Horizon 2020 Programme

Clearing House

Research and Innovation Action (RIA)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 821242

Start date : 2019-09-01 Duration : 48 Months
http://clearinghouseproject.eu

Report on business models and investment cases for UF-NBS

Authors : Mrs. Joanne SCHANTE (LGI), Félicie FORGEOIS (LGI), Helena SUAREZ GROEN (LGI), Pierre CATTOIRE (LGI), Thomas JUDES (LGI), Rik DE VREESE (EFI)

Clearing House - Contract Number: 821242

Project officer:

Document title	Report on business models and investment cases for UF-NBS
Author(s)	Mrs. Joanne SCHANTE, Félicie FORGEOIS (LGI), Helena SUAREZ GROEN (LGI), Pierre CATTOIRE (LGI), Thomas JUDES (LGI), Rik DE VREESE (EFI)
Number of pages	105
Document type	Deliverable
Work Package	WP4
Document number	D4.1
Issued by	LGI
Date of completion	2024-05-07 16:23:44
Dissemination level	Public

Summary

Based on the CLEARING HOUSE project results and city case studies, the report investigates innovative business model solutions and investment cases concerning UF-NBS. Research underscores the role of UF-NBS in safeguarding, sustainably managing, and restoring nature ecosystems to address social and environmental challenges. However, UF-NBS face major challenges in terms of funding, and therefore of widespread adoption and scaling, therefore. This is related to the multifaceted nature of UF-NBS, the complexity in measuring both qualitative and quantitative long-term impacts, amongst other factors. The business model framework is a useful tool for designing UF-NBS, ensuring the creation, delivery, and capture of value in their respective environments, and ultimately build a sustainable operating and funding model. The CLEARING HOUSE case studies and workshops results highlight the challenges faced by UF-NBS and the need for more innovative business models and investment cases. With the aim to reach actionable recommendations and ways forward for UF-NBS?s business models, the CLEARING HOUSE project has followed a problem-based analysis: starting with issue statements, finding primary and secondary sources addressing these issues and providing some answers to them (be they complete or partial), and seeking additional insights to the unsolved challenges, in order to focus on recommendations for that most important gaps. The problem-based analysis identified key UF-NBS business model solutions and innovative approaches, providing practical insights on how to address UF-NBS challenges. The analysis reveals the interconnectivity of UF-NBS business model components: value proposition, value capture and target beneficiaries, key partners and governance, key activities and cost structure, key resources, and cost reduction. Challenges experienced by UF-NBS in one of these components can be addressed through solutions and stakeholders linked to another component. The proposed solutions include a combination of partnerships, community engagement, technological innovation, and novel financial mechanisms. Key recommendations are derived from these insights, offering pathways to explore new or different types of business models and funding mechanisms. The report?s main outcome is "Innovative business models", which explores strategies to enhance urban forest sustainability and resilience through entrepreneurial approaches and revenue generation mechanisms. The core r...

Approval

Date	By
2024-05-07 17:30:39	Dr. Rik DE VREESE (EFI)
2024-05-07 17:33:53	Dr. Rik DE VREESE (EFI)

Report on business models and investment cases for UF-NBS (D4.1)

Authors

Félicie Forgeois (LGI), Helena Suarez Groen (LGI), Pierre Cattoire (LGI), Thomas Judes (LGI), Joanne Schanté (LGI), Rik De Vreese (EFI)

Contributors

Clive Davis (EFI), Etienne Aulotte (Bruxelles Environnement), Vincent Chauvet (LGI), Joanne Schanté (LGI), Gautier Michel (AxessImpact), Gregory Guillot (AxessImpact), Connell Grogan (Nature Impact), Tom Nelson (Nature Impact), Michel de Kemmeter (Club of Brussels), Pierre Rousseau (3R EcoConsulting), Franck Barroso (Innovate 4 Nature), Emanuele Quanranta (European Commission), Paul Nolan (Mersey Forest), Silvia Argentiero (Parco Nord Milano), Eugenia Vidal-Casanovas (AMB), Barbara Darr (Wald und Holz NRW), Oliver Balke (Wald und Holz NRW), Georg Nesselhauf (Stadt Gelsenkirchen), Sebastian Scheuer (HUB), Nicola da Schio (VUB), Manuel Wolff (HUB), Lukasz Mielczarek (UMKrakowa), Przemyslaw Szwalko (UMKrakowa)

TABLE OF CONTENTS

2

List of Figures

List of Tables

REFERENCE

Forgeois, F., Suarez Groen, H., Cattoire, P., Judes, T., Schanté, J. De Vreese, R., 2024. Report on Business models and investment cases for UF-NBS (4.1). H2020 project CLEARING HOUSE, grant agreement no. 821242. DOI: 10.5281/zenodo.11108668.

EXECUTIVE SUMMARY

Based on the CLEARING HOUSE project results and city case studies, the report investigates innovative business model solutions and investment cases concerning UF-NBS. Research underscores the role of UF-NBS in safeguarding, sustainably managing, and restoring nature ecosystems to address social and environmental challenges. However, UF-NBS face major challenges in terms of funding, and therefore of widespread adoption and scaling, therefore. This is related to the multifaceted nature of UF-NBS, the complexity in measuring both qualitative and quantitative long-term impacts, amongst other factors. The business model framework is a useful tool for designing UF-NBS, ensuring the creation, delivery, and capture of value in their respective environments, and ultimately build a sustainable operating and funding model. The CLEARING HOUSE case studies and workshops results highlight the challenges faced by UF-NBS and the need for more innovative business models and investment cases.

With the aim to reach actionable recommendations and ways forward for UF-NBS's business models, the CLEARING HOUSE project has followed a problem-based analysis: starting with issue statements, finding primary and secondary sources addressing these issues and providing some answers to them (be they complete or partial), and seeking additional insights to the unsolved challenges, in order to focus on recommendations for that most important gaps. The problem-based analysis identified key UF-NBS business model solutions and innovative approaches, providing practical insights on how to address UF-NBS challenges. The analysis reveals the interconnectivity of UF-NBS business model components: value proposition, value capture and target beneficiaries, key partners and governance, key activities and cost structure, key resources, and cost reduction. Challenges experienced by UF-NBS in one of these components can be addressed through solutions and stakeholders linked to another component.

The proposed solutions include a combination of partnerships, community engagement, technological innovation, and novel financial mechanisms. Key recommendations are derived from these insights, offering pathways to explore new or different types of business models and funding mechanisms. The report's main outcome is "Innovative business models", which explores strategies to enhance urban forest sustainability and resilience through entrepreneurial approaches and revenue generation mechanisms. The core recommendations emphasize reducing reliance on public sector funding by developing business models that generate independent revenue streams, then recommending the use of advanced technologies such as AI, remote sensing, and GIS to monitor and optimize urban forest management. These recommendations can be categorized as follows:

- **Co-design with funders**: Developing innovative financing models through co-design with various stakeholders. For instance, the integration of Forest Resilience Bonds is an innovative approach, where funding from forestry management bodies, utility companies, and beverage companies are pooled to support urban forest development. This model distributes risks across different stakeholders, reducing overall financial exposure and fostering a collaborative investment framework.
- **Challenge assumptions**: To embed UF-NBS into urban planning norms, advocate for a policy change that incorporates green infrastructure as a standard element of urban development. An example provided is the city of Ghent, which mandates the inclusion of public green spaces in new urban developments. This regulatory approach ensures that urban forestry is an integral part of city planning processes, promoting ecological and social well-being.

- **Clearly identify value**: Emphasize the full range of environmental, social, and economic benefits of urban forests. For example, urban forests contribute to air and water purification, enhance biodiversity, and offer recreational spaces which improve mental health and social cohesion. The development of measurable indicators such as carbon sequestration rates and biodiversity indexes help in quantifying these benefits, making a compelling case for investment in UF-NBS.

- **Promote and disseminate**: Supporting research and development on value assessment is crucial. The use of AI-driven analytics and GIS mapping in urban forestry facilitates detailed monitoring and optimization of tree health and ecosystem services, thus providing data-driven insights that enhance the valuation of urban forests.

- **Burst myth bubbles**: Leveraging technology and fostering partnerships are essential in dispelling myths about urban forestry. One example is the use of remote sensing and public participation GIS (PPGIS) to gather and analyse data on urban green spaces, which helps in community engagement and knowledge-sharing. Additionally, promoting educational initiatives such as the gamified urban forest education apps can increase public awareness and support for UF-NBS projects.

- **More innovative approaches**:
  - **Urban forestry entrepreneurship**: Privately led, startup-style initiatives are on the forefront, using technologies to manage urban green spaces efficiently. Examples include the creation of smart urban forest carbon marketplaces that utilize blockchain technology to issue tradable carbon credits.
  - **Revenue as a funding stream**: Generating income from urban forests through sustainable tourism and educational programs can financially sustain these ecosystems. Examples like the Bosland Forest in Belgium, which is marketed as a sustainable tourism destination, integrate eco-tourism with forest conservation efforts.
  - **Funding upfront costs and maintenance**: Using blended finance models mitigates counterpart risks and secures initial investment. Hybrid models, such as those leveraging cryptocurrencies for blended finance, offer a compelling method to combine diverse funding sources, enhancing the financial resilience of UF-NBS projects.
  - And others!

Urban forest developers, to whom this report is addressed, are encouraged to first question their existing business model, and then open to other more creative solutions on various dimensions of the Business Model Canvas, which could help to strengthen their funding capacity and therefore increase their sustainability on the long run.

KEYWORDS

Sustainable urban development, trees, forests, biodiversity, urban regeneration, green infrastructure, nature-based Solutions, urban-forest, green infrastructures, business models, investment cases

ABBREVIATIONS

Disclosure: All the technical definitions were defined earlier in the CLEARING HOUSE project. In order to have a clear frame of reference of what we call urban forests, urban areas, ecosystems, urban parks etc. please refer to CLEARING HOUSE deliverables.

UF-NBS: Urban forests as nature-based solutions

NBS: Nature-based solutions

NBE: Nature-based enterprise

SoA: State of the Art

KEY DEFINITIONS

Urban forests: tree-based urban ecosystems that address societal challenges, simultaneously providing ecosystem services for human well-being and biodiversity benefits. Urban forests include peri-urban and urban forests, forested parks, small woods in urban areas, and trees in public and private spaces.

Urban forestry: the practice of planning and management of urban forests to ensure their health, longevity and ability to provide ecosystem services now and in the future.

Nature-based Solutions (NBS): Nature-based Solutions (NBS) are defined 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".

Urban tree(s): usually long living woody organism including woody shrubs, usually single stemmed, with the potential to grow at a site in an urban or peri-urban area. This includes roadside trees, trees in squares, parking areas, or in parks and private gardens. Urban trees appear as individual trees, or as groups of trees.

Urban forests as nature-based solutions: UF-NBS are a subset of nature-based solutions, which build on tree-based urban ecosystems to address societal challenges, simultaneously providing ecosystem services for human well-being and biodiversity benefits. UF-NBS include peri-urban and urban forests, forested parks, small woods in urban areas, and trees in public and private spaces. UF-NBS comprise every measure a city can take to address urban development challenges by deploying tree-based ecosystems. (European Forest Institute, 2018)

Examples of UF-NBS projects: External UF-NBS project used as an illustrative example.

Case studies: Internal CLEARING HOUSE case studies (Brussels, Krakow, Leipzig, Gelsenkirchen, Barcelona)

VERSION HISTORY

Version	Date	Author	Partner	Description
0.1	02/11/2021	Lamiaa Biaz	LGI	Early draft
0.5	28/02/2024	Pierre Cattoire	LGI	Final draft
1	29/02/2024	Pierre Cattoire	LGI	V1
2	08/03/2024	Pierre Cattoire	LGI	V2
3	30/04/2024	Pierre Cattoire	LGI	V3, after revision by Rik De Vreese

1   INTRODUCTION

By 2050, approximately 70% of the world's population is expected to reside in urban areas (United Nations, 2018). The swift expansion of cities, coupled with economic and industrial progress, could result in adverse circumstances that have detrimental consequences to human welfare. To address the global challenges arising from urbanization, the CLEARING HOUSE project aims to find and implement cost-efficient Urban Forests as Nature-Based Solutions (UF-NBS) to restore nature into urban environments, enhance ecological connectivity, and ensure human wellbeing and social inclusion. CLEARING HOUSE specifically focuses on tree-based green infrastructures such as forests, parks and trees within and adjacent to urban areas.

UF-NBS are considered effective strategies to address the negative effects of climate change and urban expansion (Baro et al, 2014; Elmqvist, Gomez-Baggethun, & Langemeyer, 2016). They offer a wide range of ecosystem services, encompassing benefits like boosting biodiversity, improving air quality, moderating urban heat and assisting water regulation. Furthermore, UF-NBS are an integral component of urban environments, fostering the residential living environment by creating green spaces that bring physical and mental wellbeing to urban residents (Pearlmutter et al., 2017). Lastly, green spaces have been shown to promote learning, creativity and innovation (UN FAO, 2016).

Despite the demonstrated ability of UF-NBS to enhance the resilience of cities facing major ecological, socio-economic, and human wellbeing challenges, there remains a general shortage of investment and funding directed towards UF-NBS (Thompson, Bunds, Larson, Cutts, & Hipp, 2023) (UNEP, 2022). Moreover, the implementation of large-scale UF-NBS projects often involves substantial upfront costs and ongoing maintenance expenses, with returns on investments being difficult to calculate and materialise, and sometimes only visible after a long period, as trees need to grow and their service provisioning being related to tree size (De Vreese & Muys, 2024). Traditional public sector funding may prove insufficient and difficult to unlock across budget cycles, emphasizing the necessity for alternative and appropriate instruments and funding mechanisms.

In front of these challenges, it is critical to build attractive investment cases and sustainable, innovative business models to facilitate the uptake of these solutions. To deliver UF-NBS business models, it is generally agreed that projects need dedicated efforts across a set of activities which are not core to the project's initial value proposition. CLEARING HOUSE aims to provide supporting tools and guidance on how to develop and implement UF-NBS. This CLEARING HOUSE project deliverable D4.1 is the result of the work achieved in the project's task T4.1. It functions as a comprehensive report on UF-NBS business models (BM) and investment cases (IC) by conducting a thorough analysis of current UF-NBS business models and investment cases through a challenge-driven literature review, partner workshops, and expert interviews, to subsequently offer recommendations for the formulation of novel and improved models and investment cases.

This report starts by setting the scene for further analysis, incorporating internal findings from the CLEARING HOUSE project, external evidence on UF-NBS, and diverse expert perspectives. Following this, a comprehensive analysis is presented, investigating real world examples of UF-NBS and tailoring business models and investment cases accordingly. Lastly, recommendations are formulated on key UF-NBS business model insights, with the overarching objective to foster the sustainability and scaling of UF-NBS – either through replicability, or through increasing the size or efficiency of current projects.

This deliverable extends from prior CLEARING HOUSE findings and research, incorporating insights from case studies conducted by collaborating cities. While the CLEARING HOUSE project encompassed 10 cities — 5 European (Brussels, Leipzig, Krakow, Gelsenkirchen, Barcelona) and 5 Chinese (Beijing, Hong-Kong, Hangzhou, Huaibei, Xiamen)— this specific deliverable exclusively centred on the European context. While the formulated recommendations can be tailored to specific situations, the research conducted is focused on a European setting.

Disclaimer: While NBS are an increasingly studied approach to the challenges we face through climate change, the amount and quality of the data remains a challenge, especially when looking at specific solutions such as urban forests. While we can provide data points through primary and secondary research, please consider the level of details being described throughout this document: NBS, or UF-NBS, depending on the available data. In the last sections (learnings & recommendations), the report alternates between the two levels, as an NBS-general approach is often relevant to UF-NBS-specific approaches. For those reasons, consider this document as a snapshot of the current environment as of February 2024.

2   METHODOLOGY

2.1   Methodology overview

The methodology used for this report follows a problem-based approach in order to learn from case studies within and external to the CLEARING HOUSE project, and challenge innovative business models with the intention to build investment cases. The problem-based approach, akin to problem-based learning models in education, focuses towards answering problems rather than reiterating previously achieved conclusions, therefore aiming to create concrete new solutions to unsolved challenges. This approach started with carrying out an in-depth State of the Art (SoA) literature review on UF-NBS sustainable business models by combining the research on UF-NBS case studies (CLEARING HOUSE T2.1, da Schio et al., 2021) and inputs of the co-learning and co-design workshops (CLEARING HOUSE T3.1, De Vreese et al., 2021), complemented with reviewing the main limitations and challenges of current UF-NBS business models through a desk review, talking to expert stakeholders to learn about their experiences, and reviewing findings from previous tasks of the CLEARING HOUSE project. This methodology is described in detail below; Figure 1 presents the initial design of this methodology at the start of T4.1.

Steps	Methodology used for T4.1
1 Analysis of the State of the Art (SoA) (setting the scene)	• Literature review about UF-NBS Business Models and Investment Cases • Desk research • Interview with external stakeholders (3 interviews) • Inputs from workshops linking T2.2 to T4.1
2 Analysis: Tailoring and testing Business Models & Investment cases	• Selection of use cases based on the analysis of the SoA (workshops) • Tailoring and testing of BMs and Investment cases
3 Recommendations: Large scale deployment analysis	• Environmental, socio-cultural and socio-economic factors that are barriers or drivers of the scale of the Business Models and Investment Cases

Figure 1: Methodology used for Task 4.1 Deriving business models and investment cases

After a few iterations, the methodology followed three main steps:

1. **Setting the scene by collecting input through secondary research (chapter 3)**: Here, we introduce CLEARING HOUSE project findings on UF-NBS from previous conducted workshops and other project deliverables. This is complemented with a literature review of external publications on UF-NBS (business models), aiding in the construction of a theoretical framework for sustainable business models centred around UF-NBS. This process involved identifying key UF-NBS business model concepts, providing the ground for the analysis.

2. **Analysing these inputs to drive tailored business models and investment cases for UF-NBS (chapter 4)**: After setting the scene, a comprehensive analysis was conducted. The initial part of the analysis focused on a problem-based approach to researching the main limitations and

challenges of current UF-NBS examples and investigating their solutions through UF-NBS business models. Analysing real-life UF-NBS examples and CLEARING HOUSE case studies, entailed researching the real-life problematics that often reoccur in these cases, and how novel business model practices or learnings could help mitigate the challenges and improve the effectiveness of UF-NBS. Through the analysis, general environmental, socio-cultural and socio-economic barriers and drivers of Business Models and Investment Cases were identified.

3. **Drawing recommendations on how to model, fund, and scale UF-NBS projects (chapter 5)**: Based on the analysis results provided from step 2, recommendations for large-scale UF-NBS deployment were developed and challenged with key experts: members of the CLEARING HOUSE User Advisory Board (UAB) and city representatives from the European CLEARING HOUSE case study cities Gelsenkirchen, Krakow, Barcelona, Leipzig and Brussels. Because UF-NBS can include various stakeholders such as municipalities/local authorities, organisations, enterprises, investors, citizens and volunteers, this deliverable encourages to integrate different stakeholder perspectives. To capture diverse perspectives on UF-NBS business models and investment cases, semi-structured interviews were conducted with various experts in the field of UF-NBS finance systems and project makers.

2.2 Zoom on semi-structured interviews

To investigate the business models innovation and related investment bottlenecks for urban forests, and as well as explore potential solutions, a detailed semi-structured interview methodology was employed. The interviews were conducted following best practices for semi-structured interviews, ensuring both structure and flexibility to explore the themes comprehensively. Here were the key steps designed as part of the methodology:

- Selection of participants
- Development of an interview guide
- Pre-interview communication
- Conducting the interviews with a semi-structured approach
- Engagement and clarification during interviews
- Transcription and anonymization of interviews
- Thematic analysis of transcripts
- Validation of key findings with participants

An interview guide was crafted to anchor the conversations around the critical themes identified, such as value proposition, public-private partnerships, and funding challenges, among others. This guide comprised open-ended questions, designed to stimulate detailed discussions, and was supplemented by follow-up questions to probe deeper into specific areas of interest. Prior to the interviews, participants were contacted to explain the study's objectives and the nature of the discussions, ensuring their informed consent for participation and recording.

During the interviews, a semi-structured approach allowed for a dynamic exploration of top Investment Cases, providing the flexibility to pivot based on the participant's insights and to venture into emergent themes. Interviewers employed active listening and engagement strategies to foster an open dialogue, encouraging participants to share their experiences and perspectives freely. This approach was instrumental in uncovering nuanced understandings of the investment landscape for UF-NBS. The interview findings are incorporated into this report either as referenced insights or direct quotes.

The selected experts to interview were: Gautier Michel (AxessImpact), Gregory Guillot (AxessImpact), Connell Grogan (Nature Impact), Etienne Aulotte (Bruxelles Environnement), Pierre Rousseau (3R EcoConsulting), Tom Nelson (Nature Impact), Franck Barroso (Innovate 4 Nature).

2.2.1 Designing strategic questions

Strategic questions were dynamically integrated throughout the interview process, tailored to each participant's expertise and the unfolding conversation (see Figure 2). These questions were designed to elicit insights on not only the explicit challenges and solutions but also on the underlying factors influencing investment decisions in UF-NBS. For example, questions aimed at understanding the perceived value of non-monetary benefits of UF-NBS, strategies for leveraging public-private partnerships, and the impact of regulatory environments on investment flows. The flexibility to adjust questioning in real-time enabled a deeper exploration of complex issues, revealing innovative approaches and critical barriers to scaling UF-NBS investments.

The creation of a strategic questions bank (see Figure 4) involved a structured and informed approach. Critical themes and gaps in the existing body of knowledge on UF-NBS implementation and investment challenges have been identified in the literature review (SoA). This step was enriched by consultations with subject matter experts, which ensured the relevance and depth of the questions being formulated. From these initial stages, key themes such as the value proposition, public-private partnerships, regulatory challenges, and stakeholder engagement were distilled. The drafting of the questions was an iterative process, emphasizing open-ended inquiries that prompted detailed and reflective responses, with each question being carefully designed to probe the identified themes thoroughly.

Organisation	3R EcoConsulting
Type	Finance
Description	Pierre is an Independent Consultant for Finance and Sustainability. His main clients are large financial institutions, renowned corporations as well new disruptive entrepreneurship initiatives. Indeed, amongst several mandates, he is a Senior Advisor for BNP Paribas's Corporate Engagement Department, Project Advisor for Deme Group and Senior Advisor to the CEO of innovative nature-based businesses such TerraCrp and Blue Finance
Interviewee	Pierre Rousseau
Interview date	20/12/2023

Question bank

Find questions:	finance
Relevant questions (from the question bank): IMPORTANT: Search is AND not OR - it will filter more with additional keywords	Org type: - Are you actively investing in UF-NBS projects? - Do you conduct risk assessments specifically for UF-NBS investments? - Do you recognize long-term value creation in UF-NBS investments? - Do you collaborate with other investors to fund UF-NBS initiatives? - Have you analyzed the profitability potential of UF-NBS projects? - Do you ensure that your UF-NBS investments comply with environmental regulations? - Are you identifying new market opportunities in the UF-NBS sector? - Do you perform cost-benefit analyses for UF-NBS projects? - Are you exploring innovative financing models for UF-NBS?
Interview notes (key takeaways)	- retour des dividendes dans la structure - Marc Anseli, forets urbaines, méthodes de financement régionaux - règles d'accompagnement non pas nationales mais régionales à cause des problématiques liées à la biodiversité locale (biotope) ; endémique + prévoir le futur car les conditions climatiques changent trop vite, il faut s'adapter aujourd'hui au monde de demain ; a été chercher des techniques au Japon (gourou de la UF) - Barosina : NBS au Portugal (sud de Lisbone) ; coopérative agricole, vie + nature + biodiversité ; **boite privée porteuse du projet** ; ne pas dissocier real-estate de la partie nature ; créer des circuits de profitabilité **"on ne peut pas faire de durabilité si ce n'est pas profitable"** ; comment prendre les décisions liées à la nature par exemple wetlands ? ; il faut **"maximiser la monétisation des externalités et bénéfices biodiversité impact des oiseaux migrateurs sur le terrain"** ; intégrer, ne

Figure 2: Screenshot of expert interview notes linked to the question bank (content from the interview with Pierre Rousseau, 3R Eco Consulting)

2.2.2 Interview analysis

Following the interviews, the transcripts were meticulously analysed to identify common themes, challenges, and potential solutions. This thematic analysis was essential for distilling the wealth of information gathered into actionable insights. Interviews concluded with a validation of the key findings by the interviewed participants, which ensured the accuracy and reliability of the information captured.

2.2.3 QWIA

Recommendations are formed by applying LGI's QWIA (Quick Wins and Innovation Approach) *mapping* methodology, an innovative approach initially designed for regions. The purpose of this mapping tool is to position – and therefore question – each choice or category of strategic choices according to three criteria (see Figure 3):

- **Innovation**: The desired level of innovation of the action (X-axis, from low to high)
- **Speed**: The speed of implementation of the action and of the observation of its effects in the more or less long term (Y-axis, from slow to fast)
- **Impact**: The observed leverage of the action towards the intended outcome (bubble size)
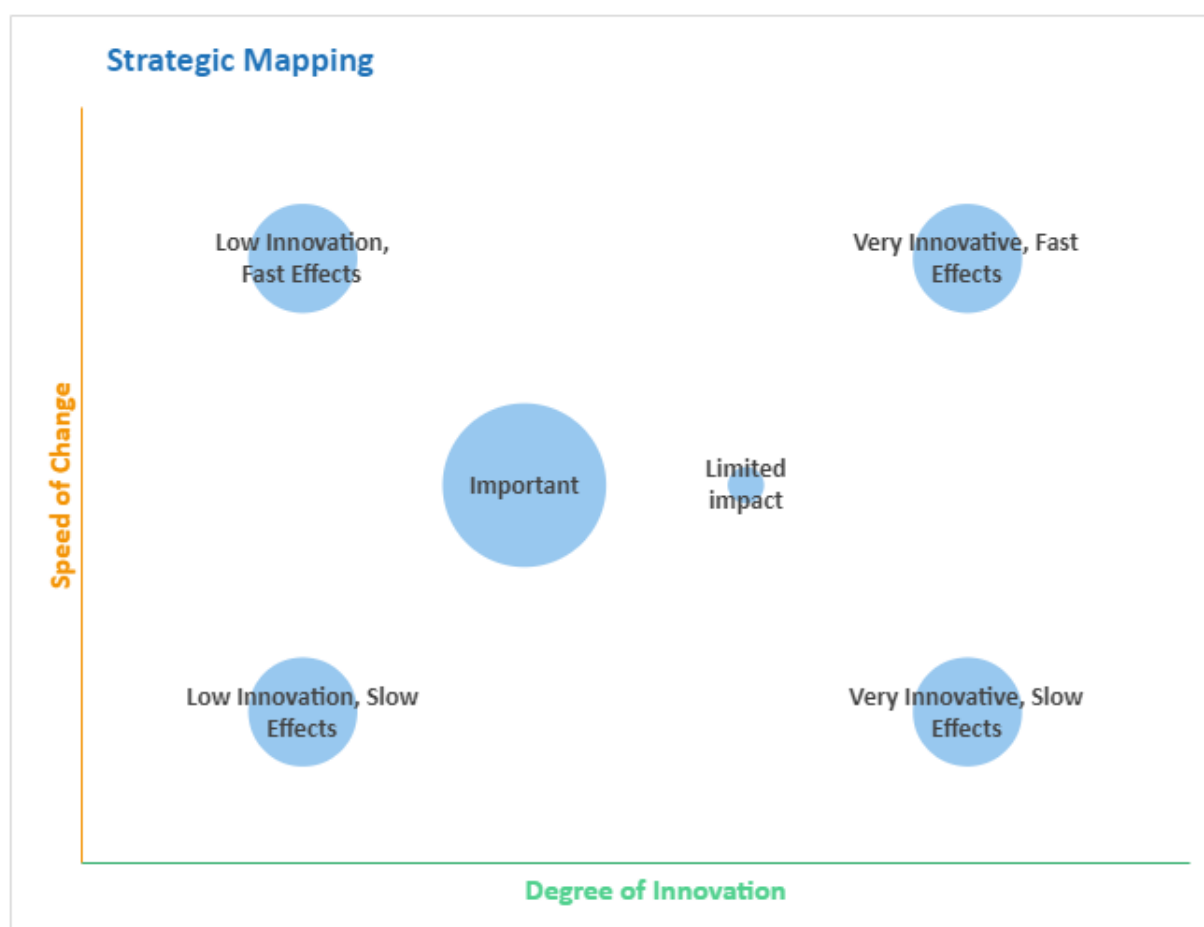
Figure 3: Example QWIA matrix ©LGI

In short, the QWIA helps rank the strongest levers for change in the short term, vs. the deepest changes needed to sustainable transformation.

Each of these criteria is quantified by combining the following parameters:

- Score from 0 to 10, awarded following a market analysis or study
- The score is slightly adjusted subjectively by the analysts, usually through expert conversations and only with the aim to further differentiate each opportunity
- A correction made with the recipient(s) of the study, insofar as the matrix is also and above all derived from the insights of a knowledgeable public

Tools at your disposal on this page:
Search results
Directive questions
Open questions

Dynamic search (press Enter to update the results) IMPORTANT: Search is OR - the more keywords, the more results:
What are you looking for? Search for Organization type, Theme, Topics.
value

Search results   *Sorted by relevance (more relevant if found in more fields)*

Strandard questions:
- Result type, Theme2, Other: Do you recognize long-term value creation in UF-NBS investments?
- Result type: Are UF-NBS solutions part of your strategy to address urban environmental challenges?
- Result type: Do you consider UF-NBS as a factor in improving city livability and attractiveness?
- Result type: Have you quantified the economic impact of your R&D efforts in UF-NBS?
- Result type: Do you have established channels for transferring UF-NBS research findings to practical applications?
- Result type: Have you adapted your business model to capitalize on UF-NBS opportunities?
- Result type: Do you align your UF-NBS offerings with specific client needs and demands?
- Result type: Are you actively developing new markets for UF-NBS-related products or services?
- Result type: Do your UF-NBS offerings directly address specific customer pain points?
- Result type: Are you actively disseminating UF-NBS knowledge to wider communities?
- Result type: Do your UF-NBS programs effectively engage students?
- Result type: Are you developing community projects that directly incorporate UF-NBS?
- Result type: Are UF-NBS solutions part of your strategy to address urban environmental challenges?
- Result type: Does your research directly contribute to advancements in UF-NBS practices?
- Result type: Have your research findings identified new economic benefits of UF-NBS?
- Result type: Do you engage in public-private partnerships to develop UF-NBS solutions?
- Result type: Do you assess how effectively UF-NBS initiatives meet market and community needs?

Project questions:
- Result: Can you describe how UF-NBS projects are being tailored to address specific urban environmental challenges in your city?
- Result: How does your research quantify and enhance the economic impact of UF-NBS in urban environments?
- Result: How is your organization facilitating the transfer of UF-NBS research findings to practical, real-world applications?
- Other: In your research, how do you approach the challenge of conducting cost-benefit analyses for UF-NBS, especially regarding their long-term benefits and intangible values?

Figure 4: Screenshot of the LGI strategic question bank for semi-structured interview of UF-NBS business models

3   SETTING THE SCENE

The CLEARING HOUSE project collected real-life data and evidence of UF-NBS from diverse case studies. The case studies provide direct connections to cities and stakeholders engaged in UF-NBS implementations. As the project developed various resources on UF-NBS, gathering these results and identifying relevant components and insights to UF-NBS business models contributes to the objective of tailoring innovative UF-NBS business models.

3.1   State of the Art

The State of the Art (SoA) is an in-depth literature review on UF-NBS business models, using external research publications and journals, and often referred to as "secondary research". The SoA fosters the understanding of the impact of urban forests, the challenges to assess these impacts which in turn hinders the scaling and access to funding for UF-NBS. The SoA then draws attention to existing UF-NBS business models, clarifying how the business model components help contribute to the long-term impact of UF-NBS.

Note: As CLEARING HOUSE is focusing on UF-NBS, other solutions to make humans feel better in the city and to mitigate and adapt to climate change such as soft solutions (eco-gestures, change of habits, soft mobility), blue solutions (installation of ponds, rivers, fountains) and grey solutions based on nature (choice of materials, porosity, thermal efficiency) are not developed in this report.

3.1.1   UF-NBS definition

Research refers to NBS as an approach to help cities solve urban challenges while protecting and enhancing natural systems and providing a range of co-benefits to improve the well-being of urban dwellers (Hawxell, Mok, Maciulyte, Sautter, & Dobrokhotova, 2019). While both NBS and UF-NBS share a common goal of utilizing nature to address urban challenges, they differ in their specific focus and implementation strategies.

NBS encompasses a broad range of approaches that integrate natural elements, such as green infrastructure, urban parks, wetlands, and green roofs, to provide multiple ecosystem services in urban areas. NBS projects often involve a mix of engineered and natural components, seeking to strike a balance between human needs and ecological sustainability. UF-NBS, however, specifically refers to all measures a city can take to address urban sustainable development challenges by planting and managing trees and their associated vegetation and environs. UF-NBS are socio-ecological interventions that combine human management with nature's functionality within urban settings, offering great potential for more sustainable urban development. Unlike the wider range of natural elements included in NBS, UF-NBS are more simply characterized by the strategic planting of trees or shrubs in urban areas, ranging from street trees to larger forested areas within or surrounding cities.

3.1.2   UF-NBS ecosystem services

UF-NBS help with the protection, sustainable management and restoration of nature ecosystems as solutions to societal and environmental challenges (United Nations, 2021). The living environment and health of urban dwellers are improved thanks to the UF-NBS schemes put in place, and thanks to their participation in the creation of projects, social ties are strengthened (ADEME, 2021). With UF-NBS strategically focusing on developing green, sustainable and resilient cities (Hawxell, Mok, Maciulyte, Sautter, & Dobrokhotova, 2019), specific urban forest ecosystem services include carbon

18

sequestration, temperature regulation, air purification, noise reduction and recreational opportunities. Such ecosystems contribute to urban biodiversity, enhance the aesthetic value of cities, and improve the overall quality of life for urban residents. While UF-NBS provide many ecosystem services which will be differently defined and listed depending upon the source and their local context, CLEARING HOUSE has aimed to provide a specific list, as a starting point for the needed analysis. Table 1 provides examples on how UF-NBS can bring numerous and simultaneous societal, environmental and economic benefits, with each contribution having capacity to trigger the others. Due to the fact that UF require time and the right weather conditions to grow and demonstrate some of their lasting social, economic and environmental advantages, UF-NBS developers are encouraged to consider these longer-term benefits over solely focusing on a short-term cost-benefits analysis during the selection and implementation processes of UF-NBS. Figure 5 visualizes the Urban Forest contributions to our social, ecological and economic environment.

Table 1: UF-NBS ecosystem services and their social, environmental and economic benefits

UF-NBS ecosystem services	UF-NBS Benefits	Type of benefit
UF contribute to absorb and filter pollutants from air	Improved Air Quality	Social benefits Environmental benefits
UF are sound barriers	Noise Reduction	Social benefits
UF help to reduce stress by providing nature surroundings	Stress Reduction	Social benefits
Urban forest can support good mental health by relaxing activities	Recreational Value	Social benefits
With UF shade and natural covered grounds, temperatures are lower, reducing the need for cooling machines during warmer seasons	Temperature Regulation	Social benefits Environmental benefits Economic benefits
UF offers a place to learn about vegetation and animals.	Training place	Social benefits Environmental benefits
Habitats for biodiversity (birds, mammals, insects, worms...)	Biodiversity Conservation	Environmental benefits
UF can be planted to grow vegetables or other NTFP (Non timber food product)	Food production	Environmental benefits Economic benefits
UF can absorb rainwater and decrease the erosion and flooding risks	Reduced Stormwater Runoff	Environmental benefits Economic benefits
UF contribute to carbon capture	Carbon Stock	Environmental benefits Economic benefits
UF will attract more residents and empower community connections	Attractivity and aesthetic value	Social benefits Economic benefits
UF will provide job and business opportunities for their implementation & maintenance	Provide jobs	Social benefits Economic benefits
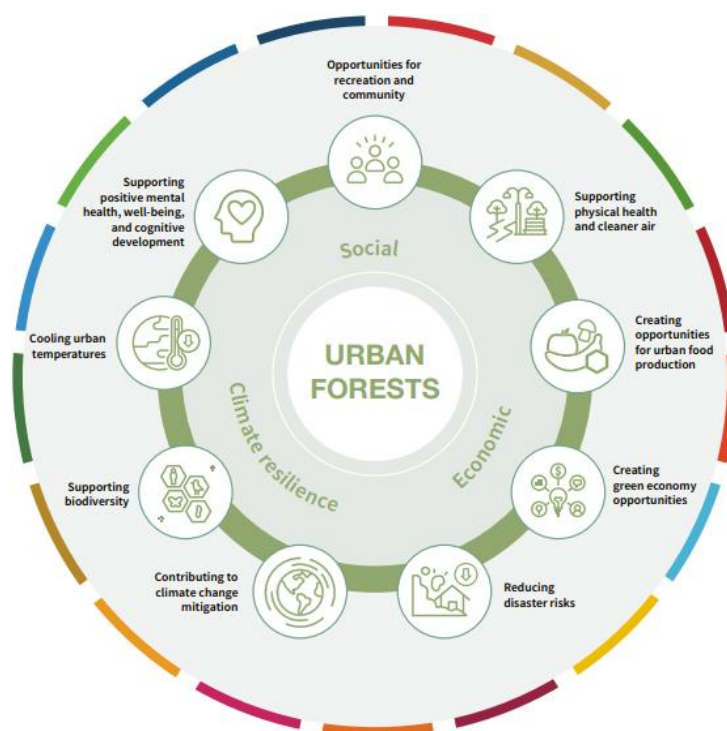
Figure 5: The social, environmental and economic contributions of urban forests (United Nations, 2021)

The widespread use of UF-NBS is part of many international strategies to achieve the UN's Sustainable Development Goals. In this way, UF-NBS can contribute to the objectives of several international initiatives:

- the United Nations Framework Convention on Climate Change (UNFCCC, e.g. the Paris Agreement),
- the Convention on Biological Diversity,
- the Strategic Action Programme for the Conservation of Biological Diversity and the Sustainable Management of Natural Resources in the Mediterranean Region (SAPBIO post-2020),
- 2020 IUCN Marseille Manifesto
- the European Green Deal, framing a number of policies, such as:
    o the European Climate Law,
    o the 2030 Climate Target Plan,
    o the European Strategy on Climate Adaptation (COM/2021),
    o the European Biodiversity Strategy 2030 (COM/2020/380),
    o the European Nature Restoration Law,
    o the European Action Plan "Towards zero air, water and soil pollution" (COM/2021/400),
    o the Sustainable Chemistry Strategy (COM/2020/667),
    o the EU Forest Strategy for 2030 (COM/2021/572)
- the European Birds and Habitats Directives,
- the European Marine Strategy Framework Directive,
- the European Water Framework Directive

In the Green Infrastructure Strategy adopted in 2013, the Commission makes direct reference to the EU Adaptation Strategy to encourage action on green infrastructure and ecosystem-based approaches to adaptation and disaster risk reduction. The EU Adaptation Strategy published by the Commission in 2013 recommends the use of ecosystem-based adaptations (EbAs) because they are considered cost-effective for different scenarios, easily accessible and providing multiple benefits (ONERC, 2019) The Biodiversity Strategy and the Forestry Strategy include a target of planting 3 billion new trees by 2030, also in urban areas – with respect to existing trees and areas of high nature value. This provides a case for developing urban forest business models and investment cases. Further, to support the implementation of the Biodiversity Strategy, the European Nature Restoration Law (NRL, under discussion) includes binding targets for urban green, such as

- no net loss of urban green space by 2030, and an increase of urban green space with 5% by 2050;
- striving towards an urban canopy cover of minimum 10% in every city by 2050;
- an Urban Greening Plan (UGP) for every town and city with over 20.000 inhabitants.

3.1.3 UF-NBS enablers & barriers

A previous study from LGI (in partnership with EcoAct for ADEME on the French climate adaptation project ARTISAN) has revealed NBS-wide challenges. These challenges will be used as a basis for the further analysis of UF-NBS business models. The in-depth analysis of barriers and enablers for the deployment of NBS covered the full range of EU literature (publications, projects, studies, etc.), and counted and compared the number of occurrences of barriers and enablers in the NBS-related reports across different sectors including urban, agriculture, tourism, water, forest, and in general (see Table 2).

Table 2: Number of NBS projects that have mentioned business model-related enablers and barriers to their NBS project for climate adaptation (LGI, EcoAct, ADEME, 2020)

Category/Sector	ENABLERS						
	Urban	Agriculture	Tourism	Water	Forest	General	Total
Legal/Regulatory							19
Policies/ Strategies							87
Participation							21
Social and Geographic Context							11
Financing							28
Industry/Partnerships/Network							40
Demand/Markets							30
Administration and Organization							0
Communication and Dissemination							6
Competition							19
Financial Management							7
Performance/Efficiency							49
Skills/Professions/Workforce							22

Category/Sector	BARRIERS						
	Urban	Agriculture	Tourism	Water	Forest	General	Total
Legal/Regulatory							14
Policies/ Strategies							28
Participation							4

Category							Value
Social and Geographic Context							10
Financing							20
Industry/Partnerships/Network							19
Demand/Markets							14
Administration and Organization							12
Communication and Dissemination							9
Competition							2
Financial Management							7
Performance/Efficiency							29
Skills/Professions/Workforce							19

KEY

	0	1 to 4	5 to 7	8 to 10	>10

The study revealed that in the realm of NBS enablers, policies and strategies emerged as the most substantial factors, particularly within the general NBS category, which received the most mentions. This finding indicated that comprehensive strategies spanning multiple sectors were crucial in enabling NBS development. Notably, the urban sector also saw a high number of mentions in this category, underscoring the importance of policy support in urban environments. Additionally, forestry was identified as a sector where strategic policy support played a key role in facilitating NBS. Partnership networks were another major enabler, especially pronounced in the forestry sector. The study highlighted the importance of building partnerships and networks as essential for the success of NBS, indicating a strong reliance on collaborative efforts. Performance, efficiency, and the complexity of solutions received the highest number of mentions overall, suggesting a recognition that effective and sophisticated NBS can significantly impact urban and forested areas.

Conversely, the study also indicated that the same factors contributing to the success of UF-NBS could also act as barriers. Policies and strategies, while crucial enablers, were also seen as significant barriers, especially in the general category. This duality suggested that while strategic frameworks can facilitate the adoption of NBS, they can also pose challenges if they are not well-conceived or adequately implemented. Funding was a universal barrier, with the highest number of mentions in the general category, reflecting the widespread challenge of securing sufficient financial resources for UF-NBS initiatives. The complexity and demand for high performance, which were strong enablers, also represented the most significant barriers, particularly in the general and forest sectors. This suggested that the complexities associated with implementing effective UF-NBS solutions require careful management to avoid becoming impediments. The study further identified specialized skills and labour as notable barriers in the agriculture sector and generally across sectors. The lack of competencies, professions, and labour necessary to implement UF-NBS effectively was seen as a challenge that needed to be addressed to realize the full potential of UF-NBS.

Sector-specific observations from the study provided additional context. The urban sector showed a balanced view of enablers and barriers, with a strong emphasis on policies/strategies and performance/efficiency/complexity in both aspects. Forestry was unique in that the complexity of solutions was seen as both an enabler and a barrier, highlighting a nuanced understanding of the challenges and benefits specific to forestry related NBS.

Interestingly, these findings are confirmed by other studies in the field, for example the Clever Cities project (Clever Cities in D5.3 on Governance, Business and finance models.), which has enumerated ten significant barriers to UF-NBS adoption: knowledge deficits; multifunctional green infrastructure governance; the dilemma of balancing multiple objectives; engaging citizens; ensuring social inclusion; securing public support; obtaining political backing; acquiring financial resources; evaluating project impacts; and the scalability of solutions.

3.1.4   UF-NBS challenges: impact assessment, funding and scaling

However, the impact assessment of UF-NBS, and consequently their widespread adoption, is marked by an issue of complexity and the lack of a universally accepted approach. This complexity arises from the multifaceted nature of NBS, involving diverse ecological, social, and economic components that interact in dynamic and sometimes unpredictable ways. The absence of a standardized method for evaluating the impacts of UF-NBS adds another layer of challenge, making it difficult to compare results across different studies and regions or to aggregate them into a coherent global picture.

The difficulty in assessing the impacts of UF-NBS is underscored by recent research that highlights the need for a holistic and integrated approach to evaluation (Jacobs et al., 2016; De Vreese et al., 2019). For instance, previous studies emphasize the importance of incorporating both quantitative and qualitative Investment Cases to fully capture the range of benefits and potential trade-offs associated with UF-NBS implementations. This suggests that traditional cost-benefit analyses are insufficient for understanding the long-term value and societal impacts of NBS, advocating instead for a more nuanced approach that considers ecological, social, and economic dimensions concurrently (Raymond, et al., 2021). Further complicating the assessment landscape is the variability in local contexts and objectives for UF-NBS implementation. The effectiveness and impacts of UF-NBS can vary significantly depending on local environmental conditions, societal needs, and governance structures (Seddon, et al., 2020). This variability necessitates tailored assessment methodologies that can adapt to specific local contexts while still contributing to a broader understanding of UF-NBS impacts. The authors argue for the development of adaptable and scalable assessment frameworks that can accommodate the diverse objectives and conditions under which UF-NBS are applied.

There remains a general shortage of investment and funding directed towards UF-NBS. Furthermore, there exist a general lack of data on both public and private funding for UF-NBS due to an absence of a common framework for assessing, managing and disclosing the impact of nature in economic terms. Studies indicate that many UF-NBS projects face challenges in demonstrating their impact, leading to perceptions of high risk and a lack of reliable and long-term revenue streams. Consequently, the limited visibility of UF-NBS projects diminishes their attractiveness, deterring banks and investors from getting involved. This lack of financial support hampers the advancement of UF-NBS initiatives and undermines their potential to address urban environmental challenges effectively (UNEP, 2022).

3.1.5   UF-NBS business models

A 'business model' is a widely used term by enterprises and organizations to explain how different mechanisms of the entity work together to deliver value to a customer and how the entity makes money from this value proposition (Connecting Nature, 2019). Although initially developed for startups and businesses, the business model concept has proven to be a useful framework that can be adapted to other types of organizations and projects, including UF-NBS, as showcased during the Connecting Nature project (2019). In other words, business models are an easy-to-use matrix through which a

specific UF-NBS project can (re-)design how it will "create, deliver and capture" value (URBAN GreenUP, 2023).

From this point on in this deliverable, when talking about the UF-NBS business model, we refer to the UF-NBS Business Model Canvas (BMC) as presented by the Connecting Nature project (Figure 6: Business model Canvas developed by EU project Connecting Nature (2019))

Key Activities	Key Resources	Value Proposition	Key Partners	Key Beneficiaries
			Governance	
Cost Structure		Cost Reduction	Capture Value	
Cost of Inaction				
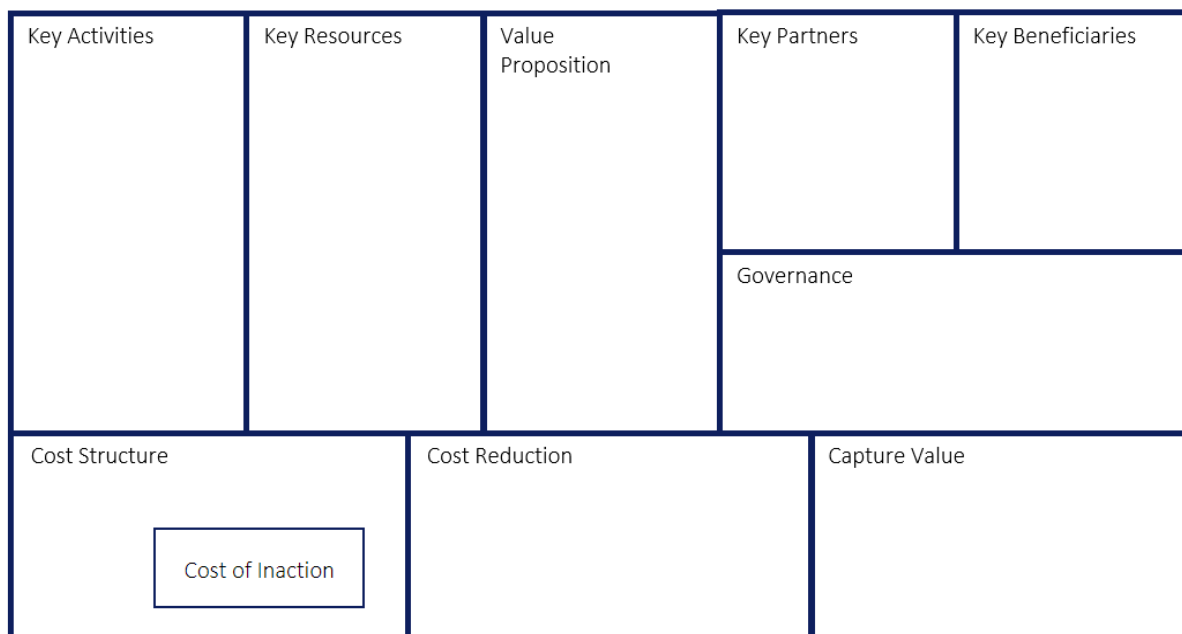
Figure 6: Business model Canvas developed by EU project Connecting Nature (2019)

To understand all aspects of the BMC we provide an explanation of all terms as used by the project Connecting Nature with certain UF-NBS examples (Connecting Nature, 2019). Each paragraph below starts with a strategic question that the NBS project holder should ask themselves and is followed by a table providing the answer to these questions across the key themes of each element of the BMC. Of course, these are neither exhaustive nor perfect examples, as each project that uses the BMC will find more specific and accurate answers to their own needs and context.

Value proposition: What is the value proposition of how the UF-NBS will deliver environmental, social and/or economic value to a community, city or region? Next to the direct value proposition of UF-NBS, it is essential to consider the additional indirect value created through nature.

Example UF-NBS Value proposition	
Valuing ecosystem services	Recognize and capitalize the value UF-NBS ecosystem services provide, such as carbon sequestration, water filtration, habitat restoration, etc. Quantify and monetize these services to attract investment and generate revenue.
Co-benefits for communities	Deliver co-benefits for local communities, such as job creation, improved livelihoods, and enhanced community resilience. Social dimensions are increasingly seen as a vital component of successful UF-NBS implementation.

Key Activities: What are the key activities and actions required to deliver the environmental, social and/or economic value proposition? What additional actions can assist the delivery of possible indirect value propositions?

Example UF-NBS Key Activities	
Tree planting labour activities	Implementing UF-NBS often revolves around the core activity of planting trees within urban areas.
Managing and preserving existing trees and green spaces	Managing and maintaining existing trees so that they can become old and provide ample ecosystem services. This also include measures to protect trees during infrastructure works, during grass mowing, events in green spaces etc.

Key Resources: What are the key resources required to deliver the environmental, social and/or economic value proposition? What additional resources can assist the delivery of possible indirect value propositions?

Example UF-NBS Key Resources	
Monitoring and verification systems	Ensuring effectiveness and credibility of UF-NBS requires robust monitoring and verification systems. Business models are incorporating innovative technologies, remote sensing, and data analytics to monitor and assess the impact of UF-NBS.

Key Partners: Who are the key partners and stakeholders required to deliver the activities and resources identified?

Example UF-NBS Key Partners	
Urban architecture companies	Urban architecture companies help design gardens and organize their placement to ensure the UF-NBS tackles the urban challenge.

Key Beneficiaries: Who are the key beneficiaries of the value proposition? Consider both direct end-user beneficiaries. Some beneficiaries can also be partners.

Example UF-NBS Key Beneficiaries	
Citizens	UF-NBS can improve the quality of life for citizens through improved air quality. When UF-NBS are specifically placed to help water management, citizens benefit from the reduced risk of flooding and water damage.

Governance: What type of governance model is effective for the UF-NBS given the different activities, resources, partners and beneficiaries? How will the UF-NBS be managed and operated on an ongoing basis?

Example UF-NBS Governance	
Public-private partnerships	Involve collaborations between governments, NGOs, local communities, and private enterprises. Combine human resources and funding to implement and scale up UF-NBS on both public and privately owned land.

Cost Structure: Considering the diverse tasks and resources needed to provide the value propositions, identify the key cost categories. Consider both fixed costs and variable costs associated to the environmental, social and/or economic value proposition.

To ensure a full cost structure analysis of UF-NBS, we not only consider the costs needed to implement the UF-NBS, but also the **cost of inaction**. The cost of inaction refers to the environmental, social or economic costs incurred if the community, city or region does not implement the UF-NBS solution.

Example UF-NBS Cost Structure	
Monitoring and maintenance costs	Costs associated with monitoring and maintaining green urban spaces to ensure the long-term effectiveness of UF-NBS.
Implementation cost	Cost for buying land for urban green space, and for establishing trees, woods and forests in and around cities and towns.

Cost Reduction: Consider how the ongoing costs of the UF-NBS for the community, city or region can be reduced.

Example UF-NBS Cost Reduction	
Volunteering	Through volunteering efforts from organizations and/or citizens, the UF-NBS can be maintained at a lower cost. Citizens can help cut trees and/or harvest fruit.
Lower public health expenditures	UF-NBS have proven impacts on citizen's health and wellbeing, leading to lower costs for health insurances.

Capturing Value: How can the value of UF-NBS be captured? This describes how the enterprise can make money from their value proposition.

Example UF-NBS Value Capture	
Market-based approaches	Examine market-driven approaches, including biodiversity offsets and carbon markets, to generate income from the environmental advantages offered by UF-NBS.
Payment for ecosystem services (PES)	Financially reward landowners or communities for implementing and maintaining UF-NBS. Create economic incentives for conserving UF-NBS ecosystems.

Next to the general business model, Sustainable Business Model Innovation (SBMI) represents a more forward-thinking approach that integrates sustainability into the core of business operations and strategies. Unlike traditional business models, which often prioritize short-term gains and efficiency, SBMI focuses on creating long-term value for both the company and society by addressing environmental, social, and economic challenges. This concept has evolved as businesses worldwide recognize the imperative to operate in ways that are not only profitable but also sustainable and responsible.

SBMI is characterized by its focus on creating and delivering value in ways that reduce environmental impact, enhance social well-being, and ensure economic viability. It involves rethinking product and service offerings, supply chain management, customer engagement, and revenue mechanisms with sustainability at the forefront. SBMI encourages companies, organizations and projects more broadly

to move beyond mere compliance with environmental regulations or corporate social responsibility initiatives, embedding sustainability into the DNA of their business practices.

3.1.6 UF-NBS business model examples

This section aims to provide some Business Model examples taken from the literature review; other Business Models are described separately across this document, depending on the sources used to identify them, and in the last sections they are based upon recommendations from this report (therefore, they do not yet have real-life examples).

Business models are tailored strategies designed to help organization and projects to find solutions to be sustainable from an economic point of view. In the case of UF-NBS, business models help to address environmental, social, and economic challenges within urban contexts by providing a strategy that helps to fund and sustain the project. Business models aim to be innovative and go beyond the traditional funding mechanisms that are often in place and that have limitations.

Table 3 highlights models such as the ForestaMi project in Milan, aiming to integrate forestation efforts into the urban fabric of the city. Similarly, the efforts of the Municipal Green Areas Authority in Krakow emphasize the importance of strategic land use and community involvement in maintaining urban green spaces.

These models, among others documented in this section, offer tangible insights into how UF-NBS developers can implement nature within their urban ecosystems from an economic and funding point of view, each tailored to specific urban challenges and opportunities.

Table 3: UF-NBS business model examples

Business model	Description
Urban forest management services or consulting services	Offer professional urban forest management services to cities and municipalities: tree genetic selection, tree nurseries, tree planting, maintenance, monitoring and management activities (as cleaning pathways from leaves and mud, tree replacement…). Provide consulting and advisory services to cities, developers, and urban planners on integrating urban forests as nature-based solutions, or to assist private and public stakeholders to build forests from scratch in cities to replace plazas or parking lots for example (afforestation). Monitoring carbon capture in forest is a specific expertise that can be valued. Revenue generation is possible through contracting with local governments or private property owners.
Carbon offset projects (carbon credits)	Forests can sequester significant amounts of carbon dioxide, making them valuable assets in carbon offset projects. Business models can integrate revenues from carbon capture in urban forests, e.g. through voluntary carbon credit schemes. Monitoring and modelling carbon capture in urban areas.
Eco-tourism and recreational services	Urban forests can attract visitors and provide recreational opportunities. Business models can leverage this by offering eco-tourism services, guided

27

	walks, nature-based activities, or even establishing amenities like cafés or visitor centres within urban forest areas. Revenue generation possible through entrance fees, guided tour charges, or commercial partnerships.
Biodiversity conservation and habitat restoration	Urban forests provide habitat for wildlife, contributing to biodiversity conservation efforts. Organizations can develop business models focused on restoring and managing urban forest ecosystems for biodiversity habitat restoration. Value creation can be in the form of biodiversity credits or PES-like schemes.
Environmental education and outreach	Urban forests offer opportunities for environmental education and community engagement. Business models can include educational programmes, workshops, and events aimed at raising awareness, building community connections, and promoting the benefits of urban forests. Revenue generation possible through participation fees, sponsorship, or grants.
Sustainable timber and forest products	Urban forests may produce timber or other forest products. Business models can focus on sustainable timber harvesting, wood processing, or the production of locally resourced, forest-derived products such as mulch, compost, or biomass for energy generation. Revenue generation possible through sales of timber and products.

Each model offers pathways for integrating green spaces into urban environments while also addressing the triple bottom line of sustainability: environmental, social, and economic aspects.

The business model of urban forest management and consulting services represents a comprehensive approach that includes genetic selection, nursery management, tree planting, and ongoing maintenance. Such services offer a revenue stream through contracts with local governments and private property owners, indicating a growing recognition of the value provided by urban greenery. Carbon offset projects, despite their potential for urban areas, present challenges in monitoring and verification, suggesting a need for innovative technologies and methodologies to demonstrate their viability in densely built environments.

Eco-tourism and recreational services capitalize on the appeal of urban forests as destinations for relaxation and education. By incorporating amenities and structured activities, these models generate revenue and enhance the public's connection to urban nature. Biodiversity conservation and habitat restoration models focus on ecological stewardship, with potential financial models based on partnerships with environmental organizations or through payments for ecosystem service.

Educational and outreach programmes harness urban forests as living classrooms, strengthening community ties and potentially attracting sponsorship or grants for funding. Meanwhile, the sustainable timber and forest product models pivot on the judicious use of urban forest yields, promoting a circular economy within the cityscape.

Linking these business models to the forthcoming section of interviews and workshops, it is apparent that while secondary research has laid the groundwork by identifying existing models, there remains a need to delve deeper into their practical application and effectiveness. Interviews and workshops with stakeholders will provide the lived experiences and nuanced perspectives that can validate,

challenge, or expand upon the theoretical underpinnings presented in secondary research. This transition from theory to practice is vital for uncovering what works in real-world settings, identifying gaps in current models, and inspiring innovation in the business models for UF-NBS implementation by UF-NBS developers.

3.2 Leveraging CLEARING HOUSE results

3.2.1 Learning from the cities

The CLEARING HOUSE project, an extensive collaborative effort involving 5 European and 5 Chinese cities, has provided real-world examples of UF-NBS business models in action and highlighted the common challenges that cities encounter from a business model point of view and possible solutions that are considered.

The CLEARING HOUSE case study cities indicate that public funding from EU, national and local governments are the main financing mechanism for UF-NBS, however some cities have also been able to incorporate volunteering efforts and small private contributions into their financing models.

Feedback from Etienne Aulotte of Brussels Environment has underscored the financial challenges and the innovative ideas required to finance urban forests, emphasizing the necessity for sustainable maintenance and the scrutiny of funding mechanisms. Other cities argue that the limited budget and prioritized challenges impede the municipalities from establishing stable, long-term strategies and commitments. This, in turn, hampers the development of funding models and strategies for UF-NBS.

The CLEARING HOUSE case studies have been pivotal in grounding theoretical concepts in practical, on-the-ground application. Leveraging the CLEARING HOUSE results, cities are encouraged to integrate all environmental aspects, including mobility, electrical networks, infrastructure, and safety, into their UF-NBS projects. This ensures that environmental considerations are woven into the fabric of city planning and that the applications of UF-NBS are practical and widespread.

AS part of T1.5 Developing an interdisciplinary analytical framework for UF-NBS, a screening tool was developed for the exploratory analysis of the CLEARING HOUSE case studies. The screening tool poses questions on both business-model related and funding related questions. Examples of questions were:

1. Which governance arrangements exist in relation to the planning, design and implementation of UF-NBS in Europe and China?
2. Which actors, institutions and resources are part of the UF-NBS design and implementation?
3. How are UF-NBS and their implementation processes framed?
4. Is the creation of new project organizations with significant local participation/stakeholder participation important for ES delivery?
5. What is the potential of public-private partnerships (investment/payment/PES) in UF-NBS implementation, restoration, and management/funding through development consents/permits?
6. How to fund UF management & maintenance; how to minimize management costs?
7. How to promote the UF-NBS business model?
8. How can NBS/ES be integrated into cities' accounting?

3.3 Going deeper with workshops

As part of task T2.2 in synergy with task T4.1, LGI organised workshops involving various stakeholders including municipalities, water infrastructure companies and financial institutions. These workshops focused on asking strategic questions regarding the implementation, financing and scaling of UF-NBS projects. To provide a comprehensive summary of the workshops, this section outlines the participants, questions raised and key takeaways from each session. The insights gained from the workshops nourished the problem-based analysis on UF-NBS BMC and IC presented in chapter 4 of this deliverable.

3.3.1 Insights from municipalities

Participants

- Maria Chiara Pastore: Architect and urban planner working for the ForestaMi project (Milan)
- Sven Noack: Master forester at GELSENDIENSTE, member of the Gelsenkirchen municipal facility (Gelsenkirchen)
- Antoni Farrero & Eugènia Vidal (AMB Barcelona)
- Przemysław Szwałko: Senior Specialist at the Municipal Green Areas Authority (Krakow)

Questions

- Which part of the municipality budget is used for UF-NBS projects?
- Which costs are considered for urban forest projects?
- What time horizon do you consider for the maintenance and for benefits evaluation?
- Who calculates cost-effectiveness?
- Which benefits are considered for UF-NBS?
- Who in a municipality calculates costs and who evaluates benefits?
- Is cost effectiveness used as an argument to implement NBS?
- Which external stakeholder municipalities work for urban forest projects?
- What arguments do you use to push for some policies?
- What are the reasons for which a place is chosen for UF-NBS implementation?

Workshop takeaways

- Around 2% of municipality budget is dedicated to UF-NBS
  - Municipality budget that is dedicated to UF-NBS projects is divided between implementation of new UF-NBS projects and maintenance of existing ones
  - Common UF-NBS costs are: land purchase, maintenance, wild fire prevention, environmental education, trees, machinery
  - To decrease operational expenditures part of UF-NBS projects, municipalities could engage citizens and attract volunteers that help maintain trees and green spaces
- Generally, the funding of new UF-NBS projects requires fundraising from the public and/or private sector
  - From workshop conversations, it seems that none of the investors (private or public) are looking for return on investment and only one municipality among the six, Gelsenkirchen, is making (modest) revenue through UF-NBS projects (selling woody biomass from maintenance in the urban forest)

> - o The implementation of UF-NBS and the choice for their location depends on three major factors: funding amount, funding source and availability of space
> - Many benefits of UF-NBS are extra-financial
>   - o External parties can be used to calculate UF-NBS benefits. For example, municipalities can work closely with research institutions that can develop tools and measurements for assessing benefits such as CO_2 absorption
>   - o Time horizons for UF-NBS maintenance can be very different depending on the project (1 year, 4-5 years, entire UF-NBS life span), which largely impact the costs to fund the UF-NBS

As a conclusion, while making revenues from UF-NBS is not the main purpose of cities or metropolitan areas (since public funders are not looking for a return on investment), tying close relationships with research institutions and universities will help them build the necessary skills to quantify and measure the benefits. For new projects, if cost effectiveness is not an argument used to realise new UF-NBS projects, the availability of space is a key negotiation element and pushing for more green city policies can help in this regard. Finally, regarding maintenance costs, one action cities and metropolitan areas can take to decrease those costs is to engage with citizens and create local communities who will voluntarily take care of the trees.

3.3.2   Insights from water infrastructure companies

Water and trees have a strong positive mutual relationship: trees protect underground water resources against pollution and reduce impact of heavy rainfalls on stormwater systems and erosion. Therefore, we decided to interview some water companies.

Participants:

- Quaranta Emanuele: Scientist and researcher European Commission (Hydropower potential and innovations, green roofs)
- Armando Quazzo: SMAT S.p.a, Italy
- Bernardi Marco: CAP Holding, water utility of the Metropolitan City of Milan, Italy.
- Marco Callerio: CAP Holding, water utility of the Metropolitan City of Milan, Italy.

Questions:

- How important is it to keep UF-NBS when doing constructions sites?
- Do you consider that UF-NBS is more or less cost-effective than a grey solution?
- Are there externalities that would affect your preferences for a UF-NBS - what are these?
- To what extent are your choices driven by regulations from government rather than budgetary reasons?

> **Workshop takeaways**
>
> - With climate change, the use of NBS in construction sites is becoming increasingly critical to decrease flooding risks
> - Compared to grey solutions, UF-NBS can be very cost-effective due to their multi-benefit perspectives, but attention needs to be paid to costs related to land acquisition and maintenance
> - Decisions and project possibilities of water infrastructure companies are often very regulation-driven

> - o Many regulations hamper the effective implementation of UF-NBS. For example, water infrastructure companies are often obliged to work with old city infrastructure which do not follow current sustainability standards.
> - o A barrier of UF-NBS is that their benefits compared to grey infrastructures are often not known or easily recognized by the general public or the decision-makers
> - o A shared methodology to assess the benefits of UF-NBS can encourage the implementation of EU strategies for UF-NBS, incentivize UF-NBS policy creation and increase the public's awareness of UF-NBS
> - o Local authorities can play a crucial role in advocating for UF-NBS through regulations and providing incentives and support to encourage UF-NBS adoption
> - As UF-NBS maintenance can be a significant cost, urban forests are an optimal decision as trees require less maintenance compared to parks or gardens.
> - Water infrastructure companies are incentivized to conserve forests in urban area as this allows to secure water supply in a city
> - Water infrastructure companies can take a leadership role in implementing and pushing for UF-NBS

3.3.3 Insights from financial institutions

As the objective of the report is to facilitate the funding and scaling-up of UF-NBS projects, especially the long-term resilience of these projects, task partners have opened conversation channels with private investors with the goal to understand the enablers and barriers to their commitment to such projects. These inputs are invaluable to UF-NBS project owners as they will (under the recommendations sections of this report) allow for a shared understanding of what is needed for the projects to attract private funding.

Participants:

- Elliot Pernet: Public Sector Specialist, Lead Cities - AXA Climate
- Michel de Kemmeter: Adjunct Professor - Brussels School of Governance (BSoG)

Questions:

- Do you fund UF-NBS project?
- Which type of UF-NBS project do you fund?
- What's the decision-making process to fund UF-NBS?
- How do you practically finance those projects?
- What are the categories of funds for UF-NBS?
- Do you use any broader criteria other than "financial return on investment" to assess projects?
- Do you have financial objectives when funding UF-NBS (Do you expect a return on investment)?
- Where do investments funds to finance UF-NBS come from?
- What's the future of UF-NBS/NBS funding?
- How to involve the private sector?

> **Workshop takeaways**
> - Funding for UF-NBS depends on the impact, scale and robustness of projects
>   - o Funding can also depend on the communication around the project

- The decision-making process behind the financing of Urban Forest Nature-Based Solutions (UF-NBS) involves considering factors such as the social impact, impact on the ecosystem, communication impact, and sustainability of the project over time
- Next to the financial return on investment, other cost-benefit methodologies can be used to integrate indicators such as biodiversity, carbon capture, job creation, temperature regulation
- NBS projects in cities face limitations such as scarce land availability and constrained municipal budgets, making it difficult to allocate funds for tree planting and maintenance
  - Limited land availability arises from conflicting land use priorities and intense competition driven by the high costs of urban real estate
- Financial institutions are exploring innovative approaches to support forest conservation without directly purchasing or financing forests:
  - Financial institutions are leveraging advanced tools, such as satellite technology and cryptocurrencies, to monitor and provide insurance coverage for forest owners and project managers
  - Financial institutions provide insurance coverage to forest owners or lead clients who wish to create UF-NBS projects, ensuring prompt payouts in the event of climate disasters
  - Satellite monitoring is used to identify burned areas for restoration efforts, including replanting trees
  - By utilizing carbon credits, these tools can be further enhanced through hybrid solutions that involve collaborating with institutions like the European Investment Bank (EIB), potentially incorporating cryptocurrencies

3.3.4 Overall conclusions from workshops

The workshops organized as part of tasks T2.2 and T4.1 of the CLEARING HOUSE project provided invaluable insights into the multifaceted aspects of UF-NBS. The diverse group of participants, ranging from municipal representatives to water infrastructure companies and financial institutions, engaged in strategic discussions that shed light on the complexities of implementing, financing, and scaling UF-NBS projects. From the municipalities' perspective, there was a clear recognition of the need for innovative funding approaches, as traditional budgets are increasingly strained and often insufficient to meet the expanding requirements of urban greening projects. Cities like Gelsenkirchen are exploring modest revenue streams from UF-NBS, while others are emphasizing the role of spatial availability and policy support to advance their green agendas.

Financial institutions highlighted the importance of multi-benefit perspectives that UF-NBS offer, presenting an opportunity to shift the focus beyond immediate financial returns to longer-term societal and ecological gains. This shift requires robust communication strategies to enhance public awareness and appreciation of UF-NBS benefits, which are often extra-financial and long-term in nature.

The workshops underscored the importance of collaboration with research institutions and universities to develop the necessary tools and methodologies to quantify and measure the benefits of UF-NBS. Such collaborations can lead to more informed decision-making and support the case for UF-NBS as cost-effective, sustainable investments. Engaging with citizens and fostering local communities to take an active role in maintaining urban green spaces emerged as a practical strategy to manage maintenance costs effectively.

4   RESEARCH RESULTS & CONCLUSIONS

This section takes on a problem-based analysis approach, where barriers to and key strategic questions on UF-NBS identified during the SoA and Interviews/workshops are investigated. Drawing on real-life UF-NBS examples, CLEARING HOUSE project case studies and insights from industry experts, the focus is on unravelling innovative solutions to UF-NBS business models. The analysis explores unanswered questions from the workshops, providing valuable insights for practitioners and decision-makers involved in the development and support of UF-NBS projects.

It is as obvious as important to stress how quickly the world is currently changing, whether because of technology or social behaviours. Several promising trends, recent groundbreaking irruption of AI or confirmed uptake of blockchain technologies could be paving the way for innovative business models, because of the very disruptive nature of the options offered by these new technologies or by other types of trends that are transforming new approaches in other sectors than NBS. Some of these trends are discussed at the end of each sub-section below.

4.1   UF-NBS Business Models

NBS are effective approaches to address environmental challenges and promote sustainable development. NBS are still considered a relatively new concept. To ensure the UF-NBS Business Model Canvas is both valuable and widely adopted, specific barriers and enablers need to be considered for each business model component. First an overview of barriers and enablers is given, then each component of the Business Model Canvas will be analysed in depth.

4.1.1   Overview of barriers and enablers

The synthesis of research, case studies, and expert interviews has identified critical enablers for the successful implementation and scaling of UF-NBS. These enablers address the main barriers, offering pathways to enhance the innovation in business models and funding mechanisms for UF-NBS. The above-mentioned workshops demonstrated the importance of multi-stakeholder collaboration, including citizen engagement, partnerships with universities, involvement of water infrastructure companies and financial institutions.

Further analysis of the CLEARING HOUSE project's stakeholder engagement activities revealed critical obstacles, such as the competition for urban space and funding with other development priorities, and the lack of expertise and resources within municipalities for UF-NBS planning, implementation, and maintenance. Economic pressure further worsen funding for UF-NBS; for example, while considering that having UF-NBS on polluted land helps to revitalise and clean the land, cities have prioritised the use of the land as industrial wasteland or by other polluted sectors due to high land costs (such as former railway wasteland (3.5 ha) acquired by Paris City Hall from the SNCF national rail for the Charonne Urban Forest (Cities4Biodiversity, 2022). The challenge of quantifying UF-NBS benefits hinders broader acceptance, despite tools like the Nature Value Explorer (see toolbox) facilitating such assessments.

The need for effective communication strategies to convince stakeholders and investors of the value of UF-NBS is also apparent. This requirement is linked to the challenge of integrating UF-NBS within existing legal, policy, and urban planning frameworks, which currently prioritize economic development over environmental considerations, as observed by stakeholders such as Etienne Aulotte from Brussels Environment. Emerging concepts like Biocities (Wilkes-Alleman et al., 2023), which

34

envision urban development with a focus on integrating nature and green infrastructure, offer potential pathways for overcoming these challenges.

Public scepticism towards private involvement highlights the need for Public-Private Partnerships (PPP) that balance public interests with the efficiency of private execution. Governance improvements and ensuring the scalability and replicability of projects with low capital expenditures are essential. It is also recommended to involve the private sector early in project development, securing long-term financing, and employing effective communication strategies. Technical, economic, and regulatory feasibility assessments are crucial for evaluating UF-NBS projects. This involves analysing resource availability, compliance with regulatory requirements, and assessing costs and benefits. An integrated planning approach that considers various stakeholders and the impacts on local ecosystems and communities is recommended. Partnerships with organizations at local and international levels can provide technical support and facilitate knowledge sharing.

> *"We fully agree with other experts that the focus needs to shift from a "public service" to a "long-term value", including economic value, of urban forests as nature-based solutions, and this starts with having the involvement of private entities and in particular investors from the start (at least), or even have them lead the project from start to finish – their approach is much more hands-on and their self-interest would work FOR rather than against the longevity of the NBS."*
>
> ***Capitalism for the longevity of NBS – Economy, financing and prioritization***
> *Rik De Vreese, Clive Davies (EFI) – interviewed December 2023*

To evaluate an UF-NBS project, it is important to analyse it in terms of technical, economic, and regulatory feasibility. For example, cities and local governments need to assess the availability of resources such as land and funding, as well as the necessary regulatory requirements and permits. The costs and benefits of the project should also be assessed, as well as the associated risks and uncertainties.

According to IUCN's report on NBS for urban areas, UF-NBS projects should be designed using an integrated planning approach that takes into account the different actors involved and the different scales (IUCN, 2020). The approach must also consider the potential impacts of projects on local ecosystems and local communities.

Cities and local governments can also partner with local and international organisations to obtain technical support for UF-NBS projects. Project partner organisations, such as environmental NGOs, foundations, and companies, can provide technical resources to support the implementation of UF-NBS projects. Partnerships with international organizations can also provide opportunities for knowledge sharing and collaboration on a global scale.

The analysis performed for this deliverable shows the interconnectivity of UF-NBS business model components, displaying how challenges in one aspect can be addresses through solutions and stakeholders linked to another, again highlighting the significance of multi-stakeholder collaboration. An overview of all barriers identified, and solutions implemented as identified for this deliverable is provided in Figure 7.

Based on the overall analysis, three main recurring solutions are:

- Cross-sector or multi-stakeholder collaboration to pool funding capabilities, human resources, material and land

- High-level regulatory support and making top-down changes for UF-NBS project implementation

- Implementing tools and resources developed within the CLEARING HOUSE project (MyDynamicForest, SIAC, SIK-HUB, Policy guidelines)

Key Activities

Barrier
• Limited public labour
Solution
• Volunteering efforts

Key Resources

Barrier
• Limited public resources & financing
Solution
• Public-private partnerships

Barrier
• Limited access to technology developments
Solution
• Cross-sectorial collaboration with universities & research institutions

Barrier
• City infrastructure constraints for trees due to infrastructure systems & cables
Solution
• Cross-sectorial collaboration

Value Proposition
Barrier
• Non-monetary benefits to UF-NBS that are not easily measurable
Solution
• Accessible qualitative indicators

Key Partners
Barrier
• Limited data on citizen perspectives on UF-NBS
Solution
• Involvement of both formal and informal institutions
• Citizen empowerment through public knowledge repository
• Technology integration for communication systems

Key Beneficiaries
Barrier
• Limited knowledge of end beneficiary needs
Solution
• Beneficiary collaboration & integration into UF-NBS projects

Governance

Barrier
• Limited knowledge and procurement resources
Solution
• Cross departmental collaboration
• Pilot projects
• Promote urban forests and empowerment of municipalities

Barrier
• Limited legislation on ecologic connectivity and lack of cooperation across governance levels
Solution
• Cities engage for improved parc legislation

Barrier
• Unclear defines cross-sectorial governance model
Solution
• Cross-sectorial integration & synergy workshops to improve collaboration

Barrier
• Lack of policy support
Solution
• CLEARING HOUSE policy guidelines

Cost Structure

Barrier
• Cost of maintenance
Solution
• Partnership and engagement

Barrier
• Limited land ownership
Solution
• Regulatory intervention & policies

Barrier
• Renaturation cost
Solution
• Collaborate with specialized companies

Cost Reduction

Barrier
• Time lag to gain benefits from UF-NBS compared to grey solutions
Solution
• Mixed solutions

Barrier
• Gentrification of neighbours
Solution
• Economic interest of parks and forests

Capture Value

Barrier
• Need for rapid adaptation to global warming and biodiversity
Solution
• Selecting resilient species
• Financial incentives for green solutions

Barrier
• Absence of economic metrics to biodiversity gain
Solution
• European projects to finance research

UF-NBS Funding
Barrier
• Insufficient Funding
Solution
• Crowdfunding
• Public-private funding mechanisms (blended finance)
• Green bonds, biodiversity credits

Barrier
• Lack of private funding
Solution
• Engaging companies
• Financial incentives
• Non-monetary valuation systems
• Community efforts and partnerships

Barrier
• Scaling investment for UF-NBS

Cost of inaction = no implementation of UF-NBS
Environmental costs:
• Reduced urban air quality
• Flooding and water distress
• Loss of biodiversity
• Increasing city temperatures

Social costs:
• Reduced physical health of urban residents
• Reduced quality of life in cities

Economic costs:
• Infrastructure costs
• Reduced property values in cities
• Climate change vulnerability costs

Figure 7: Barriers and solutions to UF-NBS along the items in the Business Model Canvas

LEGEND	Solution
	Cross-sector or multi-stakeholder collaboration to pool funding capabilities, human resources, material and land
	High-level regulatory support and making top-down changes for UF-NBS project implementation
	Implementing tools and resources developed within the CLEARING HOUSE project (MyDynamicForest, SIAC, SIK-HUB, Policy guidelines)

4.1.2 Value proposition

> *"Okay, we need to plant endemic plants, but we also need to plan for the future, meaning what you are going to do will not have the same conditions; you will never have the same climatic conditions again. People tend to say, 'Yeah, let's do what we did in the past,' which ends up doing something that is not adapted to the world of tomorrow, and people often forget about the world of tomorrow."*
>
> ***Future Planning - Endemic Species and Climate Change***
> *Pierre Rousseau (3R EcoConsulting) – interviewed December 2023*

Barrier identified: Non-monetary benefits

A main barrier to the implementation of UF-NBS is the difficulty in understanding the full value proposition UF-NBS can bring and evaluating the non-monetary benefits connected to the UF solutions. While social and environmental benefits are recognized, their economic evaluation is often not attributed, making a cost-benefit analysis of UF-NBS more challenging. Therefore, when evaluating UF-NBS and understanding their value proposition, stakeholders should always consider both quantitative and qualitative indicators. Stakeholders can use specific tools to measure and quantify the impact of UF-NBS. The EU project of NATURVATION provides a database recording the financial and economic values of nature-based solutions (NATURVATION).

Solution implemented: Accessible qualitative indicators

Next to monetary evaluations, key non-monetary indicators of nature-based solutions should be identified and evaluated. A list of recommended core indicators for assessing a range of societal and environmental factors has been proposed. Some examples are given in Table 4 (European Commission, Directorate-General for Research and Innovation, 2021):

Table 4: Indicators for UF-NBS evaluation

NBS evaluation	Indicators
Green Space Management	Green space accessibility Share of green urban areas Soil organic matter content Soil organic matter index
Biodiversity enhancement	Structural and functional connectivity of green infrastructure Number of non-native plant and animal species introduced Number of invasive alien species Species diversity within defined area as per Shannon Diversity Index Number of species within defined area as per Shannon Evenness Index
Natural and climate hazards	Disaster resilience (as per United Nations office for Disaster Risk Reduction (UNDRR) Disaster Resilience Scorecard for Cities) Mean annual direct and indirect losses due to natural and climate hazards (€) Risk to critical urban infrastructure Number of people adversely affected by natural disasters each year Multi-hazard early warning system utilisation
Health and Wellbeing	Level of outdoor physical activity (min/week) Level of chronic stress (perceived stress)

	General wellbeing and happiness
	Self-reported mental health and wellbeing
	Prevalence of cardiovascular disease
	Incidence of cardiovascular disease
	Quality of life

Understanding what indicators could play a role when analysing the value proposition of UF-NBS, allows to make clearer impact evaluations and better understand the cost-benefit analysis of the UF-NBS. While UF-NBS can have certain direct and clear benefits, such as improved air quality. There are often many more indirect environmental and social benefits that should be accounted for and that are most often overlooked. By introducing social and environmental indicators to the value proposition analysis, the impact of the UF-NBS can be made more quantifiable and measurable.

4.1.3   Key resources

Barrier identified: Limited public resources

While urban forest solutions often fall under public-sector initiatives, public entities frequently do not have the resources, knowledge or innovation in-house to design, implement or maintain the urban forest solutions.

Examples of UF-NBS projects: Rotterdam as a sponge city
Rotterdam, a Dutch city, is home to one of Europe's largest ports, and over 80% of its land situated below sea level. Considering these geographic factors, Rotterdam faces the urgent need to address climate change challenges, notably the threats posed by rising sea levels and recurrent heavy rainfall, which contribute to the risk of flooding. Not only heavy rainfall but also long periods of droughts are starting to impact the city. To combat these two issues, Rotterdam has implemented a 'sponge city' approach, where vegetation, green surfaces, gardens and parks are used to collect water quickly, store water for a long time, and eventually return the water to nature and soils when necessary. Unlike concrete, where water cannot filtrate the soil, Rotterdam uses urban greenery, which functions like a sponge to moderate extreme wet and dry conditions (DE URBANISTEN, 2019).   Image source: De Urbanisten

Solution implemented: Public-private partnerships

To ensure the necessary resources and skills are available to effectively implement UF-NBS, public sector stakeholders can work together with private experts through a public-private collaboration. The partnership allows to combine and leverage funding mechanisms, resources, innovation and skills to successfully realize the nature-based solutions.

Examples of UF-NBS projects: Rotterdam as a sponge city
To implement the "sponge garden", Rotterdam fostered a public-private partnership, a collaboration effort between an urban architectural landscape enterprise and the municipality of Rotterdam. The municipality of Rotterdam mainly funds the project, while the private stakeholders bring expertise, resources and innovation (DE URBANISTEN, 2019).

Barrier identified: Limited technology accessibility

A primary resource that stakeholders can leverage to facilitate the planning, design, and proper maintenance of UF-NBS initiatives is the use of technological tools. These tools assist in collecting, analysing, and implementing data related to UF-NBS projects. However, the development, access, and implementation of such tools can pose challenges, particularly when customization is necessary to adapt them to specific environments.

CLEARING HOUSE Case study: Leipzig
The CLEARING HOUSE Leipzig case study focused on identifying opportunities of using brownfields to compensate for the rapid city's population's increase. Brownfields are the industrial and/or commercials sites than Leipzig used to transform into areas to support urban biodiversity and green services. Because the case study aimed at ensuring a high impact on the civil society, the project depended on citizen's input for decision-making processes on the UF-NBS components. The city of Leipzig had, however, no direct access to technology support tools that could aid the decision-making process and UF-NBS data collection (CLEARING HOUSE, 2024a).

Solution implemented: Cross-sectorial collaboration with universities & research institutions

To access technological tools and resources or facilitate their development, municipalities and cities can collaborate with local universities. This approach not only aids in the creation of digital UF-NBS tools but also supports the research aspect of UF-NBS, contributing to the overall knowledge advancement in the field.

CLEARING HOUSE Case study: Leipzig
To facilitate the green transition, the city of Leipzig collaborated with the Humboldt University of Berlin, which developed the MyDynamicForest tool to help the development of green infrastructure and collect data on how green areas are perceived and used by citizens (CLEARING HOUSE, 2024a).

Barrier identified: City infrastructure constraints

In order to implement and maintain urban forests, municipalities need to have a good understanding of the city's infrastructure. Trees occupy space not only above ground, with their branches and leaves that may potentially overlap with cables, but also below ground, with their roots that may potentially

intersect with drainage systems, underground cables, and tube systems. While such infrastructures are often not fully known or updated within cities, it is essential to include all infrastructure elements of a city when implementing UF-NBS to ensure only realistic urban forest designs are developed and integrated, and to prevent other essential city services are unavailable.

CLEARING HOUSE Case study: Brussels

During the CLEARING HOUSE project, one partner, Brussel Environment realised they had no easy access to the plans of the underground networks (electricity, gas, water, sewage, telecommunications). To gain an overview of their underground city's infrastructure, Brussels Environment organised a study to research the location (horizontally and vertically) of all copper cables, telephone networks, water and gas systems. Such a study can be both time consuming and expensive.

"It's a long and expensive study, but it's necessary for all the public and private services." For example, it would be possible in this case to have this action partly financed by telephone companies wishing either to disseminate fibre Investment Cases or to replace old telephone networks (by pooling their actions and their work costs during concrete opening for example). It could also be a new policy, when a study on gas conducts is carried out, to cover all the networks in the area (CLEARING HOUSE, 2024d).

Solution implemented: Cross-sectorial collaboration

By including cross-sectorial stakeholders in the decision-making process of UF-NBS initiatives, the projects can be better adapted to the existing city's infrastructures, preventing any costly issues to arise (e.g. tree damage, trees to be removed, tree root pruning that can result in tree decay). For example, cities can work together with infrastructure companies to gain insight in the telephone network in the city. Moreover, municipalities could enforce a policy to oblige companies to disclose their network plans. This is a win, as this insight avoids not only damage to tree roots, but also to other underground infrastructure. Finally, as done in the Flemish Region of Belgium, infrastructure companies can be mandated to coordinate infrastructure work, to avoid that trees are damaged multiple times, while a one-time digging for several infrastructure interventions would be possible and desirable (also for avoiding other nuisances).

4.1.4   Key activities

Research shows, the UF-NBS Business Model Canvas should take into consideration three main stakeholder groups: the public sector (governments and public enterprises), the business sector (for-profit actors) and community sector (citizen, NGOs, associations). The business model should reflect the different goals of each stakeholder group and their possible contribution (URBAN GreenUP, 2023).

Barrier identified: Limited public labour

UF-NBS projects can require intensive physical labour due to significant demands in urban plantation and afforestation. While smaller projects can be executed by cities' own work force, large-scale projects can require high labour efforts which can either account for high labour costs or long-term planting periods.

Examples of UF-NBS projects: Green wave of trees in Vilnius

The municipality of Vilnius has set a new ambitious goal for its city to make the city greener by planting over 100,000 trees, 10 million shrubs and 300,000 climbing vines across the city streets within the next two years. The initiative aims to make the city greener and sustainable by bringing shade and protecting against pollution next to high-traffic roads. However, implementing such a large-scale tree planting project requires high labour efforts (Made in Vilnius, 2023).

Examples of UF-NBS projects: Edible Bristol

Edible Bristol is a project inspired by the 'Incredible Edible Movement', to turn Bristol into the first edible city by covering the city's parks and gardens with fruit trees and edible plants that are available for everyone to eat and enjoy. The initiative helps reduce climate pressure on food security and encourages local and seasonal food production and consumption by building local food resilience. Instead of relying on fruits imports or greenhouse farming, Bristol aims to implement and encourage local sustainable fruit production (Edible Bristol, 2024).

Solution implemented: Volunteering efforts

By engaging the community, municipalities can encourage citizens and local organizations and/or enterprises to volunteer and give some time and effort to help their city or region become greener. Activities can take many forms such as: planting trees, maintaining the green areas, planning the UF-NBS projects and educating others on green surfaces & vegetation. Cities should be aware however, that there is need for coordination, coaching, monitoring and engagement with the volunteers, and that this comes with a workload.

Examples of UF-NBS projects: Green wave of trees in Vilnius

Through sustainable urban landscaping, the city tries to promote and deliver a green city that enhances the city's visual appearance, and the mental and health of its citizens. To implement the initiative, the municipality depends on its own citizens who can volunteer to plant trees. Through community engagement, the municipality encourages citizens and community groups to participate and support the project by offering some time and effort to plant trees in their area (Made in Vilnius, 2023).

Image source: Go Vilnius

Examples of UF-NBS projects: Edible Bristol

The residents of Bristol are encouraged to participate by taking care of the trees and harvest production. The initiative thereby promotes urban greening and community involvement by operating with the support of local community members and volunteers. The residents themselves take part in maintaining the crops and trees and harvesting edible fruits and vegetables to keep the city clean and organized (Edible Bristol, 2024).

4.1.5   Key beneficiaries

Barrier identified: Limited knowledge on end beneficiaries

UF-NBS often require urban planning processes to properly design and implement green spaces in urban areas. Given that liveability is closely linked to green spaces, city residents are those who directly gain from the environmental, social and economic benefits of UF-NBS. However, to ensure the innovative solutions maximize the outcomes for the beneficiaries, it is important to understand citizens and obtain the necessary information on their preferences.

Solution implemented: Beneficiary collaboration

By engaging citizens in UF-NBS projects, municipalities can have the information they might otherwise overlook to adapt the urban space with NBS. Citizen collaboration and end-beneficiary inclusion in the co-creation of UF-NBS can help the implementation of UF-NBS and solve urban challenges, benefiting both local residents and the surrounding environment.

Examples of UF-NBS projects: Victoria-Gasteiz Survey Tool
The municipality implemented an interactive survey tool for smart planning through informed decision-making by gathering insights, feedback and experiences from citizens on a range of topics related to the towns public areas, urban development and social inclusiveness (van Ham & Klimmek, 2017).

CLEARING HOUSE Case study: Brussels
Brussels municipalities organised UF-NBS co-design workshops with the local residents to gain a better understanding how people use parks and ensure the new UF-NBS initiatives serve the needs of local residents (CLEARING HOUSE, 2024d).

4.1.6   Key partners

Barrier identified: Inclusion of citizens' perspectives (citizen engagement)

While engaging citizens has shown to be useful to gain more perspective on green areas and the use of UF-NBS, municipalities often face challenges when it comes to involving citizen feedback, primarily stemming from the complexities associated with gathering citizen data and accommodating diverse perspectives on UF-NBS. Additionally, the translation of citizen input and feedback into usable data and actionable priorities can slow down the internal decision-making process of projects.

CLEARING HOUSE Case study: Krakow
The case study on the city of Krakow centres on the Krakow River Parks, encompassing river valleys and streams. These parks play a crucial role in connecting the city with nature, aiding in flood prevention, and enhancing the urban air quality. The city of Krakow aimed to integrate citizen inputs in the decision-making process for the city's River Parks, however engaging a large quantity of citizens has remained challenging due to the large data collection requirement (CLEARING HOUSE, 2024c).

Solution implemented: Involvement of both formal and informal institutions

CLEARING HOUSE Case study: Krakow
The city of Krakow involved both informal and formal institutions in the River Park project to gain residents' input in the discussion and planning of the UF-NBS project, and also secures formal

support from the City Office to ensure the effective overall stakeholder participation (CLEARING HOUSE, 2024c).

Solution implemented: Citizen empowerment through public knowledge repository

CLEARING HOUSE Case study: Brussels
Proposing simple and inexpensive tools to involve all citizens in making a contribution to the growth of an urban forest. Brussels Environment is actively working on the production of technical sheets on urban forestry to provide citizens with tools at different scales. This kind of action is making people feel responsible and having an impact in their direct environment. The impact is undoubtedly duplicated beyond the city in which the action is taken. These tools are also being deployed in several towns to empower even more citizens (Brussels Environment, 2023).

Solution implemented: Technology integration

CLEARING HOUSE Case study: Krakow
The city of Krakow has implemented the citizen science tool, MyDynamicForest, created within the CLEARING HOUSE project, for gathering information on how urban forests are perceived and used by citizens. This tool not only facilitates data collection but also analyses the gathered information, enabling the translation of feedback into actionable plans to support the maintenance and enhancement of green spaces within the city (CLEARING HOUSE, 2024c).

4.1.7 Governance

Barrier identified: Limited public procurement

An additional challenge in the execution of UF-NBS involves the governance-related barrier, particularly the difficulty for public authorities to find and put together procurement initiatives. This issue may be caused due to the lack of knowledge and experience in UF-NBS by public authorities, the difficulty in finding skilled suppliers, institutional and legal barriers to include criteria regarding NBS, as well as the limited access to funding and low levels of community engagement that could facilitate procurement efforts (Hawxell, Mok, Maciulyte, Sautter, & Dobrokhotova, 2019; European Commission, Directorate-General for Research and Innovation, 2020).

Solution: Cross-departmental collaboration

To mitigate these challenges, cities should foster cross-departmental collaboration efforts to share knowledge. Additionally, they should collaborate with diverse community and regional stakeholders who can contribute resources and support in designing, implementing, and maintaining UF-NBS initiatives and business cases. Other stakeholders might have better connections, network and experience to gather the right procurement resources and supply chains that can help implement UF-NBS initiatives (European Commission, Directorate-General for Research and Innovation, 2020).

The successful integration of Nature-Based Solutions into urban environments does not solely depend on public authorities but should follow a collaborative bottom-up approach that includes non-state actors such as research institutions, businesses, local community groups and other urban stakeholders. These stakeholders can support and even train public procurers to address the challenges in public procurement or UF-NBS.

Solution implemented: Pilot projects

Public sector stakeholders can use pilot projects to build trust and inspire suppliers to think creatively about community engagement (European Commission, Directorate-General for Research and Innovation, 2020). Initiating private-sector efforts through pilot projects, can enhance opportunities for future collaborations and increase procurement potential.

Solution implemented: Promote urban forest and empowerment of municipalities

CLEARING HOUSE Case study: Brussels
Trainings has been developed in Brussels to empower urban forestry in municipalities. Everyone can take part in the change, by modifying their working practices and attitudes at their own level. The seminars offer an opportunity to question current urban systems, to discover innovative planning and maintenance practices and to identify the solutions to be adopted to develop UF. These cross-disciplinary meetings and exchanges also encourage stakeholders to discuss and reflect together on the strategic and policy directions to be developed. Brussels Environment also provides a series of online training sessions on reducing the use of pesticides in cities (not just for urban forestry but also for NBSs and all kinds of city parks). It is aimed at regional administrations and municipalities (19 municipalities in Brussels) (Brussels Environment, 2023).

Barrier identified: Unclearly defined cross-sectorial governance model

Land areas designated for UF-NBS frequently involve multiple stakeholders from diverse sectors. The sustained effectiveness of UF-NBS implementation and upkeep, therefore, relies heavily on collaborative decision-making and design processes. Integrating multi-stakeholder collaboration and participation can be challenging, often resulting in the absence of a clearly defined governance model for the planning, design, and management of urban green spaces.

CLEARING HOUSE Case study: Barcelona
The Barcelona case study looked into the opportunities of the Llobregat river basin, the largest inland basin in Catalonia, to become an UF-NBS to foster ecological and social connectivity of the metropolitan area of Barcelona. These efforts helped to create a living laboratory for new ideas on how to plan, establish, govern, manage and monitor tree-rich landscapes for the benefit of urban societies at large.
The Llobregat river basin required the involvement of diverse stakeholder's integral to the region. The land not only comprises 16 different municipalities but also involves both public and private ownership of land. The case study highlighted the importance of cross-sectorial collaboration amongst regional and local administrations, research institutions, municipalities, NGO's and citizens. However, due to the high number of stakeholders, the case initially lacked a well-defined governance model to ensure the long-term success of UF-NBS initiatives (CLEARING HOUSE, 2024b).

Image source: CLEARING HOUSE

Solution implemented: Cross-sector integration & synergy workshops

To ensure a clear and effective governance model exists, it is essential to include all stakeholders in the decision-making and planning process. Through organised workshops and co-design sessions, the municipalities can share their efforts and encourage multi stakeholder collaboration and participation approaches.

CLEARING HOUSE Case study: Barcelona
The Barcelona case study organised various cross-sectorial collaboration workshops focused on sharing knowledge about the challenges related to UF-NBS interventions. The workshops further facilitated networking efforts amongst stakeholders and helped building a community around the Llobregat area as a living lab base for co-design sessions (CLEARING HOUSE, 2024b).

Barrier identified: Limited legislation on ecologic connectivity and lack of cooperation across governance levels

CLEARING HOUSE Case study: Sonian Forest in Belgium (Brussels)
Belgium's existing legislation fails to adequately protect the biodiversity and ecological connectivity, particularly due to the lack in legal frameworks for preserving ecological connectivity in the built-up environment, but also do the fragmented governance system in and around Brussels. Urban planning rules are violated due to inadequate monitoring and enforcement. Green spaces are under pressure due to minimal regulations in place, and due to a high urbanisation pressure from activities associated with housing (e.g. building terraces or swimming pools and pool houses). Moreover, managing the existing green spaces is challenging due to the high maintenance costs and inadequate staff training in biodiversity and connectivity. Decision-making processes suffer from a lack of necessary expertise, as well as institutional fragmentation and a lack of cooperation across governance levels and policy sectors (OPPLA, 2023).

Solution implemented: European cities can engage for improved park legislation

One possible solution for local authorities is to join a network of national or regional parks to enhance the natural heritage of regions by fostering collective awareness of ecological issues in territorial governance. This involves coordinating various policies and management schemes for regions while considering the role and responsibility of stakeholders through collaborative actions or partnerships (Ecologie.gouv, 2022). Also projects as CLEARING HOUSE or networks as the European Forum on Urban Forestry (EFUF) or Europarcs can provide inspiration.

CLEARING HOUSE Case study: Sonian Forest in Belgium (Brussels)
The 4400-ha large Sonian Forest is spreading over the three Belgian administrative regions (Flanders, Wallonia, Brussels Capital Region) and part of the Natura 2000-network in the three regions. The three regions have their own regulation on nature protection and forest management, and other levels and department of government (national, regional, local) have competencies that impact on the management of the Sonian Forest. To cope with this multi-layered governance situation, the Sonian Forest Foundation was set up as a coordinating body, and a vision for applying for the trans-regional National Park "Sonian Forest and Brabant Woods" (OPPLA, 2023).

Barrier identified: Lack of policy support

There exists an overall lack of policies and high-level recommendations for municipalities seeking to implement UF-NBS initiatives. Consequently, while many municipalities aspire to undertake UF-NBS projects, the lack of streamlined policies and processes hinders the ease of implementation.

Solution implemented: CLEARING HOUSE policy guidelines

CLEARING HOUSE has developed policy guidelines for UF-NBS to aid stakeholders drive value from urban forests and green areas through their provided ecosystem services. The guidelines include (Davies, De Vreese, Biernacka, Wilkes-Allemann, & Zivojinovic, 2024):

- Urban forest ecosystem restoration, ecological rehabilitation, new approaches and methods
- Management guidelines for urban forests that cover key aspects of planning, policy and delivery for their role as a nature-based solutions
- Mechanisms for public and stakeholder engagement in planning and managing UF-NBS
- Change management and institutional reform for the better management of UF-NBS

4.1.8   Cost structure

Barrier identified: Cost of maintenance

One of the significant challenges in implementing UF-NBS projects is the cost of maintenance. Interviews with stakeholders show, that while maintenance is often not the top priority in UF-NBS projects, the budget for new projects tends to be high while the budget dedicated for maintenance is generally low, and seldomly increasing with an increase in surface to be managed by public greenspace authorities. The lack of dedicated budget for maintenance is partly related to the difficulty in defining the maintenance cost in terms of average cost per ha of UF ecosystem.

Solution implemented: Partnerships & engagement

Barrier identified: access to land

Land purchase can be a significant cost in developing UF-NBS, particularly when the land is privately owned (as indicated in the workshop with water infrastructure companies). Private land ownership can pose significant challenges to UF-NBS implementation, as it limits the availability of public land. Also, for private organizations and enterprises who want to implement UF-NBS, the high pressure on the land market is a challenge to find sufficient space at an affordable cost. High acquisition cost can drive out the profitability of the initial UF-NBS solution and discourage investors.

CLEARING HOUSE Case study: Krakow
The case study on the city of Krakow centres on the Krakow River Parks, encompassing river valleys and streams. These parks play a crucial role in connecting the city with nature, aiding in flood prevention, and enhancing the urban air quality. The focus of the case study was on safeguarding these green spaces, yet, due to many of them being privately owned, to secure their protection, Krakow must first raise funds for the purchasing of these areas (CLEARING HOUSE, 2024c).

Solution implemented: Regulatory intervention & policies

Local authorities can play a crucial role in advocating for UF-NBS through regulations and providing incentives and support to encourage UF-NBS adoption. It is important for local authorities to facilitate the preservation of natural sites and promote the integration of UF-NBS in already urbanized areas, minimizing the need for compensatory plantations (workshop 2 with water infrastructure companies). The availability of space is a key negotiation element in new UF-NBS projects, and pushing for more green city policies can help UF-NBS projects to gain such space (workshop 1 with municipalities).

Barrier identified: Renaturation cost

Because of high initial UF-NBS costs, cities are increasingly implementing lower-cost standardised green solutions, which are often not adapted to the cities' environment. This boosts the number of short-term UF-NBS projects instead of more long-term resilient and adapted UF-NSB projects (Deboeuf de Los Rios, Barra, & Grandin, 2022).

Solution implemented: Collaborate with specialised companies

Cities should engage with businesses and organizations that integrate landscaping and ecological practices. These entities should prioritize the well-being of city residents while also addressing ecological connectivity and enhancing resilience (Deboeuf de Los Rios, Barra, & Grandin, 2022).

4.1.9   Cost reduction

Barrier identified: Time lag to gain benefits from UF-NBS compared to grey solutions

The implementation of grey solutions is generally quicker compared to UF-NBS, given that they are often applied on a smaller scale and utilize existing grey infrastructure. Additionally, the positive impacts and outcomes of grey solutions are typically more rapidly observable and impactful. For example, while reflective paint and shaded areas immediately reduce city temperatures, tree branches take years to grow to create shading. The time lag required to witness benefits from UF-NBS constrain the potential cost reductions of these interventions.

Solution implemented: Mixed solutions

Integrating UF-NBS interventions with grey solutions enables cities to enjoy the short-term benefits of grey solutions while simultaneously establishing enduring and sustainable long-term interventions.

Barrier identified: Gentrification of neighbourhoods

Green areas, parks and forest tend to improve the quality of life in cities, increasing the cost of rent and attracting more wealthier people to the area. UF-NBS can thus create a risk of gentrification in cities and increase the segmentation between advantaged and less advantages groups (OPPLA, 2023).

Solution implemented: Economic interests of parks and forests

Green areas and urban forests can become an economically profitable place for residents through job opportunities in, for example, honey production and sport classes. In essence, cities can ensure that urban forest can become a part of the social programme to improve job opportunities for less advantaged income groups. Non-Wood Forest Products and Services (NWFP&S) encompass a diverse array of items, spanning from tangible goods like food products and handicrafts to intangible services such as recreational activities. This sector intersects with various facets of the economy and social sphere, including but not limited to the food industry, education, tourism, healthcare, sports, and even cultural domains like art and music. Within NWFP&S, there's a mix of marketable goods such as specialty foods and nature tourism packages, as well as non-marketable offerings like scenic landscapes, air quality, and biodiversity preservation (Niskanen, Pettenella, & Slee, 2007).

4.1.10 Value capture

Value capture refers to the ability of the UF-NBS to capture and retain value for a broad range of stakeholders including communities, governments and investors. While value capture involves the value created through profit, due to pricing of UF-NBS and generated revenues, long-term value is also measured in impact attributed by the UF-NBS ecosystem services. Value capture depends not solely on the financial gains linked to pricing and financing strategies, but also on how effectively UF-NBS projects address and mitigate current environmental and social challenges (EY, 2024).

Barrier identified: Rapid adaptation to global warming and biodiversity loss

One major barrier that cities face in implementing urban forests is the need for rapid adaptation to global warming and biodiversity loss.

Solution implemented: Selecting resilient species

It is essential to ensure that trees and green solutions can swiftly adapt to changing environmental conditions. This involves carefully selecting tree species that exhibit traits resistant to water stress, flooding, pests, and diseases. By prioritizing species that can thrive in these conditions, cities can build more resilient urban forests that contribute to mitigating the effects of global warming while enhancing biodiversity.

Solution implemented: Financial incentives for green solutions (instead of grey solutions)

Another barrier is the financial aspect of introducing trees into urban areas. Municipalities must demonstrate that urban forests are not only environmentally beneficial but also financially viable. One approach is to highlight the economic benefits of trees, such as their role in reducing the amount, strength, frequency and impact of flooding, lessening the flood damage . Studies like those conducted by NATURVATION provide valuable insights into the cost-effectiveness of urban greenery over a 10-

year period (NATURVATION). By showcasing the long-term cost savings associated with urban forests, cities can attract funding and support for their implementation.

Barrier identified: Absence of economic metrics to biodiversity gain

One significant barrier in biodiversity conservation efforts is the absence of metrics to effectively measure biodiversity gains. Without robust metrics in place, it becomes challenging to accurately assess the impact of conservation actions on biodiversity levels. Developing standardized and comprehensive metrics is crucial for evaluating the effectiveness of conservation strategies and ensuring sustainable management of ecosystems.

Solution implemented: European projects to finance research

One solution to this problem is to initiate multi-stakeholder projects that bring together research institutions and private sector actors. The European Commission, by HORIZON H2020 projects for example, is a significant financier and plays a crucial role in supporting such initiatives. For instance, a project started in January 2024, called GoNaturePositive!, aiming to establish a common framework for a nature-positive economy. This collaborative approach not only fosters innovation but also ensures that diverse expertise and resources are pooled together to effectively address the challenges related to nature and depleting resources (GoNaturePositive!, 2024). The handbook for evaluating the impact of nature-based solutions (European Commission, Directorate-General for Research and Innovation, 2021) provides a list of potential indicators to calculate these impacts.

4.1.11 Business Model trends in UF-NBS

The focus on value creation within urban forestry trends is notably tied to revenue generation opportunities. A detailed exploration of revenue-based UF-NBS business models is provided in a dedicated section, emphasizing the financial viability of these initiatives.

4.1.11.1 Tiny Forests®

Tiny Forests®, an enduring concept despite its age, highlights the potential for scalable and engaging urban greening projects. Originating from the Miyawaki method, developed by Japanese botanist Akira Miyawaki, this approach promotes the creation of dense, native forests in compact areas, akin to the size of a tennis court. The method promises rapid growth and high biodiversity by planting native species closely together, leveraging ecological principles for urban spaces. Key figures like Shubhendu Sharma (Afforestt) have propelled the method globally, aiding its adoption across various countries (Wageningen University & Research, 2018). These projects not only foster biodiversity but also engage communities, enhance carbon sequestration, and provide ecosystem services despite challenges such as resource intensity and maintenance requirements (Rewilding Academy, 2024).

Key Partnerships	Key Activities	Value Propositions	Customer Relationships	Customer Segments
1. Suppliers of miniature plants 2. Nurseries for sourcing high-quality plants	1. Providing expert advice 2. Sourcing and selling high-quality miniature plants 3. Offering maintenance services **Key Resources** 1. Skilled horticulturists 2. Online platform and website 3. Physical store location	1. Affordable and personalized solutions for creating green and serene environments within limited spaces 2. Expert advice from skilled horticulturists 3. High-quality miniature plants 4. Maintenance services for long-term success	1. Personalized customer support via online chat, email, and phone 2. Regular updates on plant care and maintenance **Channels** 1. Online platform for ordering plants and services 2. Physical store for customers to browse and seek advice	1. Homeowners 2. Gardening enthusiasts

Cost Structure	Revenue Streams
1. Salaries for skilled horticulturists 2. Plant and supply costs 3. Marketing and advertising expenses 4. Rental or lease costs for physical store location	1. Sales of miniature plants 2. Maintenance service packages 3. Consultation fees for expert advice

Figure 8: Tiny Forest Business Model Canvas example (FINMODELSLAB, n.d.)

The Tiny Forest business model, as detailed by FinModelsLab (Figure 8), revolves around the concept of creating dense, native forests in urban areas, utilizing a method pioneered by Japanese botanist Akira Miyawaki. This model emphasizes rapid biodiversity enhancement and efficient carbon dioxide absorption within compact spaces equivalent to the size of a tennis court. The revenue streams for this business model are diverse, including direct sales of planting services to local governments, businesses, and educational institutions, along with maintenance contracts, educational workshop fees, and potentially, carbon credit trading. The value proposition centres on offering a fast, effective method to green urban spaces, improve air quality, and enhance biodiversity with minimal land use. Key partners in this venture include local governments, environmental NGOs, and corporations seeking to improve their environmental footprint, alongside suppliers of native plants and soils.

While the Tiny Forest model presents several advantages, such as promoting urban biodiversity, enhancing local air quality, and providing educational opportunities, it also faces challenges and limitations (see Table 5). One significant advantage is its scalability; Tiny Forests can be implemented in various urban settings, from school yards to corporate campuses, making it a versatile solution for urban greening. Moreover, these forests create dense ecosystems quickly, offering immediate benefits in terms of biodiversity and carbon sequestration. However, the model's reliance on specific ecological conditions and native species may limit its applicability in certain regions. Additionally, the upfront costs for land preparation, planting, and maintenance may be prohibitive for some communities. There's also the challenge of ensuring long-term maintenance and protection of these forests, which is crucial for their success and sustainability. Despite these challenges, Tiny Forests represent a promising approach to urban environmental enhancement, blending ecological benefits with community engagement and education.

Table 5: Tiny Forest business model pros & cons (Rewilding Academy, 2024)

Pros	Cons
Biodiversity enhancement: utilizing native species to restore local biodiversity, offering habitats for various flora and fauna.	Resource intensive: requiring significant labour, materials, and land, posing logistical and financial challenges.
Carbon sequestration: contributing significantly to absorbing atmospheric CO_2, aiding in climate change mitigation.	Maintenance requirements: demands ongoing management, including weeding and monitoring for pests.
Community engagement: fostering local involvement and environmental awareness.	Ecological disruption: potential risk of disrupting existing ecosystems by introducing non-native species or altering soil compositions.
Ecosystem services: providing air purification, stormwater management, and enhancing urban environmental quality.	Applicability concerns: its effectiveness in diverse ecological environments, such as arid areas, has been questioned.

4.1.11.2 Phytoremediation

Phytoremediation leverages the natural ability of certain trees to purify air and decontaminate urban soils, presenting a valuable UF-NBS with the dual benefit of environmental remediation and economic advantages. Projects have demonstrated economic gains through job creation and future sustainable timber harvesting. Additionally, they enhance urban green spaces while avoiding costly artificial soil decontamination methods, which often involve extensive soil displacement and transport. Phytoremediation even offers a promising and sustainable approach for addressing heavy metal contamination for urban brownfields (Yan, Wang, Tan Swee, & Mohd, 2020) as described in Table 6 .

Hybrid poplar trees are for instance often used for soil and water remediation (Vibrant Cities Lab, n.d.). In addition to depollution, the Phytoremediation project in Muskegon Michigan has demonstrably created economic benefits for its city. It has provided employment opportunities for various individuals, including general labourers, equipment operators, and tree farmers. Additionally, plans are in place to sustainably harvest and reuse timber from the planted trees in the future, potentially contributing to further economic growth while adhering to responsible urban forest management practices.

This use of UF-NBS could therefore be further explored in each city, depending on each city's context, combining the financing option linked to the obligations of industries to decontaminate. Moreover, phytoremediation offers cheaper land for urban forests as these lands are often not competing with other uses such as tourism or food growing.

For example, SPIRE (Smart Post-Industrial Regenerative Ecosystem) project in Baia Mare, Romania, showcases a large-scale phytoremediation of urban heavy metal-polluted land that interestingly put together various stakeholders both public and private, with a strategic governance, some toolkits and a replicable approach. Another great example is Tempelhofer Feld, a former airport site in Berlin, applying extensive phytoremediation using poplars, willows, and birches to remove heavy metals like lead and zinc. This initiative aims to transform the area into a public park while addressing its historical industrial legacy.

Table 6: Phytoremediation business model pros & cons (Yan, Wang, Tan Swee, & Mohd, 2020)

Pros	Cons
Environmental remediation: effectively removing pollutants from soil and water, improving urban green spaces.	Species specificity: success heavily depends on selecting appropriate plant species that can tolerate and accumulate specific contaminants.
Economic benefits: generating employment opportunities and potentially leading to sustainable harvesting of timber.	Long-term commitment: requires time for plants to effectively remove pollutants, making it a slower process compared to technological solutions.
Sustainability: offering a green, cheap and sustainable method for decontaminating urban soils without the need for harsh chemical treatments.	Limited scope: not all pollutants can be remediated through phytoremediation, limiting its applicability to certain types of contamination.

4.1.11.3 Productive forests

While Europe boasts a rich history of productive woodlands, the use of alternative construction materials, coupled with urbanization and a knowledge gap in forest management, has left the urban forest largely overlooked as a potential source of timber. However, a growing recognition of its potential is emerging, fuelled by successful initiatives promoting local timber markets and advocating for improved urban forest management practices (Konijnendijk, 2008). The concept of productive forests underscores the untapped potential of urban forests as sources of timber, amidst the challenges posed by alternative construction materials and a gap in forest management knowledge (Table 7). Initiatives aimed at promoting local timber markets and enhancing urban forest management practices are gaining traction, highlighting the economic and environmental benefits of sustainable timber production.

Table 7: Productive forests business model pros & cons (Konijnendijk, 2008)

Pros	Cons
Local timber production: promotes the sustainable production of timber, reducing reliance on imports.	Management challenges: requires sophisticated forest management practices to balance production with conservation.

Economic opportunities: creates local jobs and supports local economies through timber and non-timber forest products.	Urban space limitations: urban areas may have limited space available for the establishment of productive forests.
Environmental benefits: contributes to carbon sequestration and biodiversity conservation.	Knowledge gap: there's a need for increased awareness and expertise in urban forest management for productive purposes.

4.1.11.4 Forest Gardens, Edible Forests, Food Forest

The growing popularity of edible urban forests across Europe illustrates their multifaceted benefits, from environmental enhancement to local food provisioning and community engagement. These initiatives drive social acceptance of NBS and pave the way for future urban forestry projects by involving companies and industries in the importance of urban greening.

Similarly, as an edible forest, a food forest, also known as a forest garden, is a varied assortment of edible plants designed to emulate the ecosystems and natural patterns found in nature. Food forests serve to create a sustainable food system that integrates nutritious food production, wildlife habitat preservation, carbon sequestration, green space provision, and soil health enhancement (Project Food Forest, 2016), as illustrated in Table 8.

Table 8: Edible forests business model pros & cons (Project Food Forest, 2016)

Pros	Cons
Community engagement: enhances community involvement and education on sustainable food production.	Maintenance and knowledge: requires ongoing care and a deep understanding of permaculture principles.
Local food production: provides fresh, local food sources, promoting food security and reducing food miles.	Pest and disease management: the diversity of plant species can attract pests and diseases, requiring careful management.
Biodiversity: supports a wide range of plant and animal species, enhancing urban biodiversity.	Initial investment: establishing edible forests can require significant upfront investment in terms of resources and planning.

4.1.11.5 Tree as Infrastructure (TreesAI)

The concept of Tree as Infrastructure (TreesAI), which connects apparent disparate city actors (landowners, investors, beneficiaries…) under one model to form alliances, interactions and investment streams that will support the growth and maintenance of urban forests. TAI embodies a collaborative model that unites various urban stakeholders, facilitating investments and alliances in support of urban forest growth and maintenance. The establishment of a Tree Trust as an independent legal and financial entity exemplifies the model's innovative approach to overcoming financing hurdles and fostering urban forestry initiatives.
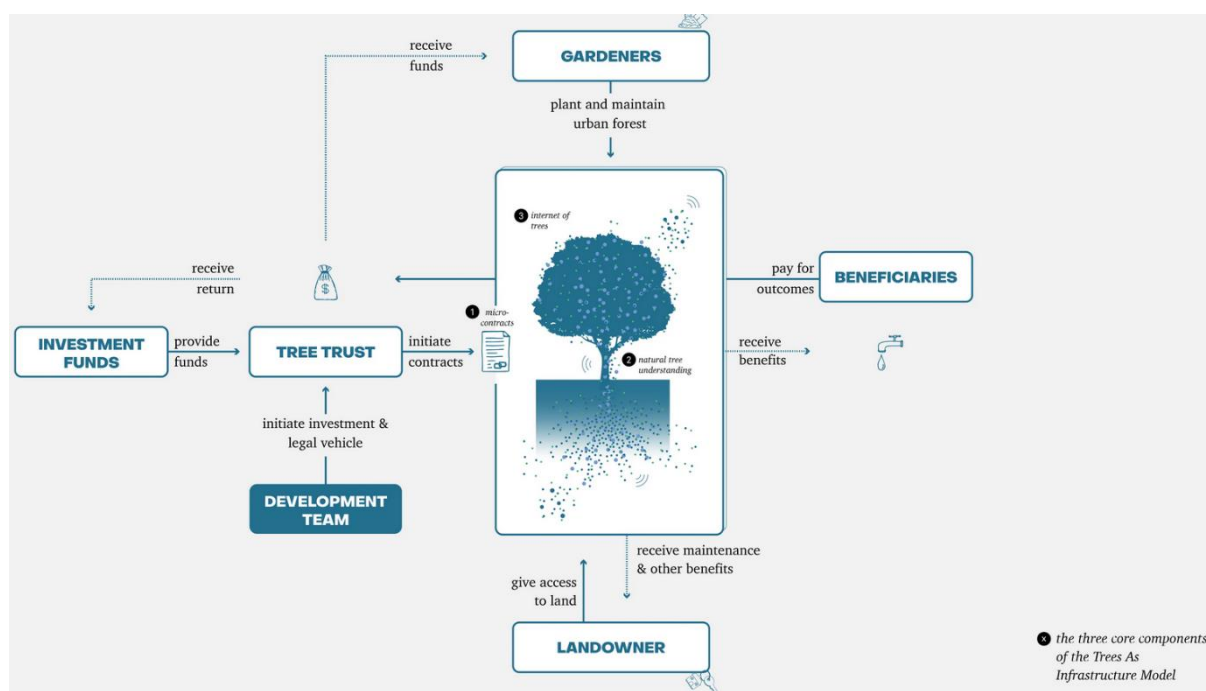
Figure 9: Trees as Infrastructure model design (Dark Matter Laboratories, 2020)

This initiative addresses a common concern raised by many public bodies regarding financing. The first phase of the Tree as Infrastructure (TreesAI) model involves establishing a Tree Trust. This trust acts as an independent legal and financial entity capable of engaging with various stakeholders and securing funding from a diverse range of sources (see Table 9 and Figure 9). These sources may include philanthropic organizations, public funding sources, and private sector investors seeking financial returns (Dark Matter Laboratories, 2020).

Stakeholders then form outcome-based contracts with the Tree Trust to participate in the planting and maintenance of urban forests. For example, beneficiaries commit to paying for the financial or other benefits they anticipate receiving from the positive environmental impacts of the urban forest. Similarly, gardeners agree to provide services aimed at cultivating the healthiest portion of the urban forest, with the expectation of compensation for their efforts.

Table 9: Trees as Infrastructure (TreesAI) business model pros & cons

Pros	Cons
Holistic urban planning: integrates trees into urban infrastructure, promoting sustainable city development.	Coordination and management: requires effective coordination among multiple stakeholders, which can be complex.
Environmental benefits: provides ecosystem services like air purification, cooling, and carbon sequestration.	Financial models: developing sustainable financial models for TAI initiatives can be challenging.
Community benefits: enhances urban liveability, health, and well-being for city residents.	Long-term commitment: ensuring the long-term maintenance and success of TAI projects demands ongoing commitment and resources.

4.2   UF-NBS funding

Despite a positive trend in their financing and implementation, cities and territorial actors, as promoters of these solutions, face difficulties in mobilising public and private funds to finance UF-NBS projects, due to factors such as the low financing capacity of public actors, and the often-distorted assumptions of private funders: low market potential, therefore uncertainty about the return on investment. Often, only through grants UF-NBS projects can maintain an activity until the UF-NBS generate income to cover the costs of the project, for example through payments for ecosystem services. However, many UF-NBS projects, often those with the most impact, need longer-term solutions to become financially viable – so private investment is needed, including financing in the form of debt or equity in the companies carrying the projects.

> *"What ultimately lacks in urban forests as a nature-based solution to be viable is that very often urban forests will be implemented by a city. And if there's a change in government, well, there's no more funding."*
>
> ***Sustainability of Urban Forests - Governance and Funding Challenges***
> *Franck Barroso (Invest4Nature) – interviewed November 2023*

Barrier identified: Insufficient funding

According to the European Commission, there is a general lack in NBS investments and funding (European Investment Bank, 2023) (European Environment Agency, 2024). While small scale projects can be cost-effective, such as enhancing small urban parks with trees, large-scale deployment of UF-NBS projects tend to require high expenses and maintenance costs. Due to this lack of funding, most UF-NBS projects tend to be relatively small in size, with more than 44% of projects being under 1 million euro (Finance for Nature Europe Online Event, 2023). Traditional funding sources from the public sector may not be sufficient to support large-scale UF-NBS projects and finding enough and appropriate investment instruments for UF-NBS can be a significant challenge.

Examples of UF-NBS projects: The Orbital Forest Tirana (Albania)
The Orbital Forest is a ring located on the outskirts of the city, connecting 14,000 hectares of parks, agricultural fields and forests of Tirana, thus preserving the ecosystem and supporting biodiversity. Urban greenery is increased through the planting of 2 million trees that integrate well with the existing ecosystem and create a natural boundary to curb urban sprawl. The project to create peri-urban green belts started in 2017 and is still ongoing. The planting of the trees in the Orbital Forest was carried out thanks to the "Donate a Tree For Tirana" campaign, allowing citizens, companies and international organizations to plant a tree contributing to the green belt. In 2021, more than 440,700 trees were planted as part of this campaign, bringing urban nature closer to residents. Funding for the project comes mainly from the budget of local public authorities and multilateral funds (such as the EBRD and the World Bank). Regional and national financing is used in combination with bank or institutional borrowing. The exact budget is not specified (Urban Nature Atlas, 2021a).

source image: Tirana Orbital Forest
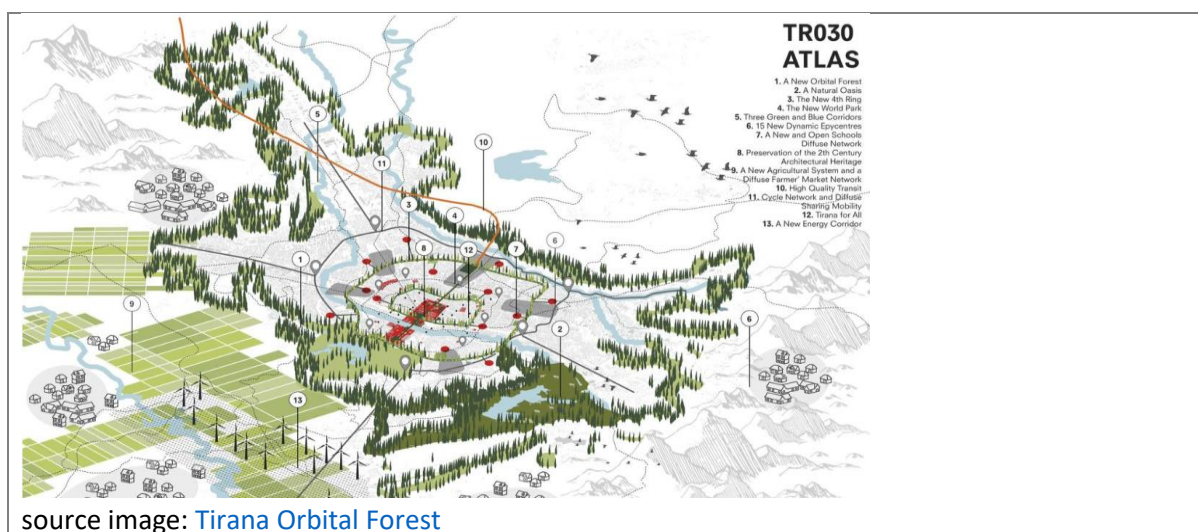
Examples of UF-NBS projects: Las Cigarreras (Alicante, Spain)
The Las Cigarreras, sustainable urban development project in Spain (Alicante) aims at the integral transformation of an important urban area, including the rehabilitation of historic neighbourhoods and emblematic mountains, as well as the creation of green spaces. The project is carried out from 2016 to 2022, with a budget of €4,000,000, financed by EU funds and the budget of local public authorities (Urban Nature Atlas, 2021b).

Examples of UF-NBS projects: Olbin district of Wroclaw in Poland
The UF-NBS project in the Olbin district of Wroclaw in Poland consists of seven pocket parks and/or green walls delimited by a green street. Locations were determined based on residents' needs and spatial constraints. The project was carried out from 2018 to 2020, with a budget of €1,400,000, funded by EU funds (Grow Green, 2022).

Solution implemented: Crowdfunding

Crowdfunding relieves pressure for funding mechanisms and allows municipalities to share the financial contribution with citizens, organizations and local enterprises.

Examples of UF-NBS projects: WowNature
WowNature is an initiative aimed to help citizens, institutions and companies grow new forests and protect existing ones. The initiative allows individuals and organisations to gift and plant trees in protected green areas and grow new forests (WowNature, 2024).

Solution implemented: Public-private funding mechanisms (blended finance)

Given the substantial funding needs associated with UF-NBS projects and the persistent high maintenance costs, the solution can be found in public-private partnerships. By leveraging both public

and private resources, investment capacities and risk sharing, the UF-NBS projects become more feasible and effective.

Examples of UF-NBS projects: Forestami (Italy, Milan)
ForestaMi is a great example of how dialogue and collaboration between public and private entities in urban forestation projects can be organised. This public-private partnership, led by the Metropolitan City and Municipality of Milan, supported by research from the Polytechnic University of Milan, the Falck Foundation, and FS Sistemi Urbani, aims to plant 3 million trees by 2030 (Forestami, s.d.). Basic funding for research, communication and project management is provided by the Metropolitan City, the Municipality of Milan and some of the other municipalities in the Milan Metropolitan Region. The costs for planting and maintaining trees is covered from private and corporate funding.

Examples of UF-NBS projects: Alliance for Ecosystem Services for Castilla La Mancha (Spain)
The region holds a forest area occupying over 3.7 million hectares that provides a range of ecosystem services including water provision, but the achievable revenues and budget for management are not sufficient to safeguard future ecosystem services. The alliance for ecosystem services promotes a cooperation of the regional government of Castilla-La Mancha with companies, foundations and NGOs that understand the value of natural capital. The partnership creates a voluntary funding stream to cover the gap required (Mediterranean Facility of the European Forest Institute, 2022).

Examples of UF-NBS projects: Nature 2050 (France)
Many projects are financed by both the public and private sectors through a fund that also acts as the main funder and regulates the choice of projects. In this way, private companies needing compensation (Paris Airport, Amazon, CDC Habitat) find themselves co-financing projects alongside public institutions or banks (Bpi France, Banque des Regions, IPSEC). Since the programme was launched in 2016, nearly thirty-five companies have joined Nature 2050, contributing around €3.5 million. Over 2018, almost €600,000 in new contributions have been committed to the programme (CDC-Biodiversité, 2022).

Barrier identified: Lack of private funding

UF-NBS need various key resources to design, implement, and maintain UF-NBS. One crucial aspect of UF-NBS business models is the exploration of innovative financing mechanisms to attract investment and fund UF-NBS projects. Traditional funding sources from the public sector may not be sufficient to support large-scale UF-NBS projects and finding enough and appropriate investment instruments for UF-NBS can be a significant challenge. UF-NBS business models are actively engaging with impact investing, green bonds, and blended finance strategies to raise funds from diverse sources, including the public and private sectors. These innovative financing mechanisms provide opportunities to leverage financial resources and enable the implementation of nature-based solutions on a broader scale.

However, currently, the primary source of funding for UF-NBS projects remains the public sector, while the private source of capital for UF-NBS projects continues to be very small. Overall, there is a general lack in UF-NBS investments, and research shows that we can triple the investment in UF-NBS by changing the ratio of investment from being predominantly public sector led to securing more investment from the private sector (Network Nature, 2021). However, gaining private funding has shown itself to be challenging due to the difficulty for the private sector in assessing their returns because of non-financial benefits (European Commission, Science for Environment Policy, 2021). Numerous incentive measures exist to encourage private sector investments in NBS. A few examples of these measures are described below (Network Nature, 2021).

Solution implemented: Engaging companies

Establishing urban forests funded by companies adjacent to their headquarters offers several key benefits. Firstly, it provides a sustainable financing mechanism for tree planting initiatives, ensuring the availability of resources for the plantation and expansion of tree areas. Secondly, it creates employment opportunities by engaging local communities or company employees in the tree planting process and possibly long-term maintenance of trees, thereby fostering a sense of ownership and pride in environmental stewardship. Such maintenance activities typically include easy actions that require limited training such as watering trees, removing weeds, replacing dead trees, protecting trees against wildlife etc. Lastly, this visible demonstration of corporate commitment to environmental sustainability serves as a powerful catalyst for public engagement and awareness, inspiring individuals to act and participate in broader societal transitions towards a greener future.

Solution implemented: Financial incentives

Through putting in place financial incentives for starting or upscaling nature-based enterprises (for example, tax incentives), governments can secure funding for UF-NBS projects, and simultaneously raise the overall awareness on UF-NBS and their social, environmental and economic impact (Network Nature, 2021).

Solution implemented: Non-monetary valuation systems

Non-monetary valuation of UF-NBS can remain tricky due to the high non-monetary impact of urban forests that is difficult to quantify. Non-monetary evaluation systems are available to help enterprises qualify their cost-benefit analysis (e.g. INVEST, Nature Value Explorer). Understanding the social and environmental benefits UF-NBS bring can encourage stakeholders to invest more time and resources into UF-NBS projects that do not directly create cash flow (European Commission, Science for Environment Policy, 2021).

Solution implemented: Community efforts and partnerships

Supporting platforms, networks and face-to-face industry events help connect and foster close relationships between nature-based enterprises (NBE) and other investors, beneficiaries, or actors across the supply chain. By connecting various stakeholders and creating a collaborative community for UF-NBS projects, stakeholders are more easily encouraged to provide funding due to the community feeling and sense of shared climate risk and collective effort (Network Nature, 2021).

Barrier identified: Scaling investment for UF-NBS

Due to fundamental features that are present in the UF-NBS markets, it is not only tricky to gain sufficient funding, but also to scale investments in UF-NBS. Such markets barriers are:

1. Long time frames: it can take a long time before urban forests or green space actually provide ecosystem services and benefits. Therefore, a certain return on investment is not immediate but rather takes a long time. Investors can be apprehensive in scaling their investment before seeing returns.
2. Risk: UF-NBS can bring various social, environmental and economic benefits, but the investor does not directly capture these benefits in monetary terms, therefore these benefits do not translate to risk-reduction for the investor.
3. Information failure: while UF-NBS can provide ecosystem services that bring social, environmental and possible economic returns, if such returns are not directly observed by the investor, it is unlikely they will increase their funding.

4.2.1   NBS funding trends

Funding for UF-NBS is constantly evolving. Governments, businesses and non-profit organisations are increasingly looking to fund UF-NBS projects because of their potential to provide environmental, economic and social benefits for local communities. This section presents key trends to watch in UF-NBS financing, with a focus on biodiversity credits, co-benefit analysis, blended finance and payments for ecosystem services.

Throughout industries, new approaches like Urban Forest Impact Bonds, Ecosystem Services Credits, and Green Infrastructure Bonds can attract private capital and leverage crowdfunding opportunities.

4.2.1.1   Biodiversity credits

In a report published on December 5, 2022, economists from the International Institute for Environment and Development (IIED), in collaboration with the United Nations Development Programme, expressed their support for the emerging market for "biocredits". Biodiversity credits are financial tools that allow companies and governments to offset their impact on biodiversity by purchasing credits that finance biodiversity conservation projects. UF-NBS projects may be eligible for the generation of biodiversity credits if they contribute to the conservation and restoration of ecosystems. Biodiversity credits can be bought and sold on specialized marketplaces. In this way, they provide a funding opportunity for UF-NBS projects (IIED, UNDP, 2022).

The WEF mentions: "One of the mechanisms to help companies achieve positive outcomes for nature is the biodiversity credit." It is an "economic instrument used to finance activities that generate net gains in biodiversity" (World Economic Forum, 2022). Biodiversity credits can be used to finance NBS projects such as wetland restoration, reforestation and the creation of biodiversity corridors. They can be purchased by companies to comply with environmental regulations or to improve their sustainability branding.

Conservation groups, from non-profits to for-profit companies working to protect ecologically important habitats or combat biodiversity loss, can convert their efforts into tradable credits. These credits could be purchased by companies, institutional investors, or individuals willing to support conservation or fulfil a sustainability mandate, just as carbon credits allow for investment in projects to reduce emissions. According to the IIED (International Institute for Environment and Development), one of the startups in the sector defines "a biodiversity unit as a 1% increase or avoided loss in the

median value of a basket of parameters, per hectare" (IIED, UNDP, 2022). This basket would vary depending on the specific ecosystem and could include things like the number of threatened species present in that area or the number of individuals of a certain species present there. It is important to note, however, that further research on these methods is needed before bio-credits can be scaled up, as the report states.

Example: The "Willamette Basin wetland restoration" project aims to restore wetlands to improve water quality, provide habitat for wildlife, and increase climate resilience. Biodiversity credits were used to help finance the project by allowing developers to offset the environmental impacts of their development projects by purchasing biodiversity credits (Environmental Incentives, 2021).

4.2.1.2   Green Bonds

Green bonds represent a significant opportunity for financing UF-NBS. These bonds, which are essentially debt instruments, align investors and issuers to raise capital for environmentally beneficial initiatives. One of the main challenges in utilizing green bonds for UF-NBS projects is ensuring that the funds raised are genuinely allocated to green initiatives, as there is a risk of "greenwashing" where projects may not deliver the promised environmental benefits. To address this issue, rigorous standards and certification processes are essential to verify the green credentials of projects funded by green bonds (Commonwealth Secretariat, 2021).

4.2.1.3   Blended finance

Blended finance presents a possible solution for projects considered higher-risk and not well-suited for the green bond market (Thompson, Bunds, Larson, Cutts, & Hipp, 2023). Although not new, blended finance is an increasingly common approach to financing NBS projects. It involves the combination of public and private financing to raise larger funds and spread the risks among different investors. Governments can provide grants and loan guarantees to attract private investment in UF-NBS projects. Private investors may be motivated by financial returns from economic value created from or around UF-NBS (for example paid educational activities or tourism), environmental benefits, societal benefits or a combination of these.

Companies can also play an important role in providing funding, technical skills and expertise. This financing strategy is promising for NBS projects in the Mediterranean, according to the Rhône Mediterranean Corsica Water Agency. The Natural Capital Financing Facility ([MFCN](#)) was a blending instrument by the European Investment Bank that financed NBS and other natural capital projects. It is replaced by [InvestEU](#), a much broader funding programme that also combines public and private funding for projects that may include NBS.

According to research blended finance is an effective approach to mobilising finance for UF-NBS projects, especially in developing countries where public funding is limited (OECD, s.d.). However, setting up blended finance can be complex and requires close coordination between the different actors involved. The United Nations Environment Programme's report "Mobilizing Private Investment for Nature-Based Solutions" highlights the importance of collaboration between governments, businesses, investors and local communities to develop robust and sustainable financing proposals for UF-NBS projects.

In sum, blended finance is a promising financing approach for UF-NBS projects, as it can mobilize significant funds and maximize the environmental and social benefits of projects. However, it requires

close coordination and collaboration between the different actors involved to ensure the success and sustainability of projects.

Example: Blue Finance, a non-profit organization, used blended finance to help finance the restoration of marine and coastal ecosystems by offering loans at lower interest rates than those offered by commercial banks. The organization has also raised funds from private and institutional investors to finance its projects. An example of a project funded by Blue Finance is the conservation of the Bahía de los Ángeles lagoon in Baja California, Mexico, which was funded by a mix of loans and grants from various public and private sources (Blue Alliance, n.d.).

4.2.1.4   *Payments for ecosystem services*

Payments for ecosystem services (PES) is an emerging trend in NBS financing. This approach involves paying landowners, local communities, and governments for the ecosystem services provided by the ecosystems they manage, such as carbon sequestration, biodiversity conservation, and climate change adaptation. The payment is also regarded as a compensation for (potential) income loss due to the sustainable management. The payment is provided by a beneficiary of the ecosystem services (e.g. water companies) or the government. PES projects can include sustainable agricultural practices, afforestation, forest and wetland restoration, and green infrastructure projects. PES can also be provided for sustainable forest management.

Payments for ecosystem services can provide a source of funding for UF-NBS projects and encourage the participation of local communities. According to a report entitled "Payments for Ecosystem Services: A Best Practice Guide", payments for ecosystem services are an effective method of financing NBS projects, which may be relevant to UF-NBS as well (Department for Environment Food & Rural Affairs, 2013). They can encourage landowners to participate in UF-NBS projects by providing them with an alternative source of income and valuing the environmental services they provide. Payments for ecosystem services can also help mobilize public and private finance for UF-NBS projects by attracting environmentally conscious investors.

Vienna, Austria has a good example of payments for ecosystem services applied to UF-NBS projects. To ensure the city's water sources remain protected, the Forestry Office of the city of Vienna maintains source protection forests around the city's water source. The forest helps filter and store rainwater, making the payments for the forest protection financially cost-effective as it helps preserve the city's rainwater, providing economic benefits to the local communities (Brears, 2024).

Example: The REDD+ programme in Ecuador aims to protect the country's rainforests by providing local communities with payments for ecosystem services provided by forests. In exchange for these payments, communities commit to protecting forests and managing them sustainably. The programme has been a success, reducing deforestation and promoting biodiversity conservation while providing economic benefits to local communities (United Nations Environment Program, 2015).

4.2.1.5   *Growing interest in UF-NBS by private companies*

Collaborating with businesses, NGOs, and communities to generate revenue through eco-tourism and "adopt-a-tree" programmes presents a sustainable model for funding UF-NBS. These partnerships can leverage the recreational and educational value of urban forests, creating a source of income while promoting environmental stewardship. While there is a notable increase in companies investing in tree planting initiatives, financial returns on such investment are typically not the primary motivation for companies to engaging in these initiatives. Instead, companies plant trees to increase their positive

contributions to the environment and society and to enhance their green image and even portray themselves as an environmentally conscious company. While the risk of greenwashing exists, with some companies overstating their impact, their primary concerns typically do not revolve around the financial returns of the initiatives (Mansourian & Vallauri, 2020). A WWF report identifies 8 main reasons for companies to invest in tree planting or protection initiatives (Mansourian & Vallauri, 2020):

1. Remediation - To reduce or reverse damage inflicted on the environment
2. Offsetting - To reduce a company's footprint (carbon or biodiversity) or compensate for greenhouse gas emissions or biodiversity loss
3. Communications - To promote an attractive public image and manage public relations
4. Marketing - To encourage sales
5. Engagement - To engage employees or customers in team-building exercises
6. Ecosystem services - To secure and retain ecosystem services
7. Sustainable Development Goals (SDGs) - To contribute to the sustainable development goals
8. Sustainable sourcing/Insetting - To plant trees within a company's own supply chains and improve its social and ecological impacts

4.2.1.6 Tech for green

The integration of digital trends into UF-NBS is increasingly recognized as a transformative approach to enhancing urban green spaces. These trends not only offer innovative funding and engagement models but also bring new challenges and considerations for project owners.

The expansion of impact investing apps and data-driven forest valuation tools represents a significant shift towards leveraging digital platforms to secure funding and demonstrate the multifaceted value of UF-NBS. The Nature Conservancy's NatureVest, for example, showcases how private capital investment directed towards nature-based solutions can create real impact, highlighting transactions like the scaling up of Blue Bonds for Ocean Conservation model in Belize (The Nature Conservancy, 2024). This approach exemplifies how digital platforms can facilitate the connection between investors and projects, emphasizing the importance of impact investing in the conservation space.

The adoption of blockchain technology for tokenization of trees and NFT ownership introduces a novel method for funding, ensuring transparency, and fostering community engagement in UF-NBS projects. This technology enables the tracking of individual contributions to urban forests, potentially revolutionizing how projects are funded and managed.

The concept of the NatureVest represents a digital parallel to biodiversity finance, where natural assets are monetized and managed within virtual environments. This approach could revolutionize how we value and interact with nature, offering new avenues for funding and public engagement in UF-NBS through virtual tourism, digital land management, and the creation of virtual ecosystems that mirror and support their real-world counterparts.

While these digital trends offer exciting prospects for the future of UF-NBS, they are still in the nascent stages and require careful consideration and exploration. Project owners should evaluate the applicability of these trends to their specific contexts, considering the potential benefits and challenges they present. As these digital approaches continue to evolve, they hold the promise of significantly impacting the funding, management, and public engagement of UF-NBS projects, albeit with a need for ongoing research and adaptation to fully realize their potential.

5   LEARNINGS & RECOMMENDATIONS

This section synthesizes the key insights derived from an extensive review of literature, case studies, and empirical data collected through workshops and interviews as part of the CLEARING HOUSE project. That being laid out, this section leverages the insights from Section 4, proposing a combination of partnerships, community engagement, technological innovations, and novel financial mechanisms as potential solutions to the challenges faced by UF-NBS projects.

5.1   Agreed-upon and proven solutions

The solutions and activities identified in the previous chapter have been grouped into five solution categories by applying LGI's QWIA (Quick Wins and Innovation Approach) *mapping* methodology, an innovative approach initially designed for regions. In short, the QWIA helps rank the strongest levers for change in the short term, vs. the deepest changes needed to sustainable transformation.

5.1.1   Overview of solutions

Within the QWIA matrix below (see section Methodology for how the project achieved this view), and especially in the decision-making processes for UF-NBS projects, the relevance of the UF-NBS findings become obvious within the importance of an action (size of the bubble), where it can be read in terms of economic impact as well as in terms of effect on climate (see Figure 10).
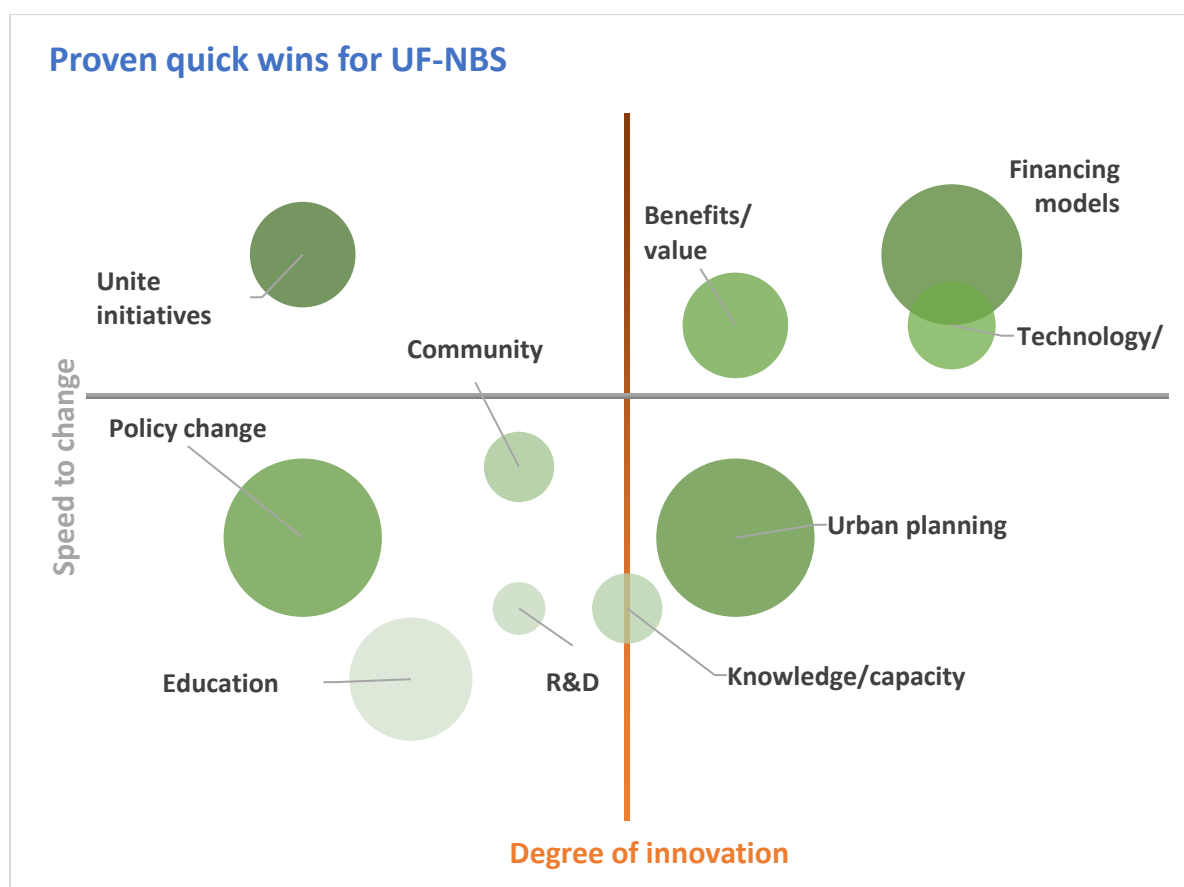

Figure 10: QWIA matrix for UF-NBS

As mentioned in the Methodology section, each leverage for change (each bubble in the graph) is mapped for its degree of innovation required, timeframe (speed to implement, including the time needed to see the first results/outcomes of the solution), and overall potential impact (size of the bubble). Note that the colour grading follows the potential impact metrics and is used only to help the reading of the graph. This means that, in the lower left quadrant, working on education doesn't necessarily demand for high-levels of innovation and it will not take a lot of time – however the expected results of this action have a large potential for impact.

The QWIA Matrix should therefore be seen as a starting point for further examination of each project's needs and capabilities, rather than a fixed visual – although it is based on the rigorous process of qualitative data gathering from the SoA, from the workshops as well as from the expert interviews.

The solutions presented on the QWIA graph are described in the next sub-sections.

5.1.2 Co-design with funders

Unite with other initiatives for creating synergies, increasing impact and reducing cost

Collaborating on UF-NBS and related environmental protection efforts can amplify impact, reduce costs, and foster innovation. For example:

- Connect initiatives focusing on urban reforestation, tree protection, biodiversity conservation and ecological restoration to create synergies.

- Leverage technology such as real-time monitoring of forest conditions to enhance the management of urban green spaces. An example of this is Wageningen University's decision to share updates and real-time activities of trees on Twitter, providing the public with insights into the inner workings of trees (Wageningen University & Research, s.d.).

- Share resources and knowledge across projects to improve the efficiency and effectiveness of UF-NBS.

Develop innovative financing models

Securing sustainable funding is pivotal for the success of UF-NBS projects. Exploring new funding mechanisms can provide the necessary capital for these initiatives. For example:

- Foster partnerships with private sector entities to leverage investment in UF-NBS.

- Investigate public-private partnerships (PPP) as a means to combine human and financial resources for larger projects.

- Explore crowdfunding platforms to engage community members directly in funding local UF-NBS projects.

5.1.3 Challenge assumptions

Embed UF-NBS into urban planning norms

Ensuring UF-NBS are integrated into urban planning and development practices is critical for their broader adoption and success. For example:

- Work with urban planners to incorporate UF-NBS into new developments, urban redevelopment and retrofit projects.

- Influence the revision of urban planning regulations to require or incentivize the conservation and development of green spaces.

- Develop and disseminate toolkits and guidelines to facilitate the integration of UF-NBS into urban landscapes.

Advocate for policy changes that facilitate funding of UF-NBS

Policy advocacy can lead to a more conducive environment for the development and integration of UF-NBS into urban planning. For example:

- Lobby for tax incentives for businesses and developers that integrate UF-NBS into their projects or corporate social responsibility approach.
- Promote the development of green infrastructure funding programmes at the municipal and national levels.
- Influence urban development policies to include UF-NBS as a standard component of urban planning.

5.1.4   Clearly identify value

Emphasize the full range of benefits

Urban Forests as Nature-Based Solutions (UF-NBS) offer a wide array of benefits beyond their immediate environmental impact. It is crucial to quantify and communicate these benefits to stakeholders and the public to enhance support and investment. For example:

- Conduct comprehensive cost-benefit analyses to highlight economic savings from for example reduced stormwater management needs, or reduced energy needs for heating and air-conditioning.

- Publicize health improvements and savings to public health systems and health insurances, and property value increases associated with UF-NBS.

- Utilize case studies and success stories to illustrate the multifaceted benefits of UF-NBS projects (NetWork Nature, 2023).

5.1.5   Promote & disseminate

Support research and development that supports assessing the value and benefits generated by UF-NBS

Investing in the research and development of UF-NBS can lead to innovative solutions and enhance the understanding of their long-term benefits and the value they create.

- Fund research projects focused on the efficacy, cost-effectiveness, and scalability of UF-NBS.

- Collaborate with academic institutions to study the impact of UF-NBS on urban environments and communities.

- Encourage the development of new technologies and methodologies that support the implementation of UF-NBS.

5.1.6 Burst myth bubbles

As described under Chapter 4, many of the barriers to the implementation of UF-NBS are related to myths from non-experts, especially funders & investors, as well as the general public, and this barrier is the main hurdle to the larger consideration of UF-NBS in urban planning as well as in investment strategies. The solutions proposed below are ways to burst these myths and enhance all other solutions presented here, which in turn will lead to easier conversations, access to funding, and potential for the scalability of UF-NBS BMCs.

Leverage technology and data

The use of digital tools and data analytics can significantly improve the planning, implementation, and monitoring of UF-NBS projects. For example:

- Implement Geographic Information Systems (GIS) for mapping and monitoring urban green spaces (for example the MyDynamicForest, SIAC and SIK-Hub tools developed by CLEARING HOUSE).

- Use data analytics to measure the impact of UF-NBS on urban ecosystems and communities (for example the SIAC and SIK-Hub tools developed by CLEARING HOUSE).

- Adopt digital platforms for stakeholder engagement and project transparency (for example MyDynamicForest and SIK-Hub tools implemented by CLEARING HOUSE).

Foster partnerships and community engagement

Creating a collaborative environment with stakeholders, including businesses, NGOs, and citizens, is essential for the sustainable development and maintenance of UF-NBS. For example:

- Establish forums for stakeholder dialogue and co-creation of UF-NBS projects.

- Engage local communities through participatory planning and volunteer opportunities (e.g. through MyDynamicForest).

- Develop educational programmes to raise awareness and build support for UF-NBS.

Promote knowledge sharing and capacity building

Sharing knowledge and building capacity among UF-NBS stakeholders can accelerate the adoption and implementation of best practices. For example:

- Host workshops and training programmes to disseminate knowledge on UF-NBS planning, implementation, maintenance, value creation and funding.

- Utilize online platforms for sharing guidelines, tools, and case studies related to UF-NBS.

- Encourage collaboration between municipalities, academic institutions, and industry experts to advance UF-NBS research and applications.

Encourage educational initiatives

Educating the next generation and the broader community about the importance of UF-NBS is essential for fostering long-term support and engagement.

- Implement educational programmes like "City of Trees" to inspire children and adults about the role of trees and nature in urban environments (CLEARING HOUSE, 2024), or "Learning About Forests" (LEAF) run by the Federation for Environmental Education (FEE) (LEAF, 2023).

- Partner with schools and community groups to develop interactive learning opportunities related to UF-NBS.

- Utilize platforms like Plant-for-the-Planet to encourage active participation in tree planting and environmental stewardship initiatives.

5.2 Sustainable Business Models (SBM) archetypes applied to UF-NBS

In the dynamic world of urban development, the integration of nature into our cities through UF-NBS is not just an option; it is a necessity for sustainable living. As we delve into this exploration, it is fascinating to see how Sustainable Business Model (SBM) archetypes, as identified by Bocken et al. (2014), offer a blueprint for innovative and environmentally friendly urban planning. By walking through these archetypes, we uncover how they can transform urban spaces and how we interact with our environment (Bocken, Short, Rana, & Evans, 2014).

In addition to the Business Model Canvas seen in previous sections, Bocken et al. (2014) define 8 archetypes for business models as seen in Figure 11.
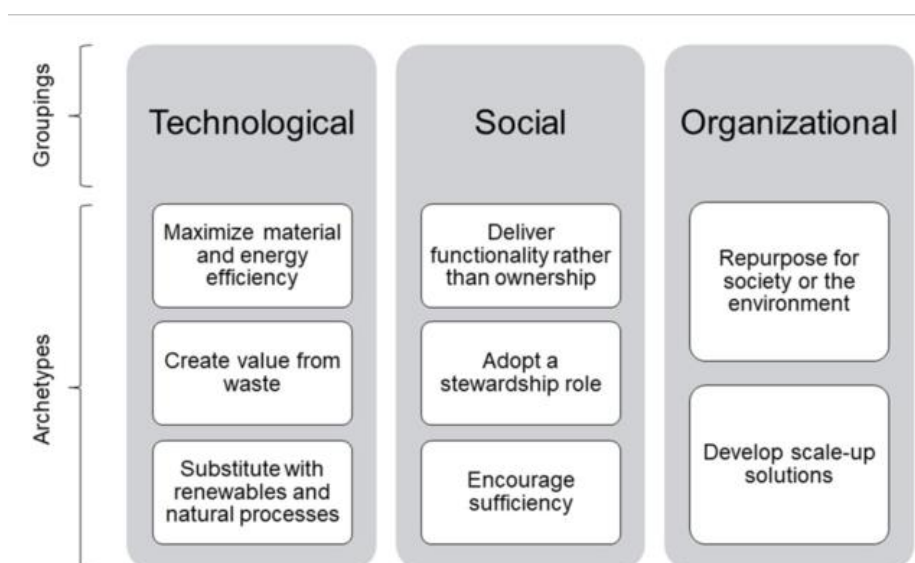

Figure 11: Sustainable business model archetypes (Bocken, Short, Rana, & Evans, 2014)

Literature is extensive on the matter and has also been reviewed by Clever Cities in D5.3 on Governance, Business and finance models.

Many abandoned spaces in cities, once overlooked, have been revitalized into thriving urban forests. Such transformations are at the heart of **re-purposing for society and the environment**. Cities like New York have embraced this with projects like the High Line, turning what was once a derelict railway into a vibrant public park (HIGH LINE, 2024). This approach not only beautifies urban areas but also tackles social challenges, offering spaces for community engagement and activities that enhance well-being.

The concept **of delivering functionality** is about creating a sense of belonging and stewardship without the need for direct ownership. Urban forest memberships or adopt-a-tree programmes are perfect examples, where community involvement is key. These programmes invite individuals and businesses to contribute and adopt a stewardship role to the maintenance and growth of urban forests, fostering a deep connection between people and their local environment.

Adopting a stewardship role emphasizes the importance of conservation and responsible resource use within these green spaces. It's about educating and engaging the community in sustainable practices, ensuring that urban forests are preserved for future generations, and supporting the management of the urban forest through volunteer labour, e.g. through the Watering Can Heroes project (GiessKannenheld*innen) in Gelsenkirchen, Germany (GELSENWASSER , 2024). Melbourne's Urban Forest Strategy, aiming to increase canopy cover, is a testament to the power of community involvement in urban forestry initiatives (City of Melbourne, 2024).

Encouraging sufficiency touches on the wise use of resources within urban green spaces. Singapore's Green Plan 2030 is a prime example, promoting efficient resource use and sustainable living practices, demonstrating that small changes in how we consume resources can have a big impact on our urban environments (Singapore Green Plan, 2024).

Linked to encouraging sufficiency is the model of **Substituting with renewables and natural processes,** which introduces a fascinating shift towards sustainability. By harnessing solar energy in park buildings or promoting natural pollination, urban forests can become self-sustaining ecosystems. The Gowanus Canal Cleanup project, for instance, showcases how phytoremediation can naturally remediate contaminated soils, turning urban blights into ecological highlights (The City of New York, 2024) .

Maximizing material and energy efficiency is crucial for the sustainability of urban forests. Initiatives like Million Trees NYC, which focuses on planting native species, show how choosing the right plants and materials can significantly reduce maintenance needs and environmental impact (The City of New York, s.d.). similarly, the Forest Laboratory in Cologne, planted in the Cologne Green Belt, shows how a fast growing and short-rotation plantation can offer the recreational and aesthetic benefits of an UF while also producing woody biomass, thus establishing its name as an energy forest (RWTH Aachen University, 2019).

Creating value from waste offers an innovative way to look at urban forestry. Projects that turn organic waste into compost or repurpose fallen urban trees into furniture or biomass highlight the potential of urban forests in supporting a circular economy, like the Sonian Wood Cooperation who are turning local timber from felled trees into locally-produced furniture (Sonian Wood Cooperation, 2024). In Ciudad de Mexico, a former landfill is actually being redeveloped into a large urban park (Cuitláhuac Park), with a large portion of the waste materials being recycled into new materials for the construction, landscaping and horticulture sectors (Metropolis, s.d.).

Lastly, **developing scale-up solutions** is about sharing knowledge and experiences to replicate successful urban forestry projects across different cities. The Clever Cities project exemplifies this by fostering collaboration and innovation in urban greening across Europe, proving that working together can lead to scalable and sustainable urban solutions (The Clevel Cities, s.d.). Such scaled-up solutions can be **repurposed into new organisational and societal initiatives** can be formed. The European Forum on Urban Forestry (EFUF) for example has formed a network of researchers and practitioners on urban forestry, who exchange knowledge and good solutions during a yearly conference and online.

To conclude, each SBM archetype not only offers a pathway to integrating nature-based solutions into urban planning, but also invites us to rethink our relationship with urban environments. By embracing these models, cities can become more resilient, sustainable, and liveable by creating greener, healthier urban spaces for all.

5.3 Innovative business models

Long-term growth is most often trifled by external pressures, be it for business-as-usual activities, industry, commerce, digital or Nature-Based Solutions. Proven time and time again, the best remedy to external pressures is independence through revenue; also proven to be a particularly difficult endeavour when it comes to forests, especially when one doesn't consider the use of trees as timber, biomass or furniture, and especially in urban contexts. It is however crucial for UF-NBS projects to consider this approach first and foremost, with the objective to depend as little as possible on the willingness of policy makers, market participants or civil society to invest in UF-NBS. With this approach at heart, another key anchor can be at least slightly lifted: the constant, recurring need for the public sector to be the main or only source of funding for UF-NBS initiatives.

> *"Despite the fact that many of our ambitious tree planting initiatives are led by city administrations, ultimately the successful creation of urban forests cannot depend on municipalities alone — successful green infrastructures, like most holistic outcomes that policymakers seek to achieve, will require the involvement, investment and care of the many actors that occupy and shape the city; from communities to landowners, and from multiple public sector bodies through to the private sector, whether start-up innovators or large-scale utilities."*
>
> *Medium Dark Matters Lab*

5.3.1 Urban forestry entrepreneurship

Urban forestry entrepreneurship is emerging as a critical and innovative response to the growing challenges and opportunities within urban ecosystems. As cities expand and the urgency to address climate change intensifies, the integration of green spaces and nature-based solutions has become a priority. Urban forestry entrepreneurs are at the forefront of this movement, leveraging the intersection of ecology, technology, and business to develop sustainable urban landscapes that benefit both the environment and urban communities.

According to insights from the Urban Forest Innovation Lab (UFIL), urban forestry entrepreneurship encompasses a wide array of initiatives aimed at enhancing urban green infrastructure through innovative business models (Pino, Florido, O'Driscoll, Doimo, & Konijnendijk, 2022). These entrepreneurs are not just focused on planting trees but are deeply involved in creating holistic solutions that address air and water quality, biodiversity, and social well-being. They utilize cutting-edge technologies such as remote sensing, GIS mapping, and AI-driven analytics to monitor tree health, optimize planting strategies, and assess the ecosystem services provided by urban forests.

The demand for urban forestry entrepreneurs is driven by several key factors. First, the increasing recognition of the role urban forests play in mitigating climate change effects, such as carbon sequestration and cooling urban heat islands, highlights the need for skilled professionals who can

plan, implement, and manage urban greenery effectively. Second, urban populations worldwide are growing, leading to denser cities where the integration of green spaces requires innovative approaches to maximize limited land use. Lastly, there is a growing body of research that underscores the health and social benefits of urban forests, including reduced stress levels, improved mental health, and enhanced community cohesion.

However, urban forestry entrepreneurship faces challenges, including securing funding, navigating urban planning regulations, and ensuring the long-term maintenance of urban green spaces. Entrepreneurs must also work to educate stakeholders on the economic, environmental, and social value of investing in urban forests to secure buy-in and support for their projects.

Urban forestry entrepreneurship represents a dynamic and essential field within the broader context of urban sustainability. By bridging the gap between ecological science and business innovation, urban forestry entrepreneurs play a pivotal role in transforming urban landscapes into healthier, more resilient, and liveable environments. As cities continue to grow and the impacts of climate change become more pronounced, the demand for skilled professionals in this field is set to increase, underscoring the importance of supporting and investing in urban forestry initiatives.

5.3.2 *Revenue as a funding stream*

Typically, UF-NBS projects are designed to achieve environmental rather than economic objectives. The revenues generated by these projects are often seen as collateral benefits rather than primary objectives. In addition, UF-NBS projects are often funded from public and private sources that are not directly related to the revenues generated by the project itself. In some cases, UF-NBS projects can generate income from the sustainable use of natural resources, such as eco-tourism or sustainable production of forest products. However, these revenues are often uncertain and depend on external factors such as economic conditions and consumer preferences. Examples of self-financing mechanisms are presented in the table below, which may be useful to consider, especially during the conceptualization phase of projects.

Similarly, insurance and guarantees are not included in this deliverable as they are not considered as financing tools, but as risk management mechanisms. While they may be important for protecting UF-NBS investments and projects from environmental and climate risks, their use will depend on the specific needs of each project and the requirements of investors. As a result, insurance and guarantees are generally not seen as key elements of UF-NBS financing, but rather as important complements to ensure the long-term viability of projects and support private investment by spreading the risk of projects among funders.

There are already existing financing instruments available to monetise UF-NBS. examples of such solutions are *deforestation-linked bonds*, which are bonds structured to align sustainable investments with efforts to reduce and promote reforestation efforts (Elwin, Robins, Willis, & Cozzolino, 2021) or *blue recovery bonds*, which are designed to support initiatives that promote the restoration and conservation of marine ecosystems (Planet Tracker, 2020).

While some solutions already help set a monetizable value to nature, they do not yet measure how companies impact such values. For the development of more technical solutions such as the Natureverse, which represents a digital parallel to biodiversity finance, where natural assets are monetized and managed within virtual environments, such measurable impact is needed. Table 10 provides more revenue generation models for UF-NBS.

Table 10: Revenue generation models

Revenue	Definition
User fees	User fees can be considered as payments made by users or beneficiaries of ecosystem services provided by UF-NBS projects. For example, users of a marine protected area can pay an entrance fee to access the area and enjoy ecosystem services through fishing, diving, or tourism. These fees can be used to fund the management and conservation of the marine area, as well as to support local communities that depend on marine resources.
	Example: The National Park Hoge Kempen (Belgium) developed a node system for guided bicycle tours. Maps with the location of the nodes and the routes between them are sold to prospective users of the network, and the received income is invested in nature management in the area.
Sale of commodities	The sale of UF-NBS products can be seen as an innovative form of financing. Products may include eco-friendly building materials, food products from sustainable agriculture, products from forest biomass, and herbal medicinal products (bioeconomy).
	Example: The sale of non-timber forest products, such as wild fruits, nuts and medicinal plants, can be a source of income for local communities while preserving forest ecosystems. The Sonian Wood Cooperation, for example, buys locally harvested wood from the Sonian Forest (Brussels, Belgium) and processes it locally into furniture, wood floorings etc.
Carbon credits & Biodiversity credits	Carbon offsets are measures to reduce the impact of human activities on the environment by offsetting greenhouse gas emissions and protecting biodiversity through UF-NBS initiatives. Carbon offsets are market-traded credits that represent a verified and certified reduction in greenhouse gas emissions. Similarly, a biodiversity credit could be generated based on the measurable improvement in biodiversity, restoring an ecosystem, removing invasive species and replanting vegetation.
	The integration of carbon and biodiversity credits into UF-NBS business models represents a forward-thinking approach to environmental restoration that balances carbon sequestration with broader ecological benefits.
	Example: The Treecological programme (BOS+, Belgium) provides individual travellers and organisations the opportunity to compensate their emissions from travelling, transport, living or daily operations through supporting forest protection, reforestation, afforestation and agroforestry projects in Belgium and the tropics.
Contributions or expenses of beneficiaries	Contributions or expenses from beneficiaries may also be used to finance UF-NBS projects. Beneficiaries can be companies, government organizations or individuals who wish to financially support UF-NBS projects to contribute to the protection and restoration of natural ecosystems.
	This directly links to Payments for Ecosystem Services (PES), these are payments by beneficiaries of ecosystem services rewarding landowners or communities for implementing, managing and preserving the ecosystems that provide ecosystem services.
	Example: The Forestami campaign invites individuals and companies to donate funding for making the Metropolitan Area of Milano (Italy) greener.

Development Contributions/ Expenses	Development contributions/charges are financial transfers from real estate developers to local authorities to cover the costs of utilities and infrastructure needed for the development of UF-NBS projects. These payments are often required under local laws and regulations and can be used to finance road construction, the provision of water and electricity, the installation of sanitation services, and the provisioning of green spaces. **Example**: The Bankside Urban Forest project in London involves each company within the Business Improvement District contributing to a fund, which is then utilized to enhance public spaces in the district. The Board of the Bankside Improvement District has opted to allocate a portion of this levy towards the creation and maintenance of an urban forest. **Example:** the city of Ghent (Belgium) obliges urban developers to include new green space in new urban developments and redevelopments. Part of the green space should be open to the public and will transferred to the city at no cost when the development is finalised.
Sustainable tourism	Sustainable tourism is a form of tourism that focuses on enhancing and preserving natural ecosystems while promoting the economic and social development of local communities. It is a way to promote nature conservation while providing direct economic benefits to local people. **Example**: In Belgium, Bosland, a 5000-hectare forest and heath complex located in the northern region, is branded as a sustainable tourism destination. The authorities overseeing the National Park are committed to fostering synergies between sustainable tourism and ecological preservation efforts. As part of this initiative, hosts within Bosland undergo training to educate visitors about the natural landscape and its significance. Additionally, local products such as beer, tea, gin, chocolates, and cookies have the opportunity to utilize the Bosland brand, thereby enhancing visibility for both the product and the National Park.

5.3.3 Funding upfront costs and maintenance

5.3.3.1 Forest Resilience Bonds

A bond is a financial instrument where an investor lends money to a borrower, typically a corporation or government entity, for a specified period of time at a fixed or variable interest rate. Bonds are commonly used by companies and governments to raise capital for various projects. Similarly to regular bonds, forest resilience bonds help gather resources for specifically UF-NBS projects. These bonds bring together money and incentives from different groups like forestry management bodies, utility companies, and beverage companies to support forest development (Blue Forest, 2024). This collaborative financing model distributes risks by spreading them across multiple stakeholders. For example, if one stakeholder experiences a financial setback, the burden is shared among others, reducing the overall risk exposure. However, these bonds may encounter difficulties, especially when a single beneficiary is responsible for delivering a large-scale green infrastructure project. Despite this, forest resilience bonds offer a stronger approach by involving multiple stakeholders in funding and managing forest projects, making them more resilient and sustainable (Christophers, 2018). The Conservation Finance Network expands beyond the forest resilience Bonds, and provides a valuable

including various effective funding and financing strategies available for realizing the potential of nature-based solutions.

5.3.4 Forming business models

We will now be shortlisting some of the most promising and innovative business models. We provide a list of 10 business models based on the main drivers and barriers identified to scaling and investing UF-NBS.

Table 11 is an analysis of the various themes, including challenges and solutions to UF-NBS studied in chapter 4 using various case studies and literacy on UF-NBS. The level of insights shows how well each theme has been studied and applied in real-life cases, and which theme can provide new business model insights.

Table 11: Summary of the level of insight for each critical aspect of SBMI for UF-NBS

Theme	Level of insights	Summary of insights
Scaling investment: challenges due to market barriers	Low	Addressed by all stakeholders, no clear solution provided yet.
Technology integration and digital transformation	Low	Integration of advanced technologies such as IoT, AI, GIS and Public Participation GIS (PPGIS) in UF-NBS for monitoring, maintenance, and data analysis.
Cross-sector integration and synergy	Low	While public-private partnerships are mentioned, broader cross-sector integration involving diverse fields like technology, health, education, and tourism to create multifaceted UF-NBS business models needs exploration.
Adaptation to rapid urbanization and demographic shifts	Low	Addressing how UF-NBS can adapt to the challenges posed by rapid urbanization, demographic changes, and the increasing need for sustainable urban spaces.
Public awareness and perception	Medium	While beneficiary collaboration is agreed as a need, strategies for enhancing public awareness, perception, and acceptance of UF-NBS are not always effective.
Value proposition: difficulty in evaluating non-monetary benefits of UF-NBS	Medium	Accessible qualitative indicators: identify and evaluate key non-monetary indicators of nature-based solutions. A main barrier to the implementation of UF-NBS is the difficulty in understanding the full value proposition UF-NBS can bring and evaluating the non-monetary benefits connected to the UF solutions. Strategies for effectively quantifying and communicating the co-benefits (economic, social, environmental) of UF-NBS to stakeholders and investors.
End beneficiary information: lack of information on	Medium	Beneficiary collaboration: engage citizens in UF-NBS projects to adapt urban space and maximize outcomes. To ensure the innovative solutions maximize the outcomes to

Theme	Level of insights	Summary of insights
citizens' preferences for UF-NBS		the beneficiaries, it is important to understand citizens and obtain the necessary information on their preferences.
Limited public labour: high labour requirements for large-scale UF-NBS projects	Medium	Volunteering efforts: engage the community to volunteer in various activities related to UF-NBS (planting, maintenance, monitoring).
Limited public procurement: governance-related barriers in public procurement	Medium	Cross-departmental collaboration: encourage collaboration for knowledge exchange and design, implementation, and maintenance of UF-NBS. Governance-related barriers and the difficulty for public authorities to use public procurement initiatives.
Cost of maintenance: high maintenance costs of UF-NBS projects	Medium	Partnerships & engagement: use partnerships and citizen engagement to carry out maintenance tasks. While maintenance is often not the top priority in UF-NBS projects, the budget for maintenance tends to be high.
Land ownership: challenges posed by land ownership in implementing UF-NBS	High	Regulatory intervention & policies: facilitate preservation of natural sites and promote integration of UF-NBS in urbanized areas. Land ownership can pose significant challenges to UF-NBS implementation as it limits the availability of land.
Long-term maintenance and sustainability	Medium	Beyond initial implementation, strategies for the long-term maintenance, sustainability, and adaptability of UF-NBS in the face of changing environmental and urban conditions.
Regulatory harmonization and policy adaptation	Medium	Developing unified regulatory frameworks and policies that encourage and support UF-NBS across different regions and jurisdictions.
Climate change adaptation strategies	Medium	Integrating UF-NBS within broader climate change adaptation strategies, considering their role in mitigating urban heat islands, improving air quality, and enhancing biodiversity.
Limited public resources: inadequate resources for designing, implementing, or maintaining UF-NBS	High	Public-Private Partnerships: Combine and leverage funding mechanisms, resources, innovation, and skills. Public entities often do not have the resources, knowledge, or innovation in-house to actually design, implement, or even maintain the urban forest solutions.
Insufficient funding: general lack of investments and funding for UF-NBS	High	Crowdfunding and blended finance: share financial contributions with citizens and leverage public-private resources.

Theme	Level of insights	Summary of insights
		Traditional funding sources from the public sector may not be sufficient to support large-scale UF-NBS projects.
Lack of private funding: difficulty in securing private funding for UF-NBS	**High**	Financial incentives and non-monetary valuation methods: encourage private sector investments in UF-NBS through tax incentives and evaluation systems. Currently, the primary source of funding for NBS and UF-NBS projects remains the public sector.

Drawing upon the insights garnered, a number of potential strategies were defined. These strategies are centred on scaling investments, integrating cutting-edge technologies, fostering cross-sector collaborations, and adapting to the evolving challenges of urban environments. The exploration reveals a spectrum of Sustainable Business Model Innovations (SBMIs) that could reshape urban ecosystems, making them more resilient and sustainable. To be as useful and straightforward as possible, we have preferred to focus on the least-studied business models and list the ten most interesting ones.

1. The analysis suggests a dynamic approach to urban forest management, where the potential **integration of AI and Internet of Things** (IoT) sensors could revolutionize the monitoring of tree health, water needs, and pest outbreaks. This model would allow for the optimization of resources and maintenance efforts based on real-time data insights. Funding for such initiatives could come from a mix of public-private partnerships, grants, and user fees, leveraging data analysis as a service to attract diverse funding sources.

2. A collaborative effort to expand urban forests through a **crowdfunding platform** has been identified as a viable strategy. This platform would connect communities, corporations, and NGOs, enabling them to contribute to and monitor the progress of urban forest projects. Such a model would not only promote citizen engagement but also foster a sense of social ownership, with funding potentially sourced from crowdfunding, corporate sponsorships, and impact investments

3. The creation of a **smart urban forest carbon marketplace** utilizing blockchain technology emerges as a novel approach. This marketplace would issue tradable carbon sequestration credits, incentivizing businesses and individuals to offset their carbon footprint and thus finance urban forest expansion. The sale of carbon credits, supported by potential government subsidies, represents a promising funding avenue.

4. In addressing the need for regenerative urban practices, **partnering with microfinance institutions** could provide low-interest loans and training to low-income communities. These resources would support the establishment of urban gardens or green spaces, enhancing food security and environmental stewardship. The model could be funded through grants, impact investors, and potential government incentives.

5. The idea of **gamifying urban forest education** through a mobile application suggests an engaging way to learn about urban ecology. By incorporating augmented reality, users could visualize the environmental impact of their actions, with funding sourced from educational grants and corporate sponsorships.

6. Adopting a tree through **NFT ownership** presents a unique method for virtual engagement with urban forestry efforts. This model would grant individuals or businesses voting rights on specific management decisions and access to exclusive events, funded initially through NFT sales and possibly supported by a secondary market for ownership transfers.

7. Promoting biodiverse **urban forest tourism** in partnership with local agencies and businesses could highlight urban forests as destinations for eco-friendly tourism, generating revenue for forest maintenance and community initiatives through tourism revenue sharing and partnership fees.

8. The issuance of **urban forest resilience bonds** is identified as a strategy for securing investment in the climate adaptation and mitigation benefits of urban forests, attracting private and institutional investors seeking sustainable opportunities.

9. Establishing a **network of urban farms and food forests** would encourage healthy food choices and community engagement. This network could be supported by subscription-based memberships, farm-to-table restaurant partnerships, and potential government grants.

10. Lastly, **engaging citizens** in urban forest monitoring through a gamified mobile app and online platforms offers a method for widespread data collection and community involvement in urban forest health, potentially funded by public grants and partnerships with research institutions or environmental NGOs.

The exploration of these potential SBMIs underscores the importance of innovative approaches in creating sustainable urban ecosystems. By carefully considering the "could, would, should" of each proposed strategy, stakeholders can navigate the complexities of urban development, ensuring that investments, technology, and collaboration converge to foster resilient and thriving urban spaces.

5.3.5   Hybrid models

In the quest to create more sustainable and resilient urban ecosystems, the realization that "one size doesn't fit all" is paramount. This truth has led to the exploration of hybrid models that marry the innovative with the traditional, the global with the local, and the public with the private. Among these, the use of cryptocurrency as a tool to equip blended finance for Urban Forests as Nature-Based Solutions (UF-NBS) stands out as a compelling example of the potential that hybrid models hold.

Hybrid models, especially those tapping into the Fourth Sector, represent an innovative approach to tackling urban environmental issues. The Fourth Sector refers to organizations that blend the mission-driven ethos of the public sector, the profit-driven mindset of the private sector, and the community-focused values of the non-profit sector. These models offer a new frontier for addressing urban environmental challenges due to their inherent flexibility, adaptability, and innovation. They embody the concept of blended finance, which involves combining various sources of financial capital to support UF-NBS projects. The SDGs Impact Accelerator is a hybrid model leveraging the Fourth Sector, as it combines the mission-driven focus of the public sector (UNDP) with the market-driven approach of the private sector partners, including corporations, investors, and philanthropic organizations, aiming to address global challenges by blending the resources and expertise of different sectors (SDG Impact Accelerator, 2022).

5.3.5.1   Thought experiment: Cryptocurrency, a catalyst for blended finance?

Cryptocurrency offers several mechanisms to act as an incentive tool for blended finance, making it a quintessential example of a hybrid model in action:

- Decentralized funding platforms: by enabling the creation of platforms where contributions to UF-NBS projects can be made directly, without the need for intermediaries, cryptocurrencies streamline the financing process. These direct payments reduce the need for intermediaries such as banks or payment processors, making the payments more efficient and more transparent.
- Smart contracts for accountability: the use of programmable agreements, executed on blockchain networks, automates the allocation of funds based on predefined conditions. This automation ensures that funds are used transparently and accountably, increasing trust among stakeholders.
- Tokenization of assets: the concept of tokenizing UF-NBS assets, such as carbon credits or ecosystem service certificates, introduces liquidity into markets that were previously illiquid. These tokens can be traded on cryptocurrency exchanges, inviting broader participation in the financing of UF-NBS projects.
- Enabling microtransactions: the ability of cryptocurrencies to facilitate small, frequent contributions democratizes access to funding. This feature allows individuals and private entities to support environmental initiatives at a grassroots level, fostering a collective effort towards urban sustainability.
- Global accessibility: the borderless nature of cryptocurrencies ensures that anyone with internet access can contribute to UF-NBS projects, regardless of geographic location. This global reach has the potential to attract a diverse pool of investors and donors, enriching the ecosystem of support for urban environmental initiatives.

While the integration of cryptocurrency into UF-NBS financing presents numerous opportunities, it is not without its challenges. Regulatory uncertainties, the volatility of cryptocurrency markets, and the environmental impact of mining processes are significant hurdles to overcome. Digital awareness may be limited, both with the potential funders, as with the potential beneficiaries, thus potentially leading to a social divide between users and non-users. To harness the full potential of cryptocurrencies in supporting NBS, it is crucial to implement robust regulatory frameworks and adopt sustainable practices that mitigate the environmental impact of these digital currencies.

The exploration of hybrid models, exemplified by the use of cryptocurrency in blended finance for UF-NBS, underscores the innovative pathways available for funding urban sustainability initiatives. By blending the strengths of various sectors and leveraging the unique capabilities of digital currencies, we can unlock new possibilities for nature-based solutions in urban environments. However, the success of these models hinges on our ability to address the inherent challenges, ensuring that our approach to urban sustainability is both effective and environmentally and socially responsible.

5.3.5.2 *Thought Experiment: Urban Green Spaces as Social Impact Hubs*

In the evolving landscape of urban development, the integration of green spaces within city planning has emerged as a critical component for enhancing urban resilience, biodiversity, and community well-being. An experiment proposes a hybrid business model that reimagines urban green spaces not just as areas for recreation and conservation, but as multifunctional "Social Impact Hubs". These hubs would leverage a combination of social entrepreneurship, community engagement, and environmental science to address urban challenges holistically.

The Social Impact Hub model positions urban green spaces as centres for social innovation, environmental education, and community engagement. By hosting a variety of activities ranging from

workshops on sustainable living and biodiversity conservation to social enterprise startups focusing on green technologies, these hubs aim to foster a culture of sustainability and social responsibility within urban communities.

- Social Entrepreneurship Incubators: partnering with local governments and private sectors to provide resources, mentorship, and funding to startups focused on environmental sustainability and community well-being. An example of this in action is the Brooklyn Navy Yard, which hosts an array of green manufacturers and tech startups, providing a blueprint for how urban spaces can support economic development and environmental sustainability simultaneously.

- Educational Programmes and Workshops: offering programmes that educate the public on urban biodiversity, sustainable practices, and climate resilience. The Gelsenkirchen case study emphasizes environmental education for sustainable development and aims to transform into a "learning city" that promotes education and participation in UF-NBS initiatives. The Grünlabor Hugo serves as a green laboratory and educational hub for the city and surrounding areas, facilitating learning and sustainable development efforts (CLEARING HOUSE, 2024e).

- Community Engagement Initiatives: facilitating community-driven projects such as community gardens, volunteer conservation efforts, and local clean-up campaigns. The Gelsenkirchen case study encouraged public involvement to cultivate a feeling of ownership and accountability. This, in turn, garnered support from visitors for ecosystem preservation.

- The financial model for Social Impact Hubs could draw from a blend of public funding, private investments, and community crowdfunding. Additionally, revenue-generating activities within the hubs, such as cafe spaces, event rentals, and membership fees for co-working spaces, could contribute to their financial sustainability. Grants and philanthropic contributions targeted towards environmental and social projects would also play a crucial role in supporting the hubs' operations and programming.

While the Social Impact Hub model offers a promising avenue for urban sustainability and social entrepreneurship, it faces challenges such as securing sustainable funding, navigating urban planning regulations, and ensuring inclusivity and accessibility for all community members. Moreover, measuring the social and environmental impact of these hubs poses a methodological challenge, requiring the development of robust frameworks for impact assessment.

Urban Green Spaces as Social Impact Hubs represent a visionary approach to rethinking the role of green spaces in cities. By integrating social entrepreneurship, environmental education, and community engagement, these hubs have the potential to create resilient, sustainable urban communities. Real-world examples such as the Brooklyn Navy Yard, the New York High Line, and Detroit's urban farms provide valuable insights into the feasibility and impact of such models. However, realizing this vision requires collaborative efforts from government, private sector, and community stakeholders, alongside innovative funding mechanisms and regulatory support. As cities continue to evolve, Social Impact Hubs could play a pivotal role in shaping the future of urban sustainability.

5.4   Recommendations: Challenged!

Based on the created recommendations, a survey (provided in Appendix 8.2) , was created and send to the CLEARING HOUSE city representatives, as well as its User Advisory Group (as its objective is to advise and support the project in order to ensure that the project results meet the various user

community needs and encompass the current context and challenges for UF-NBS development, while representing the voices of various professional communities and giving recommendations on project deliverables). The survey was responded by 9 people: Gregory Guillo (AxessImpact), Łukasz Mielczarek (UMKrakowa), Pierre Rousseau (3R EcoConsulting), Etienne Aulotte (Bruxelles Environment), Tomasz Bergier (Sendzimir Foundation), Eugènia Vidal-Casanovas (AMB), Sylvain Raifaud (Paris Region), Dagmar Haase (HUB), Georg Nesselfauf (Gelsenkirchen) and Maria Chiara Pastore (Politecnico di Milano). The aim of the survey focused on gathering feedback and evaluation regarding the proposed business model solutions. The survey specifically focused on assessing the relevance of each recommendation, the challenge in implanting them and whether the innovative solutions had already been considered within the respondent's UF-NBS projects.

The survey reveals that the most pertinent recommendations for UF-NBS involve *fostering partnerships and community engagement* along with *promoting knowledge sharing and capacity building*. While the significance of partnerships and community engagement is widely acknowledged for UF-NBS initiatives, this recommendation is also recognized as the most challenging to put into practice, due to the long time it can takes to set collaborative agreements and processes in place and the lack of available data on community needs, including citizens perspectives. This highlights the need for a more standardised tool and platform to facilitate cross-sector collaboration initiatives and enhanced communication channels with local stakeholders. Moreover, Etienne Aulotte, from Brussels Environment, specifically emphasizes the issue of ownership, advocating for a shift away from focusing on the limited available public spaces and instead urging the collaboration with local stakeholders and private owners. While Gregory Guillot from AxessImpact identifies the engagement with private companies as one of the most rewarding solutions to increase UF-NBS impact, Thomasz Bergier, from the Sendzimir Foundation in Krakow, also recognises the fact that private companies tend to provide funds for promotional benefits rather than financial gain.

The survey allowed respondents to provide their own perspective on how to encourage partnership and community engagement. According to Sylvain Raifaud from the Paris region, UF-NBS business models should be designed to serve the citizens and the organisations that are willing to take action. To acknowledge the reputational gains private companies, have for investing in UF-NBS, Lukasz Mielczarek from UMKrakowa, addresses the need to focus on broader city or regional level UF-NBS initiatives, compared to smaller local solutions, as these provide more visible opportunities to businesses. According to Etienne Aulotte and Gregory Guillot, UF-NBS business models should be easily replicable, ultimately lowering implementation costs, increasing feasibility, and leading to readily scalable solutions that are more attractive to external stakeholders. Etienne Aulotte further recommends ensuring the economic and technical aspects of UF-NBS initiatives are feasible to motivate both private and public organisations.

The survey also suggests that the limited integration of UF-NBS recommendations is caused by the shortage of innovative funding resources. Approaches such as biodiversity credits, blended finance opportunities, and payment for ecosystems have not been widely considered. This entails a deeper lack of knowledge and understanding on funding possibilities, which public-private partnerships and projects such as CLEARING HOUSE along with its developed tools and resources can enhance attention to. While a few cities have successfully integrated volunteer efforts and small private contributions into their financing models, the predominant source of funding still originates from EU, national, regional and local resources. According to Pierre Rousseau from Turbilhao Nomad, the main challenge

to increase the diversity of funding comes from the lack of knowledge in terms of return on investment and maintenance costs to encourage private stakeholders and funders to get involved.

Despite limited familiarity with financing techniques beyond public funding, there is still a growing trend in UF-NBS-specific initiatives. These include the establishment of tiny forests, the use of biomonitoring trees, and the application of green technology, many of which have either been considered or already been put into practice according to the respondents.

5.5   Building an investment case

NBS are being integrated into several international policies, such as the European Biodiversity Strategy 2030, the European Strategy on Adaptation to Climate Change, and the United Nations Decade on Ecosystem Restoration (2021-2030). The European Commission is preparing a new regulation on nature restoration, expected to be adopted in 2024, as one of the key measures of the EU's 2030 biodiversity strategy. This regulation is expected to set mandatory targets for nature restoration in Member States, which will lead to a significant increase in funding.

To be well positioned for funding, it is necessary to accept the existing challenges: the expansion of UF-NBS projects is limited due to the lack of localised quantitative data on their effectiveness and costs, limited land availability, fragmented ecosystem services, limited scalability, and high upfront expenses. These problems make it difficult to set up profitable business models and obtain funding – it is therefore essential to combine public and private forces in their implementation. Significant communication efforts are needed to identify and capture information about the UF-NBS market and demonstrate its impact. It is also important to debunk assumptions made on UF-NBS concerning their costs. For example, it is crucial to emphasize the long-term cost advantages of investing in green spaces over grey infrastructure for flood protection for example. Several other examples of the multiple benefits provided by urban forests can be provided. Maintaining parks and green zones, like the one in Brussels that has stood for over two decades, is often significantly cheaper than frequent repairs and replacements of concrete and asphalt (Etienne Aulotte). By highlighting the lower (compared) maintenance costs of UF-NBS and the intrinsic durability of green infrastructure, cities can make a compelling case for investing in urban forests as a sustainable solution for mitigating global warming and biodiversity loss while also promoting economic savings in the long run.

The Northern Forest in England serves as a prime example of the manifold advantages trees offer. The Northern Forest – spanning from the West Coast to the East Coast of England and including cities as Liverpool, Leeds and Manchester – aims to plant 50 million trees by 2043 to make the region more resilient, more beautiful and more prosperous. Beyond their environmental contributions, such as enhancing soil quality and providing habitat for biodiversity and wildlife, trees also yield economic benefits by enriching infrastructure, serving as a renewable energy source, promoting timber production, and generating employment opportunities. In England the forestry sector supports around 80,000 jobs and is worth £2bn to the UK economy every year. The northern forest highlights the need for trees, and how trees can strengthen the economy through the forestry sector, thereby emphasizing the importance of allocating funding accordingly (The Northern Forest, 2018).

The steps to follow for building an investment case are: Develop a case in a rigorous and well-researched manner, providing information on objectives, expected results, costs and benefits. The investment case must also describe the environmental and social impacts (positive and negative) of

the project, as well as the measures taken to mitigate them. When preparing call for funding for an UF-NBS project, cities and local governments can take the following steps:

- **Define clear objectives for the UF-NBS project** in terms of expected results, timeline and budget. It should be ensured that they are aligned with the environmental and social priorities of the region.

- **Identify key partners** such as local organizations, businesses, NGOs, universities, and research centres. They can bring financial resources, technical skills, and local expertise. To fund the UF-NBS project, cities and local governments can partner with local and regional organisations, including public-private partnerships, partnerships with non-profit organisations, and partnerships with universities and research centres.

- **Design the UF-NBS project** by identifying the concrete actions to be implemented to achieve the defined objectives. Include an analysis of costs and benefits, as well as measures to minimize environmental and social impacts.

- **Plan funding by identifying available public and private funding sources and understanding the funding criteria**. Start by identifying the sources of funding available for UF-NBS projects. This includes public funds such as government grants, European Union funding schemes and UN funding schemes, as well as private funds such as investors, venture capital funds and public-private partnerships. Funding sources can be prioritized based on their relevance to the project. Understand the funding criteria and check if these match your idea. The criteria may include specific objectives, sectoral priorities, geographical areas of intervention and social, environmental and financial performance criteria. Develop a rigorous funding proposal, including an assessment of the financial viability of the project.

- **Selection of funding programmes**: Research and select appropriate funding programmes for the UF-NBS project, based on their alignment with local and regional priorities, as well as their ability to fund the UF-NBS project. Cities and local authorities may also consider combining several funding programmes to meet their financing needs.

- **Use success stories from similar UF-NBS projects** to strengthen your proposal. Use case studies, evaluation reports, and examples of best practices.

- **Work collaboratively with partners and funders** to develop a robust funding proposal. Partners may include funding partners, local and regional organisations, universities and research centres.

- **Highlight the UF-NBS project**: To attract funding sources, present the project clearly and concisely, highlighting the environmental, economic and social benefits. Local events and social media can be used to raise awareness among local communities and draw attention to UF-NBS projects.

- **Mobilizing private finance**: Cities and local governments can mobilize private funds to finance their UF-NBS project. Private companies can also be asked to collaborate on UF-NBS projects.

- **Integration into long-term strategic planning**: To promote and ensure the sustainability of their UF-NBS projects, cities and local authorities can integrate them into their long-term strategic planning. They can also be promoted to stakeholders such as investors, businesses, NGOs and civil society. Marketing and communication strategies for UF-NBS projects can be developed in collaboration with funding partners. (UN Environment Programme, 2019)

"But you do this to really look at and develop short supply chains. So, if you have an activity that is reforestation or urban forestry that is purely aesthetic without any kind of profitability, it's very complex [to attract private funding sources]."

Profitability and Aesthetics - Urban Forestry Sustainability
Pierre Rousseau (3R EcoConsulting) – interviewed December 2023

5.6 Going further: Toolbox

Table 12 presents a toolbox set up for readers, city representatives and UF-NBS project developers to go further and learn more from specific sources. It contains a wealth of information including links to tools for scenario building, evaluation, benchmarking, mapping, financial planning and technical tools, or guides for financing and certification. Each reader can pick and choose what is most useful for their needs based on the "Use this resource for" column.

Table 12: Toolbox

Resource	Link	Category	Description	Use this resource to…
Green Unified Scenarios (GUS)	https://gus.earth/	All-in-one NBS Tool	The Green Unified Scenarios Is an all-in-one solution for nature-based climate projects	Utilize effective tools for urban planning, environmental impact assessment and green infrastructure implementation. Monitor, assess and regulate nature-based climate projects
NBS Catalogue by URBAN GreenUp	https://www.urbangreenup.eu/news--events/news/the-urban-greenup-catalogue-of-nature-based-solutions-is-now-public_1.kl	Catalogue	The document provides a detailed description of the green urban interventions implemented by the project	Provide cities worldwide with robust indicators on how to embrace urban challenges using nature
Climate, Community & Biodiversity Standards	https://www.climate-standards.org/	Certification Standards	The CCBS standards provide a framework for assessing the environmental and social impacts of NBS projects and for certifying projects that meet these standards.	Evaluate and certify their NBS projects to ensure their credibility with funds and investors.

Green Infrastructure Investment Coalition	https://www.giicoalition.org/	Collaboration Network	The coalition for investment in GI is a collaboration network between investors, governments, and businesses to promote investment in NBS projects.	Find investment partners for their NBS projects.
MyDynamicForest	https://www.mydynamicforest.de/app/	Evaluation Tool	The tool helps gain suggestions on UF-NBS design, local conditions and settings.	Gain knowledge on the perceptions of/about UF-NBS by citizens.
i-Tree	https://www.itreetools.org/	Evaluation Tool	i-Tree is an assessment tool for the services provided by urban trees, such as carbon sequestration, water retention, and reduction of air pollution.	Evaluate the benefits of urban trees and design NBS projects based on these benefits.
Natural Capital Protocol	https://naturalcapitalprotocol.org/	Evaluation Tool	Natural Capital Protocol is a framework for assessing the environmental and social impacts of economic activities on nature and communities.	Evaluate the impacts of their economic activities on nature and design NBS projects to mitigate these impacts.
Green Infrastructure Performance Assessment	https://www.gipassessment.com/	Evaluation Tool	Green Infrastructure Performance Assessment is a tool for evaluating the performance of NBS projects, using indicators such as water retention, pollution reduction, and air quality improvement.	Evaluate the performance of their NBS projects and make improvements accordingly.
Restoration Opportunities Assessment Methodology	https://www.roam.earth/	Evaluation Tool	ROAM is a methodology for assessing ecosystem restoration opportunities, using maps and data on land cover, land degradation, and biodiversity.	Evaluate ecosystem restoration opportunities in their city and design NBS projects to restore these ecosystems.

Conservation Finance Network Toolkit	https://www.conservationfinancenetwork.org/collection/conservation-finance-toolkit	Finance Toolkit	The Conservation Finance Toolkit is a resource explaining tools and techniques available to conservation finance practitioners	Increase the financial resources utilized and expand effective funding and financing strategies
Natural Capital Planning Tool	https://www.naturalcapitalproject.org/natcap-planning-tool.html	Financial Planning Tool	This tool allows communities to consider the long-term economic impacts of NBS projects and plan their financing accordingly.	Plan long-term financing and assess the economic costs and benefits of their NBS projects.
Climate Adaptation Finance Taxonomy	https://www.adaptationfinance.net/taxonomy	Financial Planning Tool	This taxonomy provides a list of NBS project categories for climate adaptation, along with information on the costs and economic benefits of each category.	Plan the financing of NBS projects for climate adaptation and assess the costs and economic benefits of their projects.
Green Infrastructure Valuation Toolkit	https://www.epa.gov/green-infrastructure/green-infrastructure-valuation-toolkit	Financial Planning Tool	This tool enables communities to plan the financing of NBS projects for green infrastructure, evaluating the costs and economic benefits of different project scenarios.	Plan the financing of NBS projects for green infrastructure and assess the costs and economic benefits of different project scenarios.
Biodiversity Finance Initiative	https://www.biodivfinance.org/	Financing Guide	The tool provides information on biodiversity credits and payments for ecosystem services, as well as	Understand how financial mechanisms (biodiversity credits and payments for ecosystem services) work and

			concrete examples of projects funded by these mechanisms.	how they can be used to finance UF-NBS projects in their city.
EU Guide to Financing Nature-based Solutions	https://ec.europa.eu/environment/nature/biodiversity/successstories/pdf/2020NBSFinancingGuide_EN.pdf	Financing Guide	This guide provides an overview of the funding sources available for NBS projects, including EU funds, public and private funding mechanisms, as well as international funding programmes.	Understand the different sources of funding available for NBS projects in their city and to develop effective funding strategies.
Nature Value Explorer	https://www.natuurwaardeverkenner.be/	Impact Assessment Tools	Nature Value Explorer provides a qualitative and quantitative calculation on how ecosystem services are influenced and what socio-economic value impact projects bring	Assess the impact of projects and impact of ecosystem on human welfare
Evaluating the impact of nature-based solutions	https://op.europa.eu/en/publication-detail/-/publication/d7d496b5-ad4e-11eb-9767-01aa75ed71a1	A handbook for practitioners	The Handbook aims to provide decision-makers with a comprehensive NBS impact assessment framework, and a robust set of indicators and methodologies to assess impacts of nature-based solutions across various societal challenge areas.	Measure NBS benefits and effectiveness
IUCN Guide to Nature-Based Solutions for Urban Areas	https://portals.iucn.org/library/node/49381	Implementation Guide	This guide provides specific recommendations for cities and local authorities that wish to implement NBS projects.	Understand how to identify NBS projects, mobilize funding, and monitor and evaluate NBS projects in their city.

Natural Infrastructure for Business Platform	https://naturalinfrastructureforbusiness.org/	Information Tool	The Natural Infrastructure for Business platform provides information on the benefits of NBS projects.	Find information on the benefits of NBS projects. This resource can help communities understand how NBS projects can address environmental and social issues while providing economic benefits for businesses and local communities.
Urban Forest Map	https://www.urbanforestmap.org/	Mapping Tool	Urban Forest Map is an interactive map of urban trees in participating cities, providing information on species, size, age, and the benefits of trees.	Map urban trees in their city and design NBS projects based on these trees.
Urban Nature Atlas	https://una.city/	Atlas of UF-NBS examples	The Urban Nature Atlas is an interactive map of green spaces and natural habitats, providing information on biodiversity and health benefits.	Find examples of UF-NBS, green spaces and natural habitats to possibly design new UF-NBS projects based on these examples.
Methodological guide for identification and mapping of NBS	https://growgreenproject.eu/wp-content/uploads/2018/05/NBS-Climate-Adaptation-Basque-Country.pdf	Methodological Guide	Methodological guide for their identification and mapping	Help local authorities identify their potential for NBS
Data base of the Banque Mondiale on Payments for Ecosystem Services	https://www.worldbank.org/en/topic/environment/brief/global	Monitoring Tool	This database provides information on payments for ecosystem services projects worldwide.	Track trends in NBS project financing worldwide and draw inspiration from successful projects to design their own NBS projects.

	-database-on-payment-for-ecosystem-services			
GLOBE Observer	https://observer.globe.gov/	Monitoring Tool	GLOBE Observer is a mobile application that allows citizens to monitor biodiversity, climate, and the environment using their smartphones.	Involve citizens in environmental monitoring and collect data for NBS project planning.
Green City Watch	https://www.greencitywatch.nl/	Monitoring Tool	Green City Watch uses satellite images to monitor vegetation cover, air quality, and temperature in cities.	Monitor the environmental impacts of their activities and design NBS projects to mitigate these impacts.
Earth Observation for Ecosystem-based Adaptation	https://www.eoba.info/	Monitoring Tool	EO4EBA is a remote sensing monitoring tool for evaluating the effectiveness of NBS projects for climate change adaptation.	Adapt to climate change and make improvements accordingly.
Urban Green Infrastructure Planning Guide by Green Surge	https://www.researchgate.net/publication/319967102_Urban_Green_Infrastructure_Planning_A_Guide_for_Practitioners	Planning Guide	Describes case studies of existing NBS projects with a planning guide for replication	Replicate NBS projects
Green Infrastructure Wizard	https://www.epa.gov/green-infrastructure/green-	Planning Tool	The Green Infrastructure Wizard is a planning tool that helps decision-makers design NBS projects by providing information on the benefits and costs of different NBS options.	Design NBS projects that maximize benefits and minimize costs.

	infrastructure-wizard			
PLACARD Toolbox	https://www.placard-network.eu/toolbox/	Planning Tool	The PLACARD toolkit provides tools and examples for climate change adaptation planning and risk management in cities.	Plan NBS projects that consider climate and environmental risks.
ThinkNature Platform	https://climate-adapt.eea.europa.eu/en/knowledge/adaptation-information/research-projects/ThinkNature	Platform	Collaborative platform	Need support on the understanding and the promotion of nature-based solutions in local, regional, EU and international level
OPPLA	https://oppla.eu/case-study-finder	Platform	OPPLA is a platform that allows you to find NBS projects from around the world, studies, guidelines and reference reports for NBS.	Find concrete examples of NBS projects in different contexts and draw inspiration from these projects to design their own NBS projects.
Connecting Nature	https://connectingnature.eu/	Project Platform	Connecting Nature is a platform that brings together a variety of NBS projects.	Find concrete examples of NBS projects in different contexts and draw inspiration from these projects to design their own NBS projects.
NetworkNature	https://networknature.eu/	Research and Innovation Platform	The NetworkNature platform gathers all research and innovations on NBS funded by the EU.	Find examples of NBS projects implemented in other cities and connect with experts and organizations to get advice and funding for their projects.
Spatial Impact Assessment and Classification Tool	https://zenodo.org/records/10255287	Scenario Tool	The SIAC tool is a GIS-based tool for the assessment and classification of UF-NBS.	Assess the impact of UF-NBS.

Plateforme de l'Initiative de Solutions fondées sur la Nature (Nature-based Solutions Initiative, NBSI)	https://www.naturebasedsolutionsinitiative.org/	Technical Tool	This platform provides detailed information on NBS projects, as well as approaches and tools available for planning, designing, implementing, and evaluating them.	Find technical tools to support the identification and selection of NBS projects in their city.
We Value Nature	https://www.wevaluenature.eu/	Training Resource	We Value Nature provides training resources to businesses on adopting nature-based and natural capital approaches.	Raise awareness among local businesses about the importance of NBS and encourage their participation in NBS projects in the city.

6 CONCLUSION

The CLEARING HOUSE project has revealed a need for continuous innovation in scaling and funding of UF-NBS projects. The tools and solutions created during the project, together with the city case study results, provide key resources and lessons learned to effectively integrate UF-NBS initiatives in urban settings. The cities emphasized the challenges related to implementation and funding UF-NBS, along with introducing novel UF-NBS approaches. These collective insights enhanced our comprehension and practical knowledge of green spaces, aiding the identification of key recommendations for UF-NBS business models.

The UF-NBS Business Model Canvas serves as a tool for designing UF-NBS, ensuring the creation, delivery and capture of its value. Given the extensive research available on NBS business models, this deliverable emphasizes the utilization of the existing NBS business models developed by Connecting Nature (Connecting Nature, 2019). Instead, the focus lies on the need to adopt UF-NBS business models, integrating key recommendations to ensure that the ecosystem services of UF-NBS address the specific urban challenges and cost-effectively drive and scale UF-NBS. The Business Model Canvas, helps identify both barriers and solutions to UF-NBS, highlights the need of multi-governance collaboration and integration of cross-sector learning for the efficient design and funding of UF-NBS, as well as the effective capture of its value.

Guided by the problem-based analysis of UF-NBS projects, expert interviews, and prior workshops involving municipalities, water infrastructure companies, and financial stakeholders, specific recommendations on new innovative ideas to the UF-NBS Business Model Canvas are formulated.

The first recommendation is to **co-design UF-NBS projects together with funders** by uniting the UF-NBS project with other initiatives or developing innovative financing models including public-private partnerships or crowdsourcing initiatives. By co-designing the UF-NBS project with funders, the projects directly integrate a wider set of stakeholders, including a broader set of resources and knowledge to implement and possibly scale the UF-NSB initiative.

Another key recommendation is to develop financial incentives related to urban planning and urban development, encompassing measures such as **tax incentives**, or urban development levies. Additionally, funding sources such as biodiversity and carbon credits, green bonds, and blended finance options should be chosen according to the specific needs of the UF-NBS project. Moreover, the **investment proposal** should be customized to suit the preferences and priorities of potential funders

The next critical area emphasizes the importance of **clearly identifying the value of UF-NBS beyond their immediate environmental impact**. Quantifying and communicating the wide array of economic, social and ecological benefits by leveraging technology and data enhances the planning, implementation, and monitoring of UF-NBS.

Project initiators can **foster partnerships and community engagement** by creating a collaborative environment with stakeholders, businesses, NGO's and citizens, raising awareness on UF-NBS and fostering volunteering efforts. Promoting knowledge sharing and capacity building through workshops, online platforms, and collaboration between municipalities, academic institutions, and industry experts, accelerates the UF-NBS adoption and implementation.

The final recommendations encourage the promotion and dissemination of UF-NBS through **supporting research and innovation developments**. Investment in research projects, collaboration with academic institutions, and encouragement of new technologies are proposed to enhance understanding and innovation. **Educational initiatives**, targeting both the next generation and the broader community, are deemed essential for fostering long-term support and engagement, including partnerships with schools and community groups.

In essence, these comprehensive recommendations aim to provide a holistic framework for the successful integration and sustainable development of UF-NBS, addressing financial, policy, community, technological and knowledge-related aspects. The UF-NBS business models require continuous short-term innovative actions and adoption of multi-stakeholder collaboration to ensure the long-term transformation of integrating nature in our economic processes.

7 REFERENCES

ADEME. (2021). *ADEME*. Récupéré sur Des solutions pour rafraichir les villes: https://gouttedor-et-vous.org/IMG/pdf/ademe_recueil_international_rafraichissement_urbain_numerique_2p_v3.pdf

Baro et al. (2014). Contribution of ecosystem services to air quality and climate change mitigation policies: the case of urban forests in Barcelona, Spain. *Ambio*, 466-479.

Blue Alliance. (s.d.). *Our MPAs*. Récupéré sur Blue Alliance: https://bluealliance.earth/explore-our-mpas/

Blue Forest. (2024). *Blue Forest*. Récupéré sur Blue Forest: https://www.blueforest.org/

Bocken et al. (2014). A literature and practice review to develop sustainable business model archetypes. *Journal of Cleaner production*, 42-56. doi:https://doi.org/10.1016/j.jclepro.2013.11.039

Brears et al. (2024). *Safeguarding Our Sources: Innovative Approaches to Water Source Protection*. Récupéré sur Medium: https://medium.com/mark-and-focus/safeguarding-our-sources-innovative-approaches-to-water-source-protection-5b4b10330eb0#:~:text=Vienna%2C%20Austria%20became%20the%20first,around%20the%20city's%20water%20sources

Brussels Environment. (2023). *Renature Brussels*. Récupéré sur Renature Brussels: https://renature.brussels/fr/actions

Brussels, E. (2024). *Nature Academy*. Récupéré sur Nature Academy: https://www.nature-academy.brussels/

CDC-Biodiversité. (2022). *Rapport annuel 2022.*

Christophers, B. (2018). Risk capital: Urban political ecology and entanglements of financial and environmental risk in Washington, D.C. *Sage Journals - Environment and Planning*.

Cities4Biodiversity. (2022). Urban tree planning and planting in Paris.

City of Melbourne. (2024). *Urban Forest Strategy* . Récupéré sur City of Melbourne : https://www.melbourne.vic.gov.au/community/greening-the-city/urban-forest/Pages/urban-forest-strategy.aspx

CLEARING HOUSE. (2024). *City of Trees – get inspired to learn more about trees in the city*. Récupéré sur CLEARING HOUSE: https://clearinghouseproject.eu/city-of-trees/

CLEARING HOUSE. (2024a). *CLEARING HOUSE LEIPZIG-HALLE*. Récupéré sur CLEARING HOUSE : https://clearinghouseproject.eu/project/leipzig-halle/

CLEARING HOUSE. (2024b). *CLEARING HOUSE BARCELONA*. Récupéré sur CLEARING HOUSE: https://clearinghouseproject.eu/project/barcelona/

CLEARING HOUSE. (2024c). *CLEARING HOUSE KRAKOW*. Récupéré sur CLEARING HOUSE: https://clearinghouseproject.eu/project/krakow/#1462459412197-1482c7ba-b73a

CLEARING HOUSE. (2024d). *CLEARING HOUSE BRUSSELS*. Récupéré sur CLEARING HOUSE: https://clearinghouseproject.eu/project/brussels/

CLEARING HOUSE. (2024e). *CLEARING HOUSE GELSENKIRCHEN*. Récupéré sur CLEARING HOUSE: https://clearinghouseproject.eu/project/gelsenkirchenruhr-area/

Cohen-Shacham et al. (2022). Nature-based solutions to address global societal challenges . *IUCN: International Union for Conservation of Nature* .

Commonwealth Secretariat. (2021). *Discussion paper: Accelerating Financing for nature-based solutions to support actions across the Rio Conventions.*

Connecting Nature. (2019). *Nature-Based Solutions Business Model Canvas.*

Conservation Finance Network. (2024). *Conservation Finance Network*. Récupéré sur Conservation Finance Network: https://www.conservationfinancenetwork.org/

Dark Matter Laboratories. (2020, 03 6). *Trees as Infrastructure*. Récupéré sur https://provocations.darkmatterlabs.org/trees-as-infrastructure-aa141acdf227

da Schio N et al. (2021) Report on the exploratory analysis of all the case studies (D2.1). H2020 project CLEARING HOUSE, agreement no. 821242.

Davies et al. (2024). *Guidelines for Urban Forests as Nature-Based Solutions (UF-NBS).* CLEARING HOUSE project. doi:10.5281/zenodo.10819220

DE URBANISTEN. (2019). *Sponge Garden Rotterdam*. Récupéré sur DE URBANISTEN: https://www.urbanisten.nl/work/sponge-garden-dhkxw

Deboeuf de Los Rios et al. (2022). *Renaturer les villes. Méthode, exemples et préconisations.* Ile de France: ARB îdF, L'Institut Paris Region.

Department for Environment Food & Rural Affairs. (2013). *Payments for ecosystem services: a best practice guide.*

De Vreese et al. (2019). Are stakeholders' social representations of nature and landscape compatible with the ecosystem service concept?. Ecosystem Services, 37, 100911.

De Vreese et al. (2021), Local co-design workshops synthesis report (D3.2).H2020 project CLEARING HOUSE, agreement no. 821242.

De Vreese et al. (2024). On the need of large old trees to keep cities young and vibrant. In: Shannon, K. & De Meulder, B. (2024). Urban Forests, Forest Urbanisms & Global Warming. Landscape and Architecture Projections, 2, Leuven University Press.

Ecologie.gouv. (2022, November 14). *Réseau européen Natura 2000*. Récupéré sur https://www.ecologie.gouv.fr/reseau-europeen-natura-2000-0#:~:text=Le%20r%C3%A9seau%20Natura%202000%2C%20constitu%C3%A9,enjeux%20de%20conservation%20en%20Europe.

Edible Bristol. (2024). *Growing the UK's first edible city*. Récupéré sur Edible Bristol: https://ediblebristol.org.uk/

Elmqvist et al. (2016). Ecosystem services provided by urban green. *Routledge Handbook of Ecosystem Services*, 452-464.

Elwin et al. (2021). *A deforestation-linked sovereign bond.* Planet Tracker.

Environmental Incentives. (2021). *Willamette Basin wetland restoration*. Récupéré sur https://enviroincentives.com/willamette-basin-wetland-restoration/

European Commission, Directorate-General for Research and Innovation. (2020). *Public Procurement of Nature-Based Solutions.* European Commission,.

European Commission, Directorate-General for Research and Innovation. (2021). *Evaluating the Impact of Nature-based Solutions: A Handbook for Practitioners.* Publications Office of the European Union.

European Commission, Science for Environment Policy. (2021). The solution is nature. *Future Brief*.

European Environment Agency. (2024). *Scaling nature-based solutions*. Récupéré sur European Environment Agency: https://www.eea.europa.eu/publications/scaling-nature-based-solutions

European Investment Bank. (2023). *Investing in nature-based solutions.*

EY. (2024). *Long-term value*. Récupéré sur EY: https://www.ey.com/en_gl/long-term-value

Finance for Nature Europe Online Event. (2023).

FINMODELSLAB. (s.d.). *Tiny Forest plantation service business model canvas*. Récupéré sur https://finmodelslab.com/products/tiny-forest-plantation-service-business-model-canvas

Forestami. (s.d.). *Forestami*. Récupéré sur Forestami: https://forestami.org/en/

GELSENWASSER . (2024). *giesskannenheldinnen-gelsenkirchen*. Récupéré sur GELSENWASSER : https://www.gelsenwasser.de/giesskannenheldinnen-gelsenkirchen

GoNaturePositive! (2024). *ec.europa.eu/info/funding-tenders*. Récupéré sur https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/how-to-participate/org-details/953493414/project/101135264/program/43108390/details

Grow Green. (2022). *Deliverable 1.6 Intervention Conslutions: Worcalaw.* Project Title: Green Cities for Climate and Water Resilience, Sustainable Economic Growth, Healthy Citizens and Environments .

Hawxell et al. (2019). Municipal Governance for Nature-Based Solutions . *Fraunhofer*.

HIGH LINE. (2024). Récupéré sur HIGH LINE: https://www.thehighline.org/

IIED, UNDP. (2022). *Biocredits to finance nature and people.*

IUCN. (2020). *Nature-based Solutions for cities*. Récupéré sur IUCN: https://iucn.org/our-work/topic/nature-based-solutions-cities

Jacobs et al. (2016). A new valuation school: Integrating diverse values of nature in resource and land use decisions. Ecosystem services, 22, 213-220.

Konijnendijk, C. C. (2008). The Forest and the City, The Cultural Landscape of Urban Woodland.

LEAF. (2023). *LEAF*. Récupéré sur LEAF: https://www.leaf.global/

Made in Vilnius. (2023). *It is planned to plant 1000 trees and 5000 bushes in Vilnius*. Récupéré sur Made in Vilbius: https://madeinvilnius.lt/en/news/city/1000-trees-and-5000-shrubs-are-planned-to-be-planted-in-Vilnius/

Mansourian et al. (2020). *Tree planting by businesses.* WWF.

Mediterranean Facility of the European Forest Institute. (2022). *First International Forum of the Alliance for Ecosystem Services of Castilla-La Mancha*. Récupéré sur MedForest: https://medforest.net/2022/10/04/first-international-forum-of-the-alliance-for-ecosystem-services-of-castilla-la-mancha/

Metropolis. (s.d.). *Cuitláhuac Park*. Récupéré sur Urban Sustainability Exchange: https://use.metropolis.org/case-studies/cuitlahuac-park#casestudydetail

NATURVATION. (s.d.). *Review of Economic Valuation of Nature-Based Solutions in Urban Areas .*

Network Nature. (2021). *From Nature-Based Solutions to the Nature-Based Economy.*

NetWork Nature. (2023). *CLEARING HOUSE*. Récupéré sur NetWork Nature: https://networknature.eu/clearing-house

Niskanen, A., Pettenella, D., & Slee, B. (2007). Barriers and Opportunities for the Development of Small-scale Forest Enterprises in Europe. *Small-scale Forestry, 6*, 331-345. doi:https://doi.org/10.1007/s11842-007-9035-x

OECD. (s.d.). *Blended Finance*. Récupéré sur OECD: https://www.oecd.org/dac/financing-sustainable-development/blended-finance-principles/

Office for Coastal Management. (s.d.). *Natural Infrastructure*. Récupéré sur https://coast.noaa.gov/states/fast-facts/natural-infrastructure.html

ONERC. (2019). *Des solutions fondées sur la Nature pour s'adapter au changement climatique*. Récupéré sur https://observatoires-littoral.developpement-durable.gouv.fr/IMG/pdf/onerc_rapport_2019_sfn_web.pdf

OPPLA. (2023). *Case studies The Sonian City, Belgium*. Récupéré sur https://oppla.eu/casestudy/22294

Pearlmutter et al. (2017). *The Urban Forest: Cultivating Green Infrastructure for People and the Environment.* Springer.

Pino et al. (2022). *Blueprint for Innovation in Urban Forestry.* Uforest Erasmus+ project, Deliverable 3.3 Blueprint for Innovation in Urban Forestry.

Planet Tracker. (2020). *Can blue bonds finance a fish stock recovery?*

Project Food Forest. (2016). *Project Food Forest*. Récupéré sur Project Food Forest: https://projectfoodforest.org/

Raymond, C. M., Frantzeskaki, N., Kabisch, N., Berry, P., Breil, M., Nita, M. R., . . . Calfapietra, C. (2021). A framework for assesing the impact of nature-based solutions in urban areas. *Environment Science & policy*, 7-18.

Rewilding Academy. (2024, 02 7). *Pros And Cons Of The Miyawaki Concept And Tiny Forests*. Récupéré sur https://rewilding.academy/ecosystem-restoration/pros-and-cons-of-the-miyawaki-concept-and-tiny-forests/

RWTH Aachen University. (2019). *Cologne Forest Laboratory*. Récupéré sur Institute of Landscape Architecture: https://www.la.rwth-aachen.de/cms/LA/Forschung/~queq/Waldlabor/?lidx=1

SDG Impact Accelerator. (2022). Récupéré sur SDG Impact Accelerator: https://www.sdgia.org/about-sdgia/

Seddon et al. (2020). Understanding the value and limits of nature-based solutions to climate change and other global challenges. *Philosophical Transactions of the Royal Society B: Biological Sciences*.

Singapore Green Plan. (2024). *A City of Green Possibilities*. Récupéré sur GREEN PLAN: https://www.greenplan.gov.sg/

Sonian Wood Cooperation. (2024). *Sonian*. Récupéré sur Sonian: https://sonianwoodcoop.be/

The City of New York. (2024). *Cleaning Up Gowanus Canal*. Récupéré sur Get Stuff Done: https://www.nyc.gov/content/getstuffdone/pages/gowanus-cleanup

The City of New York. (s.d.). *MillionTreesNYC*. Récupéré sur NYC Parks: https://www.nycgovparks.org/trees/milliontreesnyc

The Clevel Cities. (s.d.). *Clever Cities*. Récupéré sur Clever Cities: https://clevercities.eu/

The Nature Conservancy. (2024). *NatureVest*. Récupéré sur The Nature Conservancy: https://www.nature.org/en-us/about-us/who-we-are/how-we-work/finance-investing/naturevest/

The Northern Forest. (2018). *Resourcing the future.*

Thompson et al. (2023). Paying for nature-based solutions: A review of funding and financing mechanisms for ecosystem services and their impacts on social equity. *Sustainable Development, 31*(4), 1991-2066.

UN FAO. (2016). *Guidelines on urban and peri-urban forestry.* Forestry Paper No. 178. Rome, Food and Agriculture Organization of the United Nations.

UNEP. (2022). *State of Finance for Nature. Time to act: Doubling investment by 2025 and eliminating nature-negative finance flows.* Nairobi: United Nations Environment Programme. doi:https://wedocs.unep.org/20.500.11822/41333

United Nations. (2018). 2014 Revision of the World Urbanization Prospects. *Unites Nations Department of Economic and Social Affairs, Population Division*.

United Nations. (2021). Sustainable Urban and Peri-urban Forestry. *United Nations Economc Commission for Europe*.

United Nations Environment Program - Finance Initiative. (2022). *Are you ready for nature-related disclosures?* Récupéré sur https://www.unepfi.org/publications/are-you-ready-for-nature-related-disclosures/

United Nations Environment Program. (2015). *REDD Equateur*. Récupéré sur https://www.unep.org/fr/actualites-et-reportages/reportages/redd-equateur

URBAN GreenUP. (2023). *D7.5: Table of exploitable results, business models and financial instrument to implement NBS for private sectors .* URBAN GreenUP.

Urban Nature Atlas. (2021a). *Tirana Orbital Forest*. Récupéré sur Urban Nature Atlas: https://una.city/nbs/tirana/tirana-orbital-forest

Urban Nature Atlas. (2021b). *Las Cigarreras Sustainable Urban Development Project*. Récupéré sur Urban Nature Atlas: https://una.city/nbs/alicantealacant/las-cigarreras-sustainable-urban-development-project

van Ham et al. (2017). Partnerships for Nature-Based Solutions in Urban Areas – Showcasing Successful Examples. Dans C. van Ham, & H. Klimmek, *Nature-Based Solutions to Climate Change Adaptation in Urban Areas* (pp. 275–289). Springer, Cham.

Vibrant Cities Lab. (s.d.). *Phytoremediation with Poplar Trees*. Récupéré sur https://www.vibrantcitieslab.com/case-studies/phytoremediation-with-poplar-trees/

Wageningen University & Research. (2018, April 23). *Urban tiny forests are good for biodivesity*. Récupéré sur https://www.wur.nl/en/newsarticle/Urban-tiny-forests-are-good-for-biodiversity.htm

Wageningen University & Research. (s.d.). *Twittering tree bares its branches for climate research*. Récupéré sur Wageningen University & Research: https://www.wur.nl/en/article/twittering-tree-bares-its-branches-for-climate-research.htm

Wilkes-Allemann et al. (2023). Envisioning the future—Creating sustainable, healthy and resilient BioCities. Urban Forestry & Urban Greening, 84, 127935. DOI: https://doi.org/10.1016/j.ufug.2023.127935

World Economic Forum. (2022). *How biodiversity credits can deliver benefits for business, nature and local communities*. Récupéré sur World Economic Forum: https://www.weforum.org/agenda/2022/12/biodiversity-credits-nature-cop15/#:~:text=Biodiversity%20credits%20as%20an%20economic,deliver%20net%20positive%20biodiversity%20gains.

WowNature. (2024). *WowNature*. Récupéré sur WowNature: https://www.wownature.eu/en/

Yan et al. (2020). Phytoremediation: A Promising Approach for Revegetation of Heavy Metal-Polluted Land. *Frontiers in Plant Science*.

8 APPENDIX

8.1 Interviewee Profiles

Gregory Guillot	Asset Manager at AxessImpact
Expert in Nature-based solutions and green finance, driving ecological and social impact alongside financial returns.	

Pierre Rousseau	Independent consultant in sustainability & Finance
Independent Consultant for Finance and Sustainability, advising large institutions, corporations, and entrepreneurs on forward-thinking and effective solutions. His main clients are large financial institutions, renowned corporations as well new disruptive entrepreneurship initiatives.	

Etienne Aulotte	Head of department for nature and agriculture development at Bruxelles Environnement
After over 15 years in Bruxelles Environnement, Etienne holds expertise and experiences in biodiversity/ecosystem management, strategic planning, regional policy development along with EU project formulation and coordination.	

Connell Grogan	Co-founder of Nature Impact and Housing Impact
Nature Impact is set p with the mission to deliver science-backed, high-quality nature-based solutions across the UK. Housing Impact provides scalable, future-focused property developments that are socially inclusive and nature-positive.	

Tom Nelson	Co-founder of Nature Impact and Housing Impact
Nature Impact is set p with the mission to deliver science-backed, high-quality nature-based solutions across the UK. Housing Impact provides scalable, future-focused property developments that are socially inclusive and nature-positive.	

Michel de Kemmeter	Founder Club of Brussels
Michel de Kemmeter proposes immediate, concrete, sustainable and effective solutions to build a better world based on skills as an expert in economic transition, teacher, writer, speaker, columnist, entrepreneur-investor.	

Franck Barroso	Head of operation at Innovate 4 Nature
I4N is an incubator/accelerator for nature-positive solutions, aiming to accelerate 100+ top-tier nature-positive solutions in collaboration with strategic partners to halt and improve nature loss by 2030.	

8.2 Questionnaire

Green Visions: Gauging the Pulse of Innovation

In this section, we explore the heart of the CLEARING HOUSE D4.1 report's recommendations. Your insights will help us understand the relevance of these innovative solutions in today's urban forestry projects. As we present each recommendation, reflect on their impact and applicability within your work or experiences. Your responses will illuminate the most promising paths forward.

1

How relevant do you find the following recommendations for addressing UF-NBS challenges in your projects or experiences? *

	Not at all	Somewhat	relevant	Very Relevant
Adopt digital platforms for stakeholder engagement and project transparency	○	○	○	○
Foster partnerships and community engagement	○	○	○	○
Promote knowledge sharing and capacity building	○	○	○	○
Support research and development	○	○	○	○
Encourage educational initiatives	○	○	○	○

2

Which of the above recommendations do you foresee being the most challenging to implement in your work or projects? *

Sélectionnez votre réponse ⌄

3

Why? *

Entrez votre réponse

Rooted Challenges: Navigating the Practical Terrain

Transitioning from vision to reality often presents unforeseen challenges. This section delves into the practical aspects of implementing the UF-NBS recommendations. Share your experiences with innovative solutions, and let us know the hurdles you've encountered or anticipate. Your practical insights are invaluable in forging resilient pathways for urban forestry initiatives.

4

Have you applied or considered any innovative solutions below within your projects? *

	Not considered	Considered	Implemented
Biodiversity credits	○	○	○
Blended finance	○	○	○
Payment for ecosystem services	○	○	○
Working with private companies	○	○	○
Tech for green (AI, blockchain/tokenization, Tree as Infrastructure...)	○	○	○
Tiny Forests	○	○	○
Phytoremediation	○	○	○
Biomonitoring trees	○	○	○
Productive forests	○	○	○
Gardens/edible forests	○	○	○

5

Of the solutions that you have implemented, if any, how would you describe the overall success of it? *

Entrez votre réponse

Branching Out: Shaping the Future of Urban Greenscapes

As we look towards the horizon, the evolution of UF-NBS depends on continuous innovation and adaptation. This section invites you to critique a specific UF-NBS framework and share your vision for future directions. Your forward-thinking perspectives will help shape the development of dynamic, sustainable urban forests that can thrive in the face of global challenges.

6

Please select your **three** prefered archetypes for Business Models related to UF-NBS. *
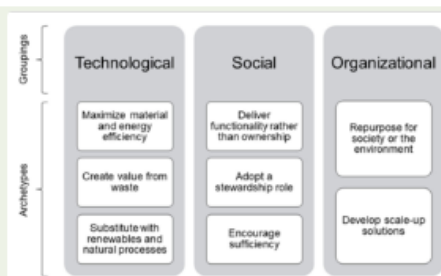
Sélectionnez au plus 3 options.

- [ ] Maximize material and energy efficiency
- [ ] Create value from waste
- [ ] Substitute with renewable and natural processes
- [ ] Deliver functionality rather than ownership
- [ ] Adopt a stewardship role
- [ ] Encourage sufficiency
- [ ] Repurpose for society or the envrionment
- [ ] Develop scale-up solutions

7

Please justify your response for question 6, what are the main weaknesses and strengths related to the application of your chosen business models? *

Entrez votre réponse

Your UF-NBS funding model

If you were part of a city case study (Gelsenkirchen, Brussels, Krakowa, Barcelona, Leipzig) during the CLEARING HOUSE project or if you develop UF-NBS priojects in your city or organisation please answer the following questions

8

Please describe how your funding model for UF-NBS projects functions (private funding, public funding, crowdsourcing, volunteering..)

Entrez votre réponse

9

What do you consider your main challenges when funding UF-NBS projects?

Entrez votre réponse

10

Did you already find certain solutions to these challenges?

Entrez votre réponse

Personal Information

Please provide your name and organization.

11

Full name *

Entrez votre réponse

12

Organization *

Entrez votre réponse

13

Can we share your feedback in the final deliverable? *

○ Yes

○ Yes, but only anonymously

○ No