

Nature as Infrastructure

**Understanding, Valuing, and Acting
for Our Resilient Future**



RATNO Institute

Research and Technology for New Energy Opportunities

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About the Publisher

RATNO Institute
Research and Technology for New Energy Opportunities

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Executive Summary

"Nature as Infrastructure: Understanding, Valuing, and Acting for Our Resilient Future" invites readers to explore a transformative perspective on how we view and use the natural world. Rather than seeing nature as a backdrop to human development, this booklet presents a bold vision where ecosystems—forests, wetlands, rivers, and coastal areas—are recognized as critical infrastructure that supports our daily lives, strengthens our communities, and enhances our resilience to environmental challenges.

In this guide, you'll discover how natural systems provide essential services: filtering our water, purifying our air, reducing flood risks, and even helping to stabilize our climate. Investing in nature as infrastructure not only offers cost-effective solutions but also enhances long-term sustainability and community health. Throughout, we share inspiring real-world examples of communities and countries that have successfully integrated nature-based solutions into their infrastructure, demonstrating the tangible benefits of embracing this approach.

Designed to inform, motivate, and guide, this booklet covers the fundamentals of Nature as Infrastructure, outlines the key benefits, addresses the challenges, and highlights practical steps that individuals, communities, and policymakers can take. With chapters dedicated to understanding the science, valuing nature's economic and social contributions, and taking actionable steps, this booklet empowers readers to advocate for, protect, and engage with natural systems as vital components of resilient infrastructure.

"Nature as Infrastructure: Understanding, Valuing, and Acting for Our Resilient Future" is more than a resource; it's a call to action for building a sustainable, thriving world where humanity and nature coexist in harmony. Dive in, and be inspired to help shape a resilient future—one where natural systems are not only protected but valued as the foundation of a healthy, prosperous society.

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1. Introduction

What is Nature as Infrastructure?

Nature as Infrastructure is a forward-thinking approach that redefines our understanding of infrastructure by incorporating the natural world's resources and systems as essential, foundational assets. Rather than relying solely on built structures like dams, roads, or treatment plants, this concept emphasizes the value of ecosystems—such as forests, wetlands, coral reefs, and mangroves—in providing the same kinds of services we typically expect from traditional infrastructure.

Just as engineered infrastructure is designed to serve society, nature performs numerous functions that benefit both people and the planet. Forests, for example, capture carbon and produce oxygen, helping regulate the climate and purifying the air. Wetlands act as natural water filtration systems, absorbing pollutants and providing clean water to communities. Mangrove forests protect coastlines from storm surges and flooding, reducing the need for seawalls or other expensive structures. These services not only contribute to human well-being but also help sustain the natural world on which all life depends.

The idea of Nature as Infrastructure goes beyond merely "protecting nature"—it promotes a perspective that sees ecosystems as vital, active components of our economy and society. By recognizing and investing in these natural systems, we can achieve benefits similar to those of traditional infrastructure, often with greater resilience, cost-effectiveness, and environmental advantages. For example, restoring a wetland may provide flood control and water purification at a fraction of the cost of a treatment plant, while also creating habitats for wildlife and recreational spaces for people.

Moreover, embracing Nature as Infrastructure aligns with addressing dual global crises: climate change and biodiversity loss. This integrated approach not only mitigates climate impacts but also safeguards biodiversity, leading to a resilient, sustainable infrastructure that serves both current and future generations. This perspective calls for a rethinking of policy, investment, and planning frameworks to ensure that nature's inherent services are maximized alongside engineered solutions, ultimately creating a balanced, sustainable infrastructure foundation for our world.

By redefining our relationship with nature in this way, we can begin to see ecosystems as allies and partners, actively shaping a future where human progress harmonizes with environmental health. This shift marks a transformative step toward an inclusive, resilient, and nature-positive approach to building and sustaining our world.

Why This Matters Now

The urgency of embracing Nature as Infrastructure has never been greater. The world faces twin crises of climate change and biodiversity loss, each amplifying the other's effects and creating a domino effect of environmental and social challenges. Climate change leads to more frequent and intense weather events, such as hurricanes, floods, and droughts, which strain human-made infrastructure and impact ecosystems globally. Simultaneously, biodiversity loss—the unprecedented decline of animal and plant species—further weakens ecosystems that are vital to our climate resilience and human well-being. By recognizing and investing in Nature as Infrastructure, we can create sustainable, cost-effective solutions to these challenges while preserving the ecosystems we depend on.

One reason this paradigm shift is essential is that traditional infrastructure, while necessary, can have significant environmental costs. High carbon emissions, habitat destruction, and pollution are often the byproducts of conventional infrastructure projects. Grey infrastructure, like concrete seawalls or drainage systems, is expensive to build and maintain, and it can be inflexible and vulnerable to changing conditions. Nature-based solutions, however, are often more adaptable, self-sustaining, and resilient to environmental changes, allowing ecosystems to recover and even improve over time.

The economic case for Nature as Infrastructure is equally compelling. A significant portion of the global economy—estimated to be more than 55% of GDP—is directly or indirectly dependent on the services ecosystems provide. For example, agriculture relies on pollination, water filtration, and fertile soil; tourism depends on vibrant natural landscapes; and coastal cities benefit from natural barriers like mangroves and coral reefs. Investing in ecosystems not only supports these economic activities but also creates a long-term cost savings by reducing the need for costly repairs or replacements of grey infrastructure, especially as climate impacts become more severe.

International initiatives, like the Kunming-Montreal Global Biodiversity Framework, underscore the importance of this shift by setting ambitious goals to protect and

restore 30% of the world's land and seas by 2030. This global framework aligns with the urgency to address the financing gap in biodiversity conservation, which currently needs an additional \$700 billion per year to meet targets. By including nature in our infrastructure planning, we can leverage funds to protect and regenerate ecosystems, making them resilient assets rather than expendable resources.

Furthermore, Nature as Infrastructure can enhance our resilience against climate impacts and support global sustainability targets. Natural systems such as wetlands and forests not only absorb carbon but also provide cooling effects, flood control, and other climate-related benefits. Their multifunctional nature means they can address multiple challenges at once—benefits that grey infrastructure cannot replicate.

In short, adopting Nature as Infrastructure now is both a practical and urgent response to our most pressing environmental crises. This approach enables us to transform our infrastructure from being merely functional into a synergistic network that supports ecological health, economic stability, and community resilience. Making this shift today positions us to build a sustainable, prosperous future where people and nature thrive together.

2. The Value of Nature-Based Infrastructure

Ecosystem Services Explained

Ecosystem services are the countless benefits that nature provides, often invisibly, to support both human life and the planet's ecological balance. These services range from basic life-supporting functions, such as purifying water and producing oxygen, to more complex roles like climate regulation, food production, and recreational opportunities. Understanding these services is essential to recognizing the value of nature as a form of infrastructure that can meet many of the same needs as traditional engineered structures.

Ecosystem services can be grouped into four main categories:

Provisioning Services

These are the resources that nature directly supplies for human use, including food, fresh water, wood, fiber, and medicinal plants. Forests, for instance, provide timber, while oceans and rivers supply fish. Nature's ability to renew these resources sustainably makes it a critical asset. For example, sustainable forestry not only provides wood but also preserves biodiversity and supports soil health, ensuring these resources remain available for future generations.

Regulating Services

These services include natural processes that help maintain environmental conditions favorable to human health and well-being. Wetlands filter pollutants from water, forests capture and store carbon to mitigate climate change, and mangroves protect coastlines from storm surges and erosion. By acting as buffers and stabilizers, these ecosystems help regulate climate, water quality, and air purity, often more effectively and at a lower cost than human-made systems like levees or air purification plants.

Supporting Services

Supporting services form the foundation for all other ecosystem services by sustaining the processes that allow ecosystems to function. These include soil formation, nutrient cycling, photosynthesis, and the pollination of crops by insects. Without these foundational services, ecosystems would deteriorate, compromising their ability to provide food, clean water, and other essentials. Pollination, for example, is crucial for many crops, supporting food production on a massive scale and contributing billions of dollars to the global economy each year.

Cultural Services

Beyond physical resources and regulatory functions, ecosystems also enrich human lives by providing spaces for recreation, spiritual growth, and cultural activities. Parks, beaches, and scenic landscapes offer recreational and mental health benefits that are invaluable yet difficult to quantify. The preservation of iconic landscapes, like coral reefs and mountain ranges, also holds cultural significance for many communities, fostering a sense of identity and heritage that connects people to their environment.

By viewing these services as integral to infrastructure planning, we begin to see how ecosystems function as natural allies in addressing human needs. Unlike single-purpose grey infrastructure, ecosystems are inherently multifunctional. For instance, a single forest can provide clean water, prevent soil erosion, support biodiversity, capture carbon, and offer recreational space. This multifaceted nature not only makes ecosystems efficient but also ensures their benefits are spread across various sectors, from agriculture and tourism to health and disaster resilience.

In a time of rapidly intensifying environmental challenges, ecosystem services are indispensable in maintaining a balanced, resilient world. Investing in and conserving these natural systems enhances their ability to continue providing these benefits, allowing us to meet our infrastructure needs while preserving ecological integrity. This approach forms the backbone of Nature as Infrastructure, where the focus shifts from merely extracting resources to nurturing the processes that sustain life and enable development in harmony with nature.

Economic Importance

Nature-based infrastructure is not only an ecological asset but also an economic powerhouse. The services provided by ecosystems—often undervalued or even invisible—directly support a large portion of the global economy. In fact, it is estimated that over 55% of global GDP, or approximately \$58 trillion, relies moderately to heavily on the benefits that ecosystems provide, including clean water, fertile soil, and a stable climate. As climate change and environmental degradation continue, the economic importance of maintaining and enhancing nature's services has become critical.

One of the key economic benefits of nature-based infrastructure is its potential to deliver cost-effective, resilient solutions for common infrastructure needs. For example, the restoration of wetlands to manage stormwater can reduce flooding and improve water quality, often at a fraction of the cost of building artificial flood control systems. Similarly, reforesting degraded landscapes can prevent soil erosion, sequester carbon, and provide habitat for wildlife, all of which bring both direct and indirect economic benefits to local communities.

Moreover, nature-based infrastructure often comes with lower long-term maintenance costs compared to grey infrastructure. While engineered solutions like seawalls or drainage systems can degrade over time and require costly repairs, ecosystems have a natural capacity to regenerate and adapt, which can reduce the frequency and expense of upkeep. A mangrove forest, for example, can recover from storm damage and continue to provide coastal protection, unlike a concrete seawall that may require complete replacement after severe weather events.

Supporting Key Economic Sectors

Several industries benefit directly from ecosystem services. Agriculture relies on pollination, nutrient-rich soil, and water regulation provided by natural systems. Tourism, particularly ecotourism, depends on the preservation of scenic landscapes, wildlife, and healthy ecosystems. Fisheries, a crucial source of food and income for millions, depend on clean, productive marine environments, which are supported by coastal wetlands and coral reefs. When these ecosystems are degraded, the industries they support are put at risk, highlighting the economic necessity of investing in nature.

The financial sector is increasingly recognizing the importance of ecosystems as economic assets. Financial institutions, development banks, and insurance companies are exploring nature-based solutions as investments with the potential to reduce environmental risks, generate returns, and enhance resilience to climate

impacts. Insurance companies, for example, are considering the role of mangroves and reefs in reducing storm damage, as healthy ecosystems can act as natural buffers that reduce claims after extreme weather events.

Cost Savings Through Nature-Based Climate Solutions

Nature-based infrastructure also supports climate resilience in economically efficient ways. Forests, for instance, are powerful carbon sinks, capturing and storing greenhouse gases that would otherwise contribute to climate change. By preserving and restoring forests, we not only help mitigate climate change but also reduce the costs associated with its impacts. According to estimates, nature-based climate solutions can provide one-third of the carbon reduction needed by 2030 to limit global warming to safe levels.

In addition, ecosystems like wetlands and forests help communities adapt to climate change by regulating temperatures, managing water flows, and absorbing excess rainfall. The savings from reduced flood damage, avoided heat-related health costs, and stabilized water supplies are substantial. These nature-based solutions can help offset the need for costly climate adaptation measures, providing a dual benefit of mitigation and adaptation at a lower overall cost.

Creating Jobs and Boosting Local Economies

Investing in nature-based infrastructure creates economic opportunities through job creation in restoration, conservation, and sustainable management of natural resources. Projects aimed at restoring coastal ecosystems, reforesting degraded land, or implementing sustainable agricultural practices can provide jobs while fostering local economies. In regions heavily dependent on natural resources, this type of employment supports not only economic growth but also long-term resilience, as communities are more likely to thrive in environments they help protect.

Nature as Infrastructure thus presents a strong economic case for aligning investment with ecological preservation and regeneration. By shifting our perspective to value natural systems as assets, we can achieve multiple economic and environmental benefits. The approach not only supports critical industries and saves costs but also builds a more resilient and sustainable economic foundation, ensuring that both people and the planet prosper.

3. Global and Local Benefits of Nature as Infrastructure

Climate Change Mitigation and Adaptation

Nature as Infrastructure offers a dual benefit in the fight against climate change by both mitigating its causes and helping communities adapt to its impacts. Natural ecosystems such as forests, wetlands, and oceans play a critical role in absorbing greenhouse gases, making them powerful tools for climate mitigation. At the same time, these ecosystems also help communities adapt to the shifting conditions brought on by climate change, offering protection against floods, storms, droughts, and extreme temperatures. In this way, Nature as Infrastructure provides an integrated approach to climate resilience, addressing both the causes and effects of climate change simultaneously.

Mitigating Climate Change through Carbon Sequestration

One of the most crucial roles that natural ecosystems play in climate change mitigation is their ability to act as carbon sinks. Forests, for instance, absorb and store carbon dioxide, a major greenhouse gas, through photosynthesis. Tropical forests alone store an estimated 25% of the world's terrestrial carbon, making them indispensable in our efforts to limit global warming. Wetlands and peatlands are also extremely efficient carbon reservoirs, storing twice as much carbon per unit area as forests, despite covering a smaller land area. By conserving and restoring these carbon-rich ecosystems, we can significantly reduce the amount of carbon in the atmosphere, directly addressing one of the primary drivers of climate change.

In addition to terrestrial ecosystems, marine and coastal habitats like mangroves, seagrass beds, and salt marshes—often referred to as "blue carbon" ecosystems—also sequester large amounts of carbon. These habitats capture carbon in both the plants themselves and in the sediment beneath them, where it can remain stored for centuries if left undisturbed. Protecting and restoring blue carbon ecosystems not only contributes to carbon reduction goals but also provides a valuable buffer against rising sea levels and storm surges.

Adapting to Climate Impacts with Natural Buffers

Beyond their role in reducing carbon, natural ecosystems provide vital adaptation benefits by buffering human communities from the effects of extreme weather events and climate variability. For example, coastal wetlands and mangroves reduce wave energy and absorb storm surges, shielding coastal areas from erosion and flooding. Studies show that intact mangrove forests can reduce wave heights by up to 66%, making them a cost-effective alternative to seawalls and other engineered defenses. This protective capacity becomes increasingly important as sea levels rise and storms become more intense and frequent due to climate change.

Similarly, forests and urban green spaces can mitigate the impacts of heat waves by providing natural cooling through shade and evapotranspiration. This cooling effect can reduce urban temperatures by several degrees, helping to prevent heat-related illnesses and deaths, especially in cities that experience intense heat during the summer months. Forests also play a role in regulating water flows, reducing the severity of floods by capturing rainfall and releasing it slowly, which can prevent downstream flooding and provide a reliable water supply during dry periods.

Enhancing Resilience through Biodiversity

Ecosystems with high biodiversity are generally more resilient to climate impacts, as diverse species often support multiple functions and can adapt to environmental changes. For example, diverse plant species in a wetland may each play a slightly different role in filtering pollutants, storing carbon, or regulating water flow. This redundancy ensures that even if some species are affected by changing conditions, others can continue to fulfill these roles, maintaining the ecosystem's overall function. By protecting and restoring biodiverse ecosystems, we enhance their ability to adapt to climate change, which in turn strengthens the resilience of communities that rely on these ecosystems for services.

Cost Savings in Climate Adaptation

The adaptive functions of natural infrastructure can offer significant cost savings compared to grey infrastructure. For instance, wetlands that manage stormwater naturally may eliminate the need for costly flood control infrastructure like levees and stormwater treatment plants. Research suggests that nature-based solutions can be as effective as grey infrastructure in protecting against climate impacts, often at a lower cost and with additional environmental and social benefits. For example, investing in natural buffers like mangroves can be up to five times more cost-effective than engineered structures in protecting coastal areas.

A Balanced Approach for Long-Term Sustainability

Nature as Infrastructure provides a balanced approach that supports both mitigation and adaptation efforts. By integrating nature-based solutions with conventional infrastructure planning, we can create resilient systems that meet present needs without compromising future stability. This approach maximizes the strengths of natural ecosystems, providing adaptive, self-sustaining benefits that grey infrastructure alone cannot achieve.

In conclusion, Nature as Infrastructure plays a vital role in addressing climate change by capturing carbon and helping communities prepare for and adapt to its inevitable impacts. By conserving and investing in ecosystems that provide these services, we can tackle climate challenges in a holistic way, achieving both environmental resilience and economic sustainability.

Biodiversity Preservation

Preserving biodiversity is a fundamental benefit of viewing nature as infrastructure. Biodiversity—the variety of life found in different ecosystems, from forests to oceans—is crucial not only for maintaining ecosystem health but also for supporting human well-being. High biodiversity levels contribute to ecosystem stability, resilience, and productivity, which are essential for providing the ecosystem services that support agriculture, water purification, and climate regulation. By investing in Nature as Infrastructure, we can protect biodiversity and, in turn, strengthen the resilience and sustainability of the very ecosystems that humanity depends on.

The Role of Biodiversity in Ecosystem Health

Biodiverse ecosystems are more robust and adaptable, able to withstand and recover from environmental disturbances better than ecosystems with limited species diversity. Each species within an ecosystem contributes to its overall functionality, often in unique ways. For instance, a forest with a variety of tree species can provide a wider range of habitats, food sources, and nutrients, supporting a broader array of wildlife. This diversity creates a complex web of interactions that helps regulate pests, cycle nutrients, and stabilize the soil, which benefits agriculture, forestry, and water management efforts.

When biodiversity is lost, these ecosystems become less resilient and less capable of providing essential services. A wetland with reduced biodiversity, for example, may no longer filter water as effectively, leading to increased pollution and diminished water quality. Similarly, a coral reef that loses its biodiversity is less likely

to support marine life and protect coastlines from storm surges. Protecting biodiversity thus ensures that ecosystems can continue to function effectively, which benefits both nature and people.

Supporting Global Food Security and Medicine

Biodiversity is directly tied to global food security, as many crops depend on wild species for pollination, pest control, and genetic diversity. Pollinators like bees, butterflies, and bats play an irreplaceable role in food production, contributing to the pollination of about 75% of leading global crops. Protecting habitats that support pollinators and other beneficial species is essential for maintaining productive agricultural systems and reducing the need for synthetic fertilizers and pesticides.

In addition to its role in food production, biodiversity is a critical source of medicinal resources. Many pharmaceuticals are derived from compounds found in plants, fungi, and marine organisms. The preservation of biodiverse ecosystems increases the likelihood of discovering new, potentially life-saving medicines. Rainforests, coral reefs, and other biodiverse habitats are often described as “nature’s pharmacies,” yet their potential remains largely untapped. Conservation efforts that protect biodiversity can thus provide direct benefits to human health, fostering the discovery of treatments and cures for various diseases.

Economic Value of Biodiversity for Tourism and Recreation

Biodiversity-rich landscapes such as tropical rainforests, coral reefs, and national parks are popular destinations for ecotourism, which generates significant revenue for local and national economies. Wildlife tourism, including safaris, birdwatching, and scuba diving, relies heavily on the presence of diverse plant and animal species. For example, coral reefs alone support tourism industries worth billions of dollars annually, attracting visitors with their rich marine life and vibrant underwater scenery.

By maintaining biodiversity, communities can develop sustainable tourism economies that bring income and employment opportunities without degrading natural resources. This mutually beneficial relationship helps fund conservation efforts while creating jobs, supporting infrastructure, and boosting the local economy. In many cases, nature-based tourism also raises awareness about the importance of biodiversity and encourages support for conservation initiatives.

Biodiversity and Resilience to Climate Change

Biodiverse ecosystems are better equipped to adapt to the stresses brought on by climate change, such as altered rainfall patterns, rising temperatures, and extreme

weather events. This resilience is because diverse species can perform overlapping ecological roles, ensuring that key functions are maintained even if some species are affected by climate change. For example, a forest with a variety of tree species is more likely to withstand pests, diseases, and climate variability, providing continued carbon storage, soil stabilization, and water regulation.

Investing in Nature as Infrastructure by prioritizing biodiversity conservation offers a pathway to create climate-resilient landscapes that benefit both people and the planet. Restoring degraded lands by planting a diverse range of native species, for example, strengthens the ecosystem's adaptability while enhancing its natural services, from flood control to carbon sequestration. Such approaches not only support biodiversity but also make ecosystems more robust in the face of climate challenges.

Biodiversity as a Public Good

Biodiversity provides benefits that extend beyond local and national borders, making it a public good that requires collective efforts to protect. Ecosystems rich in biodiversity, such as the Amazon rainforest, act as global carbon sinks, help regulate water cycles, and support a wide array of species that migrate and interact with ecosystems across continents. Preserving these global biodiversity hotspots is essential for sustaining life on Earth, both for current and future generations.

The preservation of biodiversity through Nature as Infrastructure is not only an ethical and ecological priority but also an economic and social necessity. By protecting the diversity of life on our planet, we ensure that ecosystems remain resilient and productive, capable of supporting human needs now and in the future. Investing in biodiversity-friendly infrastructure policies and conservation practices aligns with a sustainable, resilient approach to development that balances ecological health with human prosperity.

Community Resilience and Health

Nature as Infrastructure plays a pivotal role in enhancing community resilience and health by providing natural defenses against environmental hazards and improving overall quality of life. Ecosystems such as forests, wetlands, and urban green spaces offer services that reduce communities' vulnerability to disasters, stabilize food and water supplies, and promote mental and physical well-being. In an era of increasing environmental stressors and climate instability, these natural systems are essential not only for survival but also for fostering resilient, healthy, and vibrant communities.

Natural Defenses Against Disasters

Natural ecosystems are often more effective and adaptable than engineered structures in protecting communities from natural disasters. Wetlands, mangroves, and coral reefs, for example, serve as natural buffers against storms and flooding. Coastal wetlands absorb wave energy and reduce storm surge impacts, while coral reefs break up wave force, minimizing erosion and damage to coastal infrastructure. According to studies, mangroves can reduce wave heights by as much as 66%, offering a level of protection that is equivalent to artificial barriers but with added ecological benefits. These ecosystems can be restored and maintained at a fraction of the cost of building and maintaining artificial seawalls, levees, or floodgates, providing an economical and sustainable way to shield communities from natural disasters.

Inland, forests and grasslands help regulate water flow, reducing the risk of flash floods and landslides by slowing down rainwater runoff and stabilizing soil. Urban parks and green spaces play a similar role by absorbing rainfall, which reduces the strain on city drainage systems and helps prevent urban flooding. By investing in Nature as Infrastructure, communities can build resilience to increasingly frequent and severe weather events, minimizing both economic losses and risks to human life.

Supporting Food and Water Security

Natural systems are essential for maintaining food and water security, which are foundational to community resilience. Forests, wetlands, and watersheds filter pollutants from water sources, ensuring a clean supply of drinking water. Forested watersheds alone provide drinking water to more than 50% of the world's population, highlighting the critical role of ecosystems in sustaining human life. When these ecosystems are degraded, communities face water scarcity and contamination, leading to higher costs for water treatment and greater public health risks.

Ecosystems also support agriculture, a primary source of food and income for many communities, especially in rural areas. Pollination by bees, butterflies, and other insects is necessary for about 75% of global food crops, making healthy pollinator populations crucial for food security. Soil health, enhanced by diverse vegetation and natural nutrient cycling, ensures productive agriculture and stable food supplies. By preserving and restoring ecosystems that support food and water resources, Nature as Infrastructure strengthens community resilience to disruptions caused by climate change, population growth, and other stressors.

Promoting Physical and Mental Health

Access to green spaces, parks, and natural environments has a profound impact on physical and mental health. Numerous studies show that spending time in nature reduces stress, improves mood, and lowers the risk of depression and anxiety. Green spaces in urban areas provide residents with places to exercise, relax, and connect with nature, all of which contribute to improved physical and psychological health. The presence of trees, for instance, has been linked to lower blood pressure, reduced heart disease risk, and improved recovery times for hospitalized patients.

Beyond mental health benefits, urban greenery can reduce heat in cities, which are often significantly warmer than rural areas due to the urban heat island effect. Trees and vegetation cool the air through shade and evapotranspiration, providing relief from high temperatures and reducing heat-related health issues. For vulnerable populations—such as the elderly, young children, and those with pre-existing health conditions—this cooling effect can be life-saving during heatwaves, which are becoming more common and severe with climate change.

Enhancing Social Cohesion and Community Engagement

Nature-based infrastructure can also strengthen social cohesion and community identity. Parks, community gardens, and other green spaces offer shared environments where people can gather, interact, and engage in community activities. These spaces help foster a sense of belonging and mutual responsibility, as residents come together to care for their local environment. Communities that actively engage in conservation efforts, tree planting, or maintaining green spaces often report higher levels of social trust and cooperation, which are critical during times of crisis or environmental stress.

Furthermore, the preservation and restoration of culturally significant natural sites contribute to a community's heritage and identity. Indigenous and local knowledge often includes sustainable land-use practices and respect for natural resources, which can be integrated into modern conservation strategies. By valuing and incorporating these cultural aspects into Nature as Infrastructure, communities create a holistic approach to resilience that respects and enhances their unique identities and traditions.

Long-Term Cost Savings and Economic Stability

Investing in nature-based solutions for community resilience can also yield significant long-term cost savings. By protecting and enhancing natural infrastructure, communities can reduce their dependency on costly grey infrastructure for water

filtration, flood protection, and climate adaptation. For example, restoring wetlands to manage stormwater is often more economical than expanding drainage systems, and urban green spaces reduce the need for extensive air conditioning during heatwaves. These savings allow communities to allocate resources to other essential areas, such as healthcare, education, and social services, ultimately supporting economic stability and growth.

In conclusion, Nature as Infrastructure offers substantial benefits for community resilience and health. By integrating natural systems into our infrastructure planning, we build protective, sustainable, and enriching environments that improve quality of life while enhancing our ability to withstand and recover from environmental challenges. From reducing disaster risks to promoting mental and physical well-being, nature-based infrastructure provides the foundation for communities to thrive, adapt, and prosper in a changing world.

4. Key Examples of Nature as Infrastructure

Case Studies

To illustrate the potential of Nature as Infrastructure, we can look at several successful case studies from around the world where natural solutions have been implemented as part of infrastructure planning. These examples demonstrate how nature-based approaches not only solve immediate infrastructure needs but also provide long-term environmental, economic, and social benefits. From coastal protection projects to urban greening initiatives, these case studies showcase the diverse applications of Nature as Infrastructure and underscore its viability as a practical and scalable approach.

Mangrove Restoration for Coastal Protection - Indonesia

Indonesia, an archipelago highly vulnerable to rising sea levels and extreme weather, has turned to mangrove restoration as a means of coastal defense. Mangrove forests are renowned for their ability to reduce wave energy and prevent coastal erosion, shielding communities from storm surges and flooding. Recognizing these benefits, Indonesia launched a large-scale mangrove restoration program that combines conservation with economic benefits for local communities, such as sustainable fishing and eco-tourism. This approach not only enhances resilience to climate impacts but also provides jobs and income, making it a successful example of Nature as Infrastructure in action.

The New York City Watershed Program - United States

In the 1990s, New York City faced the costly proposition of building a multi-billion-dollar water filtration plant to meet federal water quality standards. Instead, the city chose to invest in the natural infrastructure of its surrounding watershed. Through a combination of land conservation, sustainable farming practices, and watershed management, the New York City Watershed Program ensures that water flowing into the city's reservoirs is clean. This approach has saved the city an estimated \$10 billion in construction and maintenance costs while providing clean drinking water to millions. The program is an outstanding example of how investing in nature can be more cost-effective and sustainable than relying solely on engineered solutions.

Coral Reef Protection in Belize

Belize's coral reefs are critical for both biodiversity and the local economy, supporting fisheries and tourism and providing natural protection against hurricanes and storm surges. Recognizing the reefs' importance, the government of Belize enacted policies to protect them, including a ban on oil exploration and investments in reef restoration. The Nature Conservancy partnered with Belize to develop an insurance mechanism that funds reef restoration following storm damage, ensuring that the coral reefs can continue to provide protective benefits. This approach highlights how Nature as Infrastructure can be supported through innovative financial mechanisms, enabling ecosystems to recover and maintain their protective functions.

Floodplain Restoration on the Rhine River - Germany

The Rhine River has a long history of devastating floods affecting towns and cities along its banks. To address these flood risks, Germany initiated a floodplain restoration project that reconnects the river to its natural floodplain. By allowing the river more room to spread during high flows, this restored floodplain absorbs excess water, reducing the flood risk to nearby communities. The project has not only reduced flooding but also restored valuable habitats for wildlife, increased biodiversity, and improved recreational spaces for local residents. This case study demonstrates the multi-functional benefits of Nature as Infrastructure, balancing flood control with ecological and community gains.

Urban Green Infrastructure in Singapore

Singapore, one of the world's most densely populated cities, has embraced urban greening as a core component of its infrastructure planning. Initiatives like the "Garden City" and "City in a Garden" policies promote the integration of green spaces, parks, vertical gardens, and green roofs throughout the city. These green spaces help reduce urban heat, improve air quality, and provide recreational areas for residents. Singapore's green infrastructure also supports biodiversity, creating habitats for birds and insects even in the urban environment. This commitment to nature-based solutions has made Singapore a global model for how cities can incorporate Nature as Infrastructure to enhance resilience and improve quality of life in urban settings.

The Great Green Wall Initiative - Africa

The Great Green Wall is an ambitious African-led project aiming to restore degraded landscapes across the Sahel region by planting trees and regenerating natural

vegetation. This initiative, spanning over 20 countries, addresses desertification, food insecurity, and poverty by creating a "green wall" of healthy ecosystems. The restored landscapes improve soil fertility, support agriculture, create jobs, and help communities adapt to climate change. The Great Green Wall exemplifies how large-scale nature-based solutions can transform entire regions, boosting local economies and strengthening resilience to environmental challenges.

These case studies highlight the versatility and effectiveness of Nature as Infrastructure. By learning from these examples, other regions can develop similar approaches, adapting them to local conditions and needs. These projects prove that nature-based solutions can provide reliable, sustainable infrastructure while enhancing resilience, supporting biodiversity, and contributing to economic growth. As more communities adopt Nature as Infrastructure, they pave the way for a future where human development and environmental health go hand in hand.

Innovative Global Examples

Nature as Infrastructure is gaining traction globally as innovative projects demonstrate its potential to provide sustainable solutions that benefit both the environment and society. Key examples, such as China's "Ecological Red Lines" policy and Ecuador's debt-for-nature swap for the Galapagos Islands, illustrate how governments are embracing nature-based approaches to tackle ecological challenges, support biodiversity, and improve climate resilience. These initiatives showcase the creative ways in which Nature as Infrastructure is being adopted at national and international levels.

China's "Ecological Red Lines" Policy

This policy is a pioneering effort to protect critical ecosystems across the country by designating specific areas as off-limits to development. These ecological zones cover more than 30% of China's land, including forests, wetlands, grasslands, and coastal regions that play a vital role in water conservation, soil stability, and biodiversity preservation. The policy aims to limit human activity in these zones to prevent habitat loss, combat soil erosion, and improve air and water quality, providing crucial ecosystem services to millions of people.

By safeguarding ecologically sensitive regions, the Ecological Red Lines policy acts as a natural infrastructure that strengthens climate resilience and reduces the need for expensive engineered solutions. For example, protected forests within these zones help regulate water flow and control flooding, while wetlands filter pollutants, improving water quality for urban and rural communities alike. This approach

highlights how regulatory frameworks can be used to integrate Nature as Infrastructure into national policy, setting an example for other countries to prioritize ecological health alongside economic development.

Ecuador's Debt-for-Nature Swap for the Galapagos Islands

In May 2023, Ecuador undertook the world's largest debt-for-nature swap, designed to protect the Galapagos Islands, one of the world's most treasured ecosystems. With support from international partners, Ecuador restructured approximately \$1.6 billion of its debt, reducing its fiscal burden and reallocating funds towards conservation efforts in the Galapagos. Through this innovative financial mechanism, Ecuador secured long-term funding for the protection and restoration of the Galapagos marine reserve, home to diverse species found nowhere else on Earth.

This debt-for-nature swap not only preserves biodiversity in the Galapagos but also strengthens the resilience of marine ecosystems that are crucial for carbon sequestration, climate regulation, and local economies dependent on sustainable tourism and fisheries. The swap sets a precedent for how countries can leverage financial restructuring to fund conservation while addressing economic challenges. It demonstrates the potential of Nature as Infrastructure to generate environmental and economic benefits through creative partnerships and financial solutions.

These examples of China's ecological zoning and Ecuador's debt-for-nature swap underscore how Nature as Infrastructure can be scaled and institutionalized through innovative policies and financial arrangements. By adopting such approaches, nations can achieve long-term environmental resilience, protect biodiversity, and support sustainable development, setting the stage for a future where natural ecosystems are seen as essential infrastructure assets.

5. Overcoming Challenges to Nature-Based Solutions

Financial and Structural Barriers

While Nature as Infrastructure offers a range of environmental and economic benefits, several financial and structural barriers currently limit its widespread adoption. These challenges include securing funding, accurately valuing ecosystem services, and overcoming a strong bias toward traditional, grey infrastructure. Simplifying these barriers can help communities, governments, and investors better understand and address the obstacles to implementing nature-based solutions.

Securing Sufficient Funding

Funding nature-based infrastructure can be challenging, as many natural solutions do not fit traditional financing models. Unlike conventional infrastructure, which can have direct revenue streams, ecosystem services such as flood protection or carbon storage do not always generate immediate, measurable returns. This makes it harder to attract private investment. Additionally, governments often have limited budgets for conservation, making it difficult to allocate sufficient resources toward these projects. Nature-based solutions may require public subsidies, grants, or innovative financing mechanisms—such as green bonds or impact investment funds—to bridge this funding gap.

Complexity in Valuing Nature

One of the most significant barriers to adopting Nature as Infrastructure is the difficulty of assigning economic value to ecosystem services. Ecosystems provide multiple benefits that are often hard to quantify, such as biodiversity preservation, mental health benefits from green spaces, and resilience to extreme weather. Although there are growing methodologies for valuing these services, the lack of standardization makes it challenging for policymakers and investors to prioritize nature-based solutions. Without a clear, widely accepted way to assess these values, nature often competes at a disadvantage against traditional infrastructure, which has well-established financial metrics.

Bias Toward Traditional Infrastructure

Conventional, grey infrastructure—such as dams, seawalls, and roads—has been the default solution for infrastructure needs for decades. This strong bias stems from familiarity, established funding models, and a perception that engineered structures offer more immediate, reliable outcomes. Nature-based solutions, by contrast, are often viewed as experimental or secondary options, even when they provide equal or greater benefits at a lower cost. Overcoming this bias requires a shift in mindset among policymakers, engineers, and communities to view natural systems as integral, reliable components of infrastructure planning.

Addressing these financial and structural barriers is essential for scaling Nature as Infrastructure. By increasing funding options, improving valuation methods, and building confidence in nature-based solutions, we can move toward a more balanced infrastructure approach that values both grey and green options. This shift will pave the way for sustainable, cost-effective, and resilient infrastructure that supports communities and the environment alike.

Policies and Supportive Environments

For Nature as Infrastructure to be effectively adopted and scaled, governments and institutions must create enabling environments that support the development, funding, and implementation of nature-based solutions. This involves establishing policies, regulatory frameworks, and incentives that encourage investment in natural infrastructure and make it easier for communities and businesses to choose these sustainable options. By creating a supportive environment, policymakers can foster an infrastructure approach that balances environmental, social, and economic priorities.

Incorporating Nature into National and Regional Policies

One of the most impactful steps governments can take is to integrate nature-based solutions into national and regional infrastructure policies. This can be achieved by including natural infrastructure as a standard option in planning frameworks, ensuring it is considered alongside traditional infrastructure in project evaluations. Countries such as China and Germany have made significant progress by designating areas where natural ecosystems, like forests and wetlands, are protected and restored specifically to support ecological services and climate resilience. Policies that mandate or encourage the use of nature-based solutions help institutionalize Nature as Infrastructure and make it an integral part of development strategies.

Setting Standards and Metrics for Ecosystem Services

Creating standardized metrics for valuing ecosystem services can help both public and private sectors understand the true worth of nature-based infrastructure. By establishing guidelines and measurement frameworks, governments can provide clear criteria for assessing the benefits of natural infrastructure, such as carbon sequestration, flood control, and biodiversity support. These standards would allow ecosystems to be valued similarly to traditional infrastructure assets, making it easier for investors and policymakers to compare options and make informed decisions. The development of such metrics by multilateral development banks (MDBs) and environmental organizations has already begun, with frameworks aimed at aligning financial flows with environmental goals.

Providing Financial Incentives and Support

Financial incentives play a critical role in encouraging the adoption of nature-based solutions. Governments can offer tax credits, subsidies, and grants to projects that incorporate Nature as Infrastructure. For example, green bonds specifically allocated for nature-based projects have gained popularity as a way to raise funds while promoting environmental benefits. Additionally, governments can provide low-interest loans or guarantees for nature-based projects, reducing the financial risk for investors. These incentives make it more attractive and feasible for municipalities, developers, and businesses to adopt sustainable infrastructure solutions, aligning economic goals with environmental priorities.

Strengthening Public-Private Partnerships

Nature-based solutions often require collaboration across sectors, as they involve a range of stakeholders, including government agencies, private companies, non-profits, and local communities. Public-private partnerships (PPPs) can be highly effective in pooling resources and expertise for nature-based projects. By creating formal frameworks that support PPPs, governments can mobilize private capital while ensuring that projects meet public environmental and social standards. For example, partnerships between governments and conservation organizations can help restore critical ecosystems, with shared funding and management responsibilities that benefit all parties involved.

Building Awareness and Capacity

To mainstream Nature as Infrastructure, it is essential to build awareness and capacity among policymakers, urban planners, engineers, and the public. Education

and training programs that emphasize the benefits, science, and implementation of nature-based solutions are crucial. Governments can support initiatives that teach decision-makers and practitioners how to integrate nature into infrastructure projects, offering workshops, case studies, and pilot programs to demonstrate the value of natural solutions. Engaging local communities and educating the public about the benefits of Nature as Infrastructure can also increase support and participation in conservation and restoration effort.

Enforcing Environmental Safeguards and Accountability

Finally, a supportive policy environment requires strong environmental safeguards and accountability mechanisms to ensure that projects align with conservation and sustainability goals. Regulations that protect ecosystems from harmful development, such as zoning laws, land-use restrictions, and habitat conservation requirements, are essential for maintaining the integrity of Nature as Infrastructure. Governments can also require that infrastructure projects include environmental impact assessments (EIAs) and periodic monitoring to ensure that natural solutions are effectively providing the intended benefits and are well-maintained over time.

By establishing these policies and supportive environments, governments and institutions can pave the way for a future where Nature as Infrastructure becomes a mainstream, reliable option. A supportive environment encourages investment in nature-based solutions, builds confidence among stakeholders, and ensures that natural ecosystems are valued, protected, and leveraged to meet the needs of society. This approach enables communities to enjoy resilient, sustainable infrastructure while conserving the natural resources that underpin global prosperity and well-being.

6. How Nature as Infrastructure is Funded

Innovative Financial Tools

Financing Nature as Infrastructure requires creative financial solutions that align with its unique benefits and challenges. Unlike traditional infrastructure projects that generate direct revenue streams, many nature-based solutions deliver indirect benefits—such as climate resilience, water purification, and biodiversity conservation—that are harder to monetize. To bridge this gap, various innovative financial tools have emerged to support and scale investments in Nature as Infrastructure. These include green bonds, nature and biodiversity loans, debt-for-nature swaps, and carbon credits, each offering distinct mechanisms to fund ecosystem conservation and restoration.

Green Bonds

Green bonds are debt securities issued to fund projects that have positive environmental or climate benefits. These bonds enable governments, municipalities, and corporations to raise capital specifically for environmentally friendly initiatives, including nature-based solutions. Proceeds from green bonds can finance a range of projects, such as wetland restoration, reforestation, and the creation of urban green spaces, which help cities manage stormwater, reduce urban heat, and improve air quality.

Green bonds are attractive to investors looking for environmentally responsible investments. By aligning financial returns with sustainability goals, green bonds can mobilize significant capital for Nature as Infrastructure. The global green bond market has grown substantially in recent years, with billions of dollars raised to fund eco-friendly projects, helping close the financing gap for sustainable infrastructure development.

Nature and Biodiversity Loans

Nature and biodiversity loans are designed to support projects that directly benefit ecosystems and biodiversity. These loans may offer favorable terms to encourage investment in natural infrastructure, including lower interest rates or longer

repayment periods. For example, a loan might fund a project that restores a degraded forest, with the understanding that the improved ecosystem will provide carbon sequestration, water filtration, and habitat benefits.

Such loans are often issued by multilateral development banks or environmentally focused financial institutions and can be structured with specific biodiversity or sustainability targets. In some cases, borrowers may receive more favorable terms if they meet environmental performance indicators, creating a financial incentive for conservation. These loans make it possible to fund Nature as Infrastructure in regions where access to capital for environmental projects might otherwise be limited.

Debt-for-Nature Swaps

Debt-for-nature swaps are agreements in which a portion of a country's foreign debt is forgiven in exchange for commitments to invest in environmental conservation. These swaps are typically negotiated between a developing country, creditors, and conservation organizations. The funds saved on debt repayments are redirected toward projects that protect biodiversity, restore ecosystems, and promote sustainable land use.

Ecuador's 2023 debt-for-nature swap for the Galapagos Islands is a recent example, where international partners helped restructure Ecuador's debt, allowing the government to allocate funds to conserve the unique and biodiverse Galapagos marine ecosystem. This model provides a dual benefit: it alleviates economic pressure on debtor countries while preserving critical ecosystems that provide global environmental services, such as carbon storage and species protection.

Carbon Credits

Carbon credits are tradable permits that represent the removal or avoidance of one metric ton of carbon dioxide (CO₂) emissions. Ecosystems like forests, wetlands, and grasslands act as carbon sinks, capturing and storing carbon that would otherwise contribute to climate change. Projects that restore or conserve these ecosystems can generate carbon credits, which are then sold to companies or governments looking to offset their carbon emissions.

The demand for carbon credits has increased as businesses seek to meet net-zero emissions targets. By establishing high-integrity, nature-based carbon credit projects, investors can support Nature as Infrastructure while contributing to climate goals. For example, a mangrove restoration project can generate carbon credits by sequestering carbon in plant biomass and soils, providing a steady income stream for conservation efforts. Carbon credits also promote global cooperation in mitigating

climate change, as developed countries can invest in natural infrastructure projects in developing nations.

Blended Finance

Blended finance combines public and private funds to support projects that may not be immediately profitable but have high social or environmental value. In this approach, public or philanthropic capital is used to de-risk investments, making them more attractive to private investors. For example, a government might provide seed funding or a first-loss guarantee for a Nature as Infrastructure project, encouraging private investors to participate by reducing potential financial risks.

Blended finance is particularly useful for nature-based solutions that have broad social benefits, such as climate resilience, biodiversity conservation, and improved public health. By blending capital from multiple sources, these projects can reach a scale that would be challenging with private or public funding alone. Blended finance allows a wide range of stakeholders to share both the costs and benefits of investing in natural infrastructure, making it an effective tool for scaling up these projects.

Performance-Linked Loans and Bonds

Performance-linked loans and bonds offer financial incentives tied to the achievement of environmental targets. These instruments allow borrowers to enjoy lower interest rates or improved repayment terms if they meet specific sustainability or biodiversity metrics. For instance, a performance-linked loan for wetland restoration might provide reduced interest rates if the project meets targets for improved water quality or increased biodiversity.

This approach aligns financial rewards with environmental impact, encouraging borrowers to prioritize nature-based outcomes. Performance-linked loans and bonds are increasingly popular as companies and governments seek to demonstrate their environmental commitments, and they provide a strong incentive for ensuring that nature-based projects deliver measurable, positive impacts.

These innovative financial tools are essential for making Nature as Infrastructure a viable, large-scale solution. By combining different funding types, stakeholders can match financial resources with the unique needs and benefits of nature-based solutions. This multi-faceted approach to financing ensures that nature-based projects receive the support they need to provide long-term environmental, economic, and social returns, allowing communities worldwide to benefit from sustainable and resilient infrastructure.

Role of Public and Private Sectors

The successful funding of Nature as Infrastructure requires coordinated efforts between public institutions and private investors. Public and private sectors each bring unique strengths to the table: public institutions can establish favorable policies, provide initial funding, and reduce risk, while private investors contribute capital, innovative approaches, and efficiency to scale nature-based solutions. When these sectors collaborate, they can mobilize the funds needed to implement and expand natural infrastructure projects, creating sustainable solutions that benefit communities, economies, and the environment.

Public Sector Contributions: Policy and Risk Reduction

Governments play a crucial role in creating a supportive environment for Nature as Infrastructure by developing policies that encourage investment in nature-based solutions. Public institutions can enact regulations, set environmental standards, and provide incentives that make nature-based projects more attractive to investors. For example, policies that require environmental impact assessments or establish “green zones” help direct funding to projects that protect or restore ecosystems, such as wetlands, forests, and coral reefs.

In addition to policy frameworks, the public sector can help mitigate financial risks that may deter private investors. Government-backed initiatives, such as guarantees or co-financing arrangements, can lower the perceived risk of investing in natural infrastructure, which may be new or unfamiliar to private stakeholders. For example, a government could offer a guarantee on loans for a reforestation project, ensuring that private lenders recover their investment even if the project encounters unforeseen challenges. By de-risking investments, public institutions make nature-based projects a more viable option for private investors.

Public funding also plays a key role in jumpstarting nature-based projects. Governments and multilateral institutions can provide initial capital or “seed funding” to get projects off the ground, allowing them to demonstrate their environmental and economic value. Once these projects show proof of concept, they are more likely to attract further private investment, enabling them to scale. This approach has been used successfully in projects funded by development banks and environmental agencies, which often act as anchor investors to encourage private participation.

Private Sector Contributions: Capital and Innovation

Private investors, such as corporations, financial institutions, and impact investors, bring essential resources and innovation to Nature as Infrastructure. Private capital

is necessary to scale nature-based solutions from small, pilot projects to larger, regional or national initiatives. For example, investment firms may fund sustainable agriculture projects or urban green spaces, which can provide returns through carbon credits, eco-tourism, or increased property values.

Private sector involvement also encourages efficiency and innovation, as companies look for profitable, scalable, and measurable solutions. Corporations are increasingly interested in investing in sustainability initiatives that align with their own climate goals and corporate social responsibility (CSR) commitments. For instance, a company with a net-zero target might invest in a forest conservation project to offset its emissions through carbon credits, benefiting the environment while enhancing the company's public image.

Additionally, private sector participation often drives the development of innovative financial products, such as green bonds, impact investments, and environmental impact bonds, which are tailored to nature-based projects. These financial products offer a range of risk-return profiles, attracting diverse investors who are committed to sustainable projects but may have different risk tolerances and investment horizons. By engaging the private sector, these innovative tools can broaden the financial base for natural infrastructure.

Public-Private Partnerships (PPPs) for Nature-Based Solutions

Public-private partnerships (PPPs) provide a powerful model for mobilizing funds for Nature as Infrastructure. In a PPP, public institutions and private companies share the costs, risks, and benefits of a project, each contributing resources based on their strengths. Governments may provide the land, regulatory support, or initial funding, while private companies offer capital, technical expertise, and project management capabilities.

For example, a PPP could be established for a coastal restoration project in which the government designates protected areas, while a private company funds the planting and maintenance of mangroves. This collaboration reduces the overall financial burden on each party and allows the project to benefit from both public oversight and private sector efficiency. Successful PPPs, such as those implemented for green infrastructure projects in urban areas, have demonstrated the potential of this model to bring Nature as Infrastructure to scale.

Blended Finance: Combining Public and Private Funds

Blended finance is an effective approach to mobilizing large-scale investment in Nature as Infrastructure by combining public and private funds. This model uses public or philanthropic funds to “de-risk” investments, making them more attractive to

private investors. For instance, a development bank might provide a concessional loan or first-loss guarantee for a nature-based project, giving private investors confidence that some of their risks are mitigated. Blended finance has been used successfully in projects like the Great Green Wall in Africa, which combines funding from governments, international organizations, and private investors to combat desertification and improve ecosystem health.

This approach is particularly valuable for projects in developing regions, where private investors may be hesitant to invest due to perceived risks. By strategically deploying public funds, blended finance can unlock private capital for projects that support biodiversity, improve community resilience, and provide sustainable economic opportunities.

Corporate and Investor-Led Initiatives

Some private investors and corporations are taking the initiative to fund Nature as Infrastructure independently, often as part of their environmental, social, and governance (ESG) strategies. Large companies are increasingly investing in nature-based projects that align with their climate targets, reduce operational risks, or provide opportunities for carbon offsetting. For example, technology companies may fund urban greening or reforestation projects to offset their carbon footprint, while financial institutions invest in green bonds to support sustainability goals.

Investment firms are also creating dedicated funds for nature-based projects, recognizing the growing demand for sustainable investment options. These funds allow institutional and retail investors to support environmental projects, providing much-needed capital for initiatives such as habitat restoration, sustainable agriculture, and eco-tourism. By including nature-based solutions in their portfolios, investors can achieve both financial returns and positive environmental impacts, aligning their investments with global sustainability goals.

Through coordinated efforts and collaborative models, public institutions and private investors can mobilize the funds needed to scale Nature as Infrastructure. By combining policy support, financial resources, and innovative approaches, these partnerships unlock new opportunities to build resilient, sustainable infrastructure that benefits society and the planet. As these collaborations grow, they set a foundation for a future where natural ecosystems are valued, protected, and leveraged to meet the infrastructure needs of communities around the world.

Examples of Funding Successes

Several successful funding initiatives have demonstrated the viability of Nature as Infrastructure, showing how innovative financial tools can support conservation, resilience, and economic growth. These examples illustrate how public and private sectors, along with international institutions, have mobilized funds to protect and restore ecosystems. Initiatives like the World Bank Rhino Bond and other pioneering projects have set a precedent for how sustainable financing can drive impactful nature-based solutions.

The World Bank Rhino Bond

The World Bank issued the world's first "wildlife conservation bond" in 2022, commonly known as the Rhino Bond. This innovative \$150 million bond was designed to fund efforts to protect and increase populations of the critically endangered black rhino in South Africa. Investors in the Rhino Bond receive payouts based not on traditional financial returns but on the success of the conservation efforts—if the rhino population grows, investors are rewarded with higher returns. The Rhino Bond is a groundbreaking example of performance-based funding for conservation, aligning investor returns directly with environmental outcomes.

The Rhino Bond also reflects the potential for financial tools to support biodiversity while involving global investors in conservation. By tying returns to real-world impact, the bond incentivizes measurable conservation successes, encouraging similar projects to adopt outcomes-focused models. This approach not only supports wildlife protection but also offers investors an opportunity to fund environmental preservation with a unique structure that rewards positive ecological results.

Ecuador's Debt-for-Nature Swap for the Galapagos Islands

In May 2023, Ecuador executed a debt-for-nature swap to protect the Galapagos Islands, securing approximately \$656 million for conservation efforts. In exchange for forgiving a portion of its national debt, Ecuador committed to investing in the protection of the Galapagos' unique marine and terrestrial ecosystems, which are home to species found nowhere else on Earth. This funding approach, facilitated by international partners and conservation organizations, redirects debt repayments into critical conservation initiatives rather than conventional debt servicing.

This debt-for-nature swap provides a model for other biodiversity-rich countries with high debt burdens, demonstrating how financial restructuring can benefit both economic stability and environmental protection. By reducing its debt in exchange for conservation commitments, Ecuador not only supports local biodiversity but also

strengthens eco-tourism—a major contributor to the national economy—while preserving a global ecological treasure.

China's Green Bond for Biodiversity

In 2021, the Bank of China issued the first biodiversity-themed green bond, raising \$580 million to fund projects that support terrestrial and aquatic biodiversity across the country. The bond's proceeds were allocated to projects ranging from forest conservation and wetland restoration to habitat protection and reforestation. This green bond reflects China's commitment to integrating natural infrastructure into its development plans, recognizing the ecological and social benefits that these projects provide.

China's biodiversity bond is notable for its scale and focus on ecological outcomes, providing significant funds for projects that protect critical habitats and biodiversity. This funding initiative not only brings financial support to ecosystem conservation but also demonstrates the potential for green bonds to drive large-scale investment in Nature as Infrastructure. The bond's success highlights how targeted financial products can attract investors interested in sustainability while supporting long-term conservation goals.

New York City Watershed Program

The New York City Watershed Program is a successful example of how public funding can prioritize nature-based solutions over traditional infrastructure. Faced with the need to improve its water quality, New York City chose to invest in the protection and restoration of the natural watershed that supplies its drinking water rather than constructing a costly water filtration plant. The city allocated funding to purchase land, support sustainable farming, and implement conservation measures within the watershed, ensuring clean water for millions of residents.

This approach saved the city an estimated \$10 billion in construction costs and continues to provide clean water through natural filtration processes. The program exemplifies how investing in Nature as Infrastructure can yield cost savings while delivering long-term environmental benefits. By preserving the natural watershed, New York City has maintained a sustainable water supply and created a model for other urban areas facing similar infrastructure challenges.

LEAF Coalition: Forest Protection through Carbon Credits

The LEAF (Lowering Emissions by Accelerating Forest Finance) Coalition is a partnership among governments and major corporations to protect tropical and

subtropical forests through carbon financing. Since its launch in 2021, LEAF has mobilized over \$1 billion in funding by allowing corporations to purchase carbon credits generated from forest conservation projects. This coalition enables forested nations to earn revenue by protecting their natural infrastructure, supporting both climate goals and biodiversity conservation.

LEAF's approach offers a sustainable funding model that incentivizes the protection of carbon-rich forests, helping to reduce greenhouse gas emissions and support biodiversity. By linking corporate funding to measurable conservation outcomes, LEAF demonstrates the potential for carbon markets to drive Nature as Infrastructure at a global scale. This coalition is paving the way for more international partnerships that leverage carbon credits to finance critical ecosystem protection.

These examples highlight the diverse ways in which Nature as Infrastructure can be funded and the benefits of aligning financial returns with environmental outcomes. Each of these initiatives illustrates the potential for innovative financing tools—whether through bonds, debt restructuring, or carbon credits—to make significant, lasting contributions to the preservation and enhancement of natural ecosystems. By continuing to develop and promote these models, the global community can unlock new funding sources and inspire similar projects that support resilient, sustainable infrastructure for future generations.

7. How Individuals and Communities Can Contribute

Actions People Can Take

Individuals and communities play a vital role in supporting Nature as Infrastructure by taking simple, impactful actions that contribute to local conservation, environmental resilience, and sustainable practices. While large-scale projects often require government or institutional support, grassroots initiatives can make a significant difference in building sustainable, green communities. From tree planting to supporting conservation groups, here are some ways individuals and communities can actively contribute to nature-based solutions and foster a healthy, resilient environment.

Tree Planting and Habitat Restoration

Tree planting is one of the most accessible and effective ways to support Nature as Infrastructure. Trees absorb carbon dioxide, improve air quality, stabilize soil, and create habitats for diverse species. Local tree-planting events, organized by schools, community groups, or environmental organizations, offer a direct way for individuals to engage in climate action and contribute to a greener community. Many cities and towns also have programs where residents can volunteer for reforestation or habitat restoration projects in local parks, watersheds, or nature reserves.

Communities can amplify the impact of tree planting by focusing on native species that are adapted to the local climate and provide suitable habitats for local wildlife. By creating “green corridors” of connected trees and plants, communities enhance biodiversity, reduce urban heat, and establish natural flood defenses. Small, consistent efforts like these add up over time, making neighborhoods more resilient to climate change and environmental stressors.

Supporting Local Conservation Initiatives

Supporting local conservation initiatives—through donations, volunteering, or advocacy—can have a substantial impact on the success of Nature as Infrastructure projects. Many non-profit organizations and conservation groups work to protect and restore ecosystems, from wetlands and rivers to coastal areas and forests. These

organizations rely on community support to conduct their work, which may include habitat preservation, species protection, or waterway restoration.

Individuals can get involved by volunteering for projects such as beach cleanups, invasive species removal, or wildlife monitoring. Financial contributions, no matter the size, also help these groups purchase resources, conduct research, and implement conservation strategies. Additionally, participating in local events and educational programs can help spread awareness, building a community-wide commitment to protecting natural infrastructure.

Advocacy for Nature-Based Solutions in Local Planning

Local advocacy is essential for encouraging cities and municipalities to adopt nature-based solutions. Individuals can participate in public meetings, write letters to local representatives, and join environmental advocacy groups to support the inclusion of Nature as Infrastructure in urban planning and development projects. For example, advocating for green spaces, rain gardens, or permeable pavements in urban areas can help cities manage stormwater, reduce heat, and improve air quality.

Community members can also advocate for policies that protect green spaces from development, promote biodiversity-friendly landscaping, and support nature-based infrastructure initiatives. By voicing their support for environmental policies and projects, individuals contribute to creating an environment where nature-based solutions are recognized as essential to resilient, sustainable communities.

Joining or Starting a Community Garden

Community gardens bring people together to cultivate plants and vegetables in shared spaces, transforming vacant lots or underutilized land into vibrant, green areas. Community gardens not only provide fresh, locally grown food but also improve soil health, promote biodiversity, and create natural habitats within urban spaces. They offer opportunities for residents to learn about sustainable practices, like composting and organic gardening, which reduce reliance on synthetic fertilizers and promote natural soil restoration.

Individuals interested in joining or starting a community garden can connect with local gardening groups, environmental organizations, or city programs. Many municipalities offer grants or land use permits to support community gardens. These spaces create a valuable bridge between urban and natural environments, fostering stronger social ties, enhancing green cover, and encouraging residents to actively engage with their surroundings.

Participating in Citizen Science Programs

Citizen science programs provide opportunities for individuals to contribute to environmental research and monitoring, collecting data that can inform conservation efforts. Projects such as bird counts, water quality testing, and plant surveys enable volunteers to gather information on local ecosystems, which researchers and conservationists use to track trends, monitor biodiversity, and identify environmental issues. Participating in citizen science fosters a deeper understanding of nature's role in local infrastructure and can inspire further involvement in nature-based initiatives.

Many organizations and universities offer citizen science programs online or through mobile apps, making it easy to participate. Community science projects also create opportunities for people of all ages to engage with nature and learn about ecosystems while contributing to valuable scientific research that supports Nature as Infrastructure.

Educating Others and Spreading Awareness

One of the most powerful actions individuals can take is to educate friends, family, and neighbors about the importance of Nature as Infrastructure. Sharing knowledge about local ecosystems, environmental issues, and the benefits of nature-based solutions helps create a culture that values and protects natural resources. Individuals can organize informational workshops, promote eco-friendly practices on social media, or collaborate with schools to introduce students to the importance of biodiversity and conservation.

When more people understand the value of natural infrastructure, they are more likely to support initiatives that protect and enhance these resources. Simple conversations, community presentations, and social media campaigns can help shift attitudes, encourage sustainable choices, and inspire community-wide action to protect and integrate nature into daily life.

By taking these actions, individuals and communities can play an active role in supporting Nature as Infrastructure. Small efforts, especially when multiplied across neighborhoods and cities, have the power to drive significant positive change. These contributions not only create greener, healthier living spaces but also foster a collective commitment to a resilient, sustainable future.

Importance of Education and Awareness

Education and awareness are foundational to the success of Nature as Infrastructure, as they shape public understanding, influence behaviors, and drive collective action. When people understand the value of natural ecosystems in providing essential services—such as clean air, water filtration, and climate resilience—they are more likely to support policies, practices, and investments that protect and enhance these resources. Encouraging education and sharing information about Nature as Infrastructure fosters a culture that values sustainability, empowers communities, and inspires long-term environmental stewardship.

Building a Knowledgeable Community

Education about Nature as Infrastructure can begin at any age and across different community spaces. Schools, local organizations, and community centers can provide workshops, presentations, and hands-on learning opportunities that highlight the importance of nature-based solutions. Schools, for instance, might integrate lessons about ecosystem services, biodiversity, and sustainable practices into their science curriculum, giving young students an understanding of how natural systems support human life and well-being.

Community workshops or public seminars can cover a wide range of topics, from water conservation and tree planting to urban green infrastructure and climate resilience. These educational events create a knowledgeable community that understands the benefits of Nature as Infrastructure, from reducing urban heat and improving water quality to providing habitats for wildlife. As awareness grows, so does public support for local projects and policies that align with these principles.

Supporting Local Policies for Nature-Based Solutions

Raising awareness about Nature as Infrastructure also involves advocating for supportive policies at the local level. Educating residents about the importance of sustainable urban planning, green spaces, and natural disaster defenses encourages them to support policies that prioritize nature-based solutions. Local governments often consider public opinion when planning new developments, parks, or infrastructure improvements; well-informed citizens are more likely to advocate for options that include green infrastructure and conservation efforts.

Individuals can actively engage with local representatives, attend public hearings, and participate in planning meetings to share the benefits of nature-based solutions. When more people understand the connection between healthy ecosystems and community resilience, they become advocates for policies that protect natural

resources, promote green infrastructure, and integrate Nature as Infrastructure into everyday life.

Encouraging Public Engagement Through Media and Social Networks

Social media, blogs, and other online platforms offer powerful tools for spreading information about Nature as Infrastructure. By sharing articles, infographics, videos, and success stories about nature-based solutions, individuals can reach a wider audience and inspire others to learn more. Online campaigns, community pages, or eco-focused groups can be created to discuss local conservation projects, organize events, or advocate for policy changes that support natural infrastructure.

Encouraging people to share their own experiences—whether it's participating in a tree-planting event, volunteering at a local park, or attending an environmental workshop—can make Nature as Infrastructure feel accessible and relatable. This grassroots communication not only spreads awareness but also builds a supportive community around sustainable practices, showing that everyone can contribute to a healthier environment.

Promoting Lifelong Learning About Natural Systems

Education on Nature as Infrastructure does not stop after a single event or workshop. Lifelong learning about ecology, climate resilience, and sustainability ensures that communities stay informed about the latest research, trends, and practices. Local libraries, universities, and conservation organizations can host talks, distribute reading materials, and provide online resources that encourage ongoing education.

Engaging with topics like permaculture, sustainable land use, and urban greening empowers individuals to understand and make informed decisions about their environment. This long-term commitment to learning creates resilient communities where people actively work to support and preserve the ecosystems around them, understanding that these natural resources are integral to their quality of life and future security.

Inspiring Future Generations

Education about Nature as Infrastructure also inspires future generations to value and protect natural ecosystems. Teaching children and young adults about the importance of biodiversity, conservation, and sustainable infrastructure empowers them to become environmentally conscious citizens. Nature-based activities, such as

school gardens, nature walks, and eco-clubs, give young people hands-on experience with natural systems, fostering an early appreciation for the environment.

When children grow up understanding the interconnectedness of human and natural systems, they are more likely to support sustainable practices and conservation as adults. Inspiring a sense of responsibility and respect for nature ensures that future generations continue to advocate for Nature as Infrastructure, maintaining a legacy of sustainability that benefits everyone.

Education and awareness are essential to embedding Nature as Infrastructure into the fabric of society. By fostering a knowledgeable, engaged, and proactive community, we can create a collective mindset that values natural systems as vital components of infrastructure. This cultural shift not only supports immediate environmental goals but also builds a resilient foundation for future generations, ensuring that ecosystems and communities thrive together.

8. Conclusion: Embracing Nature as Our Infrastructure

Summing Up the Benefits

Investing in Nature as Infrastructure is a transformative approach that addresses both immediate and long-term needs for resilience, sustainability, and economic efficiency. As we face challenges like climate change, biodiversity loss, and increasing urbanization, nature-based solutions offer a powerful and cost-effective way to create a sustainable future. Unlike traditional, grey infrastructure, which often requires extensive maintenance and upgrades, natural infrastructure is adaptive, resilient, and capable of self-renewal. This chapter highlights the multifaceted benefits of embracing nature as an integral part of our infrastructure systems.

Sustaining Our Future

Natural ecosystems provide the essential services that sustain human life, from filtering water and air to providing food and raw materials. Forests, wetlands, and oceans support biodiversity, which is foundational for ecosystem health, agricultural productivity, and even the development of new medicines. When we invest in conserving and restoring these ecosystems, we are directly supporting our own well-being and ensuring that future generations will have access to the natural resources they need. Nature as Infrastructure allows us to meet today's demands without compromising tomorrow's possibilities, fostering a future where human and ecological systems can coexist and thrive.

Enhancing Resilience Against Climate Change and Natural Disasters

One of the key advantages of nature-based solutions is their ability to enhance resilience to climate change and natural disasters. Forests, wetlands, mangroves, and coral reefs serve as natural barriers, absorbing the impacts of floods, hurricanes, and storm surges. Green spaces and urban forests help cool cities, reducing the urban heat island effect and mitigating the health impacts of extreme heat. These ecosystems act as buffers against environmental stresses, providing long-term protection for communities and reducing the vulnerability of infrastructure to extreme weather events.

As climate-related events become more frequent and intense, the adaptive capacity of natural infrastructure becomes invaluable. Unlike grey infrastructure, which can deteriorate and fail under stress, natural systems can adapt and recover over time, strengthening their protective functions. Investing in Nature as Infrastructure provides a sustainable, long-lasting solution to resilience, safeguarding both lives and properties.

Cost-Effective and Economically Viable

Nature-based infrastructure is a cost-effective solution that can reduce the financial burdens associated with conventional infrastructure. Constructing and maintaining grey infrastructure, such as dams, levees, and water treatment plants, is often costly, and these structures need frequent repairs or upgrades as they age. Nature-based solutions, by contrast, generally require lower initial investments and significantly less maintenance. For example, a restored wetland can naturally filter water, reducing the need for expensive treatment facilities, while forests sequester carbon without the cost of engineered carbon capture technology.

Economic studies have shown that the long-term savings from investing in natural infrastructure can be substantial. By choosing nature-based options, cities and countries can reduce the financial impact of climate-related disasters, lower healthcare costs related to pollution and heat, and save on infrastructure maintenance. Furthermore, natural infrastructure creates economic opportunities through eco-tourism, sustainable agriculture, and community-led conservation initiatives, providing jobs and supporting local economies. This dual benefit—cost savings and economic growth—demonstrates how Nature as Infrastructure is both a fiscally responsible and beneficial choice.

Supporting Environmental and Social Well-being

Nature-based solutions do more than provide ecological and economic benefits—they also improve quality of life. Access to green spaces, clean air, and safe water positively impacts physical and mental health, enhancing well-being across communities. Green urban infrastructure, like parks and community gardens, creates recreational areas, reduces stress, and fosters social connections. These spaces also contribute to social equity by making natural beauty and clean environments accessible to all, regardless of income or neighborhood.

At the community level, nature-based infrastructure promotes environmental stewardship, encouraging individuals to connect with and take responsibility for their surroundings. This connection to nature fosters a culture that values sustainability, creating a ripple effect where communities become advocates for conservation, climate resilience, and biodiversity protection. By investing in Nature as

Infrastructure, we not only build sustainable communities but also cultivate a society that recognizes the intrinsic value of the natural world.

Embracing Nature as Infrastructure is a forward-looking, strategic investment that addresses the pressing environmental and economic challenges of our time. By integrating natural solutions into our infrastructure systems, we secure a future that is resilient, cost-effective, and harmonious with the environment. This holistic approach to infrastructure is essential for sustainable development, ensuring that both people and the planet thrive for generations to come.

Call to Action

As we conclude our exploration of Nature as Infrastructure, it's clear that natural systems are not merely scenic backdrops but essential infrastructure that supports our lives, economies, and resilience to environmental change. Embracing this new paradigm calls for collective action from individuals, communities, businesses, and governments. We each have a role in advocating for, protecting, and engaging with natural systems to secure a sustainable, resilient future for generations to come. Now is the time to take action.

Advocate for Nature-Based Solutions

One of the most powerful actions we can take is to advocate for Nature as Infrastructure within our communities, cities, and countries. Speak up for policies that prioritize green spaces, conservation projects, and natural infrastructure in urban planning. Engage with local representatives, participate in community meetings, and lend your voice to initiatives that promote nature-based solutions. When more people express the importance of investing in ecosystems as infrastructure, we create a groundswell of public support that can drive meaningful change at all levels of government.

Support organizations and initiatives working on environmental issues and climate resilience, and encourage decision-makers to include natural solutions in their planning and funding. Together, we can create an environment where Nature as Infrastructure is valued, prioritized, and recognized as fundamental to our quality of life.

Protect and Preserve Natural Spaces

The natural spaces that surround us—whether parks, rivers, wetlands, or forests—are vital components of Nature as Infrastructure. As individuals, we can

contribute to the preservation of these ecosystems by participating in local conservation efforts, supporting habitat restoration projects, or volunteering with organizations that protect natural spaces. Whether it's planting trees, maintaining trails, or participating in beach cleanups, these small efforts strengthen and restore the natural systems that underpin our infrastructure.

Encourage others to appreciate and respect local ecosystems, emphasizing the importance of minimizing waste, conserving water, and reducing pollution. Every small action contributes to a larger movement toward protecting the environment and sustaining the natural resources that future generations will rely on. By collectively valuing and safeguarding our natural spaces, we protect the very foundation of sustainable, resilient communities.

Engage with Nature as a Community

Connecting with nature fosters a personal understanding of its value and significance. Engage with natural systems by visiting parks, forests, or waterways, and encouraging your friends, family, and community members to do the same. When people experience nature firsthand, they are more likely to appreciate its importance and advocate for its preservation. Community gardens, educational workshops, and nature walks provide excellent opportunities for people of all ages to learn about and connect with the ecosystems that support us.

As communities, we can build a culture that respects, values, and integrates nature into our daily lives. Educate others about the benefits of Nature as Infrastructure, share success stories of nature-based projects, and inspire a sense of responsibility toward our shared environment. The more we engage with and understand natural systems, the stronger our commitment will be to support and protect them.

Take Personal Action for a Sustainable Future

Each of us has the power to make choices that support Nature as Infrastructure in our everyday lives. From conserving energy and water to reducing waste and supporting eco-friendly businesses, our personal actions can collectively make a significant difference. Simple steps, such as choosing sustainable products, planting native vegetation, or reducing single-use plastics, help lessen our impact on the environment. By making conscious choices, we contribute to a culture that respects and values natural resources.

Encourage those around you to join you in making these changes, creating a ripple effect that spreads throughout your community. When we all take responsibility for our impact on the planet, we move closer to a world that values and protects Nature as Infrastructure, ensuring a sustainable future.

Building a Legacy of Sustainability

The call to action for Nature as Infrastructure goes beyond protecting our current environment—it is about building a lasting legacy of sustainability for future generations. By acting now, we are laying the foundation for a world where human development coexists in harmony with the environment, where infrastructure is resilient and adaptive, and where natural systems are recognized as essential assets. Together, we can create a future that values, protects, and integrates nature into every aspect of life.

Let this be our commitment: to advocate for, protect, and engage with nature as the critical infrastructure it is. By working together, we can create a world where people and the planet thrive side by side, building a resilient, sustainable future for all. The time to act is now.

Glossary of Key Terms

Biodiversity	The variety of life found in ecosystems, encompassing species diversity, genetic diversity, and ecosystem diversity.
Biodiversity Hotspot	Regions with high levels of species diversity and endemism that are also under threat, prioritized for conservation efforts.
Blended Finance	Combining public and private funds to reduce risk and attract private investment for nature-based or sustainable projects.
Blue Carbon	Carbon captured and stored in coastal and marine ecosystems, like mangroves, seagrasses, and salt marshes.
Carbon Credits	Tradable permits representing a reduction of one metric ton of CO ₂ emissions, often generated by conservation projects.
Carbon Sequestration	The process of capturing and storing atmospheric carbon dioxide in plants, soils, oceans, or other natural reservoirs to mitigate climate change.
Citizen Science	The participation of non-professional volunteers in scientific research, often to monitor and protect local ecosystems.
Climate Adaptation	Strategies to adjust to current or expected climate impacts, enhancing resilience against environmental changes.
Climate Mitigation	Actions that reduce or prevent greenhouse gas emissions to slow global warming, including carbon sequestration by natural systems.
Community Resilience	The capacity of a community to adapt to and recover from adverse situations, such as climate events or economic shifts.
Conservation	The protection, preservation, and careful management of natural resources to prevent exploitation, degradation, and destruction.
Cultural Services	Non-material benefits obtained from ecosystems, including recreation, spiritual enrichment, and aesthetic enjoyment.
Debt-for-Nature Swap	A financial arrangement where part of a country's debt is forgiven in exchange for funding environmental conservation projects.
Ecological Red Lines	Protected areas established to conserve essential ecosystems and biodiversity, limiting human activity to prevent degradation.
Ecological Resilience	The capacity of an ecosystem to recover from disturbances or withstand ongoing environmental changes without losing function.
Ecosystem Integrity	The completeness and health of an ecosystem, including the diversity of its species and the ecological processes that sustain it.
Ecosystem Restoration	The process of recovering and rehabilitating degraded ecosystems to regain ecological functions and biodiversity.

Ecosystem Services	The benefits that humans obtain from ecosystems, including provisioning, regulating, supporting, and cultural services.
Ecosystem-Based Adaptation (EbA)	An approach that uses biodiversity and ecosystem services to help communities adapt to the impacts of climate change.
Environmental Impact Assessment (EIA)	A process that evaluates the environmental effects of a proposed development or infrastructure project before it begins.
Environmental Stewardship	The responsibility for conserving and managing natural resources sustainably for the benefit of current and future generations.
Green Bonds	Debt securities issued to fund projects with environmental benefits, such as conservation or green infrastructure.
Green Corridors	Connected areas of vegetation that allow wildlife to move freely between habitats, enhancing biodiversity and ecosystem health.
Green Infrastructure	Infrastructure that incorporates natural systems, such as parks, green roofs, and rain gardens, to manage environmental challenges.
Grey Infrastructure	Conventional, human-made infrastructure such as roads, dams, and bridges, typically made of concrete or steel.
Habitat Fragmentation	The process by which large and contiguous habitats are divided into smaller, isolated areas, often due to human activities, affecting biodiversity.
Integrated Watershed Management	An approach to managing water resources that considers the entire watershed and its ecosystems to balance environmental, economic, and social needs.
Natural Capital	The world's stock of natural resources, including geology, soils, air, water, and living organisms, valued for their economic, ecological, and social benefits.
Nature as Infrastructure	The concept of viewing natural ecosystems (forests, wetlands, mangroves, etc.) as essential infrastructure that provides services similar to human-built structures.
Nature-Based Solutions	Strategies that use natural systems and processes to address societal challenges, such as climate change, disaster resilience, and water management.
Permeable Pavement	A type of pavement that allows water to pass through it, reducing runoff and aiding in natural groundwater recharge.
Pollination	The process by which pollinators, such as bees, transfer pollen from one flower to another, supporting crop and plant growth.
Provisioning Services	Ecosystem services that provide resources, such as food, water, and raw materials, directly used by humans.
Public-Private Partnership (PPP)	A collaborative agreement between public institutions and private companies to fund and manage projects, sharing resources, risks, and benefits.
Reforestation	The process of replanting trees in deforested areas to restore ecosystems, enhance biodiversity, and improve climate resilience.

Regulating Services	Natural processes that regulate environmental conditions, such as climate regulation, flood control, and water purification.
Renewable Energy Sources	Energy derived from resources that are naturally replenished, such as solar, wind, and hydropower, helping to reduce reliance on fossil fuels.
Resilience	The ability of an ecosystem, community, or infrastructure to withstand and recover from environmental or climate-related disturbances.
Supporting Services	Ecosystem functions essential to the survival of species and ecosystems, such as nutrient cycling and soil formation.
Sustainable Development	Economic development that meets present needs without compromising the ability of future generations to meet their own needs.
Sustainable Land Use	Land management practices that preserve ecosystems and natural resources while meeting human needs for agriculture, recreation, and development.
Sustainable Water Management	Practices that maintain water quality, conserve water resources, and ensure equitable access to clean water.
Urban Heat Island Effect	The phenomenon where urban areas experience higher temperatures due to human activities, infrastructure, and lack of vegetation.
Wetlands	Ecosystems such as swamps, marshes, and bogs that are saturated with water, providing valuable services like water purification and flood control.

Reading Materials

1. <https://www.aiib.org/en/news-events/media-center/blog/2024/Investing-in-Nature-as-Infrastructure.html>
2. <https://www.aiib.org/en/news-events/news/2023/AIIB-Launches-Report-on-Transformative-Concept-of-Defining-Nature-as-Infrastructure.html>
3. <https://hillcountryconservancy.org/nature-as-infrastructure/>
4. <https://www.aiib.org/en/news-events/media-center/blog/2024/Investing-in-Nature-as-Infrastructure.html>
5. <https://www.thegpsc.org/knowledge-products/greening-cities/nature-infrastructure>
6. <https://thackara.com/civicecology/nature-as-infrastructure-microbial-urbanism-and-design/>
7. <https://www.scientificamerican.com/article/use-nature-as-infrastructure/>
8. <https://news.openspaceauthority.org/blog/coyote-valley-nature-as-infrastructure>
9. <https://www.domusweb.it/en/architecture/2012/01/19/nature-as-infrastructure.html>