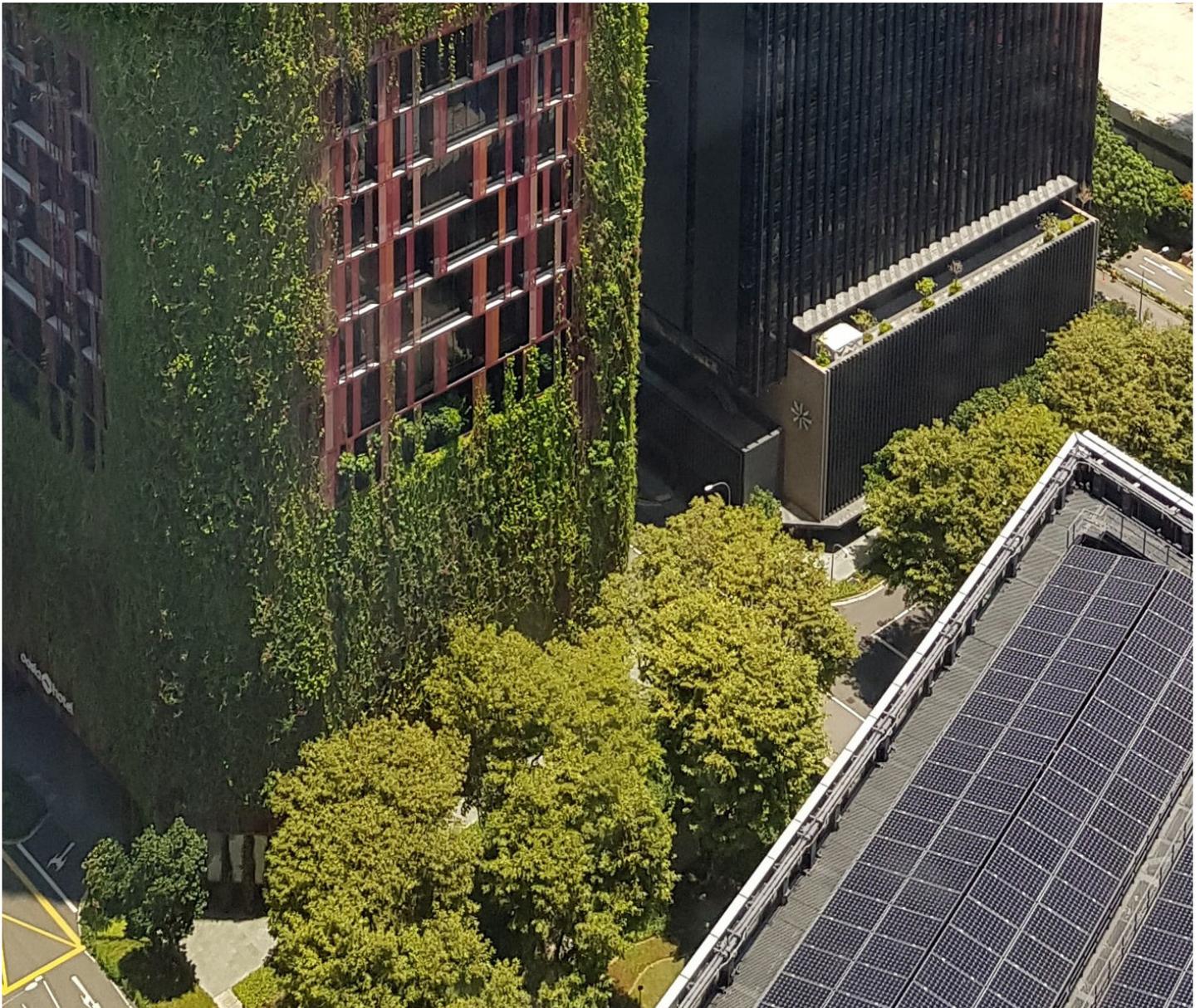# CITIES4BIODIVERSITY (C4B)
DEEP-DIVE LEARNING PROGRAM SUMMARY REPORT
Theme: Greening Cities - Integrating Urban Greening and Ecology into City and Neighborhood Planning and Connecting Green Infrastructure
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Global Platform for Sustainable Cities

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BiophilicCities

Oasia Hotel in Singapore
Image Credit: Sua Truong

Cities4Biodiversity (C4B) participants convened in April 2022 to explore the first of a series of themes critical to the purpose of C4B – developing and supporting a network of cities forging commitments to incorporate climate and nature-based solutions into project design, planning and implementation. Conducted over six days, the Green Cities Deep-Dive Learning included plenary and breakout sessions with presentations from 35 cities in 16 countries. This summary report provides a review of critical insights and expert recommendations from the Deep-Dive Learning, as well as highlights of existing policies and programs from participating cities that promote investment in urban nature.

Greening Cities: Integrating urban greening and ecology into city and neighborhood planning and connecting green infrastructure

The first Deep-Dive Learning explored the potential for the integration of ecological systems into city and neighborhood planning, connectivity through green infrastructure, and the incorporation of nature within urban landscapes to balance green and gray infrastructure investments.

Urban ecological systems provide critical, cost-effective services that include mitigating urban heat island effects, conserving biodiversity, sequestering air pollutants, recharging groundwater, promoting recreation, enhancing livability and well-being of people, as well as protecting cities from erosion and flooding. However, despite the recognized benefits of urban ecological systems, participants voiced many significant barriers to the healthy maintenance of these systems (Box 1). Globally, urban planning continues to place an overarching emphasis on gray infrastructure, often at the price of urban ecology and the degradation of urban green-blue spaces. The result is that cities encroach upon natural habitats, disturb ecosystems, and further accelerate the imbalance between man-made and natural capital.

Greening cities can provide solutions to reverse this trend (Box 2). These solutions draw from a range of disciplines and involve a diversity of potential partners. Through these solutions, cities can maximize the benefits of ecological services provided by natural systems and mitigate current biodiversity losses. Cities can be designed to protect and enhance interconnected ecological networks and support functional landscapes despite a changing climate.

Box 1: Greening Cities Barriers

- Growing urban populations and resulting sprawl and land use impacts
- Perceived competing demands between development and ecological conservation
- Need for quickly scaled solutions
- Lack of equitable access to nature in cities
- Limited administrative and technical capacity
- Lack of directed and sustaining financial support
- Challenges arising from informal settlements and limited housing options
- Climate change related impacts of extreme weather and sea level rise
- Non-monetization of ecological benefits
- Indeterminately defined boundaries for what constitutes urban land
- Lack of integration into plans and policies
- Competing demands for limited financial resources
- Absence of political will
- Improper waste management and resultant pollution of the air, water and soil
- Conversion and privatization of public lands/green spaces
- No enforcement of land use regulations

Box 2: Greening Cities Solutions

- Planning for green connectivity with networks of green and blue urban infrastructure
- Forging integrated solutions to biodiversity loss and climate change
- Leveraging nature-based solutions for urban investment
- Communicating and demonstrating the potential for successful development within ecological limits
- Engagement of political leadership at all levels of governance
- Establishing boundaries to urban sprawl
- Continuous and systematic learning and capacity building
- Developing and sharing tools to support ecological planning
- Adoption of ecological plans and policies
- Valuation of ecosystem services
- Long term ecological vision for the city implemented through short term actions and projects
- Cross-sectoral planning and coordination
- Integrating ecosystem services into land-use planning
- Financial models to support investments in nature

Focus Questions

Five focus questions were identified at the outset of the Deep-Dive Learning to guide discussion. These questions provide a framework for review of the lessons learned from the experiences and expertise shared by program participants.

1. What is an urban ecology/ecological system?
2. How can cities incorporate urban ecology into their planning and design?
3. What is "green urban infrastructure" and how can cities plan and build a network of green urban infrastructure to deliver health and climate benefits and enhance urban resilience?
4. What are the tools that support urban ecological planning?
5. How can cities balance the competing demands of green urban infrastructure that promotes urban nature and gray infrastructure that provides urban services and accommodates the needs of growing urban populations?

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1. What is an urban ecology/ecological system?

Every city is embedded in a nested set of underlying ecological systems, which consists of many intersecting natural systems and features that include rivers and forests, coastal shorelines and wetlands, and the various habitats and movement patterns of the flora and fauna that inhabit that city. The ecology of a city underpins its economy and provides many essential services, from climate regulation to water and air quality to recreation and economic development. The beginning point is to recognize the essential role of a city's ecology, and how its ecological systems lay the foundation for everything else.

Urban ecological planning is cognizant of biodiversity and the nature that exists within cities. It is a discipline that recognizes the mutual dependencies of people, nature, and biodiversity for livability and well-being (World Bank 2021). It entails the blending of gray and green infrastructure to create sustainability and vitality for cities. Ecological planning involves systematic actions to study, evaluate and plan for the long-term use and protection of this urban ecology. It describes a process for laying out a road map to guide and manage future urban growth and minimize its impact on biodiversity and ecosystem services (World Bank 2021).

Ecological urban planning acknowledges that nature and the built environment (houses, roads and infrastructure) are never separate but always commingled. Cities today, even when dominated by hard surfaces and gray infrastructure still contain remarkable nature and surprising amounts of biodiversity. Ecological planning can repair and restore past damage and disconnection: wetlands can be cleaned and restored, trees and forests can be replanted, new ecological connections can be created, and new biophilic buildings can be designed to expand and enhance the nature in cities.

2. How can cities incorporate urban ecology into their planning and design?

Deep-Dive Learning presentations illustrated opportunities for incorporating urban ecology into planning policy and practice. A first recommended step is the development of an overarching vision for the future, with implementing goals and targets included in central plans and policy. A unified vision can set forth a distinctive path that builds upon the unique biodiversity and conditions of a city.
For example, in **Chengdu, China**, the city is embracing a vision of a "city within a park". The city is implementing its vision through the development of Longquan Mountain Urban Forest Park, which will encompass an ecological reserve area that will make it one of the world's largest urban forest parks.
While **Izmir, Türkiye**, has adopted a Strategy for Living in Harmony with Nature, which establishes links between ecological parks within the urban core of the city and those in surrounding rural and peri-urban areas.

Underway in **Asunción, Paraguay**, is a "Green City of the Americas" initiative that seeks to improve the quality of life in Asunción and its Metropolitan Area by achieving more sustainable and resilient cities, integrating green transportation, solid waste management, and green area planning into a comprehensive vision for the city. Meanwhile the vision in **Lima, Peru**, is centered on the conservation of coastal hillsides and the biodiversity and cultural heritage that they contain. The Lomas de Lima (Hills of Lima) program establishes regional conservation areas on five hills that surround the city with the aim of sustaining the provision of the ecosystem services that the hills provide.

A second focus highlighted by presentations for incorporating urban ecology into planning and design is the establishment of an integrated landscape ecological approach that recognizes the need for planning at multiple scales from regional or metropolitan scales (and beyond) down to the level of a neighborhood or even a building site. This includes the protection of large scale, intact ecological habitat and the establishment and maintenance of connectivity across these planning scales.

Large-Scale Conservation Areas

In terms of large-scale conservation efforts, the Significant Ecological Areas (SEAs) Program in **Los Angeles County, California**, protects designated intact habitat that contain irreplaceable biological resources within the county. The program, established by county ordinance, includes 28 SEAs. Development within the SEAs is regulated to balance the conservation of biodiversity with private property rights. The SEAs Program complements the broader 30x30 initiative of the **State of California**. Established by executive order of the California Governor in 2020, the initiative sets forth a goal of conserving 30 percent of state lands and coastal waters by 2030 through voluntary collaboration with federal and local governments, California Native American tribes, and private landowners. Additional examples of large-scale ecological conservation efforts include those of **Barranquilla, Colombia**, to restore the Ciénaga de Mallorquín coastal lagoon and its unique estuarine, mangrove habitat, and Shancheng Park in **Chongqing, China**, which is a 20-acre biodiversity park in the heart of the city along the Yangtze River.

Ecological Connectivity

Complementing overarching visions and large-scale habitat protection is a focus on ecological connectivity. As a continued evolution of its ecological planning, **Edmonton, Canada**, adopted the BREATHE Green Network Strategy, which is a 30-year strategy to sustain a healthy city by encouraging connection and integration of open space at the site, neighborhood, city, and regional levels. In **Medellín, Colombia**, the city has created 30 different road and ravine Corredores Verdes (green corridors) across the city to improve urban biodiversity, along with providing recreational and climate adaptation benefits. While **Paris, France**, is similarly planning for blue and green ecological corridors and coherence at the scale of the Greater Paris Metropol as a central element of its Local Urban Plan.

A few different participating Chinese cities are also pursuing far-reaching ecological connectivity programs. In **Guangzhou, China**, the Conghua District is pursuing an ecological network strategy that includes 27 nature reserves, forest parks and other natural conservation clusters, covering an area of nearly 400km^2, along with pocket parks and greenways to establish connectivity. **Chengdu, China**, has developed 73 ecological corridors that connect a vast network that includes 55 ecological zones, 155 green belts, and 139 parks. The Rivers and Four Waterfront Lines project in **Chongqing, China**, is restoring the ecology of the urban shores of Yangtze and Jialing Rivers within the city to aid in flood plain resilience and recreational park creation.

Consistent with the plans and projects described above which were presented during the Deep-Dive Learning, World Bank resources include a broad range of ecological planning approaches that can be used to better incorporate nature into the city depending on the decision context and strategy (World Bank 2021). A summary of a scope of approaches drawn from both the Deep-Dive Learning and World Bank resources is presented in Table 1.

TABLE 1
ECOLOGICAL PLANNING APPROACHES

PLANNING APPROACH	PARTICIPATING CITY IMPLEMENTING APPROACH
Identify, enrich and restore native plant and animal species and habitats within existing public and private green areas.	Kigali, Rwanda
Supplement existing public spaces with new biodiverse parks and green spaces.	Izmir, Türkiye
Adapt underutilized spaces, such as steep slopes, the borders of roads and vacant lands, for new green space.	León, Nicaragua
Create new innovative spaces for the introduction of biodiversity, such as green roofs and vertical nature.	Amman, Jordan
Encourage urban gardening and agriculture for food security, food for pollinators, and its mental health and well-being benefits.	Guangzhou, China
Connect fragmented ecosystems and create ecological networks through corridors and expansion of green spaces.	Chengdu, China
Expand tree canopies using native tree species, beginning with areas of the cities with disproportionately low tree canopy percentages.	Lagos, Nigeria
Build tunnels and overpasses to enable movement of wildlife throughout the city, particularly across roads or other linear features.	Edmonton, Canada
Use nature-based solutions where possible for stormwater and flood management.	Jakarta, Indonesia
Facilitate transdisciplinary collaborations between urban planners, engineers, and ecologists to explore the implementation of nature-based solutions.	Madrid, Spain
Value and account for urban green and blue natural assets to enable proper accounting and consideration of the benefits of these assets and the costs of their loss.	Los Angeles, California
Incorporate nature-based solutions within broader investments to address primary city challenges such as climate resilience and urban living conditions.	Balikpapan and Palembang, Indonesia
Develop an index of ecological assets within the city and monitor the impact of strategies over time.	São Paulo, Brazil
Identify suitable financial mechanisms for investing in nature and building an enabling environment to induce private sector investment.	Ningbo, China
Develop strategies and planning to mainstream ecological planning and urban biodiversity, and support the development and implementation of initiatives reinforcing ambitious agendas.	California 30x30

3. What is "green urban infrastructure" and how can cities plan and build a network of green urban infrastructure to deliver health and climate benefits and enhance urban resilience?

Green infrastructure represents an important way of framing the needs of a city. It is not only the traditional hard-surface or engineered gray infrastructure of a city that makes it run. Critical to a city's functioning is its natural features - its trees, wetlands and unpaved, permeable surfaces (see, e.g., Image 1). These green features are essential infrastructure, although they have been historically undervalued and seen as optional or of lesser value compared with conventional urban infrastructure. Presentations throughout the Deep-Dive Learning demonstrated that this view has been changing and that increasingly countries and cities are prioritizing investments in green infrastructure on par with more traditional infrastructure investments.

At the national scale, a few programs illustrate the impact of a national policy that supports green infrastructure planning. The **United Kingdom's** Environment Act of 2021, slated for adoption in 2023, includes specific provisions related to green infrastructure planning. It mandates planning for a net biodiversity gain and provides support for local nature recovery strategies. The provisions of the Act are complemented by additional national strategies that include the Green Infrastructure Framework that supports the greening of towns and cities, and their connections with surrounding landscapes.

In **Sierra Leone**, with funding from the World Bank, the national government has implemented the Resilient Urban Sierra Leone project (RUSLP) to support urban planning, resilient infrastructure, and urban greening in the country's major cities of **Bo City, Freetown, and Waterloo**. Elements of the project include the identification of nodes of growth and the development of spatial plans to guide growth in a manner that minimizes impacts to ecological resources such as nature reserves, wetlands, parks and other green spaces. The project also supported the planting and digital tracking of 500K trees to improve tree canopy coverage in Freetown and Waterloo. In **Indonesia**, implemented in the participating cities of **Balikpapan and Palembang**, the Climate Village Program is a national program intended to increase the involvement of the community and other stakeholders to strengthen climate mitigation and adaptation capacity at the local level.
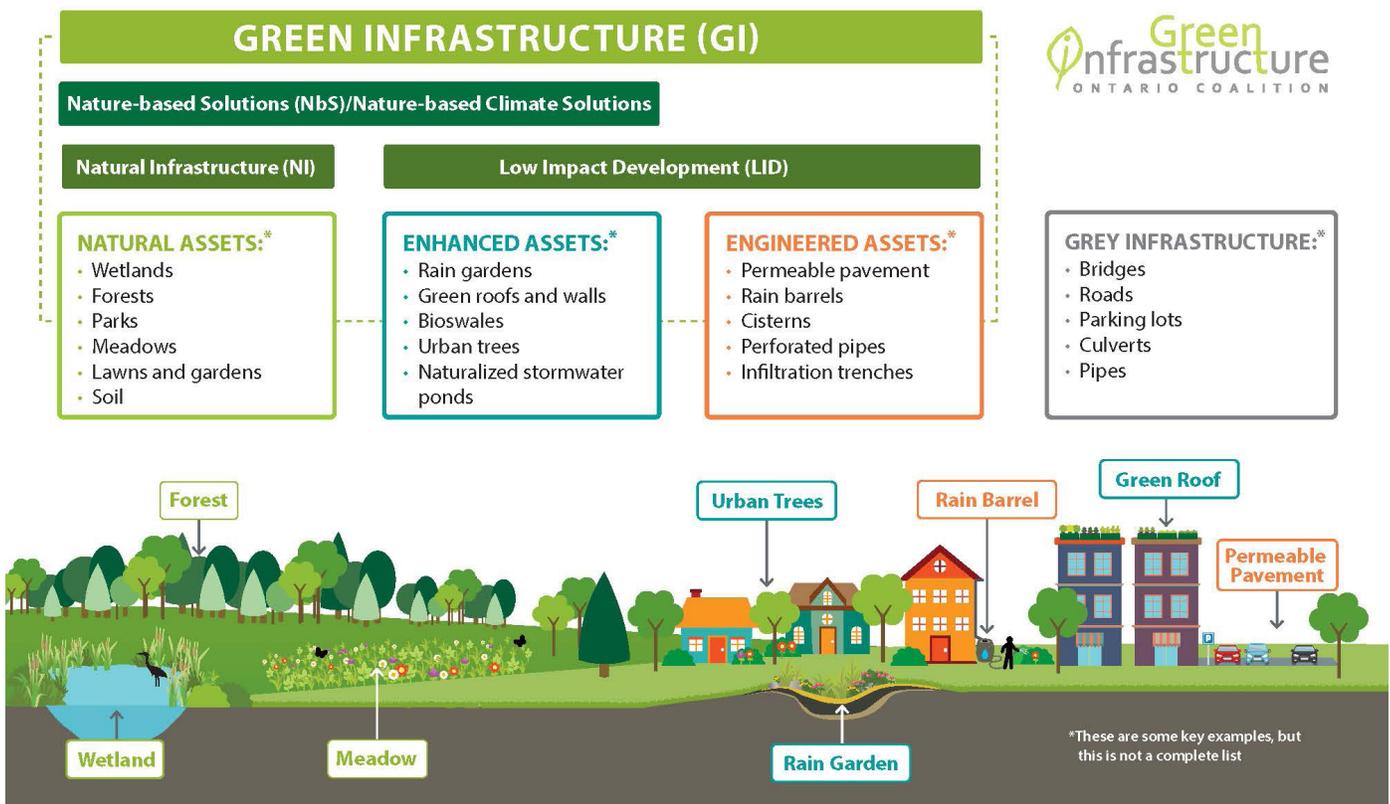

Image 1. Image Credit: Green Infrastructure Ontario Coalition.

Presentations also illustrated that comprehensive green infrastructure policies are similarly in place at the city scale.

- **Lagos, Nigeria**, has developed a regional master plan that seeks to incorporate green infrastructure at neighborhood and city scales, including support for expansive mangrove wetlands and rain forest areas.
- **Kigali, Rwanda**, has initiated the Second Rwanda Urban Development Project (RUDP II), which aims to update informal settlements, rehabilitate degraded wetlands, and provide infrastructure for secondary cities.
- **León, Nicaragua**, is incorporating green infrastructure and green spaces into a variety of different contexts: a regional hospital; sports and recreation fields; streetscapes; and a skate park.
- In **Madrid, Spain**, a new green ring for the communities southeast of the city will include 1,000 hectares of green infrastructure to link new residential neighborhoods. The program entitled A Flor de Yeso speaks to the yesiferous arid soils of the area that produce a specific geology of hills, cliffs and unique vegetation.

Along with coordinated national and local government green infrastructure programs, there were examples of programs and projects that target specific elements of green infrastructure, including urban wetlands, waterways, and trees.

Several cities are utilizing urban wetlands and waterways as critical infrastructure to capture and treat urban waters. For example, the Tebet Eco Park in **Jakarta, Indonesia**, is a large multi-functional park that includes wetlands restoration to help contain water flows and increase water retention. A boardwalk facilitates recreational access across the wetlands without negative impacts to the habitat. The Haizhu Wetland in **Guangzhou, China**, is another extensive urban wetland project that seeks to combine water conservation and treatment with flourishing biodiversity. With funding from a bond measure to support green infrastructure projects, **Los Angeles County, California**, has undertaken a habitat restoration project for Machado Lake that included the dredging of the lake and the installation of an oxygenation system.

Lagos, Nigeria, is pursuing an ongoing inventory and study of its existing wetlands, together with their flora and fauna, to prioritize their conservation. **Kigali, Rwanda**, is pursuing rehabilitation of the Rwampara Wetland for flood management, biodiversity enhancement, greenhouse gas emission reduction, and public green space.

Similar to the wetland restoration projects, a few participating cities highlighted urban river reclamation efforts that combine efforts to mitigate flooding with the creation of new greenways for recreation. These include the Otún River Boardwalk in **Pereira, Colombia**, the Rimac River restoration project in **Lima, Peru**, and the Semarang River Revitalization project in **Semarang, Indonesia**.

A critical green infrastructure investment is in urban trees and forests. For coastal cities like **Jarkata, Indonesia**, investments in mangrove trees and coastal wetlands are more effective than conventional seawalls and engineered shoreline protection, plus they sequester large amounts of carbon, provide tremendous habitats for birds and fish, and with proper maintenance, will not depreciate over time.

The innovative micro-lungs project in **Amman, Jordan**, is utilizing the Miyawaki method for the restoration and reconstruction of natural small-scale forest ecosystems to create ultra-dense, biodiverse, multi-layered forests in high-density, heavily degraded urban areas in the city.

To address rising temperatures, **Guangzhou, China**, with support from the World Bank, has designed large scale ventilation corridors to facilitate the movement of cool air across the city. The primary corridors are comprised of natural river courses that are tributaries of the Pearl River Delta. Green infrastructure with complementary road corridors spread out from the primary corridors to further disperse and move cool air through the city. While Operation Green Lagos is a continuing project handled by the **Lagos, Nigeria,** State Parks and Gardens agency that has planted over 7 million trees and created 300 parks and gardens since inception in 2011.

4. What are the tools that support urban ecological planning?

There are several tools available today to help cities successfully undertake ecological planning and development. The range of tools explored over the course of the Deep-Dive Learning are organized by category to aid in their review (Table 2). These tools emphasize the importance of sound preparation by encouraging assessment and valuation of existing conditions, along with engagement with local communities as prerequisites to planning green cities. Over time, additional tools can aid in the management of green spaces by the monitoring of key metrics and the geo-spatial communication of changing conditions.

Assessment Tools

Utilizing geo-spatial and analytical tools, cities can establish an understanding of baseline conditions for the presence and health of its ecological systems. Representative tools and examples set forth below (Table 2) can assist cities in visioning and comprehensive planning, as well as in engagement with a cross-section of stakeholders. Critical elements for assessments include not only documenting where green and blue spaces currently exist and the status of their health and connectivity, but also determining whether these spaces are permanently protected through legislation or zoning (World Bank 2021).

Valuation Tools

Through proper valuation of ecosystem assets and the services that they provide, cities can compare the benefits and costs of these resources against other proposed city infrastructure and investments. Understanding the socioeconomic value and benefits of natural processes, systems, and spaces is essential for policy makers to acknowledge nature-based alternatives and to compare them to traditional development practices. A proper accounting of the value of ecosystem resources can prevent their undervaluation and lack of protection, which often occurs despite the cost effective and sustaining benefits that they can provide to meet a range of city priorities (GPSC 2019).

Tools to Manage and Monitor Key Metrics

Informed by baseline assessments and a valuation of urban ecosystems, cities can use a variety of tools to measure the health of ecosystems over time to aid in their management. Some critical metrics include: the health of local biodiversity; access, and use of nature resources within the city; connectivity across the urban landscape; and the prioritization of ecosystem conservation in city budgets and plans. The Singapore Index on Cities' Biodiversity is a primary example of a comprehensive tool to measure the health of local biodiversity and provides an assessment not only of ecosystem health but also its societal contributions in areas of public health and nature-based education. The index has been customized by participating cities, such as **São Paulo, Brazil**, and **Los Angeles, California**, to reflect variations in local conditions.

5. How can cities balance the competing demands of green urban infrastructure that promotes urban nature and gray infrastructure that provides urban services and accommodates the needs of growing urban populations?

Ecological systems and green infrastructure can provide impactful and cost-efficient alternatives for jurisdictions of varying sizes, capacities, and resources to address numerous urban issues, such as stormwater and flood management, climate regulation, and social cohesion, in ways that are more sustainable and equitable compared to traditional gray infrastructure investments. As illustrated by Deep-Dive Learning presentations, cities can employ various evolving strategies and business models to scale and mainstream investments in ecosystems and nature-based solutions to balance investments in gray infrastructure.

Emblematic of similar efforts underway in other global cities, **Ningbo, China**, is undertaking a blue and green natural assets accounting pilot to properly value natural assets on par with more traditional gray infrastructure. This will enable fully informed decisions about the respective costs and benefits of future infrastructure choices.

A variety of large-scale projects were discussed that illustrate the potential for synergistic green-gray infrastructure projects. In **Guangzhou, China**, the Lijiao sewage treatment plant was transferred

FIGURE 3
TOOLS FOR GREENING CITIES

Assessment

Biodiversity Atlas (UCLA)	Interactive, geo-spatial mapping of the current state of biodiversity in Los Angeles that includes environmental and anthropogenic variables, species distribution, and identification of protected areas.
i-Tree	A suite of free tools developed by the U.S. Forest Service and partners that aid in easily quantifying the benefits of trees, including canopy coverage, local urban forest structure and values, carbon sequestration, water management, and air quality.
Nature Solutions Dashboard (Connecting Nature Glasgow)	Arcgis dashboard that provides health and social data in relation to geo-spatial mapping of green areas.
Park Needs Assessment (Los Angeles County)	Comprehensive assessment, including robust community engagement, to gather data to determine the scope, scale, and location of park need.
Rapid Planning Toolkit (The Prince's Foundation (UK))	Through four sequential planning steps, the toolkit aids cities in creating robust and implementable walkable neighborhood plans for rapidly growing cities or towns.
Urban Biodiversity Inventory Framework	Developed by a partnership of U.S. cities, this tool provides a methodology to assess, monitor and guide planning of urban biodiversity.

Valuation

ARIES (Artificial Intelligence for Ecosystem Services)	A tool that uses probabilistic models based on ecological and socioeconomic factors to map the flow of multiple ecosystem services and assess their benefits to people.
B£ST	Created by the not-for-profit Construction Industry Research and Information Association, this tool is designed to assess and monetize the financial, social, and environmental benefits of blue-green infrastructure.
Environmental Benefits from Nature Tool (Natural England)	A tool using a habitat-based approach to provide a common and consistent means of considering the direct impact of land use change across 18 ecosystem services.
InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs)	GIS software developed by Stanford University that provides a suite of models used to map and value the goods and services from nature that sustain and fulfill human life.
National Ecosystem Services Classification System (NESCS) Plus	U.S. EPA support tool that helps track the linkages between ecosystem services and human well-being and standardizes ecosystem services classification for the measurement, quantification, mapping, modeling, and valuation of ecosystem services for planning and development.
Natural Capital Assessment (Singapore)	Assessment of status and health of major ecosystems and quantification of the economic and societal values created by these ecosystems.
TEEB Manual for Cities	Manual for cities that includes methods and models to estimate the value of ecosystem services using a step-by-step approach, guided by case studies.
Urban Nature Navigator (NATURVATION)	A tool to assess the contributions that different nature-based solutions can make to meeting urban sustainability challenges.

Management and Monitoring of Key Metrics

CA Nature (California)	Geo-spatial tool that collects a suite of publicly accessible interactive digital mapping tools and data to combine maps of biodiversity, climate change, and public access to measure progress towards state-level protection of conservation areas.
CO-IMPACT (Glasgow)	Decision-support tool allowing cities to create impact assessment plans for nature-based projects by helping users select targets and indicators for measurement, and create a custom project plan.
Ecosystem Health Report Card (Los Angeles County)	Evaluation of ecosystem health through assessment of indicators in the categories of land use and habitat quality, biodiversity, threats to ecosystem health, and community health and well-being. Grades assigned in each category are based on data availability and accuracy, compliance with regional policy targets where applicable, and historical improvements.
Ecotopes Framework (City of Los Angeles)	Creation of urban ecological subregions, or ecotopes, within cities to differentiate urban landscape regions based on environmental conditions and stewardship objectives, in order to optimize and refine ecological management strategies.
Green Area Factor (Madrid)	Planning tool that is used to create greener neighborhoods in the city by requiring that a certain portion of developed land must consist of vegetation and/or a water surface.
Indicator of Access to Green and Blue Spaces (Scotland)	Indicator and associated interactive data explorer that measures the proportion of adults who live within a 5-minute walk of local green or blue space.
The City Biodiversity Index (CBI) or the Singapore Index on Cities' Biodiversity (SI) (Singapore NParks)	Self-assessment tool for cities to evaluate and monitor the progress of their biodiversity conservation efforts against their own individual baselines. Updated in 2021, the index comprises 28 indicators that measure native biodiversity, ecosystem services provided by biodiversity, and governance and management of biodiversity.
Urban Nature Index (IUCN)	A tool for measuring the ecological performance of cities that aligns with the United Nations Sustainable Development Goals (SDGs).

Urban Forest in Guatemala City, Guatemala
Image Credit: Marco Verch (CC by 2.0)

underground to minimize its environmental impacts. The above ground space has been transformed into green space and wetlands. The city has also sought to carefully balance the amount of land dedicated to urban development versus ecological conservation and agriculture. The city is actively increasing the amount of available land for urban agriculture in the city.

In **Madrid, Spain**, the Manantial Sur (South Spring) project integrates water treatment with water reuse to support urban agriculture and regional forestry. In this respect, the traditional water treatment infrastructure has evolved to restore degraded ecological conditions in peripheries of the city to support biodiversity and pedestrian connectivity. The project is complemented by several public-private collaborations between the city and private partners for the provision of sustainable services. The focus of these projects vary from schools supporting training for a green economy, to flower markets and hubs for ecological startup companies.

Ecological planning and green infrastructure can also contribute to economic development. **Izmir, Türkiye**, is pursing ecological tourism as an economic driver. As elements of its larger ten-year Strategy for Living in Harmony with Nature, the city is developing Izmir Heritage (Izmiras) Routes that connect the city center with the surrounding countryside and large-scale ecological parks via walking and cycling paths that celebrate the unique culture and history of the region. In a similar manner, **Chengdu, China**, is developing Longquan Mountain Urban Forest Park as the first of several regional parks connected to the urban core via greenways. The intent is that the extensive forest park will support a variety of economic activities that include eco-tourism, sports and fitness, and international cultural exchanges. Ecological planning can also aid in the provision of social services. In **Bitung, Indonesia**, the city is undertaking a relocation program for families living in sub-standard housing to areas with improved ecological conditions. In **Managua, Nicaragua**, the city has designed Casas Ecologicas (ecological houses), which aim to combine new affordable housing with rainwater harvesting to provide usable water on site, a composting system, and an urban agriculture site to create sustaining spaces for low-income residents.

RESOURCES

Cities 4 Biodiversity (C4B) Library. https://www.thegpsc.org/c4b-library.

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APPENDIX A
The C4B Initiative

Launched in September 2021, C4B is a collaborative initiative led by the Global Platform for Sustainable Cities in cooperation with partner organizations that promote nature-positive urban development through focused support of a network of cities engaging stakeholders and pursing a shared emphasis on addressing climate and other principal challenges through ecological planning and design.

Under the Greening Cities Program, C4B plans to undertake a series of Deep-Dive Learning sessions on a range of themes. In each session, cities and experts are expected to actively share their ongoing projects and initiatives and first-hand knowledge around a specific theme. Through mutual peer learning, participants gain insights into evidence-based tools and good practices from around the world, which help them address their challenges and enhance ongoing work. Each session builds on the previous sessions, offering in-depth knowledge and continuous capacity-building opportunities to the cities as opposed to one-off learning events. Augmenting the learning programs, on a case-by-case basis, C4B provides targeted technical support to participating cities to identify solutions to the existing challenges.

Participants in the First Deep-Dive Learning:

World Bank Group

Global Platform for Sustainable Cities (GPSC)
Global Program on Nature-Based Solutions for Climate Resilience

Organizational Partners

Alexander von Humboldt Institute
Biophilic Cities
Convention on Biological Diversity (CBD) Secretariat
European Space Agency
Global Environment Facility (GEF)
ICLEI—Local Governments for Sustainability
International Union for the Conservation of Nature (IUCN)

Participating Cities

Brazil
• São Paulo

China
• Chengdu
• Chongqing
• Guangzhou
• Ningbo

Colombia
• Barranquilla
• Medellín
• Pasto
• Pereira
• Yopal

France
• Paris

Indonesia
• Balikpapan
• Bitung
• DKI Jakarta
• Palembang
• Semarang

Jordan
• Amman

Nigeria
• Lagos

Paraguay
• Metropolitan Area of Asuncion

Peru
• Lima and Callao Metropolitan Area

Rwanda
• Kigali

Sierra Leone
• Bo City
• Freetown
• Waterloo

Spain
• Madrid

Türkiye
• Izmir

United States
• Los Angeles

Scotland, UK
• Glasgow

APPENDIX B
PROGRAMS AND PROJECTS FROM THE PARTICIPATING CITIES

BRAZIL	Program/Project Name	Brief Description
Sao Paulo	Biosampa	City specific biodiversity index
CANADA		
Edmonton	BREATHE	Green network connectivity strategy
	Wildlife Passage Engineering Design Guidelines	Guidelines to aid in design and construction of wildlife passages by private developers
CHINA		
Guangzhou	Ecological network	Ecological network comprised of nature reserves, key ecological clusters, ecological cores, and water corridors
	Haizhu Wetland	Extensive wetlands conservation project
	Cloud Path	Elevated boardwalk connecting eight parks
	Lijiao water treatment plant	Mixed-use development water treatment park
	Dongpu overpass	Deck park, overpass over freeway
	Urban cooling stations	Multi-stage ventilation corridors to promote urban cooling
Ningbo	Blue and Green Natural Assets Accounting pilot	Natural assets valuation and accounting
	Spatial sustainability planning	Planning for sustainability across transects
Chengdu	Park City	Program to plan for and invite investment in ecological, livable city
	Longquan Mountain Urban Forest Park	Designed to pair ecological conservation with economic benefits

	Greenways	Comprehensive program encompassing ecological corridors that connect ecological zones, green belts, and parks
	Ecological protection red line	Strict protection of areas with high ecological importance
	Giant Panda Park	Large scale habitat and ecological corridor protection
Chongqing	Rivers and Four Waterfront Lines project	Ecological river restoration and river park space creation on the Yangtze and Jialing Rivers
	Shancheng Park	Creation of new park to improve biodiversity
	Walking Systems	Construction of walking routes across varied terrain of Chongqing
COLOMBIA		
Barranquilla	Water Resources Management Plan	Management plan for riparian and wetland resources
	Ciénaga de Mallorquín	Protected of coastal lagoon and its unique estuarine, mangrove habitat
Medellín	Corredores Verdes	Ecological connectivity program
	Renaturalization Plan	Plan for addition of ecological blue and green infrastructure
Pereira	San Mateo Park	Creation of extension park with public space and ecological corridors
	Otún River Boardwalk	New areas of public space on the left bank of the Otún River

Yopal	Urban/Rural Greenways	Greenways connecting urban and rural areas
FRANCE		
Paris, France	Ecological Continuity Areas	Blue/green corridor buffers where native species and habit are favored
INDONESIA		
Balikpapan	Climate Village Program	National program to increase the involvement of the community and other stakeholders to strengthen adaptation capacity to the impacts of climate change and reduce greenhouse gas emissions
	Botanical gardens development	Development of botanical garden
Jakarta	Urban Green Spatial Planning	Planting trees and mangroves
	Tebet Eco Park	Example of developing existing parks with a blue and green infrastructure approach
Palembang	Climate Village Program	[See Above]
	Green Transportation program	Development of light rail and multimodal transportation options
Bitung	Relocation Program	Relocation of low-income housing to areas with better environmental quality
Semarang	Semarang River Revitalization	River revitalization project
JORDAN		
Amman	Green City Action Plan	Plan to address environmental challenges with sustainable

		infrastructure investments and policy measures, and produce co-benefits for citizens
	Micro-Lungs	Equitable implementation of neighborhood scale green forests using Miyawaki method
	Green Rooftops	Focus on creating equitable open space in high density areas
	Hijaz Railway Park	Conversion of railway to support green connectivity
NICARAGUA		
León	Blue Corridors	Restoration of river corridors for connectivity
Managua	Casas Ecologicas	Affordable housing pilot project incorporating rain harvesting and other ecological benefits
NIGERIA		
Lagos	Operation Green Lagos	State parks and gardens program that includes the planting of over 7 million trees and the creation of 300 parks and gardens
	Regional Master Plan	Incorporating green infrastructure at neighborhood and city scales
PARAGUAY		
Asunción	Green City of the Americas	Sustainability plan involving creation and improvement of green areas

PERÚ		
Lima and Callao Metropolitan Area	Reclamation of Rimac River	Reclamation project to mitigate flooding risks and generate space for recreation
	ACR System of Lomas de Lima (Hills of Lima)	Conservation of five coastal hills, their biodiversity and cultural heritage
RWANDA		
Kigali	Second Rwanda Urban Development Project (RUDP II)	Project to upgrade informal settlements, rehabilitate degraded wetlands, and provide infrastructure for dispersed urban hubs
	Flood and Catchment Management Project (NDF)	Rehabilitation of urban wetlands to increase green space, enhance biodiversity and control floods
SIERRA LEONE		
Bo City, Freetown, and Waterloo	Resilient Urban Sierra Leone (RUSLP)	World Bank funded effort to create spatial plan for sustainable growth and green infrastructure
	Rapid Urbanization Toolkit (Prince's Foundation, UK) (Tool)	Implementation of toolkit to create framework to address impacts of development
	Urban Nature Assets for Africa (ICLEI) (Tool)	Effort to mainstream climate and natural asset protection
SPAIN		
Madrid	Producer Neighborhoods Project	Local scale renaturing of neighborhoods as strategy for local green employment, enhancing quality of life in

		peripheral districts, and creating new opportunities for underused public spaces
	Efecto Mariposa	Forest Avenue of 23 km for cyclists and pedestrians that will give access to schools, offices and Madrid Airport
	A Flor de yeso	1000 Has of Green infrastructure in new residential neighborhoods
	Manantial Sur	Integration of water treatment plant and supporting urban agriculture in river plain
	Del Manzanares al Guadarrama	Regional connection among municipalities through riverbanks, streams and livestock routes
	Green Area Factor	Green infrastructure requirements for development
	Public-Private collaboration for Sustainable Services Facilities	Hubs for ecological startups
TÜRKIYE		
Izmir	Strategy for Living in Harmony with Nature	Long term strategy to transform city with nature based solutions
	Ecological Parks	Creation 25 new regional parks
	Ecological Corridors/ Izmir Heritage Routes (Izmiras Rotasi)	Ecological and recreation corridors to connect city center with regional parks
UNITED KINGDOM		
United Kingdom	Environment Act of 2021	National law including biodiversity net gain

		requirement and local nature recovery strategies
	Green Infrastructure Framework	Green infrastructure mapping, design and implementation
	Accessible Natural Green Space Standards	National standards to promote access to green space at multiple scales
	Environmental Benefits from Nature Tool	Tool to demonstrate multifunctional benefits of nature spaces
Glasgow, Scotland	Connecting Nature	Nature-based solutions dashboard
	Open Space Strategy	Combining goals of livability, health, and resilience
	Co-Impact	Online tool to help create nature-based solution project evaluation and monitoring plans
UNITED STATES		
California	30x30 Plan	Commitment to conserve 30 percent of state lands and coastal waters by 2030
	CA Nature GIS	Mapping tool to aid in 30x30 Plan implementation showing areas available for potential conservation
Los Angeles (City), California	Green New Deal pLAn 2019	City plan that includes goals to increase tree canopy percentage, reduce urban /rural temperature differentials, restore the LA River, achieve no net biodiversity loss, and

		create half mile access to parks
	LA City Biodiversity Index	City specific biodiversity index
	Ecotopes Framework	Management tool based on changing ecosystem across city and regional ecological landscape
Los Angeles (County), California	Stormwater Pollution Abatement Bond Measure	State bond measure to enable city to implement green infrastructure projects
	Mochado Lake	Lake restoration project funded by state bond measure
	Countywide Parks Needs Assessment	Assessment and public engagement to determine park needs
	Significant Ecological Areas	Protection of areas with high biodiversity value
	Biodiversity Atlas of Los Angeles (UCLA)	Map of biodiversity assets
	Los Angeles County Ecosystem Report Card 2021 (UCLA)	Tool for creating a culture of accountability