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Smart, Sustainable and Resilient cities:

the Power of Nature-based Solutions

ANNEX II: FINANCING NATURE-BASED SOLUTIONS FOR SMART, SUSTAINABLE AND RESILIENT CITIES



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Acronyms and abbreviations

BID	Business improvement district
CBA	Cost-Benefit Analysis
DFIs	Development Finance Institutions
EC	European Commission
Global ABC	Global Alliance for Buildings and Construction
IEA	International Energy Agency
IUCN	International Union for Conservation of Nature
LEED	Leadership in Energy and Environmental Design
NbE	Nature-based enterprises
NbS	Nature-based solutions
NCA	Natural capital accounting
NGO	Non-governmental organisation
ODA	Official development aid
SUDS	Sustainable urban drainage systems
TIF	Tax increment financing
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme

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Executive Summary

Nature-based solutions (NbS) have emerged as a concept to designate interventions which mobilise nature to respond to societal challenges while delivering multiple benefits for human well-being and biodiversity. **NbS can be powerful tools toward more climate-resilient, sustainable, dynamic and inclusive city economies**.

This report has been developed as an Annex to the *Smart, Sustainable and Resilient cities: the Power of Nature-based Solutions* working paper for the G20, which identifies the lack of access to finance as one of the key barriers to realising the full potential of NbS in cities. It aims to strengthen the case for investment in urban NbS and engage city officials, practitioners and private sector actors in the co-creation of innovative and sustainable NbS business models for their cities.

In fact, financing is often presented as one of the main barriers to NbS mainstreaming in cities. For our global climate, biodiversity and land degradation targets to be met, **current investment in NbS would need to triple over the next ten years**. Although no global figures exist on the market specific to NbS in urban contexts, some trends are pointing to an **emerging market with important potential for development.**

Typically, NbS do not meet traditional economic standards for investor engagement and are still often perceived as higher risk investments than traditional grey solutions. Such perceptions should evolve as **NbS are in many instances more cost-effective than grey solutions for the same level of risk management and provide an opportunity for the deployment of innovative financing solutions.** Natural capital accounting (NCA) approaches that support NbS benefits' valuation and monitoring can be powerful advocates for their financing.

Beyond innovative financing, participative and multilevel governance models, as well as enabling policy and regulatory environments, sound policy safeguards and appropriate monitoring schemes are also necessary to ensure the widespread adoption of high quality NbS. The last two are particularly important to prevent social justice trade-offs such as uncontrolled gentrification and avoid for NbS to reinforce existing inequalities and be used as instruments of a neoliberal green growth.

Green roofs, green walls, atria, grassed swales, water retention ponds, rain gardens, river restoration, wetlands, sustainable urban drainage systems (SUDS), large urban parks, urban forests, street trees, community gardens: many NbS types exist and each NbS intervention needs to be adapted to its local context and circumstances. Multiple business models and financing strategies can also be considered when engaging into NbS. They provide a **wealth of alternatives to NbS as an unilateral cost on municipal budgets.** Examples of promising financing options include:

- **Innovative municipal financing approaches** through which funds are raised from external sources in support to municipal financing for NbS, such as municipal climate bonds, carbon credits, public-public partnerships, blended finance, revolving funds or funding from national COVID-19 stimulus plans.
- **Private funding and public-private partnerships** where risks and responsibilities for NbS financing either lie with private actors or are shared between public and private actors, such as land value capture through, for instance, tax increment financing (TIF) or business improvement districts (BID), as well as sponsoring and entrepreneurial activities, crowdfunding and other community-sourced funding or in-kind support strategies.
- **Incentives programmes and tax schemes** which aim at encouraging investments from private actors, such as zoning strategies, including zoning bonuses and transfer of development rights, property taxes abatement, water charges earmarking, storm water fees schemes, cities labels, green building certifications, or allowing the use of vacant municipal lands for green space or community gardens.
- **Mandatory requirements** which push private investment toward NbS, such as municipal codes on impervious land cover, enforcement of biotope ratio or green roof regulations.

The options presented above can be combined in many ways when developing a tailored strategy to finance specific NbS interventions.

Around the world, pioneer cities are demonstrating these financing strategies and proving the feasibility to raise, generate and sustain revenues for large-scale investments in NbS in urban contexts. Such investments are backed by their potential to deliver disaster risk reduction and increased city resilience together with multiple benefits, including environmental impacts but also social and economic returns linked to increased attractiveness, innovation, jobs and NbE creation and improved well-being, health and quality of life for citizens.

There is a sizeable opportunity for private sector involvement, from real estate developers to local businesses, or carbon finance and other sustainability investors, including from the insurance and banking sector, who can reap some of the economic benefits of NbS. Important opportunities also exist for NbS financing through the pooling of resources across different municipal departments (parks, environment, transports, roads, health, youth, leisure, tourism, sports, etc.), fiscal revenues, development aid or national budgets, private foundations, NGOs and community sourcing. Some NbS also have the potential to generate revenues supporting their viability.

Based on these considerations and as a general orientation, a few guiding principles can be followed toward the financing of NbS in cities.

Beyond the existence of a political impetus for G20 cities and beyond utilizing to utilise NbS in their transition toward a more sustainable and resilient urban development, the following recommendations were identified to unlock the potential of the emerging urban NbS market:

- **Support municipalities in creating enabling regulatory and legislative environments** so as to avoid the systematic favouring of grey infrastructure over NbS in urban planning processes, clarify opportunities for public-private partnerships around urban NbS and allow public municipal finance reforms when needed.
- **Advance efforts on valuation and accounting for NbS multiple benefits** to create the necessary transparency and accountability environment for market development, including through NCA and efforts led by the investor community.
- **Increase skillsets and awareness on NbS.** Municipalities need to raise their awareness of NbS alternatives - to avoid turning to traditional grey infrastructure by default - and their capacity to deploy innovative financing strategies or tailored NbS management plans. The investor community would benefit from increased organisational awareness and in-house expertise for NbS. Finally, general public awareness of NbS multiple benefits needs to increase as public acceptance is gaining weight in supporting decision makers' choices toward NbS.
- **Demonstrate and document more successful business models and financing strategies, especially in cities of the global South** for consistent, evidence-based information on NbS business models and financing strategies to lower the transaction costs of entering the NbS market.

Principles toward the financing of NbS in cities



01 Inviting NbS into our urban economies

Nature-based solutions (NbS) have emerged as a concept to designate interventions which mobilise nature to respond to societal challenges while delivering multiple benefits for human well-being and biodiversity. Although no multilaterally-acknowledged definition of NbS exists, the term is widely used by practitioners all around the world as an umbrella concept encompassing a broad range of established approaches such as ecological restoration, ecosystem-based adaptation, green infrastructure, ecosystem-based disaster risk reduction, integrated water resources management, etc. The International Union for Conservation of Nature (IUCN) definition is one of the most commonly used and defines NbS as "actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits" (IUCN World Conservation Congres 2016).

Green roofs, green walls, atria, grassed swales, water retention ponds, rain gardens, river restoration, wetlands, sustainable urban drainage systems (SUDS), large urban parks, urban forests, street trees, community gardens, many types of NbS interventions can be considered in urban environments (see Appendix). One main characteristic of NbS interventions is that each needs to be tailored to its local circumstances, including the specific challenges to be addressed, the geographical, social, cultural, political and economic contexts to ensure its sustainability.

Nature-based solutions (NbS) have emerged as a concept to designate interventions which mobilise nature to respond to societal challenges while delivering multiple benefits for human well-being and biodiversity.

Over the past decade, NbS have gained recognition as practical answers to many of the challenges facing contemporary urban development. With over half of the world population now living in cities and this number expecting to reach almost 70% by mid-century (United Nations 2016), cities are being called upon as front-line players in the fight against global environmental crises which have already started to affect the lives of their citizens. This requires a transition toward healthier, greener, more resilient, equitable, and sustainable urban environments. Giving NbS interventions a central role in this transition has the potential to help cities reduce disaster risks such as these from flooding, erosion, landslides or heat waves, build increased resilience and deliver multiple benefits for climate change, biodiversity, human health and well-being, water and food security, as well as other social, economic and environmental benefits. NbS can also support cities' efforts to build back better after the COVID-19 sanitary crisis.



1.1. This report

Financing is often presented as one of the main barriers to NbS mainstreaming in cities (Mayor et al. 2021). In July 2021, the G20 Climate and Energy Ministers' Meeting adopted a Smart, Resilient and Sustainable Cities Action Plan calling for action to identify: "*mechanisms that spur investment at the local level, particularly reinforcing a sustainable financial framework to facilitate cities' access to bilateral, multilateral and private sources of capital to implement them [NbS]*"(G20 2021).

This report has been developed as an Annex to the *Smart, Sustainable and Resilient cities: the Power of Nature-based Solutions* working paper for the G20 (UNEP, UNDP 2021) which identifies the lack of access to finance as one of the key barriers to realising the full potential of NbS. As a step forward, this report aims at strengthening the case for investment and provides a collection of financing options for different types of urban NbS[1]. It has been developed as a motivational effort to engage city officials, practitioners, and private sector actors in the co-creation of innovative and sustainable NbS business models for their cities.

It presents the state and specificities of the market for NbS in cities (section 1) and uses as very concrete entry points some well recognised NbS types to illustrate and inspire a collection of possible financing options for NbS in cities (section 2). It builds on the high political momentum for mainstreaming NbS in cities and provides recommendations to unlock the financial flows necessary for scale up (section 3).

1.2. The market for NbS in cities

The recent *State of Finance for Nature* report shows that about USD 133 billion per year are being allocated to NbS today. To meet our global climate, biodiversity and land degradation targets these investments would need to triple over the next ten years (UNEP 2021).

The state of the NbS market

The report notes that 86% and 14% of total NbS investment are from public and private sources, respectively. While these shares are similar to global general ones for investments in infrastructure projects[2] (World Bank 2017), constraints on municipal budgets and competing priorities have led to an increased recognition of the role of private actors for NbS financing (Almassy et al. 2017).

Although no global figures exist on the market specific to NbS in urban contexts the analysis of the Naturvation Urban Nature Atlas, a database of 1,000 NbS in European cities, provides interesting insights. Local authorities remain the first funding source for NbS in cities before regional and national budgets or European Union funds. The market for city NbS is dominated by small scale interventions. A study notes a scale of individual NbS projects of often less than EUR 500,000 (Toxopeus and Polzin 2021) with a trend toward the increase of very small projects of less than EUR 50,000 (Almassy et al. 2017).

Another observed trend is the recent proliferation of nature-based enterprises (NbE), which are "for-profit or non-profit companies, organizations or initiatives engaged in economic activity that contribute to the development and delivery of NBS", most NbE are micro enterprises according to the European Commission's classification (McQuaid and al. 2021). This confirms that NbS can spur economic development including job creation.

Overall, these trends and figures show a market for NBS "at an early stage of development with much potential for growth" (McQuaid and al. 2021).

1 *Although this report is focused on urban environments, some of the presented NbS may also be applicable in non-urban contexts.*

2 *In 2017, 83% of global investment in infrastructure development came from governments or state owned enterprises and 17% from private sources.*

NbS investability

This still immature market can, in part, be explained by the specificities of NbS interventions when looked at through an economic lens. Some of them have a common or public good nature such as in the case of public urban parks or street trees. Typically, NbS do not meet economic standards for investor engagement on metrics such as scale, return on investment, or risk. As compared to standard grey infrastructures[3] which depreciate over time, NbS tend to appreciate over time and the return on investment for their capital costs is often associated with a longer timeframe. NbS interventions are often small scale, and context or site specific. This leads to higher transaction costs for investors and can challenge the application of innovative financing models (Cooper and Matthews 2020). NbS transaction costs are also raised by the lack of transparent and consistent market data providing evidence for success and failures, coupled with the still immature NbS expertise and skillset among both public and private investors (World Bank 2020; Green Purpose Company and Finance Earth 2021; Marchal et al. 2019). These factors, combined with policy and regulatory environments which are often still favouring grey infrastructure over NbS, result in the perception of NbS as high risk investments. However, such perception should evolve. The literature tends to show that NbS are in many instances more cost-effective than grey solutions for the same level of risk management (Coent et al. 2021). Around the world pioneer cities are demonstrating the feasibility of investing in NbS, providing evidence for innovative financing mechanisms and sustainable NbS business models.

Accounting and valuing NbS benefits

In order to support wider financing of NbS in cities, it is critically important to assess quantitatively the value of costs and multiple benefits of NbS to compare them to "business as usual" strategies relying on grey solutions. Although some NbS benefits are well documented, such as land value increases[4], others, such as climate adaptation impacts or well-being benefits, which are non-market but often the most valued by society, can be difficult to account for, monetize and translate into revenue flows (Cooper and Matthews 2020) and require specific methods that establish economic value indirectly. Natural capital accounting (NCA) approaches can be powerful tools in support to such benefit valuation and monitoring (see dedicated Annex). Cost-benefit analyses (CBA) can also contribute to strengthen confidence of policymakers and provide benchmarking references for public budget planning as well as private investment (see Figure 2. and Box 1.) Efforts are ongoing to support the establishment of recognised methodologies, building on existing work on NCA and valuation of ecosystem services. For instance, the European Commission (EC) just released a handbook providing guidance for practitioners to evaluate the impact of their NbS (Wendling et al. 2021) and the World Bank just published a comprehensive framework for valuing the benefits associated with NbS for integrated urban flood management (Wishart et al. 2021). The IUCN is also piloting a new Urban Nature Index to measure and monitor cities' ecological impacts which could help demonstrate how NbS can make a difference at the city scale[5].

3 *Grey infrastructure refers to conventional approaches which do not typically involve natural ecosystems. The "grey" denomination comes from the fact that these infrastructures are often made out of concrete, such as dams or seawalls.*

4 *The IGNITION project has looks at evidence of land value impacts for green walls, roofs, spaces, street trees and SUDS in European countries in the literature. See: https://www.greatermanchester-ca.gov.uk/what-we-do/environment/natural-environment/ignition/*

5 *https://iucnurbanalliance.org/an-introduction-to-the-iucn-urban-nature-index/*

NbS Stakeholders

In part due to their multiple benefits and urban context, city NbS business models often imply complex stakeholder value chains. The wealth of actors involved in creating, delivering, and capturing NbS values make simple buyer-supplier relationships difficult to establish. These actors and their roles differ from one NbS type to another and vary throughout the lifecycle of the intervention and over time including as actor preferences change (McQuaid 2021). Relevant stakeholders to the NbS market include subnational and national governments. NbS multiple benefits offer the possibility of involving a wide range of government departments such as these dedicated to green spaces and environment, health, roads and transport, infrastructures, urban planning, youth, sport, culture, tourism, etc. They also include other public funding sources such as development funding institutions (DFI), as well as city residents and peri-urban populations, city visitors and tourists, local community organisations, NGOs, charities, private foundations, real estate and infrastructure developers, investors including from the insurance sector, NbE and other technical partners such as engineering firms, as well as other private companies such as water utility companies, and local businesses.



Beyond financing

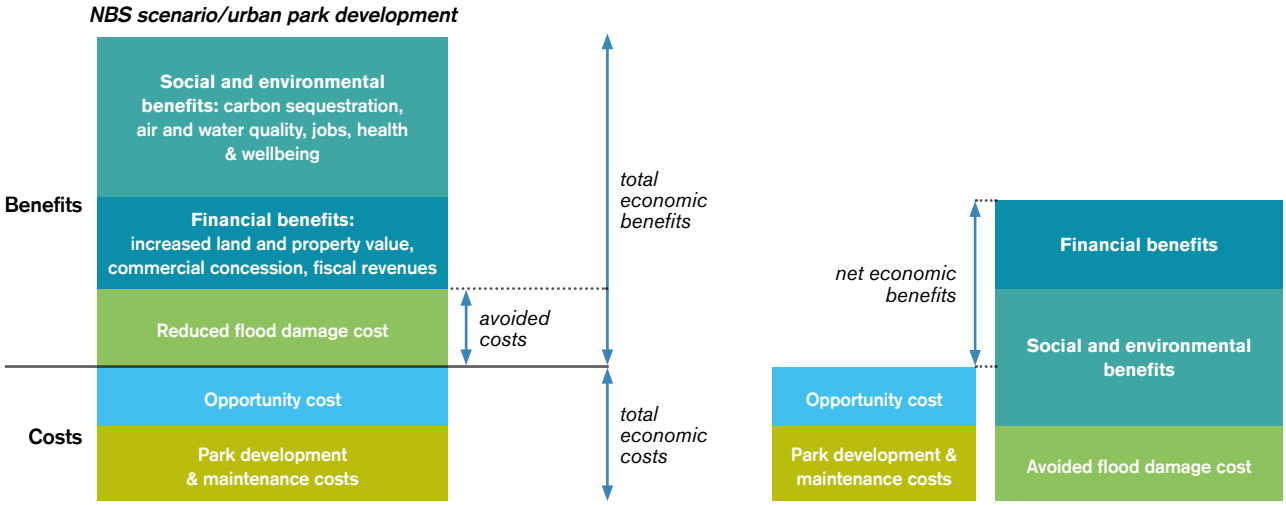
The complex stakeholder value chains and diffuse benefits of NbS makes coordination of their multiple stakeholders and associated interests critical to their success and cost-efficiency. NbS represents a clear opportunity to engage in innovative, collaborative and multilevel governance models toward a more participative urban management (UNEP, UNDP 2021; Mayor et al. 2021). Such governance models and their co-creation by the various stakeholders can also help address the so-called silo gaps within the public sector (Mayor et al. 2021).

Local policies have been identified as one of the main drivers for NbS implementation (Almassy et al. 2017) and national and local governments need to provide the enabling policy and regulatory environment to allow for NbS mainstreaming in urban planning processes. In addition to policy and legal reforms, early involvement of civil society stakeholders in the NbS development process, sound policy safeguards, and appropriate monitoring schemes are also necessary to ensure quality NbS. These will help prevent social justice trade-offs such as uncontrolled gentrification, or city NbS only targeted at well-off neighbourhoods, and avoid turning NbS into vehicles of “a neoliberal ‘green growth’ failing to deliver widespread socio-economic benefits” (Toxopeus and Polzin 2021).

NbS can be powerful tools toward more climate-resilient, sustainable, dynamic and inclusive city economies. With financing identified as one of the main barriers to their implementation, recent years have seen efforts and research initiated on innovative business models and financing options adapted to NbS specificities. The following chapter takes a look at operational options that can be put in place to unlock financial flows toward their wider adoption by cities across the world.

NbS can be powerful tools toward more climate-resilient, sustainable, dynamic and inclusive city economies.

Figure 1. Example of a CBA for an urban park. *The relative value displayed is not representative of a real case, and costs and benefits will greatly vary across geographies and jurisdictions and depending on assumptions made including on the future trajectory of climate change.*







02 Showing the way toward NbS investments in our cities

Just like the many options that can be considered for NbS types, many NbS business models and financing strategies exist providing a wealth of alternatives to NbS as a unilateral cost on municipal budgets. A recent literature review identified no less than 30 financial instruments that have been mobilised alone or in combination for NbS financing (Maciulyte 2020). Efforts have been undertaken to establish NbS business model catalogues but, in practice, each NbS intervention requires a model tailored to its local context and priorities that will cut across different established business models (Toxopeus 2020). Depending on their local circumstances, two cities might choose to deploy a similar type of NbS in different ways in terms of spacial design, governance model and financing strategy.

To support NbS planners in finding the right fit for their city, using the concrete entry points of specific city NbS types, this section provides an overview of key elements to be taken into account when planning for a NbS intervention together with a collection of promising financing options, selected based on specific criteria.

Methodology

The six NbS types presented below, namely large urban parks, street trees, river restoration, SUDS, green roofs and community gardens, have been selected for the diversity of investability profiles they offer, the broad range of sectors and urban challenges they cover and because they are well recognised NbS types referred to across different NbS classifications and in the recent literature on urban NbS.

The financing mechanisms identified provide an inspirational collection of possible financing options for NbS in cities. This collection is not exhaustive but aims to show diverse options available to overcome the financing barrier to NbS implementation in cities and to inspire urban NbS developers in the development of their NbS business models and financing strategies. Their selection is based on a review of NbS literature and experiences. To ensure an inspiring, yet balanced pool of examples, particular attention has been given to financing options that are innovative, involve the private sector, have already been tested, are not restricted to unique local contexts, can enable financing of large scale or programmatic interventions, and are not associated with obvious trade-offs, especially social justice ones (such as the establishment of entrance fees to previously public parks).

To avoid repetition, each NbS financing option highlighted is only presented once but most of these options can be applied across different NbS types.

The different options considered can be grouped under the following approaches[6]:

1. **Innovative municipal financing approaches** for raising funds from external sources in support to municipal financing of NbS;
2. **Private funding (or in-kind support) and public-private partnerships** where risks and responsibilities for NbS financing either lies with private actors or are shared between public and private actors;
3. **Mandatory requirements** to push private investment toward NbS; and
4. **Incentives programmes and tax schemes** aimed at encouraging investments from private actors.

6 *These categories are adapted from UNaLab (Maciulyte 2020)*

2.1. Large urban parks

Large urban parks refer to large green areas within a city, commonly geared toward recreational and social purposes and largely open to the public (Nature4Cities 2016). Not all urban parks qualify as NbS. To qualify as NbS, an intervention should mobilise nature through a physical or discursive intervention to respond to an urban challenge and be associated with identified benefits for human well-being and biodiversity (Almassy et al. 2017). Examples of NbS urban park interventions could be a new park created on an abandoned railway track featuring local tree species, or the re-thinking of a park's operations to re-purpose for climate adaptation and mitigation. More broadly, large urban parks can also be synonymous with urban forests, which are all trees on both public and private land of a city (Nowak 2010).

Expected benefits

The creation, restoration, or improvement of large urban parks addresses various societal challenges and can deliver multiple benefits. Well-conceived urban parks can be associated with:

- climate benefits including carbon storage and microclimate regulation,
- water security from storm water run-off reduction,
- biodiversity benefits from habitat provision,
- public health benefits by enabling physical and recreational activities and cleaning the air of detrimental pollutants, and
- social and economic development by facilitating social interactions, cultural richness, environmental education, or by making the city more attractive to tourists, potentially generating increased local revenues and to a lesser extent, job creation for their design, management and maintenance (Nature4Cities 2016).



Costs

When looking at the costs of large urban park NbS, different elements need to be taken into consideration. When necessary, securing appropriate land for establishment of a new park can be the most difficult challenge as land development tends to put pressure on urban green space and raise opportunity costs. Other factors include the size and characteristics of the site, and the park's design, features and facilities.

Planning, maintenance and management are the other costs that need to be taken into account when planning for an urban park NbS. These will vary based again on the design, functions, type of vegetation and management of the park and on local context parameters such as climate, equipment and labour costs. City-wide NbS park development and management programmes might bring cost savings compared to isolated stand-alone interventions. A study notes park development costs ranging from EUR 60-240 per metre square for urban park in Europe (Holden 2006). Maintenance costs are usually calculated as costs per year per metre square. For the maintenance, some studies point to a range of EUR 0-10 per square meter per year. (Nature4Cities 2016; World Bank 2021; UNaLab 2019).

The creation, restoration, or improvement of large urban parks addresses various societal challenges and can deliver multiple benefits.

Key beneficiaries and stakeholders

In the development of a large urban park NbS intervention, different stakeholders need to be considered. Municipalities and their park departments are usually in charge of such projects. Other public sector departments can also be involved such as those focused on tourism, sport, youth, education, water management, etc. The intervention can drive improved perceptions by their citizens and tourists as well as potential revenues from tax increases. Typically, municipalities also bear the costs for park creation, improvements, maintenance, and management. However, as the following sections will show, there are financing options that can help supplement municipal budgets.

Residents living close to the park, or within the "15-minute neighbourhood"[7], are the primary beneficiaries, with expected gains from a health, social and recreational perspective. They can also benefit from potential reductions in local flooding events and heatwaves depending on geographical locations. Owners can also see the price of their property increase as a result of an urban park creation nearby. In some contexts, these residents can be active partners, including through contributions to fund raising support, establishment of park protection organisations, etc. Beyond residents living in close proximity to the park, all visitors, which can be city inhabitants or tourists are also beneficiaries. They are not expected to provide direct funding but can generate supporting revenues through their contribution to parking fees, paid activities and events or purchases in commercial concessions on the park premises.

Shops and other businesses, such as hotels in the vicinity of the park might also benefit from the increased visitor traffic and the improved quality of life of their employees, and as such could be receptive to helping to finance the park project. Real estate developers benefitting from increased land values can also support the financing of urban parks, as can commercial concessions on the park premises and other entrepreneurial partnerships such as cafes, for hire bikes, shops, or sponsored events. Technical stakeholders associated with park development and maintenance can include urban planners, landscape architects, ecologists, horticulturists, and gardeners for whom jobs can be created. Non-profit organizations, including NGOs, conservancies or foundations have also been associated with the creation or management of parks. National governments can be stakeholders of such NbS and retrieve benefits including from health costs savings. Such health cost savings can also benefit to insurances companies which can take advantage of urban park disaster risk reduction potential, for instance from flooding events.



7 *Moreno, C., 2020. The 15-minute city. TED Talks : www.ted.com/talks/carlos_moreno_the_15_minute_city*

Examples of financing options

Large urban park interventions are not primarily intended for revenue generation but they can attract financial flows beyond regular municipal budgets. The following examples present some interesting options to engage private actors in large urban park financing.

Innovative municipal financing approaches

An example of innovative municipal financing approach for large urban park interventions are **municipal climate bonds,** which are bonds issued and managed by municipalities that have been certified under the *Climate Bonds Standard and Certification Scheme*[8] to fund climate mitigation and adaptation measures. Such bonds are typically bought by investors who have an interest in investing in the city's sustainability such as insurance companies. In 2015, the city of Paris, France, issued a EUR 300 million climate bond, part of which will be dedicated to planting 20,000 trees in the city and creating 30 hectares of new parks[9]. In the United Kingdom, investors associations recently launched a capacity building and awareness raising campaign to help municipalities acquire the necessary skills to develop local climate bonds[10].

Public-private partnerships

Business improvement districts (BID), also known as city improvement districts, can be an interesting option to finance large urban parks in touristic or business areas (Minneapolis Park & Recreation Board 2015). Across a specific neighbourhood, land owners and businesses agree to pay an additional assessment and establish a non-profit organisation to collect and allocate funds raised toward improvements to the area. One of the most famous park BID is the Bryant Park Corporation established in the 1980s in New York, United States, by prominent businesses to turn a lost urban amenity in their neighbourhood into the renowned Bryant Park[11].

Incentives programmes and tax schemes

Zoning strategies, such as zoning incentives / bonuses and transfer of development rights, can also be useful options for park development, improvement or maintenance. These can be established by municipalities to secure contributions from real estate developers or land owners, or to have them integrate NbS parks into their projects either to comply with an established standard or in exchange for permission to bypass certain zoning limitations. For instance, in Toronto, Canada, as part of the city's park funding system, developers are required to save a percentage of their land for parks. Developers not willing to do so have the alternative to pay a park levy fee to transfer resources to a fund dedicated to park improvements in the city (Minneapolis Park & Recreation Board 2015).

The above are just a few examples and other options presented below such as carbon credits, blended finance, sponsoring and entrepreneurial activities, land value capture, public-public partnerships, tax increment financing and more can also be considered in designing financing strategies for this NbS type.

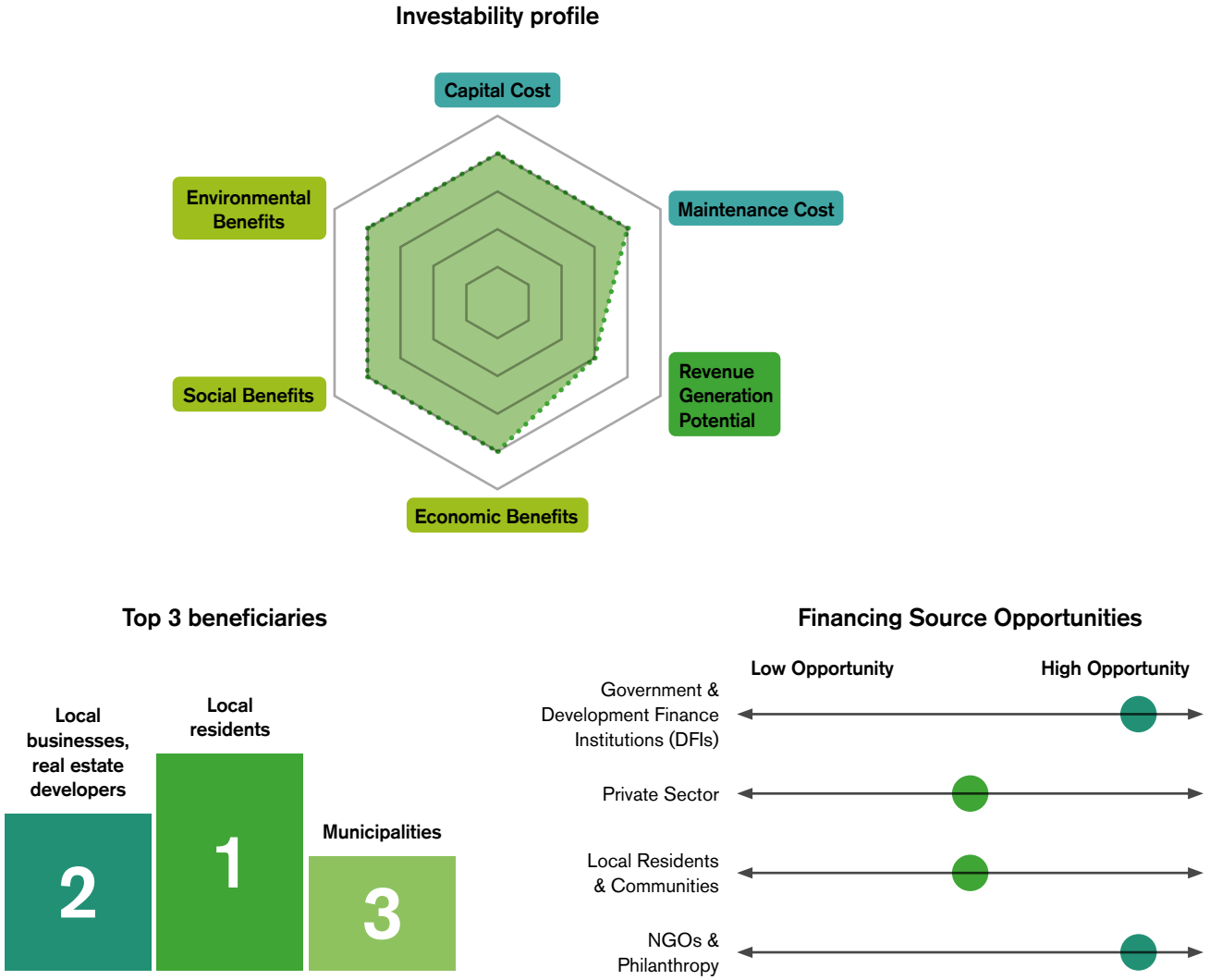
8 *https://www.climatebonds.net/standard*

9 *https://climate-adapt.eea.europa.eu/metadata/case-studies/climate-bond-financing-adaptation-actions-in-paris*

10 *https://www.greenfinanceinstitute.co.uk/news-and-insights/local-climate-bonds-a-cost-effective-way-to-raise-billions-for-councils-green-plans-says-new-campaign/*

11 *https://bryantpark.org*

Figure 2. Large urban parks summary. *These visuals intend to give a generic overview of the investability profile, top 3 beneficiaries, and level of funding opportunities from four main sources for large urban parks NbS. Values presented are based on a general assessment from the non-exhaustive research conducted in the development of this report and are subject to variations from one specific NbS configuration to another.*



2.2. Street trees

Street trees are essential elements of urban landscapes. This NbS encompasses the planting, renewal, maintenance and conservation of all trees planted along public roads, streets, boulevards, driveways, sidewalks, bicycle paths or tramlines. Associated NbS denominations include urban trees, tree infrastructure, or single line trees. Street trees are also sometimes referred to as a sub-category of urban forests. A street tree intervention qualifies as NbS only if due consideration has been given to parameters such as location, tree species adapted to the urban context and local climate, possibility for roots connections, irrigation management, necessary protection measures, etc. to ensure that the trees will deliver multiple benefits (UNaLab 2019, Nature4Cities 2016).

Expected benefits

NbS street trees can bring significant benefits to urban environments and beyond. Their primary benefits include climate change mitigation and adaptation from sequestering carbon dioxide, regulating local climate through shading and cooling, improving water management from increased water infiltration and decreased water run-off. They help mitigate air pollution levels by filtering air pollutants, especially from road traffic. For instance, they can act as green barriers along transport infrastructures, reducing pollution penetration and traffic noise. Street trees can also prevent landslides, including from road infrastructure, provide habitats and habitat continuity for biodiversity and are essential elements of green corridors in the form of tree-lined roads, bicycle lanes and sidewalks connecting urban parks and other green spaces. Street trees' visual and physical impacts also contribute to the well-being of urban populations, as demonstrated in a study that correlated tree cover with better mental health in cities. The size of these benefits will vary depending on the scale of the intervention, from single tree to large scale projects such as a tree-lined bicycle lanes crossing through the city (UNaLab 2019; Nature4Cities 2016; URBAN GreenUP 2018; Somarakis et al. 2019).

Key beneficiaries and stakeholders

There are many stakeholders associated to street trees interventions. As these are implemented on public spaces, municipalities have a natural responsibility for street trees programmes. Beyond environment or green space departments, another important department to involve is that responsible for roads and transport. Infrastructure companies, especially those from the transport sector, are also interesting stakeholders to engage as street trees can help mitigate some risks to their operations such as landslides or the overheating of tram rails. The transport sector is indeed a key actor of NbS street trees interventions, which offer opportunities to combine ecosystems and transport infrastructures. Urban populations living or commuting near street trees are the main beneficiaries of this NbS. Beyond health and other well-being benefits, such interventions can in some instances raise the value of nearby properties. In terms of technical partners for whom this can mean job creation, there are landscape designers and urban planners, horticulturists and gardeners. NGOs and local community organisations can also be active partners to support financing and implementation (Nature4Cities 2016; URBAN GreenUP 2018; UNaLab 2019; Somarakis et al. 2019).

Costs

The costs of street trees NbS include planting and maintenance as well as associated planning and management costs. The URBAN GreenUP project notes that investment in such interventions typically is recovered in around 5 years. Costs can vary greatly based on location, road conditions, associated features and selected species. Maintenance costs mainly include watering, pruning and regular inspection every 3-5 years. The endemic character of street trees that supports adaptation to local soil and climate conditions can help reduce maintenance costs. The Nature4Cities project notes that street trees are one of the most efficient NbS in terms of cost-benefit balance (UNaLab 2019; Nature4Cities 2016; URBAN GreenUP 2018).

Examples of financing options

Although they are not intended to directly generate revenues, there are many options to finance the costs of street tree interventions. Below are a few examples.

Innovative municipal financing approaches

Carbon credit registries enable the certification of carbon credits for purchase by polluters to offset a portion of their emissions. Forest carbon credits have been in use for some time, but had not yet been applied to urban trees. A study showed that some carbon market investors were willing to pay a "premium price" for city tree credits due to their own proximity with urban environments (Poudyal et al. 2015). In 2015, in the United States, the *City Forest Credit Registry* was launched. Adapted from the voluntary carbon market, these carbon credits attempt to capture the monetary value of all benefits from urban trees to direct investment toward impact certified planting programmes[12]. Another interesting example is this of the "Freetown the Tree Town" tree growing campaign being implemented in Freetown, Sierra Leone. The city has put in place a digital footprint for street trees and partnered with the Greenstand NGO to create a platform enabling companies and investors to purchase carbon offsets from Freetown trees. The funds from carbon credit sales are directed toward community organisations acting as the trees' "growers and stewards"[13].



Private funding and public-private partnerships

Sponsoring or adopt-a-tree programmes are options that encourage local populations or businesses to provide funding or in-kind support to street trees development and maintenance. It proposes to individuals, communities or companies to directly fund street trees or reduce funding needs by planting or helping to maintain street trees. Some of these programmes include placing small signs on trees to acknowledge adoption or turn these into memorials. The city of Moscow has such programme in place through which volunteers support the maintenance of the city trees, having "oversight and responsibility for their trees"[14].

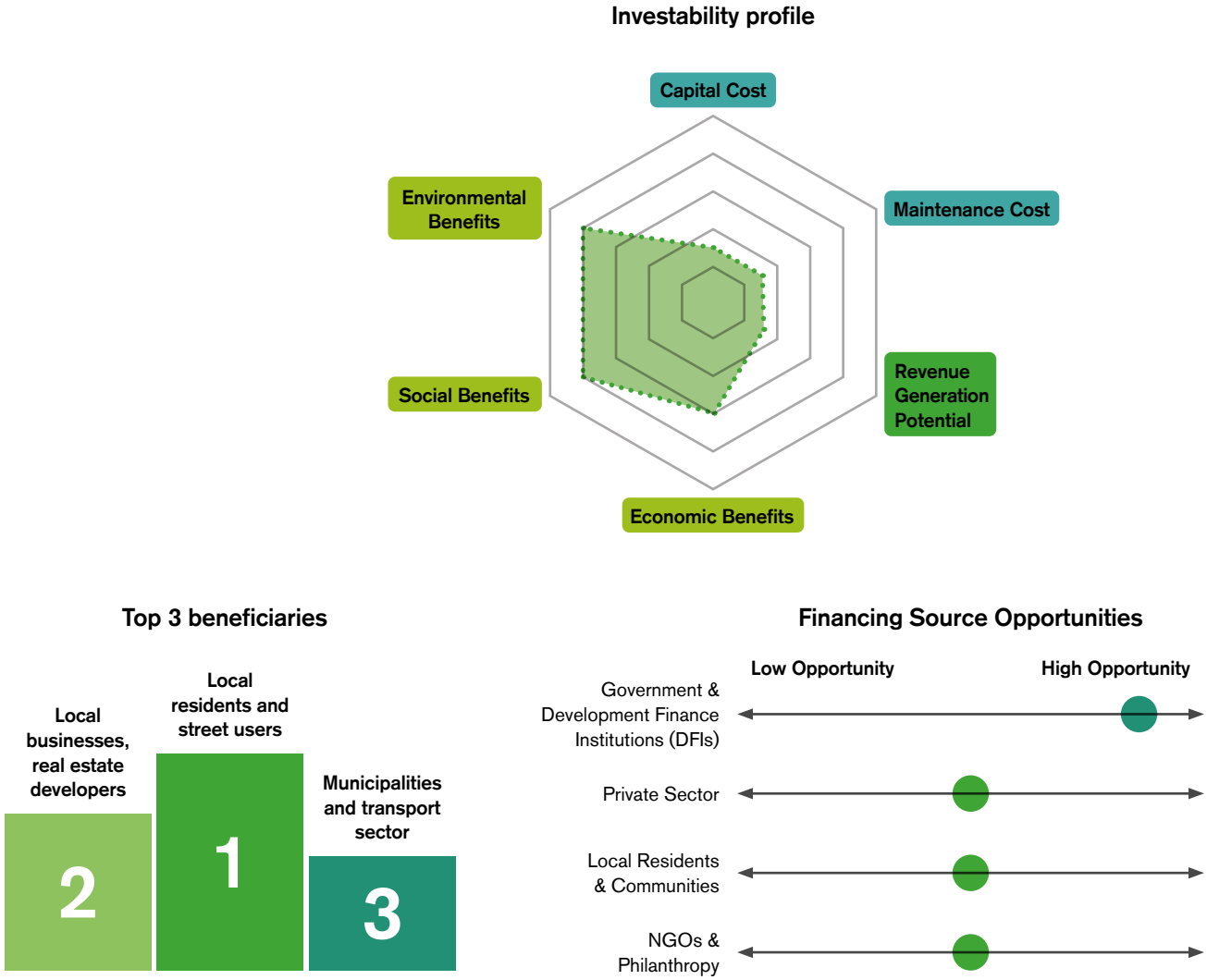
Incentives programmes and tax schemes

Another incentive instrument are **cities labels**, which are city recognition schemes based on specific standards. Some of them have criteria for urban trees coverage and care. City labels can make cities more attractive to tourists and help attract high-income residents and businesses. This can provide return on investments to municipalities through taxes and local revenues generation. The *Tree for Cities of the World*, a programme from the Food and Agriculture Organisation (FAO) and the Arbor Day Foundation, has established a label for urban trees management. In 2020, 120 cities across 23 countries had been recognised under the programme[15].

These are just a few examples and other options presented above and below such as municipal climate bonds, BID, land value capture, public-public partnerships and more, can also be considered in designing financing strategies for this NbS type.

12 *https://www.cityforestcredits.org*
13 *https://knowledge-uclga.org/IMG/pdf/transform-freetown-2-year-final-report-min-2.pdf*
14 *https://www.ci.moscow.id.us/223/Adopt-A-Tree-Program*
15 *https://treecitiesoftheworld.org*

Figure 3. Street trees summary. *These visuals intend to give a generic overview of the investability profile, top 3 beneficiaries, and level of funding opportunities from four main sources for street trees NbS. Values presented are based on a general assessment from the non-exhaustive research conducted in the development of this report and are subject to variations from one specific NbS configuration to another.*







2.3. River restoration

The IUCN defines restoration as "the re-establishment of natural physical processes (e.g. variation of flow and sediment movement), features (e.g. sediment sizes and river shape) and physical habitats of a river system (including submerged, bank and floodplain areas)" (Addy et al. 2016). A river restoration NbS can take various forms such as stream reopening of a buried river, channel widening or re-meandering, renaturing of riverbanks, reconnecting a riverbed to existing flood plains, etc. It can relate to different parts of the river, its bed, banks or associated floodplains and be of different scales from reopening or daylighting a small part of a river to reopening the stream and renaturing the banks of a river across a city. It can even include the restoration of the river catchment and imply waste and pollution inputs reduction measures. River restoration NbS can also be referred to as river revitalisation or renaturing (UNaLab 2019; URBAN GreenUP 2018; Nature4Cities 2016).

Expected benefits

River networks are natural storm water management systems and their restoration can be particularly important to implement in flood-prone areas. Their reopening, the ecological restoration of their banks, the widening of their bed or soil improvement can lead to improved urban water management and water quality. River restoration usually increases water retention capacity resulting in reduced flood risks. The vegetation on river beds and banks can retain some water pollutants improving water quality, reduce their erosion, create cooler areas and contribute to carbon absorption and reduced air pollution levels. Such interventions can also bring biodiversity impacts with restored or reconnected habitats for flora and fauna. Depending on the nature of the restoration, important recreational and aesthetic values can also be associated to the site with benefits for physical and mental health and socio-economic development (UNaLab 2019; URBAN GreenUP 2018; Nature4Cities 2016).

Key beneficiaries and stakeholders

A river restoration project should look to involve a broad range of stakeholders. In municipalities, environment, park or natural resources departments together with departments of tourism, education, youth, and sports can be associated with the project. The municipality is usually expected to take primary responsibility for the project, which can in turn improve its reputation, make the city more attractive, and drive associated tax returns and reduced storm water management costs. City water boards and water companies can also benefit from river restoration, including from reduced operation costs and improved water quality and can be asked or encouraged to contribute to its financing. Neighbourhood residents and local businesses are some of the main beneficiaries of the project. Their quality of life and business opportunities can be positively impacted by the neighbourhood revitalization such project can bring. Nearby owners and real estate developers might see their property prices increase. Public consultations can help ensure buy-in from the local population and partners, and best tailor the project to its context and user needs.

In some contexts, beyond businesses and property owners, insurance companies can also be important beneficiaries from decreased damage to insured goods and properties. In fact, there is a rising interest in NbS from the insurance sector where companies are turning toward more ex-ante interventions in addition to compensation. Recent research show that the insurance sector, can play a role in supporting NbS market development either as investors[16], insurance or re-insurance providers, innovators[17] or as partners to support risk management and reduction, damage valuation and data provision (Marchal et al. 2019).

River restoration interventions can also lead to the creation of jobs for technical partners which are essential to their sound realisation. Scientists, NGOs and local community organisations are other actors that can support financing and implementation, for instance through research programmes for site monitoring or the organisation of educational activities on-site (UNaLab 2019; URBAN GreenUP 2018; Nature4Cities 2016).

16 *See example of the restoration and resilience project to reduce flooding risk in Miami, United States, supported by an insurance company:* ***https://www.nature.org/en-us/newsroom/chubb-partnership/***

17 *New insurance products are being developed such as the first nature-based insurance solution launched in 2017 to protect one of Mexico's coral reefs. See:* ***https://www.nature.org/en-us/about-us/who-we-are/how-we-work/working-with-companies/companies-investing-in-nature1/swiss-re/***

Costs

Costs include project planning and design work, which can require preliminary feasibility assessment work from qualified experts, including engineers, landscape architects and ecologists. The most important costs are expected to be the capital costs for restoration such as reopening of the stream or reconfiguration or replanting of the bed and banks. These costs can vary greatly from one type of intervention to another (Ayres et al. 2014), for instance if land needs to be acquired, roads are to be destroyed or if decontamination work needs to take place. As an example, a study analysing costs across four European countries notes a range of EUR 15-1,000 per linear meter for water course re-meandering (Ayres et al. 2014), while another study focused on France provides a range of EUR 900-2,500 per linear meter for stream reopening (Adam et al. 2007). Maintenance and monitoring costs also need to be accounted for in the planning process.

Examples of financing options

There are various options which can be considered when looking at financing a river restoration project. A few of them are presented below.

Private funding and public-private partnerships

One option for the development of NbS based on river restoration are **entrepreneurial activities**, where the municipality that is primarily responsible for its funding generates revenues directed to its operations through commercial concessions from shops on the riverfront or through temporary leasing of some riverbank sections for private events. Parking fees can also generate financial flows for maintenance. For instance, a municipality can decide to direct fees from public parking in the river area to its maintenance. The restored Sabarmati River in Ahmedabad, India, has such concessions for restaurants and other shops as well as event leasing in place to finance its maintenance[18].

Another interesting aspect of the Sabarmati River restoration project is that its developers calculated that due to land value increase in the project area, the sale of 20% of the total land reclaimed for the project could have covered the full project costs. Such a financial strategy is referred to as **land value capture**, where municipalities pay or repay for their investments in urban improvements through the capture of the associated increase in land value, either through sales or through additional taxes (World Bank 2018). Such financing strategies need to consider social justice aspects to avoid the crowding-out of low-income communities due to higher land prices. In Box 2. a case study on land value capture is also presented.

Tax increment financing (TIF) is another way to capture increased land value. It enables local government to access funding for the upfront financing of an urban improvement and then pay back investors through the increase of tax revenues that the improvement generates. TIF are generally performed in the form of bonds. Such a financing option is best suited for large scale river restoration projects or when these are part of larger urban regeneration programmes[19]. The Cheonggyecheon river restoration in Seoul, Korea, which was part of a larger USD 323 million urban regeneration project, calculated that surrounding land values increased by about 25-50% after the project and that a TIF implemented over 20 years at the Korean tax rate could have paid for the entire project[20].

Innovative financial approaches

Public-Public partnerships designate the co-financing of a project by different public departments, it can be between different government levels and/or different departments. For instance, in Eindhoven, Netherlands, the Water Board agreed to fund part of the restoration of the Gender River, as well as the maintenance of the river course, recognising its positive impact on the water sewage system. Other funding sources for the project will include public funds as well as a **land value capture mechanism** through which building and land owners in the vicinity of the river are obligated to contribute to the project. In exchange they will receive allowance for more building units (Maciulyte 2020).

18 *https://urban-regeneration.worldbank.org/Ahmedabad*
19 *https://urban-regeneration.worldbank.org/node/17*
20 *https://urban-regeneration.worldbank.org/Seoul*

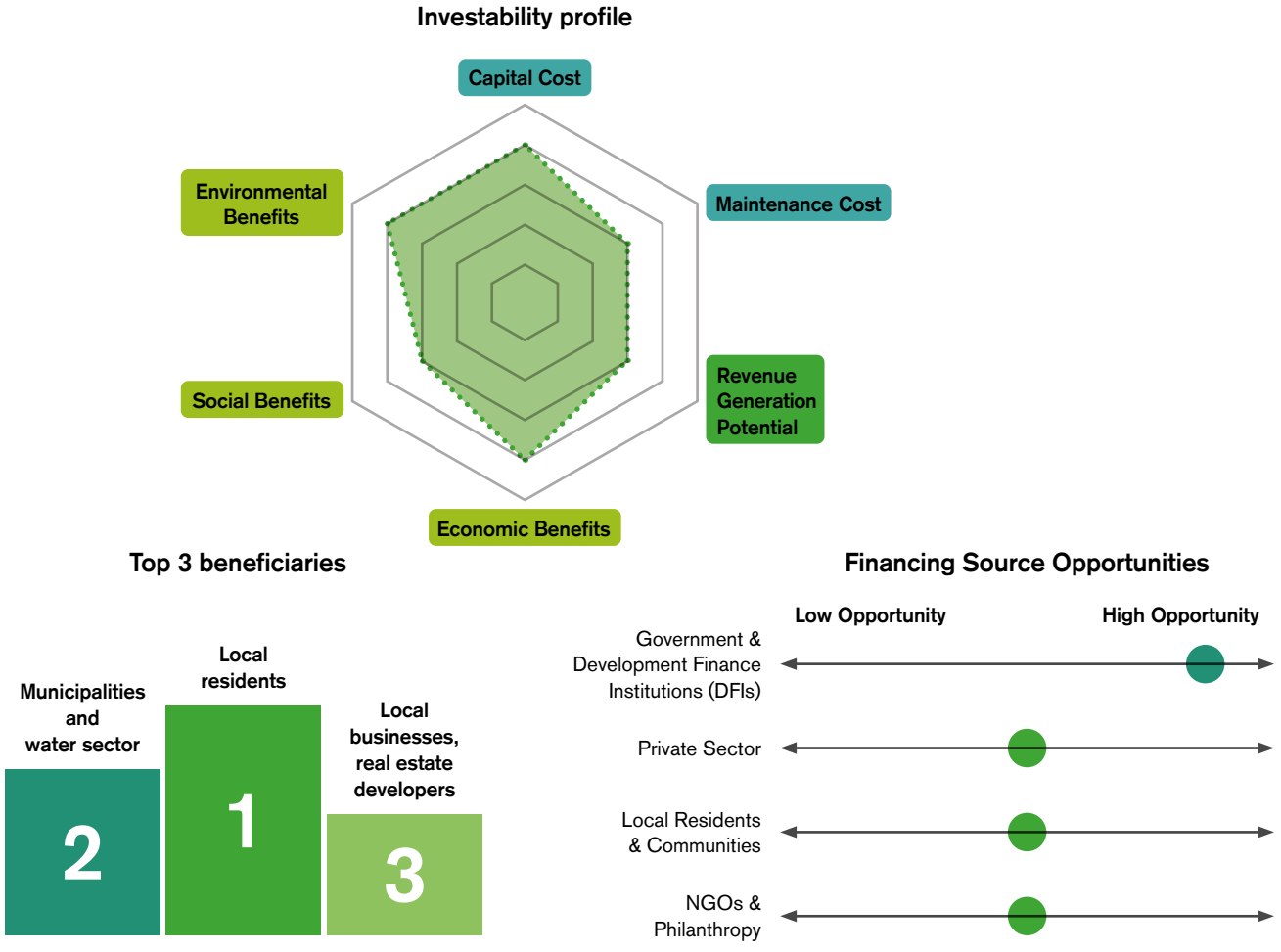
Incentives programmes and tax schemes

Water charges earmarking toward water related NbS can also support the financing of river restoration. Peru has established such an earmarking scheme toward watershed conservation and climate change adaptation. It requires that 1% of all water charges be earmarked for water quality NbS. The city of Lima is using funds collected, which amounted to USD 30 million between 2016-2018, to finance green and blue infrastructure projects (Cooper and Matthews 2020).

These are just a few examples and other options presented above and below such as municipal climate bonds, blended finance, BID, sponsoring, municipal codes on impervious land and biotope ratio, and more can also be considered in designing financing strategies for this NbS type.



Figure 4. River restoration summary. *These visuals intend to give a generic overview of the investability profile, top 3 beneficiaries, and level of funding opportunities from four main sources for river restoration NbS. Values presented are based on a general assessment from the non-exhaustive research conducted in the development of this report and are subject to variations from one specific NbS configuration to another.*



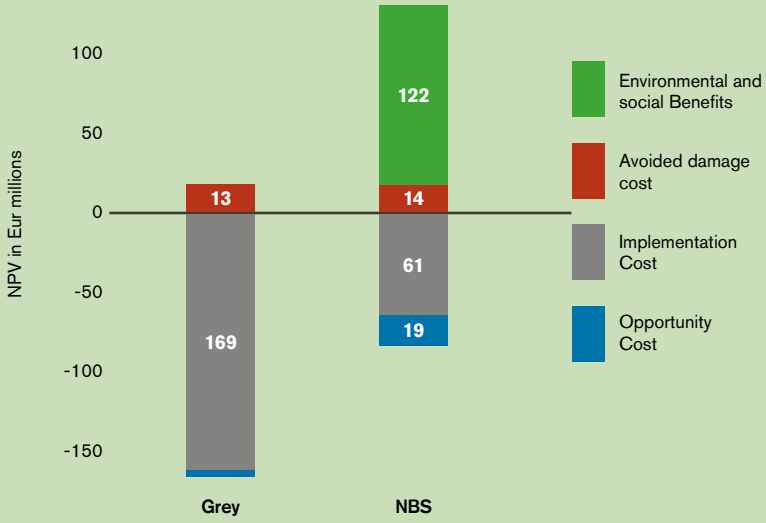
CASE STUDY 01

Cost-benefit analysis for NbS in the Brague catchment area, France

More frequent and severe flood events are some of the most visible impacts of climate change on urban environments. In order to support wider adoption of NbS, it is critically important to rigorously assess and value the costs and benefits of NbS and compare them to more "traditional" strategies relying on grey solutions. This case study presents the findings of a CBA comparing grey and green infrastructure solutions for flood mitigation in the Brague Catchment area, France.

The Brague river catchment area stretches over 60km2 and regulates water flows towards densely populated coastal areas, between the cities of Nice and Cannes. In October 2015, severe rainfall triggered deadly and devastating flashfloods in the region, causing over EUR 500 million of losses[21] and exposing its vulnerability to meteorological events. A detailed CBA was conducted (Gnonlonfin et al. 2019) to compare the relative costs and benefits of a traditional grey strategy relying on the construction of two large flood retention dams to mitigate flood risks, with a NbS as an alternative. The NbS strategy focuses on small natural retention basins spread over 200 hectares of the catchment area, combined with river corridor restoration. It notably aims to build light wood debris traps, widen the river channel, restore 13 hectares of riparian forest and 11 hectares of wetlands. It would also require buying and demolishing 50 to 70 houses highly exposed to flood risks and establishing building codes in some of the catchment areas.

The CBA analysis was performed using historical and theoretical data on floods with known return period for both the NbS and grey scenario to calculate mean annual avoided damage. The environmental and social benefits for the NbS scenario were assessed based on the method of transfer of values from other catchments as well as a valuation based on interviews from 400 local stakeholders.



The CBA clearly underlines the higher cost efficiency of the NBS, with a grey scenario more than twice as expensive as the NbS option. The NbS appears to be a cost-effective solution for flood risk mitigation, with one Euro of damage costs avoided for EUR 4.3 spent on implementation, while for the same avoided costs, the grey solution required EUR13 in implementation spending. Moreover, when accounting for environmental and social benefits (biodiversity and natural habitats quality, economic development, quality of life, and social cohesion and territorial coherence), the NbS becomes economically net positive, with an estimated EUR 1.7 of benefits for every Euro spent. This highlights the importance of assessing economic impacts beyond the value of avoided damage, and to consider the multiplicity of benefits that NbS can generate, in order to capture their full value.

21 https://oppla.eu/casestudy/18475

2.4. Sustainable urban drainage systems (SUDS)

The IGNITION project defines SUDS as systems "that manage water using natural methods, unlike drainage systems within grey infrastructure."[22] SUDS NbS can relate to creation, restoration or maintenance of dry detention or retention ponds, rain gardens, biofilters, bio- or vegetated swales, infiltration basins, green pavements for bicycle and pedestrian lanes, etc. or a combination of these. They use natural processes for storage, infiltration, draining and purification of storm and wastewater and can also provide green areas. They sometimes require the "de-sealing" of impervious land cover (Maciulyte 2020; Nature4Cities 2016; URBAN GreenUP 2018).

Expected benefits

SUDS' main impacts are linked to water management. They can decrease flooding risks and associated pressure on urban water management systems through reduced runoff rates and increased storm water retention volumes. They can improve water availability and quality through better groundwater recharge and enable pollutant and contaminant filtering. They can also impact biodiversity, including by providing fauna and flora habitat continuity. When they imply the development of new green areas, SUDS can also store carbon and help mitigate urban heat island effects for climate change mitigation and adaptation, and are also associated with improved quality of life and socio-economic developments from the green space provision (Nature4Cities 2016).

Costs

Upfront costs for SUDS installation are generally smaller than these associated with grey infrastructure providing the same function, but they are associated with longer term funding and higher maintenance costs (Toxopeus and Polzin 2021). Maintenance includes cleaning sites, pruning and mowing of vegetation. It can also include civil works maintenance such as control of inlet and outlet structures for water flow and of water quality. SUDS interventions need to be appropriately designed and planning costs also need to be accounted for. All of these costs vary based on site conditions, scale and nature of the project. For instance, looking at European market prices, the Urban Green Up project notes capital costs of between EUR 10-60 per meter cube of water storage for ponds and grassed swales and EUR 60-100 per meter square for bicycle-pedestrian green pavement.

Key beneficiaries and stakeholders

Water infrastructure responsibility usually lies with the public sector with perceived risks associated with privatisation by citizens (Toxopeus and Polzin 2021). Beyond public local water board and commissions, SUDS are relevant to different municipality departments such as these in charge of green space areas, natural resources or roads but also housing, public infrastructure and urban development. Like for other NbS analysed, SUDS can bring reputational benefits to municipalities. Although these have a role to play in regulating and establishing standards and policy they are not necessarily the main funding source for SUDS. Water companies, land owners and project developers, which are SUDS' main beneficiaries, are also expected to contribute to their financing. Insurance companies may also have an interest in SUDS due to their flooding risk reduction potential. When SUDS create or are part of larger green spaces, they bring benefits similar to those of urban parks or river restoration projects to local residents and businesses and more broadly to the urban population and tourists. Technical partners for whom SUDS can drive job creation include urban planners, landscape architects, specialised engineers, green space management NbE and companies proposing alternatives to concrete, impervious floors, as well as gardeners (Nature4Cities 2016).

22 *https://www.greatermanchester-ca.gov.uk/media/4422/financing-suds-a-case-study-dales-brow-ignition.pdf*

Examples of financing options

Different options are available to support investment toward SUDS. A few of these are presented below.

Innovative municipal financing approaches

Blended finance approaches can be interesting instruments for financing large scale SUDS interventions in official development aid (ODA) recipient countries. Such approaches use development aid to attract commercial capital and de-risk investment. The Philippines Water Revolving Fund has implemented the blending of ODA with domestic and private commercial bank funding. ODA's inclusion enables the lowering of borrowing rates and longer repayment terms as compared to the standard approach applied by private banks when loaning funds. It also de-risks investment for commercial banks by providing a credit-enhancing guarantee and ensuring alignment with their best practices. A credit rating system and a water project appraisal training for private sector actors have also been deployed to encourage banks' engagement. The revolving fund uses loan repayments to fund the next projects (Cooper and Matthews 2020; Paul Jr 2011).

Mandatory requirements

Municipal codes on impervious land cover or enforcement of biotope ratio on land usage intensity and biologically active areas can make private actors, including landowners and developers, turn to SUDS to ensure their compliance with the codes or ratio. The biotope area factor, a consolidated ecological urban index developed in Berlin, Germany, in the 1990's, has been used as an urban planning tool in cities across Europe to enforce impervious land cover ratios (Cooper and Matthews 2020). It has recently been applied to assess land cover in Padoa, Italy. Padoa has established municipal codes on land permeability ratios in 2011 prescribing 30 – 40 % land permeability in residential areas, 70 % for parking areas, and 90 % for green public areas (Prokop et al. 2011; Pristeri et al. 2020).

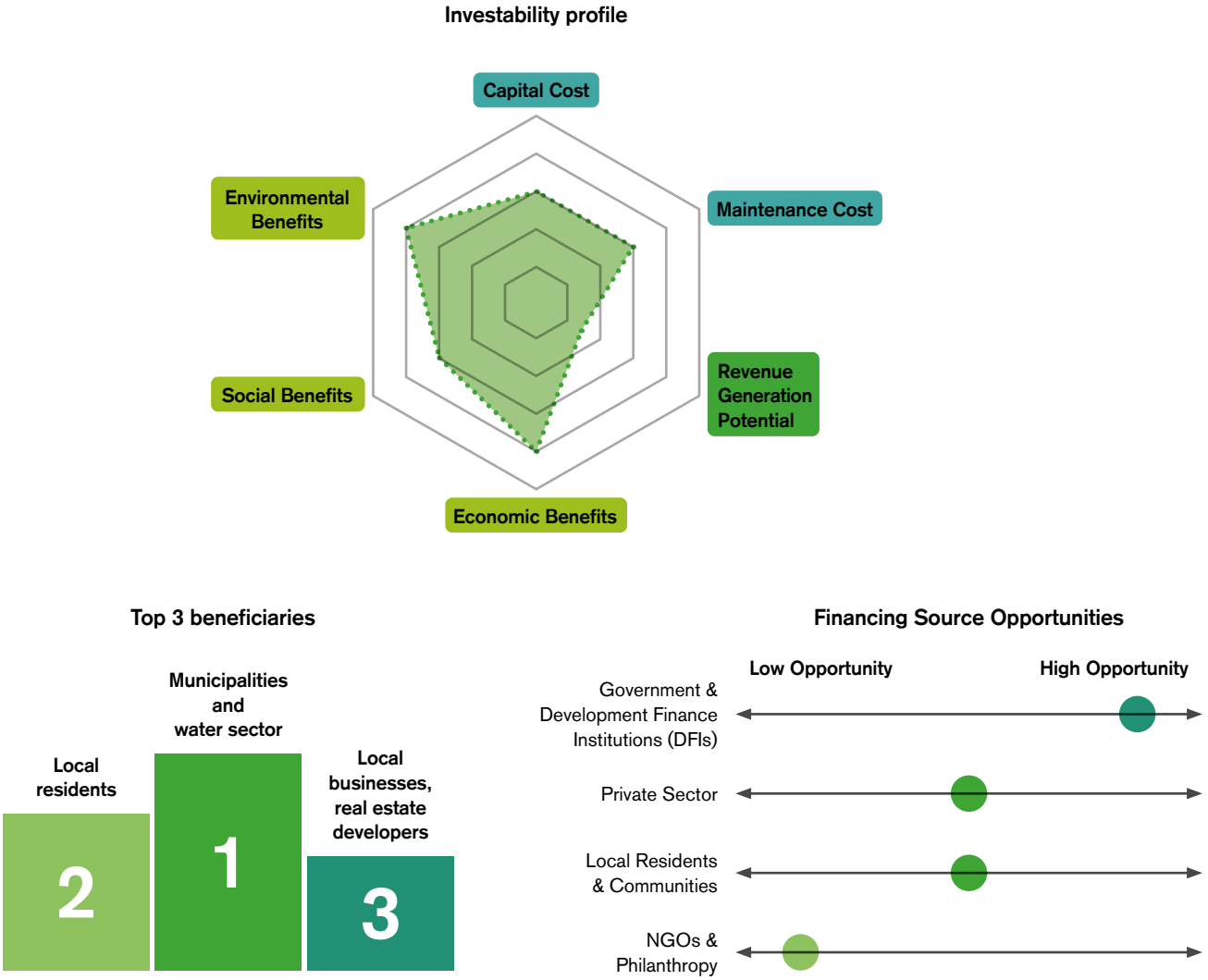
Incentives programmes and tax schemes

Many cities have established **storm water fees schemes** which can be used as incentives for private participation in SUDS financing. For instance, discount rates can be applied to property owners engaging in SUDS development on their property to help them cover the costs. In Washington, D.C., United States, a local storm water trading market has been set up through which landowners can earn credits based on their land capacity to absorb rainwater and sell these to developers who are unable to meet the impervious land cover standards on their new properties[23].

These are just a few examples and other options presented above and below such as municipal climate bonds, BID, zoning strategies, public-public partnerships and more can also be considered in designing financing strategies for this NbS type.

23 https://www.nature.org/en-us/magazine/magazine-articles/planning-for-a-rainy-day/

Figure 5. SUDS summary. *These visuals intend to give a generic overview of the investability profile, top 3 beneficiaries, and level of funding opportunities from four main sources for SUDS NbS. Values presented are based on a general assessment from the non-exhaustive research conducted in the development of this report and are subject to variations from one specific SUDS NbS configuration to another.*



2.5. Green roofs

Green roofs are vegetated layers on top of buildings and constructions. Intensive or semi-intensive green roofs have a substrate of at least 15-20 cm and are usually accessible to the public for gardening or recreational purposes. Extensive roofs have a thinner vegetated layer usually comprised between 8-15 cm and are less often accessible to the public. These can for instance house bees or conventional solar panels. Rooftops have different structures and carrying capacities that need to be taken into account in green roof design, especially for the retrofitting of existing buildings. One of the principles behind green roofs is the restoration on buildings of some of the biodiversity that has been destroyed for their construction (URBAN GreenUP 2018; UNaLab 2019).

Expected benefits

In cities, roofs surfaces account for an important portion of impervious land cover and impacts of a significant scale can result from the large adoption of green roofs. Green roofs are associated with a number of benefits. At the building level, they can contribute to energy savings from reduced heat flux into the building, increased roof lifespans from roof structure protection, and water runoff reductions from retention, buffering and evapotranspiration. There are also studies showing noise reduction in buildings with green roofs, as well as increases in property value and in well-being from the provision of green space. At the neighbourhood and city levels they provide air pollution reduction and urban heat effect and flood risk mitigation. They can also improve water quality. Their aesthetic values have also been pointed out. On a larger scale, they can deliver climate benefits from carbon storage as well as biodiversity benefits[24] (UNaLab 2019). The scale of their impact increases with the area coverage and is maximised when large green roofs are located near one another or adjacent to other green areas (Burszta-Adamiak and Fialkiewicz 2019).

Large scale adoption of green roofs in cities can reduce pressure on the city water management system as well as storm water management costs.

Key beneficiaries and Stakeholders

Building owners are the primary beneficiaries of green roofs. As for all NbS linked to a building, the investment responsibility lies at a decentralised level with the owner, including building residents, real estate developers, or with the company responsible for the green roof operations as in the case of green roof urban farms (Toxopeus and Polzin 2021). However, these actors may need support and incentives to engage in such investments. Municipalities can provide legal and technical assistance as well as incentive programmes to unlock these investments. They also have a role to play from an urban planning perspective to ensure the bulk of green roofs' benefits will be realised and avoid the adding up of single projects scattered all across the city (Burszta-Adamiak and Fialkiewicz 2019). They can also lead by example, installing green roofs on municipal buildings. Large scale adoption of green roofs in cities can reduce pressure on the city water management system as well as storm water management costs. National governments can also be considered as secondary beneficiaries. With green roofs supporting increased roof longevity and reduced flooding damages, insurance companies can also have an interest in getting involved in their development. Technical partners include structural engineers, architects and other NbE specialised in green roof development and maintenance (UNaLab 2019, 4; 2019; Maciulyte 2020).

24 *Ignition project Green roofs evidence database, accessible here: https://www.greatermanchester-ca.gov.uk/media/3241/green_roofs_nbs_evidence_base_ignition_july_2020.xlsx*

Costs

Costs related to green roofs include planning, installation and maintenance. These vary depending on the size and destination of the roof but also on its intensive or extensive nature, the vegetation it hosts, and its type of irrigation system. More complex and intensive roofs will require higher planning, capital and operating costs. According to some studies, in the United States extensive roofs may cost around EUR 25-75 per meter square. For intensive green roofs, United Kingdom prices start at EUR 100 per meter square (Nature4Cities 2016). Part of these costs can be offset by increased property prices, energy savings and increased roof longevity.

However some studies suggest that without public funding support, green roofs have an overall negative or delayed return on investment, in part due to their roof longevity benefits only accruing after 20 years (Toxopeus and Polzin 2021; Nature4Cities 2016). Entrepreneurial activities associated to green roofs can also pay for some of their costs. For instance, the roof can be rented to a company for installation of a rooftop restaurant, an urban farm or apiary. Rooftop farming is still an unproven concept and there is currently insufficient hindsight on profitability given that many such businesses are still at the pilot stage (Toxopeus and Polzin 2021).

Examples of financing options

Various instruments can be leveraged to finance green roofs. A few of them are presented below.

Mandatory requirements

Many cities across the world have adopted **green roof regulations**, obligating private owners and developers to establish green roofs on certain buildings and in certain areas. For instance, the municipality of Recife, Brazil, requires native vegetation green roofs and storm water reservoirs to be installed on all new buildings which have more than four floors. In Cordoba, Argentina, a bylaw request all new and existing buildings with over 400 square meter floor area to convert to green roofs (GlobalABC/IEA/UNEP 2020).



Incentives programmes and tax schemes

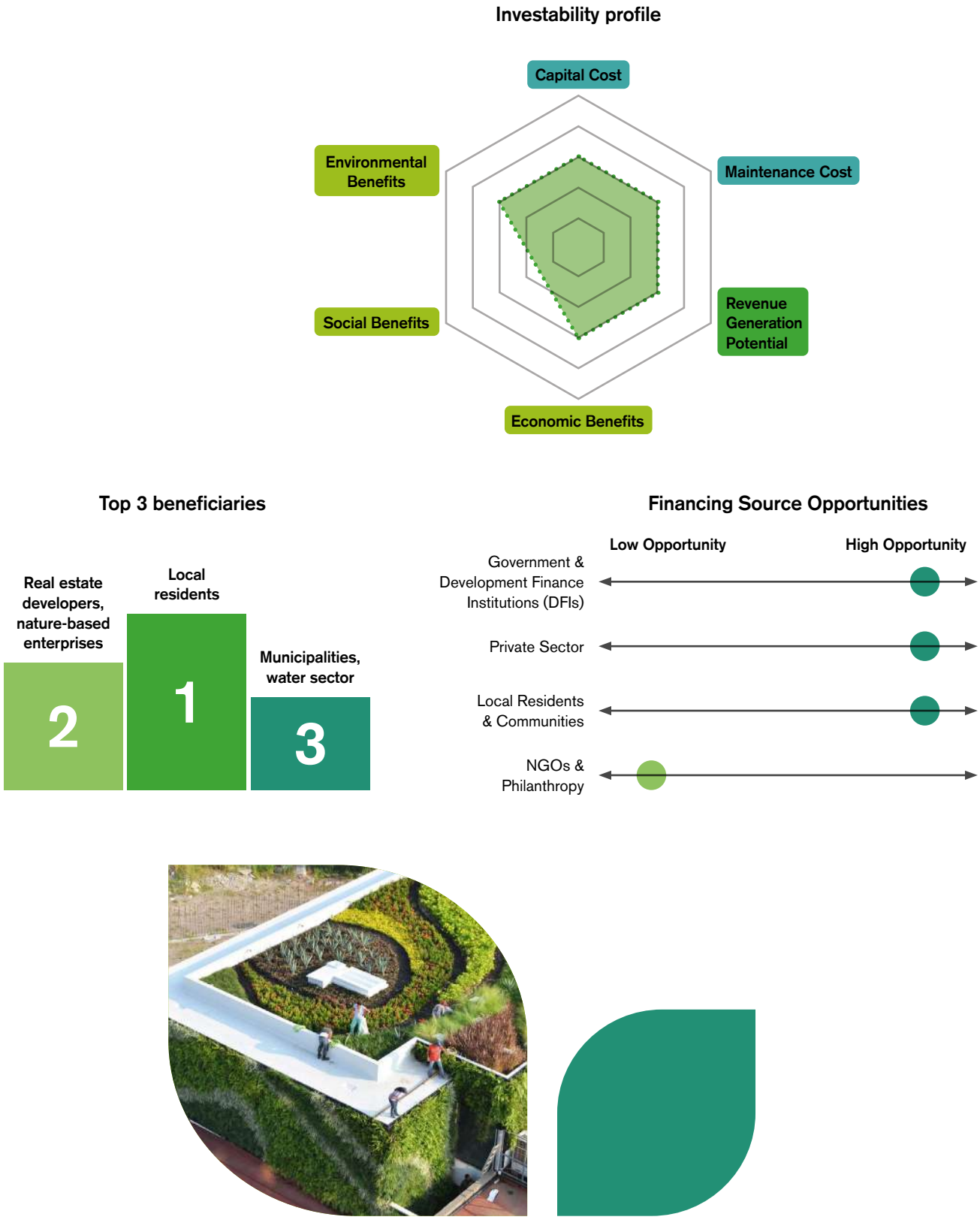
Property taxes abatement is another instrument which can be used to unlock investment in green roofs. For instance, in Mexico City, Mexico, owners and developers installing green roofs on their buildings are eligible to receive a 10% discount on their property taxes (GlobalABC/IEA/UNEP 2020).

The use of **green building certification** recognising the environmental value of green roofs is also a way to leverage investments. Certified buildings can attract high-income buyers and be sold at higher prices. The Leadership in Energy and Environmental Design (LEED) certification, developed and used in the United States, grants additional credit points to buildings integrating green roofs[25].

The above are just a few examples and other options presented above and below such as BID, TIF and other land value capture mechanisms, zoning strategies, sponsoring, entrepreneurial activities and more can also be considered in designing financing strategies for this NbS type.

25 *https://www.buildings.com/articles/27448/4-ways-your-roof-can-earn-leed-certification-credits*

Figure 6. Green roofs summary. *These visuals intend to give a generic overview of the investability profile, top 3 beneficiaries, and level of funding opportunities from four main sources for green roof NbS. Values presented are based on a general assessment from the non-exhaustive research conducted in the development of this report and are subject to variations from one specific green roof NbS configuration to another.*



2.6. Community gardens

Community gardens are pieces of land within a city where a group of people cultivate vegetables, fruits, herbs, or ornamentals on shared or individual plots. They are generally established on publicly accessible land, such as derelict or abandoned public spaces, but can also be found in schoolyards, hospitals, residential or factories' backyards, etc. The primary purpose of community gardens is often food production in an urban agriculture setting, but they can also be associated with recreational and social cohesion, biodiversity conservation, and educational purposes. Community gardens can be an integral part of sustainable urban food systems (Cochran and Minaker 2020; Nature4Cities 2016).

Expected benefits

One of the main benefits of community gardens, especially in low-income locations, is food security from increased food production and access to quality products. They are also associated with physical and mental health, as well as other well-being benefits from their social cohesion, recreational, educational and aesthetic functions. They can lead to economic and urban development benefits with positive impacts on their neighbourhoods and revenues from product sales or food bill savings. As green spaces, community gardens can also bring environmental impacts, such as pollution reduction, stormwater management, heat island effect mitigation or provision of biodiversity habitats. They can also result in avoided carbon dioxide emissions from food transportation (Cochran and Minaker 2020; UNaLab 2019; Nature4Cities 2016). Such benefits vary from one community garden project to another depending on size, site initial conditions and local context.

Costs

Costs of community gardens are generally low and predominately incurred during the installation phase. Costs can include land acquisition, soil decontamination, landscaping work and/or gardening equipment. In many cities, urban development pressure on land is raising the opportunity cost for communities interested in securing appropriate land for community gardens. They often look for alternatives to land acquisition, such as free access to derelict or abandoned public or private land. Securing land over the long term remains a challenge for many community gardens. Other costs include maintenance costs, which are usually low and mainly include equipment maintenance and replacement and water fees. This costs can vary greatly from one location to another based on soil, water, and gardening equipment prices (Cochran and Minaker 2020; UNaLab 2019; Nature4Cities 2016).

Key beneficiaries and Stakeholders

The main beneficiaries of community gardens are their gardeners and the communities growing food who are expected to capture most of their economic, health and well-being benefits. These are often targeted at vulnerable communities such as low-income families but can include a broad range of publics. They can be managed by individuals or moral entities such as community centers, schools, or charities. These actors are also commonly those bearing the costs of the garden, though some of the costs (e.g., cost of installation) can be covered by third parties such as municipalities, NGOs, private foundations or corporates, for instance in the case of large land holdings which fund or provide in-kind support for community gardens for employees. Municipalities have a particular role to play in supporting land access for community gardens and can also provide other forms of in-kind or financial support. Supporting such initiatives can have a positive impact on the local government's reputation, enhance some of the city derelict areas, and lead to city improvements potentially associated with increased tax revenues. Residents and businesses from the neighbourhood may also benefit from these area improvements, especially when they are established on previously abandoned spaces. Some community gardens can generate employment for gardeners, instructors or community organisers. National governments, in particular national health services or agencies, can also reap some of their benefits, for instance, from health costs avoided and can thus have some interest in financing community gardens (Cochran and Minaker 2020; UNaLab 2019; Nature4Cities 2016).

Examples of financing options

Financing of community gardens lies mainly with their users and there are various options to support these in securing necessary funding for their installation and maintenance. A few of them are presented below.

Innovative municipal financing approaches

Community gardens like many NbS, have a role to play in building back better after the COVID-19 sanitary crisis. **Funding from national governments, including from COVID-19 stimulus plans,** can support their financing. Recovery plans represent a clear opportunity to reform business-as-usual investments and policies and meet environmental objectives (UNEP 2021). In France for instance, EUR 17 million of the national recovery plan dedicated to the agriculture sector will provide grants for local community garden projects[26].

Incentive programmes and tax schemes

Municipalities can trigger the development of community gardens by **allowing the use of municipal vacant lands**. In Bangkok, Thailand, district municipalities have allowed the Bangkok City Farm Program to use vacant public space for community gardens. This programme, which provides grants to grassroots community networks for community garden initiatives, also provides an interesting example of a **public-public partnership** between different levels of governments. In fact, grants funding comes from the central government Health Promotion Agency. The agency used this programme to address the challenge of urban food insecurity in Bangkok, including poor food quality and increasing prices[29].

Private funding and public-private partnerships

Crowdfunding and other community-sourced funding strategies have been widely in use to finance the installation of community gardens. They usually utilize the organisation of a fund-raising campaign by a community, with the campaign being targeted at the local area and beyond. One example is the Tottenham's Selby Community Centre in London, United Kingdom, which set up a crowdfunding campaign and managed to raise the necessary funds to transform its backyard into a community garden. The garden's operations pay for themselves through the sale of garden products at the Centre's café[27].

Entrepreneurial activities linked to the marketing of community garden products can also provide a sustainable financing source. For instance, in Quito, Equator, the AGRUPAR project established over 3,600 community gardens mainly on non-constructable city land. Among others, the project provides its participants with food processing and marketing training and organises farmer markets. Over 100 urban farmer entrepreneurships have been formalised under the project, creating over 330 jobs. Beyond access to healthy food for self-consumption, the 12,000 gardeners benefit from USD 175 additional income per month and overall, the farmer markets generated USD 350,000 in sales in 2018[28].

These are just a few examples and other options presented above such as zoning incentives or bonuses and transfer of development rights, sponsoring, BID and more can also be considered in designing financing strategies for this NbS type.

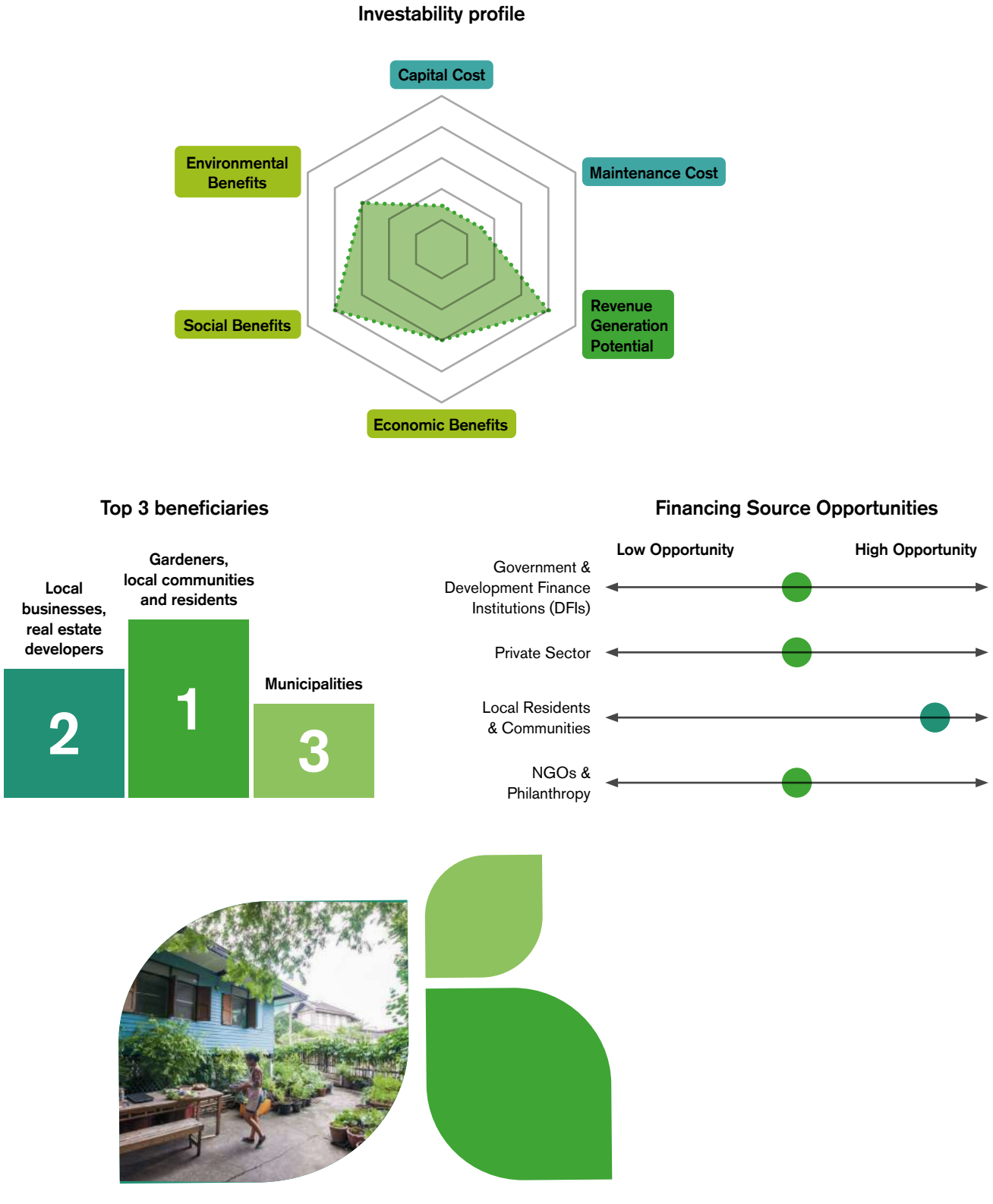
26 *https://agriculture.gouv.fr/francerelance-lancement-de-lappel-projets-jardins-partages*

27 *https://cities-today.com/crowdfunding-used-for-new-community-gardens/*

28 *https://www.futurepolicy.org/global/quito-agrupar/*

29 *https://fscluster.org/sites/default/files/documents/food_system_planning_case_study_2_bangkok_promoting_urban_agriculture_through_networks_150321.pdf*

Figure 7. Community garden summary. *These visuals intend to give a generic overview of the investability profile, top 3 beneficiaries, and level of funding opportunities from four main sources for community garden NbS. Values presented are based on a general assessment from the non-exhaustive research conducted in the development of this report and are subject to variations from one specific community garden NbS configuration to another.*

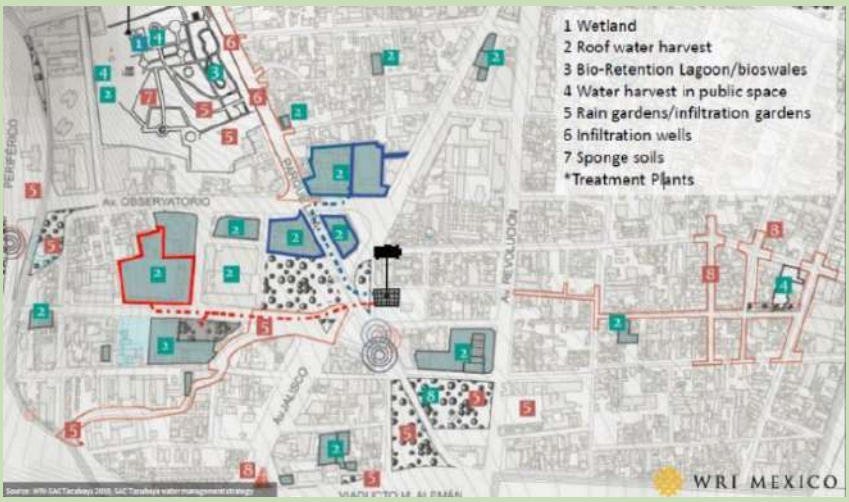


CASE STUDY 02

Financing green infrastructure through land value capture in Mexico City

Land-based financing instruments aim to monetise future land and property value creation to finance green infrastructure development. Such instruments can provide additional resources to complement limited public budgets to improve the design of urban development plans and mainstream NbS into infrastructure planning. A variety of instruments have been developed, such as:

- **building rights transfers** consisting in the sale of building rights from one site to another;
- **impact and exaction fees** referring to one-time fees generated from new construction or development projects;
- **Business Improvement Districts (BID)** or betterment levies where landowners and businesses contribute to fund improvements in the area.



Tacubaya's *Sistema de Acción por Cooperación* (Acting by Cooperation System, or SAC) was created to coordinate urban development and facilitate investment in green infrastructure in this working-class district of Mexico City. SAC manages a Trust Fund capitalized by various land-based financing instruments, notably building rights transfers. The Mexico City Government holds more than 960,000 square meters of building rights over four of Tacubaya's public parks, that will not be used. These building rights can therefore be sold and transferred to developers and allow higher density residential development in other areas of Tacubaya. The fees generated are then used to improve infrastructure, incorporating NbS elements such as rain gardens, bioswales, green roofs, etc.

SAC Tacubaya comprises two separate committees to (1) assess and approve land-based financing transactions and (2) manage the SAC Trust Fund. The latter is designed as a transparent and inclusive governance platform, ensuring participation of a wide range of stakeholders - notably community leaders, in determining priorities for investment and ensuring that planned investments benefit all residents. The SAC therefore acts as a platform interconnecting urban planning and financing to ensure additional investment capabilities are utilised towards the realisation of a coherent development plan for the neighbourhood, and that prospects of increased land and property value do not trigger unwanted developments and gentrification.

SAC had raised over USD 22 million by 2018, selling approximately 212,500 of a total of 960,257 m2 of transferable building rights (WRI-SAC Tacubaya 2019; Marsters et al. 2021).

The options presented above are just a selection from the broad range of available financing strategies[30]. Carbon finance, climate bonds, tax incentive schemes, zoning strategies, city and building labels, land value capture, sponsoring, entrepreneurial activities: many options can be looked at by NbS developers to generate revenues toward the financing of NbS in cities. These also show an important potential for private sector involvement, from real estate developers to carbon finance and other sustainability investors, such as insurance companies, who can reap some of the economic benefits of NbS. Other sources such as community sourcing, fiscal revenues, foundations, development aid or national budgets might also be very interesting options to consider. In fact, the previous sections demonstrate that many mechanisms exist to enable municipalities to raise, generate or sustain revenues for large-scale public investments in NbS with the promise of multiple benefits, including social and economic returns linked to increased attractiveness, innovation, job and NbE creations, environmental protection and better health and quality of life for their citizens (McQuaid 2021).

They also show that the following guiding principles can be followed toward the financing of NbS in cities.

Principles toward the financing of NbS in cities

- Identify the benefits that NbS investment will bring, including compared to grey infrastructure, and try to account and valuate these, for instance through NCA approaches
- Map the different stakeholders, how benefits will be distributed amongst them and how each might consequently contribute to NbS financing and/or governance
- Evaluate the financing needs, especially capital and maintenance costs, as well as the revenue potential
- Design a tailored business model based on assessed benefits, stakeholders and costs
- Develop an associated financing strategy, considering the wealth of available innovative financing mechanisms

Tools exist to support NbS developers in identifying tailored business models and associated financing strategies for their NbS. For instance, the ConnectingNature project has developed a NbS "business model canvas" and an associated guidebook to help developers come up with business models adapted to their specific intervention and local context[31]. A recent report for the MAVA foundation has also developed a tool to help NbS proponents understand the capacity of their NbS to attract different types of investments (MAVA foundation, UNEP-MAP SCP/RAC not published yet).

30 *For further options, the online BIOFIN "catalogue" provides a comprehensive list financing instruments tools and strategies that are applicable to the field of biodiversity finance:* ***https://www.biofin.org/finance-solutions***

31 ***https://connectingnature.eu/nature-based-solutions-business-model-canvas***

03 Unleashing the urban NbS market potential

There is clear political momentum for G20 cities and beyond to utilise NbS in their transition toward more sustainable urban development. In 2019, a NbS-for-climate manifesto was co-signed by 70 governments, private sector actors, NGOs and international organizations at the UN Climate Action Summit. NbS have been made a central instrument of the G20 Smart, Resilient and Sustainable Cities Action Plan adopted on 23 July 2021 at the Climate and Energy Ministers' Meeting. They were also a key topic of the IUCN World Conservation Congress held in September 2021. Moreover, they are part of the pathway toward achieving the goals of the UN Decade on Ecosystems Restoration. Finally, their mainstreaming in cities has been underlined as having the potential to make a significant contribution to the Sustainable Development Goals, especially Goal 11 on sustainable cities and communities (Naturvation Guide 2020).

Despite the existence of this political impetus and promising financing options, the needed scale of public and private investment toward NbS mainstreaming in cities has yet to materialize. Financing continues to be seen as one of the main barriers to their implementation, along with institutional and governance challenges (Mayor et al. 2021). With the improvement of urban finance today seen as "a global development imperative" (Platz et al. 2017), a few key actions can be taken to unlock the potential of the urban NbS emerging market:

Support municipalities in creating enabling regulatory and legislative environments. In many cities the regulatory and legislative environments still favour grey infrastructure over green and blue NbS infrastructure in urban planning processes (Cooper and Matthews 2020). Clearer definition of roles and responsibilities in public-private partnerships around urban NbS would facilitate the structuring of corresponding financing mechanisms. In addition, in some cities, public municipal finance reforms would be required to realize some of the financing options presented in the previous section (Platz et al. 2017).

Advance efforts on valuation and accounting for NbS multiple benefits. As noted previously, there is a need to augment existing efforts to improve valuation of NbS multiple benefits, including through NCA approaches at the municipal level. This will help create the necessary transparency and accountability environment for market development. It will also support private sector and impact fund managers in their regular impact monitoring and reporting obligations vis-à-vis their investors, facilitating more impact investors' engagement. Further research from the perspective of financial institutions could also be beneficial to clarify how they perceive risks and benefits and how to turn their identified barriers into enablers. Recent calls-to-action have been made for the investor community to develop its own sustainable finance standards (World Bank 2020; UNEP, UNDP 2021; Green Purpose Company and Finance Earth 2021).

Increase skillsets and awareness on NbS. The skills and necessary expertise to engage in NbS innovative financing strategies (and more generally NbS planning and management) are often lacking in municipalities and in the investor community. Often, municipality officials opt for grey infrastructure as a default solution and do not yet have the awareness to consider a comparison with a potential NbS. When they do have knowledge of alternative solutions for urban development, many city officials working in areas relevant to NbS lack the skills to develop innovative financing strategies or tailored management plans. Investor communities, beyond lacking access to consistent impact data, are also often missing organisational awareness and in-house expertise to navigate the complexity and nuances associated to NbS. In addition, skilled technical partners or NbE can be difficult to find in some locations, raising NbS implementation costs. Finally, public acceptance is gaining weight in supporting decision makers choices toward NbS and improved communication on their multiple benefits as well as further collaboration with civil society is needed. Raising awareness and developing the skillsets of these key stakeholders will be critical to accelerate the development of the NbS market (Urban20, C40 Cities Finance Facility 2021; Green Purpose Company and Finance Earth 2021; World Bank 2020; Anderson and Renaud 2021).

Demonstrate and document more successful business models and financing strategies, especially in cities of the global South. While there is increased evidence for successful NbS and more NbS catalogues and databases are in development, consistent data on CBA and financing strategies is often missing. For instance, recent research highlighted the need expressed by the insurance sector for more the evidence-based information on NbS risk reduction and multiple benefits generation to strengthen their level of confidence in the market (Marchal et al. 2019). The lack of available information raises the transaction costs of entering the NbS market (Green Purpose Company and Finance Earth 2021). In addition, most documented urban NbS are located in Europe and North America, leaving a gap in cities of the global South. Documenting and disseminating experiences on NbS, their business models and financing strategies, especially in cities of the global South, will also support efforts on valuation and accounting and enable increased awareness and skillsets for relevant stakeholders.



Appendix
Urban NbS types

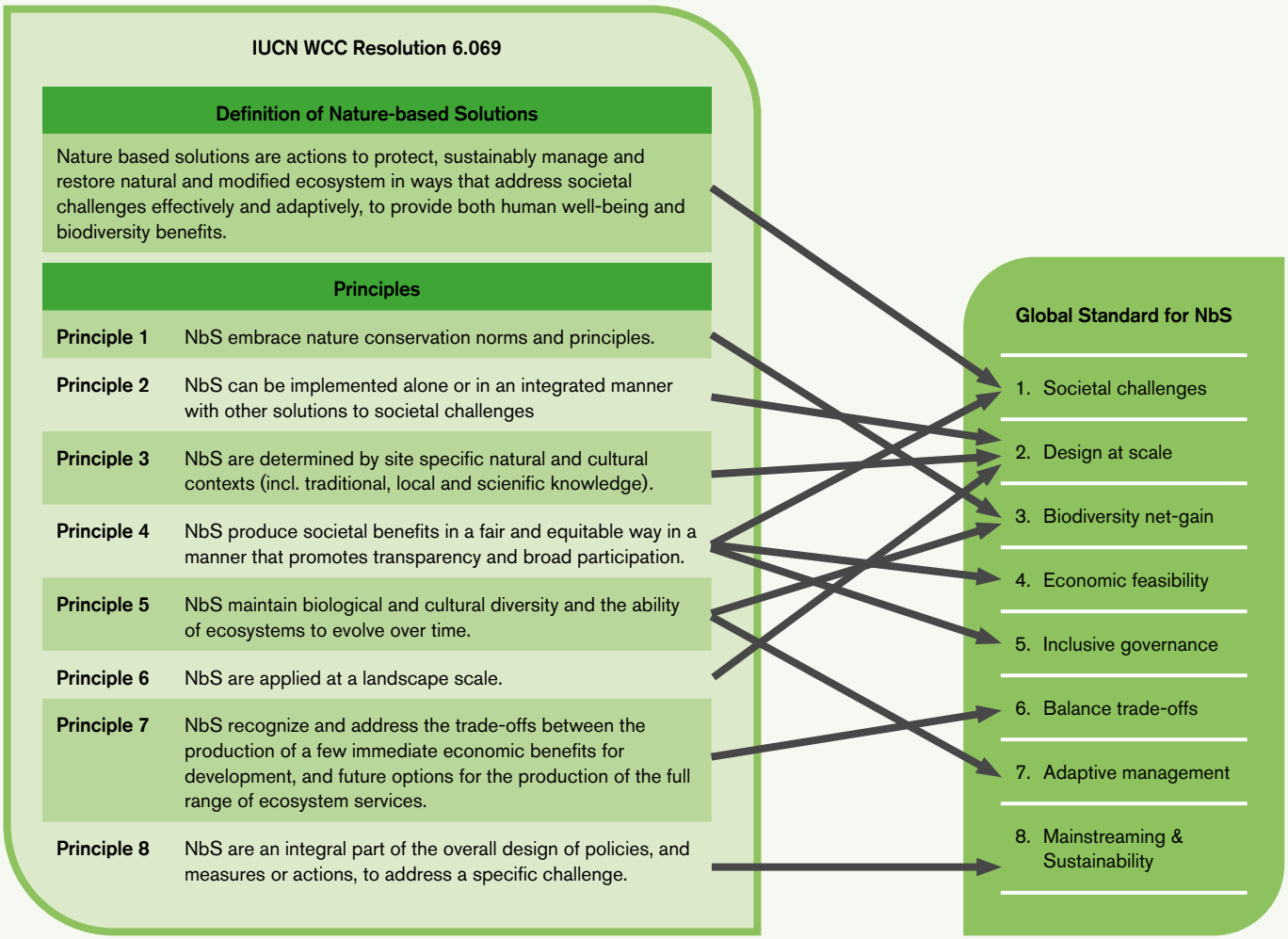
Green roofs, green walls, atria, grassed swales, water retention ponds, rain gardens, river restoration, wetlands, sustainable urban drainage systems (SUDS), large urban parks, urban forests, street trees, community gardens, NbS interventions can take many forms, and the literature has identified different categories of NbS (see table 1.)

Table 1. *Examples of NbS classifications*

Classification	Description	Main categories
The Naturvation Urban Nature Atlas	This database of over 1,000 NbS interventions across Europe distinguishes eight main categories of NbS under which they list 29 NbS types (Almassy et al. 2017).	Allotments and community gardens, blue areas, derelict areas, external building greens, green areas for water management, green indoor areas, grey infrastructures with green features, and parks or semi-natural urban green areas.
URBAN GreenUP's NbS catalogue	NbS are grouped into four classes under which 42 NbS types are listed (URBAN GreenUP 2018)	Renaturing urbanization, singular green infrastructures, water interventions, and non-technical interventions.
J.A.C. Castellar et al.	Based on NbS lists from four European projects, this typology establishes seven classes of NbS under which 32 NbS types are grouped (Castellar et al. 2021).	Spatial arboreal units, spatial mixed vegetation unit, technological vertical units, technological horizontal units, river interventions, soil interventions and biodiversity interventions.
Catalogue of Nature-based Solutions for Urban Resilience	The catalogue identifies 14 NBS « families » (World Bank 2021)	Urban forests, terraces and slopes, river and stream renaturation, building solutions, open green spaces, green corridors, urban farming, bioretention areas, natural inland, wetlands, constructed inland, wetlands, river floodplains, mangrove forests, salt marshes, and sandy shores.

Many other classifications exist cataloguing NbS from different perspectives, such as their technical aspects, drivers, purposes, types of practices they imply, etc. They show that no international standard for NbS typology exists but that there are many options available to engage in NbS. Most importantly, these different classifications recognise that in practice, NbS interventions will cut across their tentative categories and types. For instance, the restoration of a river through the reopening of the river stream and the re-naturalization of the river banks might be part of a larger urban park or new eco-district project which would include other NbS features such as sustainable urban drainage systems or street trees. Beyond types and categories, each NbS intervention needs to be tailored to its local circumstances, including the specific challenges to be addressed, the geographical, social, cultural, political and economic contexts to ensure its sustainability. The IUCN has developed a methodological framework to guide the design and scaling-up of NbS. It aims to promote further standardisation in NbS approaches and to provide public and private stakeholders with strong assurance about the impact of NbS. The guidance provides eight core principles and criteria to support implementation of quality NbS (see Figure 1.).

Figure 1. *Link between the NbS Principles and the NbS Standard Criteria. (© IUCN)*



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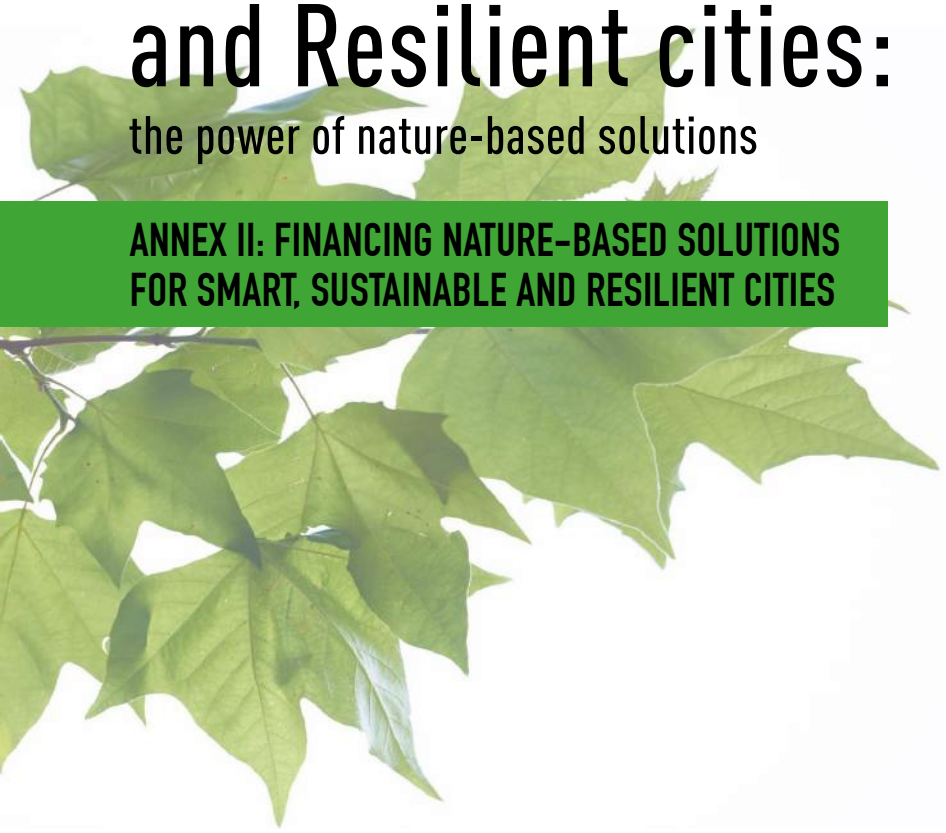
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Smart, Sustainable and Resilient cities:

the power of nature-based solutions

ANNEX II: FINANCING NATURE-BASED SOLUTIONS FOR SMART, SUSTAINABLE AND RESILIENT CITIES



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