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BUSINESS MODELS FOR FINANCING NATURE-BASED SOLUTIONS IN URBAN CLIMATE ACTION

A Knowledge Resource for Cities in Developing Countries

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List of Abbreviations

AF	Adaptation Fund
BOT	Build-Operate-Transfer
CAPEX	Capital Expenditures
CO_2	Carbon Dioxide
CSR	Corporate Social Responsibility
DBO	Design-Build-Operate
DFIs	Development Financing Institutions
DRR	Disaster Risk Reduction
EC	European Commission
EEA	European Environment Agency
EIB	European Investment Bank
ESCO	Energy Service Companies
EU	European Union
EUR	Euro
GAEA	Giving to Amplify Earth Action
GCF	Green Climate Fund
GEF	Global Environment Facility
GHG	Greenhouse Gases
IDB	Interamerican Development Bank
INGO	International Non-Governmental Organizations
IUCN	International Union for Conservation of Nature
MDBs	Multilateral Development Banks
NbS	Nature-based Solutions
NGOs	Non-Governmental Organizations
OECD	Organisation for Economic Co-operation and Development
OPEX	Operational expenditures
PES	Payments for Ecosystem Services
PPP	Public-Private Partnership
RES	Renewable Energy Sources
SLBs	Sustainability-Linked Bonds
SMEs	Small-to-Medium Enterprises
SUDS	Sustainable Urban Drainage Systems
TNC	The Nature Conservancy
TNFD	Taskforce on Nature-related Financial Disclosures
UHI	Urban Heat Island
UNEA	United Nations Environment Assembly
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
WWF	World Wide Fund for Nature

1 Introduction

This publication serves as a comprehensive guide to financing and developing business models for Nature-based Solutions (NbS) addressing climate challenges in urban areas.

1.1 Defining urban Nature-based Solutions

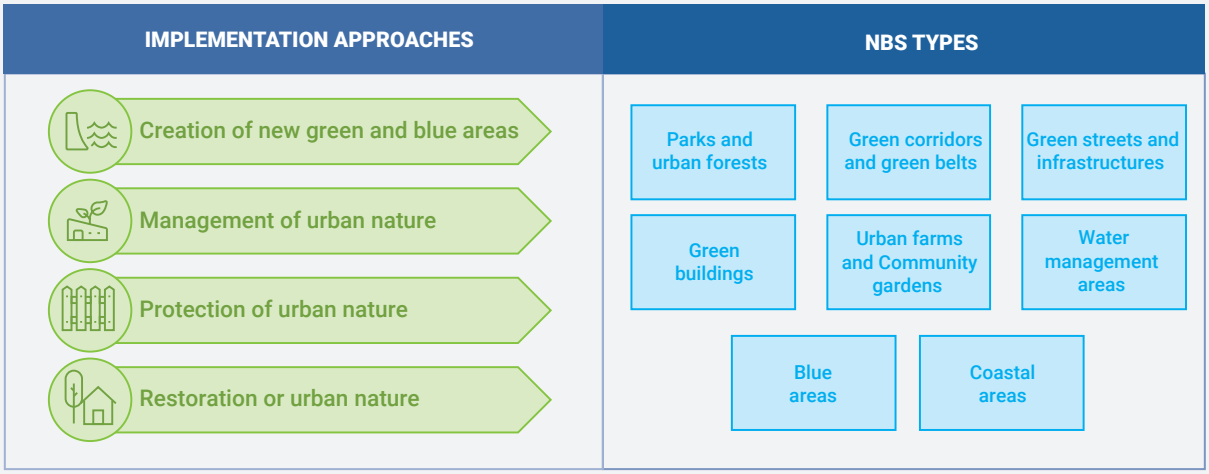
Building on previous frameworks by the International Union for Conservation of Nature (IUCN) and the European Commission (EC), the United Nations Environment Assembly (UNEA) adopted a formal definition of NbS in 2022 (EC 2015; Cohen-Shacham et al. 2016; UNEA 2022). Resolution 5/5 defined NbS as "actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits" (UNEA 2022, p. 2).

Note to the reader: While NbS are applicable across multiple ecosystem types, including terrestrial, freshwater, coastal, and marine environments, this guide focuses on urban ecosystems, consisting of grey infrastructures and natural areas within cities that are interconnected to surrounding terrestrial and aquatic systems. According to the internationally accepted definitions, NbS encompass various approaches such as ecosystem-based management, green and blue Infrastructure development, sustainable forest management and natural water management (European Environment Agency [EEA] 2021). These terms are used interchangeably in this publication.

Box 1: Framing NbS in the context of urban environments

In urban areas, NbS can tackle various development challenges and support different infrastructure and ecosystem management needs by creating new natural areas as well as managing, protecting or restoring existing ones, including green spaces, such as parks and gardens, and blue spaces, like rivers, lakes and coastlines (Open Platform for Nature-Based Solutions [OPPLA] 2023); Urban Nature Atlas [UNA] 2023). Figure 1 provides an overview of possible NbS intervention approaches in urban areas and the main NbS types these interventions target.

Figure 1: NbS intervention approaches and NbS types in urban areas



Source: Authors

1.2 Barriers to upscaling urban Nature-based Solutions

NbS can significantly contribute to both climate adaptation and mitigation efforts while achieving a broad range of environmental and socio-economic benefits in cities and improving quality of life (Raymond et al. 2017; Dumitru and Wendling 2021). However, although upscaling urban NbS is considered increasingly critical for climate actions in cities, their widespread adoption remains limited. Key implementation barriers at the systemic level include insufficient and ineffective regulatory, governance and financing mechanisms (United Nations Environment Program [UNEP] 2021a; Dorst et al. 2022; Stork et al. 2023). The policies and laws that could drive or mandate the adoption of NbS are often lacking, and when they exist, they may be incomplete or poorly enforced. The governance mechanisms for implementing NbS may lack clear responsibilities and coordination or fail to engage stakeholders adequately. Furthermore, the uptake of NbS is also hindered by the limited availability of public and private funding, the fragmentation of smaller investments dispersed across various sectors, and the lack of knowledge and practical experience in developing bankable NbS projects (UNEP 2021b; World Wide Fund for Nature [WWF] and South Pole 2022). In addition, physical and financial data supporting consistent planning, implementation and monitoring of NbS investments is also limited.

1.3 Business Models approach to scale-up financing for urban Nature-based Solutions

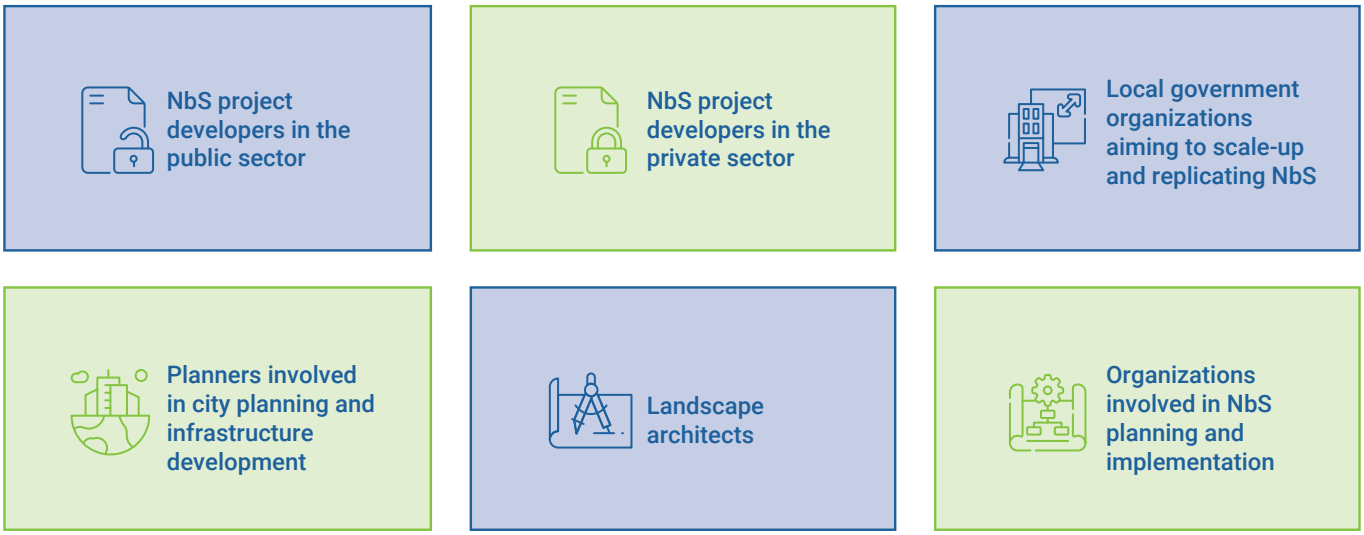
Acknowledging these NbS implementation challenges, this knowledge resource focuses on developing and financing viable, scalable and replicable NbS initiatives that address climate change in the urban context. Successful NbS project development requires careful planning to ensure that projects identify and achieve their full potential benefits, attract investments from public and private sources using financial innovations, establish effective governance approaches, and secure stakeholder support for long-term sustainability.

Business models are commonly used as a starting point, offering a practical framework for organizing project and investment planning and helping to structure relevant information for investors, project stakeholders and the public. As such, they can also help to demonstrate the value creation and delivery potential of NbS (Egusquiza et al. 2021; Mayor et al. 2021). Value-proposition-based NbS business models can ensure that projects' environmental, social, and economic benefits are recognised and communicated, demonstrating their monetary and non-monetary values and strengthening stakeholder support.

1.4 Target audience and structure of the publication

The publication is designed as a knowledge resource for NbS project developers in the public and private sectors and other stakeholders involved in NbS planning and implementation (see Figure 2). Its primary intention is to support the adoption of NBS approaches in cities in developing countries, drawing on global implementation experience. However, its content is also relevant across various countries' contexts.

Figure 2: Intended audience of the knowledge resource



The knowledge resources cover the following topics:

- **Section 2:** Mapping NbS benefits for climate adaptation and mitigation in urban areas;
- **Section 3**: Managing urban NbS, including stakeholder involvement approaches;
- **Section 4:** Financing urban NbS, with a focus on assessing the financial benefits and cost of projects and identifying financing sources and financing mechanisms;
- **Section 5:** Examples of NbS business model canvases addressing various climate challenges with different urban NbS.

2 Benefits of Nature-based Solutions for climate action in cities

Understanding and assessing the benefits of urban NbS is crucial for securing political support, creating project and investment plans, attracting funding, and fostering local support and ownership of NbS projects. This chapter provides an overview of the application opportunities, the potential benefits, and the beneficiaries of urban NbS for climate-resilient urban development.

2.1 Building climate resilience with Nature-based Solutions in cities

NbS can enhance climate resilience in urban settings by offering innovative approaches to manage multiple climate hazards, such as reducing heat stress, managing flooding and storm surges, mitigating sea-level rise impacts and the risks of landslides (Chausson et al. 2020; UNEP 2021a; UNEP 2023b). Beyond adaptation, NbS can contribute to climate change mitigation by supporting carbon sequestration and promoting energy savings (Seddon et al. 2020; Pan et al. 2023; UNEP and IUCN 2021).

As cities confront diverse climate risks, selecting and implementing appropriate NbS to tackle various climate challenges and address local needs will be essential. For example, cities can explore various sustainable urban draining solutions (SUDS) and nature-based water management approaches to effectively manage extreme precipitation events, while expanding urban greenery can be particularly effective in reducing heat stress. Figure 3 provides an overview of the different urban NbS, with high potential to address specific climate adaptation and mitigation challenges in cities.

Figure 3: Urban NbS with high potential to address different climate challenges

CLIMATE ADAPTATION				CLIMATE MITIGATION	
Heat mitigation	**Flood and stormwater management**	**Drought mitigation**	**Coastal protection**	**Carbon sequestration**	**Emissions reduction**
• Urban forest, large parks • Green corridors, street trees • Blue areas (rivers and lakes) restoration • Green roofs, green walls and green facades • Street greening	• Swales, filter strips, rain gardens • Permeable pavements • Bioretention ponds and infiltration basins • Floodplain restoration • Wetland restoration • Street greening • Urban forest, large parks • Green roofs and walls	• Rainwater harvesting • Bioretention ponds and infiltration basins • Floodplain restoration • Wetland restoration • Street greening	• Mangrove restoration • Coastal wetlands restoration • Dune stabiliza-tion/protection • Coral reefs protection	• Urban wetlands restoration • Urban forests	• Green roofs and walls • Green corridors (via offering low-carbon transport methods)

Source: Authors

Cities can implement NbS at various urban scales, including small-scale initiatives, like green roofs and rain gardens; neighbourhood and district-level projects, such as parks and lake restoration; and landscape-scale initiatives, such as green corridors, green belts, river and floodplain restoration. While NbS covering larger areas have greater potential to deliver benefits, urban space is often scarce, especially in fast-growing cities. However, if a mix of small and medium-scale projects are implemented systematically across cities, they can also create synergies and collectively deliver extensive benefits (Cortinovis et al. 2022). The benefits of NbS could be further expanded if their implementation is integrated with other urban strategies, such as energy efficiency programmes or sustainable transport initiatives, and mainstreaming across different governance levels. For example, reopening a previously covered river or creating green corridors could promote sustainable modes of mobility, such as cycling and walking, while green-roof and green-wall solutions integrated with renewable energy and energy efficiency measures on buildings could further increase energy saving.

To tackle various climate challenges, cities worldwide have already started adopting and incorporating different NbS approaches into their climate strategies, as illustrated by the examples in Figure 4.

Figure 4: Examples of NbS approaches addressing climate change in cities

1 Melbourne, Australia: The City of Melbourne implemented a large-scale urban forestry programme to reduce urban heat stress and mitigate the impacts of droughts (City Melbourne 2012).

2 Copenhagen, Denmark: The City of Copenhagen introduced a Cloudburst Management Plan, provisioning the implementation of green-blue infrastructure to enhance the city's resilience to extreme rainfall events (City of Copenhagen 2012).

3 New York City, USA: The Bluebelt Program of New York City aims to preserve and restore natural drainage systems, including streams and wetlands, to manage stormwater sustainably, mitigate urban flooding and improve water quality while creating green spaces and protecting wildlife habitats (New York City Department of Environmental Protection 2024).

4 Lima, Peru: The Metropolitan Municipality of Lima launched the "Green Lima" Program to restore green spaces by planting over 120,000 trees across metropolitan districts, aiming to reduce urban pollution, enhance CO_2 capture, mitigate heat waves, increase shade, and improve residents' quality of life (Servicio de Parques de Lima [SERPAR] n.d.).

5 Kampala, Uganda: The Kampala Capital City Authority introduced a large-scale urban greening project, including planting 500,000 trees across the city, as part of broader efforts to foster climate resilience and carbon sequestration (Kampala Capital City Authority 2016).

6 Pekalongan City, Indonesia: Financed by the Adaptation Fund (AF) and implemented by the Partnership for Governance Reform in Indonesia, the "3-S approach" ecosystem-based coastal adaptation programme aims to build coastal resilience to climate change impacts and natural disasters in Central Java through technical and nature-based measures, such as restoring beach sediment and planting mangroves (AF 2021a).

2.2 Mapping the benefits of Nature-based Solutions for climate change adaptation and mitigation

There is growing evidence that NbS delivers a range of measurable climate adaptation and mitigation benefits along with substantial environmental and socio-economic co-benefits in urban contexts (UNEP2021b; Castelo, Amado and Ferreira 2023; Debele et al. 2023). This section provides an overview of these benefits, focusing on NbS's contributions to climate resilience and improved quality of life in cities.

Adaptation benefits: NbS can alleviate urban heat stress by lowering the ambient and surface temperature, providing critical cooling effects and mitigating Urban Heat Islands (UHI). The cooling potential varies by NbS type and specific urban context, with reductions in air temperature averaging around 1.1°C and surface temperature reductions averaging around 4.4°C (Ferrario et al. 2024). NbS can also effectively manage stormwater, reduce the risk of flooding and landslides and regulate water flows and storage to reduce drought occurrence (van Zanten et al. 2021). For example, retention ponds, swales and rain gardens can reduce peak discharge by over 40 per cent, and permeable pavement can decrease stormwater flow by up to 80 per cent (Kõiv-Vainik et al. 2022). At the same time, while wetland restoration, green water management solutions and rainwater harvesting hold significant potential for enhancing water storage and groundwater recharge in urban areas, their application for drought mitigation remains small (Yimer et al. 2023). Moreover, evidence also suggests that NbS can support the protection of coastal areas (Chausson et al. 2020); for instance, healthy coral reefs were found to reduce wave height by up to 84 per cent, while a 500-meter-wide mangrove forest can reduce wave height by 50–100 per cent (Perricone et al. 2023).

Mitigation benefits: NbS also support climate mitigation in urban areas through carbon sequestration. Urban parks and forests have a higher capacity to store carbon, and specific types of blue spaces, such as urban wetlands and ponds, can act as carbon sinks if adequately protected and managed because their condition influences their capacity to act as carbon sinks (Pereira et al. 2024). In addition, NbS can contribute to the reduction of Greenhouse Gas (GHG) emissions. Overall, urban NbS has been estimated to reduce carbon emissions by up to 25 per cent in the residential, transport, and industrial sectors by improving streetscape and building design, reducing energy demand, and promoting sustainable lifestyles (Pan et al. 2023). For example, green roofs and green walls could deliver up to 25-35 per cent energy savings by decreasing heating and cooling needs in cold and hot weather, respectively (Panduro et al. 2021; Kandel and Frantzeskaki 2024).

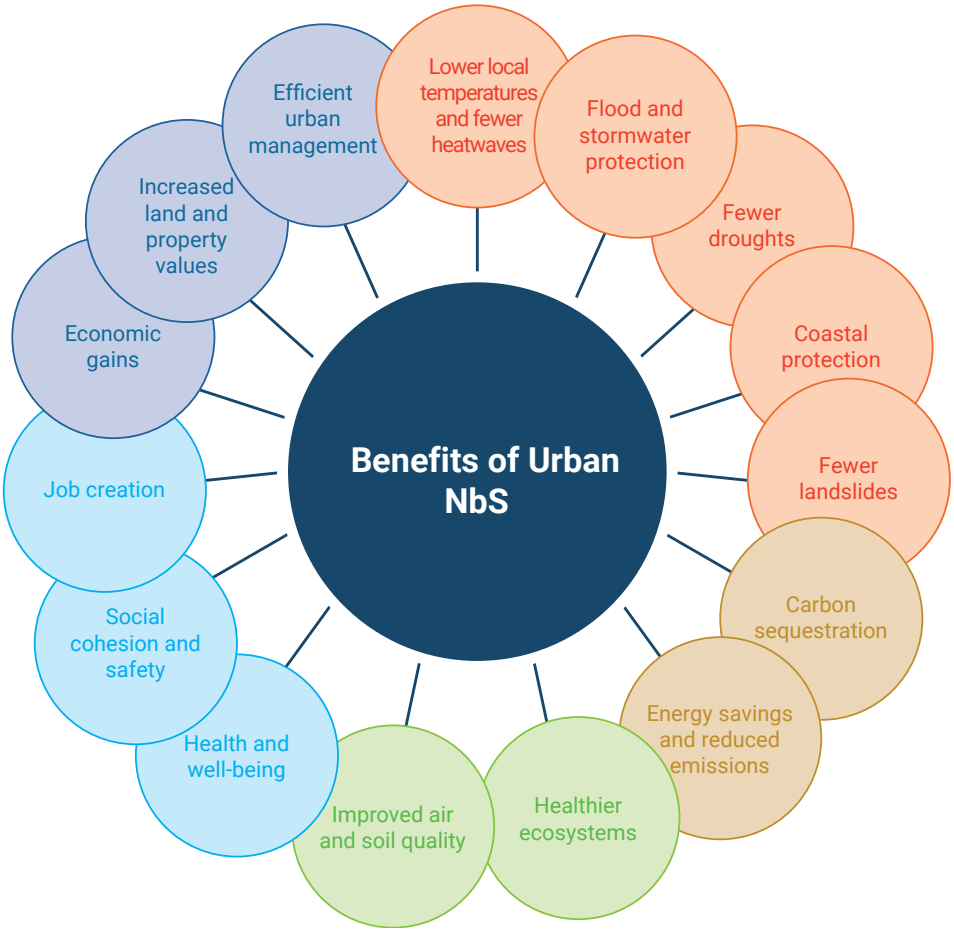
Environmental co-benefits: NbS in urban areas can also support the protection and restoration of natural ecosystems, enhance biodiversity, and improve air, water and soil quality (UNEP 2021b; Meisel et al. 2022). Studies show that NbS interventions can increase species richness by an average of 67 per cent (Key et al. 2022), and urban parks and green corridors can support biodiversity more effectively than isolated green spaces (Beninde, Veith and Hochkirch 2015). Urban vegetation has also demonstrated a positive capacity to reduce air pollutants, such as decreasing particulate matter concentrations by 16–63 per cent (Gong et al. 2023; Lozano et al. 2023).

Social co-benefits: By mitigating climate stressors, NbS can contribute to city dwellers' physical and mental well-being and improve community resilience to extreme weather events. Green spaces were found to increase the self-perceived physical and mental health of city residents, and large-scale urban greening programmes, such as establishing urban parks or creating green corridors, have been associated with increased quality of life and the life expectancy of residents (Triguero-Mas et al. 2015; Wilson and Xiao 2023). Green walls were also shown to contribute to increased attention and enhanced relaxation, and green spaces positively correlate with improved mental and physical health (Elsadek Liu and Lian 2019; Morrison and Harthley 2020). NbS can also enhance social interaction, promote social cohesion by reducing inequalities, decrease crime rates, and preserve cultural and natural heritages (Bulkeley et al. 2023; Castelo, Amado and Ferreira 2023).

Economic co-benefits: NbS projects can support job creation and economic development by increasing property value, generating tax revenues and attracting investments and businesses, such as tourism (Debele et al. 2023). For example, in New York City, commercial office buildings with more visible green spaces experienced a statistically significant increase in sale prices, ranging from 8.9 per cent to 10.5 per cent and a rental price increase between 5.6 per cent and 7.8 per cent (Yang et al. 2021). NbS can also generate indirect economic gains, such as reduced infrastructure and healthcare costs, through increased resilience to extreme weather events and environmental pollution (van Zanten et al. 2021; Meisel et al. 2022). Mangroves alone are estimated to protect 18 million people globally from flooding and avoid United States dollars (USD) 82 billion annual losses (Beck et al. 2018).

Figure 5 summarises the key adaptation and mitigation benefits and the associated environmental and socio-economic advantages of urban NbS.

Figure 5: Multiple benefits of NbS in urban areas addressing climate change



Source: Authors

2.3 Beneficiaries of urban Nature-based Solutions

Identifying the beneficiaries of urban NbS initiatives is crucial for maximising their benefits and developing the projects into sustainable business models that address the various needs of users and stakeholders. This section provides an overview of urban NbS projects' potential beneficiaries, as illustrated in Figure 6.

Figure 6: Beneficiaries of urban NbS projects

Source: Authors

The primary beneficiaries of urban NbS initiatives are undoubtedly the residents of the cities. Research has shown that almost all NbS initiatives benefit citizens by improving ecosystem services, reducing environmental impacts, providing access to green spaces, supporting health and well-being, and delivering economic benefits (Bulkeley et al. 2023).

Vulnerable and marginalised communities, who often have limited access to green spaces in cities and are affected more by adverse environmental impacts (Wolch, Byrne and Newell 2014; Venter et al. 2023), can benefit significantly from NbS. For instance, children, youth, and individuals with functional or invisible disabilities can gain increased access to green spaces that specifically address their needs and foster social interactions. Socio-economically disadvantaged populations in low-income, low-quality housing and neighbourhoods can benefit from NbS interventions through improved livability and reduced risks of damage from extreme weather events, provided that these interventions are well-designed, socially inclusive, and adequately implemented and monitored (Anguelovski et al. 2022). NbS can also be designed to safeguard the rights of Indigenous groups by protecting natural and cultural heritages and promote gender equality by involving women in the planning and management of green-blue spaces and by creating work opportunities (Trohanis, Jongman and Escobar Saenz 2023; Caswell and Jang 2024).

Municipal governments and public sector organizations, such as educational and public health institutions**,** utility services, and energy and transport companies, can also directly benefit from NbS. These include decreased risk to their buildings and infrastructures from extreme weather events, lower operational costs through more efficient water consumption and energy use for heating and cooling, and enhanced health and well-being of the users of these facilities and the services provided. **Companies and businesses** that adopt NbS solutions can improve their premises, processes, overall performance, and public image. For companies involved in natural resource management, NbS can also offer opportunities to enhance the climate resilience of their activities and services. **Landowners and real-estate developers** can increase property values, improve their properties' overall environmental performance, strengthen customer and community relationships, and, as a result, achieve higher returns on investments. **Local businesses** may profit from NbS via economic opportunities (e.g., in the tourism sector), increased property values and job creation.

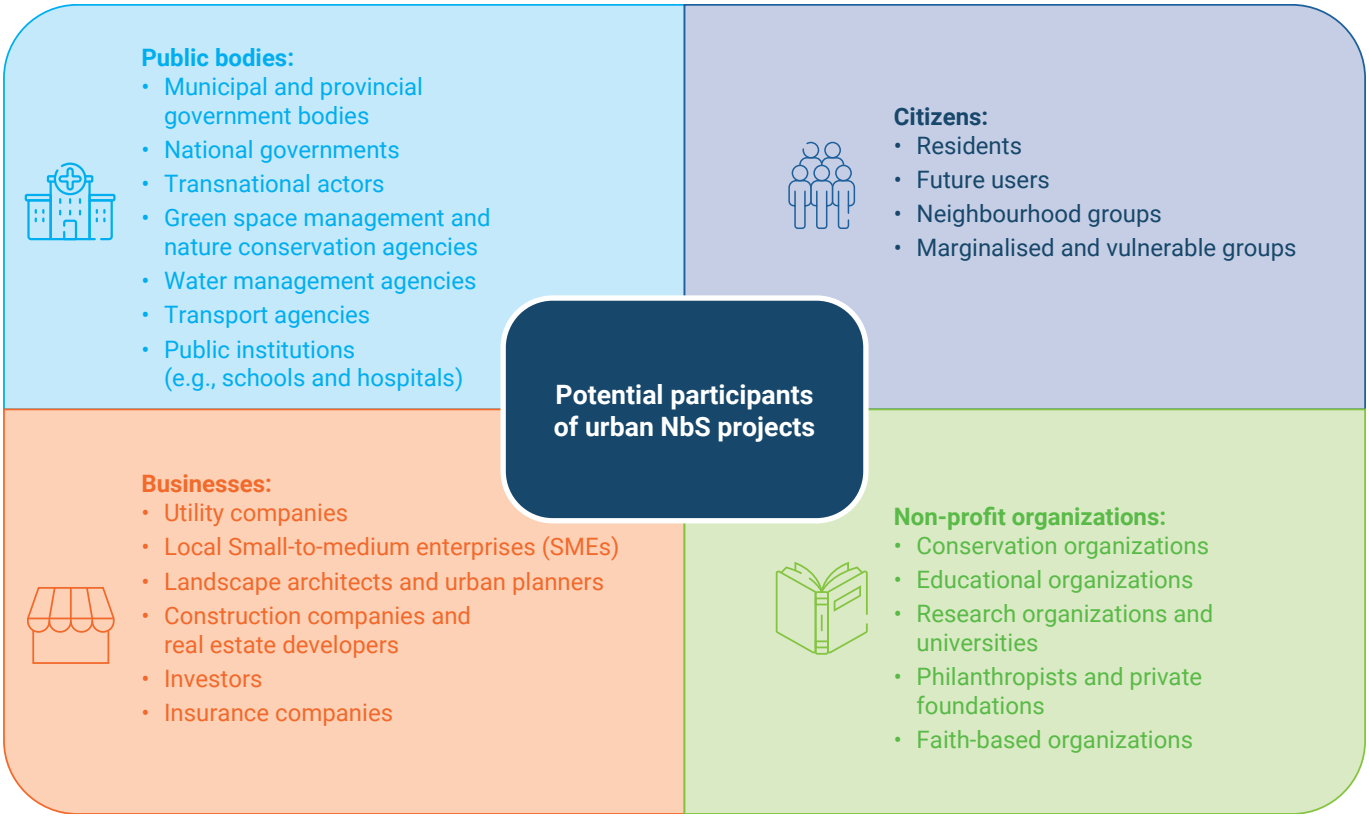
3 Governance of urban Nature-based Solutions

Successful NbS business models require a comprehensive understanding of the project's implementers and the stakeholders who influence or benefit from these projects (Mayor et al. 2021). This section outlines the key participants in NbS projects, the governance models guiding their implementation, and approaches for stakeholder involvement.

3.1 Key participants of urban Nature-based Solutions projects

Urban NbS initiatives can be implemented by various actors, including government entities, non-profit organizations and private sector participants (OPPLA 2023; UNA 2023; Interlace Hub 2023). Effective NbS project implementation also requires the engagement of diverse stakeholders (Kiss et al. 2021; Castelo, Amado and Ferreira 2023). These stakeholder groups may include public bodies at various governmental levels, residents and future users, local businesses, potential funders and non-profit organizations, all of whom may also lead NbS projects in other contexts. Their perspectives, needs and requirements can influence the planned projects' feasibility, design and investment models, and their engagement is vital for long-term project sustainability. Figure 7 provides an overview of potential participants of urban NbS projects, whether as implementers or stakeholders.

Figure 7: Key participants in urban NbS projects



Source: Authors.

Within the **public sector**, local, regional, and national government bodies, public sector institutions, and transnational organizations often initiate and implement NbS projects.

- **Local governments:** Municipal actors frequently lead NbS projects involving public spaces, such as urban park development or green corridor creation. In addition, local government organizations own extensive lands and buildings for transportation, educational, healthcare, or social purposes, offering additional opportunities for integrating NbS interventions across various sectors. Municipal governments and their agencies are also important stakeholders in projects implemented by other organizations, as they often play a key role in providing permits, land and resources.

- **Public sector organizations:** Publicly funded institutions, such as schools, universities, hospitals, public utilities, and transport enterprises, are well-positioned to implement urban NbS. They can use their own premises or service infrastructures for greening courtyards by installing green roofs and rain gardens to reduce stormwater run-off.

- **National and regional governments:** Depending on the country's governance structure, many NbS projects are implemented partially or entirely by regional and national authorities. More extensive interventions, such as river or watershed management programmes, also require collaboration between multiple levels of government.

- **Transnational actors:** The European Union (EU) has been driving the implementation agenda of NbS in Europe and its partner countries and has supported numerous urban initiatives as a funder. In developing countries, international organizations and non-governmental organizations (NGOs) have played a crucial role in initiating, funding and executing NbS in collaboration with local actors. These efforts are often supported by official and philanthropic donor funding, which is increasingly focused on climate action.

Among **non-profit organizations and private actors**, NGOs, grassroots and community groups, businesses, universities, and research organizations contribute significantly to urban NbS initiatives (OPPLA 2023; UNA 2023; Interlace Hub 2023).

- **Non-profit organizations:** NGOs and civil society organizations are key actors in urban NbS. These organizations can implement their own projects, usually smaller-scale ones, or partner in larger initiatives.

- **Community groups and citizens:** Urban NbS projects can also be grassroots initiatives launched by individuals or neighbourhood groups. These are typically smaller-scale, localised efforts and heavily reliant on local contributions.

- **Research organizations and universities:** Given the innovative nature of urban NbS and the frequent need for scientific data and information to develop projects, universities and research organizations often implement demonstration or innovation projects and contribute to designing, implementing, or evaluating larger projects to ensure scientific rigour.

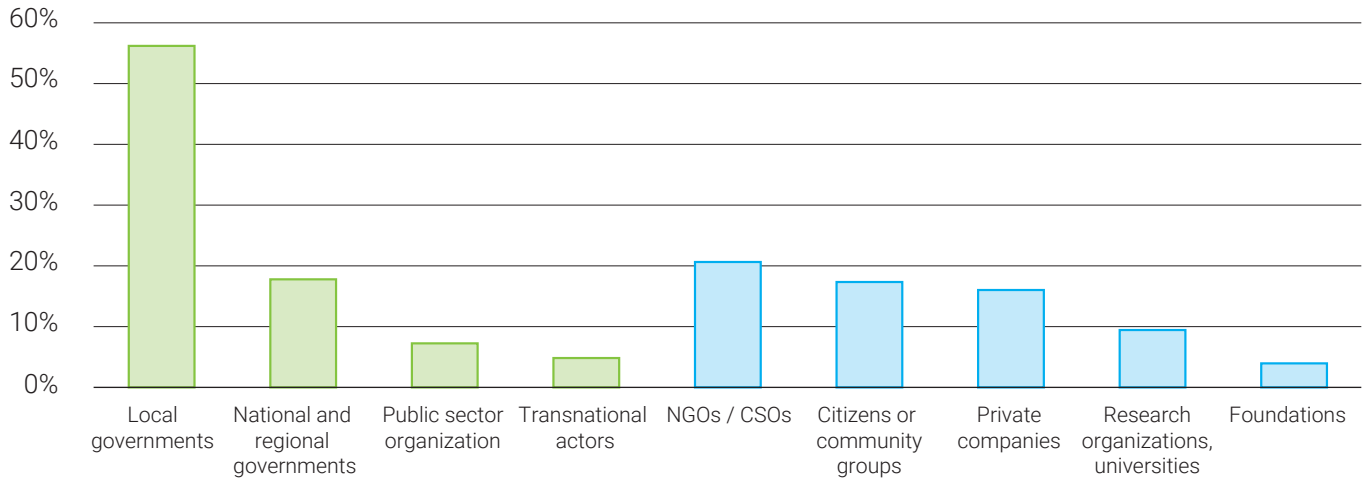
- **Private companies:** Businesses have played a limited role in scaling up urban NbS so far, and their initiatives tend to be smaller in scale and often driven by corporate social responsibility (CSR) goals. However, companies, especially those involved in natural resource management or owning large land areas, may have significant potential to implement NbS projects. For example, energy service companies (ESCOs) can be particularly instrumental in NbS promotion in certain circumstances. ESCOs can provide financial and technical solutions that enhance energy efficiency and sustainability, often investing in energy-saving projects and sharing financial savings with their clients.

- **Philanthropists:** Although private and corporate foundations are more likely to be involved exclusively in financing NbS, they can also play a role in implementing such projects. They typically cooperate with other stakeholders and focus on projects with catalytic impacts.

- **Institutional investors:** Banks, equity funds, insurance companies and pension funds could offer substantial, long-term funding to NbS. However, their current involvement is limited and rarely focuses on urban areas.

Figure 8 provides an overview of the frequency of the involvement of the different actors in urban NbS governance and management.

Figure 8: Frequency of involvement of different types of actors in NbS governance and management



Source: Authors' calculation based on data from the UNA (2023).

In addition, there are other relevant actors whose potential role may be overlooked by NbS projects. These include large landowners, private healthcare, utility and transport companies, and faith-based and military organizations that could leverage their lands and infrastructures to implement NbS projects and various funders, such as insurance companies, pension funds or commercial banks that could ensure critical funding for interventions (Bulkeley et al. 2023).

3.2 Governance models

Besides identifying the key actors involved in NbS projects, it is essential to establish effective governance models through which these actors can implement the projects and collaborate with their stakeholders.

Urban NbS can be implemented through various governance models (UNA 2023), as also shown in Figure 9.

- **Government-led initiatives:** Traditional top-down initiatives can be led by local, regional or national government bodies, e.g., to create an urban park, restore a river or lakeside and implement SUDS. *For example, in the city of Aubagne within the Marseille Metropolitan Area, France, the local government and a public agency specialising in water management and flood prevention implemented the Huveaune River revitalisation project to support flood prevention, biodiversity protection and recreational uses by removing artificial banks, stabilizing slopes, diversifying flow patterns, and planting native species. (EPAGE HuCA 2023).* Government-led projects have a high potential to be aligned with local (and national) sustainability and climate goals and ensure the delivery of multiple environmental and socio-economic benefits. However, they often compete with other government financing needs, resulting in limited funding availability (Conway et al. 2020). Because these projects are frequently planned and implemented by (local)

Figure 9: NbS governance models

Source: Authors.

government entities alone or with limited stakeholder involvement, they may risk overlooking the needs of users and other stakeholder groups. In addition, potentially limited focus on self-sufficiency or revenue generation (Stork et al. 2023) can undermine their long-term sustainability.

- **Projects led by non-governmental organizations, community groups and private companies:** These initiatives are usually established with a specific goal, such as creating a rain garden to manage flash flooding in a neighbourhood or installing green roofs on company premises. *For instance, the Santalaia residential building project in Bogotá, Colombia, featuring one of the world's largest vertical gardens, was developed by a private company (Groncol) and integrates over 115,000 plants and supports the reduction of building temperature and energy consumption as well as the reduction of UHI and air pollution. (Greenroofs 2024)* Such projects often work with a small to mid-size budget and need to aim for self-sufficiency and cost reductions (Stork et al. 2023). Social or economic purposes frequently motivate the implementation of these projects, with climate benefits often occurring incidentally. At the same time, they may be able to consider user needs more effectively and securely, creating stronger ownership among stakeholders.

- **Co-governance arrangements:** Multilevel and multistakeholder NbS governance models have been increasingly popular for NbS projects (EC 2023). These co-governed projects are characterised by close collaboration between governmental and non-governmental actors and can be initiated by either public or private entities. Larger, more complex projects often involve research partners to design viable projects, local NGOs or community groups to integrate community perspectives and promote local ownership, and private companies to attract additional funding and resources. *The Delhi Development Authority (DDA), India, created a network of Biodiversity Parks to protect landscapes, promote biodiversity, and deliver multiple ecological services, such as carbon sequestration. DDA implements the initiative in collaboration with the University of Delhi's Centre for Environmental Management of Degraded Ecosystems, which oversees the scientific development and the technical management of the parks. (DDA 2024)* While revenue generation may not be the primary focus of these projects, it can become more central when for-profit actors are also involved (Stork et al. 2023).

3.3 Stakeholder involvement approaches

To ensure a collaborative approach in the planning and implementation of the projects and involve a diverse group of stakeholders beyond the implementation actors, various types of participatory processes can support their involvement (EC 2023). As shown in Table 1, these processes range from more traditional consultation to more complex processes where stakeholders actively participate in project design and management, such as co-planning, joint implementation or citizen monitoring (UNA 2023).

As discussed in Section 2.2., NbS projects must specifically consider including **marginalised and vulnerable groups,** who can significantly benefit from NbS but may not be adequately involved in stakeholder processes (Borelli, Conigliaro and Salbitano 2021). Those managing NbS projects should consider local and traditional knowledge during the design of interventions, remove the structural barriers that limit the participation of these groups, actively involve them in governance processes, and promote the equitable distribution of project benefits to facilitate the involvement of these groups (Caswell and Jang 2024). Integrating gender perspectives in NbS design and implementation processes is also crucial to address the differences in climate impacts on women and men while promoting women's empowerment and gender equality (Inter-American Development Bank [IDB] and UNEP 2021). For women, it is crucial to consider their different roles, responsibilities and needs during project design, enhance their skills to implement NbS projects, ensure their representation in decision-making and secure their rights to land and resource use (Trohanis, Jongman and Escobar Saenz 2023; Caswell and Jang 2024).

Table 1: Stakeholder involvement processes supporting the implementation of urban NbS projects

Stakeholder Involvement Process		Definition
Planning	**Visioning**	Structured workshops aimed at creating a shared nature-positive development vision for the project or the community
	Co-planning and co-design	Collaborative workshops or focus group meetings to plan and design NbS projects
	Participatory budgeting	Engaging the community to develop ideas for funding projects or participate in budgeting decisions for project applications
	Consultation	Gathering input and feedback from stakeholders through workshops, surveys and community meetings
Implementation and management	**Joint implementation**	Involving stakeholders directly in the execution of NbS projects, such as tree planting
	Co-management	Collaborative management of NbS where different stakeholders share decision-making responsibilities
	Capacity-building	Providing stakeholders with the necessary skills and knowledge to participate in NbS implementation processes
	Taskforce groups	Formalised groups of stakeholders to manage specific aspects of NbS projects, such as integrating climate considerations
	Citizen oversight	Boards or advisory groups for citizens to oversee the implementation of NbS projects and provide feedback
Monitoring	**Citizen science**	Involving the community in scientific data collection related to the NbS projects, such as biodiversity mapping in parks
	Citizen monitoring and review	Involving community members in monitoring and evaluating NbS projects, such as regularly monitoring the physical conditions of riverbanks
	Feedback mechanisms	Mechanism to collect regular feedback from stakeholders throughout the project lifecycle

Source: Based on UNA 2023

4 Financing urban Nature-based Solutions

Financing is crucial for successful NbS implementation. Even the most promising NbS initiatives may fail to be realised or maintained without sufficient financing, limiting their potential to deliver the intended benefits. This chapter provides an overview of financing strategies for urban NbS projects aimed at climate change adaptation and mitigation, covering the following:

- Valuation of benefits and costs associated with urban NbS investments
- Potential financing sources
- Relevant financing mechanisms and instruments
- Key challenges of financing NbS and opportunities to scale up financing.

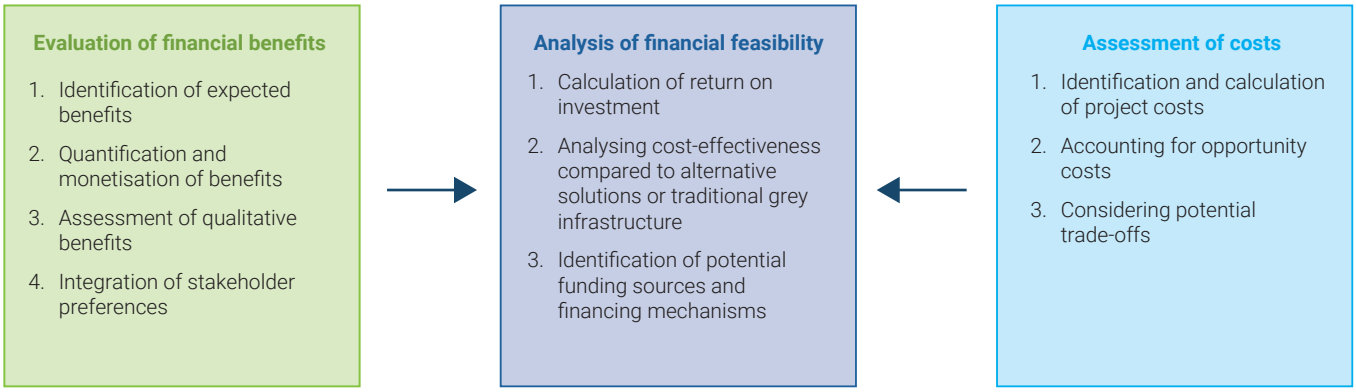
4.1 Assessing the benefits and costs of urban Nature-based Solutions

As presented in Chapter 2, NbS investments can effectively aid cities in climate change adaptation and mitigation while delivering various environmental and socio-economic co-benefits to diverse stakeholders. In 2022, global investment in nature reached USD 200 billion. However, investments in activities harmful to nature were more than 30 times higher, reaching USD 7 trillion (UNEP 2023a). This disparity highlights the urgent need for NbS projects to make compelling business cases and establish viable complements and alternatives to traditional grey infrastructures.

Investing specifically in urban NbS could yield benefits up to nine times greater than costs: an average annual investment increase of USD 98 billion by 2050 was estimated to generate USD 3.1 trillion in annual benefits and lead to USD 59 trillion net gains by 2050 (Meisel et al. 2022). For instance, afforestation projects and retention ponds have demonstrated a net positive economic impact on flood reduction, with cost-benefit ratios of 3.5 and 5.6, respectively (Ruangpan et al. 2024). A global assessment of NbS for disaster risk reduction (DRR) also found that NbS can be as cost-effective and no less effective in hazard mitigation than traditional grey infrastructure solutions (Vicarelli et al. 2024).

To assess the effectiveness and competitive advantages of planned NbS projects, project developers need to **evaluate the expected benefits and asses them relative to the costs** incurred throughout the project lifecycle, as illustrated in Figure 10.

Figure 10: Assessment framework for making the business case for NbS implementation



Source: Authors.

4.1.1 Evaluation of financial benefits

NbS projects can realise various financial gains, result in cost reductions, and deliver additional economic benefits from social and environmental benefits, as shown in Table 2.

Table 2: Examples of economic benefits of urban NbS projects

Economic benefits	Examples
Financial gains	▸ Increased property prices and rental fees from enhanced green spaces ▸ Higher municipal revenues from increased property taxes ▸ Revenue from visitor fees for environmental and recreational services ▸ Increased local business revenues ▸ Sales of carbon, water and biodiversity credits ▸ Revenue from facility rentals and events
Cost savings	▸ Lower infrastructure investment costs (e.g., for flood prevention) ▸ Lower infrastructure maintenance costs (e.g., for stormwater management) ▸ Decreased heating/cooling expenses due to shading and cooling effects ▸ Reduced damage costs from extreme weather events ▸ Lower healthcare expenditures for heat-related and respiratory illnesses
Indirect economic benefits	▸ Increased productivity and reduced sick days (e.g., due to access to green spaces) ▸ Increased economic activities as a result of increased foot traffic ▸ Attraction of businesses as a result of renovating degraded natural areas ▸ Long-term workforce retention and higher talent attraction as a result of an appealing cityscape with green and blue spaces ▸ Increased social stability and decreased crime rates as a result of increased social cohesion and sense of place

Sources: Based on Debele et al. (2023), UNA (2023) and Chausson et al. (2024).

While direct financial gains and many cost savings are relatively straightforward to assess, the (accurate) economic valuation of environmental and social outcomes is more complex (van Zanten et al. 2021; UNEP 2021c). The complexity arises because NbS projects can deliver diverse environmental and social benefits (as presented in Section 2.2), with many of them only materialising in the long run. Different NbS types and benefits require different measurement techniques, data collection infrastructure, and evaluation approaches. Benefits can also be challenging to quantify in monetary terms as ecosystem services providing environmental and social benefits often lack established market value, although they are invaluable for environmental health, resilience and community well-being.

Due to these challenges, traditional (economic) valuation methods often fail to capture the total value of NbS. Ecosystem Service Assessments have been established as a valuable framework to account for the full spectrum of environmental services and benefits provided by NbS and to overcome specific assessment challenges, various valuation approaches have been proposed, as shown in Table 3 (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services 2022; Lozano et al. 2023).

Table 3: Economic valuation methods of the benefits and the ecosystem services provided by NbS

Methods	Approaches
Cost-based methods	Replacement, alternative, opportunity, recovery, and damage costs
Market-based methods	Market price; input-output assessment
Revealed preference methods	Hedonic pricing; travel costs; cost of averting behaviour; random utility costs; cost of illness
Stated preference methods	Contingent valuation survey; conjoint analysis; choice modelling
Qualitative participatory evaluation methods	Focus groups; in-depth evaluation; Q-methodology; Delphi survey

Source: Adapted from Croci and Lucchitta (2021) and Lozano et al. (2023)

While valuation methods and practices are available, a total economic value assessment can be resource-intensive. For larger-scale NbS projects, a more comprehensive analysis of their environmental and socio-economic benefits is crucial to provide project developers, funders, and stakeholders with an estimate of the project's total economic value. In the case of smaller-scale projects, the resources required for a complete economic valuation may outweigh the advantages. In such cases, evaluating primary benefits and seeking evidence from similar projects can provide a pragmatic estimation of the expected benefits.

4.1.2 Assessment of costs

The **costs of various NbS types can vary significantly**, ranging from minimal expenditures to substantial budget needs (Panduro, Nainggolan and Zandersen 2024). Some NbS, such as changes in management or conservation practices of existing green areas, require almost no investments, while others, like green walls and green roofs, have a higher square meter implementation cost. Larger projects, such as park creation, river restoration, or coastal protection, inherently require larger budgets due to the extensive areas they cover. Table 4 provides presents an indicative overview of the investment cost requirements of selected urban NbS, from low costs to extensive projects requiring significant investments.

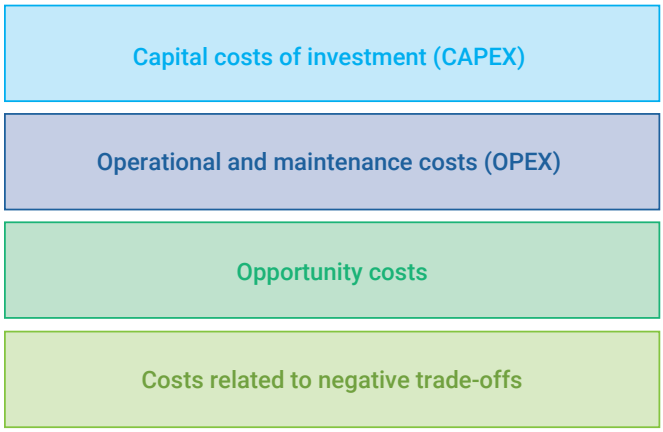
Table 4: Examples of urban NbS according to indicative cost requirements

Lower square meter costs	Moderate square meter costs	Higher square meter costs	Large-scale projects with significant investment needs
Filter strips	Rain gardens	Green roofs	Urban forest/Large urban park
Swales	Retention pond	Green walls	River renaturing
Greening tramway and railroad tracks	Permeable pavements	Botanical gardens	Wetland restoration
	Pocket parks	Lake restoration	Mangrove restoration
Community gardens	Riverbank greens	Constructed wetlands	Coastal protection
	Green corridors		

Sources: Winch, Hartley and Lane (2020), Panduro et al. (2021), Di Pirro et al. (2023) and UNA (2023).

When estimating **investment costs**, NbS projects should account for capital expenditures (CAPEX) and operational costs (OPEX), similarly to traditional grey infrastructure projects. In addition, NbS projects should consider opportunity costs, such as alternative land uses and expenses related to negative externalities and trade-offs (IDB and UNEP 2021; van Zanten et al. 2021). The general cost structure of NbS investments is presented in Figure 11.

Figure 11: General cost structure of urban NbS investments



A thorough understanding of the different CAPEX and OPEX costs associated with urban NbS is essential for planning, implementing, operating and maintaining the completed projects in the long term. As outlined in Table 5, each stage of an NbS project incurs specific costs that require tailored financing approaches:

- **Planning:** NbS projects are often experimental, and even if tested elsewhere, the local context and site specifics can influence their feasibility. In this stage, initial financing is needed to determine the project's overall feasibility, engage relevant stakeholders, and secure financing for implementation.

- **Implementation:** This phase involves costs for detailed project design, land acquisition, permits, procurement of technologies and materials, labour and transportation to establish the NbS and the supporting infrastructures.

- **Operation and maintenance:** After completion, projects enter the operational phase to deliver the intended benefits. During this phase, expenses are incurred for project management, community engagement, maintenance to ensure long-term project functionality, monitoring and data analysis to enable adaptive project management, secure funding for operation, and building evidence for future NbS initiatives.

Table 5: The main types of NbS investment costs

Project stage		Type of Costs	Explanation
Planning	CAPEX	Feasibility studies	Research and assessment of NbS project feasibility
		Site assessments	Assessment of the project sites, including geological, hydrological, and ecological evaluations
		Risk assessment	Assessment of risks associated with the project implementation
		Stakeholder involvement	Engaging local communities, government agencies, and businesses in the planning process
		Cost-benefit analysis	Evaluation of the project's economic viability
		Monitoring and evaluation plan	Plans for monitoring and evaluating the NbS project
Implementation		Land acquisition	Acquiring land for the NbS projects
		Site remediation	Contamination cleanup and demolition of old infrastructures in case of brownfield sites
		Design	Developing detailed designs and engineering plans
		Permitting	Obtaining permits and complying with regulations
		Construction	Materials, technologies, and equipment for the infrastructure and landscaping
		Human resources	Labour for construction and installation of NbS
		Transportation	Transporting materials, equipment, and labour to the project site
Operation and Maintenance	OPEX	Administrative costs	Staff salaries, administrative tasks, insurance coverage and financial costs
		Community engagement	Outreach and engagement of local communities to ensure the long-term project sustainability
		Vegetation management	Labour and material costs of management of vegetation (e.g., planting, pruning, and weeding)
		Water management	Costs of managing water flows and water quality (e.g., irrigation, sediment removal)
		Building management	Costs of managing amenities and previously existing buildings if the projects were implemented on brownfield sites
		Structural maintenance	Repairing or replacing infrastructure components
		Monitoring	Data collection and assessment for monitoring performance and reporting results

Source: Authors.

It is important to note that a significant portion of the expected costs occurs during the implementation phase as capital investment costs (Mayor et al. 2021). At the same time, although many NbS projects reduce operational costs compared to traditional grey alternatives, saving energy, reducing the need for wastewater management, and mitigating the impacts of extreme weather events still require regular expenditures for operation and maintenance.

Besides direct costs, project developers should also consider the **opportunity costs of urban NbS**. For example, land costs are higher in densely populated urban areas, thus decreasing the overall cost-effectiveness of larger green and blue spaces compared to other land uses such as housing or parking (Panduro et al. 2021). NbS initiatives may also result in **trade-offs**, leading to unintended costs if the projects are not carefully planned. For instance, introducing non-native tree species can become invasive and occupy spaces from native vegetation, disrupt ecosystems, and impact soil quality and water resources (Key et al. 2022). In socially disadvantaged areas, NbS interventions could inadvertently cause displacement of people living in informal settlements or drive out lower-income residents and small businesses (Bressane, da Cunha Pinto and de Castro Medeiros 2024).

Once the costs and the benefits of NbS projects are estimated and the overall value of the planned investment is determined, project developers can explore various sources and mechanisms (or their combination) to finance their projects. The following sections give an overview of the type of organizations that can provide financing (Section 4.2) and the type of financing instruments NbS projects can consider (Section 4.3).

4.2 Financing sources

Urban NbS can rely on diverse financing sources to support project planning, implementation, and maintenance. These sources may encompass international and domestic contributors across public, private, and philanthropic sectors, as presented in Table 6, and each plays a potentially unique role in enabling urban NbS. This section outlines the primary funding sources for urban NbS, including public funding from national and local governments, international organizations, development finance institutions, and contributions from philanthropic organizations. It discusses the potential role of corporations and institutional investors in upscaling NbS financing. A more detailed exploration of the specific financing mechanisms, such as grants, loans and collaborative public-private instruments, like public-private partnerships (PPPs), blended financing and crowdfunding, that mobilise these funds can be found in Section 4.3.

Table 6: Categories of funding and financing sources available for urban NbS

	Public	Private
International	International organizations Multilateral Development Banks (MDBs) Development Financing Institutions (DFIs) Bilateral aid agencies	Companies Institutional investors, pension funds and insurance companies Non-government organizations Foundations Philanthropic organizations Communities
National	National governments State/Regional governments Local governments National Development Banks Government agencies	

Source: Authors.

4.2.1 Public funding

Domestic public funding from **national, state, regional and local governments** is crucial for supporting the early uptake of NbS in urban areas. Due to limitations in economic assessment and slower returns on investments (as described above), public funding has been dominating the NbS financing landscape (Biasin et al. 2024; European Investment Bank [EIB] 2023; UNEP 2023b). As a result, local governments are typically the most involved in financing and implementing urban NbS, with many projects funded or co-funded by national, state, or regional governments (UNA 2023).

Government organizations can channel funding to NbS investments by earmarking funds to plan, design and implement NbS projects, providing subsidies and tax incentives to reduce the costs for businesses and households investing in NbS and offering project grants to various organizations. *For example, the Manila, Philippines, metropolitan government allocated funds to a large-scale "Adopt-a-Park Program" to increase and improve green spaces (Metropolitan Manila Development Authority 2023). In Illinois, USA, the Environmental Protection Agency (EPA) introduced a Green Infrastructure Grant programme to finance NbS projects that reduce stormwater run-off (Illinois EPA 2023).* In addition, to raise additional financing for NbS implementation, governments can also use their funds to attract financing from private sector entities, e.g., enter PPPs or issue bonds to raise capital for NbS investments. Section 4.3 discusses the use of each financing mechanism in detail.

Implementation agencies with specific mandates, such as environmental protection, nature conservation, disaster risk management agencies, water management, and transportation authorities, are well-positioned to integrate NbS into their management approaches and infrastructure projects. **Funding sources can also extend beyond traditional government agencies.** *For example, the UK's National Lottery Community Fund (UK NLCF), a non-departmental public body, supports community-led urban nature projects by channelling resources from National Lottery ticket sales (UK NLCF 2024).* **Public-sector entities**, such as water and energy utilities and educational, social and cultural institutions, can fund and implement their own (usually smaller scale) NbS projects. Improving the climate resilience of their infrastructures and buildings can also reduce operational costs, improve environmental performance, and contribute to the well-being of users.

National Development Banks or state-owned banks can also provide financing for local governments to support NbS investments in cities systematically, which can be especially critical in developing countries, where local governments often struggle to secure funding for NbS while required to secure essential services and infrastructures (Conway et al. 2020). **Sovereign Wealth Funds** are also well-suited to offer patient capital for long-term investments, increasingly integrating climate considerations into their investment strategies (International Forum of Sovereign Wealth Funds 2020).

Despite these efforts, public funding must overcome various challenges, including allocating sufficient funds, simplifying bureaucratic processes, building implementation capacity, ensuring equitable financing and securing long-term political support.

4.2.2 International public funding

In developing countries, international funding from multilateral organizations and bilateral aid agencies is progressively expanding financial support to promote NbS.

Global environmental funds increasingly recognise NbS for enhancing climate resilience in urban areas. Major funds, including the Green Climate Fund (GCF), the Global Environmental Facility (GEF), and the AF, have started mainstreaming nature-based climate consideration into their funding strategies, recognising the importance of NbS in built environments to tackle climate change (AF 2021b; GEF 2022a). The GEF and the AF predominantly offer financial assistance through grants, and they typically support governments and intergovernmental and non-governmental actors. The GCF works with a more diverse portfolio of financial instruments, allocating 40 per cent as grants, 40 per cent as loans, and the remaining 20 per cent as equity, results-based payments, and guarantees, aiming to mobilise private sector resources through its Private Sector Facility (GCF 2024a; GCF 2024b). Annex 1 provides an overview of these funds and their relevance to urban areas.

Multilateral Development Banks (MDBs) are key players in international climate finance, with substantial capacity to promote NbS, aligning with their commitments made during the 26th Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) in 2021 (MDBs 2021). Building on this commitment, during the 28th Conference of the Parties

in 2023, the MDBs also set out to establish principles for tracking nature-positive financing and enabling comparisons across funding mechanisms. Consequently, several MDBs have launched NbS programmes and initiatives, as presented in Annex 2.

International public financing for NbS is distributed bilaterally through Official Development Assistance from donor countries to developing economies. Significant contributions are provided by Germany, the United States of America, France, Japan, and various EU institutions for nature and adaptation-related objectives (Stockholm Environment Institute 2024). *For instance, the German Federal Ministry for Economic Cooperation and Development (BMZ) promotes NbS in its international cooperation to create synergies across climate change mitigation, adaptation, and biodiversity protection (BMZ 2022).*

However, many donors have yet to prioritise NbS explicitly. Funding modalities are not always aligned with NbS financing needs and fail to catalyze private investments (Swann et al. 2021). Lengthy accreditation processes, lack of coordination among funds and donors, high competition, co-financing requirements, and resource-intensive project design and approval processes further complicate access to these funds (Pettinotti and Quevedo 2023).

4.2.3 Philanthropic donors, non-profit organizations, and community funding

NbS project developers can seek philanthropic funding from private or corporate foundations and international NGOs (INGOs). Philanthropic organizations distribute an estimated USD 2-3 billion annually (Tobin-de la Puente and Mitchell 2021), a potentially significant resource for NbS addressing climate change. In addition, local non-profit and grassroots organizations often have some capacity to finance smaller projects.

Foundations primarily award direct grants to non-profits, including INGOs, charities, advocacy groups, grassroots organizations, universities, and research organizations. Although climate change has not historically been at the forefront of their funding activities, in recent years, pledges and funding allocations have been increasing toward climate action (McKinsey 2021). While philanthropic grants are often insufficient to cover entire project costs, they offer a flexible funding source for project planning, design, and capacity building (WWF and South Pole 2022). Philanthropic contributions are also increasingly utilised to help attract finance from private companies. *The Giving to Amplify Earth Action (GAEA) initiative, launched by the World Economic Forum's Centre for Climate and Nature, [is] set to mobilise USD 3 trillion annually by promoting public-private-philanthropic collaborations to achieve net-zero emissions and restore nature.* (World Economic Forum 2024).

INGOs, particularly those working with nature and biodiversity, have been expanding their NbS project portfolio, funding projects directly or collaborating with local partners. *For example, the Nature Conservancy (TNC) has been building capacities of private companies for NbS implementation and created an impact investing team that can help develop investments at scale (TNC 2024). WWF (2024) has established an NbS Origination platform to connect investors with prospective NbS project developers and facilitate access to funding.* City networks, such as the World Resource Institute's Cities4Forest Initiative or ICLEI – Local Governments for Sustainability [ICLEI]'s Cities with Nature Initiative, provide cities with additional funding and collaboration opportunities,

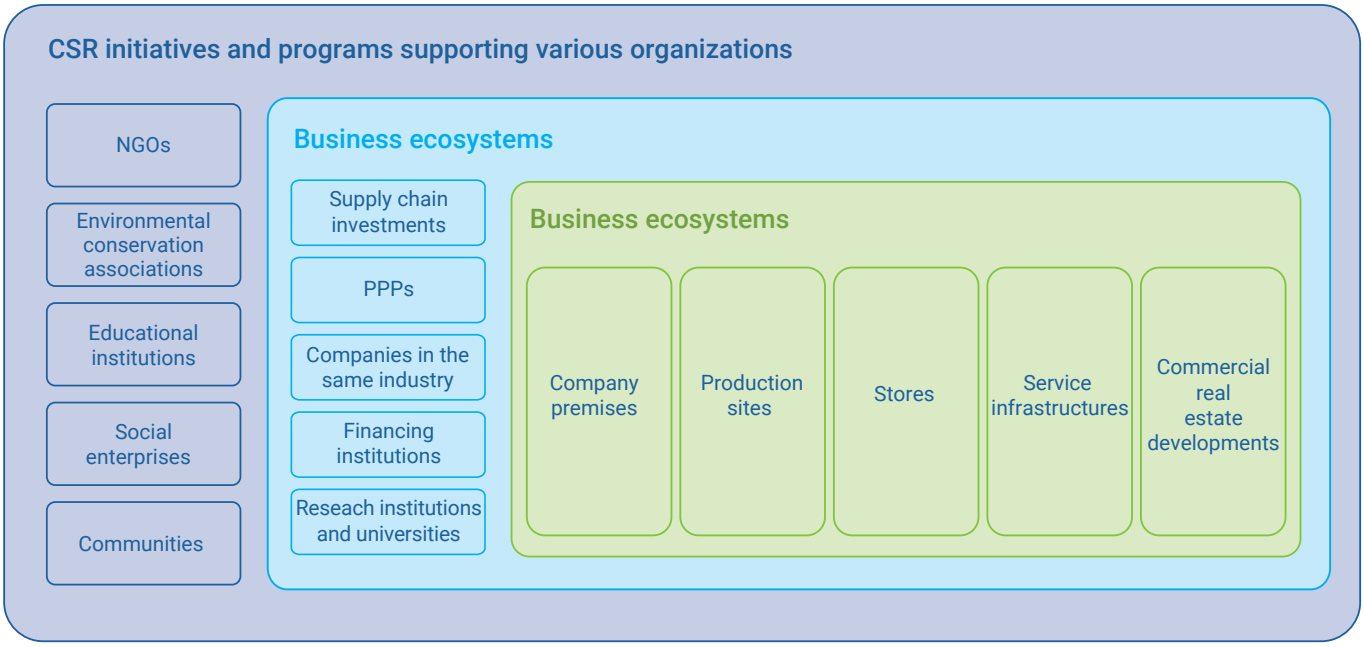
National and local non-profit organizations, although primarily recipients of grants, may also distribute targeted small-scale funding. Their in-depth understanding of local contexts gives them a competitive advantage in influencing policy decisions and securing stakeholder engagement. **Grassroots movements and community crowdfunding** can also support implementing local NbS projects and provide complementary financing to operate projects, such as purchasing seeds for tree planting.

4.2.4 Corporate investments

Companies across nearly all supply chains face nature-related risks, particularly concerning water security and local climate. Despite this, even in highly nature-dependent industries, only a few companies assess these risks and invest in NbS to regenerate natural assets (S&P Global 2024). This gap presents significant opportunities for industrial firms, retailers, and service providers to expand investments in urban NbS initiatives. Besides various environmental, social, and economic benefits, these investments can help companies achieve corporate climate targets (Vidal et al. 2023).

While less than 20 per cent of nature-related investments are financed by private resources (UNEP 2023a), businesses have various entry points for NbS investment, including operations, collaborations with their business networks, and CSR initiatives. Figure 12 illustrates these strategic entry points, discussed further below.

Figure 12: Strategic entry points for business investments in urban NbS



Source: Authors.

Companies can allocate budgets to **integrate NbS into their operations and processes:**

- **Premises and business sites:** Companies can establish green infrastructures, like green roofs or walls, to reduce indoor temperature, increase energy savings, and implement green stormwater management infrastructures. These solutions can be particularly beneficial when scaled across multiple sites and integrated systematically into operations.

- **Service provision:** Companies involved in natural resource management (e.g., water, wastewater, and energy providers) can adopt NbS to improve service quality, reduce maintenance costs, and lower financial risks related to environmental pressures. *For instance, a constructed wetland using natural plant processes can improve water quality, reduce energy costs, support carbon sequestration and mitigate flood risk (International Financial Corporation 2023).*

- **Real estate development and construction:** Developers and construction companies can systematically integrate NbS into their projects to gain competitive advantages by increasing property values, improving energy and water management performance, regulating indoor and outdoor temperatures, and reducing damage risks from the increasingly frequent extreme weather events caused by climate change (Aoun 2023). With growing legislative and investor expectations regarding nature conservation (Taskforce on Nature-related Financial Disclosures [TNFD] 2023), early integration of NbS can help avoid regulatory and financial risks.

- **Energy Service Companies (ESCOs):** ESCOs can finance and implement NbS projects as part of their energy efficiency services. By integrating NbS, such as green roofs, living walls, and urban green spaces, into their energy-saving measures, ESCOs can offer performance-based contracts where savings from reduced energy consumption and improved ecosystem services are used to fund the projects.

Companies can also partner with their stakeholders to improve their overall (climate) resilience through NbS. Larger corporations may set nature-based goals within their supply chains and incentivise suppliers to adopt NbS by introducing a water stewardship initiative in peri-urban forest areas. Companies can also enter into PPPs to share the financial risks of projects with public bodies, form consortia with other companies for larger-scale, more complex investments, collaborate with financial institutions or international organizations to access capital and work with universities or research institutions to innovate NbS.

Furthermore, **companies can integrate NbS into CSR strategies** and sponsor projects like urban reforestation or conservation initiatives of NGOs, educational or environmental organizations, and community groups. Besides financing individual projects, established CSR funds could also systematically integrate and mainstream NbS into their activities.

Despite numerous opportunities, corporate NbS investments may be hindered by high initial investment risks and limited availability of adequate financial assistance mechanisms (e.g., tax incentives or subsidies). Although general NbS quality standards and disclosure requirements are emerging (IUCN 2020), industry-specific guidelines and implementation experience remain limited. Challenges, such as outdated and contradictory regulations, management and stakeholder resistance, conflicting internal priorities regarding performance targets and reluctance to collaborate further obstruct the uptake of NbS (Weller 2021).

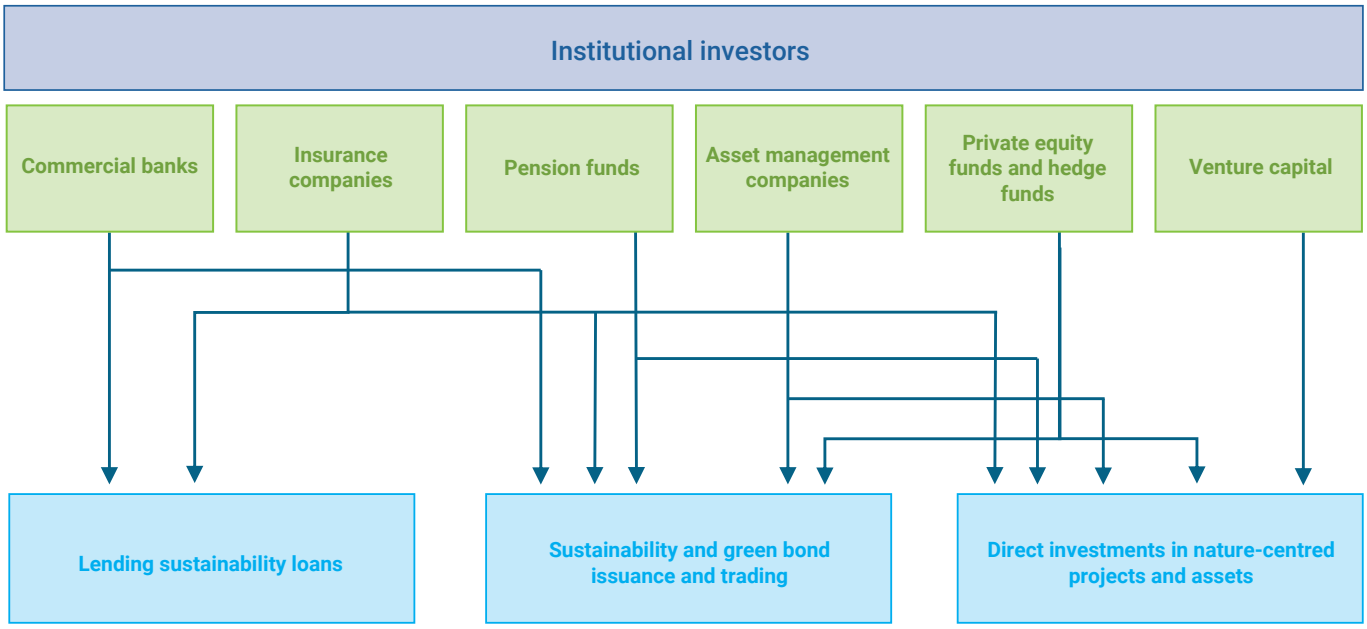
4.2.5 Institutional investors

Institutional investors pool and invest substantial capital in various assets, including commercial banks, insurance companies, pension funds, private equity firms, and asset management companies. While their involvement in NbS investment could significantly contribute to urban climate mitigation and adaptation efforts, current engagement in urban NbS financing remains minimal, with limited evidence of success. Drawing on experiences with NbS implemented in other contexts, this section introduces potential financing approaches to urban settings, with further details on specific innovative mechanisms provided in the subsequent Section 4.3.

Integrating nature considerations into business and financial institutions' activities is experiencing rapid growth. As of October 2024, 190 financial institutions managing EUR 22.6 trillion in assets have signed the Finance for Biodiversity Foundation's (2020) pledge, committing to integrating nature considerations into their activities.

As shown in Figure 13, institutional investors can invest in NbS in three main ways: **lending, bond issuance or trading, and direct investment in projects or assets** (Tobin-de la Puente and Mitchell 2021).

Figure 13: Institutional investors and typical financing activities



Source: Authors.

Commercial banks can provide sustainability loans, underwrite sustainability bonds, or finance large-scale nature-centred investment projects in cities, such as river reopenings or wetland restorations to better manage stormwater and improve water quality and biodiversity, Industries with high nature dependency will also increasingly need such loans to improve the climate resilience of water and waste infrastructures, develop nature-positive grey infrastructures and transportation networks (Choudhury et al. 2023).

Asset and investment management companies can invest in NbS projects by building green bond portfolios, purchasing stocks of companies implementing NbS, or directly investing in NbS initiatives through specialised funds. Some asset management companies established specialised funds focusing on natural capital investments (Van Raalte and Ranger 2023). *Relevant examples, although with a primary focus on non-urban NbS, include Climate Asset Management, a joint venture of HSBC Bank Group and Mirova of Natixis Investment Managers*. Innovative financing vehicles, including private equity funds, are also emerging and could be potentially applied to urban NbS, as detailed in Section 4.3.7.

Given their long-term investment horizon, pension funds and insurance companies are well-placed to finance NbS projects (Biasin 2024; EIB 2023). **Pension funds** can integrate climate and nature considerations into their investment strategies, mitigating long-term adverse health, safety and economic impacts on society. *For instance, they can invest in larger-scale ecosystem restoration projects in floodplains or coastal areas of cities.* Although these projects may take 10–15 years to reach their full potential, in the long term, they could significantly enhance public health and reduce the risks of extreme weather events, ultimately reducing overall healthcare costs and disaster risk management expenses. **Insurance companies** can reduce risks to insured businesses and lower insurance claims by investing in NbS (University of Cambridge Institute for Sustainability Leadership [CISL] 2022). Beyond directly financing NbS, they can also offer tailored insurance products to protect or restoration of natural assets in urban and peri-urban areas and incentivise nature-positive actions through premium discounts for companies investing in nature protection or sustainable water management practices (UNEP Financial Initiative [UNEP FI] 2023). Examples of potential insurance schemes supporting urban NbS are discussed in Section 4.3.11.

Despite various opportunities and growing awareness, private investment in NbS remains limited. This limitation is mainly due to the scarcity of bankable projects. Competitive projects require on-the-ground NbS expertise, feasibility studies, economic analysis, larger project scales, and stakeholder collaboration (WWF and South Pole 2022). Some of these financing barriers can be tackled with innovative financial solutions, such as sustainability bonds and blended financing, which will be discussed further in Section 4.3. Guidelines developed by the EU Taxonomy for Sustainable Finance and the TNFD can also help investors channel investments into urban NbS. Furthermore, risk mitigation solutions, such as risk-sharing mechanisms, insurance products, and guarantees, can lower the risk profile of NbS projects, making them more attractive to investors overall.

4.3 Financing mechanisms and instruments

As outlined in Section 4.2, urban NbS can be funded by various public and private organizations at both international and national levels and can use various mechanisms to channel financing towards NbS investments. The strategic use and combination of diverse sources are essential for scaling up NbS investment with different complementary mechanisms (Falduto, Noels and Jachnik 2024). This section examines the various financing mechanisms and approaches that mobilise and apply funding for urban NbS, as shown in Table 7. It includes standard funding mechanisms, such as grants and loans, and innovative approaches, including public-private partnerships and blended financing.

Table 7: Overview of NbS financing mechanisms and the organizations that may provide them

	Financing sources									
Financing mechanisms and instruments	**National government**	**Local government**	**International Funds**	**MDBs/DFIS**	**Bilateral aid agencies**	**Institutional Investors**	**Companies/ Businesses**	**Philanthropic donors**	**INGOs/NGOs**	**Grassroots and individuals**
Government funding	✓	✓								
Subsidies	✓	✓								
Tax Incentives	✓	✓								
Grants	✓	✓	✓	✓	✓			✓	✓	(✓)
Loans	✓	✓	✓	✓	✓	✓				
Sustainability bonds	✓	✓		✓		✓	✓			
Equity investments				✓		✓	✓	(✓)		
PPPs	✓	✓	(✓)	✓		✓	✓	(✓)		
Blended finance	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Payments for Ecosystem Services	✓	✓	✓	(✓)	(✓)			✓	✓	
Insurance schemes	✓		✓	✓		✓			(✓)	
Crowdfunding						✓	✓	✓	✓	✓

Source: Authors.

4.3.1 Government funding

Through various revenue sources, governments can directly support public services, infrastructure, and social or environmental initiatives within urban settings. Accordingly, and as discussed in Section 4.2.1., government funding has a significant role in financing urban NbS.

Overview

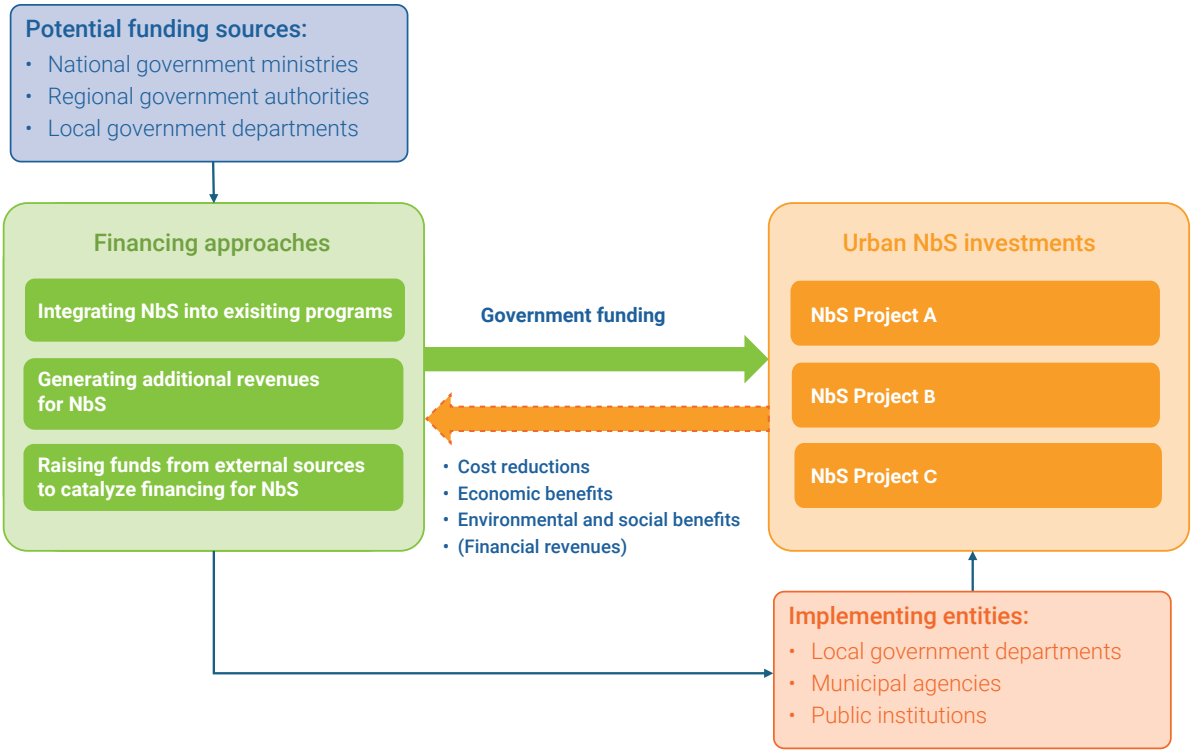
Governments can finance urban NbS projects by allocating earmarked funds from their budget (Trinomics and IUCN 2019). National government ministries, regional authorities, and municipal departments can earmark government funding for urban NbS. Besides using these funds themselves, these entities can also transfer funds to other public bodies, including government agencies and public institutions.

Governments can secure financing for NbS in cities through various approaches, which include:

- **Using existing and already available government funds by:**
  - Incorporating NbS objectives into existing infrastructure, environmental, and community programmes.
  - Integrating NbS approaches in procurement practices by requiring their application in service and utility provision and infrastructure development contracts (Gabaldón Moreno and Promes 2022).
  - Reallocating budgets (e.g., from grey infrastructure projects) to prioritise NbS investments that simultaneously provide public health services or better living conditions.
- **Generating additional revenues for NbS investment by:**
  - Pooling revenues into dedicated funds from taxes, public services fees, or other municipal revenues.
  - Introducing or increasing taxes on activities with significant environmental impacts and earmarking these revenues specifically for NbS financing.
  - Raising revenues via land sales or leases and introducing land value capture mechanisms, such as development charges or tax increment financing, which allow governments to capture a portion of the increased land and property values resulting from public investments
  - Introducing taxes or user fees for accessing natural areas and green and blue infrastructures.
- **Raising funds from external sources to catalyze financing for NbS by:**
  - Using government funds as seed funding to access international funding
  - Attracting additional investments from private sources by establishing PPPs
  - Issuing green bonds to mobilise capital for NbS investments (Maciulyte et al. 2018).

Government funding provided through various financing approaches for supporting NbS projects in urban areas can generate financial returns, cost savings to public bodies, and various environmental, social and economic benefits, as discussed in Sections 2.2 and 4.1.1.

Figure 14: Schematic illustration of government funding for supporting urban NbS projects



Source: Authors.

Opportunities

Government funding is suitable for funding large-scale urban NbS projects and sustaining projects with higher maintenance needs over extended periods. Since government-funded NbS projects can be designed without strong expectations for financial returns, they can focus on the delivery of public goods, help disadvantaged communities, promote social inclusion and create jobs for local businesses.

Potential barriers

Governments, especially local governments, may be unable to allocate sufficient funds for NbS due to competing financing requirements for basic services (Conway et al. 2020). Lengthy bureaucratic processes and institutional capacity challenges can hamper project planning and implementation (Brears 2022). In addition, short-term political cycles can also hinder the long-term political support required for NbS investments.

Case study: Funding the Cheonggyecheon Stream Restoration, Seoul, South Korea

This restoration project transformed a 5.8 km-long area in central Seoul into a green-blue corridor by revitalising the Cheonggyecheon Stream. In 2003, the Seoul Metropolitan Government decided to remove a deteriorating elevated highway instead of renovating it, revitalising the stream under the highway and creating a space for recreation. The government financed the project through public funds. The project had a budget of approximately USD 380 million, with USD 120 million allocated for landscape restoration. The primary funding came from the Metropolitan government's general budget. In addition, the government reallocated around USD 95 million to the restoration project, which was initially earmarked for the highway renovation. By downsizing less critical projects and increasing the efficiency of administrative processes, the municipality saved an additional USD 77 million. Moreover, the revitalisation efforts and increased property values attracted private sector interest, and as a result, businesses also contributed to the redevelopment efforts. The project was completed in 2005 and, among other benefits, has resulted in enhanced heat regulation, air quality improvements, increased tourism and economic activities and rising property prices.

Source: Urban Sustainability Exchange (n.d.)

4.3.2 Environmental subsidies

Environmental subsidies, which are government transfers to private entities supporting environmental protection and ecosystem service provision, aim to promote the generation of public benefits that would otherwise often underproduce. As such, they are well-positioned to promote NbS in cities (Scolobig et al. 2023), and local governments are beginning to introduce these mechanisms.

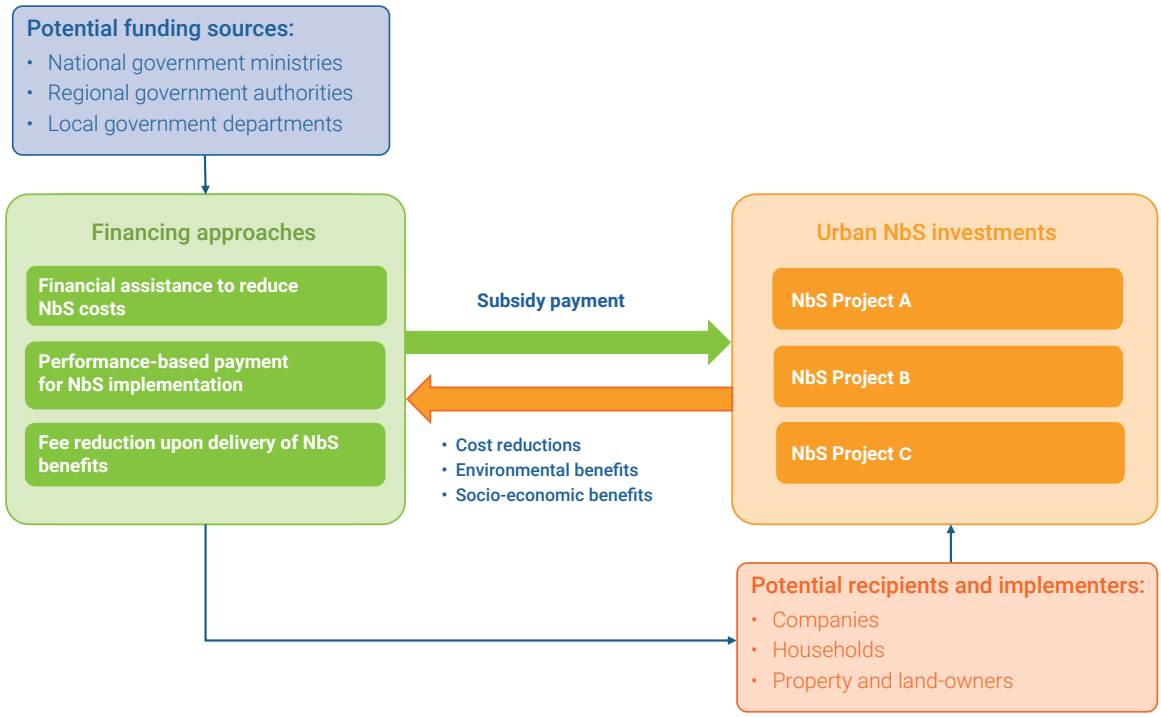
Overview

Governments provide environmental subsidies to businesses, land and property owners primarily to encourage the adoption of technologies or practices that deliver environmental benefits. As such, they are designed to reduce the financial barriers to adopting environmental technologies or approaches (McDonald 2023). These subsidies can be particularly effective in promoting urban NbS, where private land and property owners play a crucial role in implementation, such as installing green roofs on private buildings or implementing water management measures on company sites.

Environmental subsidies for urban NbS can take various forms (see Figure 15), including:

- **Financial assistance for implementation costs:** Provided as direct payments to reduce the upfront cost of technologies, infrastructure, or expertise needed to implement NbS projects. *For example, local governments can distribute subsidies that covers part of the installation costs of green roofs implemented on privately owned buildings. See the case study below on subsidy provisions supporting the implementation of Hamburg's Green Roof Strategy.*
- **Performance-based payments:** Direct transfers linked to the delivery of NbS projects or the provision of sustained ecosystem services in urban areas (e.g., the area maintained, ecosystem services provided). *For instance, the Urban Tree Challenge Fund of the UK, besides covering part of the initial costs of tree planting, offers annual payments for three years to support tree maintenance activities such as watering and weeding (UK Forestry Commission, 2024)*
- **Fee reductions:** Reducing charges for environmental services upon the installation of NbS. *For example, the Baltimore City Department of Public Works' Stormwater Fee Reduction Program allows property owners to earn stormwater fee credits for implementing green infrastructure measures to manage runoff and improve water quality.*

Figure 15: Schematic illustration of environmental subsidies provision for urban NbS



Source: Authors.

Opportunities

Environmental subsidies can promote the implementation of national and local policy goals, including climate change adaptation and mitigation. In addition, these subsidies can incentivise the early adoption of innovative NbS approaches and technologies (Brears 2022). The application process is usually more straightforward than accessing other financing instruments, such as grants; thus, they can attract a broad range of implementers and can be structured explicitly for marginalised communities and vulnerable groups.

Potential barriers

Environmental subsidies may favour specific solutions over potentially more efficient ones. The subsidy programmes may also not be accessible to all beneficiaries (e.g., low-income households). Moreover, influencing the outcomes of the subsidy programmes can be challenging, and, therefore, they may not be the most cost-effective solution.

Case study: Subsidy Provision in Hamburg's Green Roof Strategy

Hamburg's Green Roof Strategy aims to increase the number of green roofs across the city and green at least 70 per cent of new buildings and renovated roofs. A key component of this strategy is the provision of subsidies to incentivise property owners to install green roofs. The Ministry for Environment and Energy of Hamburg has allocated three million Euros to promote green roof implementation until the end of 2024. Property owners can receive up to 60 per cent of the costs for green roof construction per square meter as a non-repayable subsidy. The maximum subsidy amount is EUR 50,000, but specific projects, such as those in the inner city and properties with public or joint residential access, can receive additional financial support. In addition, property owners with green roofs can benefit from a 50%–100% reduction in rainwater fees. Applicants must include a site plan, design proof, permits obtained, and total cost estimations in the application form to qualify for the subsidies. The approved projects must be completed within two years, and applicants must submit proof of funds use and completion. The subsidies are managed by the IFBank Hamburg and are paid after the project is completed.

Source: Free and Hanseatic City of Hamburg, Ministry of Environment and Energy (n.d.).

4.3.3 Tax incentives

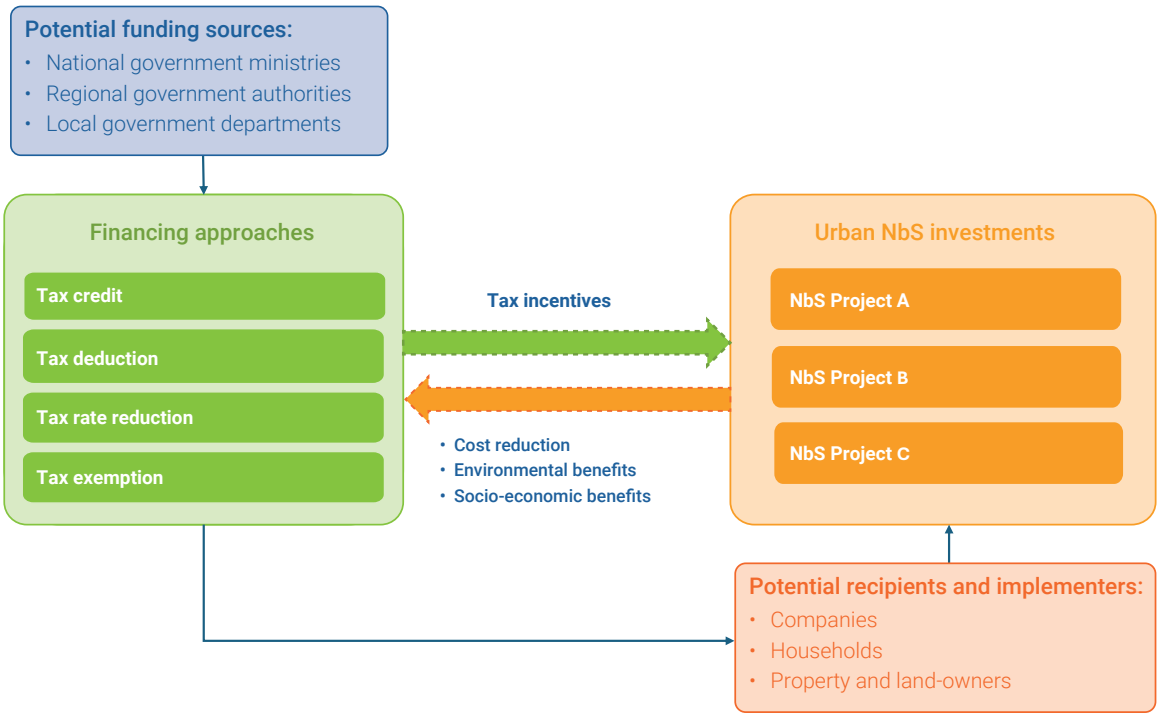
Similar to subsidies, tax incentives can effectively promote NbS investments and practices. These government incentives can encourage property- and landowners, businesses, and investors to implement NbS projects (TNC 2020).

Overview

Tax incentives are regulatory instruments to reduce the tax liabilities of organizations and individuals. As a specific type of subsidy, tax incentives lower tax obligations or grant tax exemptions in exchange for protecting and enhancing ecosystem services (EIB 2023). Several types of tax incentives exist (OECD 2022), that can be considered for supporting urban NbS (see Figure 16), including:

- **Tax credits**: Direct reductions from the overall tax liability. *For instance, property owners may receive a tax credit for installing a green roof or establishing a green stormwater infrastructure; see below the case study on the Stormwater Management Property Tax Credit of Anne Arundel County, Maryland, USA.* Development impact and building permit fees could also be reduced with tax credits when incorporating NbS in projects.
- **Tax deductions:** Applied to taxable income, deductions cover specific costs related to NbS projects, such as expenses incurred from research and development (R&D) for green roofs or installing permeable pavements and bioswales. *For instance, in the Netherlands, environmental investment tax deduction schemes allow businesses to reduce taxable income by investing in eligible green assets, such as rainwater installations (Rijksdienst voor Ondernemend Nederland, n.d.).*
- **Tax rate reduction:** Lowering tax rates on activities, assets, or revenues related to or linked to the implementation of NbS projects, such as reductions in property tax or VAT.
- **Tax exemptions:** Full exemption of specific incomes or transactions from taxation. *France offers property tax exemptions for undeveloped land on nature protection sites, including relief on inheritance and income taxes for landowners who commit to long-term environmental management (Trinomics and IUCN 2019).*

Figure 16: Schematic illustration of tax incentives for urban NbS



Source: Authors.

Opportunities

Similar to environmental subsidies, tax incentives can promote the implementation of national and local policy goals and the involvement of the private sector and households by incentivising the adoption of NbS in urban areas. Compared to other financing mechanisms, application for tax incentives is typically more straightforward.

Barriers

Tax incentives require upfront investments from recipients, which can discourage applications given that the initial investment costs of NbS can be high. Accordingly, tax incentives may primarily benefit wealthier individuals and larger corporations. In addition, if not well designed, tax incentives may favour specific solutions and slow the adoption of more cost- and resource-efficient solutions.

Case study: Stormwater Management Property Tax Credit Program, Anne Arundel County, Maryland, USA

The Stormwater Management Property Tax Credit introduced in Anne Arundel County incentivises residential and commercial property owners to adopt nature-based stormwater management practices. The programme offers a 10 per cent property tax credit on the cost of materials and installation for eligible NbS practices, up to USD 10,000 over five years. To qualify, property owners must submit their applications within 45 days of completing their project; the improvements must not be mandated by law and must be on the approved list of measures, such as rain barrels, rain gardens, green roofs, constructed wetlands and living shorelines. The Department of Public Works, which manages the programme, first reviews the applications for eligibility and compliance and notifies the property owners about the approval or rejection of their application. Approved practices must pass an inspection to ensure they meet the required standards. Once approved, the tax credit can be applied from the following year to reduce the property tax bill. The credit cannot be combined with other tax credits, but properties with these practices may qualify for a reduced watershed protection and restoration fee.

Source: Anne Arundel County, Maryland (2024).

4.3.4 Grants, multilateral and bilateral aids

As discussed in Section 4.2, various public and private entities offer grants for urban NbS. Besides government spending, grants are the most common type of NbS financing mechanism (UNA 2023).

Overview

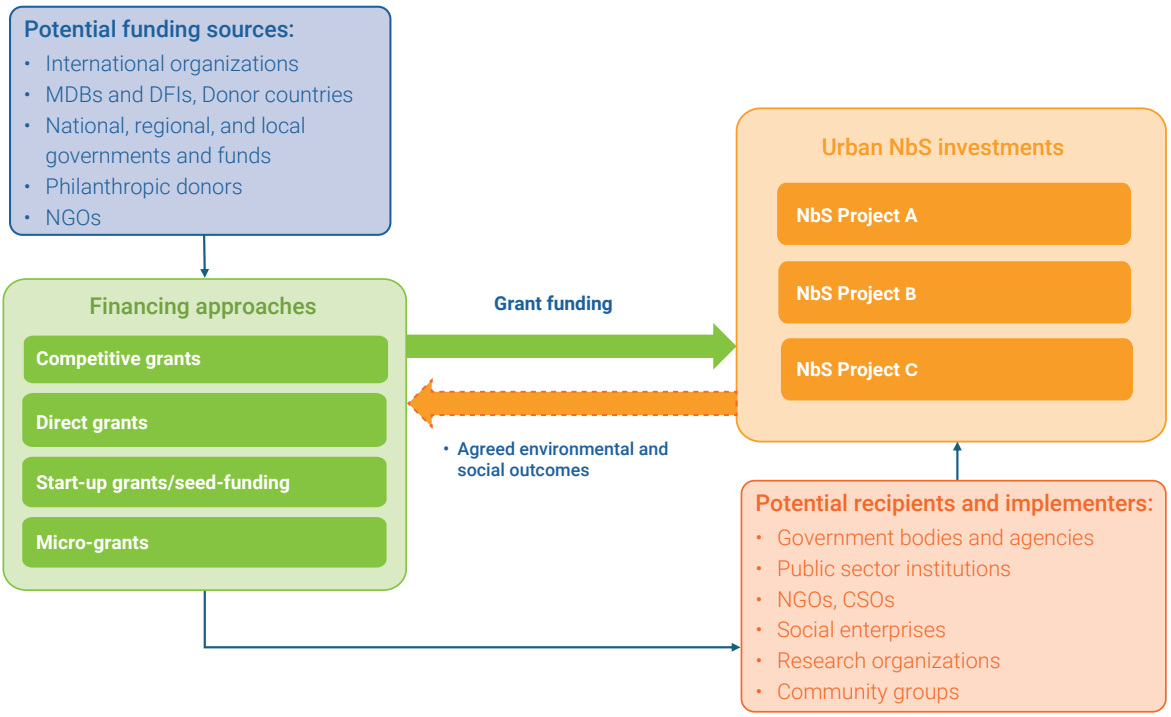
Grants are direct payments to entities like government agencies, NGOs, research organizations, and community groups. Grant funding sources include international organizations, MDBs, DFIs, donor countries, national, regional and local governments and agencies, philanthropic donors, and NGOs. Although funders do not require repayment, grant recipients are usually expected to deliver agreed-upon outcomes and results (Tobin de la Puente and Mitchell 2021). As such, grants can support various NbS activities, including feasibility studies, project planning, implementation, and capacity-building (see Figure 17).

Different types of grant funding are relevant to finance urban NbS projects, including:

- **Competitive grants:** Awarded through a competitive application process, these grants are commonly used to finance various urban NbS initiatives, ranging from green corridor creation to floodplain restoration. Some funders also require the recipients to match the grant with additional funds.
- **Direct grants:** Financial support provided without a competitive application process, such as government transfers or corporate grants. These grants often fund targeted NbS investments to support the implementation of specific strategies or the enforcement of legislation, such as green roof installations, tree planting or green water management solutions.
- **Seed-funding and start-up grants:** Initial financial support for launching new NbS projects that could scale up. These grants are more suitable for NbS with revenue-generating opportunities, *such as a technology company installing green roofs or pilot application of community-based urban farming initiatives that could be extended city-wide.*
- **Microgrants**: Tailored to support small-scale, localised projects of grassroots organizations and community groups. *Examples include the installation of a rainwater harvesting system and small-scale reforestation efforts.*

When used strategically, grants can influence policy, promote innovation, build partnerships, capacities and skills and foster the systematic integration of NbS into public and private investments. In addition, they can support pooling other financing sources, such as loans or equity funding (Swann et al. 2021).

Figure 17: Schematic illustration of urban NbS grant funding



Source: Authors.

Opportunities

Grants can provide initial funding to support the testing and piloting of different urban NbS. Grants can also cover the upfront investment costs of larger-scale NbS projects in cities, such as park creation, which are often challenging to finance through public funding alone. By funding in early project stages, grants can help de-risk projects and encourage private investors to participate with reduced risk. Furthermore, grants can help local communities and organizations implement NbS tailored to specific challenges or support disadvantaged or marginalised groups.

Potential barriers

Compared to repayable capital, grant funding is limited, and the application process can be highly competitive. Funding identification, proposal development, project monitoring and reporting can be resource and time-intensive. Compliance with donor requirements can also be challenging. Furthermore, since grants are usually awarded for a specific period, the long-term sustainability of the NbS projects can be impacted, especially when the operational and maintenance costs are higher (e.g., a dune stabilisation project).

Case study example: The Urban Forest Fund programme of Melbourne, Australia

The City of Melbourne established the Urban Forest Fund competitive grant programme to support greening projects on privately owned properties. Since its launch in 2017, the Fund has distributed over USD 1.7 million for greening projects, including green roofs and walls, street greening, and community gardening. In its latest round of funding in 2023, the Fund offered two types of grants. The first grant stream provided grants for "High-Impact Greening" projects with public benefits from AUD 50,000 to AUD 500,000. Priority was given to projects in areas with low tree canopy cover, limited open space, or significant tree loss. The second grant stream supported community-led Laneway Greening projects, offering smaller grants between AUD 10,000 and AUD 25,000. It prioritised projects involving local community champions and demonstrating collaborative efforts. The Urban Forest Fund offers matched funding grants, which require applicants to match each dollar received from the Fund. Funding was allocated through a formal funding agreement. The initial payment was made upfront, with a second payment following the completion of the project. Eligible costs covered by the grants include direct costs of the greening projects, design, and project management, up to 15 per cent of the total project cost. However, maintenance costs are not covered.

Sources: City of Melbourne (2023)

4.3.5 Loans

Public budgets and grants are often insufficient to fully fund large-scale urban NbS projects, such as river restoration or coastal protection projects. Addressing the financing gap could involve using loans as an emerging financial mechanism for NbS, building on its established use in climate finance (Falduto, Noels and Jachnik 2024).

Overview

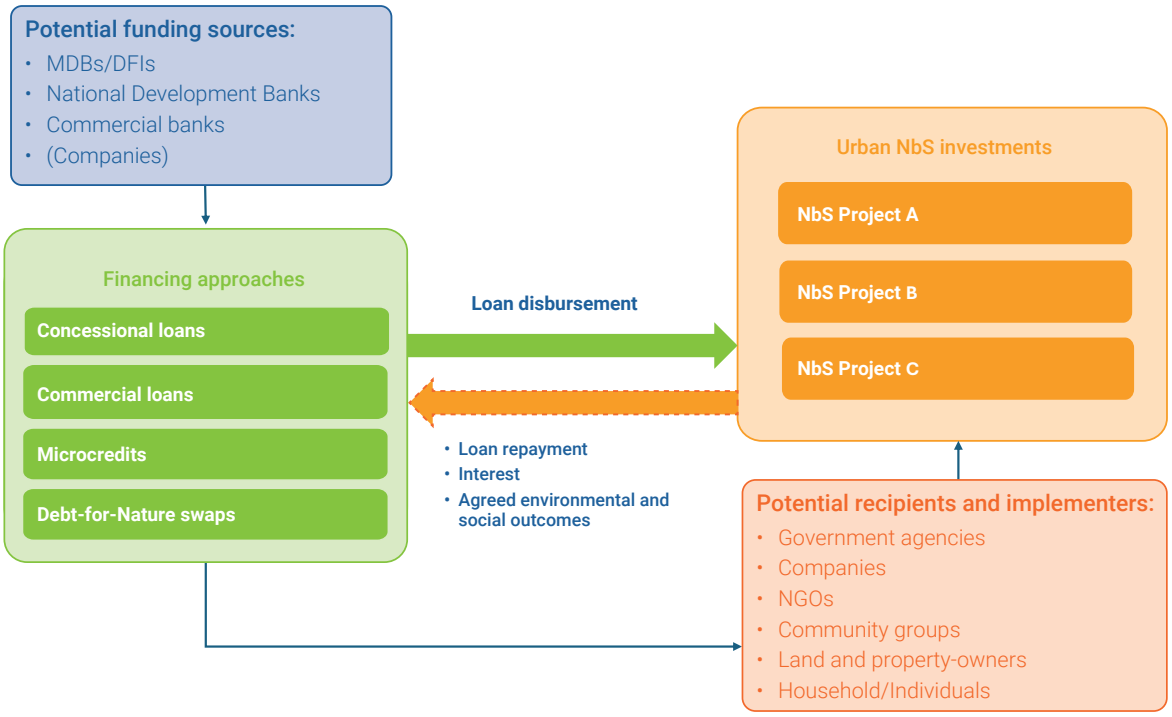
Loans for NbS projects are typically provided by international funds, multilateral or national development banks, DFIs, and less often by commercial banks (UNA 2023). The following types of loans are relevant for urban NbS implementation (see Figure 18):

- **Concessional loans:** These loans are usually offered by MDBs, DFIs, and government agencies and are provided with below-market interest rates and extended repayment periods. Concessional loans often require compliance with specific social and environmental objectives. As such, NbS projects, especially with an adaptation focus, have a good potential to access loans with favourable terms to manage climate risks (Machiels et al. 2024). *In urban areas, examples can include loans for nature-based flood protection and wetland restoration to mitigate flood risks, as illustrated in the case study.*

- **Commercial loans:** Loans issued at market-rate interest, typically by commercial banks. Due to usually longer-term returns on urban NbS investments, these projects are often considered high-risk to meet the regular payment requirements (EIB 2023). However, revenue-backed loans, where repayment is tied to the project's income streams, e.g., user fees for environmental and recreational services, could help reduce these risks. *Potential NbS investment opportunities within urban areas include eco-parking facilities with rain gardens and bioretention areas or urban green spaces designed for recreational opportunities that generate revenue.*

- **Microcredits:** Smaller loans are given to small-scale projects or grassroots organizations to implement NbS projects. Microcredits often have flexible terms, such as minimal capital requirements, making them suitable for community-driven urban-NbS activities. *For example, microcredits could be used to install a green roof or a rainwater harvesting system on a community building, where the loan can be repaid from savings on energy and water from reduced heating, cooling and water usage.*
- **Debt-for-Nature swaps:** Special loan restructuring agreements where lending terms are modified or loans are (partially) cancelled in exchange for environmental conservation commitments and investments. While currently limited in scale, Debt-for-nature swaps have the potential for greater use as developing countries increasingly address infrastructure gaps (Tobin-de la Puente and Mitchell 2021). *For example, a Debt-for-Nature swap could be used in urban areas to finance NbS coastal protection initiatives.*

Figure 18: Schematic illustration of loan provision for urban NbS



Source: Authors.

Opportunities

Loans are relatively abundant compared to government funding or grants. They can enable the pre-financing of larger green and blue infrastructure projects in urban areas and smaller NbS investments of businesses, and property owners, particularly with revenue-generating or cost-reduction potential. Loans can also complement other financing instruments, such as grants or equity financing. In addition, sustainability and green loans are often provided with more favourable conditions.

Potential barriers

Loans usually involve initial capital requirements and interest rates, which can be especially challenging for urban NbS projects that face unique financing barriers, such as high land prices. Fixed repayment terms add challenges because NbS investments often deliver long-term benefits that can be difficult to monetise.

Case study: Concessional loan provision for the Beddagana Wetland Park, Colombo, Sri Lanka

The project's primary objective was to preserve and rehabilitate wetlands in Sri Jayawardenapura Kotte's administrative capital to increase flood retention capacity and offer recreational opportunities. The project was implemented as part of a more extensive urban regeneration programme, the Metro Colombo Urban Development Project (MCUDP), aiming to reduce flooding and improve priority local infrastructure and services. The MCUDP was jointly financed by the International Bank for Reconstruction and Development (IBRD) of the World Bank Group and the Government of Sri Lanka. The World Bank granted a concessional loan of USD 213 million, while the Government of Sri Lanka contributed USD 100 million. The loan was initially approved in 2012, and the original closing date was 2017, which was later extended to 2021. The Wetland Park cost approximately USD 1.2 million and was financed from the IBRD loan under the MCUDP's Component 1 on flood and drainage management.

Sources: World Bank (2021b)

4.3.6 Sustainability bonds

Sustainability bonds have significant potential to channel investments into NbS projects and facilitate large-scale interventions (Thompson et al. 2023). Despite the growing interest in environmental-focused thematic bonds, their application for nature-focused objectives has been limited (Deutz et al. 2020). The limitation is particularly the case in urban areas, where only a few sustainability bonds have been issued so far with explicit aims of financing NbS projects addressing climate change.

Overview

Sustainability bonds are debt instruments issued by governments, municipalities, corporations, and financial institutions to finance projects with social and environmental benefits. They function similarly to traditional bonds; however, issuers must also report on the use of proceeds and the resulting environmental and social impacts (Organisation for Economic Co-operation and Development [OECD] 2017). These bonds are often guided by frameworks such as the Sustainability Bond Guidelines, the Green Bond Principles, and the Climate Bonds Standard to ensure compliance with social and environmental goals (International Capital Market Association [ICMA] 2024). Types of sustainability bonds relevant to urban NbS development include (see Figure 19):

- **Sustainability bonds:** Finance projects that contribute to broader sustainability goals and deliver environmental and social benefits (NAP Global Network 2024). In the urban context, these bonds can finance diverse NbS projects, enhancing climate resilience while promoting health, well-being and social cohesion.

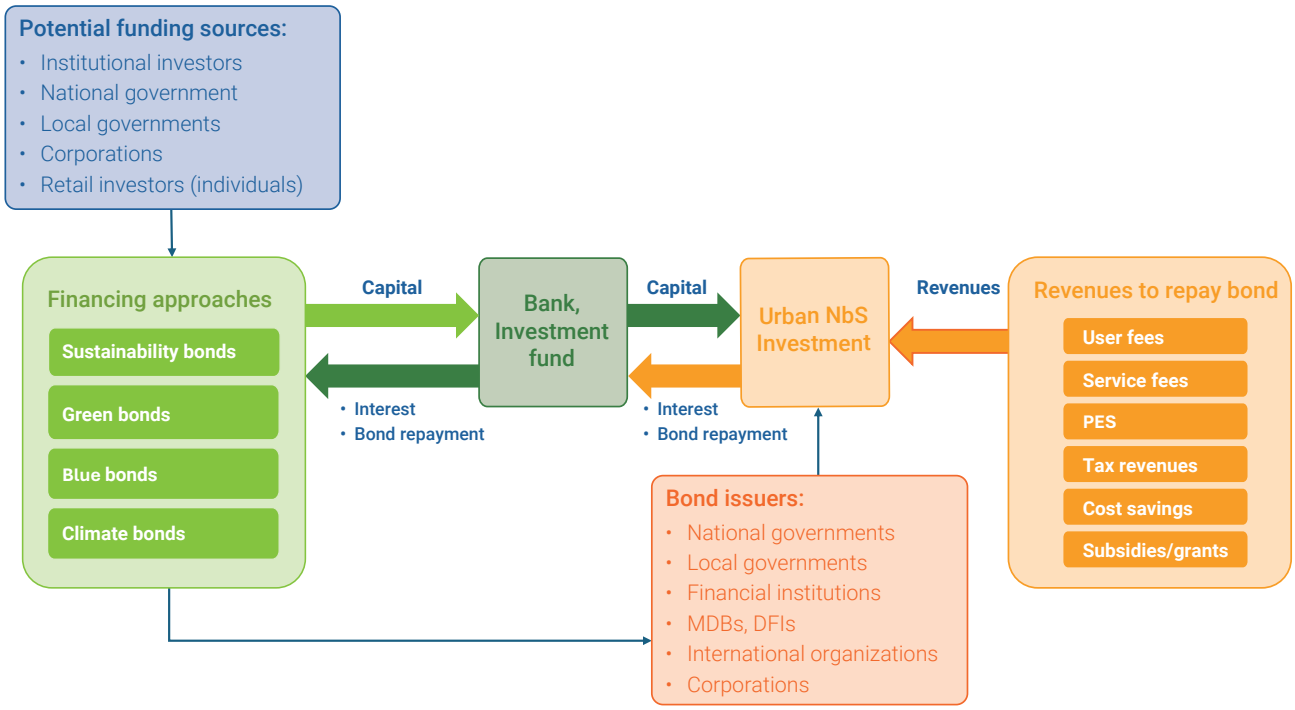
- **Green bonds**: These bonds specifically target projects with positive environmental impacts. As such, they can finance various urban NbS projects, including green roofs, green stormwater infrastructures, green corridors or green belt projects.

- **Blue bonds:** These bonds are traditionally aimed at marine and coastal areas but can potentially finance freshwater projects in urban areas. *For example, they can finance nature-based coastal protection and water management projects that support stormwater and flood protection, pollution prevention and wastewater management solutions within cities (Bosmans and Mariz 2023; TNC 2023).*

- **Climate bonds:** These bonds are aimed explicitly at financing projects that address climate objectives (Climate Bonds Initiative 2021). *For example, climate bonds can finance urban NbS projects to reduce urban heat stress through increased green canopy cover and enhance flood resilience through urban wetlands and rain gardens that absorb excess water during storm events.*

In addition, environmental impact bonds and sustainability-linked bonds (SLBs) can also be considered for financing urban NbS projects. Environmental impact bonds are innovative schemes that only generate returns to investors if the project meets predefined performance targets, such as pollution reduction or habitat restoration (Trotta 2024). SLBs do not finance specific projects but are issued with pre-defined sustainability performance targets and incentivise the issuers with financial rewards or penalties based on their achievement of these targets (Haq and Djeneba 2022). As such, they can be particularly helpful in financing the early stages of urban NbS project development based on agreed-upon performance targets (EIB 2023).

Figure 19: Schematic illustration of bond financing urban NbS investments



Source: Authors.

Opportunities

Urban NbS projects often require significant upfront investment, and sustainability bonds can offer a secure, long-term financing source (CCFLA, 2024). Cities can access considerable funds through sustainability bonds to implement NbS projects that reduce urban climate risks. Investors may also accept lower returns in exchange for environmental services and benefits. In addition, many governments and international organizations promote green bonds through regulations, tax incentives and subsidies, and the number of (institutional) investors interested in financing sustainable projects is expanding (OECD 2017).

Potential barriers

Urban NbS projects often have more extensive financial return periods, which could reduce investors' interest. Bonds can also be subject to market risks, affecting their overall value (CCFLA, 2024). Last, due to limited standardisation, sustainability bonds can create a risk of greenwashing, with proceeds not contributing to planned projects (OECD 2017).

Case study: Central Arkansas Green Bond for urban watershed

Central Arkansas Water (CAW) issued a USD 31.8 million value green bond in 2020 to protect drinking watersheds in the central Arkansas metropolitan area for over 500,000 consumers. The bond was the first-ever certified green bond to acquire forests specifically for watershed protection. CAW collaborated with the World Resource Institute to issue bonds, and it was certified under the Climate Bonds Initiative's water infrastructure criteria. After issuance, Morgan Stanley purchased the bond with a 2.136 per cent interest cost. CAW finances the bond interest repayment from customer rates and the dedicated watershed protection fee. The watershed fee was initially set at USD 0.45 per water meter per month and later increased to USD 0.90, generating approximately USD 2.3 million annually. In total, around 33 per cent of the bond proceeds are allocated for green infrastructure to acquire over 4,500 acres of forested land, grant conservation easements to landowners, and introduce other protection measures in the watershed, including sustainable forestry management practices, reforestation, and native species restoration in non-forested areas. The forested areas are also certified under the Sustainable Forestry Initiative management standard.

Sources: Central Arkansas Water (2021); Central Arkansas Water (2021)

4.3.7 Equity investments

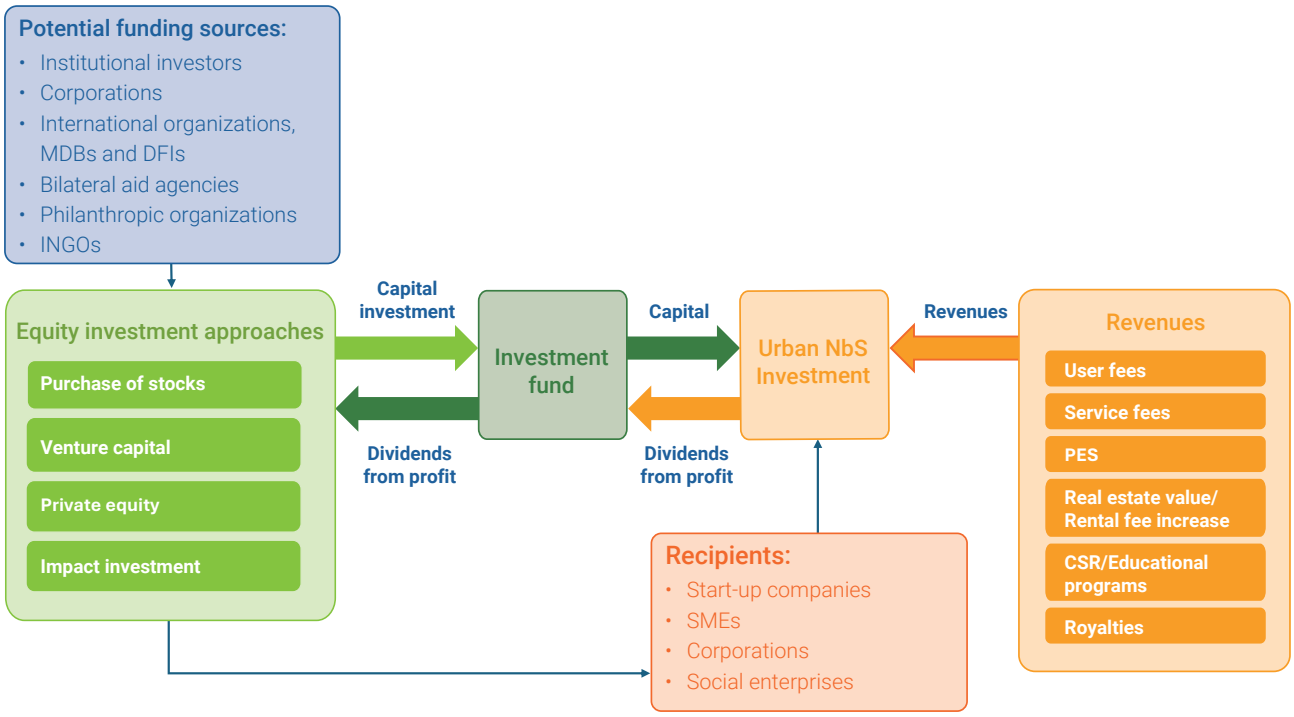
While government funding, grants, and, to a certain extent, loans and PPPs are already moderately well or well-developed NbS financing mechanisms, market-based and revenue-generating instruments remain underutilised (de los Casares and Ringel 2023). Private investors can invest in urban NbS in two ways: first, businesses can develop and directly finance NbS interventions and second, through institutional investors purchasing shares or investing in equities of companies that focus on natural assets or NbS. Promoting equity financing can be important to mobilise private sector resources and create bankable NbS projects (EIB 2023; WWF and South Pole 2022).

Overview

Equity investors offer capital in exchange for (partial) ownership of a project or asset. Key types of equity financing relevant to urban NbS projects include (see Figure 20):

- **Purchase of stocks:** Investors can purchase stocks to become partial owners in companies incorporating NbS into urban infrastructure or real estate development projects. While nature-based enterprises might not be frequently listed independently on stock markets, they can be part of larger corporations.
- **Venture capital:** These investments target early-stage and higher-risk projects. *Venture capital can be relevant for innovative urban NbS projects that demonstrate strong revenue generation potential, such as a natural wastewater management technology company.*
- **Private equity:** These investments finance more mature projects or companies, where investors primarily seek predictable investment returns. *For example, private equity investment could be used for large-scale nature restoration projects, which (after completion) can generate revenues through payments for ecosystem services (PES), carbon credits or eco-tourism revenues.*
- **Impact investments:** Besides generating revenues, impact investments focus on generating positive and measurable environmental and social impacts (TNC 2023). As such, they often allow extended investment periods and accept lower return-on-investment. Impact investments could be suitable for various types of urban NbS projects. However, to date, such investments have primarily focused on larger-scale nature conservation and reforestation projects outside metropolitan areas.

Figure 20: Schematic illustration of equity financing for urban NbS investments



Source: Authors.

Opportunities

Equity financing can promote the development of innovative solutions in early-stage urban NbS by mitigating project implementation risk through shared financial responsibility. Once initial private financing is secured, it can also help attract additional private finance. Equity investors are directly interested in ensuring successful project outcomes, thus often providing additional resources, such as technical expertise and market access, to support the financed projects.

Barriers

Urban NbS projects are often considered high-risk investments, limiting the willingness of investors to invest. Investors typically seek higher financial returns over a shorter period, but NbS investments may not be able to demonstrate strong revenue-generating potential and generate benefits in the long term (Biasin et al. 2024). In addition, since many NbS are delivering public goods, such as clean water, sharing ownership may not be suitable or feasible for all projects.

4.3.8 Public-Private Partnerships (PPPs)

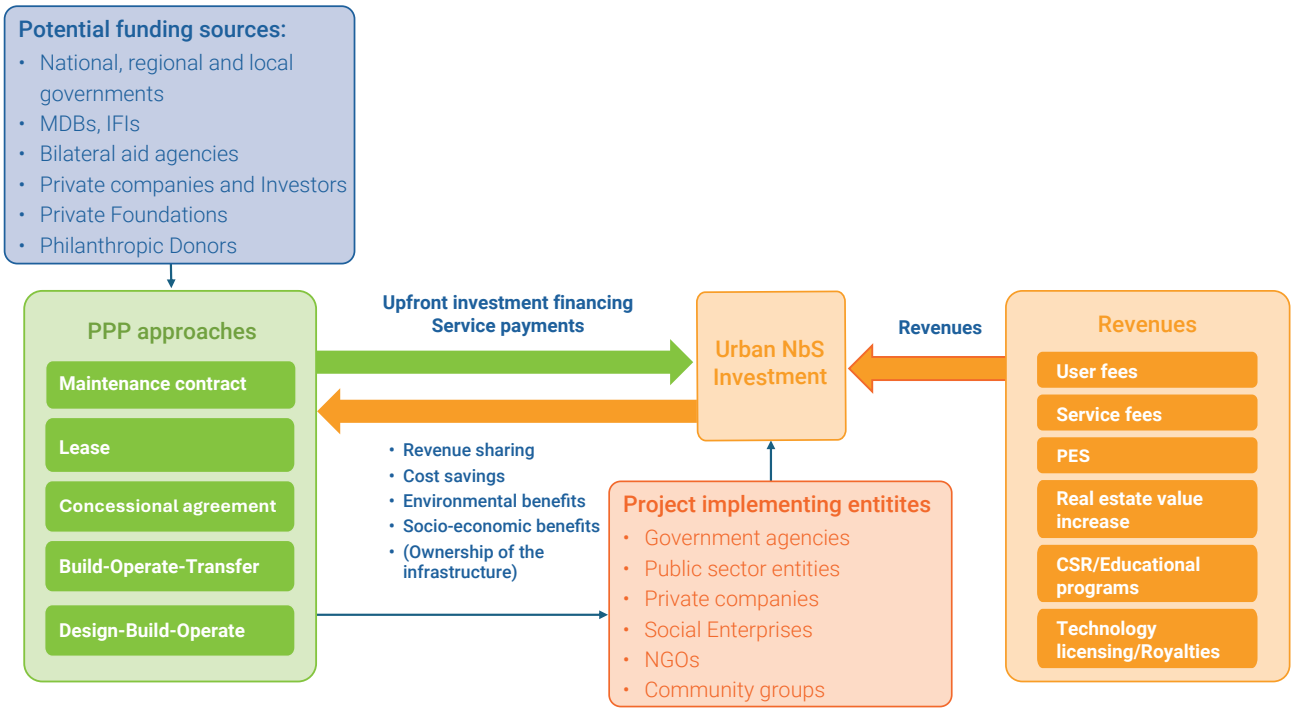
PPPs are formal collaborations between public and private sector entities to finance, implement and manage large-scale investment projects. Although PPPs have not been used widely for NbS investments, they can be effective financing mechanisms for green and blue infrastructures in urban areas, aligning the interests of private investors and public actors and enhancing project implementation (Favero and Hinkel 2024; Scolobig et al. 2023).

Overview

In PPP arrangements, the private sector entity contracts with the public actors to realise an investment or infrastructure project or to deliver a public service and share the investment costs, implementation risks, and responsibilities. During the contracting period, the private entities operate (or own) the project and generate revenues directly from users or via public financing. Once the agreement is completed, the project management, the operation, and potentially the ownership are transferred back to the public actor. (UN-Habitat 2016)

PPPs have different modalities that involve private companies to various extents, including maintenance contracts, leases, long-term concessions, build-operate-transfer (BOT), design-build-operate (DBO) projects (Brears 2022; World Bank PPP-LRC 2022). *For example, an urban coastal restoration project could be implemented under a longer-term concessional agreement, with the private company managing the areas, receiving public financing for the restoration activities and potentially, additional revenues for eco-tourism, educational and research activities. A constructed wetland project completing or replacing wastewater management infrastructures could be developed under a BOT agreement and financed by user fees until transferred back to the public actors.*

Figure 21: Schematic illustration of PPPs for urban NbS investments



Source: Authors.

Opportunities

PPPs could mobilise private resources for large-scale green and blue infrastructure investments in cities and reduce public budget requirements, reducing the financial risks of implementation for both public and private actors. Moreover, the involvement of the private sector can improve the management efficiency and the outcomes of the NbS projects, while the involvement of public actors can ensure the delivery of the expected environmental and social benefits (Maciulyte et al., 2018).

Potential barriers

NbS projects have limited revenue generation capacity, which may limit the feasibility of PPP agreements. In addition, private actors may prioritise cost-effectiveness over the delivery of environmental benefits. Due to their fixed contractual arrangements, long-term PPPs may limit adaptive management practices essential for NbS projects.

Case study: PPP for coastal defence at Pevensey Bay, United Kingdom

The Pevensey Bay project is a pioneering PPP that restores and maintains the coastal defences of Pevensey Bay in East Sussex. The project's primary focus was to restore and maintain a 9 km stretch of seashore with natural solutions, primarily beach nourishment and shingle management. The coastal defences protect urban and natural areas on a 50 km² area. The British Environmental Agency initiated the agreement in 2000 for 25 years. The contract was awarded competitively to Pevensey Coastal Defence Ltd. (PCDL), a consortium that several private companies formed to realise this project. Under the PPP contract, the Environmental Agency oversees the project, and the PCDL consortium is responsible for the design, implementation, and maintenance of the coastal defences. Each partner company in the consortium has specific responsibilities assigned. The agreement was valued at approximately USD 37.5 million (on 1999 prices) and is pre-financed by the consortium members with defined annual costs/payments from the environment agency to PCDL. The PPP model enables risk sharing between the public sector and the consortium, resulting in an estimated 15 per cent savings on recurring obligations for the environmental agency.

Source: Pevensey Coastal Defence (2024).

4.3.9 Blended finance and de-risking mechanisms

Blended finance is an investment structuring approach that strategically uses development or public finance to mobilise private financing sources (Brears 2022). By addressing the higher investment risk and the comparatively lower returns associated with NbS investments, blended finance can make them more appealing for private sector participants (Van Raalte and Ranger 2023). The approach has already been used in various sectors related to climate action, including areas relevant to NbS, such as forestry and landscape conservation (Machiels et al. 2024). Because private investments in urban NbS projects have been limited, blended financing and de-risking approaches could encourage private sector involvement in urban NbS initiatives.

Overview

In blended finance mechanisms, public or philanthropic actors provide concessional capital and guarantees or insurances to lower the investment's risk or improve returns. The following approaches can be used to promote urban NbS investments (OECD 2018; Earth Security 2021; see Figure 22):

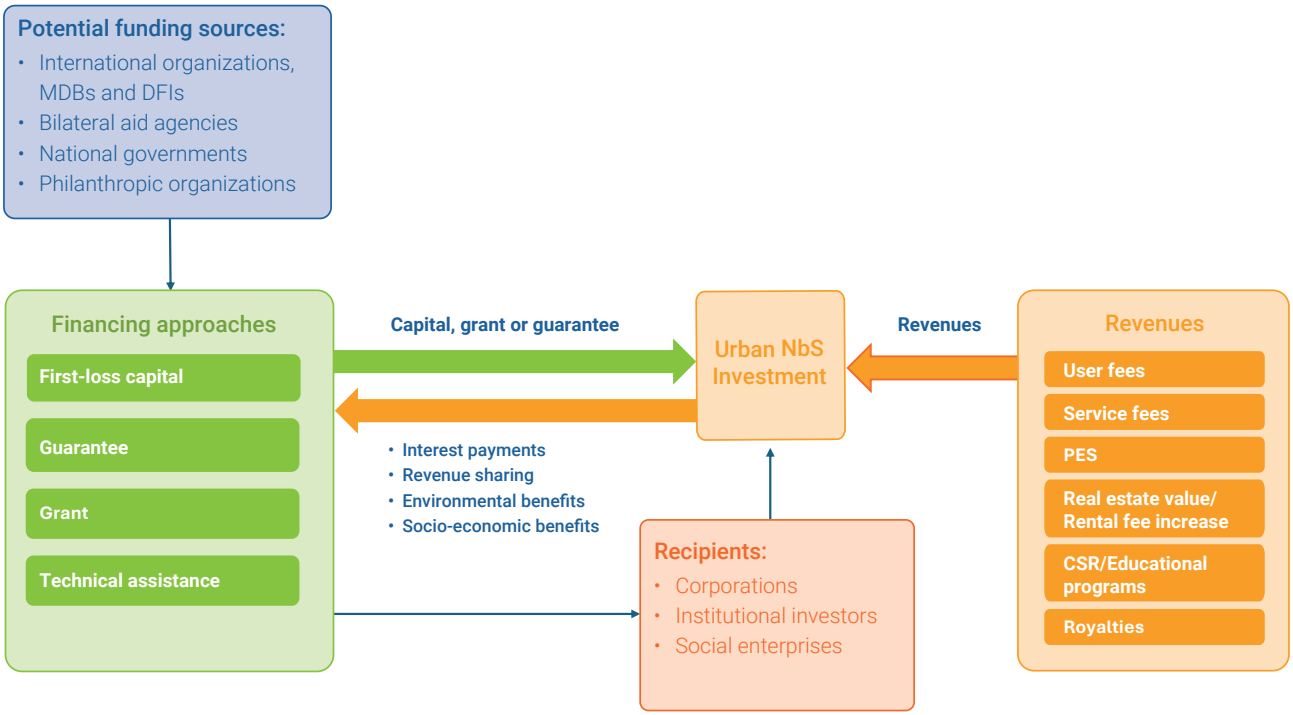
- **Concessional finance:** Public or philanthropic donors provide loans at below-market rates or equity on subordinate terms to absorb initial losses in a project. These are typically repaid after other investors have been compensated.
- **Guarantees and insurances:** Risk guarantees fully or partially cover financial losses in case there is value loss or no repayment, helping to de-risk projects for private investors. Risk insurance can also be offered to NbS investors to insure them against potential losses.

- **Project preparation grant:** These grants support the early stages of project development and are used to establish baselines, conduct feasibility studies, and develop project pipelines.

- **Technical assistance support:** Public actors can build the capacity of private actors in areas like financial management.

Beyond specific mechanisms, blended financing can also be structured through collaborative arrangements, bringing together potential financing for urban NbS from various public and private entities. *For example, urban* ***water funds*** *can be established to pool resources for investing in sustainable watershed management and green infrastructure approaches to ensure the long-term provision of clean water, natural water treatment, soil improvement and ecosystem restoration (Calvache, Benítez and Ramos 2012).* These funds can include financing from public entities, such as local governments, water utilities, private companies and NGOs, and as such, they can create an opportunity for downstream water users in urban areas to invest in sustainable water management practices in upstream watersheds (TNC 2024).

Figure 22: Schematic illustration of blended financing



Source: Authors.

Opportunities

Blended finance can support large and complex projects as it involves private and philanthropic financing and focuses on ensuring economic sustainability (CCFLA 2024). As such, blended finance can also catalyse scaling up smaller pilot projects.

Potential barriers

Blended financing mechanisms can be slow to establish and difficult to manage due to their complex structure and requirements to ensure the delivery of intended benefits (OECD, 2018). Dependency on public funds may hamper the design of viable and replicable NbS projects.

Case study: Urban Resilience Fund (TURF)

The Urban Resilience Fund (TURF) was launched in 2021 by Meridiam, a global investor and asset manager specialising in long-term public infrastructure projects, in collaboration with the Rockefeller Foundation and UN Capital Development Fund (UNCDF). The Fund supports the sustainable development of cities in Europe and Africa to address urbanisation and climate change challenges. TURF raised EUR 500 million for project investments, including a EUR 20 million catalytic capital fund for project preparation, a EUR 150 million investment fund for OECD countries, and EUR 350 million for non-OECD countries. The fund works closely with city authorities to develop infrastructure solutions that deliver multiple and equitable benefits. For instance, in Nouakchott, the capital of Mauritania, TURF finances an integrated coastal protection initiative to protect 75,000 residents from flooding while enhancing biodiversity and creating economic opportunities. It aims to restore a 12 km dune ridge, construct a sea boulevard connecting the city centre to its fish market, and establish two green corridors between the city and the sea. The project will be implemented between 2023 and 2027 by a public-private company jointly owned by TURF and the Government of Mauritania.

Sources: Meridiam (2024a) and Meridiam (2024b).

4.3.10 Payments for Ecosystem Services

PES are financial incentives offering land and property owners revenues for ecosystem services such as biodiversity conservation or carbon sequestration (Jack, Kousky and Sims 2008). The PES mechanism is also applicable in urban NbS investments and can support activities such as stormwater reduction, tree planting, and maintenance (Richards and Thompson 2019).

Overview

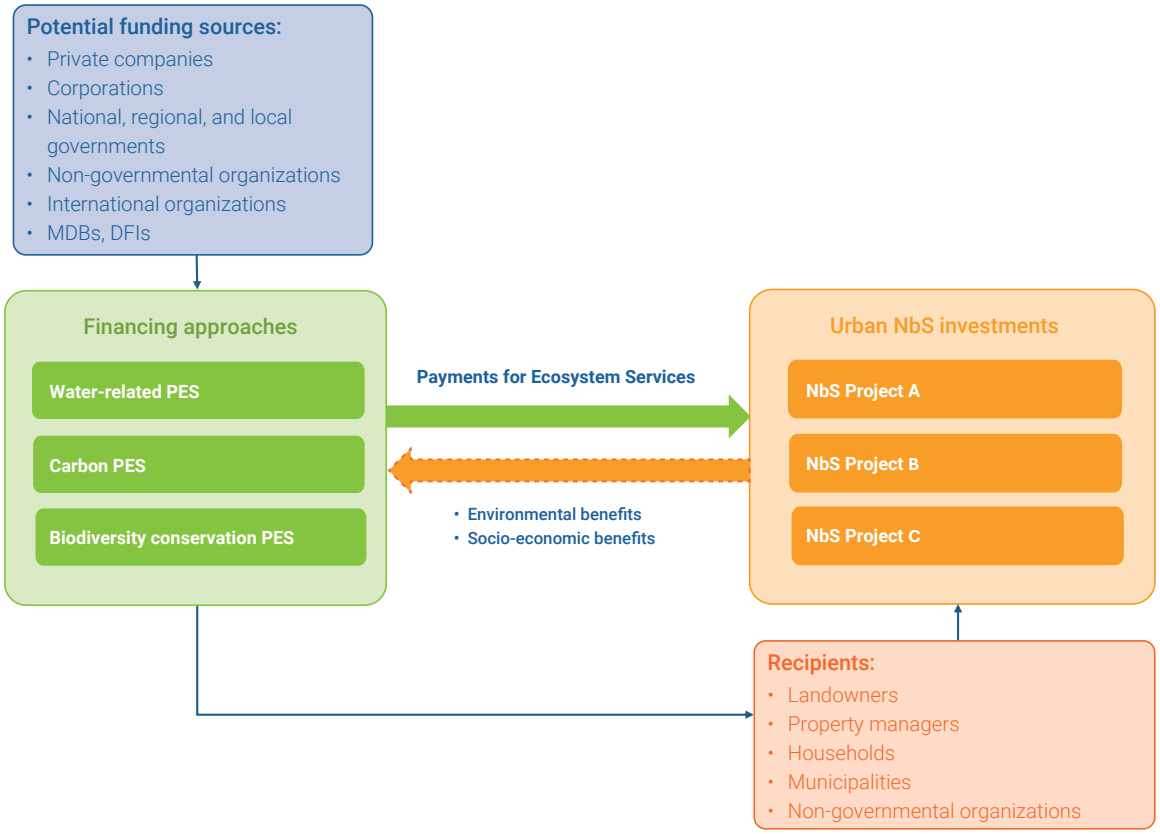
PES schemes are market-based instruments that create direct economic incentives for providing ecosystem services (Salzman et al. 2018). They are based on voluntary transactions where the provider of the PES pays the land or property owner for NbS, which improves the natural environment or reduces environmental risks. PES providers can be national and local governments, private companies, international organizations, or NGOs (Cities Climate Finance Leadership Alliance [CCFLA] 2024, Brears 2022). They can be collective arrangements where multiple entities fund the PES schemes or bilateral, stand-alone agreements (McDonald 2023). PES are usually direct, periodic payments (quarterly or annually) and depend upon the delivery of sustained ecosystem services.

The most common types of PES schemes, which can apply to urban NbS projects (see Figure 23), include:

- **Carbon sequestration:** Payments to landowners or project developers who use carbon sequestration practices, such as afforestation and wetland restoration.
- **Biodiversity:** Payments for creating or restoring and protecting habitats and planting trees within urban areas.
- **Water management:** Payments to landowners or households who adopt nature-based practices that improve water management or water quality, such as green stormwater management solutions for reducing runoffs.

PES can also use transfer-based instruments, where local governments, communities, and landowners receive tradeable credits for verified services, such as carbon storage, water pollution reduction or biodiversity conservation. These credits can be sold in voluntary or compliance markets. Voluntary carbon markets are increasingly seen as an emerging revenue stream for nature conservation; however, it is crucial to ensure buyers work towards their climate mitigation commitments and strategies (Finance Earth 2021; TNC 2023). In addition, NbS investment financed from carbon offsetting credits must also be developed according to global NbS standards and guidelines, such as providing net biodiversity gain and respecting the rights of local communities (Seymour and Langer 2021; IUCN 2020).

Figure 23: Schematic illustration of PES for urban NbS



Source: Authors.

Opportunities

PES can serve as a direct incentive and income source for communities to improve their cities' environment and natural areas. It can also encourage private investors to implement NbS projects (Richards and Thompson 2019). Besides, PES can ensure a continuous and reliable revenue stream for the delivery of ecosystem services, thus motivating project implementers to operate and maintain the established green and blue infrastructure.

Potential barriers

PES schemes rely on voluntary participation, which can limit their uptake. Marginalised communities may also not be able to access and benefit from PES schemes. Moreover, measuring and verifying project outcomes can be challenging (Salzman et al. 2018).

Case study: Financing urban reforestation through carbon credits in Austin, Texas, USA

In 2018, TreeFolks, an urban forestry NGO, launched an initiative to plant over 2,000 trees in the City of Austin in collaboration with the City's Watershed Protection Department and Parks and Recreation Department. The project focuses on reforesting riparian zones and park areas to increase canopy cover, mitigate urban heat islands, enhance biodiversity and foster community engagement through volunteer participation. This effort is financed through the generation of carbon credits, validated and certified under the Urban Forest Carbon Program of the City Forest Credits (CFC). CFC, a non-profit carbon registry, facilitates funding for urban forestry projects by enabling the sale of verified carbon credits in voluntary carbon markets. The issued credits also quantify additional co-benefits like improved air quality and stormwater interception. The credits generated by TreeFolks' planting initiative are sold to the City of Austin's Sustainability Office to support the city's carbon neutrality goals.

Source: CFC (2024).

4.3.11 Insurance schemes

Insurance schemes can incorporate nature consideration and support NbS investments to reduce nature-related risks of investments, insured organizations and their activities. Nature-related risks can stem from physical damage to ecosystems, evolving regulatory requirements, and market demands requiring more stringent environmental and climate considerations (UNEP FI 2023). Because cities are especially vulnerable to climate-induced risks, specific insurance products can enhance the protection of natural assets (such as coastlines) in urban areas through nature-based approaches. Insurance companies could also offer premium discounts to customers who implement NbS to protect their insured properties from climate-induced weather events. Insurance products can be used to underwrite sustainability bonds to finance urban NbS projects.

Overview

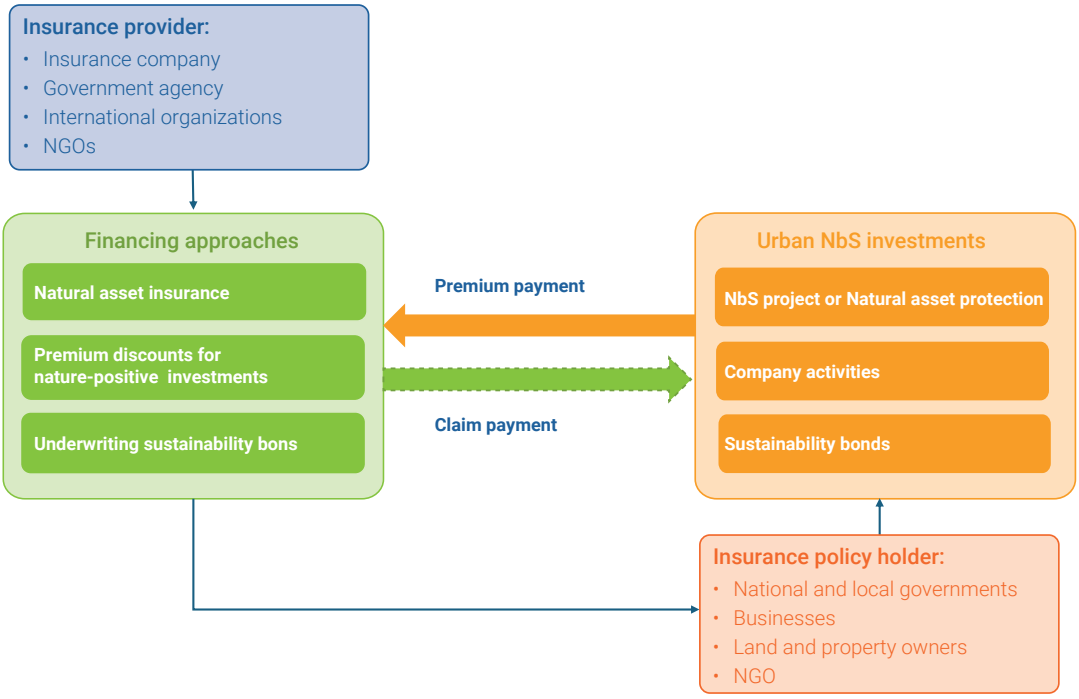
Insurance schemes are typically provided by private insurance and reinsurance companies, but governments, international organizations and sometimes NGOs can also provide them. Insurance providers can integrate nature considerations into existing insurance products or develop targeted insurance (see Figure 24). Although mainly in the experimental phase, various insurance schemes have demonstrated the potential to support NbS interventions in urban areas, including:

- **Natural asset insurances:** Tailored insurance products can offer cover for protecting or restoring natural ecosystems, such as mangroves or wetlands. *For example, parametric insurance issues payouts after hurricanes or extreme weather conditions destroy natural ecosystems (TNC 2023).* In addition, insurance products could also mitigate the financial risks associated with NbS investments by providing guarantees for project developers and investors. For instance, revenue insurance could protect investors in urban nature restoration projects by guaranteeing compensation if the project fails to deliver the expected ecological benefits and revenue streams, such as carbon credits or water purification services.

- **Premium discounts for nature-positive investments**: Insurance companies can incentivise customers to invest in nature protection or sustainable forest or water management practices by offering premium discounts on insurance products (Marchal et al. 2019; UNEP FI 2023). Ecological forest management has been shown to reduce the risks of natural disasters like wildfires and floods, lowering insurance costs for those proactively protecting the environment (TNC 2023). In urban areas, insurance companies could offer premium discounts to property owners who implement nature-based stormwater management approaches reducing the risks of flash floods.

- **Underwriting sustainability bonds:** Insurers can support NbS by underwriting sustainability bonds that fund nature conservation and restoration projects. These investments can help finance large-scale efforts to protect and restore biodiversity while the insurance guarantees the bond's repayment, making the investment less risky for bondholders. (MSCI 2024).

Figure 24: Schematic illustration of insurance schemes promoting urban NbS



Source: Authors.

Opportunities

Insurance can help mitigate natural disasters' financial impact on ecosystems and communities. Insurers can also reduce the frequency and severity of insurance claims related to natural disasters, resulting in lower premiums (CISL 2022; UNEP FI 2023). As such, these insurances can incentivise insurance companies and insured entities to invest in nature-based approaches.

Potential barriers

The assessment of nature-related risks is challenging, and this makes the pricing of risks complicated (Marchal et al. 2019; UNEP FI 2023). There can be a mismatch between the beneficiaries of NbS and those who manage the natural assets or finance investments. This misalignment can reduce the perceived value of these schemes (CISL 2022).

Case Study: Private sector-backed insurance for reef protection in Mexico

In Quintana Roo, Mexico, a Coastal Zone Management Trust was established to maintain and protect the Mesoamerican coral reef and the beaches along the coast. The trust receives funds from various sources for the maintenance of the reef, and since 2019, it has also purchased an annual insurance policy to insure the coral reef against damage from natural disasters. The insurance provides payouts when the wind speeds exceed 96 knots along the Quintana Roo coastline. Upon activation, the insurance payouts finance immediate and long-term reef restoration efforts, such as clearing debris and reattaching broken corals. This innovative insurance scheme was the first attempt to use private sector funds directly to restore a natural ecosystem after hurricane damage.

Source: TNC (2023)

4.3.12 Community financing: Donations and crowdfunding

Community financing is based on private donations from local fundraising and crowdfunding platforms.

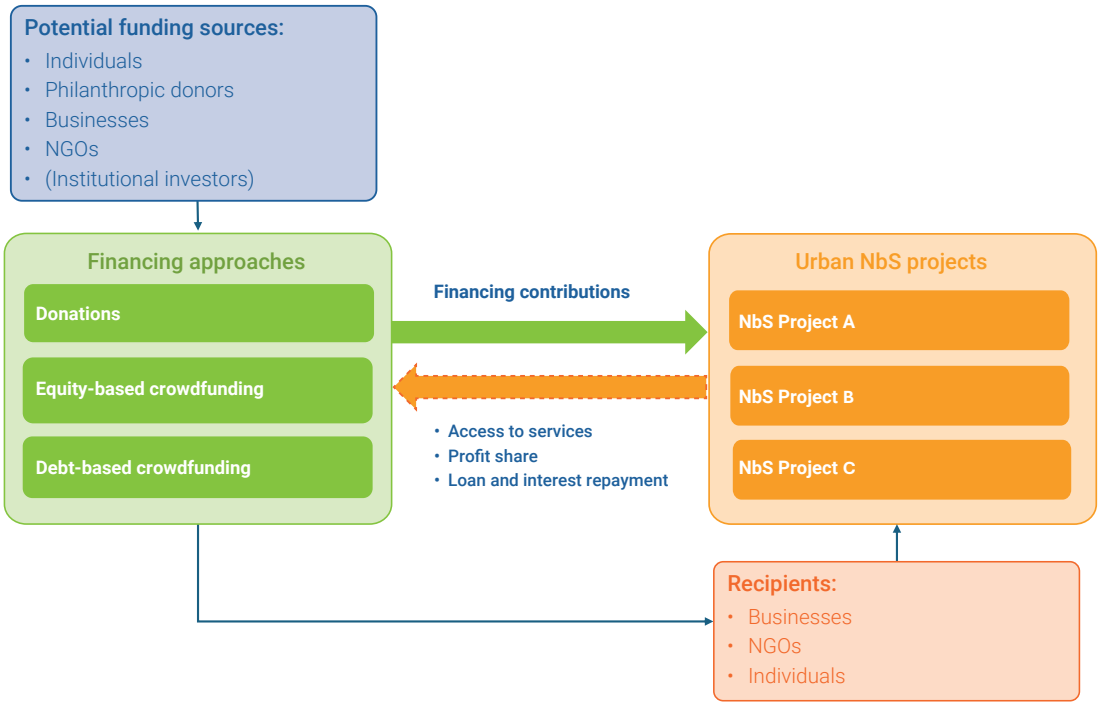
Overview

Local fundraising in cities can mobilise resources from individuals who directly benefit from NbS. Many urban NbS projects engage local communities and collect smaller financial contributions to support implementing or maintaining projects, such as funding tree planting. Beyond financial contributions, community support may also include the provision of land or voluntary labour.

Crowdfunding raises capital by collecting contributions from individuals and private entities to finance projects (Trinomics and IUCN 2019). Funding can be sourced through donation campaigns or online platforms, enabling project developers and businesses to obtain funding for various projects (see Figure 25). Key crowdfunding types relevant to urban NbS include (Maehle et al. 2020):

- **Donations**: Financial support provided without expecting a return. Contributors may sometimes receive non-financial rewards, such as early access to services.
- **Equity-based crowdfunding**: NbS projects or businesses can raise capital from investors by offering equity in exchange for potential return on their investment. For example, a company installing green stormwater infrastructure solutions might raise initial capital via a crowdfunding platform by selling equity in the company.
- **Debt-based crowdfunding**: NbS projects or businesses can obtain loans on crowdfunding platforms, which they repay with interest over time. Like sustainability bonds, this model allows NbS projects to secure financing for the initial investment costs, such as establishing a green roof on a community building and financing the repayment through cost savings generated by increased energy and water efficiency.

Figure 25: Schematic illustration of crowdfunding supporting urban NbS projects



Source: Authors.

Opportunities

Community financing is an alternative source for individuals or small businesses that may not qualify for accessing traditional financing. If the fundraising is successful, it can demonstrate demand for the NbS project and help attract further investment. Community fundraising can also help build community support around projects and deliver multiple benefits more equitably.

Potential barriers

It can be challenging to attract contributors on crowdfunding platforms. Funding goals may not be reached, resulting in the projects failing. Equity and debt-based crowdfunding may fall under stricter financial regulations than donations, complicating the financing process.

Case study: Equity crowdfunding for NbS

RaiseGreen is a crowd-investing platform designed to finance green projects. The activities supported include NbS-focused investments, such as companies implementing green stormwater management practices. RaiseGreen provides a marketplace where investors can purchase equity or debt, and project developers can access financing. The platform is open for individuals, startups, NGOs and local governments to seek funding for sustainability initiatives. The platform is suggested to help lower traditional financing barriers such as high upfront capital costs and impact certification requirements, reduce investment risks, and expand access to capital.

Sources: Global Infrastructure Hub (2021) and RaiseGreen (2024).

4.4 Key barriers to financing and strategies to overcome financing challenges

Although various financing sources and mechanisms are available for NbS projects in cities, widespread investment in such projects faces several barriers. This section overviews these challenges and discusses strategies to scale up NbS investments despite these obstacles.

4.4.1 NbS financing challenges

NbS investment faces several challenges (Toxopeus and Polzin 2021; Ng'etich 2022; WWF and South Pole 2022; de los Casares and Ringel 2023; EIB 2023). These include:

- the correct and comprehensive valuation of the multiple benefits of NbS;
- continued reliance on public financing sources, along with limited involvement of private financing sources
- the coordination between multiple public and private financing organizations and
- lack of experience in designing viable and sustainable financing approaches for various NbS types.

Valuation and Monetisation

As discussed in Chapter 4.1.1, the comprehensive valuation of NbS benefits is challenging. NbS often deliver multiple environmental and socio-economic benefits that extend beyond the immediate project implementation area and are realised over a more extended period. Beyond the evaluation challenge, many NbS benefits (e.g., public health and biodiversity protection) cannot be accounted for by traditional accounting methodologies for investment decisions. Another significant benefit of NbS investments is their potential to reduce costs (e.g., by avoiding damage or lowering the cost of health care). However, many of these cost savings are realised over a longer time, making them difficult to incorporate into traditional financial planning of investments.

Reliance on public financing sources with limited private sector involvement

While public funding is scarce, finite, and shared among competing societal and development priorities, private sector interest and readiness to invest in NbS remains low. The low willingness of the private sector to invest in NbS is primarily due to financial barriers like perceived high risks and the long-term investment timelines for realising

successful NbS investments because NbS projects often require longer financing timelines than traditional investments, leading to limited or uncertain short-term returns. Thus, NbS investments are more suitable for investors with long-term horizons (e.g., pension funds or insurance companies) and businesses with higher nature-dependency ratios (e.g., utility companies providing natural resource-based services in urban areas). However, the uptake also remains slow in these sectors. In addition, the financial mechanisms available to finance the operational and maintenance costs of NbS projects are more limited, requiring the exploration of financial innovations and new market-based mechanisms (Thompson et al. 2023; Favero and Hinkel 2024).

Limited coordination between public and private financing actors

NbS projects are often complex, requiring involvement and participation from various urban actors and sustained community support and ownership. They must be developed with multifunctionality and multi-stakeholder needs in mind because long-term success is only possible if there is ownership and commitment from implementation partners and community members. Traditional public-private partnership arrangements may not always be useful for NbS investments with higher upfront investment risk and lower return on investments. At the same time, blended financing mechanisms and arrangements are still underutilised for NbS investments.

Limited availability of successful NbS business models and bankable projects

While NbS projects are recognised to have the potential to generate multiple co-benefits, their initial planning and development may require considerable resources (IDB and UNEP 2021). Creating successful business models is further complicated by the context-specific nature of NbS, making them more complex to replicate (van Raalte and Ranger 2023). In addition, even with private sector actors willing to accept lower returns and higher risks and with additional support from public sector actors, commercial revenues may not be sufficient to cover all investment risks. Additional revenue generation mechanisms are not well explored or underutilised, and their upscaling would require novel and innovative approaches.

4.4.2 Opportunities to scale up NbS financing

Funders can consider innovative solutions tailored for different financing instruments and specific types of NbS to overcome the aforementioned challenges. Table 8 summarises possible strategies to scale up NbS financing according to funding and financing sources.

Table 8: Strategies to scale up NbS financing

Sources	Approach	Solution
Government funding	Identify new ways of channelling funding to NbS	Climate budgeting allocates a significant portion of a city's budget to address climate-related issues through strategic financial planning
		Land value capture mechanisms pooling private lands to designate green and blue infrastructures within given areas
	Revenue generation	Eco-taxes on activities with negative environmental impacts, intensive use of natural resources or grey infrastructures
		User fees of natural infrastructures, such as stormwater fees
		Selling development rights and leases of lands to raise funds
		Development levies to fund the investment costs of urban NbS
		Tax increment financing pre-financing NbS projects by leveraging future increases in property values
	Promoting the involvement of property and landowners	Introducing regulations requiring property landowners and businesses to integrate NbS into new developments or renovations
		Introducing environmental subsidies and tax incentives for property and landowners, businesses
	Encouraging private investments	Establishment of revolving funds/loans to finance NbS investments through the repayment of loans or continuous financial contributions
		Requiring companies to allocate CSR budgets for NbS initiatives
		Integration of NbS into procurement processes and PPPs
Public domestic and international funding	Pay-for-results grants	Grants provided based on achieving specific outcomes related to climate and environmental goals
	Blended finance, guarantees, and insurance schemes	Technical assistance for investment planning of projects that can be implemented with blended financing
		Guarantees and risk insurance for NbS investments to reduce the risk for private investors
	NbS bonds	Issuing NbS bonds to finance nature-focused investments
Private companies	Cost savings	Reducing the cost of utility services and incidental damages by implementing NbS
	Exploring blended financing	Creating stewardship schemes, where several private companies invest in the protection of natural assets, such as watershed areas
		Developing investment schemes where financing resources are provided by different beneficiaries (Scolobig et al. 2023)
	Revenue generation	Generating revenues through the sale of commodities
		User charges for the use of green and blue infrastructures
		Collecting revenues from PES and the sale of carbon and nature credits
	Leveraging ESCOs	Using ESCOs to finance energy-efficient NbS projects via performance-based contracts, ensuring shared energy savings and financial benefits
Institutional investors	Banks	Debt issuance through the securitisation of natural capital, using assets like land and carbon storage as collateral (EIB 2023)
		Facilitating financial transactions where debt is forgiven in exchange for local investments in environmental projects (Finance for Biodiversity 2020)
		Offering contingent loans to NbS project developers with the repayment conditional on revenue generation (EIB 2023)
	Insurance companies	Introducing insurance products that provide coverage for NbS projects reduces the risk of insurance provision and investments
	Investment funds	Aggregation of multiple individual projects into a single investment product (Favero and Hinkel 2024)
		Seeking investment from funds with longer investment horizons (e.g., by pension funds) to better align with the timelines of NbS projects

Sources: Authors compilation based on Maciulyte et al. (2018), Trinomics and IUCN (2019), IDB and UNEP (2021), EIB (2023), Scolobig et al. (2023), UNEP (2023b), NAP Global Network (2024), CCFLA (2024), Favero and Hinkel (2024), and Machiels et al. (2024).

5 Business models for urban Nature-based Solutions

This section presents generic business models for urban NbS investments that can effectively respond to cities' climate change adaptation and mitigation needs. These models aim to serve as a starting point for planning more detailed NbS investment plans for projects and organizing relevant information for investors, project stakeholders and the public.

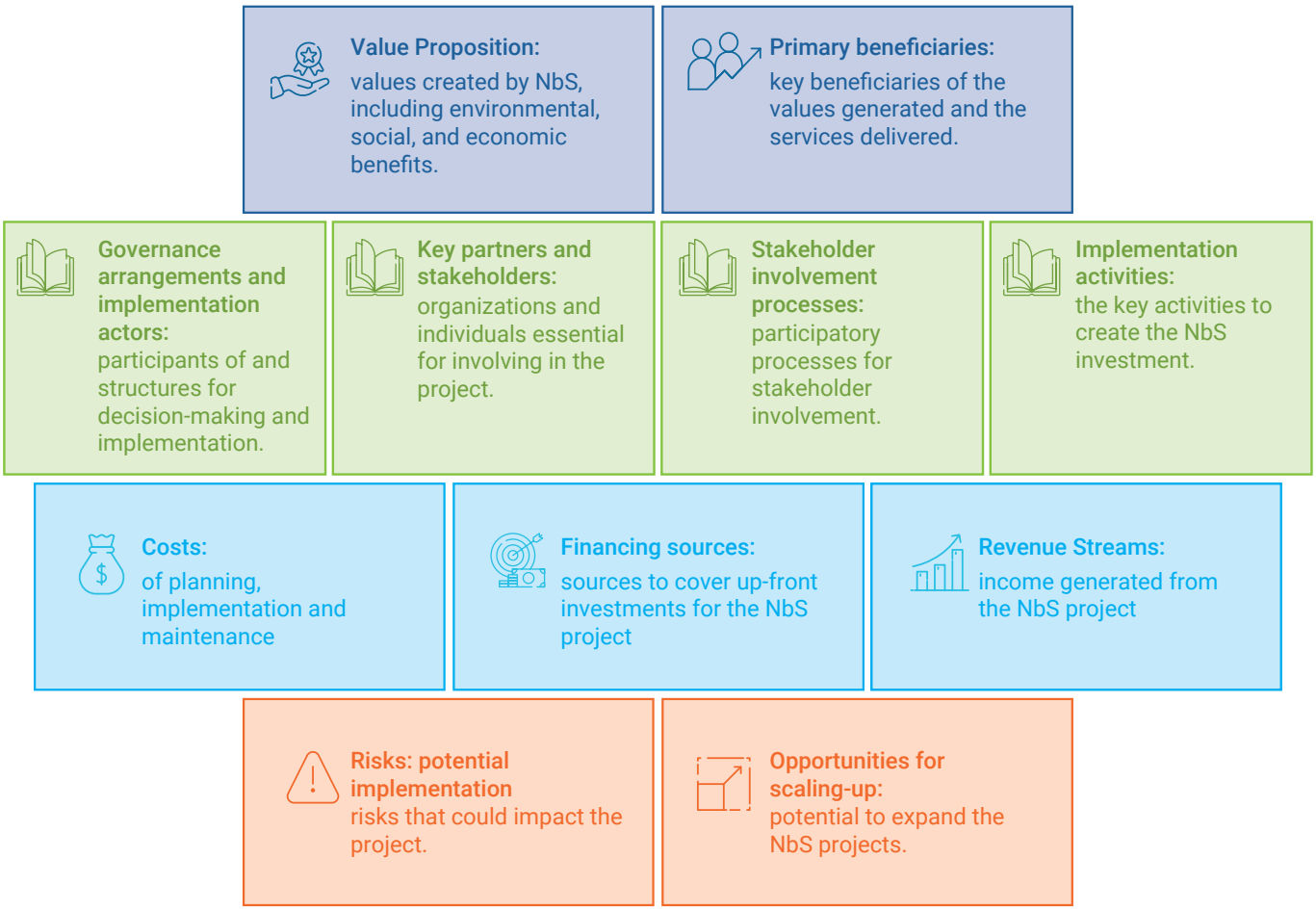
The presented business models are tailored for specific NbS types that address urban sustainability challenges, including urban heat stress, water management, coastal protection, carbon sequestration and energy efficiency (see Table 9). While for this publication, each NbS type is contextualised within a specific climate challenge, NbS have the inherent potential to address multiple climate hazards simultaneously (Debele et al.2023), and as such, the application of these models also deliver multiple co-benefits for various climate challenges discussed in this chapter, as well as additional environmental and socio-economic benefits.

Table 9: NbS addressing climate challenges in urban areas for which business model canvases are presented in this chapter

Category	Examples of urban Nature-based Solutions
Addressing urban heat	Urban parks
	Green buildings: Roofs and vertical surfaces
	Renaturing rivers and lakes
Flood management	Green areas for water management: rain gardens, vegetated swales, filter strips
	Urban floodplain restoration
Drought management	Rainwater harvesting
	Greening of grey infrastructures
Coastal protection	Mangrove restoration and conservation
	Dune stabilisation and restoration
Carbon sequestration	Urban wetland restoration
	Urban forest areas

The business model framework applied here is based on two previously developed NbS Business Models Canvas approaches (Egusquiza et al. 2021; Stork et al. 2023). The applied approach aims to provide a comprehensive initial understanding of NbS projects as investment opportunities, advocating for systemic transition towards NbS approaches in cities. The model incorporates the aspects included in Figure 26.

Figure 26: Key elements of the urban NbS Business Model canvas



Source: Adapted from *Egusquiza et al. (2021) and Stork et al. (2023)*

The business models presented in this section were informed by cases presented in existing NbS databases, including the Climate-ADAPT (EEA 2024), PANORAMA (2024), UNA (2023), OPPLA (2023), Urban Governance Atlas (Interlace Hub 2023) and the UrbanGreenUp (2018) case study depository, and reviews of NbS implementation or its specific aspects (Maciulyte et al. 2018; Gann et al. 2019; Toxopeus 2019; Teutli et al. 2020; Panduro et al. 2021; Somarakis, Stagakis and Chrysoulakis 2021; World Bank 2021a; EC 2023; Serra-Llobet et al. 2022; Naumann et al. 2023; Lozano et al. 2023).

While the below-presented business model canvases provide a general framework for building a business case for urban NbS investments, assessing the actual profitability of specific NbS projects will require detailed analysis, which includes evaluating each project's unique benefits, cost-saving opportunities, investment and maintenance costs, broader regulatory requirements, and market needs on a case-by-case basis, as discussed in Section 4.1.

5.1 Urban NbS Business Models for addressing urban heat stress

This section presents an overview of business models for selected urban NbS types, which have a high potential to reduce urban heat and regulate temperature, including urban parks, green buildings with green roofs and walls, and the renaturing of rivers and lakes.

5.1.1 Urban park creation or renovation

Urban park development can encompass various activities to enhance green spaces within cities. These include greening neighbourhood spaces, creating small pocket parks to serve residents, and developing or restoring larger urban parks with various functionalities and recreational opportunities. The creation or restoration of urban parks involves green space development, the establishment of supporting infrastructures and amenities, and activities to operate, maintain and monitor them.

Main benefits:

- Mitigation of urban heat
- Increased water retention capacity
- Increased carbon sequestration
- Improved air quality
- Space for recreation and community gatherings
- Improving quality of life and health
- Increase in property values, tourism, and local business activities

Primary beneficiaries:

- Local residents: benefits from reduced temperatures, air quality improvements and recreational opportunities
- Businesses in the vicinity: increased foot traffic and economic activity
- Municipal government: Gains from reduced infrastructure and healthcare costs, and potential increase in property values

Implementation activities:

- Site identification and land acquisition
- Site analysis, community engagement and design·
- Permitting
- Site preparation
- Installation of utilities and irrigation system
- Construction of pathways
- Landscaping and planting
- Construction of playgrounds, sports facilities and amenities
- Installation of lighting, signage and security
- Maintenance and monitoring of site conditions

Implementation actors and governance arrangements:

Development by:

- Local governments
- Public sector entities
- Private companies, businesses
- Public-private partnerships

Management by:

- Local government, park department
- Park management authority
- Joint management with community

Key partners and stakeholders:

- Residents
- Government agencies
- Community groups and organizations
- Local businesses

Stakeholder involvement approaches:

- Consultation process for park design
- Joint implementation (e.g., tree planting)
- Community volunteering program (e.g., to support plant maintenance)
- Feedback provision

Costs:

- Park planning and design
- Land acquisition
- Permits
- Material and labour cost of construction and infrastructure
- Green infrastructures and planting
- Operational expenses for maintenance, security, utilities and plant care
- Administration and community engagement

Financing up-front investment:

- Local government funding
- Land value capture
- International donor funding
- Companies CSR funds
- Grants from private foundations
- Sustainability bonds
- Community funding from donations and crowdfunding

Revenue streams:

- Event hosting
- Rentals of facilities
- Membership programs
- Corporate sponsorships
- Adopt-a-park donation programs for corporations and individuals
- Increased property taxes

Risks:

- Extreme weather events could damage the park infrastructure
- Long-term funding not secured for maintenance
- Reduced safety or safety perceptions
- Gentrification due to increased property values
- Maintenance challenges

Opportunities for scale-up:

- Connecting park creation for green corridor development
- Expanding the park with additional NbS features such as wetlands to support flood and stormwater management
- Including community gardens to support local, community food production

5.1.2 Greening buildings

Green building development can include green roofs, walls, vertical gardens, and green facades. Green roofs are vegetative layers on rooftops. Extensive green roofs have low-maintenance plants that regulate temperature and manage stormwater. Intensive green roofs include shrubs and trees and can also offer recreational opportunities. Green walls and facades are planting structures attached to or covering the vertical surfaces of buildings.

Main benefits:

- Mitigation of urban heat and temperature regulation
- Energy efficiency
- Increased water retention capacity
- Improved air quality
- Habitat creation and biodiversity enhancement
- Aesthetic and recreational value
- Increased property values

Primary beneficiaries:

- Building owners and tenants: Reduced energy costs, enhanced property value, improved building aesthetics and well-being of tenants/employees
- Local residents: Reduced temperature and improved air quality, pleasant urban environment
- Municipal governments: Reduced burden on stormwater infrastructure, reduced energy consumption and improved air-quality city-wide, and enhanced urban biodiversity

Implementation activities:

- Planning and design
- Roof preparation
- Establishing insulation and drainage
- Setting up growing medium
- Planting
- Regular maintenance
- Monitoring and adjustments

Implementation actors and governance arrangements:

Implementation and maintenance by:

- House/building owners
- Property developers
- Private companies
- Local governments

Key partners and stakeholders:

- Building owners and developers
- Building residents and users
- Municipal departments
- Public building administrators
- Companies
- Universities and research institutions

Stakeholder involvement approaches:

- Co-design of roofscape
- Joint maintenance of green roof
- Citizen monitoring activities (e.g., observation of butterflies)

Costs:

- Structural and environmental assessment
- Design
- Permitting
- Site preparation
- Material for infrastructure and planting
- Labour for installation
- Irrigation systems (if needed)
- Maintenance
- Monitoring equipment

Financing up-front investment:

- Government grants or subsidies to public entities, NGOs or private for-profit and non-profit organizations or households
- Tax incentives to private for-profit and non-profit organizations or households
- Local government funding for public buildings
- Companies directly funding projects as corporate investments or CSR activities
- Grants from philanthropic and non-profit organizations to public organizations or households
- Loans from financial institutions

Revenue streams:

- Reduced energy costs
- Tax incentives
- Increased property values
- Increased rental income
- Event hosting
- Income from urban agriculture

Risks:

- Construction challenges
- High maintenance costs
- Weather-related damages
- Safety perceptions

Opportunities for scale-up:

- Launching educational and research programs
- Assessing and demonstrating the benefits of green roofs to motivate other actors for green roof implementation
- Complementing the green roofs with solar panels
- Creating a network of green roofs citywide for systemic benefits

5.1.3 Renaturing rivers and lakes

Urban river and pond restoration projects focus on revitalising natural water bodies, such as rivers, streams, lakes and ponds in cities. Restoration activities primarily include removing pollutants, reopening or reconfiguring channels for natural flow, stabilising banks, and planting native vegetation.

Main benefits:

- Temperature regulation and reduction
- Flood risk reduction
- Improved water quality
- Enhanced biodiversity and habitat creation
- Recreation and tourism opportunities
- Increased property values and local business activity

Primary beneficiaries:

- Local residents: Reduced temperatures, improved life quality and recreational opportunities
- Municipal governments: Reduced infrastructure cost, improved capacity to manage floods and stormwater, and potential increase in property values
- Businesses: Increased economic activity in the vicinity

Implementation activities:

- Hydrological and ecological assessments
- Removal of pollutants and debris
- Re-establishment of natural river channels
- Bank stabilisation and erosion control
- Planting native vegetation
- Creation of riparian buffers
- Installation of recreational facilities
- Water quality and biodiversity monitoring

Implementation actors and governance arrangements:

Implementation actors:

- Local governments (with state or national governments)
- Public-private partnerships (e.g., with water service providers)

Management by:

- Local governments
- Water service utilities
- Water and environmental management agencies
- Joint management with community groups

Key partners and stakeholders:

- Government agencies
- Residents
- Community groups
- Environmental NGOs
- Research organizations
- Local businesses

Stakeholder involvement approaches:

- Co-planning restoration
- Consultation process
- Joint management (e.g. river clean-up events)
- Educational workshops and tours
- Community monitoring

Costs:

- Assessment and design
- Legal and environmental permitting
- Costs of channel reconfiguration, riverbank stabilisation
- Planting of green infrastructure
- Public access points and amenities (e.g., trails)
- Community outreach and promotion
- Monitoring equipment and programs

Financing up-front investment:

- Local government earmarked budget
- Land value capture·
- International, national funding or grants
- Company CSR funds
- Private investments
- Grants from environmental foundations and NGOs
- Corporate sponsorships and CSR programs
- Community funding through crowdfunding and fundraising events

Revenue streams:

- Reduced water management costs
- Increased land and property values
- Ecotourism and recreational activities
- PES
- Water and biodiversity credits

Risks:

- Extreme weather events could disrupt restoration efforts
- Pollution incidents from surrounding areas
- Regular maintenance needs
- Resistance from stakeholders due to land use changes

Opportunities for scale-up:

- Design a multifunctional blue-green space that also provides recreational and aesthetic benefits
- Integrating with other NbS projects, such as wetland restoration and green corridors
- Expanding restoration efforts to create larger, interconnected blue infrastructures for city-wide benefits
- Creating volunteer opportunities for community engagement
- Developing partnerships with educational institutions for ongoing research and monitoring

5.2 Urban NbS Business Models for reducing urban flooding

This section provides business model canvases for establishing SUDS with rain gardens, vegetated swales, and filter strips and implementing floodplain restoration projects to manage stormwater and reduce urban flooding events.

5.2.1 Green areas for water management

Green water management solutions re-create natural processes to manage rainwater sustainably. SUDS elements may include rain gardens, vegetated swales, filter strips, and biofiltration basins. Rain gardens are shallow, vegetated basins, while swales and filter strips are vegetated channels that can store, filter and drain stormwater. Biofiltration, or bioretention basins, are more extensive, engineered basins filled with vegetation to filter and allow water to infiltrate the ground.

Main benefits:

- Flood risk reduction
- Improved water quality through filtration of pollutants
- Habitat creation and biodiversity enhancement
- Temperature reduction
- Erosion and landslide control
- Reduced costs of urban management
- Increased property values

Primary beneficiaries:

- Home-, building- and land-owners: Reduced flood risk, reduced temperatures and improved local environment
- Developers and municipal governments: Lower infrastructure maintenance costs, enhanced urban resilience, potential increase in property values
- Local businesses: Lowered maintenance costs, reduced risks of damages from flooding

Implementation activities:

- Site identification
- Hydrological and ecological assessments of target areas
- Design and planning of SUDS elements like rain gardens and swales
- Building support infrastructure
- Selecting and planting vegetation
- Setting up systems for water quality and performance monitoring
- Workshops and training for local communities to secure maintenance support

Implementation actors and governance arrangements:

Development by:

- Local governments (with state or national governments)
- Public-private partnerships (e.g., water service providers)
- Companies or private landowners
- NGOs or community groups

Maintenance by:

- Local government
- Water services utility
- Water and environmental management agencies
- Joint management with community groups

Key partners and stakeholders:

- Building and house-owners
- Land-owners and developers
- Municipal departments
- Building residents and users
- Public utility and real estate companies
- Universities and research institutions

Stakeholder involvement approaches:

- Consultation meetings to secure stakeholder support
- Educational programs to raise awareness among stakeholders
- Involving residents in maintenance
- Citizen monitoring activities

Costs:

- Hydrological and ecological assessments
- Cost of design
- Fees for permits
- Materials and labour for building supporting infrastructure
- Planting
- Monitoring equipment
- Community outreach

Financing up-front investment:

- Local governments and public service utilities funding projects
- Companies, as corporate investments
- Government grants or subsidies to public entities, NGOs or private for profit and non-profit organizations or households
- Grants from non-profit organizations to public organizations or households
- Project developers issuing sustainability bonds

Revenue streams:

- Reduced water management costs
- PES
- Tax credits
- Company sponsorship and crowdfunding support for maintenance

Risks:

- Potential damage from extreme weather events
- Contamination from surrounding areas
- Ensuring ongoing maintenance and care
- Opposition from local stakeholders

Opportunities for scale-up:

- Creating integrated SUDS across districts to maximise flood and stormwater management benefits
- Introducing sewer fee reduction mechanism to motivate land and building owners to implement SUDS elements for water management
- Increasing community participation in maintenance and monitoring

5.2.2 Urban floodplain restoration

Floodplain restorations are large-scale projects that aim to re-establish a floodplain's natural dynamics and connectivity among its rivers or streams. Activities can include reconnecting natural floodplains to rivers and restoring natural hydrology patterns, re-planting native vegetation, and creating/restoring wetlands within the floodplains (Serra-Llobet et al. 2022).

Main benefits:

- Flood risk reduction
- Water quality improvements
- Carbon sequestration
- Ecosystem restoration and biodiversity improvements
- Temperature regulation
- Recreational opportunities
- Regeneration of derelict areas

Primary beneficiaries:

- Local communities: Benefiting from reduced flood risks and enhanced recreational opportunities.
- Farmers in peri-urban areas: Gaining from flood-adapted agricultural practices
- Local governments and economies: Benefiting from increased tourism and recreational activities

Implementation activities:

- Securing land in restoration areas
- Permitting process
- Construction of river channels and excavating areas for water bodies
- Habitat restoration and planting
- Maintenance
- Monitoring

Implementation actors and governance arrangements:

Implementation by:

- National and local governments and government agencies
- International organizations
- NGOs
- Academic and research institutions
- Private utilities
- Landowners

Management by:

- Government agencies
- Water management agencies and utilities
- Often in collaboration with NGOs, research and conservation organizations and landowners

Key partners and stakeholders:

- National and regional governments and agencies
- Local governments and agencies
- Academic and research organizations
- Non-governmental organizations
- Local businesses and farmers
- Local/indigenous communities

Stakeholder involvement approaches:

- Public hearings and community meetings
- Co-planning with local landowners and conservation groups
- Advisory committees to oversee and support implementation
- Education and training
- Citizen monitoring
- Feedback mechanism to support adaptive management

Costs:

- Land acquisition
- Costs of planning and permitting
- Equipment and labour costs of construction and infrastructure improvements
- Material and labour costs of planting and habitat creation
- Management and maintenance
- Monitoring

Financing up-front investment:

- National, regional and local government funding
- Grants and technical assistance from international organizations and NGOs
- Private investments and equity financing when projects include economic or recreational benefits
- Sustainability, green or blue bonds
- Insurance investments

Revenue streams:

- Increased agricultural revenues
- Revenues from tourism and recreational activities
- Enhanced property values (due to decreased risk of flooding)
- PES
- Revenues from selling water and carbon credits
- Fees charged for CSR activities

Risks:

- High upfront costs and potential competition for existing land uses
- Potential for increased flooding if the project is not properly designed or managed
- Unintended ecological consequences if restoration activities are not carefully managed

Opportunities for scale-up:

- Linking smaller restoration sites to create larger, contiguous areas of restored floodplain.
- Engaging multiple stakeholders to support implementation and secure maintenance
- Introducing monitoring to support adaptive implementation management
- Integrating floodplain restoration with sustainable water management to support broader climate change adaptation and mitigation objectives

5.3 Urban NbS Business Models for drought management

Drought management in urban areas can be challenging because the source of drought conditions often falls outside of cities' jurisdiction. The solutions presented in the previous section for stormwater and flood management can also reduce the risk of droughts by maintaining groundwater levels, increasing humidity and reducing temperatures. This section presents two additional NbS business models canvases for urban drought management: rainwater harvesting and greening of grey infrastructures.

5.3.1 Rainwater harvesting

Rainwater harvesting is collecting and storing rainwater for reuse in buildings, courtyards, institutional spaces and urban agricultural areas. Rainwater harvesting systems can vary from simple rain barrels to more complex systems with tanks, pumps and purification systems.

Main benefits:

- Water conservation and drought resilience
- Lowered water bills and sewer fees
- Reduced stormwater run-off and flooding events
- Soil erosion and pollution control

Primary beneficiaries:

- Homeowners and property owners: Increased water security and reduced water fees
- Landowners and urban farmers: Reliable water source for irrigation and livestock
- Municipalities: Lowered demand on public water supply and reduced stormwater

Implementation activities:

- Assessment of site-specific water conditions
- Design of the rainwater harvesting system, including catchment area, storage, filtration, and distribution.
- Setting up the harvesting infrastructure
- Regular inspection and cleaning
- Monitoring system performance for necessary adjustments

Implementation actors and governance arrangements:

Implementation and management by:

- House/building owners
- Property developers
- Private companies
- Local governments on public buildings and lands

Key partners and stakeholders:

- Households and property owners
- Building users and residents
- Businesses with operational facilities
- Landowners and farmers
- Water utilities and other
- public service entities
- Public building administrators
- Local governments and municipal departments

Stakeholder involvement approaches:

- Education and training for potential implementers
- Co-design and joint implementation for larger-scale, district/community-wide rainwater harvesting initiatives

Costs:

- Design costs
- Equipment purchases and installation costs
- Operational costs of water treatment, maintenance and repairs
- Water quality monitoring costs

Financing up-front investment:

- Local government funding to public buildings
- Government subsidies and tax incentives
- Local government grants
- NGO grants
- Loans from financial institutions

Revenue streams:

- Reduced water and sewer fees
- Selling surplus harvested water
- Increased property values

Risks:

- Upfront investment requirements can be too high for households
- Regular maintenance and monitoring is needed to ensure functionality
- Water quality problems due to contamination

Opportunities for scale-up:

- Launching initiatives to educate the public and businesses about rainwater harvesting benefits
- Creating networks of rainwater harvesting systems
- Integrating renewable energy sources (e.g. solar-powered pumps)
- Introducing regulatory requirements for new constructions or building renovation

5.3.2 Greening grey infrastructures: streets, roadsides, public spaces

In densely built-up urban areas, green space can be expanded by transforming grey infrastructures into smaller patches of green spaces. Transformation can include planting trees along streets, roadsides, railway and tram tracks and greening public spaces like playgrounds, parking lots and institutional areas like schoolyards. Besides drought reduction, street greening initiatives have a high potential to reduce urban heat stress and support stormwater management.

Main benefits:

- Increased water retention capacity
- Groundwater maintenance
- Microclimate regulation
- Improved air quality
- Enhanced aesthetic and visual appeal of streets
- Improved health through increased greenery
- Reduced noise pollution
- Increase in property values and local business activity
- Regeneration of derelict areas

Primary beneficiaries:

- Residents and pedestrians: Benefits from reduced temperatures, air quality improvements, and improved street aesthetics
- Public facilities and utilities: Reduced costs of infrastructures, microclimate regulation for reduced indoor temperature, energy savings
- Municipal government: Gains from reduced infrastructure and healthcare costs, and potential increase in property values

Implementation activities:

- Site selection and analysis
- Community engagement and planning
- Site preparation
- Infrastructure, irrigation system establishment
- Planting of trees, shrubs, and other vegetation
- Installation of street furniture (e.g., benches)
- Construction of permeable pavements
- Maintenance and monitoring

Implementation actors and governance arrangements:

Development by:

- Local governments
- Public institutions
- NGOs or Community groups
- Local businesses, private utilities
- Public-private partnerships

Maintenance by:

- Public green space management companies
- Private utilities
- Community groups
- Joint management with residents

Key partners and stakeholders:

- Residents
- Government agencies
- Public and private utilities
- Community groups and organizations
- Local businesses

Stakeholder involvement approaches:

- Consultation process and co-design for street greening design
- Joint implementation (e.g., community planting days)
- Community volunteering program for maintenance
- Tree health monitoring and reporting system
- Feedback provision mechanisms

Costs:

- Site assessment and planning
- Material and labour cost of infrastructure
- Planting costs
- Maintenance expenses (e.g., watering, pruning)
- Monitoring costs

Financing up-front investment:

- Local government funding
- Subsidies/tax incentives provided to private organizations
- Grants from NGOs, private foundations
- CSR funding from companies
- Community funding from donations and crowdfunding
- Land value capture
- Sustainability bonds

Revenue streams:

- Sponsorships from local businesses
- Adopt-a-tree programs for individuals
- Event hosting (e.g., festivals, markets)
- PES and Carbon credits

Risks:

- Poor soil quality or water availability can affect vegetation health
- Extreme weather events, pest infections, or invasive species could damage greenery
- Potential conflicts over space use (e.g., parking vs. greening)
- Safety concerns
- Vandalism
- Securing financing for maintenance

Opportunities for scale-up:

- Creating green corridors connecting multiple streets and creating superblocks
- Expanding greening initiatives to include vertical gardens and green roofs
- Integrating street greening with public transport and cycling infrastructure
- Developing educational programs for community support and involvement
- Upscale into a city-wide program to involve private sector actors and secure financial revenues (e.g., via carbon offsetting, sustainability bonds)

5.4 Urban NbS Business Models for coastal protection

NbS projects can support coastal protection in urban areas in various ways, including beach nourishment, dune stabilization and restoration, living shorelines, and the protection and restoration of coastal vegetation. The following section presents business model canvases for mangrove restoration and conservation, and dune stabilisation and restoration.

5.4.1 Mangrove restoration and conservation

Mangrove restoration and conservation is rehabilitating and protecting degraded mangrove forest ecosystems to improve their ecological functions that support coastline stabilisation and protection against coastal erosion and storm surges. Mangrove restoration activities can include restoring natural water and tidal flows, removing debris, pollutants or invasive species and planting and growing mangrove seedlings (Teutli et al. 2020). Effective mangrove restoration also requires community engagement and ongoing monitoring.

Main benefits:

- Flood and storm surge protection
- Coastline stabilisation
- Temperature regulation and reduction
- Carbon sequestration
- Enhanced biodiversity and habitat creation
- Livelihood support
- Improved water quality
- Opportunities for ecotourism
- Increased coastal property values and local business activities

Primary beneficiaries:

- Coastal communities: Reduced coastal erosion, increased storm protection and increased recreational opportunities
- Businesses: Safeguarded and increased economic activities related to fisheries, tourism, and local commerce
- Municipal governments: Reduced infrastructure cost, enhanced coastal protection, and potential increase in property values and revenue generated by businesses

Implementation activities:

- Site identification
- Ecological assessments Stakeholder engagement
- Site preparation, including water flow restoration, debris removal
- Nursery establishment for mangrove seedlings
- Planting and growing mangrove seedlings
- Installation of facilities (boardwalks, observation towers)
- Water quality and biodiversity monitoring
- Regular maintenance and adaptive management

Implementation actors and governance arrangements:

Implementation by:

- Local governments (with regional or national governments)
- NGOs
- International organization
- Companies and private foundations
- Public-private partnerships (e.g., with environmental organizations, businesses)

Management by:

- Local communities
- Local NGOs, grassroots organizations
- Local governments and environmental management agencies
- Collaboration with businesses in the fisheries and aquaculture sectors

Key partners and stakeholders:

- Residents and local communities
- NGOs and grassroots organizations
- Municipal departments, government agencies
- Local businesses

Stakeholder involvement approaches:

- Co-planning restoration
- Consultation
- Community planting
- Joint management (e.g., mangrove planting)
- Educational workshops
- Community monitoring and citizen science programs

Costs:

- Site assessment costs
- Planning and design costs
- Legal and environmental compliance costs
- Site restoration costs
- Planting and growing mangrove seedlings
- Establishment of public infrastructures and amenities
- Maintenance and management costs
- Monitoring equipment

Financing up-front investment:

- Local government funding
- International, national funding or grants
- Company CSR funds
- Private investments and equity financing
- Grants from private foundations and NGOs
- Community funding through crowdfunding
- Insurance investments

Revenue streams:

- Extreme weather events could disrupt restoration efforts
- Pollution incidents from surrounding areas
- Regular maintenance needs
- Resistance from stakeholders due to land use changes

Risks:

- Extreme weather event impacts (e.g., forest fires)
- Invasive species can undermine native biodiversity
- High upfront costs and insufficient funding for conservation and management
- Resistance or lack of community support from local communities and landowners
- Displacement of local Indigenous communities

Opportunities for scale-up:

- Integration with other NbS projects, such as coral reef restoration, for synergetic benefits
- Design multifunctional blue-green spaces that also provide social and economic benefits
- Creating volunteer opportunities for community engagement
- Increasing gender equality by providing work opportunities, income sources and involvement in management
- Expanding restoration efforts to create larger, interconnected coastal infrastructures for region-wide benefits

5.4.2 Dune stabilisation and restoration

Dune stabilisation and restoration aim to prevent erosion, preserve habitats, and maintain biodiversity in coastal areas by improving the structural integrity of coastal dunes. Activities can include planting native vegetation, sand fencing and dune nourishment.

Main benefits:

- Flood and storm surge protection
- Reduction of coastal erosion
- Habitat creation
- Improved water quality
- Reduced costs of coastal protection
- Increased coastal property values
- Support to local business activities
- Regeneration of derelict areas

Primary beneficiaries:

- Coastal communities: Reduced coastal erosion and increased storm protection
- Businesses: Safeguarded and increased economic activities related to tourism and fisheries.
- Municipal governments: Reduced infrastructure costs, enhanced coastal protection, and potential increase in property values and sustainable tourism

Implementation activities:

- Assessment of site conditions and stakeholder engagement
- Planning of stabilisation approach
- Site cleaning from debris and invasive species
- Establishment of dune fencing and access infrastructures
- Planting native species to stabilise dunes
- Regular monitoring and vegetation replanting/
- management

Implementation actors and governance arrangements:

Development by:

- Local governments (potentially in collaboration with national or regional governments)
- National or regional agencies and authorities
- NGOs and community groups
- International organization
- Universities and research institutions
- Companies and private foundations)

Management by:

- Local governments and environmental management agencies
- Local communities
- Local NGOs, grassroots organizations
- Collaboration with local businesses

Key partners and stakeholders:

- National and regional government agencies
- Municipal departments, government agencies
- Local businesses
- Construction companies
- Local/Indigenous communities
- NGOs and grassroots organizations

Stakeholder involvement approaches:

- Stakeholder consultation
- Co-planning restoration
- Joint implementation and management (e.g., dune planting)
- Educational workshops and trainings
- Community monitoring

Costs:

- Site assessment and planning
- Coastal stabilisation equipment, materials, and labour
- Cost of planting and growing native vegetation
- Establishment of public access points
- Maintenance and management
- Monitoring equipment and programs
- Community outreach and promotion

Financing up-front investment:

- Local or national government funding
- International, national funding or grants
- Company CSR funds
- Grants from private foundations and NGOs
- Community funding through crowdfunding
- Insurance investments

Revenue streams:

- Ecotourism and recreational activities
- PES
- Carbon and biodiversity credits
- Reduced coastal management and disaster risk costs

Risks:

- High and ongoing maintenance needs to safeguard restoration results
- Human activities could disrupt local ecosystems
- Extreme weather events could halt restoration efforts
- Pollution incidents from surrounding areas

Opportunities for scale-up:

- Community engagement to ensure long-term support to restoration efforts
- Integration with other coastal protection projects, such as coral reef restoration.
- Design multifunctional blue-green spaces that also provide social and economic benefits, e.g., offer opportunities for ecotourism

5.5 Urban NbS Business Models for carbon sequestration

Urban NbS projects not only have the capacity to support adaptation but also to sequester carbon emissions and reduce GHG emissions via energy-saving measures. The following section includes two NbS examples with significant carbon sequestration potential.

5.5.1 Urban forest conservation and restoration

Urban forest areas are natural or planted woodlands often located in the peripheries of urban centres. These forests can provide various ecosystem services and offer urban residents recreational, physical exercise and revenue-generation opportunities. NbS in urban forest areas can include protection, conservation, ecological management and restoration activities.

Main benefits:

- Carbon sequestration
- Improved air quality through pollutant absorption
- Temperature regulation lowered local temperature
- Conservation of natural habitats for various species
- Improved water management (flood and drought risk reduction)
- Increased recreational opportunities
- Improved health and reduced healthcare costs
- Increased business opportunities (e.g., tourism, farming)
- Increased property values

Primary beneficiaries:

- Residents: Benefitting from air quality improvements, temperature regulation, and recreational opportunities
- Municipal governments: Enhanced urban resilience and increased carbon sequestration capacity
- Local businesses (e.g., in tourism, agriculture): Increased/safeguarded economic opportunities
- NGOs/Educational institutions: Citizen involvement, research and educational opportunities

Implementation activities:

- Assessment of current land uses, existing ecological conditions in the area
- Identifying stakeholders
- Identifying suitable locations for forest development, conservation, or restoration
- Environmental impact assessments and feasibility studies
- Land acquisition and permits
- Restoration of soil and natural water courses
- Planting native tree species
- Installation of amenities and facilities (e.g., walking trails, signage)
- Setting up a management plan for the forested area
- Monitoring changes in biodiversity and control of invasive species
- Education and community involvement in management and monitoring

Implementation actors and governance arrangements:

Implementation by:

- National and local governments and government agencies
- International organizations
- NGOs and community groups
- Collaboration with the involvement of NGOs, academic and research institutions, private utilities, landowners, community groups or local businesses

Management by:

- Government agencies often in collaboration with NGOs, research and conservation organizations and landowners

Key partners and stakeholders:

- Local governments and agencies
- National and regional governments and agencies
- NGOs and community groups
- Academic and research organizations
- Local businesses and farmers
- International organizations, donors
- Indigenous communities

Stakeholder involvement approaches:

- Co-planning with local communities, landowners and conservation groups
- Public hearings and community meetings
- Joint implementation (e.g., tree planting)
- Awareness-raising campaigns about protection of forested areas
- Citizen monitoring to support adaptive management

Costs:

- Land acquisition
- Costs of planning and permitting
- Material and labour costs of habitat restoration and planting
- Costs of management and maintenance
- Administration and costs of public engagement
- Monitoring

Financing up-front investment:

- National, regional and local government funding
- Grants and technical assistance from international organizations
- Grants and technical assistance from NGOs
- Corporate sponsorship, grants from philanthropic foundations
- Private investments and equity financing when projects include economic or recreational benefits
- Sustainability and green bonds

Revenue streams:

- Revenues from ecotourism (guided tours, entrance fees)
- Revenues from sustainable forestry
- Enhanced property values (due to the proximity of forest areas)
- PES
- Revenues from selling carbon credits

Risks:

- Extreme weather event impacts (e.g., forest fires)
- Invasive species can undermine native biodiversity
- High upfront costs and insufficient funding for conservation and management
- Resistance or lack of community support from local communities and landowners
- Displacement of local Indigenous communities

Opportunities for scale-up:

- Engaging community groups and encouraging community-led initiatives to support implementation and secure maintenance
- Gathering information about early results to support adaptive implementation management
- Accessing international climate finance and green bonds scheme
- Integration with regional and national plans to secure project sustainability and support broader climate change adaptation and mitigation goals
- Partnering with neighboring municipalities and regions to create a network of peri-urban forest areas

5.5.2 Urban wetland restoration

Wetland restoration is re-establishing degraded wetland areas to their natural state to provide their original ecological functions. While urban wetlands can have significant potential for carbon sequestration (Were et al. 2019), wetlands are also very efficient for flood and drought management by storing excess rainwater first and then slowly releasing it to the ground. They can help maintain groundwater levels and increase local humidity during dry periods.

Main benefits:

- Increased water retention capacity
- Maintenance of groundwater levels
- Reduced flood risk
- Improved water quality from pollutants filtration
- Microclimate regulation
- Carbon sequestration
- Erosion control
- Habitat creation
- Recreational opportunities
- Regeneration of derelict areas

Primary beneficiaries:

- Local residents: Benefits from improved water quality, reduced flood and drought risk, and enhanced recreational spaces.
- Municipal government and authorities: Reduced infrastructure and water treatment costs and potential increases in property values.
- Local businesses: Increased economic gains from tourism, recreation and real estate development and reduced costs of potential droughts

Implementation activities:

- Site assessment
- Restoration plan design
- Permitting
- Site preparation
- Restoration of natural water sources and channels
- Planting native vegetation and removing invasive species
- Establishing amenities for access and recreation
- Maintenance and management plan development
- Monitoring equipment and program

Implementation actors and governance arrangements:

Implementation by:

- Local governments (potentially with state or national governments)
- Public-private partnerships (e.g., with water service providers)
- Non-governmental organizations, community groups

Management by:

- Local government
- Water services utility
- Water and wetland management agencies
- Joint management with community groups

Key partners and stakeholders:

- Government agencies (e.g., environmental protection, water management)
- Local residents
- Research institutions
- NGOs and community groups
- International organizations

Stakeholder involvement approaches:

- Co-planning restoration
- Consultation with residents
- Joint implementation (e.g., removal of invasive species)
- Training and capacity-building of local communities to support restoration efforts
- Citizen involvement in monitoring

Costs:

- Structural and environmental assessment
- Design and permitting fees
- Equipment and labour for site restoration
- Planting and vegetation management
- Maintenance
- Monitoring equipment

Financing up-front investment:

- Local government earmarked budget
- International, national government funding or grants
- Private investments and equity financing
- Grants from environmental foundations and NGOs
- Corporate sponsorships and CSR programs
- Community funding through crowdfunding and fundraising events

Revenue streams:

- PES for improved water quality
- Voluntary carbon credits
- Ecotourism and educational tours
- Income from sustainable harvesting
- Corporate sponsorships
- Research and conservation grants

Risks:

- Accumulation of pollutants from various sources can degrade water quality
- Non-native species can disrupt native ecosystems
- Altered weather patterns as a result of climate change can damage wetlands
- Maintenance challenges for balancing water, managing sedimentation and infrastructure degradation
- Securing funding for maintenance
- Opposition from residents or stakeholders, land-use conflicts

Opportunities for scale-up:

- Exploring recreational functions and ways of community involvement
- Combining wetlands restoration with urban parks and recreational facilities
- Integrating wetlands into larger-scale floodplain restoration project

5.6 Energy efficiency improvements in buildings

By complementing NbS projects, green buildings can also integrate various energy efficiency improvements to complement or amplify the benefits of energy savings.

5.6.1 Green buildings: natural ventilation, shading and passive cooling

Green buildings can utilise design strategies that enhance energy efficiency by making use of natural environmental conditions, thereby reducing reliance on artificial systems.

Main benefits:

- Reduce energy use, lowering utility bills
- Minimise carbon footprints and conserve resources
- Improved air quality and indoor temperatures enhance well-being
- Reduced energy and maintenance costs lead to significant savings.
- Meet strict building codes and earn green certifications
- Enhance brand reputation and attract eco-conscious clients

Primary beneficiaries:

- Building owners: Lower operational costs, higher property values, and potential incentives.
- Occupants: Improved health and comfort through better air quality and temperature control.
- Developers: Enhanced marketability and differentiation in the real estate market.
- Government and regulatory bodies: Achieving sustainability goals and promoting public health and safety.
- Local economy: Job creation and economic growth through green building projects and materials sourcing

Implementation activities:

- Conduct environmental assessments and optimise building orientation
- Develop eco-friendly designs using energy modeling
- Choose sustainable, locally sourced building materials
- Implement green construction practices and install passive systems
- Test systems rigorously and perform energy audits
- Train teams and occupants on green practices and maintenance
- Track energy usage and schedule regular system maintenance

Implementation actors and governance arrangements:

- Board of Directors to oversee green building strategies
- Sustainability Committee with multidisciplinary experts
- Project Management Office to manage green building projects
- Stakeholder Advisory Group to engage stakeholders for feedback and guidance
- Green Building Certification Team to secure and maintain green building certifications
- Internal Audit and Compliance Team to review and ensure compliance with green building regulations

Key partners and stakeholders:

- Architectural firms
- Construction companies
- Material suppliers
- Government Agencies: Support compliance with regulations and offer incentives
- Green Certification Bodies: Certify buildings to recognised green standards.
- Research Institutions: Innovate and validate efficient solutions

Stakeholder involvement approaches:

- Regular consultations
- Workshops and seminars
- Surveys and feedback forms to collect stakeholder opinions and suggestions
- Stakeholder Advisory Boards

Costs:

- Expenses for sustainable architectural and engineering services
- Costs for eco-friendly and energy-efficient materials
- Costs for specialised green building construction practices
- Fees for obtaining green building certifications (e.g, LEED, BREEAM)
- Investments in developing and testing new green technologies
- Expenses for training teams and educating occupants on sustainability
- Costs for implementing and maintaining performance monitoring systems

Financing up-front investment:

- Financial support from government programs
- Specialised loans and mortgages by banks and financial institutions
- Tax breaks and credits for investing in energy-efficient buildings
- Partner with ESCOs that provide up-front capital for energy-efficient upgrades in exchange for a share of the energy savings

Revenue streams:

- Earn regular income from leasing out green buildings to tenants who value sustainability and energy efficiency
- Generate revenue from selling eco-friendly properties at a premium price due to their higher market value
- Benefit from reduced energy costs, which can be substantial over the building's lifetime

Risks:

- The upfront investment for sustainable materials and technologies can be significantly higher than traditional construction costs
- New green technologies may have performance uncertainties or require frequent updates and maintenance
- Changes in government policies or regulations can affect the viability and cost of green building projects
- Limited demand or market acceptance for green buildings may be affected by rental and sale prices
- Securing financing can be challenging, and there is a risk of higher interest rates or unfavorable loan terms

Opportunities for scale-up:

- Expand services to retrofit existing buildings with green technologies, tapping into a vast market of older buildings needing energy efficiency upgrades
- As awareness of climate change and sustainability grows, the demand for green buildings is increasing, presenting a significant market opportunity.
- Grants and subsidies offered by governments to promote green construction, making projects more financially viable
- Use advancements in green technologies, such as improved solar panels and energy-efficient materials, to enhance building performance and reduce costs

5.6.2 Green buildings: Integration of Renewable Energy Sources for lighting, heating, and cooling

Main benefits:

- Buildings with integrated RES significantly reduce energy consumption
- Minimised carbon footprint and reliance on fossil fuels
- Lower long-term operational costs
- Reliable and efficient heating, cooling, and lighting
- Meets and often exceeds sustainability regulations.
- Stands out with innovative and sustainable building solutions

Primary beneficiaries:

- Building owners: Lower operational costs and higher property values
- Occupants: Improved comfort and sustainability
- Developers: Gain competitive edge and market appeal.
- Environment: Reduced carbon emissions and resource conservation
- Government and regulatory bodies: Achieve sustainability goals and promote public health

Implementation activities:

- Conduct comprehensive feasibility studies to assess the potential for RES integration
- Perform site assessments to identify optimal locations for RES installations
- Develop architectural and engineering designs that incorporate RES technologies
- Install and commission renewable energy systems in compliance with standards
- Implement systems to monitor and optimise RES performance in real-time
- Establish maintenance schedules and plan for future upgrades.
- Engage stakeholders and provide training on RES system

Implementation actors and governance arrangements:

- Partnerships between government and private sector
- Local governments lead planning and implementation of
- community-driven projects for RES integration
- Engage ESCOs to design, finance, and implement RES projects
- Establish multi-stakeholder committees for RES project collaboration.
- Leverage international funding and technical assistance for RES projects

Key partners and stakeholders:

- Renewable energy providers
- Architectural and engineering firms
- Construction companies
- Government agencies:
- Green Certification Bodies: like LEED, BREEAM for certifying buildings with integrated RES

Stakeholder involvement approaches:

- Consultation with stakeholders to gather input and feedback
- Educational events to inform stakeholders about the benefits and processes of integrating RES
- Visits and tours of green building sites to demonstrate RES integration in practice

Costs:

- Expenses for sustainable architectural and engineering services
- Higher costs for eco-friendly and energy-efficient materials
- Increased costs for specialised green building construction practices.
- Fees for obtaining green building certifications like LEED or BREEAM
- Investments in developing and testing new RES technologies.
- Expenses for training teams and educating occupants on sustainability
- Costs for implementing and maintaining performance monitoring systems

Financing up-front investment:

- Financial support from government programs
- Specialised loans for green building projects
- Tax breaks for sustainable investments.
- Investment from sustainability-focused investors
- Issue bonds to raise capital for green projects
- Partner with ESCOs for upfront capital in exchange for energy savings

Revenue streams:

- Earn from leasing green buildings
- Sell excess renewable energy back to the grid
- Generate revenue from selling eco-friendly properties
- Benefit from reduced energy costs.
- Offer ongoing maintenance services.
- Consulting services: Provide expertise on RES integration
- Conduct workshops on sustainable practices

Risks:

- Upfront investment in RES and materials
- Performance uncertainties of new technologies
- Impact of changing policies on green projects
- Limited demand for green buildings
- Challenges in securing favourable financing
- Specialised maintenance requirements
- Complexity and cost of green certifications
- Not realising expected energy savings, including the impact of extreme weather on RES performance

Opportunities for scale-up:

- Increased awareness and demand for sustainable and energy-efficient buildings present significant growth opportunities
- Leverage financial incentives, grants, and subsidies offered by governments to promote RES integration
- Utilise advancements in renewable energy technologies to enhance building performance and reduce costs
- Partner with corporations committed to sustainability to develop green office spaces and campuses
- Access green bonds, sustainable investment funds, and favorable loan terms specifically for eco-friendly projects
- Contribute to the development of smart cities by integrating

6 Key takeaways

As showcased in this publication, cities can implement urban NbS, ranging from green roofs to urban parks and river restoration projects, to address various climate challenges. The systematic integration and mainstreaming of urban NbS can offer transformational solutions for many of the adaptation actions, mitigation tasks, and other socio-economic stressors cities face due to climate change. Although NbS projects are often developed to tackle a single set of problems, such as urban heat or stormwater management, they can address various issues concurrently and simultaneously deliver a range of other benefits. NbS can also be combined with other environmental measures, such as energy efficiency improvements, to accelerate contributions to climate mitigation efforts.

Urban NbS, when tailored to local climatic, geographical, social and economic conditions, offer exceptional value for cities in developing countries. These urban areas, often characterised by limited resources and rapid expansion, require cost-effective strategies to manage multiple challenges simultaneously. NbS presents an affordable approach that enhances climate resilience, manages environmental and infrastructural pressures, and tackles socio-economic issues concurrently. By leveraging natural elements and processes, these solutions can help cities adapt to climate change, improve air and water quality, reduce strain on built infrastructure, and create green job opportunities. This multifaceted approach allows developing urban areas to maximise the impact of their investments, promoting sustainable growth and improved quality of life for residents in the face of resource constraints and rapid urbanisation.

To realise the transformative potential of urban NbS, project developers should adopt a business model approach to ensure that projects are goal-oriented, realistic, suitable, feasible and sustainable.

When designing NbS projects, developers need to consider various aspects. In addition to financial returns, environmental and socio-economic benefits should be considered for their long-term indirect financial gains and potential to reduce climate change's human and economic costs. Thorough project planning should consider the necessary activities and related costs for implementing and maintaining the project results, the most suitable governance models and stakeholder involvement approaches, and financing sources for the upfront investment costs and revenues to secure the maintenance of the project results. This knowledge resource provides a detailed overview of these aspects and summarises them in general business model canvases to support the systematic overview of these elements.

As a first step, urban NbS projects must identify the full range of climate, environmental and socio-economic benefits to maximise their potential and meet diverse stakeholder needs.

As discussed in Chapter 2, various NbS interventions enable cities to concurrently address multiple urban challenges and diverse stakeholder needs, making them highly valuable for sustainable urban planning and development. However, for such benefits to be realised, urban NbS projects must take a systemic approach to NbS to understand the full range of benefits, the value they offer and the stakeholders they serve. Doing so is the initial step toward creating value propositions that attract investment.

The roles of project implementers and key stakeholders should be adequately considered when developing sustainable business models for urban NbS projects.

As presented in Chapter 3, urban NbS projects may be government-led, community-driven, or implemented in various co-governance arrangements. Since projects are often implemented under complex governance structures and involve various government, non-profit, private sector, and community actors, stakeholder engagement should be prioritised to address potential implementation and management challenges. Participatory approaches can also ensure the inclusion of diverse community members, especially marginalised and vulnerable groups, during planning, implementation, and monitoring.

A comprehensive cost-benefit analysis can further strengthen the business case for NbS.

From a project perspective, NbS initiatives must assess the economic and socio-environmental benefits relative to their costs to justify investment and demonstrate value against traditional grey infrastructure. As presented in Chapter 4.1, planned urban NbS projects should evaluate direct financial gains, such as increased property values, tax revenues, and cost savings from reduced infrastructure maintenance and energy use, alongside indirect benefits, including enhanced public health, resilience to climate impacts, and social cohesion. Due to the complexity of accurately valuing long-term and non-market benefits, urban NbS projects, especially on a larger scale, must adopt robust valuation frameworks to capture the full range of NbS impacts.

The assessment of financing options is vital to ensure sustained project funding, and there are various avenues that public and private organizations can use to scale up NbS investments.

There is no singular way to finance NbS projects in cities, although, to date, most NbS interventions are publicly funded, with less than 20 per cent financed solely by private sources. As presented in Sections 4.2 and 4.3 of this publication, governments will continue to be pivotal in financing NbS projects through government funding, subsidies and tax incentives, grants and concessional loans, especially in those cases when the delivery of public benefits is at high stake and potential revenue sources and bankability potentials are lower. However, when NbS can deliver ecosystem services that can be more easily monetised, such as carbon sequestration, flood or drought mitigation and coastal defence from storm surges, the potential role of private financing should be explored further. PPPs, sustainability bonds and blended financing instruments can offer different ways to involve investors. Suitable financing strategies should be selected according to the type of NbS, the implementing actors, and the expected costs, benefits, and revenue-generating opportunities.

Addressing financing barriers for urban NbS requires innovative solutions.

Section 4.4 identifies key obstacles to financing urban NbS, including the challenges of valuing NbS benefits, reliance on public funds, limited private sector engagement, and the multi-stakeholder complexity of many projects. Comprehensive valuation frameworks and tools can help capture the full range of NbS benefits and demonstrate economic impact. To increase public funding, governments can consider additional funding channels, climate-focused budgeting, and user fees. Domestic and international public funding can be optimised through outcome-based grants and blended finance mechanisms to ensure efficient public funding. To attract private financing, PPPs, blended finance models and risk-sharing mechanisms, like guarantees and insurance, can effectively pool investment, particularly in sectors dependent on natural resources. In addition, public and private sectors can access NbS financing via bonds. Banks, insurance companies, and investment funds can also support NbS projects through tailored mechanisms, including sustainability loans, insurance products, and investment aggregation.

Annexures

Annexe 1: Major international funds promoting NbS application for climate resilience

Organization/ Fund	Overview	Funding areas relevant to NbS in cities
Global Environmental Fund (GEF)	Launched GEF provides financial support to developing countries and economies transitioning to address pressing environmental challenges and meet their international environmental commitments. Funding has been received from 40 donor countries since its establishment. GEF has raised USD 5.33 billion for the GEF-8, 2022–2026 funding cycle.	NbS was identified as a cross-cutting priority for the GEF-8 (2022–2026) funding cycle. Among the 11 Integrated Programs of GEF-8, several aim to promote NbS implementation. The Sustainable Cities Program aims to integrate NbS in urban development via demonstration projects and improved enabling environments. The Net-Zero Nature-Positive Accelerator and the Blue and Green Islands Programs also aim to invest in NbS. The Least Development Countries Fund (LDCF) and the Special Climate Change Fund (SCCF) prioritise funding for projects using NbS for climate change adaptation.
Adaptation Fund (AF)	Established under the UNFCCC, the AF finances projects and programmes that help vulnerable communities in developing countries adapt to climate change. It raises funds from governments, private donors, and Certified Emission Reductions' proceeds issued under the Clean Development Mechanism projects. USD 1 billion has been committed, with 160 concrete, localised projects in the most vulnerable communities of developing countries.	More than 20 per cent of the Fund's portfolio supports ecosystem resilience. Urban development is one of the thematic sectors, as the AF recognises the key role of cities in tackling climate. Other relevant sectors include coastal zone management, DRR, ecosystem-based adaptation, forests and water management.
Green Climate Fund (GCF)	The GCF operates in over 120 countries. It aims to foster innovative and high-impact climate investments by collaborating with public and private partners and mobilising financing from diverse sources. A commitment exists to provide USD 14 billion for project funding, USD 7.8 billion for mitigation, and 6.2 billion for adaptation.	Several results areas of the GCF could accommodate NbS. These include health, food, and water security; livelihoods of people and communities; infrastructure and built environment; ecosystems and ecosystem services under the Adaptation theme; buildings, cities, and infrastructure; and forests and land use under the mitigation theme.

Sources: GEF (2022a), GEF(2022b), AF (2021), GCF (2024a), and GCF (2024b). Information as of May 2024.

Annexe 2: Examples of MDB funds and programmes promoting NbS application for climate resilience

Organization/Fund	Overview of funding areas relevant to NbS in cities
Climate Investment Fund	A multilateral climate finance partnership of MDBs providing concessional finance introduced a "Nature, People and Climate Program" to foster the implementation of integrated NbS. The Program aims to empower local communities by facilitating bankable project development, enabling regulatory and market conditions for NbS deployment, and promoting nature-based enterprises.
World Bank	The World Bank has been a significant promoter of NbS investments, with over USD 5.5 billion invested in 100 projects between 2012 and 2021. The Global Program on Nature-Based Solutions for Climate Resilience, financed through the Global Facility for Disasters Risk Reduction and Recovery, aims to transition traditional grey infrastructure approaches towards nature-based infrastructure development by providing operational support, developing tools and fostering partnerships.
European Union	The European Union has been a forerunner in providing international funding to promote and support the practical implementation of the NbS concept for urban resilience for EU member states and its partner countries. Between 2017 and 2022, the European Investment Bank (EIB) implemented the Natural Capital Finance Facility programme to demonstrate how NbS investments can attract private capital. The Facility provided loans and investments in equity funds to support NbS projects that address various challenges, including climate change (EIB, 2023). In 2023, the European Bank for Reconstruction and Development established its approach to nature protection, which includes investments in nature-positive projects, such as green-blue infrastructures.
Asian Development Bank (ADB)	In 2023, the ADB announced the establishment of the Nature Solutions Finance Hub for Asia and the Pacific, aiming to de-risk NbS projects funded by global development partners (ADB, 2023).

Sources: World Bank Group (2022), World Bank (2022), ADB (2023), Climate Investments Fund (2024).

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