

- **Urban Constraints:** Managing restoration activities in a dense urban setting required innovative solutions to balance ecological restoration with existing infrastructure.
- **Long-Term Monitoring:** Continued assessment ensures that planted vegetation thrives and stream health improvements are maintained over time.

Takeaways:

- **Integrated Stream Restoration:** The use of bioengineering techniques and native vegetation demonstrates how natural methods can stabilise urban streams, enhance biodiversity, and improve water quality.
- **Community and Ecology Balance:** The project highlights the importance of blending ecological restoration with public access and education, creating a space that serves both environmental and community needs.
- **Long-Term Monitoring:** Effective stream restoration requires continued monitoring and adaptive management to ensure the success of plantings, erosion control, and water quality improvements.
- **Floodplain Connectivity:** Reconnecting streams to their floodplains is a critical strategy for urban resilience, as it mitigates peak flows during storms and supports ecological health.







5.2.2

lodge creek urban buffer project

Project Overview

Location: Charlottesville, Virginia

Designers: Chesapeake Landscape Professionals, in collaboration with local volunteers and environmental organisations

Client: City of Charlottesville and local environmental nonprofits

Size: 1,500 square feet of urban riparian buffer

Context: Lodge Creek is a small urban waterway experiencing degradation from stormwater runoff, limited vegetation, and pollution from surrounding impervious surfaces. This community-driven project aimed to create a native vegetative buffer to mitigate runoff impacts, restore habitats, and enhance community involvement.

Purpose: To establish a riparian buffer that mitigates runoff, improves water quality, and fosters biodiversity while actively involving the community in ecological restoration.

Key Design Strategies

Renaturing:

- **Buffer Plantings:** Installed native grasses, flowering perennials, shrubs, and trees to stabilise soils, reduce erosion, and filter pollutants. The plantings were designed to bloom seasonally, providing aesthetic value and pollinator resources.
- **Stormwater Mitigation:** Designed swales and infiltration areas within the buffer to slow and filter stormwater flow, reducing the volume and velocity entering Lodge Creek.
- **Pollinator Habitats:** Incorporated plant species specifically chosen to attract bees, butterflies, and other beneficial insects, contributing to urban biodiversity.

Resilience:

- **Erosion Reduction:** Vegetative root systems now anchor soils along the creek banks, minimising erosion during rain events.
- **Stormwater Management:** Vegetation intercepts and absorbs runoff, removing pollutants and sediments before they reach the creek.
- **Wildlife Connectivity:** The buffer connects green spaces, providing movement corridors and habitat for urban wildlife, including birds and small mammals.

Community Engagement:

- **Volunteer Planting Days:** Local residents, including students and civic groups, participated in planting activities, fostering a sense of ownership and stewardship.
- **Public Workshops:** Organised events educated community members on the importance of riparian buffers, native plants, and urban water quality improvements.

- **Aesthetic Enhancements:** The buffer design incorporated flowering plants and natural seating areas, transforming a neglected urban creek into an attractive community feature.

Outcomes and Lessons Learned

Impact:

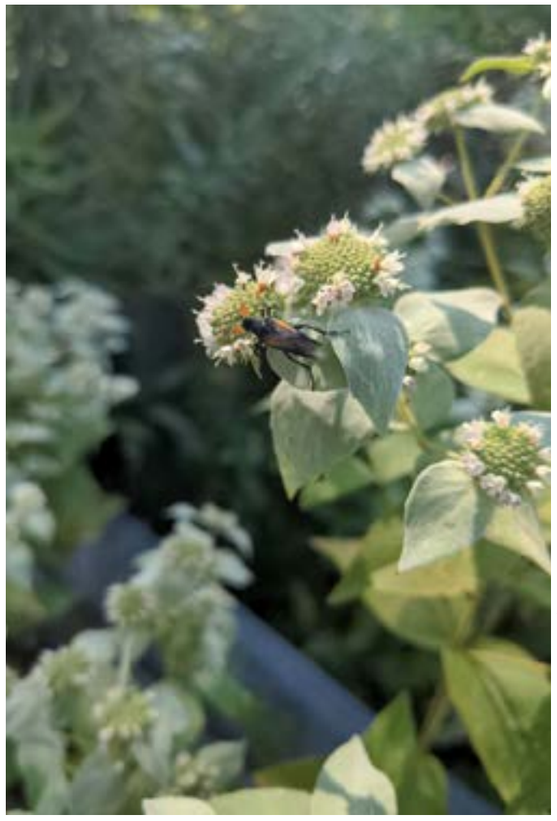
- **Community Awareness:** Increased local understanding of the role of riparian buffers in improving water quality and fostering biodiversity.
- **Ecological Gains:** The buffer has improved water quality in Lodge Creek while supporting pollinators and small wildlife.
- **Flood Resilience:** Reduced peak stormwater flows have mitigated localised flooding issues, protecting nearby infrastructure and properties.

Challenges and Innovations:

- **Small Urban Footprint:** Designing within a constrained urban space required creative strategies to maximise ecological and hydrological benefits.
- **Ongoing Maintenance:** Community engagement ensured long-term upkeep, including removing invasive species and replanting where necessary.

Takeaways:

- C**ommunity-Driven Restoration:** Active involvement of local residents in planting and maintenance ensures long-term success and fosters a sense of ownership over urban ecological projects.
- **Small-Scale Impact:** Even compact urban spaces can deliver significant ecological and hydrological benefits when designed strategically with native vegetation and stormwater management features.
- **Biodiversity Enhancement:** Introducing pollinator-friendly species not only restores habitat but also supports broader urban ecological networks.
- **Education and Awareness:** Public workshops and visible results from projects like Lodge Creek can inspire further grassroots ecological initiatives and increased community support for sustainability efforts.



5.3

policies

Byera Hadley Travelling Scholarships Journal Series

5.3.1

biophilic cities network

Overview

Jurisdiction: Charlottesville, Virginia, USA

Policy Type: Global Urban Sustainability Initiative

Purpose: The Biophilic Cities Network, established in 2013 by the University of Virginia's (UVA) School of Architecture, promotes the integration of nature into urban environments worldwide. It connects cities committed to advancing biophilic principles, such as biodiversity preservation, climate resilience, and community well-being, fostering a global exchange of ideas and best practices. Charlottesville serves as a founding member and an example of how smaller cities can implement impactful biophilic initiatives.

Key Features

Global Collaboration:

- Connects over 20 cities worldwide, including Singapore, Melbourne, and Pittsburgh, to share strategies and knowledge about embedding nature into urban life.
- Facilitates joint projects, research, and events, such as the Biophilic Cities Global Summit.

Educational and Research Leadership:

- Anchored by UVA's School of Architecture, which provides research, resources, and professional development opportunities for biophilic urban design.
- Produces publications, including the Biophilic Cities Journal, to share case studies and advancements in urban sustainability.

Local Implementation:

- Charlottesville demonstrates biophilic principles through urban gardens, pollinator pathways, stream restorations, and the expansion of public green spaces.
- Projects align with broader goals of the Biophilic Cities Network, emphasising accessibility and ecological health.

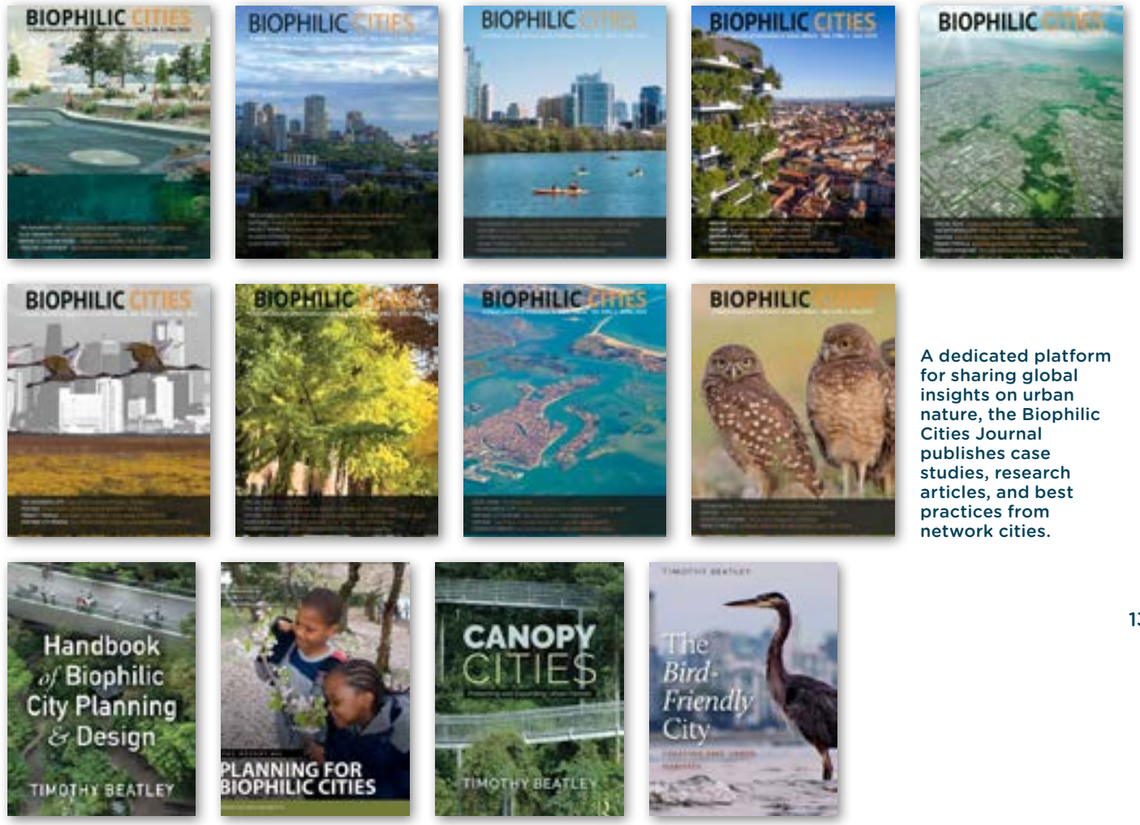
Resources and Events:

- The network provides toolkits, a Pattern Library of design strategies, and a rich calendar of events, webinars, and summits to support members in their biophilic transformations.

Relevance to Renaturing and Resilience

Renaturing:

- **Urban Biodiversity:** Encourages the creation of habitats for pollinators, birds, and native species through green corridors, gardens, and parks.
- **Community Greening**: Promotes tree planting, urban gardening, and public art celebrating nature, strengthening connections between people and their environment.



A dedicated platform for sharing global insights on urban nature, the Biophilic Cities Journal publishes case studies, research articles, and best practices from network cities.

The Biophilic Cities Network supports and promotes a diverse range of books on biophilic urbanism, sustainability, and nature-based design.

Through documentaries, interviews, and event recordings, the network shares compelling stories of biophilic transformation.

“Biophilic cities are about ensuring that nature is not an afterthought but an essential part of urban life, improving quality of life for people and ecosystems alike.”

– Tim Beatley, Founder, Biophilic Cities Network

- **Water Systems Restoration:** Advocates for stream daylighting and wetland restoration, improving urban water health and ecosystems.

Resilience:

- **Climate Adaptation:** Nature-based solutions like urban forests and green roofs mitigate heat island effects, manage stormwater, and enhance air quality.
- **Health and Well-being:** Accessible green spaces support mental and physical health while fostering social connections.
- **Equity:** Priorities providing underserved communities with equitable access to nature, addressing disparities in urban environments.

Impact and Outcomes

Successes:

- **Global Influence:** The network’s members have implemented innovative projects, from Singapore’s sky gardens to Wellington’s green infrastructure plans.
- **Charlottesville’s Leadership:** Demonstrates scalable biophilic initiatives in a smaller city context, such as pollinator-friendly landscapes and urban agriculture programs.
- **Knowledge Sharing:** Resources like the Biophilic Cities Journal and the Pattern Library inspire cities worldwide to adopt nature-based solutions.

Challenges:

- **Funding and Resources:** Scaling biophilic projects often requires significant financial investment and public-private collaboration.
- **Engagement:** Maintaining long-term commitment from communities and governments can be challenging without visible short-term outcomes.

Lessons Learned:

- **Scalable Design:** Even smaller cities like Charlottesville can lead impactful initiatives by tailoring biophilic solutions to their context.
- **Collaborative Partnerships:** Academic, governmental, and nonprofit collaboration enhances biophilic project development and longevity.

Influence on Urban Design

The Biophilic Cities Network has significantly influenced urban planning and design in Charlottesville and other member cities, embedding nature into the fabric of urban life. By prioritising ecological health, public green spaces, and community engagement, biophilic urbanism redefines how cities are designed for the future.

Recommendations for Other Cities

- **Join the Network:** Membership offers resources, events, and a collaborative platform for implementing biophilic strategies.
- **Engage Communities:** Involve residents in planning and stewardship to ensure the success of biophilic initiatives.
- **Leverage Educational Partnerships:** Collaborate with academic institutions for research, tools, and innovative ideas.


Austin, USA


Barcelona, Spain


Busan, South Korea


Edinburgh, Scotland

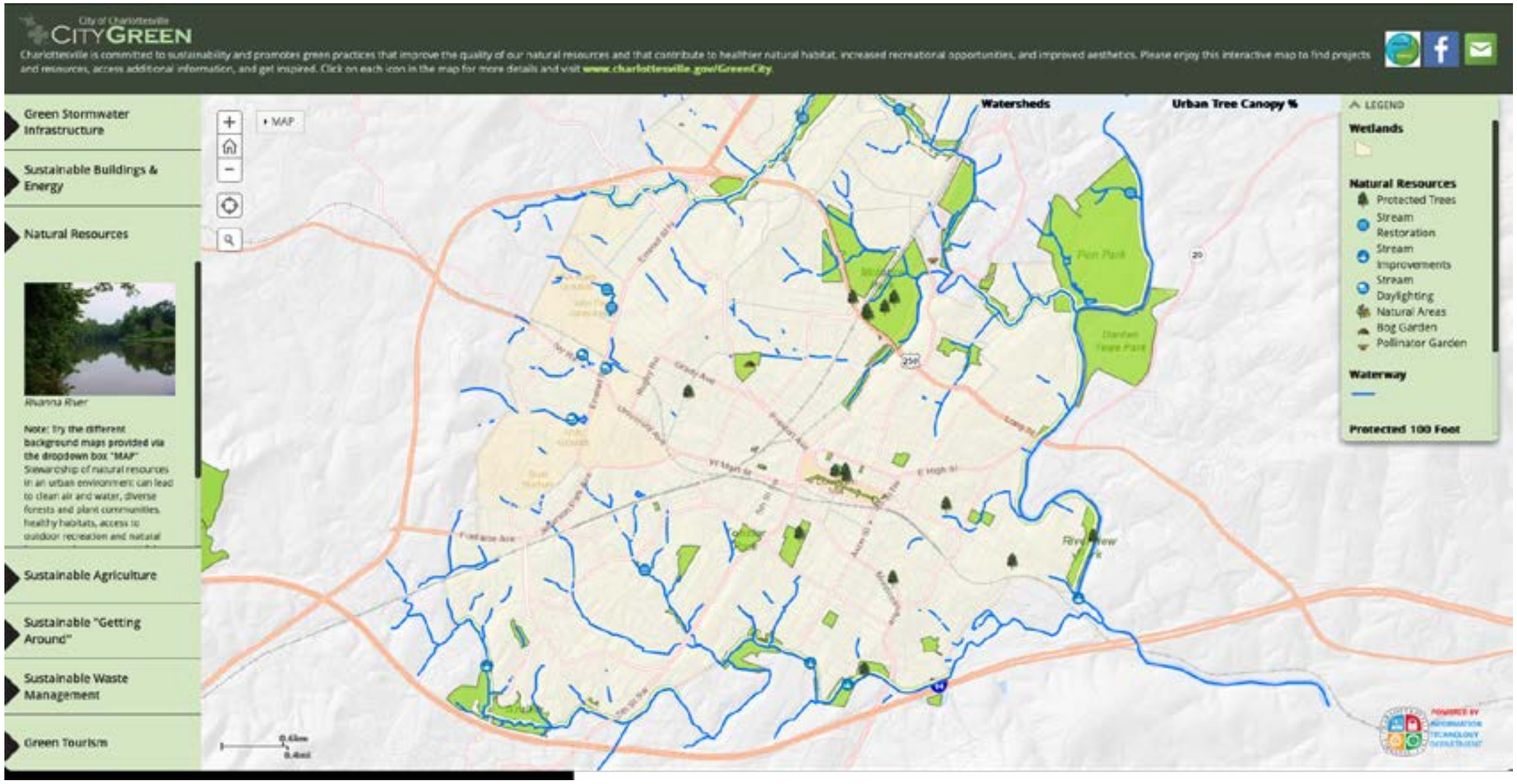

Fremantle, Australia


Wellington, Aotearoa New Zealand

The Biophilic Cities Network unites diverse cities from around the world, each committed to integrating nature into urban life. From bustling metropolises to coastal and historic cities, members share a vision of greener, healthier, and more resilient communities, adapting biophilic principles to their unique cultural and ecological contexts.

5.3.2

citygreen map



Overview

Jurisdiction: Charlottesville, Virginia, USA

Policy Type: Public Engagement and Environmental Education Initiative

Purpose: The CityGreen Map, developed by Charlottesville's Office of Sustainability, is an interactive tool that highlights green infrastructure, sustainability projects, and urban biodiversity initiatives. The map serves as both an educational resource and a catalyst for public engagement, fostering participation in Charlottesville's environmental goals while promoting equity and resilience across the city.

Key Features

Themes: The map is divided into six themes, providing an accessible overview of Charlottesville's sustainability efforts:

1. **Green Stormwater Infrastructure:** Showcases bioretention areas, rain gardens, green roofs, and permeable pavements that address stormwater management and water quality.
2. **Sustainable Buildings & Energy:** Highlights energy-efficient buildings, renewable energy installations, and infrastructure supporting the city's carbon neutrality goals.
3. **Natural Resources and Habitats:** Features urban forests, native plant habitats, and riparian restoration projects that promote biodiversity and ecosystem connectivity.
4. **Sustainable Agriculture and Food Equity:** Includes community gardens, farmers' markets, and urban farms that support local food production and improve access to fresh, healthy food, particularly in underserved communities.
5. **Sustainable Transportation:** Maps bike lanes, EV charging stations, and walkable areas, encouraging low-carbon transportation options.
6. **Community-Led Green Projects:** Showcases grassroots efforts like tree-planting initiatives, recycling programs, and environmental education campaigns.

- **Interactive Engagement:** The map allows users to explore project layers, learn about specific initiatives, and connect with volunteer opportunities or other ways to support green infrastructure projects.

Relevance to Renaturing and Resilience

Renaturing:

- **Ecological Connectivity:** Highlights projects that restore habitats and green corridors, supporting biodiversity and enabling residents to connect with nature.
- **Urban Food Systems:** By mapping urban farms and community gardens, the map fosters urban agriculture that builds local food systems while reconnecting communities with ecological cycles.
- **Community Green Space:** Encourages active participation in urban greening efforts, such as tree-planting and habitat restoration, which enhance quality of life and ecological health.

Resilience:

- **Stormwater and Climate Adaptation:** Projects like bioswales and green roofs manage stormwater runoff while reducing urban heat island effects, improving climate resilience.
- **Energy and Transportation:** Sustainable energy systems and low-carbon mobility infrastructure reduce reliance on fossil fuels, enhancing energy security and emissions reduction.
- **Equity in Action:** Emphasises initiatives like food equity programs and public green space accessibility,

WELCOME TO Charlottesville OFFICE OF SUSTAINABILITY

Charlottesville A Green City

Charlottesville's CityGreen Map showcases natural resources like protected trees, stream restoration, pollinator gardens, and bog gardens, promoting urban ecology and community engagement.

"The CityGreen Map showcases Charlottesville's commitment to sustainability, providing residents with an engaging platform to explore and participate in green initiatives, proving that even small communities can lead in environmental innovation."

– Charlottesville Office of Sustainability

addressing disparities in underserved communities and fostering social resilience.

Impact and Outcomes

Successes:

- **Community Engagement:** The map has increased public participation in sustainability efforts by providing an accessible platform for learning and involvement.
- **Environmental Awareness:** Acts as a centralised educational resource, helping residents and organisations understand the importance of urban greening and sustainable practices.
- **Catalyst for New Projects:** Increased visibility and engagement have supported the expansion of green infrastructure and urban agriculture initiatives.

Challenges:

- **Data Maintenance:** Regular updates and interdepartmental coordination are required to ensure the map remains accurate and relevant.
- **Access Equity:** Ensuring the map and its resources reach underserved communities and non-digital users remains a priority.

Lessons Learned:

- **Collaboration and Inclusivity:** Involving community members and local organisations in the map's development and maintenance has enhanced its impact.
- **Transparent Communication:** Regular updates and accessible tools ensure continued trust and engagement from the public.

Influence on Urban Design

The CityGreen Map has become a key resource in Charlottesville's urban planning strategy, aligning green infrastructure projects with broader sustainability and equity goals. By tracking and promoting projects, the map ensures that green design principles are integrated into citywide development while encouraging residents to advocate for new initiatives.

Recommendations for Other Cities

- **Develop Interactive Tools:** Create similar maps to visualise and engage communities in urban sustainability efforts.
- **Foster Equitable Access:** Ensure tools are accessible to all residents, including underserved populations, to maximise impact.
- **Align with Broader Goals:** Use platforms like the CityGreen Map to track progress toward sustainability and resilience objectives.

Charlottesville's CityGreen Map highlights diverse ecological and community initiatives across the city, from stream daylighting projects like Emmet-Ivy Garage and The Dell that restore natural water flows (top), to vibrant landscaping efforts such as the John Warner Parkway Pollinator Garden and Washington Park Bog Garden that enhance biodiversity (middle). The map also showcases community-centred programs like Cultivate Charlottesville's Urban Agriculture Collective, connecting urban gardens like the City Schoolyard Garden to broader efforts in food justice and empowerment, exemplified by the collective's impactful initiatives (bottom).

CULTIVATE CHARLOTTESVILLE

City Schoolyard Garden
Urban Agriculture Collective
Food Justice Network

6

philadelphia, pennsylvania

First Nations and Traditional Ecological Knowledge

Long before Philadelphia became a major city, the Lenape people lived along the Delaware and Schuylkill Rivers, practicing sustainable land management. They engaged in rotational agriculture, controlled burns, and river stewardship, ensuring the health of fish populations and wetland ecosystems. These practices maintained biodiversity and sustained their communities for thousands of years.

European colonisation in the 17th century led to land dispossession and forced relocation of the Lenape people. The transformation of the Delaware River into a commercial hub disrupted the delicate ecological balance. Today, Indigenous groups continue to advocate for land restoration and cultural preservation, integrating traditional ecological knowledge into conservation initiatives, particularly around the Delaware River watershed.

Colonisation and the Transformation of the Delaware River Basin

Philadelphia was founded in 1682 by William Penn, envisioned as a "green country town" with parks and tree-lined streets. However, the city's rapid industrialisation in the 18th and 19th centuries replaced forests and wetlands with factories, shipyards, and extensive infrastructure.

The Delaware and Schuylkill Rivers, once teeming with fish and wildlife, became polluted from sewage, coal runoff, and industrial waste. Expanding railroads and canals further reshaped the landscape, while deforestation and urbanisation led to flooding and declining air quality. By the early 20th century, Philadelphia faced severe environmental degradation, prompting early conservation efforts to reverse decades of damage.

Contemporary Urbanisation and Ecological Innovation

Philadelphia has embraced green infrastructure, ecological restoration, and climate resilience to improve urban sustainability. The Green City, Clean Waters program, launched in 2011, is a national model for stormwater management, using green roofs, rain gardens, and permeable pavement to reduce runoff and improve water quality.

Projects like the Schuylkill River Trail and the Delaware River Waterfront Revitalisation have transformed former industrial zones into thriving ecological corridors, reconnecting residents with the city's waterways. Urban agriculture initiatives, such as Bartram's Garden and the East Park Revitalization Alliance, demonstrate how nature can be reintegrated into dense urban environments.

Philadelphia has also expanded its urban tree canopy through TreePhilly, a program aimed at improving air quality, reducing heat islands, and enhancing biodiversity. However, balancing urban development with ecological preservation remains a challenge, especially as housing demand increases.

Ecosystems and Biodiversity: A Changing Landscape

Despite its dense urban core, Philadelphia supports diverse ecosystems, including wetlands, riparian corridors, and forested parks. The John Heinz National Wildlife Refuge, located along the Delaware River, provides critical habitat for migratory birds, amphibians, and native plant species.

However, habitat fragmentation, invasive species, and legacy pollution continue to threaten biodiversity. Restoration efforts focus on reintroducing native plants, improving stream buffers, and expanding tree canopy coverage. The city's Rebuild program invests in restoring public green spaces in underserved neighbourhoods, ensuring that ecological restoration benefits all residents.

Philadelphia's urban biodiversity initiatives extend to smaller-scale projects, such as pollinator gardens, rooftop farms, and community orchards, which enhance ecological connectivity while fostering food security and environmental education.

Climate Challenges and Resilience Strategies

Philadelphia faces growing climate threats, including extreme heat, flooding, and rising sea levels. Many low-lying areas are vulnerable to storm surges and heavy rainfall, straining the city's aging stormwater infrastructure. Hurricane Isaias (2020) highlighted these risks when widespread flooding impacted transit and low-income neighbourhoods.

To address these challenges, Philadelphia has developed flood resilience strategies, including wetland restoration, expanded stormwater retention systems, and floodplain restoration along the Delaware River. Investments in green stormwater infrastructure have reduced the burden on traditional drainage systems, helping mitigate the risk of sewer overflows.

Heat islands are another growing concern, particularly in historically redlined neighbourhoods with limited green space. The Heat Resilience Plan prioritises tree planting, cool roofs, and shaded public areas to reduce heat stress in vulnerable communities. The city is also investing in energy-efficient buildings and renewable energy expansion as part of its Net-Zero by 2050 plan.

Economic and Social Considerations

Philadelphia's environmental progress exists alongside significant economic disparities. The city has one of the highest poverty rates among major U.S. cities, and access to green space is not evenly distributed. Low-income communities often experience higher pollution levels, fewer trees, and greater exposure to extreme heat and flooding.

To address these inequities, initiatives such as Green Futures and Clean & Green Philly focus on ensuring that environmental investments benefit all neighbourhoods, not just wealthier areas. The Philadelphia Energy Authority supports green workforce training, creating job opportunities in solar energy, weatherisation, and sustainable construction for underrepresented communities.

However, concerns over eco-gentrification persist, particularly in neighbourhoods undergoing rapid revitalisation. Balancing sustainability efforts with affordable housing policies will be critical to ensuring that green investments do not displace vulnerable populations.

6.1

people

6.1.1

frederick steiner, university of pennsylvania

“Cities are at a turning point. Everything we design today must be rethought for the future—we need to plan not just for the next decade, but for the next seven generations.”

Bio

Frederick (Fritz) Steiner is the **Dean of the Stuart Weitzman School of Design** at the **University of Pennsylvania (Penn)** and a leading voice in **ecological urbanism, landscape architecture, and regional planning**. With a career spanning over three decades, he has shaped sustainable urban development in the U.S. and internationally. Before returning to Penn, he served as Dean at the University of Texas at Austin for 15 years.

A former student of Ian McHarg, Fritz continues Penn’s legacy of **integrating ecology into urban planning and design**. He is closely involved in **Penn’s campus development, urban resilience research, and the McHarg Center**, ensuring that sustainability and biodiversity are at the core of both academic inquiry and real-world urban interventions.

Key Themes from the Interview

Carrying Forward the Ian McHarg Legacy

Penn has long been a hub for ecological urbanism, **building on the legacy of Ian McHarg’s ‘Design with Nature’**. However, Fritz emphasises the importance of looking forward rather than just celebrating the past.

“What matters most is what we do today—how we apply these ideas to contemporary challenges, rather than just reflecting on history.”

Under his leadership, the McHarg Center, PennPraxis, and the School of Design continue to shape research and policy in **urban resilience, climate adaptation, and ecological restoration.**

The Role of Design in Making Cities More Resilient

Beyond academia, Fritz plays an active role in shaping Penn’s campus and urban landscape. He co-chairs the Campus Design Committee, where he applies **sustainable and biophilic principles to new buildings and landscapes**.

“Penn’s campus is now an arboretum—what was once a network of city streets and parking lots has been transformed into a green oasis.”

The Power of Urban Greening: Small Interventions, Big Impacts

Fritz highlights local-scale urban transformations that demonstrate the impact of **reclaiming spaces for nature:**

- **Schumacher Green**, a former parking lot now converted into green space.
- **Small parks replacing asphalt**, including a former dean’s parking lot now turned into a public plaza.
- **Street greening projects**, such as Cedar Street’s rain gardens and tree planting under Philadelphia’s GreenPlan initiative.

“These changes aren’t just about aesthetics—they improve stormwater management, support biodiversity, and make cities more liveable.”

Policy & Infrastructure: Philadelphia’s Water-Sensitive Urban Design

Philadelphia is a **leader in water-sensitive urban design,** tackling stormwater and combined sewer overflows through green infrastructure rather than costly engineered solutions.

“Instead of relying on massive underground pipes, Philadelphia invested in street rain gardens, tree planting, and landscape-based water management.”

Linking Research to Real-World Impact: PennPraxis

To bridge academic research with policy and practice, Penn operates PennPraxis, a **non-profit planning and design organisation** that works with cities worldwide.

“PennPraxis allows us to engage in real-world projects, from urban design in Philadelphia to planning initiatives in the Galápagos Islands.”

This work has led to:

- **Resilience planning for cities** across the U.S.
- **Collaboration with Indigenous communities**, including mapping the historic Lenape highway network.
- **Energy retrofits and sustainable urban design projects**, ensuring research directly influences policy and built environments.

Climate & Biodiversity: The Need for Long-Term Thinking

Fritz advocates for a long-term, systems-based approach to urban resilience, emphasising the **interconnectedness of climate adaptation, biodiversity conservation, and community wellbeing**.

“Everything we design today must be rethought for the future—cities need to plan not just for the next decade, but for the next seven generations.”

Drawing from Indigenous planning philosophies, he stresses the importance of **thinking beyond immediate urban growth** to ensure ecological and social sustainability.

Looking Ahead

Fritz sees the future of urban resilience and ecological planning centred on:

- **Scaling up water-sensitive urban design**, ensuring cities embrace landscape-based stormwater solutions over hard infrastructure.
- **Expanding ecological restoration efforts**, integrating green infrastructure into all aspects of city planning.
- **Strengthening interdisciplinary collaboration**, ensuring that planners, designers, and policymakers work together for long-term sustainability.
- **Prioritising biodiversity and climate adaptation**, shifting urban policy to consider nature and equity as fundamental pillars of resilience.

6.1.2

keith vandersys, university of pennsylvania

“The climate crisis is too complex for standardised solutions—every intervention must be context-specific, flexible, and informed by science.”

Bio

Keith VanDerSys is a **Senior Lecturer in Landscape Architecture** at the **University of Pennsylvania’s Weitzman School of Design** and **Co-Director** of the **Environmental Modeling Lab** at the **McHarg Center**. His work sits at the **intersection of landscape architecture, environmental analysis, and computational modelling**, with a particular focus on **resilient coastal infrastructure and climate adaptation**.

With a background in architecture and architectural theory, Keith transitioned into landscape-scale research, developing advanced **spatial analysis and simulation modelling techniques** to address **coastal resilience, hydrology, and environmental change**. His expertise in **remote sensing, data analytics, and computational tools** allows him to bridge the gap between **scientific research, policy, and design applications**.

Key Themes from the Interview

From Architecture to Environmental Modelling

Keith’s career shifted from architectural practice to large-scale environmental modelling, driven by the realisation that **landscape systems require deeper analytical tools and interdisciplinary collaboration**.

“We found that traditional architectural tools weren’t enough—we needed to integrate remote sensing, hydrology, and coastal morphology into our design thinking.”

This shift led him to develop new computational methods to **translate scientific and engineering data into actionable design strategies.**

The Role of Technology in Landscape Architecture

Keith’s work involves bringing advanced environmental analysis tools into the landscape architecture field, using:

- **Remote sensing** for land-use change and ecological monitoring.
- **Hydrodynamic modelling** for understanding sea level rise and storm surge impacts.
- **Geospatial analysis** to inform watershed-scale planning.

“The challenge is not just gathering data, but translating it into something useful for designers and policymakers.”

This interdisciplinary approach ensures that coastal resilience strategies are informed by science but remain adaptable for real-world application.

Resilient Coastal Infrastructure & Climate Adaptation

Much of Keith’s research focuses on **climate resilience in coastal cities**, where rising sea levels, extreme weather, and shifting ecologies require new approaches to urban and landscape planning.

“The infrastructure and engineering models we’ve relied on were built for a stable climate—now we’re in a state of unpredictability, and our systems need to reflect that.”

He emphasises that traditional engineering solutions (e.g., seawalls, levees) often fail under non-stationary climate conditions, necessitating **nature-based, adaptive infrastructure**.

The Challenge of Translating Data into Design

Keith highlights the complexity of integrating technical analysis into design practice, requiring both **quantitative rigour and qualitative spatial thinking**.

“Our role is to bridge the gap between scientists who create environmental models and designers who need to apply them in urban and regional contexts.”

This often involves:

- **Custom scripting and coding** to process and visualise environmental data.
- **Cross-disciplinary collaboration** with engineers, ecologists, and planners.
- **Communicating findings** in visually intuitive ways, making complex data accessible to stakeholders.

Lessons from Resilient by Design: The Limits of Conventional Approaches

Keith participated in **Resilient by Design: Bay Area Challenge**, where teams tackled climate resilience strategies for San Francisco’s waterfront communities. His team used **social and environmental vulnerability mapping** to identify at-risk areas, leading to difficult conversations about managed retreat.

“We presented a land-swapping strategy to gradually relocate the most vulnerable communities—but managed retreat is politically and emotionally fraught.”

This underscores a broader challenge in climate adaptation: balancing immediate feasibility with long-term necessity.

Looking Ahead

Keith sees the next era of landscape architecture and urban resilience focusing on:

- **Expanding coastal resilience efforts**, ensuring cities can adapt to sea level rise, extreme weather, and shifting ecosystems.
- **Bridging science and design**, improving how complex environmental data informs spatial planning.
- **Reforming education**, ensuring future practitioners have the technical expertise to work in large-scale environmental systems.
- **Moving beyond “one-size-fits-all” solutions**, tailoring climate adaptation strategies to local ecological, social, and political conditions.

6.2

projects

6.2.1

schuylkill river trail and park

Project Overview

Location: Philadelphia, Pennsylvania

Designer(s): Schuylkill River Development Corporation (SRDC) in partnership with the City of Philadelphia

Client: City of Philadelphia

Physical Size: Approximately 8 miles of trail and greenway along the tidal Schuylkill River, with plans to connect over 130 miles of trail as part of a regional network

Context: The Schuylkill River Trail and Park is a transformative urban development project aimed at revitalising the Schuylkill River corridor from the Fairmount Dam to the Delaware River. This initiative seeks to reconnect the city with its waterfront, promote outdoor recreation, and enhance urban ecology.

Purpose: The project aims to provide a continuous, accessible multi-use trail for pedestrians, cyclists, and other non-motorised users, fostering community engagement and promoting environmental stewardship.

Key Design Strategies

Renaturing:

- **Ecological Restoration:** The project involves rehabilitating former industrial lands along the river, removing contaminants, and restoring native vegetation to improve habitat quality and biodiversity.
- **Urban Biodiversity:** The park's landscaping incorporates a diverse range of plant species, creating habitats for wildlife such as birds, butterflies, and small mammals. This supports ecological networks within the urban fabric.
- **Green Infrastructure:** Rain gardens, bioswales, and permeable surfaces manage stormwater runoff, reduce pollution, and enhance water quality in the Schuylkill River.

Resilience:

- **Natural Infrastructure:** The trail and park act as a buffer, mitigating flooding and managing stormwater runoff, which enhances the city's resilience to climate change impacts.
- **Community Engagement:** Collaborative development with local communities fostered ownership, pride, and stewardship among residents.
- **Economic Revitalisation:** The trail's presence has spurred tourism, increased property values, and attracted investments, revitalising adjacent neighbourhoods.

Outcomes and Lessons Learned

Impact:

- **Recreational Opportunities:** The trail provides a continuous path for walking, running, cycling, and other recreational activities, enhancing quality of life for residents and visitors.

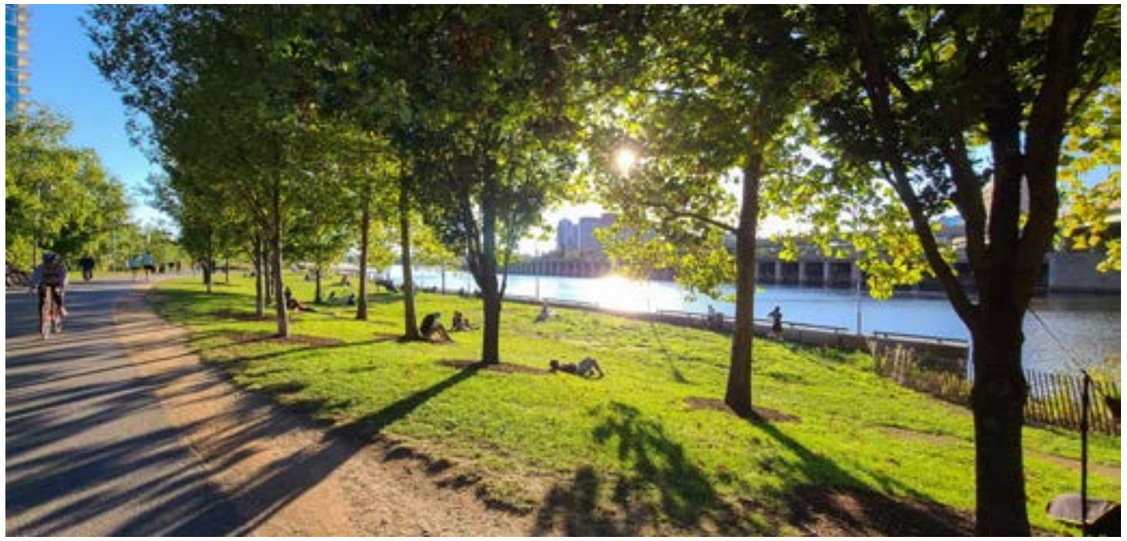
- **Environmental Benefits:** Restoration efforts have improved water quality, increased urban green space, and contributed to the city's overall ecological health.
- **Social Cohesion:** The trail serves as a communal space that brings together people from diverse backgrounds, strengthening social ties and fostering community well-being.

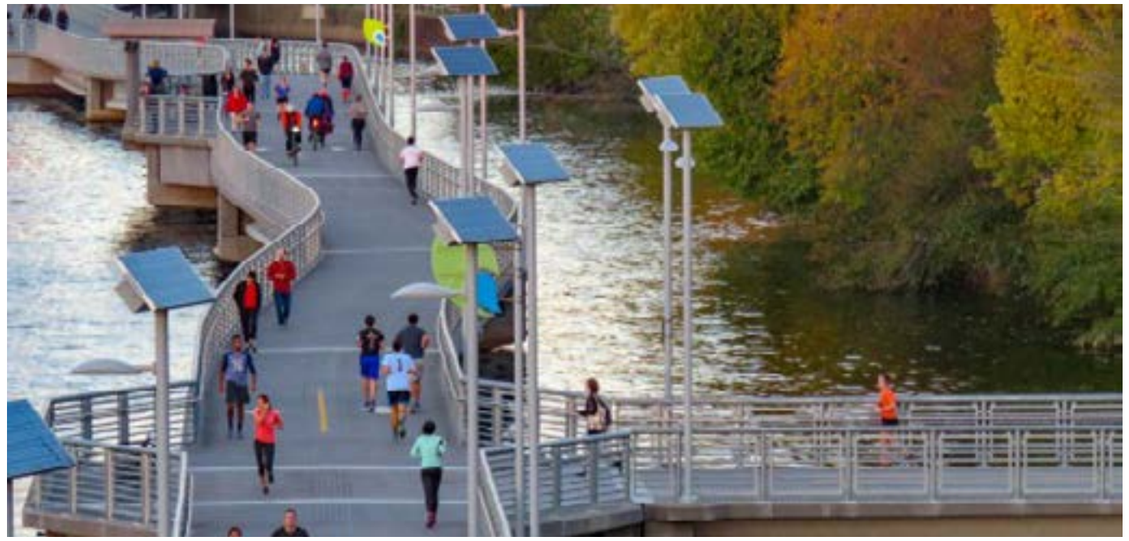
Challenges and Innovations:

- **Funding and Maintenance:** Ensuring consistent funding for development and upkeep remains a challenge, addressed through innovative public-private partnerships and community involvement.
- **Connectivity:** Efforts are ongoing to close gaps in the trail network and create seamless linkages, supported by federal grants and regional collaboration.

Takeaways:

- **Urban Biodiversity:** The Schuylkill River Trail and Park demonstrates how nature can thrive within a bustling metropolis through thoughtful ecological integration.
- **Resilience in Design:** The project showcases how natural infrastructure can mitigate climate risks while providing recreational and social benefits.
- **Community Connection:** Beyond ecological and recreational value, the trail and park foster strong community bonds and improve public health through active living.
- **Inspiration for Urban Design:** Projects like this highlight the power of nature to transform cities into vibrant, resilient, and inclusive spaces that harmonise with the natural world.





6.2.2

penn campus arboretum

Project Overview

Location: Philadelphia, Pennsylvania – University of Pennsylvania, West Philadelphia Campus

Designer(s): University of Pennsylvania Facilities and Real Estate Services (FRES), supported by the Morris Arboretum and other specialists

Client: University of Pennsylvania

Physical Size: Approximately 300 acres

Context: Situated within a vibrant urban university campus, the arboretum demonstrates how an institutional setting can prioritise ecological health and community resilience. By weaving natural systems into the built form, the arboretum bridges urban density and green infrastructure.

Purpose: To enhance urban biodiversity, foster educational and research opportunities, and contribute to ecological sustainability and community resilience, while also offering a model for integrating large-scale natural systems into a dense built environment.

Key Design Strategies

Renaturing:

- **Diverse Plantings:** Over 6,500 trees and 240 species provide a robust and visually striking urban forest that supports biodiversity and creates habitats for urban wildlife.
- **Layered Planting Strategies:** Trees, shrubs, and understory plantings are used to define spaces, enhance microclimates, and create multi-functional environments for education and recreation.
- **Specialty Gardens and Urban Parks:** Ten gardens and five parks serve as ecological nodes, fostering interaction between people and nature, while showcasing principles of ecological restoration.
- **Living Collections as Educational Spaces:** Pathways, seating, and interpretive signage integrate educational opportunities into the landscape, promoting an understanding of natural systems among users.

Resilience:

- **Climate Adaptation:** The arboretum incorporates drought- and pest-resistant species, demonstrating a forward-thinking approach to climate resilience. For example, trials of climate-adaptive live oaks are underway.
- **Heat Mitigation and Stormwater Management:** Extensive tree canopy reduces urban heat island effects and improves stormwater retention, offering practical applications for urban designers.
- **Community Engagement and Well-being:** Green spaces are designed to support social cohesion and mental health, creating environments that encourage relaxation, study, and social interaction.
- **Integrated Tree Management:** Policies ensure that

trees are planted, pruned, and replaced with an emphasis on long-term ecological and aesthetic value, setting a precedent for comprehensive urban forest management.

Outcomes and Lessons Learned

Impact:

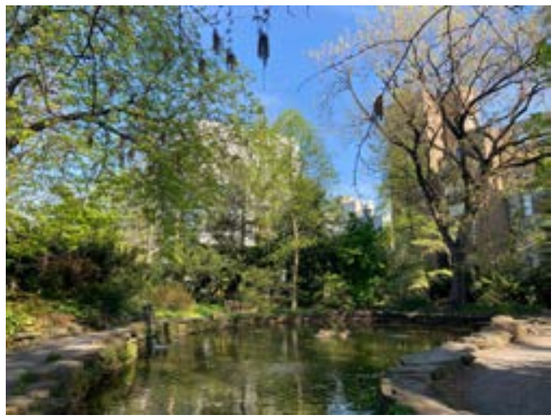
- **Environmental Benefits:** The arboretum's urban forest stores over 1.5 million pounds of carbon, reduces building energy costs by over $51,000 annually, and provides essential stormwater retention.
- **Educational Opportunities:** Initiatives like the Penn Plant Explorer make the arboretum an accessible tool for learning and exploration, connecting users to the landscape digitally and on-site.
- **Community Connection:** Programs such as the Creating Canopy tree giveaways and the Penn Park Orchard engage the university and broader community in hands-on stewardship of green spaces.

Challenges and Innovations:

- **Urban Development Pressures:** The arboretum has developed innovative solutions to protect trees during construction, such as establishing root protection zones and employing advanced monitoring systems.
- **Climate Resilience Challenges:** Strategies to combat pests like the Emerald Ash Borer include proactive treatments and planting pest-resistant species for future growth.
- **Balancing Functionality and Aesthetics:** Careful design ensures that pathways, seating, and other built elements integrate seamlessly with the natural environment, maintaining accessibility without compromising ecological value.

Takeaways

- **Urban-Biodiversity Integration:** The arboretum illustrates how green spaces can thrive within dense, high-traffic urban settings, offering inspiration for architects and designers to incorporate layered planting strategies and habitat creation into their projects.
- **Resilient Urban Design:** The emphasis on stormwater management, urban heat island mitigation, and pest-resistant species provides actionable strategies for designing climate-resilient landscapes.
- **Living Systems in Design:** The arboretum underscores the value of designing landscapes that serve as living laboratories, integrating natural systems into spaces that support education, research, and recreation.
- **Multifunctional Urban Spaces:** By creating spaces that balance ecological health with human interaction, the Penn Campus Arboretum provides a blueprint for integrating nature into the built environment in meaningful ways.

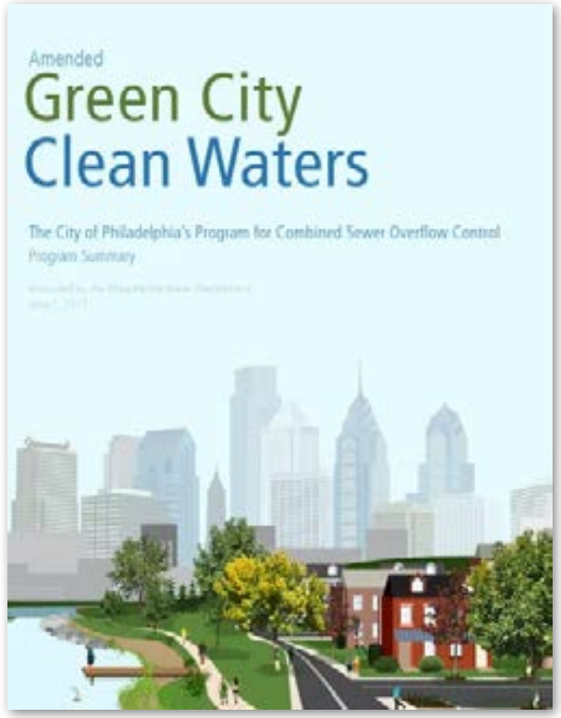


6.3

policies

6.3.1

green city, clean waters



Overview

Jurisdiction: Philadelphia, Pennsylvania, USA

Policy Type: Integrated Green Stormwater Infrastructure Plan

Purpose: Green City, Clean Waters (GCCW) is a citywide initiative by the Philadelphia Water Department (PWD) designed to reduce combined sewer overflows (CSOs) and improve water quality using green stormwater infrastructure (GSI). The program integrates natural systems into the urban landscape to manage stormwater sustainably while enhancing public spaces, supporting biodiversity, and increasing community resilience.

Key Provisions

Scope

- Spanning 25 years (2011–2036), GCCW aims to implement green infrastructure projects across the city to mitigate stormwater runoff and reduce pollution in local waterways.
- Covers over 10,000 acres of impervious surface transformation.
- Includes streetscapes, parks, schoolyards, vacant lots, and public spaces.

Targets

- Reduce 85% of combined sewer overflows by 2036.
- Install 9,564 greened acres to manage stormwater at the source.
- Improve the health of tens of thousands of Philadelphia's street trees, parks, and waterways.

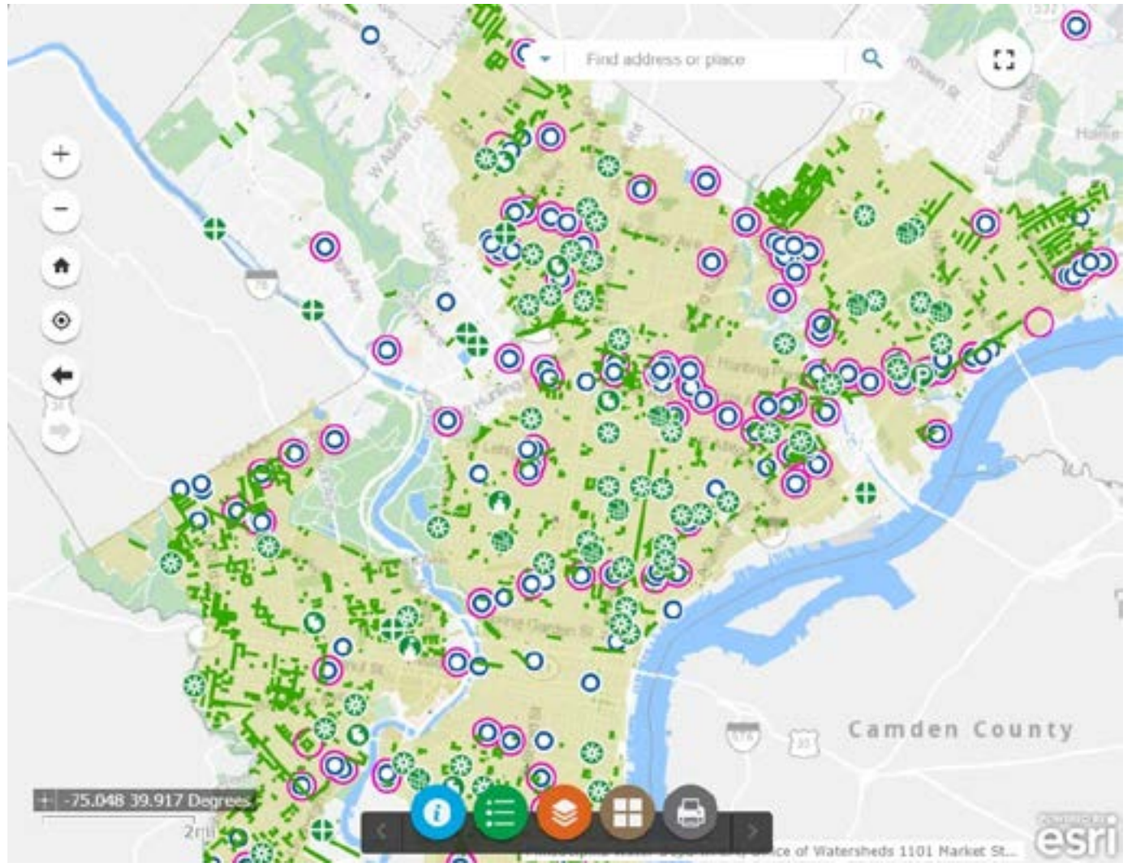
Incentives or Mandates

- Developers are required to comply with Philadelphia's Stormwater Regulations, encouraging the use of green infrastructure in private developments.
- The Stormwater Credit Program provides financial incentives for property owners who implement green stormwater solutions.
- Public-private partnerships support widespread adoption, particularly in underinvested neighbourhoods.

Relevance to Renaturing and Resilience

Renaturing

- **Expanding Green Infrastructure:** Projects include rain gardens, tree trenches, green roofs, and bioswales, increasing urban biodiversity and creating wildlife habitat.
- **Revitalising Waterways:** GCCW has led to extensive wetland restoration and stream daylighting, improving local ecosystems and supporting native species.
- **Transforming Urban Spaces:** Initiatives like Green



"Green City, Clean Waters is more than a stormwater plan—it's a blueprint for a more resilient, livable, and sustainable Philadelphia."

– Philadelphia Water Department

A former asphalt-covered schoolyard transformed into a vibrant, stormwater-absorbing green space, featuring rain gardens, permeable play surfaces, and native plantings. This project enhances outdoor learning opportunities, reduces urban heat, and manages stormwater on-site, making it a model for nature-based education and equity-focused infrastructure improvements in Philadelphia's schools.

Schoolyards convert asphalt-covered schoolyards into permeable, nature-based play spaces that support environmental education.

Resilience

- **Climate Adaptation:** Green infrastructure reduces the urban heat island effect, lowers flood risk, and enhances air quality.
- **Stormwater Management:** GCCW prevents 1.5 billion gallons of stormwater annually from overwhelming the sewer system, reducing flood hazards.
- **Community Benefits:** Public parks and green spaces improve social cohesion and offer health and wellbeing benefits, particularly in historically underserved communities.

Impact and Outcomes

Successes

- More than 3,000 green infrastructure sites have been installed across Philadelphia.
- Improved water quality in the Delaware and Schuylkill Rivers due to reduced pollutant runoff.
- Programs like TreePhilly and Green Streets have enhanced neighbourhood liveability while supporting wildlife.

Challenges

- **Funding constraints:** As a $2.4 billion investment over 25 years, maintaining financial resources remains a challenge.
- **Equity concerns:** Some communities have received more investment than others, leading to calls for better distribution of benefits.
- **Long-term maintenance:** Green infrastructure requires ongoing stewardship, and municipal funding structures sometimes lack flexibility to cover maintenance costs.

Lessons Learned

- **Integrated planning is essential:** GCCW demonstrates the effectiveness of embedding nature-based solutions into urban infrastructure.
- **Public-Private collaboration strengthens outcomes:** Partnerships with businesses, developers, and community organisations have expanded program reach.
- **Multi-Benefit infrastructure is the future:** By addressing stormwater issues while enhancing public spaces, GCCW sets a precedent for nature-based urban resilience strategies.

Influence on Urban Design

Philadelphia's approach to stormwater management has reshaped urban development, setting new standards for nature-based infrastructure in dense cities. Streets, parks, and private developments are now expected to integrate stormwater retention and ecological enhancements into their design.

One of Philadelphia's largest private-sector green infrastructure projects, the Navy Yard's green streets integrate permeable paving, bioswales, and tree trenches to manage stormwater across a rapidly developing commercial district. The project demonstrates how business campuses and industrial sites can adopt sustainable stormwater solutions while improving aesthetics, reducing heat, and enhancing urban ecology.

Recommendations for Other Cities

- **Adopt flexible stormwater regulations:** Encouraging green infrastructure compliance through incentives fosters private sector participation.
- **Invest in community engagement:** Programs like Soak It Up Adoption empower local residents to maintain and advocate for urban greening projects.
- **Prioritise equity in green investments:** Ensuring green infrastructure benefits reach marginalised communities strengthens social and environmental justice.

6.3.2

treephilly

TreePhilly fosters a greener Philadelphia by providing free yard and street trees, empowering residents through community tree giveaways, and training local 'TreeKeepers' to care for urban forests. Through these initiatives, the program enhances canopy cover, improves air quality, and strengthens community resilience.

Overview

Jurisdiction: Philadelphia, Pennsylvania, USA

Policy Type: Urban forestry initiative

Purpose: TreePhilly is a citywide urban forestry program led by Philadelphia Parks & Recreation and Fairmount Park Conservancy, with sponsorship from TD Bank. Launched in 2011 in response to the Greenworks Plan, TreePhilly provides free trees to residents, supports community-led greening projects, and promotes climate resilience and environmental equity by increasing the city's tree canopy.

Key Provisions

Scope

- **Citywide engagement:** Prioritises neighbourhoods with low tree canopy coverage and high environmental burdens such as extreme heat and air pollution.
- **Community partnerships:** Works with local organisations, neighbourhood groups, and schools to distribute trees and encourage long-term care.
- **Greening public and private spaces:** Expands tree coverage in parks, along streets, in schoolyards, and in private yards through strategic planting efforts.

Targets

- **Tree canopy goal:** Increase tree canopy coverage to 30% in every neighbourhood by 2025 to address disparities in urban forestry.
- **Tree distribution:** Since 2012, TreePhilly has provided over 25,000 free trees to Philadelphia residents.
- **Neighbourhood-based planting expansion:** Partnering with communities to plant thousands of trees annually in areas most impacted by climate change.

Incentives or mandates

- **Free tree giveaways:** Held twice a year (spring and fall) for residents, ensuring planting occurs in optimal seasons.
- **Educational workshops:** Offers free resources, training, and online materials to help residents care for their trees long-term.
- **Grant programs:** Supports neighbourhood greening projects with funding and technical assistance, helping communities establish urban forestry initiatives.

Relevance to Renaturing and Resilience

Renaturing

- **Expands urban green spaces:** Increasing tree cover helps absorb pollution, reduce heat, and promote biodiversity.
- **Wildlife habitat support:** Trees provide essential habitat for pollinators, birds, and urban wildlife, creating ecological corridors across the city.

"TreePhilly is not just about planting trees; it's about making neighborhoods healthier, greener, and more resilient."

— Philadelphia Parks & Recreation

- **Enhancing public spaces:** Tree-lined streets and greened schoolyards improve neighbourhood aesthetics, community cohesion, and recreational access.

Resilience

- **Climate adaptation:** Trees cool urban areas, helping mitigate the urban heat island effect and improving overall thermal comfort in the city.
- **Stormwater management:** Expanding the tree canopy reduces runoff, lowering flood risks and improving water quality.
- **Public health benefits:** Increased greenery reduces stress, improves mental health, and lowers rates of respiratory illnesses by filtering air pollution.

Impact and Outcomes

Successes

- **Tree canopy growth:** Thousands of trees have been planted in historically under-canopied neighbourhoods, bringing shade and ecological benefits to communities that need it most.
- **Public engagement:** In 2021 alone, TreePhilly partnered with 27 organisations to host 11 tree giveaway events.
- **Equity-focused greening:** Targeting high-need areas, ensuring that tree canopy expansion supports climate justice and urban equity.

Challenges

- **Tree maintenance responsibility:** Residents must care for their trees, which can be a barrier in some lower-income areas.
- **Development pressures:** Ongoing construction and redevelopment threaten tree preservation, requiring stronger policies to balance growth with green infrastructure.
- **Ensuring long-term tree survival:** Many urban-planted trees struggle due to soil compaction, pollution, and limited root space.

Lessons learned

- **Targeted outreach is essential:** Focusing on low-canopy neighbourhoods maximises environmental and social impact.
- **Post-planting support increases survival rates:** Providing mulch, watering resources, and maintenance workshops has improved tree longevity.
- **Cross-sector partnerships strengthen urban forestry:** Collaborating with schools, businesses, and local groups expands planting capacity and funding sources.

Influence on Urban Design

TreePhilly has shaped Philadelphia's urban greening policies, promoting tree planting as an essential component of:

- New developments, ensuring tree canopy preservation in construction zones.
- Greener schoolyards and parks, embedding shade and ecological benefits into public spaces.
- Street tree policies, improving pedestrian experiences and reducing vehicular heat buildup in dense urban areas.

Recommendations for Other Cities

- Implement free tree distribution programs: Encourage private property greening to maximise tree canopy expansion.
- Ensure equity in tree planting: Prioritise vulnerable communities most impacted by heat and pollution.
- Invest in long-term tree care: Establish maintenance funding and stewardship programs to ensure tree survival.
- Create public-private partnerships: Engage businesses, foundations, and nonprofits to support funding and outreach efforts.
- Incorporate trees into urban planning: Integrate urban forestry into climate action plans, zoning policies, and transportation strategies.

7

new york city, new york

First Nations and Traditional Ecological Knowledge

Before New York City became one of the world's most densely populated urban centres, the Lenape people lived in harmony with the region's rivers, forests, and tidal wetlands. Their deep ecological knowledge guided seasonal fishing, controlled burns, and sustainable land management, ensuring abundant resources without depleting natural ecosystems. The Hudson River Estuary was a vital source of food, transportation, and spiritual significance.

The arrival of Dutch and English settlers in the 17th century led to land dispossession and environmental disruption, as forests were cleared, wetlands drained, and rivers industrialised. Today, Indigenous groups such as the Ramapough Lenape Nation continue advocating for land recognition and ecological restoration, particularly in the Hudson River and New York Harbour.

Colonisation and the Transformation of the Harbour

New York City's transformation from an Indigenous homeland to a global trade hub began with the founding of New Amsterdam in 1624. The city's natural harbour and deep waterways made it an ideal commercial centre, driving rapid expansion. By the 19th century, industrialisation had reshaped the city's coastline, replacing tidal marshes with docks, piers, and landfill projects.

The Hudson and East Rivers, once rich with oysters, fish, and marine life, became polluted from industrial waste and sewage runoff. Expanding railroads, bridges, and tunnels further altered the landscape, while land reclamation projects added thousands of acres to Manhattan's footprint. By the mid-20th century, unchecked urbanisation had destroyed much of the city's natural ecosystems, leading to severe air and water pollution.

However, the environmental movement of the 1970s, sparked in part by the Clean Water Act (1972) and local activism, laid the foundation for restoring New York's waterways and green spaces.

Contemporary Urbanisation and Ecological Innovation

New York City has embraced green infrastructure, climate resilience, and ecological restoration as part of its urban development strategy. Projects like The BIG U, a 10-mile flood protection system integrating parks and wetlands along Lower Manhattan, showcase how nature-based solutions can strengthen the city's climate defences while enhancing public space.

The Hudson River Park Estuarine Sanctuary and Living Breakwaters Project off Staten Island focus on restoring marine habitats and reducing storm surge risks, while the High Line and Freshkills Park demonstrate how former industrial sites can be transformed into biodiverse urban green spaces.

At the building scale, New York has implemented green roof mandates, rainwater capture systems, and permeable pavements to reduce runoff and mitigate heat islands. The city's MillionTreesNYC initiative has expanded tree canopy coverage, improving air quality and biodiversity. However, balancing sustainability efforts with ongoing development remains a challenge as the city continues to grow.

Ecosystems and Biodiversity: A Complex Balance

Despite its density, New York City contains surprisingly diverse ecosystems, including salt marshes, freshwater wetlands, and urban forests. These habitats support wildlife, from peregrine falcons nesting on skyscrapers to oyster reef restoration projects in the Hudson River.

The Jamaica Bay Wildlife Refuge, one of the largest urban nature reserves in the U.S., plays a crucial role in supporting migratory birds along the Atlantic Flyway. Efforts to restore the Bronx River have helped reintroduce native fish species such as alewife and herring.

However, challenges remain, including habitat fragmentation, invasive species, and pollution. Programs like GreenThumb community gardens and pollinator-friendly plantings along greenways aim to enhance biodiversity and ecological connectivity within the city.

Climate Challenges and Resilience Strategies

As a coastal metropolis, New York City faces sea-level rise, extreme heat, and intensified storms due to climate change. The devastation of Hurricane Sandy (2012) highlighted the city's vulnerability, prompting major investments in coastal protection and urban resilience planning.

The NYC Climate Resiliency Plan integrates wetland restoration, elevated infrastructure, and floodplain expansion to protect vulnerable neighbourhoods. The city has also increased investment in stormwater management, using bioswales and blue-green roofs to absorb heavy rainfall and prevent sewer overflows.

Urban heat islands are another pressing concern, particularly in low-income neighbourhoods with limited tree cover. To address this, New York has expanded street tree planting, cooling centres, and reflective surfaces to mitigate heat stress. The city is also investing in offshore wind energy, electrification, and expanded bike infrastructure as part of its commitment to achieve carbon neutrality by 2050.

Economic and Social Considerations

While New York's green initiatives have improved quality of life, they have also contributed to rising property values and displacement, particularly in neighbourhoods undergoing waterfront revitalisation and park expansions.

To address these inequities, the city has integrated environmental justice initiatives into its sustainability planning. The Duwamish Valley Action Plan prioritises climate adaptation in historically marginalised areas, while programs like Green City Force provide green job training for low-income youth.

Community-led advocacy groups such as the NYC Environmental Justice Alliance work to ensure that green infrastructure investments are equitably distributed, particularly in communities historically burdened by pollution and lack of green space.

7.1

people

Byera Hadley Travelling Scholarships Journal Series

7.1.1

matthijs bouw, one architecture and urbanism

“We are only at the beginning of the climate transition. What we do now will define the cities of the future.”

Bio

Matthijs Bouw is an architect, urban planner, and founder of **One Architecture and Urbanism**, a firm specialising in climate-resilient design and infrastructure adaptation. Originally from the Netherlands, he is also a **Professor of Practice** at the **University of Pennsylvania’s Weitzman School of Design**. His work focuses on **coastal resilience, nature-based solutions, and urban water management**, with projects across the U.S. and internationally.

Matthijs played a key role in **Rebuild by Design**, co-leading **The Big U**, a flood protection and resilience strategy for Lower Manhattan that integrates flood barriers with parks, green spaces, and social infrastructure. His expertise lies in **bridging design, policy, and governance** to create urban adaptation strategies that are **flexible, community-driven, and ecologically integrated.**

Key Themes from the Interview

The Big U: A New Model for Urban Flood Protection

Following Superstorm Sandy, Matthijs co-led The Big U, a modular flood protection system for Lower Manhattan. Rather than a single flood wall, the strategy consists of **localised, neighbourhood-specific projects** designed to provide **storm surge protection while enhancing public space**.

“Instead of one big wall, we designed a network of adaptable, community-driven projects.”

Sections are now under construction, marking a shift toward integrating **flood resilience with urban life, parks, and infrastructure**.

From Coastal Defence to Citywide Resilience

The Big U was just the beginning. Matthijs is now working on expanding climate adaptation beyond coastal barriers to include:

- **Urban water management**, addressing stormwater flooding through green infrastructure.
- **Heat mitigation**, integrating tree canopies and cooling landscapes into urban planning.
- **Public health considerations**, ensuring that climate resilience investments also improve air quality, mental health, and social well-being.

“We started with coastal resilience, but now we see the need to redesign entire urban systems to address climate risks.”

Climate Strong Communities: Neighbourhood-Level Resilience

Beyond large infrastructure, Matthijs is leading **Climate Strong Communities**, a New York City initiative focused on developing **localised climate adaptation strategies** at the neighbourhood level.

“Big infrastructure is important, but everyday resilience starts at the community level—where people live, work, and gather.”

This initiative ensures that climate adaptation is not just top-down but also shaped by local needs, helping neighbourhoods design stormwater solutions, cooling strategies, and green public spaces.

Rethinking the Funding Model for Urban Resilience

One of the biggest challenges to implementing climate resilience in the U.S. is the **fragmented, competitive grant system** that funds projects in short-term cycles. Unlike in the Netherlands, where long-term investments in climate adaptation are coordinated nationally, U.S. cities must piece together financing project by project.

“The issue isn’t a lack of funding—it’s the structure of funding that makes long-term planning difficult.”

This creates **disjointed projects, uncertainty in implementation, and delays in systemic adaptation efforts**. Matthijs advocates for integrated investment models that allow cities to plan holistically.

The Role of Public Infrastructure in Climate Resilience

Matthijs sees an urgent need to redefine the role of public infrastructure in the climate crisis. Historically, urban planning in the U.S. has been privatised and fragmented, limiting cities’ ability to act collectively on adaptation.

“The climate crisis forces us to rethink the role of public infrastructure—how we plan, fund, and govern urban adaptation.”

To address this, he is working on **multi-agency collaborations** where **transportation, water management, and climate adaptation** are planned together, ensuring infrastructure investment delivers long-term social and environmental benefits.

Looking Ahead

Matthijs believes that climate adaptation must become a core function of urban governance, requiring:

- **Integrated infrastructure investment**, where cities coordinate mobility, housing, and resilience in a unified strategy.
- **Policy reform to streamline funding**, ensuring cities can implement long-term, systemic climate strategies.
- **Community-driven adaptation**, ensuring adaptation efforts are equitable and inclusive.

7.2

projects

7.2.1

kingsland wildflowers

Project Overview

Location: Greenpoint, Brooklyn, New York City

Designer(s): Alive Structures, with consultation from Larry Weaner Associates

Client: Broadway Stages, in partnership with Newtown Creek Alliance and NYC Audubon

Physical Size: Approximately 2,300 square meters (25,000 square feet)

Context: Located in an industrial area atop a film studio, Kingsland Wildflowers reimagines under-utilised rooftop space as a biodiverse, multifunctional green roof. The project responds to urban ecological challenges and integrates community engagement with high-performance green infrastructure.

Purpose: To demonstrate how industrial rooftops can be transformed into thriving ecosystems that support native wildlife, enhance urban resilience, and foster community stewardship while maintaining functionality as part of the built environment.

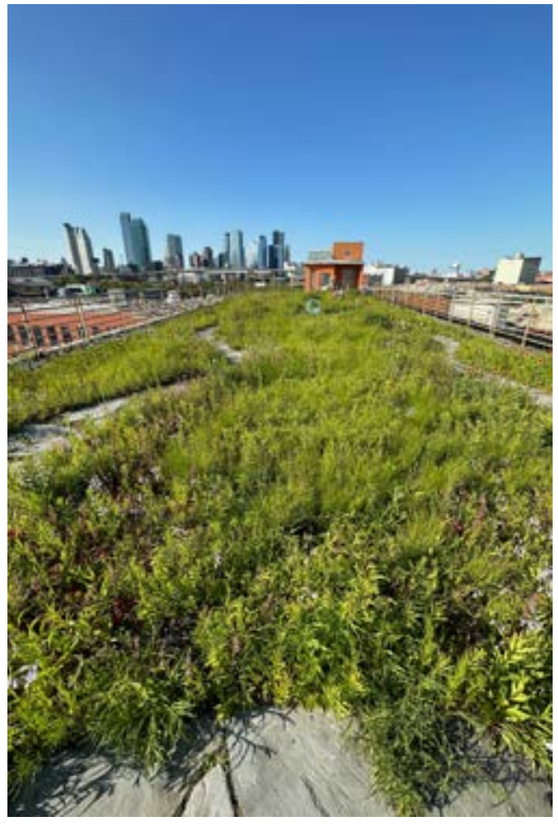
Key Design Strategies

Renaturing:

- **Native Ecology Focus:** The design incorporates native wildflowers, grasses, and shrubs that attract pollinators and support local wildlife. These species were selected for their ecological function, aesthetic appeal, and adaptability to rooftop conditions.
- **Biodiversity in Layers:** Varying soil depths and plant groupings mimic natural ecosystems, creating microhabitats for diverse species, including migratory birds, butterflies, and bees.
- **Ecological Connectivity:** By linking green spaces within an otherwise fragmented urban fabric, the project fosters corridors for wildlife movement and ecological integration.

Resilience:

- **Stormwater Management:** The green roof retains significant volumes of stormwater, reducing runoff to the combined sewer system. This aligns with New York City's broader goals of mitigating urban flooding and water pollution.
- **Energy Efficiency:** Vegetation enhances building performance by improving insulation, reducing heating and cooling demands, and mitigating the urban heat island effect—key considerations for architects designing in dense urban areas.
- **Community-Centred Design:** The roof functions as a community engagement space, hosting educational programs, workshops, and public tours. These activities build environmental awareness and connect residents to ecological initiatives in their neighbourhood.
- **Dual-Purpose Spaces:** The roof accommodates ecological and social functions while remaining part of an active film studio, showcasing a successful balance between operational needs and



environmental goals.

Outcomes and Lessons Learned

Impact:

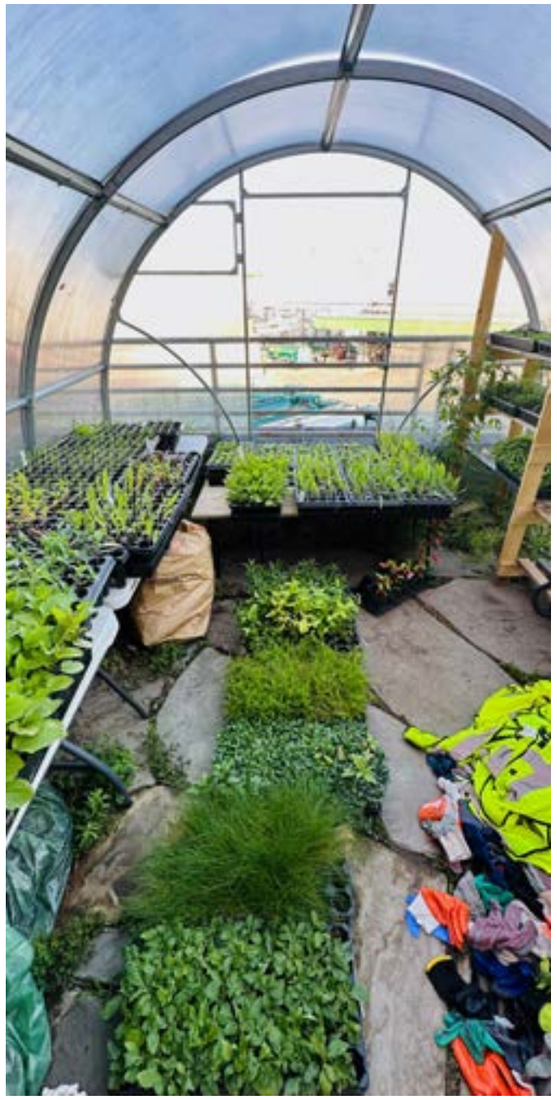
- **Urban Biodiversity:** The project has established a thriving urban ecosystem that serves as a critical habitat for pollinators and migratory species, offering a replicable model for other dense urban environments.
- **Sustainability Benefits:** The green roof contributes to stormwater retention, energy savings, and carbon sequestration, advancing the city's sustainability targets.
- **Community Engagement:** Regular public events and collaborations with schools, artists, and environmental organisations position the green roof as a vital community resource.

Challenges and Innovations:

- **Structural Constraints:** Designing for a pre-existing industrial building required extensive load capacity analysis and innovative lightweight soil solutions to ensure safety and performance.
- **Funding Mechanisms:** Leveraging public-private partnerships and grant funding, such as support from the Greenpoint Community Environmental Fund, highlights the importance of strategic financing in urban greening projects.
- **Maintenance Models:** The partnership with community organisations ensures ongoing care, monitoring, and adaptive management of the roof's ecosystem.

Takeaways

- **Repurposing Urban Spaces:** Kingsland Wildflowers demonstrates the transformative potential of retrofitting under-utilised spaces for ecological and social benefit. Architects and urban designers can incorporate similar strategies into industrial, commercial, or mixed-use developments.
- **Designing for Multi-functionality:** The project showcases how green roofs can provide simultaneous ecological, social, and operational value, making them essential elements of resilient urban development.
- **Collaboration and Funding:** Strong partnerships between private enterprises, environmental organisations, and the public sector were critical to the project's success—offering a replicable funding and governance model for urban greening initiatives.
- **Scalable Solutions for Climate Adaptation:** The integration of lightweight soils, native species, and stormwater systems offers scalable strategies for architects and landscape architects designing for dense urban areas.



7.2.2

pier 26 at hudson river park

Project Overview

Location: Tribeca neighbourhood, Manhattan, New York City

Designer(s): OLIN Studio, with ecological consultation by Biohabitats and lighting design by Tillett Lighting Design Associates

Client: Hudson River Park Trust

Physical Size: Approximately 2.5 acres

Context: Pier 26 is situated along the Hudson River Estuary, a biologically rich environment where freshwater meets saltwater. The pier was transformed from a disused maritime structure into an immersive public space that prioritizes ecological restoration, community engagement, and recreation. The design recreates Manhattan's historic ecosystems before urban development, providing a rare glimpse of the region's natural heritage.

Purpose: To educate visitors about the Hudson River Estuary's ecosystems, create a dynamic recreational space, and enhance the ecological value of the urban waterfront while showcasing innovative design for resilience and sustainability.

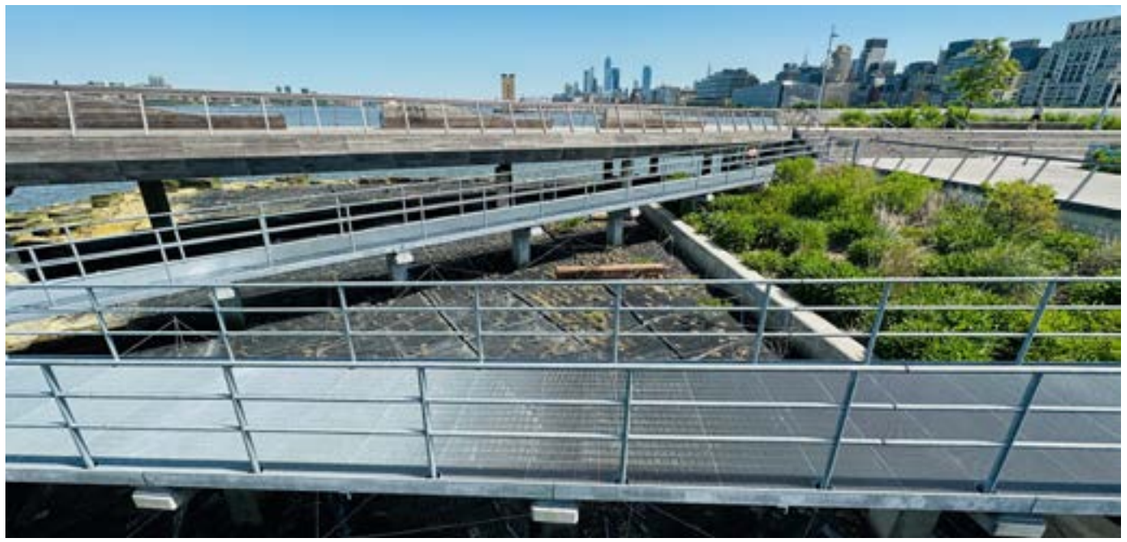
Key Design Strategies

Renaturing:

- **Ecological Gradient:** The pier's design emulates the transition from upland forests to tidal wetlands. Five native ecological zones—woodland forest, coastal grassland, maritime scrub, rocky tidal zone, and the Tide Deck—represent the region's historical ecosystems and support native biodiversity.
- **Tide Deck:** This 15,000-square-foot pile-supported structure at the western end of the pier mimics tidal wetlands, providing visitors with close interaction with tidal flows, native plants, and marine life. It functions as an "ecological get-down," blending education and nature observation.
- **Tribeca Habitat Enhancement Project:** Over 200 habitat features, including reef balls and gabions, were placed in the Hudson River to promote marine biodiversity, improve water quality, and reintroduce native oysters. Approximately 11.2 million larval oysters were seeded, contributing to habitat restoration efforts.

Resilience:

- **Native Planting and Stormwater Management:** Carefully selected native plant species withstand tidal flooding, salt spray, and urban heat. These plantings mitigate the urban heat island effect and manage stormwater, integrating resilience into the park's design.
- **Marine Habitat Restoration:** The estuarine enhancements support ecological resilience by improving conditions for fish, birds, and marine invertebrates, reinforcing the park's role in climate adaptation and biodiversity conservation.



- **Lighting Design:** Ecologically sensitive lighting strategies, balancing visitor safety with habitat protection. Shielded fixtures prevent light trespass at the water's edge, minimising disruption to aquatic species while creating a serene nighttime experience.

Community Engagement:

- **Recreational Amenities:** Public spaces include a multi-use recreation field, boardwalks, a spacious lawn, and shaded seating areas, fostering interaction and relaxation.
- **Science Playground:** The marine science-themed playground features sturgeon-shaped structures, educating children about the Hudson River's aquatic life through play.
- **Educational Infrastructure:** The forthcoming Estuarium will serve as a hub for research and public education, deepening visitors' understanding of estuarine ecosystems through interactive exhibits and programming.

Outcomes and Lessons Learned

Impact:

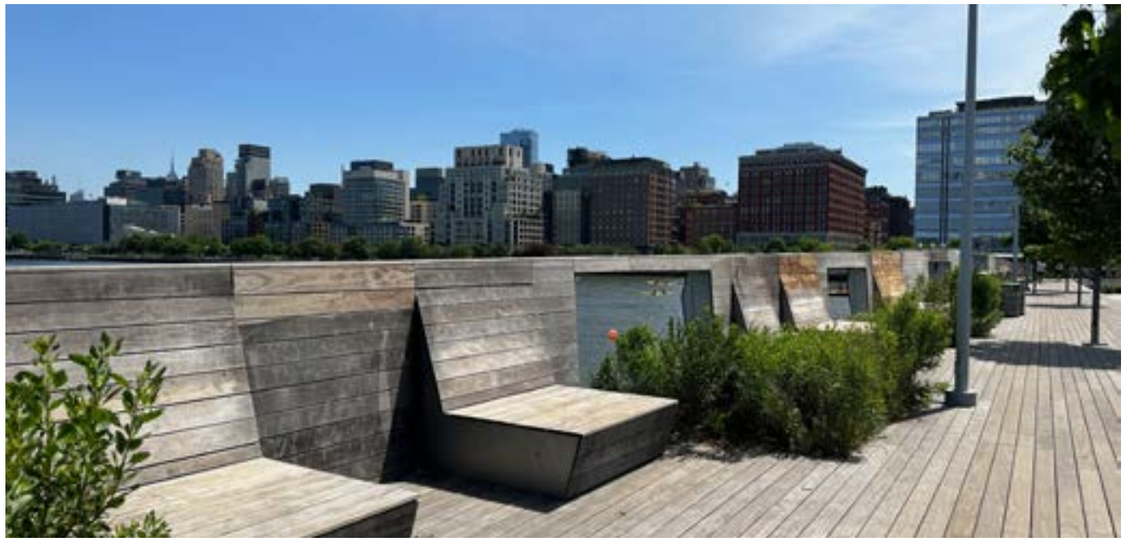
- **Ecological Restoration:** The pier successfully reintroduces native plant communities, enhances biodiversity, and creates essential habitats, contributing to the Hudson River's ecological health.
- **Community Vitality:** Pier 26 has become a beloved public space, providing residents and visitors with access to nature, recreation, and education in a dense urban setting.
- **Public Awareness:** The Tide Deck and the planned Estuarium educate and inspire visitors to value and protect local ecosystems, fostering environmental stewardship.

Challenges and Innovations:

- **Design Complexity:** Creating an ecological gradient on a pier required innovative engineering solutions to support diverse plant communities and withstand tidal and urban conditions.
- **Collaborative Success:** The project's success depended on close collaboration between landscape architects, ecologists, lighting designers, and community stakeholders.
- **Maintenance Needs:** A comprehensive maintenance plan ensures the long-term health of plantings, habitat structures, and educational components, emphasising the importance of ongoing stewardship.

Takeaways

- **Integrated Ecological Design:** Pier 26 exemplifies how urban parks can balance ecological restoration, recreation, and education, setting a standard for multifunctional spaces in dense cities.
- **Resilient Urbanism:** The integration of native ecosystems into urban design enhances resilience to climate impacts while supporting biodiversity, offering scalable solutions for other waterfront developments.
- **Educational Integration:** Designing spaces that foster both recreation and education deepens public appreciation for local ecologies, reinforcing the role of urban parks as living classrooms.
- **Collaborative Design Process:** The success of Pier 26 highlights the importance of interdisciplinary collaboration among designers, scientists, and community members to achieve ecological and social goals.



7.2.3

hunter's point park south

Project Overview

Location: Long Island City, Queens, New York

Designers: SWA/BALSLEY and WEISS/MANFREDI, in collaboration with Great Ecology

Client: New York City Economic Development Corporation (NYCEDC)

Size: Approximately 37.5 acres

Context: The site was a former industrial area, including a rail depot and coal yard, with no public access to the waterfront. The project transformed it into a vibrant public park while addressing climate resilience and urban ecology.

Purpose: To create a resilient and sustainable public park that integrates recreational amenities, ecological restoration, and flood protection, serving as a model for urban design in the face of climate change.

Key Design Strategies

Renaturing:

- **Ecological Restoration:** Native plant communities and wetlands were reintroduced to create habitats for wildlife and connect visitors to the region's natural heritage.
- **Tidal Wetland Design:** A tidal wetland designed by Great Ecology enhances biodiversity, storm resilience, and serves as an educational focal point for visitors.
- **Ecological Corridors:** Integrated corridors support migratory and resident species while improving ecological connectivity.

Resilience:

- **Tiered Design:** The park's tiered design incorporates bulkheads, riprap, and other infrastructure to protect against future flooding.
- **Flood Storage:** A synthetic turf oval functions as both a recreational space and a flood storage area during extreme weather events.
- **Tidal Wetlands:** Wetlands buffer storm surges and are designed to accommodate rising sea levels, contributing to the park's long-term resilience.
- **Climate Adaptability:** The park demonstrated its resilience during Hurricane Sandy, withstanding significant impacts without losing functionality.

Community Engagement:

- **Recreational Amenities:** The park includes playgrounds, fitness zones, a dog run, a bikeway, picnic terraces, and basketball courts, providing spaces for a diverse range of activities.
- **Waterfront Access:** The cantilevered platform offers a dramatic connection to the East River and unobstructed views of the Manhattan skyline.

- **Public Art:** Installations such as Nobuho Nagasawa's "Luminescence" integrate cultural narratives with the park's ecological themes.
- E**ducational Wetlands:** Wetlands are seamlessly integrated into the park's design, serving as a tranquil retreat and a hands-on educational resource.

Outcomes and Lessons Learned

Impact:

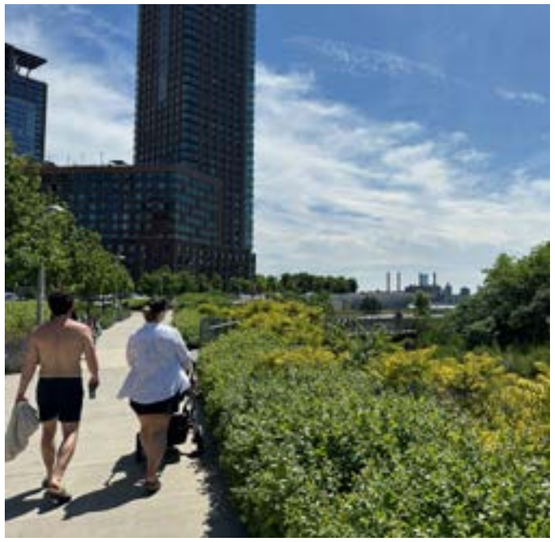
- **Biodiversity Gains:** Enhanced urban biodiversity through functional habitats for local and migratory species.
- **Community Engagement:** Established itself as a vital recreational space for the community, fostering engagement and environmental education.
- **Resilience Demonstrated:** Effective flood-resilient infrastructure protected the park during extreme weather events, including Hurricane Sandy.

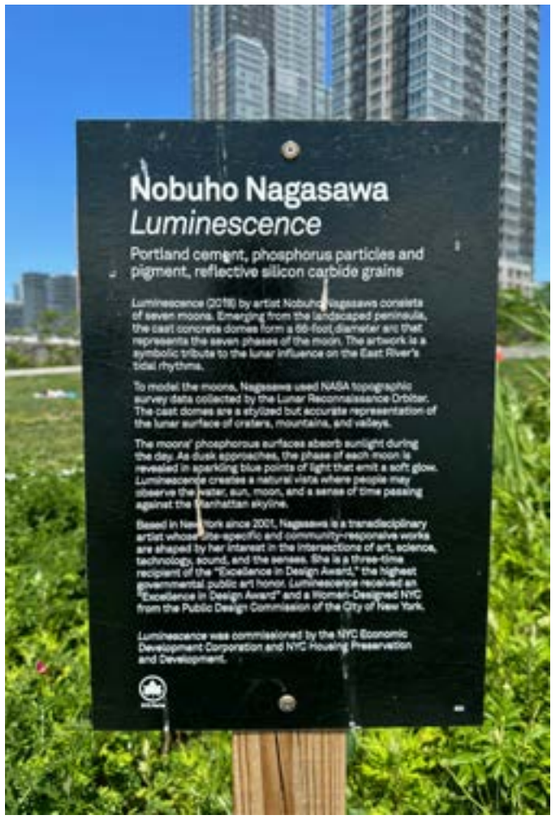
Challenges and Innovations:

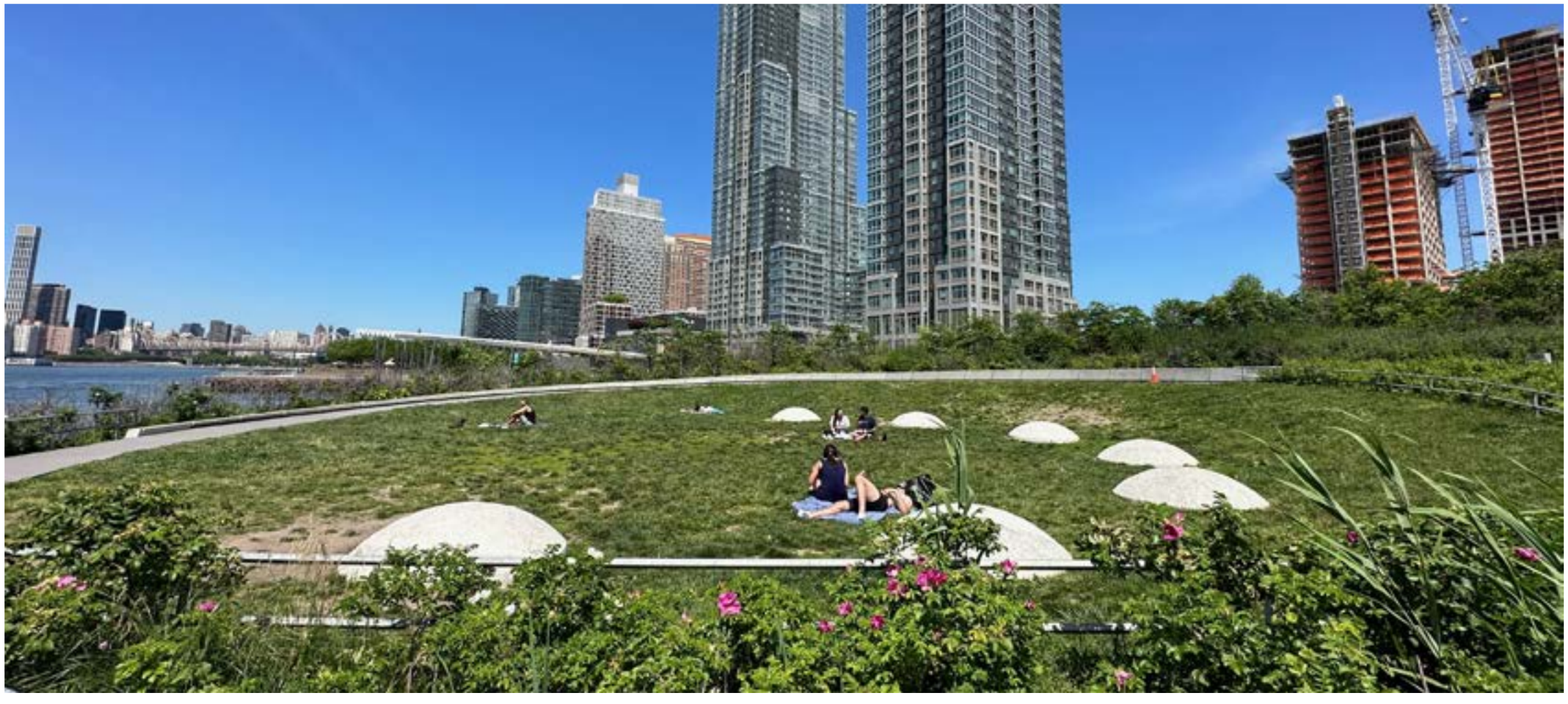
- **Site Transformation:** Transforming a contaminated industrial site into a verdant public park required innovative ecological and infrastructural solutions.
- **Regulatory Collaboration:** Navigating complex permitting processes involved collaboration with agencies like the U.S. Army Corps of Engineers and the NYC Department of Environmental Conservation.
- **Multifunctional Integration:** Seamless integration of ecological, recreational, and flood-resilient features showcases a forward-thinking approach to urban design.

Takeaways

- **Integrated Design Approach:** Thoughtful integration of ecological restoration, flood protection, and public amenities is key to creating multifunctional urban spaces.
- **Resilient Urban Design:** Incorporating wetlands and flood-resilient infrastructure is essential for climate-adaptive urban development.
- **Ecological Expertise:** Collaborating with ecological consultants enhances environmental outcomes and regulatory compliance while providing educational opportunities for the public.
- **Community-Centric Development:** Inclusive design fosters a sense of place and ensures the long-term success of urban parks.




Nobuho Nagasawa
Luminescence
Portland cement, phosphorus particles and pigment, reflective silicon carbide grains
Luminescence (2018) by artist Nobuho Nagasawa consists of seven moons. Emerging from the landscaped peninsula, the cast concrete domes form a 66-foot diameter arc that represents the seven phases of the moon. The artwork is a symbolic tribute to the lunar influence on the East River's tidal rhythms.
To model the moons, Nagasawa used NASA topographic survey data collected by the Lunar Reconnaissance Orbiter. The cast domes are a stylized but accurate representation of the lunar surface of craters, mountains, and valleys.
The moons' phosphorous surfaces absorb sunlight during the day. As dusk approaches, the phase of each moon is revealed in sparkling blue points of light that emit a soft glow. Luminescence creates a natural vista where people may observe the water, sun, moon, and a sense of time passing against the Manhattan skyline.
Based in New York since 2001, Nagasawa is a transdisciplinary artist whose site-specific and community-responsive works are shaped by her interest in the intersections of art, science, technology, sound, and the senses. She is a three-time recipient of the "Excellence in Design Award," the highest governmental public art honor. Luminescence received an "Excellence in Design Award" and a Women-Designed NYC from the Public Design Commission of the City of New York.
Luminescence was commissioned by the NYC Economic Development Corporation and NYC Housing Preservation and Development.



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7.2.4

the high line

Project Overview

Location: Manhattan, New York City

Designers: James Corner Field Operations (landscape architecture), Diller Scofidio + Renfro (architecture), and Piet Oudolf (planting design)

Client: Friends of the High Line and the City of New York

Size: 1.45 miles (2.3 kilometres) long, covering approximately 6.73 acres

Context: Built on a former elevated freight rail line, The High Line weaves through Manhattan's West Side, transforming an abandoned industrial relic into a public park that bridges nature and urban life.

Purpose: To create an accessible and innovative public space that preserves the historical integrity of the rail structure while fostering biodiversity, community interaction, and urban resilience.

Key Design Strategies

Renaturing:

- **Native Planting Design:** The park features over 500 species of perennials, grasses, shrubs, and trees, many of which are native to the region. This planting palette replicates the self-seeded vegetation that grew on the abandoned rail line, providing habitats for birds, bees, and other pollinators.
- **Layered Ecologies:** Different sections of the park mimic distinct ecological conditions, including woodland zones, open grasslands, and wetland-inspired areas. These varied habitats support biodiversity while enriching the visitor experience.
- **Green Roof Infrastructure:** The High Line incorporates a sophisticated green roof system with lightweight soils and drainage layers that support plant communities and manage stormwater runoff.

Resilience:

- **Stormwater Management:** Permeable paving and planting beds absorb rainwater, reducing stormwater runoff by up to 80% and easing pressure on the city's drainage system.
- **Heat Island Mitigation:** Dense vegetation cools the park and surrounding areas, alleviating the urban heat island effect and creating a more comfortable microclimate.
- **Structural Adaptation:** The existing steel framework was strengthened to support the weight of the vegetation and soil layers while preserving the industrial aesthetic of the rail line.

Community Engagement:

- **Recreational Opportunities:** The High Line offers seating areas, walking paths, and gathering spaces, catering to diverse recreational needs while integrating seasonal programming and events.
- **Cultural Integration:** Public art installations and

live performances engage visitors and reflect the creative energy of Manhattan's West Side.

- **Accessibility:** Elevators, ramps, and wide paths ensure that people of all ages and abilities can enjoy the park, fostering inclusivity in urban design.

Outcomes and Lessons Learned

Impact:

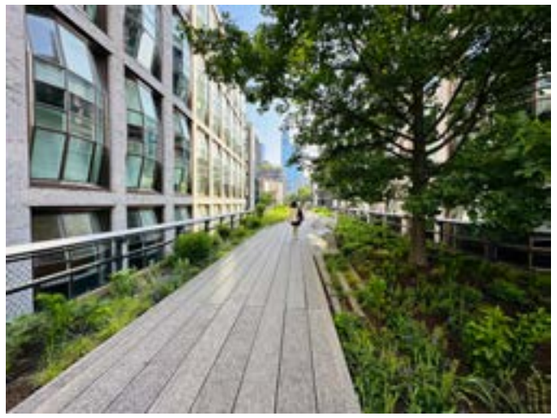
- **Ecological Benefits:** The High Line has become a critical green corridor, supporting over 300 plant species, migratory birds, pollinators, and other wildlife.
- **Community Revitalisation:** The park has revitalised surrounding neighbourhoods, spurring economic development, increasing property values, and attracting millions of visitors annually.
- **Global Inspiration:** The High Line has set a benchmark for adaptive reuse and urban linear parks, inspiring similar projects worldwide, such as Seoul's Cheonggyecheon Stream and Paris's Promenade Plantée.

Challenges and Innovations:

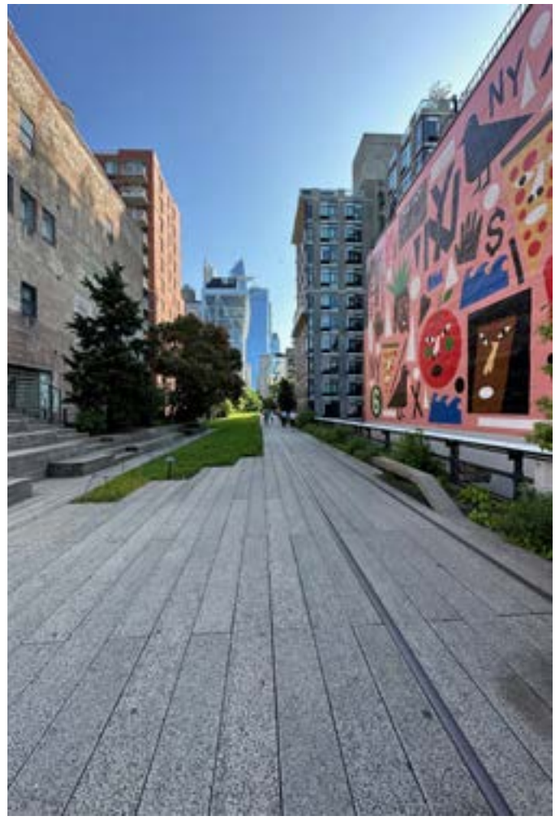
- **Balancing Crowds and Ecology:** High visitor numbers create wear and tear, challenging efforts to maintain the ecological integrity of the planting design.
- **Maintenance Demands:** The intensive planting design requires ongoing care, significant investment, and seasonal replanting to sustain its visual and ecological functions.
- **Gentrification Effects:** The High Line contributed to rapid gentrification in the surrounding neighbourhoods, increasing property values but displacing pre-existing communities and businesses. This has sparked criticism and calls for more equitable urban development practices.
- **Advocacy and Community Support:** Early grassroots efforts were essential in saving the rail line from demolition and transforming it into a world-renowned public park.

Takeaways

- **Innovative Adaptive Reuse:** The High Line illustrates how disused infrastructure can be transformed into multifunctional public spaces that serve ecological, cultural, and economic roles.
- **Biodiversity in Cities:** Integrating ecological zones and native plants into urban projects can enhance biodiversity, providing habitats even in dense metropolitan environments.
- **Stormwater Solutions:** Green infrastructure strategies such as permeable paving and green roofs mitigate urban flooding and reduce strain on city drainage systems.
- **Equity in Development:** Addressing gentrification and ensuring equitable benefits for pre-existing communities is a crucial consideration for large-scale urban projects.
- **Community Involvement:** Engaging local stakeholders ensures the long-term success of urban transformation projects while fostering a sense of ownership and connection.




Guardian
A MINDFUL WALK
HIGH LINE



7.3

policies

7.3.1

resilient neighborhoods initiative

Jurisdiction: New York City, USA

Policy Type: Climate resilience and land use initiative

Purpose: The Resilient Neighborhoods Initiative (RNI) is a community-based planning effort led by the New York City Department of City Planning (DCP) to enhance the resilience of neighbourhoods at high risk of flooding and climate change impacts. The initiative integrates zoning, land use policies, and infrastructure planning to help communities adapt to rising sea levels, storm surges, and extreme weather events while maintaining long-term housing, economic stability, and ecological restoration.

Key provisions

Scope

- **Neighbourhood-specific planning:** RNI targets ten coastal and flood-prone neighbourhoods, including Broad Channel, Hamilton Beach, Edgemere, Gerritsen Beach, and the East Shore of Staten Island.
- **Integration with NYC's climate agenda:** The initiative aligns with broader resilience and sustainability strategies, including OneNYC, the NYC Comprehensive Waterfront Plan, and Zoning for Coastal Flood Resiliency.
- **Resilient zoning updates:** New zoning codes allow for flood-resistant construction while restricting development in areas highly vulnerable to sea level rise.
- **Floodplain development regulations:** Establishes Special Coastal Risk Districts that manage growth in high-risk areas while enabling adaptation of existing structures.
- **Green and blue infrastructure integration:** Encourages nature-based flood mitigation, including tidal marsh restoration, stormwater green infrastructure, and permeable streets.
- **Economic and housing resilience:** Ensures zoning reforms support local businesses and housing while preventing displacement from rising flood risks.

Relevance to renaturing and resilience

Renaturing

- **Coastal and wetland restoration:** Projects focus on dune stabilisation, tidal marsh expansion, and the creation of living shorelines to provide natural storm buffers.
- **Stormwater management:** The initiative promotes the use of bioswales, rain gardens, and green streets to absorb and manage runoff.
- **Urban biodiversity enhancements:** Encourages tree

"Resilience is about more than just bouncing back—it's about transforming how we live in coastal communities for the future."

– NYC Department of City Planning

planting, waterfront parks, and habitat restoration to support ecological resilience in flood-prone areas.

Resilience

- **Flood adaptation and risk reduction:** Zoning reforms ensure new buildings incorporate floodproofing measures, elevated structures, and adaptive materials.
- **Infrastructure resilience:** Investments in elevated roadways, upgraded stormwater drainage, and protective flood barriers strengthen essential infrastructure.
- **Community-driven adaptation:** RNI works with residents, businesses, and stakeholders to develop resilience plans that reflect neighbourhood priorities.

Impact and outcomes

Successes

- **Stronger flood protections:** Zoning changes and infrastructure investments have improved resilience in multiple high-risk neighbourhoods.
- **Improved housing and land use planning:** The initiative ensures future development aligns with long-term flood risk projections.
- **Multi-benefit resilience projects:** Many adaptation strategies also provide environmental, economic, and public health co-benefits.

Challenges

- **Balancing growth with climate adaptation:** Managing development restrictions while maintaining housing affordability remains a challenge.
- **Long-term funding and implementation:** Ensuring sustained investment and enforcement of resilience policies requires ongoing political and financial commitment.
- **Equity and climate gentrification concerns:** Some resilience strategies may lead to rising property values, increasing risks of displacement.

Lessons learned

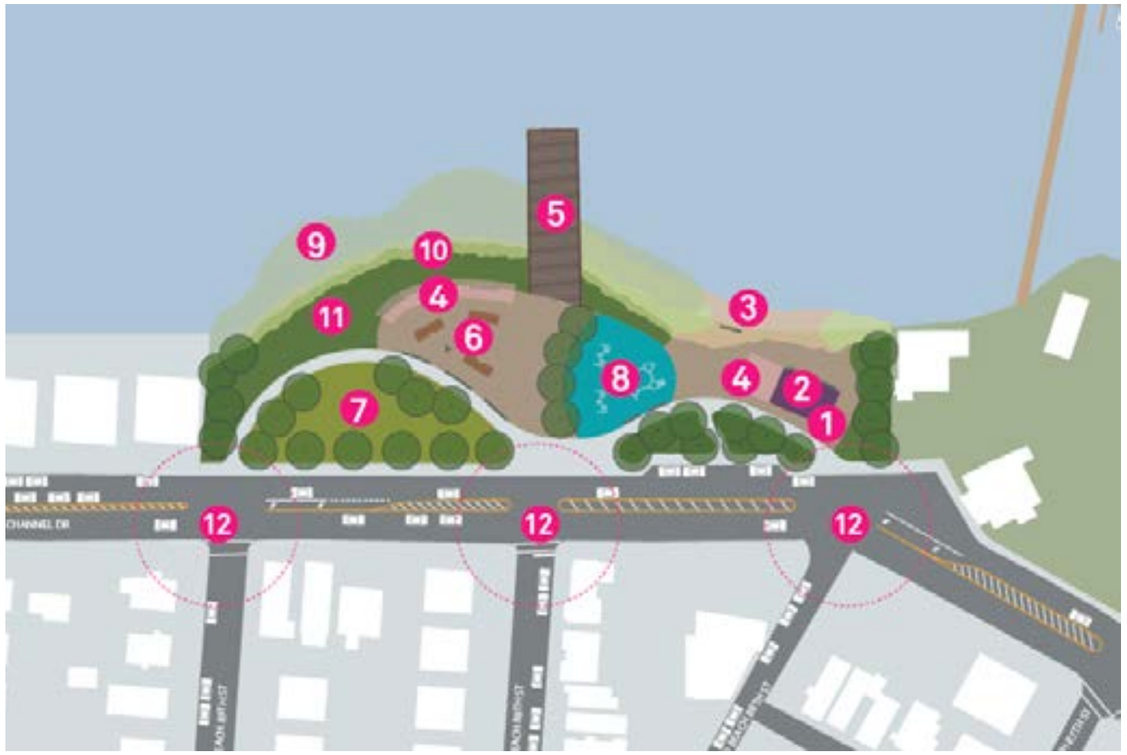
- **Flexible zoning policies support climate adaptation:** NYC's experience highlights the need for adaptable land use strategies that evolve with changing climate risks.
- **Community engagement is critical to success:** Incorporating local knowledge into resilience planning ensures solutions meet the needs of residents.
- **Multi-layered resilience strategies are most effective:** Combining zoning reforms, infrastructure investments, and ecological restoration provides comprehensive flood protection.

Influence on urban design

The Resilient Neighborhoods Initiative has shaped how NYC integrates climate resilience into land use and infrastructure planning. By embedding flood mitigation strategies into zoning laws, the city has set a precedent for urban areas facing similar climate challenges.

Recommendations for other cities

- **Incorporate climate risks into zoning policies:** Cities should proactively update zoning codes to reflect sea level rise, storm surge, and extreme weather projections.
- **Leverage nature-based solutions:** Coastal wetlands, permeable streets, and stormwater green infrastructure offer long-term flood protection with ecological co-benefits.
- **Engage communities in resilience planning:** Public participation ensures that adaptation efforts reflect local needs and priorities.
- **Prioritise affordable and adaptive housing:** Resilience policies should support both climate adaptation and housing stability to prevent displacement.

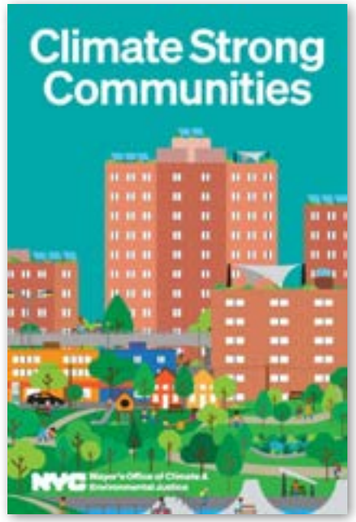


Beach 88th Street Park – A Resilient Neighborhoods Initiative Project

Transforming an underutilised waterfront into a resilient public space with flood protection, native landscaping, and recreational access.

7.3.2

climate strong communities



Overview

Jurisdiction: New York City, USA

Policy Type: Climate resilience and environmental justice initiative

Purpose: Climate Strong Communities (CSC) is a citywide program launched by the Mayor's Office of Climate and Environmental Justice to address climate risks in historically underserved neighbourhoods. The initiative prioritises community-led planning, infrastructure investments, and funding access to improve resilience against flooding, extreme heat, and coastal storms.

Key provisions

Scope

- **Targeted neighbourhoods:** CSC focuses on six Phase I neighbourhoods: Corona, Brownsville, Canarsie, Port Richmond, Soundview, and East Harlem. These areas were selected based on historic disinvestment, climate vulnerability, and lack of previous recovery funding.
- **Multi-hazard resilience approach:** The initiative integrates solutions for storm surge, tidal flooding, urban heat, and extreme rainfall, ensuring that climate adaptation measures address multiple risks simultaneously.

Investment and funding strategies

- **Leveraging federal and state funding:** CSC maximises funding opportunities from sources such as the Inflation Reduction Act, Federal Emergency Management Agency (FEMA) grants, and state climate resilience programs.
- **Community-led project prioritisation:** Residents participate in Neighborhood Support Teams (NSTs) to identify climate threats, select priority projects, and shape funding applications.
- **Sustainability and equity-focused investments:** CSC funds projects that strengthen environmental justice, promote urban green space, and improve public health outcomes in at-risk neighbourhoods.

Relevance to renaturing and resilience

Renaturing

- **Urban forestry and green infrastructure:** Projects include street tree plantings, green corridors, and vegetated stormwater management systems to cool urban areas and mitigate flooding.
- **Nature-based flood protection:** CSC supports wetland restoration, tidal marsh expansion, and the creation of permeable green spaces to absorb excess stormwater.
- **Sustainable public spaces:** Investments in community gardens, waterfront access, and resilient park design provide climate adaptation benefits while enhancing

"Climate Strong Communities is about investing in neighborhoods that have historically been left behind, ensuring that everyone has the tools to prepare for and thrive in a changing climate."

– Mayor's Office of Climate & Environmental Justice

urban biodiversity.

Resilience

- **Flood-resilient housing and infrastructure:** CSC promotes elevated structures, resilient utilities, and stormwater capture systems to protect at-risk communities.
- **Extreme heat mitigation:** The program expands "Cool Corridors" initiatives, installing shade trees, reflective materials, and green roofs to reduce heat exposure in vulnerable neighbourhoods.
- **Community-driven adaptation:** Residents play an active role in co-developing and implementing climate resilience strategies, ensuring long-term local engagement and sustainability.

Impact and outcomes

Successes

- **Prioritisation of historically underserved communities:** Unlike previous recovery efforts that left gaps in funding, CSC targets environmental justice communities that face compounding climate threats.
- **Multi-benefit resilience projects:** Many CSC projects provide climate resilience, public health, and economic development benefits, demonstrating the effectiveness of integrated adaptation strategies.
- **Community trust and engagement:** The Neighborhood Support Team model ensures that climate solutions align with local needs, fostering long-term partnerships between residents and city agencies.

Challenges

- **Ensuring sustained funding:** Securing long-term financial support for project maintenance and expansion remains a challenge.
- **Balancing development with climate adaptation:** Some flood-prone communities require managed retreat or land-use changes, which can be controversial and difficult to implement.
- **Measuring long-term impact:** The success of adaptation efforts depends on how well projects reduce climate risks over decades, requiring continuous monitoring and assessment.

Lessons learned

- **Community engagement leads to stronger outcomes:** Climate adaptation is most effective when communities drive decision-making and project development.
- **Nature-based solutions enhance urban resilience:** Integrating wetlands, urban forestry, and green infrastructure creates cost-effective, multi-benefit flood and heat mitigation strategies.
- **Proactive planning prevents future crises:** Investing in climate adaptation before disasters occur reduces future costs and disruptions to communities.

Influence on urban design

CSC is reshaping how New York City integrates climate resilience into urban planning, influencing policies related to land use, infrastructure investment, and environmental justice. The initiative is setting a precedent for city-led, community-driven climate adaptation efforts that balance resilience with equitable development.

Recommendations for other cities

- **Develop neighbourhood-scale climate resilience plans:** Localised approaches ensure that adaptation strategies align with community priorities and environmental conditions.
- **Expand green infrastructure investments:** Cities should prioritise tree planting, floodable parks, and stormwater management systems as part of climate adaptation efforts.
- **Create equitable funding pathways:** Ensuring that historically marginalised communities have access to climate resilience funding is critical to achieving environmental justice.
- **Strengthen public-private partnerships:** Engaging businesses, non-profits, and universities can expand the reach and impact of urban climate resilience programs.

Developed through community workshops, these graphics illustrate key climate threats and community assets identified by residents. They capture discussions on extreme heat, flooding, and infrastructure vulnerabilities, shaping targeted adaptation strategies under the Climate Strong Communities initiative.

8

insights

8.1

key design strategies for renaturing cities

Successful urban renaturing goes beyond adding green space—it integrates ecology, resilience, and community into the city. The strongest projects embed biodiversity in infrastructure, adapt to climate challenges, and foster public engagement.

Across the case studies, 15 essential design strategies emerge, grouped into three key themes::

1. **Ecological Integration & Biodiversity** – Creating diverse, connected, and functional urban ecosystems.
2. **Climate & Water Resilience** – Embedding nature-based solutions for flood, heat, and stormwater management.
3. **Social & Community Engagement** – Ensuring that renatured spaces serve people, culture, and well-being.

These strategies offer a practical framework for architects, landscape architects, planners, and policymakers looking to embed nature into the urban environment—not as an afterthought, but as a fundamental component of city design.

1. Ecological Integration & Biodiversity

Creating urban spaces that function as ecosystems, fostering biodiversity and ecological health.

- **Native & Climate-Adapted Planting** – Selecting native and adaptive species that support pollinators, birds, and local wildlife.
- **Habitat Creation & Connectivity** – Establishing continuous ecological corridors through parks, streetscapes, and rooftops to connect fragmented habitats.
- **Multi-Layered Planting Strategies** – Incorporating canopy trees, shrubs, perennials, and ground covers to enhance biodiversity and provide multi-functional habitats.
- **Urban Waterway & Wetland Restoration** – Rehabilitating riparian corridors, wetlands, and tidal zones to support aquatic ecosystems and filter pollutants.
- **Pollinator & Wildlife-Supporting Features** – Designing landscapes to actively attract and sustain pollinators (butterflies, bees, and birds) with specific floral resources and nesting sites.

2. Climate & Water Resilience

Embedding nature-based solutions to address climate adaptation, water management, and urban resilience.

- **Stormwater Capture & Green Infrastructure** – Using bioswales, permeable paving, green roofs, and rain gardens to reduce urban runoff and recharge groundwater.
- **Heat Island Mitigation** – Incorporating tree canopies, reflective surfaces, and vegetation to reduce urban heat and improve microclimates.
- **Flood Adaptation & Coastal Resilience** – Designing parks and landscapes that act as flood buffers, using wetlands, dunes, and tiered landscapes for coastal protection.
- **Soil & Streambank Stabilisation** – Restoring degraded land with bioengineering techniques (live stakes, coir logs, native vegetation) to prevent erosion and sediment loss.
- **Energy-Efficient & Self-Sustaining Green Infrastructure** – Designing landscapes that integrate renewable energy, passive cooling, and water recycling to lower environmental impact.

3. Social & Community Engagement

Fostering inclusive, accessible, and multi-use green spaces that connect people with nature.

- **Community Stewardship & Volunteer Programs** – Engaging residents in planting, maintenance, and habitat expansion, fostering long-term care.
- **Educational & Interpretive Features** – Integrating signage, guided tours, workshops, and interactive elements to enhance public understanding of ecological systems.
- **Multi-Use Public Spaces** – Designing parks and landscapes for both ecological and social functions, incorporating play areas, gathering spaces, and cultural programming. Examples: Heron's Head Park Nature Exploration Area, Salesforce Transit Center, The High Line.
- **Art & Cultural Integration** – Embedding public art, murals, and sculptures that reflect the environmental and cultural significance of the site.
- **Equity & Accessibility in Design** – Ensuring green spaces are inclusive, safe, and easily accessible for all, including people with disabilities.

Summary of Key Takeaways

This synthesis of 15 key strategies across three major themes provides a practical framework for architects, urbanists, and policymakers:

- Ecological Integration & Biodiversity:
  - Ensure native, layered, and connected habitats across urban spaces.
  - Restore wetlands, rivers, and pollinator networks for ecological health.
- Climate & Water Resilience:
  - Implement stormwater capture, coastal adaptation, and heat mitigation strategies.
  - Design for long-term climate resilience through natural systems.
- Social & Community Engagement:
  - Foster volunteer participation and local stewardship.
  - Design spaces for education, public programming, and equitable access.

This approach bridges ecological function with human experience, ensuring that renaturing projects become long-term assets for both cities and ecosystems.

8.2

key policy strategies for climate-resilient and equitable cities

A successful urban resilience strategy integrates environmental, social, and economic considerations, ensuring climate adaptation efforts are equitable, effective, and community-driven. The following five overarching principles capture key lessons from the case studies and provide a framework for cities looking to implement similar initiatives.

1. Nature-Based Solutions for Climate Resilience

Cities should leverage ecological infrastructure to mitigate climate risks and enhance resilience to extreme weather events.

- **Green stormwater management** – Expand green roofs, bioswales, rain gardens, and permeable surfaces to reduce runoff and prevent flooding.
- **Urban heat mitigation** – Prioritise tree planting, reflective surfaces, and green corridors to reduce heat island effects and improve microclimates.
- **Coastal and flood resilience** – Restore wetlands, dunes, and natural buffers to absorb storm surges and manage sea level rise.
- **Biodiversity enhancement** – Implement native planting, habitat connectivity, and pollinator-supportive landscapes to strengthen urban ecosystems.

2. Equitable Community Engagement & Stewardship

Ensuring long-term success requires deep community participation, co-creation, and stewardship.

- **Participatory planning** – Involve residents, community groups, and local businesses in decision-making to align projects with neighbourhood needs.
- **Equitable access to green spaces** – Focus on historically underserved communities by prioritising investments in neighbourhoods with limited tree canopy and public green space.
- **Stewardship & education programs** – Develop volunteer programs, workforce training, and public awareness campaigns to foster long-term care and community ownership of green infrastructure.
- **Cultural and place-based integration** – Recognise local histories and traditions by incorporating public art, storytelling, and cultural programming into projects.

3. Policy, Governance & Funding Strategies

Robust policies and long-term funding commitments are essential for sustaining resilient infrastructure and environmental justice efforts.

- **Integrated planning & policy alignment** – Ensure climate resilience strategies are embedded across municipal departments (planning, transportation, housing, and public health).
- **Innovative financing & incentives** – Utilise green bonds, resilience funds, and public-private partnerships to scale up investments in sustainable infrastructure.
- **Regulatory support for green infrastructure** – Implement zoning and building codes that require or incentivise nature-based solutions in new developments and retrofits.
- **Monitoring & adaptive management** – Establish performance metrics and data-driven approaches to track climate adaptation progress and adjust strategies as needed.

4. Multi-Benefit Infrastructure & Public Space Design

Cities should integrate resilience into everyday infrastructure by creating multi-functional spaces that serve both environmental and social needs.

- **Parks as climate infrastructure** – Design public parks to double as flood detention areas, urban cooling zones, and habitat restoration sites.
- **Complete streets & green mobility** – Incorporate green infrastructure along transportation corridors to enhance pedestrian comfort, bikeability, and stormwater management.
- **Building-integrated green design** – Promote the use of green roofs, living walls, and energy-efficient building designs to enhance urban sustainability.
- **Water-sensitive urban design** – Integrate natural water management features into streetscapes, plazas, and waterfront developments.

5. Scaling Innovation & Knowledge Sharing

Cities can accelerate impact by learning from global best practices and fostering cross-sector collaboration.

- **Peer learning networks** – Join or establish coalitions (e.g., Biophilic Cities Network, 100 Resilient Cities) to share knowledge and best practices.
- **Pilot projects & experimental urbanism** – Test innovative solutions in small-scale projects before scaling citywide.
- **Technology & data-driven solutions** – Utilise geospatial analysis, climate modelling, and AI-driven planning tools to improve decision-making.
- **Replication & adaptation** – Develop adaptable frameworks that allow successful models to be scaled and modified based on local conditions.

These five strategic recommendations—centred on nature-based solutions, equity, governance, design, and knowledge-sharing—offer a holistic framework for cities seeking to enhance resilience and sustainability. By integrating ecological principles with strong community engagement and policy support, cities can create lasting environmental and social benefits, ensuring that urban spaces remain liveable, climate-resilient, and inclusive for future generations

8.3

key insights from experts on renaturing and resilience

The people interviewed for this report represent a diverse group of **designers, planners, scientists, policymakers, and advocates**, all working at the intersection of **nature, cities, and climate resilience**. From architects and urban designers to ecologists, community organisers, and policy leaders, their work spans **research, governance, community engagement, and large-scale infrastructure projects**.

Despite differences in background and focus, their insights converge around a shared vision: **cities must embrace nature, rethink infrastructure, engage communities, and move beyond short-term, siloed approaches to resilience**.

Across the conversations, five major themes emerged:

1. **Embedding Nature in Urban Systems** – Cities must integrate ecological thinking into planning, not as an add-on, but as a fundamental principle.
2. **Rethinking Infrastructure for Climate Resilience** – The future of urban adaptation lies in multi-functional, nature-based solutions.
3. **Centring Equity in Climate Action** – Resilience must prioritise communities most vulnerable to climate change, ensuring access to nature and environmental justice.
4. **Shifting Governance & Funding Models** – Overcoming fragmented governance and short-term funding cycles is critical to long-term adaptation.
5. **Building a Culture of Collaboration & Action** – The transition to resilient cities requires a shift in mindset—embracing interdisciplinary work, knowledge-sharing, and bold experimentation.

These themes reflect a growing consensus: cities need urgent, systemic change to become more resilient, just, and ecologically integrated.

1. Embedding Nature in Urban Systems

A common thread across all interviews was that **nature cannot be an afterthought in city-making**. Instead, it must be embedded at every level—from policy to design, from infrastructure to community life.

- **Biophilic design & biodiversity integration** – Urban landscapes should not just be green but ecologically functional, supporting wildlife, pollinators, and biodiversity corridors.
- **Restoring natural systems** – Urban creeks, wetlands, and native habitats must be restored and protected to maintain ecosystem services.
- **Green infrastructure at scale** – Nature-based solutions like green roofs, living shorelines, and tree canopies must be implemented citywide to support urban cooling, flood resilience, and air quality.

"We need to design cities that don't just sustain life but regenerate it—where buildings function like ecosystems, water is treated as a precious resource, and urban nature thrives alongside communities." – Kirstin Weeks

2. Rethinking Infrastructure for Climate Resilience

Many interviewees stressed that traditional **grey infrastructure (pipes, levees, seawalls)** alone cannot solve climate challenges. Instead, cities must adopt **multi-benefit, adaptable solutions** that **integrate ecology, water management, and public space**.

- **Rethinking flood protection** – Instead of rigid barriers, urban resilience should embrace flexible, localised, and adaptive solutions, as seen in The Big U in Manhattan.
- **Stormwater as a resource** – Cities must shift from draining water away to capturing, filtering, and reusing it through permeable landscapes, wetlands, and green streets.
- **Cooling the city –** With urban heat rising, increasing tree canopy and vegetated spaces is not optional—it is essential for public health and liveability.

"Resilience isn't just about protecting cities from climate risks—it's about designing places that work with nature, support communities, and adapt over time." – Richard Mullane

3. Centring Equity in Climate Action

A strong theme across discussions was the need to **prioritise social and environmental justice** in urban resilience efforts. Historically marginalised communities often experience the worst climate impacts, with less access to green space, higher exposure to heat, and greater risk of displacement.

- **Equitable access to nature** – Greening efforts must focus on historically underserved neighbourhoods, ensuring access to cooling, recreation, and biodiversity.
- **Community-driven adaptation** – Resilience planning must be co-created with local communities, ensuring that solutions reflect their needs, histories, and aspirations.
- **Avoiding green gentrification** – Urban greening can drive rising property values and displacement—policies must ensure that nature-based investments do not push out vulnerable residents.

"We need to ensure that adding nature doesn't force out the very people who need it most." – Tim Beatley

4. Shifting Governance & Funding Models

Many interviewees highlighted the **systemic barriers** to implementing large-scale resilience projects, particularly **fragmented governance and short-term funding cycles**. Unlike places with centralised climate planning, cities in the U.S. must compete for grants, leading to piecemeal solutions rather than integrated long-term strategies.

- **Overcoming siloed governance** – Planning, transport, and environmental agencies must coordinate efforts to integrate resilience across all urban policies.
- **Securing long-term funding** – Competitive grant-based funding creates uncertainty—cities need dedicated, long-term climate investment strategies.
- **Policy reform for green infrastructure** – Building codes, zoning laws, and development regulations must incentivise or require nature-based solutions.

"The issue isn't a lack of funding—it's the structure of funding that makes long-term planning difficult." – Matthijs Bouw

5. Building a Culture of Collaboration & Action

While technical solutions are crucial, many interviewees emphasised that **urban resilience requires a shift in mindset**—embracing **cross-disciplinary collaboration, knowledge-sharing, and bold experimentation**.

- **Breaking professional silos** – Urban designers must work alongside scientists, engineers, policymakers, and communities to create holistic solutions.
- **Learning from global best practices** – Cities must share knowledge and scale up successful models from other regions.
- **A shift in political will** – Climate action must move from reactive to proactive, embedding resilience in every decision cities make.

"For biophilic cities to succeed, we need to stop seeing nature as an 'extra'—it must be embedded into the core of how cities function." – JD Brown

Looking Ahead: A Call to Action

Despite the challenges, every expert interviewed shared a **hopeful vision for the future**—one where cities are **more resilient, equitable, and deeply connected to nature**.

- **A future where nature is central to urban life** – Not just in parks, but in streets, rooftops, and infrastructure.
- **A shift toward long-term, systemic climate planning** – Moving beyond short-term fixes to deep, structural resilience.
- **Communities as co-creators of resilience** – Ensuring that climate adaptation is led by and for the people it affects most.

"We are only at the beginning of the climate transition. What we do now will define the cities of the future." – Matthijs Bouw

This is **a moment of transformation**. The challenges are urgent, but the solutions are already taking shape. The next step is not just to **imagine better cities—but to build them, together**.

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- **Annie Ryan** – Urban Strategist, Hassell
- **Joshua Baker** – Outreach Program Manager, Lloyd EcoDistrict
- **Lori Hennings** – Senior Natural Resource Scientist, Oregon Metro
- **Tim Beatley** – Professor of Urban Planning, University of Virginia ; founder of the Biophilic Cities Network
- **JD Brown** – Program Director, Biophilic Cities
- **Frederick (Fritz) Steiner** – Dean, University of Pennsylvania's Weitzman School of Design
- **Keith VanDerSys** – Senior Lecturer & Co-Director, Environmental Modeling Lab, University of Pennsylvania
- **Matthijs Bouw** – Founder, One Architecture and Urbanism; Professor of Practice, University of Pennsylvania

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about the author

Stewart Monti is an environmental designer and sustainability consultant based in Sydney, Australia. His work focuses on integrating ecological principles into urban environments, with an emphasis on resilience, biodiversity, and regenerative design.

Born and raised in Sydney's Inner West, Stewart's early experiences in Marrickville—a neighbourhood defined by its dense urban fabric yet punctuated by significant pockets of green space—shaped his appreciation for the interplay between nature and the built environment. Despite the industrial backdrop of his childhood, he recalls a deep connection to parks, rivers, and the outdoors, which later influenced his professional trajectory.

Before transitioning into environmental design, Stewart worked extensively in project and construction management. His firsthand experience with large-scale urban developments—particularly the transformation of greenfield sites—provided valuable insight into the tensions between conventional development practices and ecological integrity. This perspective ultimately led him to pursue architecture, drawn by the potential to shape more sustainable, people-centred environments.

While studying architecture at the University of Technology Sydney (UTS), Stewart's interests in urban ecology, nature-based design, and climate resilience deepened. He engaged in research under the guidance of leading practitioners such as Jason Twill, Paul Stoller, and Rob Roggema, where he explored the intersections of urbanism, sustainability, and biodiversity. His master's studies provided the foundation for Renaturing for Resilience, a project that has evolved over several years into a broader investigation of how cities can foster deeper ecological connections.

Professionally, Stewart is now a leader in sustainable master planning, guiding projects that reimagine urban resilience and ecological integration at precinct and city scales. Through his work at Atelier Ten and other research initiatives, he continues to advance strategies that move beyond sustainability toward regenerative, living urban systems.

Renaturing for Resilience remains an ongoing exploration, now extending into new formats beyond this report, including a podcast and further applied research. It is part of a broader initiative, *Urban Refugia*, which seeks to reshape the way cities interact with nature—not by adding nature to cities, but by fostering cities within nature.

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