

Working Group Meeting

Green Urban Development: Biodiversity, Natural Capital Accounting and Nature-Based Solutions for Cities

Summary Report

May 8 – 10, 2019 The World Bank, Washington DC, USA









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Background

The Global Platform for Sustainable Cities, or GPSC *www.thegpsc.org*, is a knowledge platform managed by the World Bank which promotes an integrated approach to sustainable urban planning and strategic growth. During 8-10 May 2019 the Working Group Meeting "Green Urban Development: Biodiversity, Natural Capital Accounting and Nature-Based Solutions for Cities" was organized by GPSC in collaboration with the International Union for Conservation of Nature (IUCN) and The Nature Conservancy (TNC). The event obtained support from the Global Environment Facility (GEF) and was held at the World Bank Group's Headquarters in Washington, DC.

The event was convened to bring together 60+ experts and city representatives to:

- Facilitate an understanding of approaches to city biodiversity conservation and creation, and methods for accounting of city level natural capital; and
- Discuss how cities can be supported to integrate biodiversity strategies and the benefits of natural capital into their planning processes.

Attendees represented the following cities/organizations:

- Cities and National Governments: Mendoza, Argentina; Brazil (Anápolis, Ilhéus, Jaguariúna, Rio de Janeiro, São Paulo, Sustainable Cities Knowledge Platform and the Innovation Observatory, and the Ministry of Regional Development); Edmonton, Canada; Ningbo, China; Environmental Protection Agency of Ghana; Asunción, Paraguay; Kigali, Rwanda; National Parks Board of Singapore; and London, UK.
- Agencies/ Organizations/ Others: C40; Convention on Biological Diversity; Ernst and Young; Future Cities Laboratory; ICLEI Local Governments for Sustainability; IUCN; Natural Capital Project; Natural Capital Solutions; TNC; UN Development Programme; United Nations Industrial Development Organization; University of Pennsylvania, Department of Landscape Architecture; Urban Biodiversity Hub; Vivid Economics; World Resources Institute (WRI); and WWF.
- **Global Environment Facility (GEF):** GEF; and GEF Scientific and Technical Advisory Panel (STAP) UN Environment Programme.
- World Bank: Climate Change Group; Global Practice for Social, Urban, Rural and Resilience, Global Practice for Environment and Natural Resources, and other divisions of the World Bank Group.

A full list of attendees is included in Annex A.

Overview of the Sessions

The GPSC Working Group Meeting "Green Urban Development: Biodiversity, Natural Capital Accounting and Nature-Based Solutions for Cities" was held from 9 – 10 May 2019 at the World Bank Group's Headquarters in Washington, DC. It brought together about 60 participants comprised of city representatives and leading experts from international organizations, academia and the private sector to discuss how to integrate biodiversity strategies, natural capital accounting and nature-based solutions into the city planning processes and support green urban development. The session began with the presentation of the Working Paper, "Biodiversity and Natural Asset Valuation in Cities," which provided an overview of the concepts of city biodiversity, natural asset accounting and green infrastructure investment together under the umbrella goal of supporting green urban development.

A series of presentations were shared by attendees, focusing on innovative green urban developmentrelated tools and initiatives from around the world, including the cases of Brazil, Singapore, and the United Kingdom. It was followed by interactive panel discussions, and participants discussed the related challenges (e.g. the unavailability of natural asset spatial inventory data, the difficulty of establishing common metrics that different cities can apply, and the lack of a concrete spatially explicit plan for biodiversity at the city level).

Several participants raised the important point that the existing urban policies for biodiversity conservation tend to be limited to high-level goals, when the topic can actually be much further leveraged and integrated given its instrumental and intrinsic value. City representatives from Argentina, Brazil, China, Ghana, Paraguay, and Rwanda presented their existing challenges (e.g. poor infrastructure, expansion of informal settlements, conflicting interests, policies and laws, and weak enforcement tools), and identified the need to decentralize the concepts for public understanding and coordinate cross-sectoral dialogues across different institutions for prioritization and implementation.

The meeting concluded with a set of recommendations and strategic directions for the next steps, which re-emphasized the importance of bringing together and mutually supporting the three topics – biodiversity, natural capital, and nature-based solutions – to leverage their synergies. The participants also highlighted the role of cities in promoting sustainable green urban development by integrating the concepts into the overall urban design and planning strategies/ policies to enhance cities' livability and competitiveness. Overall, the meeting also provided an important dialogue opportunity which set the stage for further cooperation through the GPSC network for potential pilot projects in selected cities.

Day 1 | 8 May

I. Opening of the Working Group Meeting

Welcome and Objectives of the Meeting

Ms. Xueman Wang, GPSC Program Coordinator, welcomed the participants and provided an overview of the GPSC Program. She highlighted that the objectives of the Working Group Meeting were to help cities understand how to integrate biodiversity strategies, natural capital accounting (NCA) and nature-based solutions into their planning processes and support green urban development – drawing on the expertise from around the world.

Opening Remarks

Mr. Aloke Barnwal, Senior Climate Change Specialist, welcomed the participants and delivered remarks on behalf of GEF. Mr. Barnwal stressed the importance of the topic in the upcoming GEF-7 funding cycle and also of bringing together knowledge from different cities and disciplines.

Mr. Sameh Wahba, Director for the World Bank's Social, Urban, Rural and Resilience Global Practice, also welcomed the participants and thanked GEF, IUCN and TNC for supporting this initiative. He emphasized that the meeting was very timely, given the continued expansion of urban areas, the threats of extinction for many species and the altering of natural environments due to the increasing human population. Mr. Wahba referred to the newly released UN report which outlines that uncontrolled rapid urban expansion is a major threat to natural habitats and global biodiversity. He also highlighted the importance of the global discussion on the topic, as well as the role of cities in ensuring sustainable green urban development.



Fig 1. Mr. Aloke Barnwal, Senior Climate Change Specialist, GEF, and Mr. Sameh Wahba, Director, World Bank, addressed the Working Group Meeting participants

Rapid Introduction of Participating Cities and Organizations (Batch 1) Open PDF Online

Participants were assigned to three groups and had a chance to introduce their city/ organization and their main undertakings in the areas of city biodiversity, natural capital accounting and nature-based solutions in the context of green urban development. Batch 1 included: Mendoza, Argentina; Brazil (Anápolis, Ilhéus, Jaguariuna, Rio de Janeiro, São Paulo, Sustainable Cities Knowledge Platform and the Innovation Observatory [Sustainable Cities Program/ Management Center for Strategic Studies], and the Ministry of Regional Development); C40; Edmonton, Canada; Ningbo, China; and the Convention on Biological Diversity.

II. Framing and Overview

<u>Working Paper: Green Urban Development – A Framework for Integrating Biodiversity and</u> <u>Ecosystem Services, Natural Capital Accounting and Natural Infrastructure</u>

The session began with the presentation of the draft Working Paper "Biodiversity and Natural Asset Valuation in Cities," which was prepared by a team led by Ms. Xueman Wang with contributing authors from Vivid Economics to inform and frame the proceedings for the participants. Ms. Wang first provided the context in which the Working Paper was developed, addressing the challenges arising from the rapid urban expansion. She also presented how rapid urbanization can be a threat to natural habitats and global biodiversity, negatively affecting the livability and compromising human wellbeing. In the face of such challenges, she emphasized that cities have great opportunities to introduce and integrate the green urban development concepts into their "green vision" and "green strategies," and ultimately into the overall master plan. She stressed that the three topics – biodiversity, natural capital and nature-based solutions – should not be treated in isolation but must be mutually supported and enhanced.

Following the introduction, Mr. Ashley Gorst from Vivid Economics presented the Working Paper, providing an overview of the concepts of city biodiversity, natural asset accounting and green infrastructure investment together under the umbrella of supporting green urban development.

(i) Natural assets and green infrastructure

Cities often provide infrastructure and services that bring public benefits, but green infrastructure is often not considered as a mainstreamed vital service. Cities are also often constrained in their ability to provide public goods necessary for green development due to limited resources, lack of institutional capacity and inconsistent values and norms. In order to overcome these challenges, cities need a better understanding of the benefits that their urban natural assets provide and have a systematic way of prioritizing investments.

Stock of natural assets					
Parks		Waterbodies		erbodies Street trees	
Flow of services					
Provisioning services	Reg	ulating services	Habitat servi	ices	Cultural services
FoodTimber	ClimaAir ai	ate stability nd water quality	 Genetic and sp biodiversity Pollinators for agriculture 	ecies	Recreational activityTourismPlace-making
Value of services					
Benefits to individuals, business and public sector					

Fig 2. Services and Benefits Provided by Natural Assets (Source: Vivid Economics and Brander and Eppink)

Different types of green infrastructure can be deployed by cities to pursue their own green development ambitions, and cities have a significant number of options to intervene and invest in green urban development by planning, creating and maintaining urban natural assets in and around their areas.

(ii) Biodiversity in cities

Biodiversity underpins the services provided by many natural assets and can also be seen as an asset by itself. It is important to define the role of biodiversity in the context of natural assets and with respect to the ecosystem framework. Currently, urban policies for biodiversity conservation tend to be limited to high-level goals where biodiversity can be much further leveraged and integrated, given its instrumental and intrinsic value.

(iii) Natural capital accounting

Natural capital accounting can help cities assess benefits of green and blue infrastructure in a financial framework consistent with other public infrastructure. In fact, cities are increasingly using natural capital accounting as a tool to assess and monitor the quality of their environment and make better policy decisions. For example, London's natural capital account demonstrates the value of multiple ecosystem services provided by its urban green spaces.

(iv) Integration of the concepts

Biodiversity assessments could be integrated into accounts by linking biodiversity to specific services or by including indices in physical accounts. It can help cities take a targeted approach towards the management of specific assets, while also providing an opportunity to follow an integrated approach to city planning. After Mr. Gorst's presentation, Mr. Rob McDonald from TNC moderated the discussion focusing on two questions:

- 1. How can city biodiversity, natural capital accounting and natural infrastructure contribute to a city's green vision?
- 2. What are the key challenges of incorporating these issues into the urban planning process?

Key points raised during the discussion included the unavailability of the data to map the assets and the difficulty of establishing common metrics that different cities can apply. Participants also discussed the possibilities of linking different policies in relation to the natural assets and developing multiple scenarios for decision-making, as well as the complementary role of the private sector.

III. City Biodiversity

Rapid Introduction of Participating Cities and Organizations (Batch 2) Open PDF Online

Moderated by Professor Richard Weller of the University of Pennsylvania, Session 3 started with the rapid introduction of Batch 2, which included: University of Pennsylvania; Ernst and Young; Future Cities Laboratory; Environmental Protection Agency of Ghana; GEF Scientific Advisory Panel - UN Environment; ICLEI Local Governments for Sustainability; IUCN; the Natural Capital Project; Natural Capital Solutions; Asunción, Paraguay; and the National Parks Board of Singapore.



Fig 3. Prof. Weller and Prof. Edwards presented the works of the University of Pennsylvania and Future Cities Laboratory

Overview: Approaches to Quantifying Biodiversity and Ecosystem Services in the Urban Context

Open PDF Online

Mr. Rob McDonald of TNC delivered a keynote on how to choose the tools and methods when quantifying biodiversity and ecosystem services in the urban context. He first presented the key concepts of planning for biodiversity and human well-being by illustrating three types: (a) resource use focused; (b) biodiversity focused; and (c) ecosystem service focused, in which the emphasis is on increasing interaction between cities and natural areas. He then introduced the ecological spatial planning model, outlining the process as follows:

- 1. Define the problem or policy issue;
- 2. Take inventory: What ecosystem services matter?
- 3. What natural infrastructure provides those services?
- 4. Identify options for actions;
- 5. Assess options and implement; and
- 6. Implement monitoring and adaptive management.

In terms of the ecosystem service valuation, he emphasized that cities should consider: (a) supply and demand aspect of the ecosystem service value; (b) information needed; and (c) purpose of the information. Mr. McDonald also shared stormwater mitigation and biodiversity models and pointed out that that the level of details in the analysis should drive the decision of choosing the appropriate tool.

	Fragstats	Connectivity models	Metapopulation models (e.g., RAMAS)	Conservation planning software
Key outputs:				
Landscape metrics of fragmentation	Yes	Varies	Varies	Varies
Connectivity metrics	Some simple metrics	Yes	Yes	No
Demographic information	No	No	Yes	No
Optimal conservation plans	No	No	No	Yes
Existence value	No	No	No	No

Fig 4. Biodiversity Models (Source: TNC)

City Practice Open PDF Online

The Singapore Index on Cities' Biodiversity: Sharing 10 Years of Application by Cities Globally

Ms. Lena Chan of Singapore's National Parks Board presented the Singapore Index on Cities' Biodiversity (SI). Ms. Chan explained the context and the development process of the SI, outlining the limitations of the previous indices (e.g. Environmental Sustainability Index, Environmental Performance Index, Cities of Opportunity, etc.). She discussed the SI indicators for the three categories, (a) biodiversity, (b) ecosystem Services, and (c) governance and management.



Fig 5. Singapore Index on Cities' Biodiversity (Source: Singapore National Parks Board)

Ms. Chan also presented that SI could: (a) provide guidelines on how to enhance native biodiversity; (b) serve as a provision of biodiversity inputs into the master planning of cities; (c) provide a basis for calculation of economic value of biodiversity and ecosystem services; and (d) serve as the biodiversity component of other indices. Currently, 26 city governments around the world have applied the SI, and 12 cities are in the process of applying the index.

Natural Asset Mapping: One of Edmonton's Tools for Biodiversity Planning and Protection

Mr. Grant Pearsell of the City of Edmonton, Canada presented the city's experience in biodiversity planning and protection using the natural asset mapping technique. Edmonton has been tracking its natural assets to understand the ecological connectivity and promote a common framework that helps the City and its stakeholders to consider the sustainability of natural assets in future planning and land development decisions. For example, the Urban Primary Land and Vegetation Inventory covers 128,696 ha, and includes 37 natural, semi-natural, and other site types with main level of classification aligned with provincial ecosite mapping.



Fig 6. Environmental Sensitivity Mapping and the Open Data Portal (Source: City of Edmonton)

The data provided profound insights into the ecological landscape of Edmonton, and the city has integrated the data sets for various uses, including environmental sensitivity mapping, natural systems connectivity mapping, wetland conservation, habitat restoration, climate adaptation plan development, and development planning, as well as for monitoring greenhouse gas emissions from land use change. The information is shared on the city's open data portal for broader applications, including public education purposes.

São Paulo, Challenges of Sustainable Development and Preservation of Biodiversity

Mr. Rodrigo Ravena from the Secretariat for Green and the Environment presented the biodiversity of São Paulo, Brazil focusing on its vast rainforest ecological corridors. For the protection of the rainforest, São Paulo devised a conservation and recovery plan and has carried out 10 main actions, which include implementing the Ecological Restoration Program in the Units of Conservation, urban parks, linear parks, and private spaces, as well as applying incentive instruments for conservation and recovery of remnant of the rainforest as the Payments for Provision of Environmental Services (PSA). The PSA rewards property owners who preserve areas that provide relevant environmental services for the city's sustainability, such as water production, organic agriculture, and preservation of remnants of the Atlantic Forest and biodiversity.

Rapid Introduction of Participating Cities and Organizations (Batch 3) Open PDF Online

The afternoon session started with the rapid introduction of Batch 3, which included: TNC; UN Development Programme and the Paraguay Ministry of Environment and Sustainable Development; United Nations Industrial Development Organization; London, United Kingdom; Urban Biodiversity Hub; Vivid Economics; World Resources Institute; WWF; and World Bank.

City Biodiversity Discussion

Participants continued the discussion on city biodiversity, revisiting the very definition of biodiversity, and addressed that cities have to evolve in sophisticated ecosystems, while a viable urban ecology must be built on the existing natural assets. However, it is a complicated process, especially because most cities do not have a concrete, spatially explicit plan for biodiversity at the city level. To further mainstream biodiversity into the city planning, it is important to bring the concept into the master plan, land-use plan, and sectoral plans.

Cities in Action

Participants were assigned into three groups, each focusing on: (a) Ilhéus, Brazil; (b) Asunción, Paraguay; and (c) Sakumo Ramsar Site, Ghana. City representatives led discussions, identifying challenges and strategies in establishing and implementing city biodiversity approach and incorporating it into the city's planning process. Experts of each group helped facilitate the discussion and provided guidance on the strategy and the next steps.

Plenary Reports

Ilhéus, Brazil

Mr. Mario Alexandre Correa de Sousa, Mayor of Ilhéus, presented the overview of the city and its rich biodiversity. He discussed the difficulty of protecting biodiversity in the face of urban development and intensified agricultural practice, as well as the challenges they pose to the administrative and planning structures. Notwithstanding, he emphasized the city's efforts in protecting and managing the biodiversity and also that the rich and diverse ecological landscape is the greatest asset of the city and the ecological stability of the city will not be compromised. The Mayor also discussed the importance of engaging diverse stakeholders throughout the process and the need for a better coordination mechanism.



Fig 7. Mario Alexandre Correa de Sousa, Mayor of Ilhéus, Brazil, presented the case of Ilhéus

Asunción, Paraguay

Ms. Tamara Bogarin from the Municipality of Asunción provided the overview of the city and discussed the "Asu Ecosustentable Proyect," which includes five main areas of action, such as managing the protected areas, monitoring urban biodiversity and wildlife, and managing urban green corridors. Key points from the group discussion entailed the importance of working with stakeholders, such as academia and the National Museum of Natural History of Paraguay, to develop a more integrated vision. Ms. Bogarin also presented that the applicability and usefulness of different tools presented in the meeting (e.g., the Singapore Index) will be further analyzed and implemented to support the relevant project activities in Asunción.

Sakumo Ramsar Site, Ghana

Mr. Kwame Boakye Fredua from the Environmental Protection Agency presented the Sakumo Ramsar Site of Ghana. The main challenges of the site included pollution, land degradation, grazing, and encroachment through infrastructure development, as well as the reduction in the number of some species. In order to address the challenges, a number of project-level interventions (e.g. reengineering wetlands to increase the residence time and biological purification, tree planting by utilizing treated waste-water to conserve biodiversity and control pollution, etc.) are currently taking place. The group discussed the opportunities to expand the ongoing efforts as follows: (a) increase the capacity of the waste-water treatment on the site; (b) expand community outreach and education programs; (c) enhance the biodiversity of the site for ecotourism purposes; (d) work with the city government to develop new business models for urban development finance and biodiversity conservation; and (e) enforce the existing laws governing the Ramsar site.

Wrap Up of Day 1

Ms. Xueman Wang summarized the different tools and methods discussed, as well as the key conclusions. She emphasized the crucial roles that cities play in fostering green urban development as well as the potential opportunities they can explore. She also highlighted that green resilient urban development should take place within the context of broader regional plans.

Day 2 | 9 May

IV. City Natural Capital Accounting and Nature-Based Solutions

Insights and Lessons Drawn from the Existing Work Open PDF Online

Moderated by Mr. Russell Galt of IUCN Urban Alliance, Day 2 started with a presentation "Natural Capital Accounting at the National Level: Wealth Accounting and Valuation of Ecosystem Services (WAVES)" by Mr. Raffaello Cervigni of the World Bank.

(i) Global level work

The analytics of the World Bank report "The Changing Wealth of Nations" (2018) presents that natural capital accounts for a large share of total national wealth for lower-income countries and the value of per capita increases as countries develop. This highlights the importance of natural capital accounting for decision-makers. The World Bank also supports global consultation, knowledge sharing, and standard setting for natural capital accounting.

(ii) Country level work

WAVES is active in 26 countries with different modalities of engagement. It has been scaling up the development of accounts and there has been growing interest in ecosystem services. It has been supporting the use of NCA in the policy-making processes in countries like Guatemala, Indonesia, Rwanda, and Zambia, and NCA is being institutionalized in many countries such as Botswana, Colombia, and Costa Rica.





(iii) Way forward

NCA has been gaining momentum, but further efforts are needed to deliver impacts at scale. There remain important gaps in global data sets on natural capital (e.g., fisheries, water, ecosystem services, etc.). While some 80+ countries are developing natural capital accounts (or are planning to), few have complete, ready-to-use accounts. In order to help the efforts, the Global Program for Sustainability promotes the use of quality data on natural capital and ecosystem services to inform decisions by governments, the private sector, and public institutions.

City Natural Capital Accounting Open PDF Online

London, England

Mr. Ashley Gorst from Vivid Economics and Mr. Peter Massini from the City of London co-presented London's natural capital accounting and explained how it could be carried out at the city level. Mr. Gorst first gave an overview of building London's natural capital account for parks, comprised of three steps: (a) define the extent and condition of natural assets and gather the data (e.g., parks and gardens, community gardens, etc.); (b) define the services the assets provide (e.g., physical activity and health, amenity, carbon sequestration, etc.); and (c) calculate the economic value of the ecosystem services. Following the overview, Mr. Massini presented how natural capital accounting in London is beginning to affect the city's urban planning and policies. Facing various urban development and demographic changes, as well as climate change, London is focusing on green infrastructure to build a sustainable,

functioning city, using the natural capital accounting data to guide and support the strategic direction. It helps people understand the significant value of green infrastructure – ranging from enhancing air and water quality, to preventing flooding, and improving biodiversity and ecological resilience.

Stirling, Scotland

Mr. Jim Rouquette from Natural Capital Solutions presented the case of Stirling, Scotland, focusing on the costs and benefits of implementing new green investments on natural capital within the existing built environment. He explained the steps of a spatial assessment framework, which maps the comprehensive physical and monetary flow of benefits before and after the investments, as well as the associated costs. He illustrated this by using the examples of two planned investments, a city park and a river revitalization project. Various benefits of the investments (e.g. urban heat dissipation, water flow regulation, and accessibility to nature) along with their estimated values, were illustrated on the indicative maps. He also shared how the demand for some services, such as the air quality regulation demand, can be mapped based on indicators of air pollution sources and societal need for air purification.



Fig 9. Spatial Assessment Framework and Natural Capital Assets: Pre- and Post-investment (Source: Natural Capital Solutions)

Bringing the data together, Mr. Rouquette emphasized that natural capital accounting can be applied successfully to assess proposed developments in cities and also integrated with standard economic appraisals. Stirling's case demonstrated that the benefits of investing in natural capital are considerable and should be taken into account in decision-making processes.

Singapore

Mr. Peter Edwards from the Future Cities Laboratory (FCL) presented a project assessing natural capital in Singapore, which involves: (a) quantifying the current status and health of the terrestrial and coastal marine ecosystems; (b) quantifying the economic and societal value of the ecosystem services to society; (c) assessing interactions between urban development (urban assets) and natural capital (natural assets); and (d) assessing future policy and development opportunities that integrate natural capital within a sustainable future city. FCL applied a similar stepwise process of the national accounting best practice, but specific considerations were made based on the city context, such as the typology of ecosystems. In order to gather the data, new technologies for fine-scale quantification were adopted, including LiDAR, HiRes multispectral imagery, orthophotography, Google street views, and Cloud Platforms. Mr. Edwards presented how different ecosystem services (e.g. water flow and climate regulation, carbon storage, and ecosystem service hotspots) could be mapped and simulations run using tools and models such as DART, OpenFoam, and WRF to inform the ecosystem services. He emphasized the data could be used as an interactive decision support tool for city planners, designers, and the public.

Q&A and Discussion

The four presenters participated in the panel discussion and talked about the approaches and methodologies further. They stressed that natural accounting should be linked to city strategies,

targets, and plans, and also addressed the practical challenges and limitations in carrying out natural capital accounting at the city level. Ms. Xueman Wang also shared her views on the areas in which the methodologies can be applied to, within the context of the World Bank's projects (e.g. the economic benefit analysis component for investment projects).



Fig 10. Discussion in progress

Integrating Green and Gray Infrastructure to Support Urban Water Security, Climate Resilience, and Biodiversity Open PDF Online



Fig 11. Integrating Green and Gray

Ms. Suzanne Ozment from the World Resources Institute (WRI) and Mr. Steven Carrion from the World Bank co-presented the Natural Infrastructure Initiative. Ms. Ozment presented the new report codeveloped by the WRI and the World Bank, *Integrating Green and Gray* (2019) which provides guidance on how to integrate "green infrastructure" with traditional "gray infrastructure" to support the smooth and safe functioning of societies in the face of multiplying environmental threats.

The report provides a framework to evaluate green infrastructure from a technical, environmental, social, and economic perspective, and to assess key enabling conditions. Ms. Ozment emphasized the importance of the monitoring process and engaging communities from the beginning, as well as the need for a supportive policy framework. Mr. Carrion presented that

there has been a steady rise in the use of the Nature-based Solutions (NBS) in the World Bank's operations, and there are opportunities for growth as most operations are still focusing on the conventional gray infrastructure interventions. Mr. Carrion also introduced the works of the NBS Community of Practice at the World Bank in knowledge sharing and providing the related resources.

Q&A and Discussion

The presenters and participants discussed the multi-criteria analysis approach and specific examples of benefits and costs of integrating green and gray infrastructure, such as the stormwater fee and wastewater treatment cost-savings. The group also discussed the limitations and challenges of implementing NBS, as well as the importance of partnering with the private sector – especially with engineers. Ms. Xueman Wang shared the example of Singapore's ABC (Active, Beautiful and Clean) waters program and incorporating NBS into the World Bank development and rehabilitation projects.

Cities in Action

For the afternoon session, participants were assigned to four groups, each supporting one city to prepare an action plan on how to enhance its natural capital (including biodiversity) and incorporate these considerations into the city's strategic green vision and urban planning processes for implementation. The cities included: (a) Mendoza, Argentina; (b) Ningbo, China; (c) Anápolis, Brazil; and (d) Kigali, Rwanda. The city action plans were presented on Day 3 in a "Shark Tank" format.

Day 3 | 10 May

V. Presentation of City Action Plans and Feedback

Presentation of City Action Plans Open PDF Online

Mendoza, Argentina

Day 3 started with the city action plan presentation by Ms. Maria Maria Ontanilla from Mendoza. Located in a region of foothills and high plains, Mendoza is focusing on preserving the piedmont territory and creating a climate-resilient 'oasis city,' but it is facing a number of challenges such as the expansion of informal settlements, natural risks, informal urbanization blocking access to the piedmont, and poor infrastructure.



Fig 12. The Ecosystem of Mendoza (Source: City of Mendoza)

Applying the NCA approach, Mendoza can map the ecosystem services provided by the piedmont, develop multiple urbanization scenarios, and compare the associated costs and benefits. NCA will help strengthen its Territorial Plan (2019-2030), and it can be also applied to future projects. In order to carry out the action, Mendoza will work with the local, provincial and national government and learn from the best practices and collaborate with other cities who have implemented similar policies, as well as experts in different disciplines and the community.

Following the presentation, two experts (Ms. Anne Guerry from Natural Capital Project, and Mr. Rodrigo Ravena from São Paulo) provided insights as follows:

- The informal settlements should be included throughout the planning and implementation processes;
- The city needs not only multiple scenarios, but also different versions of each scenario with varying factors and trajectories, to better understand and anticipate the impacts of the strategies.

Ningbo, China

Ms. Huining Zhou from Ningbo and Mr. James Patterson-Waterson from Vivid Economics copresented the city action plan for Ningbo. Ms. Zhou provided an overview of the city and its current green urban development conundrums, such as the greenery with a high maintenance cost, and greenery planning mainly focusing on the aesthetic aspect, not taking Ningbo's own biodiversity and ecosystem values into consideration. Mr. Patterson-Waterson presented Ningbo's green strategy and ecological approach to creating urban green space, including the "sponge city" initiative and Ningbo Greenways. He discussed that NCA can help integrate multiple GEF interventions as an overall approach and establish the baseline data to enable informed decision-making, while raising the awareness of the value of green space for citizens and developers. He explained the steps of conducting NCA and also addressed the constraints, such as data collection and the property rights and accountability system of natural assets. The results of NCA will help protect natural assets within the ecological red line, extend the city in an orderly manner in the form of GOD (green-oriented development) and develop a baseline to monitor future performance.



Land use planning process of Ningbo City

Fig 13. Vision and Green Strategy, and Land use Planning Process of Ningbo (Source: Ningbo City)

Mr. Lena Chan, Mr. Rob McDonald, and the participants shared their insights into the different opportunities Ningbo can explore as follows:

- Support close multi-agency collaboration and frame various scenarios showing how different green infrastructures fit together to enhance the biodiversity;
- Focus on Ningbo's native species and do not overlook the aesthetics of their ecological performance, which influence the public's perception and understanding of the green strategy.

Anápolis, Brazil



Fig 14. Mr. Zayek presented the action plan of Anápolis

Mr. Antonio Zayek from Anápolis presented the "Pro Agua Project" that Anápolis is currently undertaking to mitigate problems associated with rainwater, such as flooding, sedimentation, and erosion. The city has been working with the public and private sectors as well as the local communities, but it needs further strategic collaboration at the technical, legal, and financial level to ensure sustainable implementation of the project. Since last year, it has been working with the ANDUS (Support to the Brazilian National Agenda for Sustainable Urban

Development) on an integrated sustainable urban development pilot project as a part of the national initiative. To mainstream biodiversity, NCA, and nature-based solutions, Anápolis will: (a) start collecting baseline data on natural assets; (b) bring together different stakeholders (local governments, the private sector, academia, religious institutions, local communities, etc.); (c) create a list of policies with the stakeholders using baseline data for the urban and rural areas; (d) create a business plan for policy implementation; and (e) legislate and integrate the plan into the city's master plan.

The shark tank discussion was led by Ms. Ingrid Coetzee of ICLEI and Mr. Peter Edwards of the Future Cities Laboratory, who shared the following insights:

- *Every step is an experiment document the steps and data thoroughly;*
- Bring in a monitoring component into the process specifying the indicators and the methods of analyzing the outcomes;
- Collaborate with diverse stakeholders to protect the entire functional landscape of the very important and fragile cerrado;
- Also focus on managing the nutrients of the ecosystem.

Kigali, Rwanda

Mr. John Kalissa presented the city action plan for Kigali. While Kigali is promoting green sustainable development, a number of challenges like urban development and high population density are threatening its ecological character, especially its wetlands. Supported by GEF, it is developing regional environmental management projects and the Kigali urban environmental restoration project, focusing on urban wetlands and waste management. However, there exist institutional challenges such as conflicting policies and laws, weak enforcement tools, and lack of compliance at the local level. In order to further mainstream the green urban development concepts, Kigali needs to decentralize the concepts first and coordinate through cross-sectoral dialogues across different institutions.

Key NCA Functions	Planning Institution	Statistics Institution	Sectoral Agencies
Analysis / Assessment	 Policy analysis Trend analysis Modeling Interpretation 	Statistical consistencyCompatibility	 Physical condition & trend Geospatial analysis?
Compile / Report	SynthesisPolicy Briefs	 Regular Reports Special publications 	 Sectoral / Technical Reports
Develop Guidelines	 Evaluate Plans Budget Cycle	 SEEA Guidelines / Formats 	 Sectoral surveys & data requirements
Collect / Cross Check	Convene dialogue	 National Data Repository 	 Sectoral Data Access & Repository

What's Needed to Sustain NCA – Key Functions across Different Institutions

Ms. Carter Ingram of Ernst and Young and Mr. Peter Massini of London shared the reflections on Kigali as follows:

- With the ongoing projects, Kigali demonstrates an exceptional case and the perfect opportunity to examine the synergies and challenges of integrating the city level NCA with the national NCA;
- Given the number of existing projects and potential future projects, as well as the conflicting interests of different institutions involved, systematic prioritization of the objectives for mainstreaming NCA could prove to be crucial.

Next Steps and Conclusion of the Meeting

Ms. Xueman Wang thanked all participants and re-emphasized the importance of bringing together the three topics – biodiversity, natural capital, and nature-based solutions. She also highlighted the role of cities in promoting sustainable green urban development.

Ms. Wang recapped the importance of biodiversity as a spatial urban ecology and how the understanding of biodiversity directly translates into the city's actions and practices towards green urban development. The meeting saw NCA is a tool, and it is important to consider how the tool can be integrated into the overall urban planning, strategies, and policies. Ms. Wang also noted the meeting's emphasis that nature-based solutions should be incorporated into overall urban infrastructure design and planning schemes to enhance cities' livability and competitiveness.

Understanding the intricate synergies among the three topics, the next step for GPSC will be supporting cities to implement the practices in the following ways:

- Finalize the Working Paper based on the valuable inputs from the participants to provide concrete guidance and a framework for cities;
- Continue the discussion in the 3rd GPSC Global Meeting, which will take place in São Paulo, Brazil, 16-20 September 2019;
- Continue working together with different cities and countries to incorporate the lessons learned and support their green urban development with appropriate tools and means, and start pilot projects with new partner cities;
- Continue the network's close collaboration with the Convention on Biological Diversity.

Fig 15. Kigali Action Plan to Sustain NCA (Source: City of Kigali)

Annex A: Meeting Agenda

Day 1

8 May 2019 Room 8P-100			
8:30 - 9:00	Registration and Continental Breakfast Outside Meeting Room		
Session 1: Opening of the Working Group Meeting			
	Objectives of the Meeting (Xueman Wang, GPSC Program Coordinator, World Bank)		
9:00 – 9:40	Rapid Introduction of Participating Cities and Organizations (Batch 1, 20 min) Representatives of cities and organizations are invited to share a short presentation on their main undertakings in the areas of city biodiversity, natural capital accounting and nature-based solutions in the context of green urban development. The introduction will be conducted in batches throughout three sessions during day 1 (for the order of the presentations, see the annex).		
Session 2: Fram Moderated by F	ning and Overview Rob McDonald, Lead Scientist, TNC		
9:40 – 10:30	 Presentation of the Working Paper: Green Urban Development - A Framework for Integrating Biodiversity and Ecosystem Services, Natural Capital Accounting and Natural Infrastructure (Xueman Wang, GPSC, World Bank, and Ashley Gorst, Vivid Economics, 20 min) Discussion How would city biodiversity, natural capital accounting, and natural infrastructure contribute to a city's green vision? What are the key challenges of incorporating these issues into urban planning process? 		
10:30 - 10:45	Coffee Break		
Session 3: City Biodiversity Moderated by Professor Richard Weller, Chair of the Department of Landscape Architecture and Co-executive Director of the Ian L. McHarg Center for Urbanism and Ecology, University of Pennsylvania			
	Rapid Introduction of Participating Cities and Organizations (<i>Batch 2, 20 min</i>)		
	Overview: Approaches to Quantifying Biodiversity and Ecosystem Services in the Urban Context (<i>Rob McDonald, Lead Scientist, TNC, 15 min</i>)		
10:45 – 12:30	 City Practice (30 min) Singapore Biodiversity Index: Lena Chan, Senior Director, International Biodiversity Conservation Division at Singapore National Parks Board City of Edmonton, Canada: Grant Pearsell, Director of Urban Analysis City of São Paulo, Brazil: Rodrigo Ravena, Chief of Staff of the Secretariat for Green and the Environment 		
	Q&A		

12:30 - 13:30	Lunch
	Rapid Introduction of Participating Cities and Organizations (<i>Batch 3, 20 min</i>)
13:30 – 14:45	 City Biodiversity – Discussion (Cont'd) How would city biodiversity contribute to a city's green vision? What are the key steps to planning for biodiversity and ecosystem services in a city? What are the key challenges for implementation? What are the key indicators used for monitoring city biodiversity? How is the data collected? What information is needed to support decision-making? How can data be packaged and communicated to maximize influence on decision-making? What lessons and experience can be drawn from cities?
14:45 – 15:00	Coffee Break
	Cities in Action (1.5 hr) We will break into three groups, each focusing on one or two cities. City representatives will lead discussions, identifying challenges and strategies in establishing and implementing city biodiversity and incorporating into city's planning process. Experts in each breakout group will facilitate the discussions and help cities with the strategy and next steps.
15:00 – 17:00	 Plenary Reports (30 min) Each breakout group will report back to the whole meeting on: Opportunities and key constraints for a city to pursue city biodiversity Strategies for overcoming the challenges and constraints Plan for the next steps
	Participating Cities - Asuncion, Paraguay - Sakumo Ramsar Site, Ghana - Ilhéus, Brazil
17:00	Wrap Up of Day 1
17:30	Reception

Day 2

9 May 2019 Room L-103			
8:30 - 9:00	Continental Breakfast Outside Meeting Room		
Session 4: City Natural Capital Accounting and Nature Based Solutions Moderated by Russell Galt, Director, IUCN Urban Alliance			
	 Insights and Lessons Drawn from the Existing Work (World Bank, 15 min) Natural capital accounting at the national level: Wealth Accounting and Valuation of Ecosystem Services (WAVES) Raffaello Cervigni, Lead Environmental Specialist, World Bank City Natural Capital Accounting (45 min) London: Peter Massini and Ashley Gorst, Vivid Economics 		
9:00 - 10:45	 Stirling: Jim Rouquette, Director, Natural Capital Solutions Singapore: Peter Edwards, Professor, Future Cities Laboratory 		
	 Q&A and Discussion Whether and how could the methods for national-level capital accounting be used for city level accounting? What are the tools for data collection? How would natural capital accounting in cities be utilized for urban planning processes? 		
10:45 - 11:00	Coffee Break		
11:00 - 12:00	Integrating Green and Gray Infrastructure to Support Urban Water Security, Climate Resilience, and Biodiversity (Suzanne Ozment, WRI, and Steven Carrion, World Bank, 30 min) Q&A		
14:30 - 15:30	 Discussion What are the interactions among city biodiversity, natural capital accounting and nature-based urban infrastructure? How would cities incorporate these three topics into urban planning processes, including spatial planning? 		
15:30 – 17:00	 Cities in Action We will form a number of small groups – each will support one city to prepare an action plan on how to enhance a city's natural capital (including biodiversity) and incorporate these considerations into the city's strategic green vision and urban planning processes for implementation. Key considerations include: Mapping key natural assets and ecosystem services essential for their city. Threats to these key assets and ecosystem services? The role that nature plays in the vision and strategy of a city? Planning processes and decisions that could safeguard key assets and ecosystem services? Data/tool needs to support these planning decisions? Key steps (pressing requirements) that incorporate city biodiversity, natural capital accounting, and nature-based solutions into urban 		
	 strategic plans and implementation? (Cities that will participate in GEF Sustainable Cities programs may flesh out specific project activities to support their action plan.) 		

15:30 – 17:00	Participating Cities - Mendoza, Argentina - Ningbo, China - Anápolis, Brazil - Kigali, Rwanda
17:00	Wrap Up of Day 2

Day 3

10 May 2019 Room L-103		
8:30 - 9:00	Continental Breakfast outside Meeting Room	
Session 5: Pres	entation of City Action Plans and Feedback	
9:00 - 10:30	Presentation of City Action PlansEach presentation will be followed by expert feedback and discussion:-Mendoza, Argentina-Ningbo, China	
10:30 - 10:45	Coffee Break	
10:45 - 11:45	Presentation of City Action Plans (Cont'd) - Anápolis, Brazil - Kigali, Rwanda	
11:45 - 12:00	Next Steps and Conclusion of the Meeting (GPSC)	
12:00 - 13:00	Lunch	

Brown Bag Lunch Event

9 May 2019 | MC Building 9-100

	Brown Bag Lunch (BBL) Presentation on Urban Biodiversity, Natural Capital Accounting, and Nature-based Infrastructure
12:30 - 14:00	A BBL is an informal learning event targeting World Bank staff. All participants are invited to attend. The BBL location and further information will be provided during the Working Group Meeting.

Annex B: Attendees

Country/ City Representatives

Name	Title	Country/ City (alphabetical order)
María Marta Ontanilla	Director of Housing and Habitat	Argentina, Mendoza
	General Coordinator for Regional and Urban Management	
Ana Paula Bruno	Support, National Secretariat for Regional and Urban	Brazil
	Development, Ministry of Regional Development	
	Sustainable Cities Program (PCS),	
Carlos Alberto Pelozo Gomes	Sustainable Cities Knowledge Platform and the Innovation	Brazil
	Observatory	
Raiza Gomes Fraga	Management Center for Strategic Studies (CGEE), Sustainable	Brazil
	Cities Knowledge Platform and the Innovation Observatory	
Antonio Zayek	Director of Water Resources	Brazil, Anápolis
Mario Alexandre Correa de	Mavor of Ilhéus	Brazil. Ilhéus
Sousa		
Soane Galvao Barbosa	First Lady of Ilhéus	Brazil, Ilhéus
Carolina Freire Lima	Director of Government Projects	Brazil, Jaguariúna
Ramon Arigoni Ortiz	Project Management Office Coordinator	Brazil, Rio de Janeiro
Rodrigo Ravena	Chief of Staff of the Secretariat for Green and the Environment	Brazil, São Paulo
Grant Pearsell	Director, Urban Form and Corporate Strategic Development, City Planning	Canada, Edmonton
Huining Zhou	Senior Officer	China, Ningbo
Kwame Boakye Fredua	Programme Officer, Environmental Protection Agency	Ghana
Isabel Gamarra de Fox	Ministry of Environment and Sustainable Development	Paraguay
Tamara Bogarin	Environmental Management of the Municipality of Asunción	Paraguay, Asunción
John Kalisa	Researcher in Urban Wetlands Restoration	Rwanda
Long Chan	Senior Director, International Biodiversity Conservation Division,	Singaporo
	National Parks Board	
Peter Massini	Greater London Authority	U.K., London

Agencies / Organizations / Others

News	Title	Affiliation	
Name	nue	(alphabetical order)	
Mandy Ikert	Head of the Adaptation and Water Initiative	C40	
Oliver Hillel	Programme Officer	Convention on Biological Diversity (CBD)	
Jane Carter Ingram	Senior Manager	Ernst and Young	
Peter Edwards	Professor	Future Cities Laboratory	
Tori Okner	Head of Strategy and Partnerships	ICLEI Local Governments for Sustainability (ICLEI)	
Ingrid Coetzee	Senior Manager	ICLEI	
Russell Galt	Director ILICN Urban Alliance	International Union for the Conservation of Nature	
		(IUCN)	
Frank Hawkins	Director for North America	IUCN	
Anne Guerry	Chief Strategy Officer and Lead Scientist	Natural Capital Project	
Jim Rouquette	Director	Natural Capital Solutions	
Rob McDonald	Lead Scientist for Cities	The Nature Conservancy (TNC)	
Joel Paque	Policy Lead for Cities	TNC	
Veronique Gerard	Programme Officer	UN Development Programme (UNDP)	
Maria Irene Gauto	Technical Manager	UNDP	
Mark Draack	Industrial Development Officer and Thematic Lead on Sustainable	United Nations Industrial Development	
Mark Draeck	Cities	Organization (UNIDO)	
	Professor, Chair of the Department of Landscape Architecture		
Richard Weller	and Co-executive Director of the Ian L. McHarg Center for	University of Pennsylvania	
	Urbanism and Ecology		
Zuzanna Drozdz	Research Associate	University of Pennsylvania	
Jennifer Rae Pierce	Head of Partnerships & Engagement	Urban Biodiversity Hub	
James Patterson-Waterson	Head of Cities and Infrastructure	Vivid Economics	
Ashley Gorst	Senior Economist	Vivid Economics	
Naina Khandelwal	Economist	Vivid Economics	
Mariana Orloff	Associate II, GPSC Resource Team	World Resources Institute (WRI)	
Suzanne Ozment	Associate II	WRI	
Terra Virsilas	Associate I, GPSC Resource Team	WRI	
John-Rob Pool	Implementation Manager	WRI	

Beth Olberding	Research Assistant	WRI
Tabaré Curras	Global Advisor Urban Energy Transitions	WWF
Kevin Taylor	Senior Program Officer, Cities and Climate	WWF
Nirmal Bhagabati	Senior Scientist on Forests and Natural Capital	WWF

Global Environment Facility

Name	Title	Unit
Mohamed Imam Bakarr	Lead Environmental Specialist, GEF Sustainable Cities program	Global Environment Facility (GEF)
Aloke Barnwal	Senior Climate Change Specialist, GEF Sustainable Cities program	GEF
Mark Thomas Zimsky	Senior Biodiversity Specialist	GEF
Akio Takemoto	Senior Environmental Specialist	GEF
Christian Hofer	Senior Communications Officer	GEF
Sunday Leonard	Programme Officer	GEF Scientific and Technical Advisory Panel (STAP) - UN Environment Programme
Virginia Gorsevski	Programme Officer	GEF STAP - UN Environment Programme

World Bank

Name	Title	Unit
Sameh Wahba	Director	Social, Urban, Rural and Resilience Global Practice (SURR)
Xueman Wang	Senior Urban Specialist and GPSC Program Manager	SURR/ GPSC
Raffaello Cervigni	Lead Environmental Economist	Environment and Natural Resources (ENR)
Juan Pablo Castaneda Sanchez	Environmental Economist	ENR
Steven Carrion	Consultant	Global Facility for Disaster Reduction and Recovery (GFDRR)
Marco Boggero	Consultant	SURR
Xiang Xu	Consultant	SURR
Lincoln Lewis	Urban Development Analyst	SURR/ GPSC
Qiyang Xu	Program Coordinator	SURR/ GPSC
Yuna Chun	Program Coordinator	SURR/ GPSC