**A thesis submitted to the Department of Environmental Sciences and Policy of Central European University in part fulfilment of the Degree of Master of Science**

# Partnerships for financing, installing, and maintaining urban forest and tree projects

**Andrea NYILAS**

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Andrea NYILAS

**CENTRAL EUROPEAN UNIVERSITY**

**ABSTRACT OF THESIS** submitted by:

Andrea NYILAS

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This thesis aims to answer questions related to urban forest and tree projects from the perspective of their implementation across. In Europe, financing urban trees relies on municipality budgets which are shrinking parallel to the phenomenon of high urbanization, loss of biodiversity, climate change and other events threatening our civilization. The need for urban nature, including urban trees and the ecosystem services they provide is increasing. Best practices for financing urban trees and upscaling these methods are essential. This thesis examines cases from three cities: Budapest, Vienna, and Utrecht. It provides information on the partnership structure of the selected case studies. Recognizing the incentivizing and disincentivizing factors of project implementation is essential to improve mechanisms related to re-naturing cities. The thesis discusses some practical and policy recommendations and hopes to contribute to the improvement of our dense cities.

**Keywords:** urban forest, urban tree, nature-based solutions, NBS, green infrastructure, GI, UGI, ecosystem services, partnership, financing

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# 1. Introduction

Most people in the 21st century will live in urban areas where the power for decision-making is concentrated; thus, urban areas can be seen as being at the forefront of shaping the future of the planet in the 'Anthropocene' (Crutzen 2002) The negative effects of urbanization should play a key role in shaping our understanding of required actions. Priority should be given to solutions incorporating urban nature, including urban trees to limit the reliance on grey infrastructure and decrease the amount of built-in areas to prevent and mitigate environmental stress. The utilization of space for new developments with an increased focus on using green infrastructure elements would be less costly in many cases and would preserve urban nature helping us address the challenges of urban areas.

## 1.1. Aims of the research

The decision to investigate factors that enhance the implementation of urban forest and tree projects is rooted in the recognition of their increasing importance in tackling a wide range of urban sustainability challenges, from climate change to human health and well-being, biodiversity conservation and others. There is call in literature for research to find and characterize best practices in NBS including urban forest and tree projects. This research looked at different aspects of urban forest and tree projects in search of partnerships for financing and partnerships for the installation and maintenance of urban forest and tree projects. Furthermore, I aimed to research the factors that incentivize and disincentivize these projects. Traditional ways of financing are problematic: in Europe most urban forest and tree projects rely entirely on municipal budgets which are shrinking. Partnerships are key to alleviating risks, distributing project costs and enabling more effective maintenance.

### 1.2.Outline

This thesis is in total seven chapters. Chapter 1 (Introduction) introduces the reader to the aims of the research and provides information on its relevance. Chapter 2 (Literature review) contextualizes the research by characterizing the selected field and providing an overview in the form of a history and current, unresolved issues. The chapter also justifies the thesis by pointing out gaps in the literature. Chapter 3 (Methodology) informs the reader on the research approach, its methods, and design. Chapter 4 (Conceptual Framework) provides a conceptual model including all the stakeholders and the channels of contribution to urban forest and tree projects. Chapter 5 (Results) presents the key themes of the research findings. Chapter 6 (Discussion) analyzes the results and contains practical recommendations based on them. Chapter 7 (Conclusions) reviews the processes of the research, critically reflects on them, and summarizes the main findings.

## 2. Literature Review

### 2.1.Current and future environmental and social challenges of urban areas

Today, 55% of the world's population lives in urban areas, a proportion that is expected to increase to 68% by 2050 (United Nations, Department of Economic and Social Affairs, Population Division 2018). Increasing densification of cities results in the use of underutilized lands, for example green spaces are used for further developments (Emilsson 2017). Cities already experience the effects of traffic congestion, noise pollution, and the urban heat island effect. All these have serious health implications and considerably affect the well-being of people. However, depletion of nature, including urban trees in cities as a result of densification further exacerbates the problem of unsustainability which is a major issue in Europe. Currently, 74% of Europe's population resides in urban areas and integrated policies are needed to connect social, economic and environmental aspects of city life and decrease the negative effects of urbanization and create sustainable

livelihoods (United Nations, Department of Economic and Social Affairs, Population Division 2018). Cities are both experiencing the following negative effects and creating themselves. Thus, it is crucial for cities to follow a pathway to a sustainable future and prevent non-efficient use of resources, minimizing their urban footprint, loss of biodiversity, environmental problems and social inequalities (Haaland 2015).

Besides the grey infrastructure developments in cities, over the last 50 years, human activities have released large quantities of carbon dioxide and other greenhouse gases to trap additional heat in the lower atmosphere (World Health Organization 2019). This effect is significantly higher in areas with a high-degree of built-up and little green space (Emilsson 2017). The urban heat island (UHI) effect is defined as higher temperatures within urban areas compared to their surroundings (Oke 1982). This effect is also strengthened by human activities including air conditioning and car use, as well as dark surfaces and less shading by vegetation, such as tree canopy. The predicted levels of climate change in cities foresees that it will dangerously affect parts of Europe where the population is not adapted to such extreme temperature increase and are unable to cope with it (Emilsson 2017). Heatwaves will increase in the future and the risks of heat stress for humans will rise (Intergovernmental Panel on Climate Change 2014).

In 2015, the global community adopted a set of goals for sustainability, the SDGs, to help protect the planet while preserving prosperity and ending poverty. However, the increasing speed of urbanization threatens to undermine the achievement of SDGs due to the increasing proportion of carbon emissions and resource depletion among other significant negative impacts (Food and Agriculture Organization of the United Nations 2019).

Mitigation and adaptation must take place at every level: at a global scale, at the EU scale supported by coordinated national policies, and at the city scale. Among the many problems urbanization currently causes, climate change is just one, often cited as the major threat to humanity, but several

other issues such as biodiversity loss, collapse of ecosystems, increasing pollution levels, and depletion of resources all threaten the existence of our civilization. Climate change in urban areas puts further pressure on biodiversity and weakens the resilience of cities by having "effects on individuals, populations, species, ecological networks and ecosystems" (Bellard 2012). It alone will not only cause heat waves which will result in discomfort, migration and high mortality rates, but will also be the major cause of other extreme weather events, for example floods, droughts, wildfires and severe storms and out of these climate hazards multiple ones will hit several parts of Europe. These hazards are mapped for the twenty-first century by Forzieri et al. using an ensemble of climate projections and are evaluated based on expected changes in both heat and cold waves, river and coastal flooding among others. "Europe will see a progressive and strong increase in overall climate hazard and key hotspots emerge particularly along coastlines and in floodplains in Southern and Western Europe, which are often highly populated and economically pivotal" (Forzieri, et al. 2016).

Addressing these challenges and creating more resilient cities must involve restoring ecosystems. If urban areas follow path of urbanization, there will be more frequent occurrences of social and economic losses. Such an economic and societal pressure was July of 2016, the hottest month since temperatures have been measured by NASA claiming human lives (NASA 2016). Extreme events will be more frequent, and cities' unpreparedness will lead to a situation where gradual adaptation will no longer be an option.

## 2.2.Incorporating nature into cities – Nature-Based Solutions

There has been a significant amount of research on incorporating natural components into cities and this includes several pathways of interdisciplinary research measuring their success based on the recognition of their role in restoring healthy ecosystems within urban areas and making cities

resilient. In an approximately chronological order research areas focusing on the incorporation of nature into cities are urban forests (UF), ecosystem services (ES), green infrastructure (GI) and, more recently, Nature-Based Solutions (NBS) (Escobedo, et al. 2019). "The specific metaphors or terms related to the use of natural components in cities appear to be constantly evolving and "snowballing", diversifying and gaining in popularity at a rapid and accelerating rate, and eventually declining in use" (Escobedo, et al. 2019). The different approaches all have incorporated nature as a focus; however, they focus on a different element of using nature in cities. These terms evolved over the past decades and there is a need to use universal definitions to efficiently incentivize decision-making. Use of applied science approaches for managing natural systems in and around cities has gained recent popularity as NBS, the purposeful use of nature's services, and it includes the planning of forests and trees in and around human settlements (European Commission a). NBS has the feature of being multi-purpose and multi-service and has the ability to provide benefits besides alleviating a series of critical issues (Kabisch, et al. 2016a).

Relying on ecosystem services to address the challenges outlined above are not entirely new and have been applied with different approaches as previously mentioned. Let us look how the concept of NBS has evolved and the way it provides the basis for research on integrating nature in urbanized areas. Environmental and ecosystem services were founded in the scientific literature around the 1970s (International Union for Conservation of Nature 2016) and the term 'ecosystem services' was coined by Gretchen Daily (Daily 1997). The systematic approach gained wider recognition in the 2005 Millennium Ecosystem Assessment synthesis report (World Health Organization 2005) to increase awareness and provide a basis for policies regarding the implementation of conservation, restoration and sustainable management efforts. The assessment report highlighted the demands regarding ecosystem services and emphasized their protection to further sustain humans' needs and a healthy ecosystem for resilience and human well-being. The NBS concept

emerged in use by international organizations, first the IUCN and the World Bank and later appeared in policy settings as well, including its increasing use by the European Commission. 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" (International Union for Conservation of Nature 2016)The NBS term first was used as a policy and communications tool and recently gained popularity in the scientific literature. NBS is now part of the Horizon2020 Research and Innovation Program with nearly €80 billion of funding available over 7 years (2014 to 2020) – in addition to the private investment that this money will attract (European Commission b). NBS offers solutions in a multidimensional way. It intends to support the achievement of the sustainable development goals, enhance human well-being and the resilience of ecosystems providing ecosystem services (International Union for Conservation of Nature 2016). NBS address the major societal challenges linked to climate change, food and water security, health (Intergovernmental Panel on Climate Change 2014). Whereas GI is mainly directed at the spatial planning of green elements in an urban setting, NBS aims to combine it with social and economic benefits.


FIGURE 1. NBS: ECOSYSTEM-BASED APPROACHES ADDRESSING SOCIETAL CHALLENGES

NBS consist of "'green' ecological domains such as building facades and roofs, urban green space connected to grey infrastructure (green playgrounds, street green), parks and urban forests, allotments and community gardens" and also of "green-blue spaces such as lakes, urban drainage systems, permeable surfaces and wetlands" (Toxopeus and Polzin 2017).

**NBS are based on the following preliminary principles:**

| Preliminary principles of NbS |
|---|
| Embrace nature conservation norms (and principles) |
| Can be implemented alone or in an integrated manner with other solutions to societal challenges (e.g. technological and engineering solutions) |
| Are determined by site-specific natural and cultural contexts that include traditional, local and scientific knowledge |
| Produce societal benefits in a fair and equitable way, in a manner that promotes transparency and broad participation |
| Maintain biological and cultural diversity and the ability of ecosystems to evolve over time |
| Are applied at a landscape scale |
| Recognize and address the trade-offs between the production of a few immediate economic benefits for development, and future options for the production of the full range of ecosystems services |
| Are an integral part of the overall design of policies, and measures or actions, to address a specific challenge |

FIGURE 2. PRELIMINARY PRINCIPLES OF NBS (INTERNATIONAL UNION FOR CONSERVATION OF NATURE 2016)

NBS aim for nature conservation and are either implemented as a single solution or as part of or parallel with engineered and technological solutions. They provide biological, cultural and societal benefits, regard ecosystem services as pivotal and are applied at a landscape scale. NBS can take

the form of wetland management, forest conservation, restoration of drylands, green infrastructure and using natural coastal infrastructure (International Union for Conservation of Nature 2016). This table by Kabisch et al. 2016 provides to be a framework for the effectiveness of NBS based on the necessary principles. The effectiveness of urban forest and tree projects could be evaluated

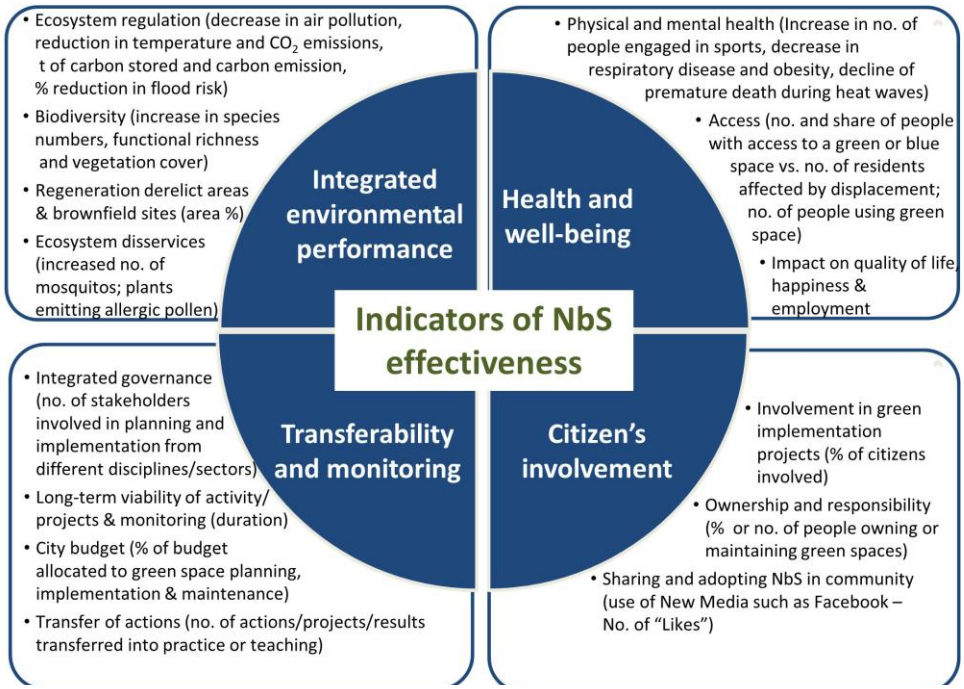


FIGURE 3. INDICATORS OF NBS EFFECTIVENESS (N. N. KABISCH 2016B)

based on this matrix. The first element indicating the effectiveness is integrated environmental performance aiming at ecosystem regulation, biodiversity, regeneration of derelict areas, but also including disservices of ecosystems. The second is improved health, well-being, and quality of life people. There is a need for an integrated governance where stakeholders from different sectors are involved in the project working together with the municipality, long-term viability of the project and projects and results could be transferred via further practice of the implementation or teaching.

Citizen involvement, according to Kabisch is also a cornerstone of effectiveness of NBS (N. N. Kabisch 2016b).

## 2.3.Urban green spaces as an ecological domain of NBS

In cities, besides reducing soil, water and especially air pollution, urban green spaces can provide citizens with a sense of relief and escape from urban life and nurture their mental health by enabling interaction with living organisms (Pearlmutter 2017). This section is going to provide a literature review on how Urban Green Infrastructure (UGI) serves as a basis for NBS, including urban green spaces and urban trees. UGI promotes the capacity of local ecosystems to alleviate the adverse effects of urbanization by mitigating the impacts of heat and precipitation hazards. UGI is defined by the European Commission as "a strategically planned network of natural and semi-natural areas, known as Green Urban Areas (GUAs)." GUAs include all types of green space, from city parks, to rooftop gardens and tree-lined streets (European Commission 2013). However, different types of UGI essentially form part of the NBS umbrella term under different ecological domains. If the focus on these solutions to provide health, social and economic benefit, the term is then embedded in the NBS term. There are heavy overlaps between the uses of the terms, usually it is their focus that tends to be different. For example, UGI networks provide a variety of ecosystem services and they also improve the lives of citizens of urban areas as well as supporting the green economy, creating job opportunities, and providing a basis for biodiversity, but in the case of UGI there is an emphasis on providing corridors, linking and creating green spaces for climate mitigation and protecting biodiversity. To enhance the adoption of green infrastructure in general, the European Commission has developed a specific EU-side Green Infrastructure Strategy promoting investments in GI (European Commission 2013) mainly due to recognizing its function to mitigate the so-called urban heat island effect (Calfapietra 2019). The GI strategy is a pillar of the EU 2020

Biodiversity Strategy contributing to all of its targets. Urban forest and trees are the backbone of UGI, but are also a type of NBS belonging to the green ecological domain of NBS. I use urban forest and urban trees combined into one term, to emphasize the need for both; urban forestry generally includes both urban forests and trees along streets and in green spaces. Urban forests and trees fit into the categories of both NBS and UGI. Urban forest and trees belong to the green ecological domain of NBS. (Toxopeus and Polzin 2017)

## 2.4.Ecosystem services provided by urban forests and urban trees

Urban green management generally aimed at enhancing amenity values and maintaining biodiversity, recently due to the provision of NBS there is now a focus on urban forests' and trees' contribution to mitigating environmental problems, and this includes ecosystem services relating to "carbon sequestration, pollution mitigation, microclimate regulation, storm water attenuation, energy conservation, provisioning of goods and other services" (Pearlmutter 2017). Urban forests and trees have a major role in climate mitigation; however, in urban areas their services go beyond that by supporting sustainable livelihoods and areas for humans and other organisms. Although, there is a contradiction between the desired densification of urban areas to prevent urban sprawl and the need for nature and its services in cities, strategically implemented urban forest and tree projects can support ecosystems in urban areas and provide their citizens with various services on which they rely for their existence and the importance of these will likely increase even further in the future. A healthy ecosystem can provide many services to humans and the term for these is ecosystem services (ES). ES are defined as the direct and indirect contributions of ecosystems to human well-being and are divided into four major categories: (i) cultural services, (ii) regulating services, (iii) provisioning services and (iv) habitat services (Brouwer, et al. 2013). Forests and trees provide multiple health benefits, sustain water resources, help to combat climate change, and

protect global biodiversity, hence hold an immense value to cities. Inner forests (trees within cities) have a significant role of carbon sequestration, transpiration cooling, cooling surfaces by providing shades, depositing pollutants, reflecting radiation, offsetting heat islands (and lower energy bills), and supporting human health and biodiversity. (World Resources Institute n.d.).

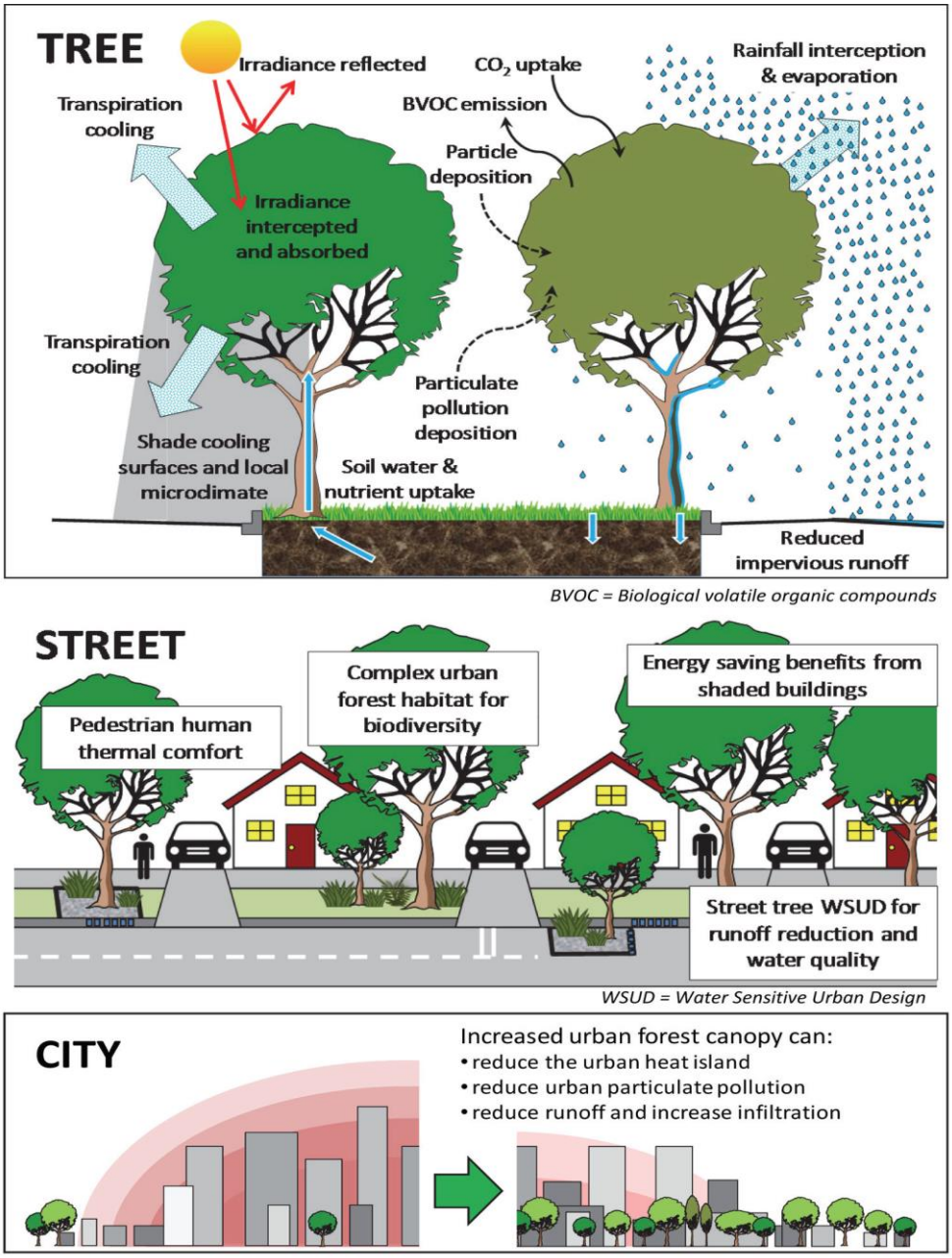


FIGURE 4. SERVICES PROVIDED BY URBAN FORESTS AND TREES (S. J. LIVESLEY 2016)

Despite the need for new real estate developments, urban residents rely on urban forests, residential gardens and other green spaces for their daily recreation needs and for multiple other ecosystem services. Generally, urban green spaces "play a role in recreation and health, supporting everyday life; contribute to the conservation of biodiversity and to the cultural identity of the city; offer places for nature experiences; help maintain and improve the environmental quality of the city; and bring natural solutions to technical problems" (Kabisch, et al. 2016a). Although, there has been a significant effort to research the ecosystem benefits of urban green spaces which include urban forests, the development of these areas is still a challenge due to their low priority in many countries in the policy field and there is no sufficient financial budget for them (Kabisch, et al. 2016a). Health benefits specifically related to urban green spaces are reduced mortality (Gascon, et al. 2016), cardiovascular health (Tamosiunas, et al. 2014) and mental health (Annerstedt and al. 2012). Moreover, "in last two decades, a number of studies have shown that people who have a good availability of UGSs—mostly based on the indicator of residential proximity to UGS—were more likely to use it for physical activity" (Kabisch, et al. 2016a).

Urban forests and trees are provided with a framework by UGI and NBS, proving the validity of their importance for climate change mitigation, improving health, social cohesion and economic benefits. The arboreal component of urban nature seems to be the most suitable to represent the participatory aspects in planning and implementation and benefit from it (Calfapietra 2019) and above all urban trees seem to be the most effective in providing a set of ecosystem services (Livesley 2016). Urban forest and trees, having the potential to increase participation throughout the whole implementation process, may serve as a basis for awareness raising about NBS in general among the urban communities.

To reduce temperature and pedestrian thermal stress in streets, the combination of green measures including vegetated terrain, green walls and street trees, is most effective. Large trees providing deep shade contribute strongly to thermal comfort (Pearlmutter 2017).

## 2.5. Methods for the valuation of ecosystem services provided by urban forests and trees

The importance of the valuation of ecosystem services provided by trees surged the emergence of several tools that are used for such assessments. The IUCN prepared a report in which – besides guidance document tools and tools for modelling – tools for data collection, mapping, and valuation types of ecosystem services are presented. These tools are evaluated and compared according to their features and which ecosystem services they are capable to present data on. The report also provides information on what type of data input is needed, whether the data obtained through the software is qualitative or quantitative and if scenario comparison is possible. In the case of urban forest and trees payment for ecosystem services is enabled through precise economic valuation of these ecosystem services. One such tool specifically used to evaluate the ecosystem services provided by trees to support urban forest management is i-Tree Eco which estimates the value of benefits of individual or multiple trees. i-Tree Eco can run functional analyses on pollution removal and human health impacts, carbon sequestration and storage, hydrology effects, building energy effects, tree bio-emissions. Several other analyses are available including cost benefit analysis (USDA Forest Service, Davey Tree Expert Company, Arborday Foundation, Society of Municipal Arborists, International Society of Arboriculture, Casey Trees, and SUNY College of Environmental Science and Forestry n.d.).

## 2.6.Implementation of urban forest and tree projects

Implementation of NBS, including urban forest and tree projects, generally often faces challenges at different levels of implementation. The first step to upscaling NBS is the recognition of sustainability challenges. For this, well-established policies are necessary to provide an external enabling environment. Benefits and costs of implementation of NBS must be measured. Including the costs of long-term inaction in the benefits, may incentivize the use of NBS, including urban forest and tree projects. Implementation of urban forest and tree projects includes:

- Conceptualization of projects and engaging with stakeholders
- Technical and financial planning
- Installation
- Maintenance
- Monitoring
- Reporting
- Learning and adjustment

Financing the installment and maintenance of urban forest and tree projects is a key aspect of implementation, and a major difficulty due to limited access to financial resources at municipalities who are mainly responsible for urban forest and tree projects across Europe. Currently, there are national and regional policies in the European context to support urban forest and tree projects such as the GI strategy of the European Commission. Complementary polices incorporated into urban forestry and accepted by the literature as direct and indirect policies regarding urban forest and tree projects help bottom-up approaches; hence attracting investments:

- Engineers may be using barriers of trees to deflect noise pollution away from adjoining residential areas

- Community development workers may use tree planting to encourage community activity and social interaction among different segments of society
- Business corporations may sponsor tree planting as a way of strengthening their environmental impact
- Environmental NGOs may promote trees as a way of recruiting supporters and volunteers
- Government officials may include the urban forest in strategies to promote public health and enhanced quality of life in urban areas addressing other urban challenges as well
- Developers may adopt an ambitious scale of urban greening in advance of building work as a way of boosting land value and stimulating urban economic regeneration (Konijnendijk, et al. 2005).

These complementary policies are the basis of alternative financing schemes. Initiating partnerships with different stakeholders and beneficiaries will help tap into financial resources needed for the installment and the maintenance of urban forest and tree projects.

Generally, investments into urban nature can take the form of private investments or public investments in the form of funding structures and providing key resources. The traditional way of funding urban forest and tree projects relies entirely on municipal resources, although, further resources are available from citizens and real estate developers. A key enabler for the implementation of NBS, including urban forest and tree projects, is creating a diverse group of partners and financiers, from state money to foundation grants (Toxopeus and Polzin 2017). Recognizing that land value increases as a result of the proximity of nature or combining natural elements itself could incentivize alternative financing schemes (Toxopeus and Polzin 2017).

## 2.7. Partnerships enabling financing, installment and maintenance of urban forest and tree projects

Partnerships and engagement can enable both alternative financing options and reducing installment and maintenance costs in the long-run. The complex regulatory and auditing processes require an understanding of the political, policy and financial environment in which urban forestry must operate. People and organizations must work in partnerships formed around a shared vision and to secure their long-term commitment to joint action (Konijnendijk, et al. 2005). To conceptualize partnerships for urban forests and tree projects differentiation between stakeholders and partners and their roles is essential. It is important that the stakeholders identify in advance what resources they might be able to tap in before entering the partnership as well as how they can contribute to enabling the success of the project. Stakeholders may be defined as anyone having an interest in the increased amount of urban forest or number of trees even based upon their nature of being beneficiaries of them or projects aiming at planting trees, or because they are somewhat affected throughout the creation and management processes. Therefore, they are not necessarily directly involved in the creation, management, organization and implementation of the projects. In the case of tree projects, it is desirable to get as many beneficiaries involved as possible. Partners, on the other hand, are directly involved in the creation and management process. Partnerships require precise definitions of aims coupled with a flexible and responsive approach to delivery (Konijnendijk, et al. 2005). A distinct identity for a specific project can help tap into resources and communicate the aims to the wider public separating from the partners' identity, therefore, reducing confusion. This may involve setting up a website and creating a business model. This also enables the partnership to have an embedded review or feedback mechanism and facilitate necessary adaptation (Konijnendijk, et al. 2005).

Mapping out stakeholders and organization forms enables us to see what financing options there are and how each partnership structure enables new form of investment (either monetary or non-monetary) into these projects. Also, new partnership structures may positively affect willingness to pay for ecosystem services in an urban setting via more awareness and more information-sharing. Partnership frameworks are the basis for finding alternative methods for financing and installment and maintenance of urban forest and tree projects.

## 2.8.Research gaps

Partnerships exist; however, there is limited access to these cases, their structures, dynamics and challenges in the literature. Although, "long-term cooperation between public and private parties are generally set up to allow for efficient risk, cost and benefit sharing, successful partnerships are often hampered by complexity of actor composition" (Toxopeus and Polzin 2017). Essentially, building models of partnerships, finding solutions for the challenges regarding partnerships and projects could contribute to mainstreaming working examples. "The further investigation, elaboration and empirical validation of these and further potential success factors may profit substantially from a meta-analytic approach which combines the systematic description of partnership case studies with their objective evaluation. There is great need for a consolidation of knowledge that would lead to recommendations for good practice in the field of UF and GI" (Hansmann 2016). In order to mainstream models of partnerships for enhancing urban nature on a systematic level, there is a need to understand the gaps, the hindering and incentivizing factors, conducting comparative case study analyses in given contexts due to the unique policy and governance backgrounds. More successful cases are needed to draw partnership models and understand the dynamics and enabling factors. "There is limited research on the ways the knowledge on Nature-Based Solutions can advance urban policy and planning to enable their

mainstreaming. This is due to the fact that the majority of the research focuses on single case studies" (Frantzeskaki 2019). "Recent research has shown that there is a need to forge new networks and develop trans-disciplinary and inclusive partnerships and governance approaches in order to foster the uptake of Nature-Based Solutions" (Van Ham and Helen 2017). Hereby, regarding urban forest and tree projects I would like to compare some cities' well-working adaptation of multi-stakeholder partnerships.

# 3. Methodology

## 3.1.Inductive approach for qualitative data analysis

The work on the thesis started with a literature review on NBS and GI including urban forest and tree projects. The focus was to understand the dynamics of re-naturing cities. The desk study part of my research allowed me to identify different sources, mechanisms and instruments of funding for urban nature in Europe. Literature has highlighted the need for more research on cases where re-naturing or implementation of NBS in general has been successful and the need for case studies regarding the implementation of urban forest and tree projects since they seem to be facing several limitations. Traditional ways of funding urban forest and tree projects are entirely coming from the municipal funds, but in light of emerging challenges and the limitations of the current financing models there is a need for alternative methods to solve the problem of lack of financial resources. The literature review helped direct focus to bottom-up approaches and the need for more successful case studies based on which upscaling can be achieved. My methodology is based on an inductive approach which involves building based on my observations. "Inductive reasoning is often referred to as a 'bottom-up' approach to knowing, in which the researcher uses observations to build an abstraction or to describe a picture of the phenomenon that is being studied" (Reseach methodology n.d.). I looked for patterns in partnerships, practices and approaches. The qualitative data I collected

throughout my research helped me build frameworks and generate meanings of the data in the form of documented and suggested approaches and recommendations. I also aimed at enriching the literature lacking best practices in Europe, specifically related to urban forests and trees. The methodology helped me reach conclusions, generate valid theory as well as contribute to the field in the form of theoretical and practical recommendations. The research process during its evolution enabled me to constantly compare data and further investigate questions. I aimed to understand the current dynamics of bottom-up approaches to urban forest and tree projects.

## 3.2.Post-positivist research approach

My research is also reflecting the post-positivist and critical theory since my basic, preliminary findings were that the burdens of implementing urban forest and tree projects in cities follows a certain trend and eliminating obstacles requires further research and the exploration of alternative solutions. Current mechanisms and governance structures often negatively influence planning outcomes and a new coherent framework that can serve as a basis for scalable practices is necessary. My approach is post-positivist in a way that I hold the assumption that the directions my preliminary research took as well as my assumptions and ideologies influenced my research; therefore, I cannot objectively present every single detail of it as raw data. It also involves constructing the interviews together with the participants. The opinion I formulate by saying that certain embedded systems have to change in order to enable better ways of implementing urban forest and tree projects in cities and that there is a significant need to map and overcome obstacles were justified by the interviewees opinions on the subject. My research is interpretive building on case study-based qualitative analysis. “Interpretivists don't always abandon standards such as the rules of the scientific method; they simply accept that whatever standards are used are subjective, and therefore potentially fallible, rather than objective and universal” (Willis 2007). At the same

time, respecting that there is no universal truth (existentialist attitude towards research), theory can be built to enhance some general context for policies to be embedded into. The interconnected nature of economic, social and natural factors all influences the current context. These contexts (European, national, regional, city-level) further determine the decisions and perceptions of opportunities. Therefore, my approach also holds the assumption that besides the existence of no universal truth, the current context is also just a dimension valid at a specific time and place and that can be changed by actions taken in the good direction to reach aims – such as re-naturing cities for the ecosystem services nature provides.

### 3.3.Research questions

I aimed to contribute to the research on the implementation of NBS, focusing on urban forests and trees and to find answers via the investigation of projects and the following questions:

1 What is the general attitude towards partnerships for urban forest and tree projects at the municipal level?
2 Are urban forest and tree projects part of any explicitly stated NBS or GI strategy?
3 What are the partnership structures used for financing urban forest and tree projects?
4 What are the partnership structures used for installing and maintaining urban forest and tree projects?
5 What other factors incentivized and disincentivized the overall implementation of urban forest and tree projects?

### 3.4.Case study method – selection of cases

When scientists define generalizations, it means they must be truly universal, unrestricted as to time and space. The case study method refuses that assertions can be of enduring value context-free (Roger, Hammersley and Foster 2000). The introduction of the case-study method presented

by Roger points out a typical human attribute: the preference to categorize, generalize and control. However, it might result in avoiding learning small but useful steps and changes that in the long run, put together would change our practices more significantly than decisions based on generalizations only. Especially, regarding the fact and the existentialist point-of-view, I believe that spatial and temporal context matters so much that by the time we wish to apply general knowledge derived from studying a phenomenon in a specific context, it may in fact become invalid due to changes in the context our knowledge was derived from.

The reason for my case study analysis is not only to find best practices that work in one given context but finding efficient partnership models and alternative methods of financing that have broader applicability.

My selection of the cities for the case studies are justified by my familiarity with Budapest and I would like to see a stronger mechanism embedded in the system to create urban nature in addition to preserving what exists. Vienna was selected due to the comparability of the two cities and possibility for cooperation in the region through new financing channels, knowledge-sharing, cooperation, common strategy for the future, adapting from each other's' practices, pointing out gaps and trying to lead towards adaptive management of urban forests and trees. Utrecht was selected due to contacts with Naturvation researchers who suggested also including their city research on financing trees in my research. The selection of was also informed by desk research and by an initial research on forest and tree projects in each city. Evaluation of cases and categorizing them as best practice cases were based on comparison with other cases found during the desk research based on the importance of partnerships for financing and for installment and maintenance. In the best practice cases emphasis was on forming partnerships with different sectors and the project was successfully implemented. Furthermore, in all the best practice cases

educational factors played an important role, and partnerships were formed taking this value into account.

### 3.5.Semi-structured interviews

Interviewee selection was based on desk study focusing on partnerships in forest and by determining tree projects, and to answer whether urban forest and tree projects are explicitly present in an NBS or GI strategy at the city-level, I contacted all the municipalities, since municipalities are still the basis for collaboration and a major actor in projects related to urban forest and tree projects. Long-run success of different partnership structures can also be enabled by municipalities' approach on the long-run. I conducted interviews at all municipalities' responsible departments in person to find out about projects where collaboration or partnership served as a basis for implementation: establishment of the project and long-term maintenance. The preliminary research and snowball sampling were a way to also find interviewees for the semi-structured interviews who are involved in these projects. I conducted research with mainly one or two respondents at a time using a blend of mostly open-ended and to a lesser extent closed questions. These questions, due to the diversity of the answers and their depth were accompanied by follow-up 'why' and 'how' questions that were more process-oriented. Each interview lasted between one or two hours.

### 3.6.Data coding and analysis

I recorded the interviews based on agreement and confidentiality. Analyzing the interviews started by transcribing the interviews, focusing on main themes. Then, I categorized the information by bracketing and creating categories (hand coding) which later on helped me come up with the categories of the results and support the discussion section. The last step of the qualitative analysis of my transcripts was to interpret the meaning and interrelate themes and descriptions. My analysis

followed Creswell's line of analysis. Following the transcription of the recorded interviews, I in an undefined order read all the transcriptions. I took notes on a paper as I was reading them. After completing this with about half of the interviews, I listed all the topics that emerged during the interviews and clustered them. I abbreviated the topics by using one descriptive word for them and used it as a code. Then, I reduced the number of categories by grouping topics that are related. These categories then served as a basis for my analysis. I arranged the codes/themes into a conceptual map and wrote a narrative for each theme. These helped me formulate the results and discussions sections (Creswell and Creswell 2018).

### 3.7. Limitations of the research

I had started my research with the ambition to also obtain concrete financial data regarding the investments in urban forest and tree projects. However, neither the interviews nor the documents I received – for example related to the budget, balance sheets or accounting documents – show such items separately. Urban forest and tree projects at municipalities fall under the investment category in the balance sheet. The lack of specific financial information was not due to the unwillingness of respondents, but entirely due to the lack of detailed data. Also, the number of questions and the time of the actual research posed a limitation. Possibly my own insights and bias also influenced the nature of my research and research approaches as well which I have described in the methodology section regarding the theory I held throughout the research process.

## 4. Conceptual Framework

In order to analyze my case studies and present the most important themes answering my research questions contributing to the field, I created a conceptual model of stakeholders of urban forest and tree projects – for the sake of simplicity using urban trees as a concept in the framework – on which

later in the results and discussion section I build my analysis and which I use as a starting point for further practical recommendations.

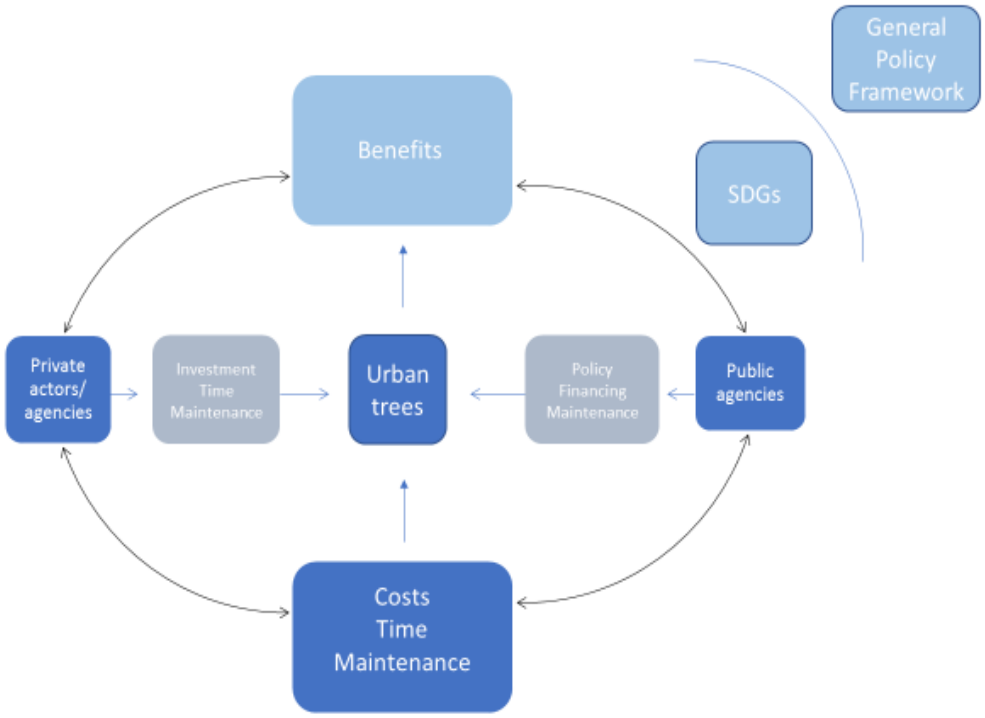


FIGURE 5. CONCEPTUAL MODEL OF STAKEHOLDERS AND CHANNELS OF CONTRIBUTION TO URBAN FOREST AND TREE PROJECT IMPLEMENTATION

The conceptual model aims to capture the different ways in which stakeholders may contribute to projects related to urban forests and trees and how the dynamics might affect these processes and how these benefit all the stakeholders. The benefits overall contribute to achieving the United Nation's Sustainable Development Goals, namely Goal 3. Good health and well-being, Goal 4. Quality education, Goal 6. Clean water and sanitation, Goal 10. Reduced inequalities, Goal 11. Sustainable cities and communities, Goal 13. Climate action, Goal 15. Life on land, Goal 17.

Partnerships for the goals. This is supported by the general framework of the European Union in the form of policies, strategies and support funds.

# 5. Results

## 5.1. Municipalities' approaches towards urban forest and tree projects

The following table lists the interviews I conducted at municipalities (capital city and district in Budapest) and further interviews with research institution or NGO employees. In the results and discussions sections I refer to the interviewees by their number listed in the table by which institutions can be tracked but the anonymity of the interviewee is protected.

| City | Occupation | Date of interview | Interviewee |
|---|---|---|---|
| Budapest | Employee of the municipality of Budapest | 27 May 2019 | Interviewee number 1 |
| Budapest | Employee of the municipality of Budapest | 30 May 2019 | Interviewee number 2 |
| Budapest | Employee of the municipality of Budapest | 30 May 2019 | Interviewee number 3 |
| Budapest | Employee of the municipality of Óbuda-Békásmegyer | 28 May 2019 | Interviewee number 4 |
| Budapest | Employee of the municipality of Óbuda-Békásmegyer | 28 May 2019 | Interviewee number 5 |
| Budapest | NGO employee in Budapest | 13 June 2019 | Interviewee number 6 |
| Utrecht | Employee of the municipality of Utrecht | 4 June 2019 | Interviewee number 7 |
| Utrecht | Researcher | 6 June 2019 | Interviewee number 8 |
| Utrecht | NGO employee in Utrecht | 5 June 2019 | Interviewee number 9 |
| Vienna | Employee of the municipality of Vienna | 20 June 2019 | Interviewee number 10 |

FIGURE 6. INTERVIEWS CONDUCTED

Budapest has a size of 56.6kha. According to data from Global Forest Watch, Budapest lost 176ha of tree cover between 2001 and 2018, which is equivalent to a 2.5% decrease since 2000. As of 2010, 7.0% of Budapest was natural forest cover. Natural forest cover is 3.98kha, plantations make up 2.89kha, and non-forest areas account for 49.7kha. According to the data of Global Forest Watch of 2010, tree canopy is less than 30% in the capital of Hungary. (Global Forest Watch n.d.)

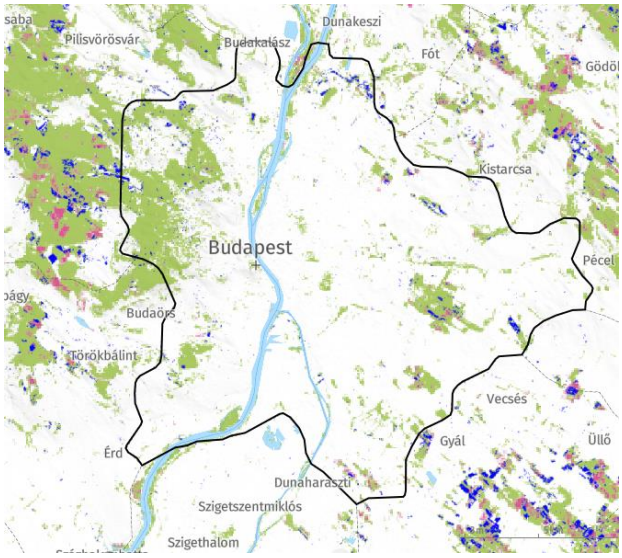


FIGURE 7. URBAN FOREST COVER IN BUDAPEST (GLOBAL FOREST WATCH N.D.)

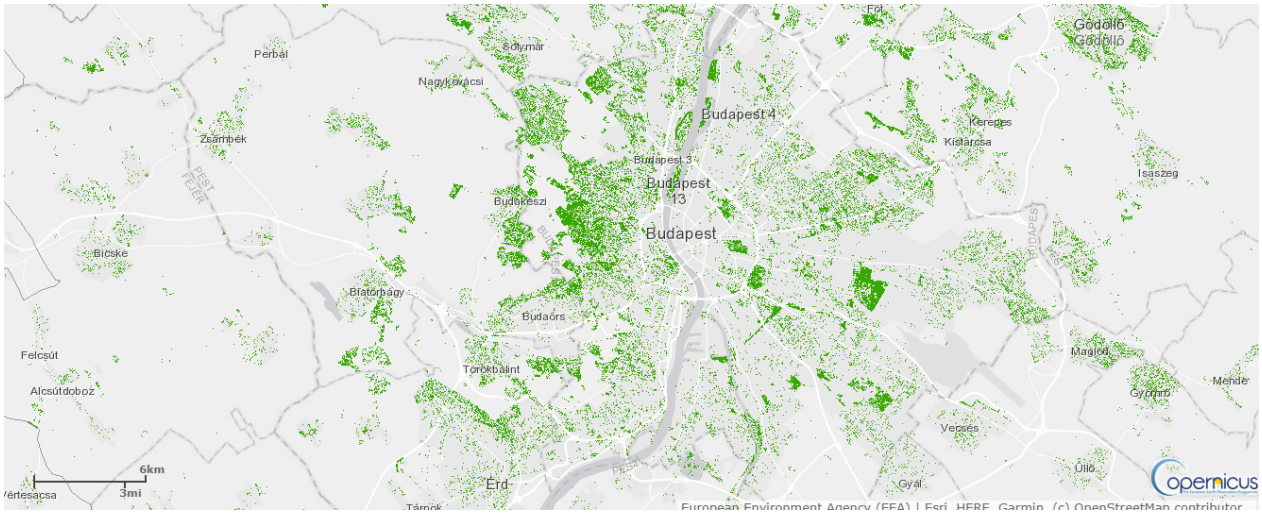


FIGURE 8. STREET TREES IN BUDAPEST (COPERNICUS PROGRAMME N.D.)

In Budapest, interviews helped me find answers from different levels of governance and NGO practice including attitudes, approaches, and practices related to partnerships for urban forest and tree projects. In Budapest the municipality of the capital city and the municipalities of the districts of Budapest operate separately regarding creating GI, including planting trees. There is no coherent strategy overarching the municipalities, neither at the municipality of Budapest. GI strategy exists in Hungary on a national level. There is no specific NBS agenda or climate change strategy in Budapest according to the interviews I conducted. According to Interviewee number 2 and 3 "a major problem is the segregated nature of decision-making among the different departments"[1]. Communication poses a challenge to come up with a coherent strategy. According to interviewee number 2 and 3 "there is no information and knowledge-sharing about the activities and the strategies with the departments"[2] According to interviewee number 2 and number 3 access to EU funds seems to face the obstacle of bureaucracy and experts' recommendations are evaluated with a delay and in many cases, application to funding is not possible due to their inability to meet the deadline because of the prolonged provisioning. Therefore, GI-related funds often become inaccessible.

The municipality of Budapest initiated a project named 10.000 trees for Budapest in 2016 with a strong communication campaign. The plan was to plant 10.000 trees in three years. The project entirely belongs and is managed by Főkert Zrt. which is owned by the municipality of Budapest. However, there is no partnership involved in the project, both the management and the financing are responsibilities of Főkert Zrt. According to interviewee number 1 "clashes of interests and more complicated maintenance"[3] are the reasons why alternative ways of financing and maintaining or

[1] "Az egyik legnagyobb probléma, hogy a döntéshozatal nagyon osztott a különböző osztályok között."
[2] "Nincs információcsere a tevékenységekről és az osztályok stratégiájáról."
[3] "érdekütközések és bonyolultabb fenntartás"

forming partnerships is not considered on the capital city level. Interviewee number 1 claimed that it would make the process more difficult. According to interviewee number 1, participation of citizens is not considered as an option; however, they try to communicate more openly to the public to prevent conflicts. Unfortunately, according to some analyses (Bardóczi 2016), the project's communication campaign was stronger than the capacity of what such a project could aim for. The project mainly aimed to mitigate conflicts that emerged as a result of depletion of nature across Budapest and the demolition of existing and valuable older trees. (Bardóczi 2016) According to certain estimates, the municipality of Budapest should and could have aimed for the immediate planting of 30.000 trees instead of 10.000. (Bardóczi 2016)

Interviewee number 1 has provided information on one of their current major undertakings which is reconstructing the inner yards of housing units in the center of Budapest. In those projects 75% of the costs are covered by the municipality and the housing unit has to pay 25%. The design is usually up to the management of the housing unit. In the discussion section I would like to make a recommendation regarding these projects.

Interviewee number 2 and 3 provided information on the project 'Management and Utilization of Urban Forests as Natural Heritage in Danube Cities' also includes the municipality of Budapest and the municipality of Vienna as a partner; however, it is mainly financed by the European Union. It is an ongoing project which started in June 2018 and will end in November 2020. Three European Union funds finance the project: ERDF, IPA, ENI. The total budget for the project, including all the participating cities is 2.8 million euros to which cities can contribute. The leading partner city is Europe's Green Capital as of 2016, Ljubljana. Each city's municipality and a forest management company must participate. This project is not exclusively a tree planting project but may enhance the partnerships and help the cities build strategies together for preserving biodiversity. It aims to

help partnerships in order to resolve conflicts and promote the importance and financial opportunities in green tourism. For example, in Budapest, the project aims to help restore and enhance the quality of the forest near Hármashatár hill and eliminate parking lots to create new patches of forest. As a final stage of the project, an ecosystem services analysis will be conducted. 85% of the Budapest project will be financed by the EU funds, 10% by the Hungarian state and 5% by the municipality of Budapest. According to interviewee number 2 and 3 turning parking lots near existing forests into patches of forests might be a successful approach in Budapest.

District municipalities operate separately regarding GI implementation as well as urban forest and tree planting. My interview with interviewee number 4 and 5 revealed that citizens of the district are often surprised that empty spaces are not planted; however, even within the district, many tree places and areas belong to the municipality of Budapest.

Vienna has a size of 41.7kha. According to data from Global Forest Watch, Vienna has lost 140ha of tree cover between 2001 and 2018, which is equivalent to a 1.4% decrease since 2000. As of 2010, 15% of Budapest was natural forest cover. Natural forest cover is 6.36kha, plantations make up 3.54kha, and non-forest areas account for 31.8kha. According to the data of Global Forest Watch of 2010, tree canopy is less than 30% in the capital of Austria. (Global Forest Watch n.d.)

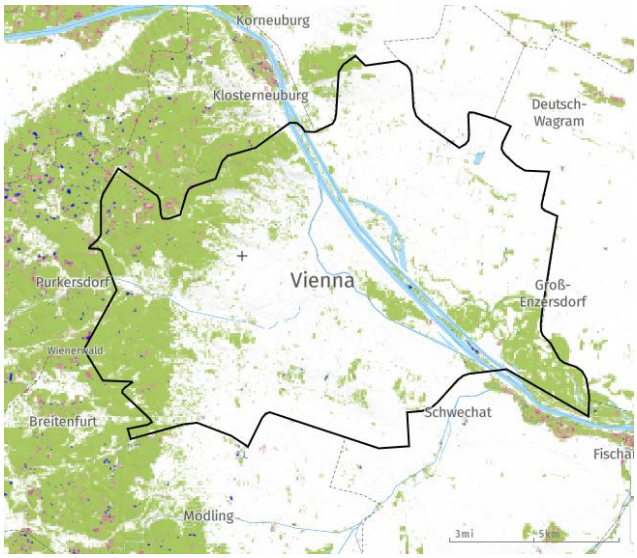


FIGURE 9. URBAN FOREST COVER IN VIENNA (GLOBAL FOREST WATCH N.D.)


FIGURE 10. STREET TREES IN VIENNA (COPERNICUS PROGRAMME N.D.)

In Vienna, strategy-making regarding urban forest and trees is more coherent as planting new trees or creating new green areas is the responsibility of the Forest Department of the Municipality of Vienna. Furthermore, according to interviewee number 10, "creating strategies always happens in collaboration with other departments" and there is information-sharing among departments. There is no NBS strategy, but there is a strategy for green spaces. The most recent of these strategies is included in the urban development plan called Step 2025 and both above-mentioned strategies are laid out in the plan. This usually contains a plan for new GI elements within the boundaries of the

city. However, according to my interviewee number 10, “the plans throughout the years have become less and less detailed on the map and more focused on overall visualization”. This usually makes the plan “more flexible and less strict”, hence, it hinders implementation and re-naturing of the city. This is one and “financing is another reason” why the city struggles to meet its desired goals. According to interviewee number 10 the “concept of climate change adaptation and social cohesion is explicit” both in the urban development strategies and the discussions while creating the strategies. Furthermore, the municipality works together with the community and local NGOs for urban forest and tree projects recognizing their impacts and putting an emphasis on them even if not within the NBS framework. One of their main partners is wienXtra, an educational NGO in the case of urban forest and tree projects. WienXtra works closely together with the municipality. Recently, according to interviewee number 10, the municipality has been trying to negotiate further afforestation projects with construction companies who are developing larger new areas. Project discussions have just recently been initiated following a regulation introduced two years ago. Connecting existing urban green areas is also one of the major pillars of the urban development strategy.

Utrecht has a size of 9.93kha. According to data from Global Forest Watch, Utrecht has lost 27ha of tree cover between 2001 and 2018, which is equivalent to a 2% decrease since 2000. As of 2010, 16% of Budapest was tree cover. Tree cover is 1.57kha and non-forest areas account for 8.36kha. According to the data of Global Forest Watch of 2010, tree canopy is less than 30% in Utrecht. (Global Forest Watch n.d.)

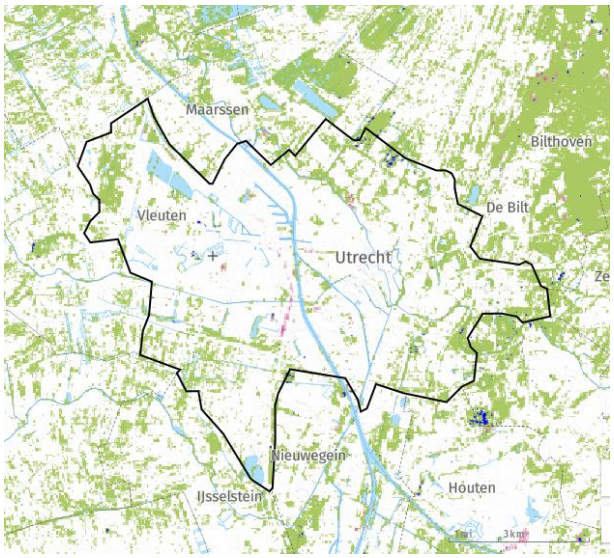


FIGURE 11. URBAN TREE COVER IN UTRECHT (GLOBAL FOREST WATCH N.D.)

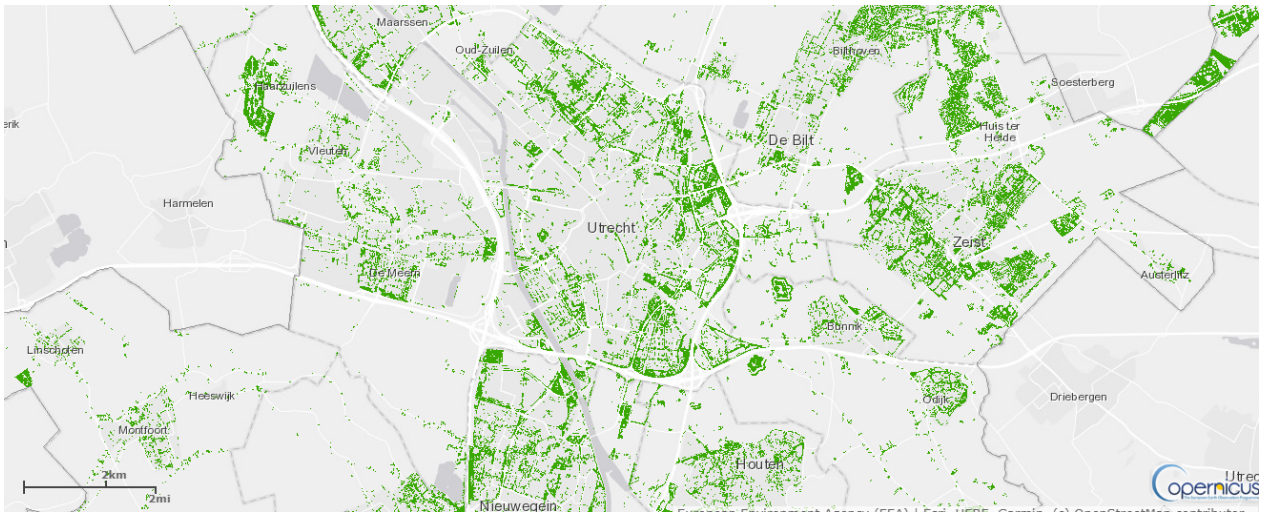


FIGURE 12. STREET TREES IN UTRECHT (COPERNICUS PROGRAMME N.D.)

According to interviewee number 7, in Utrecht, an explicit focus on both GI and NBS are present in the strategy of the municipality linking them to "climate change, health, socio-economic and socio-cultural benefits". The term 'NBS' was mentioned preceding the question on the existence of GI or NBS strategies. Utrecht participated in the Enroute city lab and in the MAES Urban pilot (2015-2016) in which, together with scientists, the municipality mapped out various ecosystem services in Utrecht resulting in a report. There is an existing Green Structure Plan for the city which includes GI and ecosystem services. There is an Agenda for Healthy Urban Living which serves as

an incentive to measure the effects of both private and public investments. With a green and blue framework that supports ecosystem benefits, Utrecht has an integrated and systemic approach that combines local climate regulation, noise reduction, recreation and cleaner air.

Green Structure Plan actions aim at sustainable urbanization also explicitly stating the role of trees in improving air quality, reducing urban heat island effect, and capturing CO2; or the positive influence of living nature for a healthier city according to interviewee number 7. Connecting green areas and creating new green areas is highly prioritized. There is an existing strategy called 2009 tree policy. Utrecht is currently working on a common framework for a multi-scale assessment of urban GI and urban ecosystem services which will provide an overview of policy opportunities and needs for connecting urban GI to local policy making. In the period 2007 to 2016, in addition to its own resources 23.4 million of third-party investments was realized according to resources I gained insight into via interviewee number 7. According to interviewee number 7 "due to the participation of residents and companies there is a growing share of private funds in green investments" which are assessed as an important factor in increasing the number of green spaces in the city. Furthermore, interviewee number 7 finds it important to mobilize investments via their personal network and colleagues' personal network as well. According to interviewee number 7, since national budget for GI disappeared, it is very important to tap into "resources of foundations". Moreover, a municipal Green Program stimulates funds and co-finances projects involving other partners, one of the major ones being IVN Utrecht which is one of the biggest educational NGOs with 1,300 involved IVN volunteers working on a greener society. The projects are in collaboration with a network of professionals: site managers, recreation sector, education, childcare, health institutions, governments and other partners.

## 5.2.Case studies for partnerships for finance, installment and maintenance

The following table shows the selected cases due to their partnership structure supporting the financing, installing and maintenance of the projects. The cases were selected as a result of the preliminary research focusing on urban forest and tree projects in the selected cities, followed by an analysis regarding the partnership structure, its diversity based on the conceptual framework, both regarding the financing of the project and its implementation.

| Case title | Description | Partners | Funding |
|---|---|---|---|
| Óbuda's district-level tree project | During the course of 10 years, the municipality of Óbuda-Békásmegyer is planting 10.000 trees in the district involving private partners, communities and citizens. | Municipality of Óbuda<br>Citizens<br>Local communities<br>Private investors | Municipality<br>Sponsors<br>Citizens |
| ObstStadt Wien – Fruit city Vienna | The association plants fruit trees in the city to provide citizens with free fuit for citizens emphasizing the environmental and health value of fruit trees. | ObstStadt Wien<br>Municipality of Vienna<br>Citizens | ObstStadt Wien<br>Municipality of Vienna<br>Sponsors<br>Citizens |
| Young Trees of the Young | Citizens, mostly families with children participate annually in the afforestation campaign "Forest of the Young Viennese" and to contribute to the creation of a new forest. | Municipality of Vienna<br>wienXtra<br>Citizens | Municipality of Vienna<br>wienXtra<br>Sponsors<br>Citizens |
| Tiny Forests | Tiny Forests are dense, native forests which are the size of a tennis court. They are the result of a strong financial and management collaboration for biodiversity and socio-ecological benefits. | IVN<br>National Postcode Lottery<br>The Tree Party<br>Municipalities<br>Hoek<br>Utrecht Naturlijk<br>Ludens | IVN<br>National Postcode Lottery<br>The Tree Party<br>Municipalities |

FIGURE 13. PARTNERSHIP STRUCTURE AND FINANCIAL RESOURCES OF SELECTED CASES

## Óbuda's district-level tree project

Within the framework of the Guckler Károly Environment Program between 2017-2019 which is part of an overarching Environmental Sustainability Program of Óbuda-Békásmegyer district, there is a tree-planting program which aims at planting 10.000 trees only in the district of Óbuda-Békásmegyer in the course of ten years together with the citizens of the district. Private properties and properties belonging to the municipality of the capital do not participate in the project. This case was specifically selected due to its high ambitions and its emphasis on community involvement. The annual volume of the tree planting of Óbuda-Békásmegyer is similar to the volume of the 'Forest of Young Viennese' project. Currently the district has 38.877 trees according to the tree cadaster of the district municipality. The initial stages of tree planting accounted for 351 trees in 2017, 1072 in 2018 and also the same 1072 is planned for 2019 to keep up with the plan. This program is a close partnership between the municipality of Óbuda-Békásmegyer, Óbuda-Békásmegyer Városfejlesztő Kft., local communities, citizens and private companies regarding both financing and installment of the project in the form of community tree planting. The tree planting is supported by experts and involves citizens, schools and other local communities. It serves educational purposes, and although interviewee number 4 and 5 say that it does not always reduce costs of installment and maintenance, community tree planting is beneficial for urban areas in the long-run due to its educational and awareness-raising purposes. Trees and money are donated by private companies and citizens, too. According to interviewee number 4 and 5 the communication campaign about the community involvement is successful and it mobilizes more sponsorship for the program. Citizens are also able to choose where the sponsored trees are planted. Processes sometimes have to be modified as a result of a continuous learning process, for example, as a at the beginning of the program, there was a completely unrestricted selection of tree types,

but it soon turned out that it may conflict the street view and types of trees have to be limited in certain areas.

FIGURE 14. COMMUNITY TREE PLANTING BY THE MUNICIPALITY OF ÓBUDA-BÉKÁSMEGYER (MUNICIPALITY OF ÓBUDA-BÉKÁSMEGYER 2019)

### ObstStadt Wien - Fruit Tree Project of Vienna

In collaboration with NGOs and the local community, the municipality of Vienna is planting fruit trees in order to re-nature the city, strengthen social cohesion, raise awareness about sustainable and healthy solutions for the urban environment as well as provide citizens with the opportunity to harvest the fruit. The financing model in this case is a simple 100 euro/tree, equally divided between contributors and the municipal department. There is partnership for finance involving citizens as well as for installment and maintenance in the form of community involvement.

FIGURE 15. OBSTSTADT WIEN - PLANTING FRUIT TREES (LOKALE AGENDA 2019)

### Afforestation campaign “Wald der jungen WienerInnen” – "Forest of young Viennese"

An afforestation action initiated by the municipality of Vienna plants 10.000 new native trees and shrubs such as oaks, lime trees and maples in areas with new forests together with the community and foresters every year. The reforestation activities are organized by the Department of Forestry and Agriculture of the City of Vienna in cooperation with the Department of Education and Extracurricular Youth Care. Partnership is formed with wienXtra for financing and organizing the annual tree planting project. There are private sponsors and citizens’ donations supporting the project. Installing and maintenance takes place based on a collaboration with citizens. The project puts emphasis on education and awareness raising.

### Tiny forests in Utrecht

Tiny Forests are a result of a financial and management collaboration of the National Postcode Lottery, IVN, municipalities, and the Tree Party, a Dutch NGO. Municipalities can apply for Tiny

Forests and implement the project in close collaboration with the partners. A Tiny Forest is a dense, native forest which stimulates biodiversity in the urban setting and offers opportunities to tackle climate change and to serve educational purposes and is of the size of a tennis court. Municipalities can apply for Tiny Forests and implement the project in close collaboration with the partners. Utrecht has four Tiny Forests as a result of the partnership. This project is possibly the best example for a diverse partnership portfolio both regarding financing, installment and maintenance. Planting the Tiny Forests takes place with community involvement and the existing forests serve educational purposes. According to interviewee number 9 "there are classes held outside, children can learn about native forests". The project relies on community maintenance mostly; therefore, "citizens can learn how to take care of nature"- according to interviewee number 9. Tiny forests not only support biodiversity which, according to interview number 9 is backed by scientific research, but there is a strong emphasis on social cohesion and awareness raising.


FIGURE 16. A TINY FOREST FOR BIODIVERSITY AND EDUCATION IN UTRECHT

FIGURE 17. A DENSE, NATIVE FOREST IN THE MIDDLE OF UTRECHT

## 5.3.Factors incentivizing the implementation of urban forest and tree projects

### Valuation of urban forests and trees

Interviewee number 8 revealed that research on the valuation of trees and creating an accounting system for valuing the economic and social value of trees is possibly the most important step towards mainstreaming partnerships for urban forest and tree projects. Payment for ecosystem services is an option, but for these the actual economic value of trees and the ecosystem services they provide must to be part of an accounting system. The valuation of trees would help policy-makers and decision-makers to incentivize partnerships for urban forest and tree projects.

### Recognizing and openly communicating challenges and opportunities among departments

"Creating networks of greenery in Utrecht is a response to challenges, including density, climate change, and health" – according to interviewee number 7. In Utrecht, the municipality departments closely collaborate with each other in order to fight these challenges. The first step is recognizing the challenges, formulating strategies and openly communicating them. Connecting the city

landscapes, creating new greenery, having tree projects is explicitly prioritized in Utrecht. This was supported by interviewee number 2 and 3 in the form of how the lack of communication among departments hinders the implementation of urban forest and tree projects. Interviewee number 4 and 5 stressed the need for better communication between departments so that cross-planning in the same urban space does not occur.

### Recognizing new ways of funding

Diverting from the traditional model which is financing trees exclusively from municipality funds is essential in the case of shrinking municipality budgets and more challenges facing cities according to my interviewee at the municipality of Utrecht. "The national government is not investing anymore in the city greenery due to policy changes" according to interviewee number 7 which further decreases the money available for greenery. The Dutch government handed over the GI implementation tasks to the provinces and the cities. "I always say to our city council that I make from one million two. Actually, I make from one million three, because the third million is from city programs" – my interviewee finds it important to activate personal networks for new ways of financing. "People have ideas and people are very involved in the maintenance" – the cost of maintenance can be minimized if there is community involvement at the same time enhancing social ties. Explicit business models also form the basis for effective projects because it helps define the pillars and the aims and the partners involved with detailed responsibilities. In the case of Vienna and Óbuda, the same principle formed the basis of those projects. According to interviewee number 10 financing of urban forest and tree projects is often enabled by the collaboration with the educational NGO, wienXtra. "Third Sector bodies are often able to access funding from a variety of sources which are unavailable to statutory bodies and government departments in the form of grants, awards and trust funds." (Whitehead, et al. 2017) According to interviewee number 4

"companies are happy to come and sponsor the tree planting project, because it is a good PR opportunity for them"[4].

### Regional collaboration

One of the major themes emerging during the interviews was the importance of regional collaboration regarding forest and tree project planning. Interviewee number 7 highlighted the "importance of different collaborations on regional and provincial level among cities", there is now "open communication and collaboration that did not exist before". Interviewee number 10 explained the importance of the similarity (peri-urban areas, size, layout) between Vienna and Budapest and how the two capitals could benefit from the proximity in creating strategies for climate adaptation by restoring urban nature and GI and also learning from each other's practices. According to interviewee number 10 the peri-urban forests existing near Vienna and Budapest "have a significance in protecting the cities and helps urban GI strategies in general". According to interviewee number 2 and 3 EU projects similar to the UrbforDan involving more cities may enhance collaboration, partnerships and communication that are all important for having more urban nature.

### Role of research

Interviewee number 4 and 5 explained the mechanism of how they initiated the project of Óbuda aiming at encouraging community involvement. "We conducted a thorough research on similar projects. We checked different projects around the world and tried to look at solutions and do



[4] "A cégek örömmel jönnek és szponzorálják a faültetéseket, mert nekik ez jó PR."

something that does not exist here yet"[5] – said interviewee number 5. Discussions followed the research period to design the project, its communication and implementation.

### Community involvement leading to awareness

In all the cases, citizens' participation was recognized as a key incentivizing factor because it not only raises awareness but is also able to reduce maintenance costs in the long-run and provide more support for urban trees. It may also increase costs, when education of local communities and citizens is the aim, but generally, in the long-run it provides more benefit. It also enhances further channels of financing in the form of sponsorship and donations. According to interviewee number 4 "our policy-makers appraised the importance of these projects because they enjoy social support."[6]

## 5.4. Factors disincentivizing the implementation of urban forest and tree projects

### Density of cities – management of tree places

A major concern in all the cities is density. This was mentioned as a problem by all the municipalities. In the city center, the tree places or management of tree places can be very expensive, according to interviewee number 7. According to interviewee number 4 and 5 there are many problems related to the available tree places such as surprises during the project, because theoretically available tree places are practically not available due to other projects or different green space developments. Furthermore, the trunk is often not removed following the cutting of the tree and it is costly, labor-intensive to remove it; additionally, it takes a few years until



[5] „Alapos kutatást végeztünk hasonló projektekről. Megnéztük, hogy milyen megoldások léteznek, hogy olyat csináljunk, ami itt még nem létezik."
[6] „Politikusaink felmérték, hogy van értelme, mivel társadalmi támogatottságot élveznek ezek a projektek."

conditions are satisfactory for tree planting there. Another concern in all the cities is the public utilities network; however, proper registry on it and precise update on any changes should enable the creation of new tree places.

### Property rights

In Budapest related to the strong division between the municipality of Budapest and the districts related to GI implementation and urban forest and tree projects, the problem of who owns the tree places came up. Within the boundaries of districts there are areas and available tree places that belong to the municipality of Budapest; therefore, cannot be utilized by the municipalities of districts. Also, interview number 10 said that "having more flexibility buying land" would be essential to obtain. There is currently a high bureaucracy which hinders the creation of green spaces.

### Social problems associated with real urban forests

In Utrecht as well as in Budapest, social problems associated with urban forests were mentioned as an obstacle that must be considered in the case of forest projects. In this case, communication is a key factor in finding a solution. In the case of creating one of the Tiny Forests in Utrecht, the project manager received emails from citizens claiming that creating the Tiny Forest will increase insecurity. Communicating that the size of the Tiny Forests are of a tennis court alleviated this concern. Furthermore, according to interviewee number 9 "there were workshops and platforms for discussions on the Tiny Forests with citizens" which cost a lot of money but resulted in the support of citizens.

### Obstacles related to applying for EU funds and grants

Although, there are EU funds available for GI, there are several obstacles when applying for them. In Vienna, according to interviewee number 10 due to the budget constraints resulting in the lack of staff, there is not enough capacity to monitor and apply for these funds. Furthermore, language was mentioned as a concern related to EU projects. Interviewee number 4 explained the problem of lack of language skills: "We had some project proposals which often did not receive funding, but there were some that received funding, but project partners withdrew. […] The difficulty with Interreg projects is that English knowledge is essential, if the project team lacks it, either they outsource project management, or not due to its costs. Project managers are expensive; therefore, these projects usually fail."[7]

## 6. Discussions

Interviews revealed that each city has a different approach to urban forest and tree projects. All cities acknowledge the need for more urban forest and tree cover; however, the interviews, the tone of the interviews, the different aspects on which interviewees focused showed essential differences. The approach of the municipality of Utrecht seemed to reflect the most enthusiasm and the themes of 'climate change', 'adaptation', and 'health and well-being' were clearly distinct and part of the explicit NBS strategy. Partnerships with the third sector was regarded as a way of tapping into new financial resources as well as serving educational purposes, exemplified by the Tiny Forests and the ObstStadt and the Forest of the Young Viennese cases. In Vienna, urban forests and tree

[7] "Voltak Interreges projektkezdeményezéseink, amik nem jutottak el odáig, hogy projekt legyen belőlük, mert általában nem nyertek támogatást. Voltak olyanok, amelyek nyertek, de azt követően a projektpartnerek léptek vissza. […] Az Interreges projektek esetében az a nehéz, hogy nyilván kell egy angol tudás, amely ha nincs meg, akkor kell külső projektmenedzser. De egy külső projekt menedzser drága, és ezért általában kudarcba fulladnak ezek a projektek."

projects are highly prioritized, there were several projects I have had the opportunity to discuss with interviewee number 10 and out of these I selected the ones focusing on partnerships the most explicitly. In the case of Vienna, educational purposes and community involvement were the focus of these projects as an investment for the future. In the project of Óbuda-Békásmegyer, a similar approach was adopted, placing considerable emphasis on community involvement and awareness-raising and attracting private companies' sponsorships. The municipality of Budapest regarded community involvement as an obstacle. Involving communities may be costly, especially when experts are needed to educate the public; however, it clearly has benefits in the long-run as supported by all the selected case-studies.

## 6.1.Recommendations

From the interviews I concluded that transparency is key in making projects work. Although, it seems to be obvious, communication of plans or strategies faces obstacles even within the same municipality and makes it difficult to implement urban forest and tree projects. Transparency and communication should be systematically integrated into the operation processes.

Many European cities face the problem of density and lack of space for urban forests. Managing and monitoring tree places well and using all the capacities still lacks efficiency. Improvement in maximizing the use of all the available places and creating new areas would be essential. In Budapest, the role of residential homes/owner occupied blocks might be able to play a role in re-naturing the city. These areas' reconstruction is supported by the municipality of Budapest and if conditions are suitable, trees could be planted instead of fountains and other grey infrastructure elements where conditions are satisfactory. As in the UrbforDan project, certain parking spaces still within the boundaries of the city could be transformed into natural areas and cultivated. In

Budapest, underground parking lots would solve the problem of parking in the city, and trees could be planted where there are currently above-ground parking lots.

EU funds available should be closely monitored and registered in a system on either a city or a national level to make access and selection more efficient. Furthermore, operative plans should be registered on a city level, since project implementation fails too often due to 'cross-planning'. The same area may be designed for different purposes and tree planting becomes impossible. Urban forest and tree projects enjoy priority if there is only one level of governance in a city and if existing trees and tree places are monitored and registered. There should be a solution for the precise registry of any changes of public utilities networks, as well. This is clearly a problem in all the selected cities, and often leads to projects failing.

Furthermore, the tree cadasters could be made publicly available for people to look at, monitor them, and make suggestions such as in the case of Melbourne where people can even email a tree. The municipality of Óbuda is planning on creating a well-working online tree cadaster with a similar idea as a result of research on the topic. Research and knowledge are key to mainstreaming NBS including urban forest and tree projects.

A one-layered governance structure supports the implementation of urban forest and tree projects due to a less fragmented decision-making process. Departments of municipalities need to find a methodology for collaboration and strengthen their communication enabled by workshops, forums, and other communication platforms. Formulating common strategies and forming partnerships and tapping into resources created by the networks that become available by these partnerships would contribute to the implementation of more urban forest and tree projects.

Partnerships need to be prioritized and initiated by municipalities. Networks provide new financial resources and if based on an explicit and well-formulated business model emphasizing the benefits

NBS including urban trees provide, these projects have the potential to be implemented. A strategy binding partners with clear roles and responsibilities supports implementation. Knowledge-sharing events, workshops and platforms should regularly take place in cities emphasizing the importance of urban forest and tree projects.

It is essential to recognize that community involvement – not only communicating towards citizens but enabling their active participation – make labor and further financial resources available. An action-oriented mindset is needed. The municipalities of Óbuda-Békásmegyer, Vienna and Utrecht seemed to be more solution-focused, whereas the interviews at the municipality of Budapest seemed to focus on factors that hinder the realization of projects.

## 6.2.Virtual Urban Nature Market/Fund

During my research period I came up with another practical recommendation with respect to all NBS, not exclusively to urban forest and trees. On a European level creating a virtual urban nature market could potentially foster urban nature projects. I am using the term virtual market, because certain aspects of it would show similarity to how a bank operates or how international carbon markets aim to cover the global emissions.

The principle is to create a European-level urban nature budget, from which money could be mobilized specifically for NBS projects. The NBS agenda of the European Union would provide both the scientific evidence and a firm policy setting.

It would have to operate on three levels. The European Union level besides providing the scientific and policy background would create a budget specifically for urban nature in the form of a fund. Each member state could create its 'sub-fund', too, into which additional financial resources could flow. On city-level, municipalities would have to have a 'fund and an account number' where

money for urban nature will flow and would have to have a database or registry, where they deal with the administration of the inflow of money.

Financial resources would be generated in several ways:

1. Private companies have a tax liability and they have an obligation of tax declaration. According to EFA (European Fundraising Association) almost all of their members and most European nations offer tax incentives for individuals and give tax relief to businesses. (European Fundraising Association 2018) This accounts for some of the deductible amounts based on which companies do not need to pay taxes. They can offer this deductible amount in the form of donations to the fund created by cities.

2. Citizens based on their income also have an obligation of tax declaration. Annually, in several countries there is a donation in the form of 'percentage philanthropy' (Bullain n.d.) which, in the case of Hungary for example, is based on the idea of offering 1% of the income tax as a donation to a freely selected charity, organizations, including non-profit organizations. The Urban Nature Fund could potentially be one of the selected targets of these donations. In countries where such systems do not exist, simple fundraising or donations could provide an additional financial resource.

3. Each member state could also support the system by offering a certain amount to urban nature which might be politically important, especially in the upcoming decades in which citizens of urban areas will experience the consequences of climate change, loss of biodiversity and pollution levels.

4. The European Union budget or fund would be specifically designed as a resource for funding NBS projects.

When an NBS project is initiated by a company or the city, the resources could be added together as a grant scheme, and after designing specific funding structures, support systems for each type

of NBS, the project managers could apply for support. For example, if a company designs a green wall, applying for a grant from the Urban Nature Fund would start the process, would have to be approved at the municipality-level as well as the European level and the project manager would be able to tap into extra resources both the ones donated by companies and citizens and the European Union fund-provided money.

An extension of this scheme could be creating a map where citizens could request more nature and companies aiming at strengthening their image could potentially meet the needs. This might enable more social cohesion and more collaborative design and management or urban nature.

## 7. Conclusion

This research aimed at contributing to knowledge on NBS, specifically urban forest and tree projects. Urban areas face social and environmental challenges due to extensive urban development often neglecting the use green infrastructure elements. Depletion of nature due to densification which is a major problem in all the examined cities, Budapest, Vienna, and Utrecht as well as other European cities threatens urban areas with the collapse of ecosystems, health risks and higher exposure to hazards of climate change. These critical issues can be addressed by 'multi-purpose' and 'multi-service' NBS. (N. N. Kabisch 2016b) Urban forest and trees belong to the green ecological domain of NBS. (Toxopeus and Polzin 2017) Across Europe, urban forest and tree projects are financed by municipal budgets which are shrinking. Therefore, new ways of financing through partnerships are essential. These partnerships are formed between citizens, NGOs, financial institutions and municipalities. My research contributed to the literature by addressing the call in literature for more best practice cases regarding partnerships. These partnerships generally aim for financing the projects and the installment and maintenance aspects of the implementation. The conceptual framework of this thesis provides a model on what stakeholders can support urban

forest and tree projects and in what ways. According to Kabisch, NBS implementation is effective if it promotes an integrated environmental performance, health and well-being, transferability and monitoring, and citizens' involvement. (N. N. Kabisch 2016b) These were major criteria when selecting the cases for urban forest and tree projects. The desk study, document analysis, and the interviews provided answers to whether in the selected cities there is an explicit NBS or GI strategy and how it supports urban forest and tree projects. Possibly, due to the nature of the semi-structured interviews and the various themes that emerged, the research has its limitations. There were recurrent themes to answer the questions on what incentivizes and disincentivizes the projects of urban forest and trees which I categorized in the results section.

The interviews draw attention to the importance of recognizing the challenges and formulating strategies for the successful re-naturing of cities. The research supported the role of the third sector pointed out by (Whitehead, et al. 2017) in forming partnerships. Both in the projects in Vienna and in Utrecht one of the major financing partners were educational NGOs. All the case studies proved the importance of community involvement, even if initial costs might increase due to the need for experts' knowledge and participation. Interviews revealed that involving citizens, local communities such as schools, benefits tree projects in the long-run, because they promote sponsorship and donations. Educational aspects of these projects have high significance due to being able to shape future approaches.

Future research might find different actors from the third sector supporting urban forest and tree projects or GI or NBS. Collaborations seem to play a significant role and different findings would enrich the literature by offering more alternatives. Research could monitor the success of these emerging partnership-based projects and should they encounter challenges, research could address finding the solutions from different case studies where those challenges were successfully tackled.

# References


Tamosiunas, A., Grazuleviciene, R., Luksiene, D., Dedele, A., Reklaitiene, R., Baceviciene, M., … and Milinaviciene, E.. 2014. Accessibility and use of urban green spaces, and cardiovascular health: findings from a Kaunas cohort study. In *Environmental Health*.

Annerstedt, M., Östergren, P. O., Björk, J., Grahn, P., Skärbäck, E., & Währborg, P.. 2012. Green qualities in the neighbourhood and mental health–results from a longitudinal cohort study in Southern Sweden. In *BMC Public Health 12.1*, 337.

Bardóczi, Sándor. Örüljünk-e Tarlós 'Tízezer új fát Budapestre!" programjának? In *Kettős Mérce.* 2016. Accessed: June 02, 2019. https://kettosmerce.blog.hu/2016/10/31/oruljunk-e_tarlos_tizezer_uj_fat_budapestre_programjanak?token=0438e0d6c6448c3499388eb3e513a60e

Bellard, C., Bertelsmeier, C., Leadley, P., Thuiller, W., & Courchamp, F. 2012. Impacts of climate change on the future of biodiversity. In *Ecology Letters 15(4)*, 365-377.

Brouwer, R., Brander, L., Kuik, O., Papyrakis, E., & Bateman, I. 2013. *A synthesis of approaches to assess and value ecosystem services in the EU in the context of TEEB.* Amsterdam: University of Amsterdam, Institute for Environmental Studies.

Bullain, N. Explaining Percentage Philantrophy: Legal Nature, Rationales, Impacts. ICNL.

Calfapietra, Carlo. 2019. Green Infrastructure: Nature-Based Solutions for sustainable and resilient cities. In *Urban Forestry & Urban Greening 37*, 1-2.

Copernicus Programme. Copernicus - The European Earth Observation Programme. Accessed: July 26, 2019. https://land.copernicus.eu/local/urban-atlas/street-tree-layer-stl.

Creswell, John W., and David J. Creswell. 2018. *Research Design Qualitative, Quantitative, and Mixed Methods Approaches.* London, UK: Sage publications.

Crutzen, Paul J. 2002. The anthropocene. In *Journal de Physique IV. Proceedings. Volume 12. No. 10.*

Daily, Gretchen. 1997. *Nature's Services. Societal Dependence on Natural Ecosystems.* Washington DC: Island Press.

European Fundraising Association. 2018. Tax Incentives for Charitable Giving in Europe. Accessed: 27 July, 2019. https://efa-net.eu/wp-content/uploads/2018/12/EFA-Tax-Survey-Report-Dec-2018.pdf

Emilsson, Tobias. 2017. Impacts of Climate Change on Urban Areas and Nature-Based Solutions for Adaptation. In *Nature-Based Solutions to Climate Change Adaptation in Urban Areas*, 15-27.

Escobedo, F. J., Giannico, V., Jim, C. Y., Sanesi, G., & Lafortezza, R. 2019. Urban forests, ecosystem services, green infrastructure and nature-based solutions: Nexus or evolving metaphors? In *Urban Forestry & Urban Greening 37,* 3-12.

European Commission. 2013. *Communication from the commission to the European Parliament, the Council, the European Economic and Social Committee and the committee of the regions.* Accessed 27 May, 2019. https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52013DC0249.

—. a. *Nature-Based Solutions.* Accessed 10 May, 2019. https://ec.europa.eu/research/environment/index.cfm?pg=nbs.

—. b. *What is Horizon 2020?* Accessed: 12 May, 2019. https://ec.europa.eu/programmes/horizon2020/en/what-horizon-2020

Food and Agriculture Organization of the United Nations. 2019. Accessed: 27 May, 2019. http://www.fao.org/3/a-i6210e.pdf.

Forzieri, G., Feyen, L., Russo, S., Vousdoukas, M., Alfieri, L., Outten, S., … and Cid, A. 2016. Multi-hazard assessment in Europe under climate change. In *Climatic Change*, 106.

Frantzeskaki, Niki. 2019. Seven lessons for planning nature-based solutions in cities. In *Environmental Science and Policy*.

Gascon, M., M. Triguero-Mas, D. Martínez, P. Dadvand, D. Rojas-Rueda, and A. Plasència. 2016. Residential green spaces and mortality: a systematic review. In *Environment International 86*, 60-67.

Global Forest Watch. *Global Forest Watch.* Accessed: 26 July 2019. https://www.globalforestwatch.org/.

Haaland, C., and van den Bosch, C. K. 2015. Challenges and strategies for urban green-space. In *Urban Forestry and Urban Greening*, 760-771.

Hansmann, R., Whitehead, I., Krajter Ostoić, S., Živojinović, I., Stojanovska, M., Jones, N., ... and Barstad, J. 2016. Partnerships for Urban Forestry and Green Infrastructure Delivering Services to People and the Environment: A Review on What They Are and Aim to Achieve. In *South-east European Forestry*. ETH Zurich.

Intergovernmental Panel on Climate Change. 2014. *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report*.

International Union for Conservation of Nature. 2016. *Nature-based Solutions to address global societal challenges*. Edited by E Cohen-Shacham, G Walters and C Janzen.

Kabisch, N., Frantzeskaki, S. Pauleit, S. Naumann, M. Davis, M. Artmann, D. Haase, S. Knapp, H. Korn, J. Stadler, K. Zaunberger, and A. Bonn. 2016b. Nature-based solutions to climate change mitigation and adaptation in urban areas: perspectives on indicators, knowledge gaps, barriers, and opportunities for action. In *Ecology and Society 21(2)*, 39.

Kabisch, N., Strohbach, M., Haase, D., & Kronenberg, J. 2016a. Urban green space availability in European cities. In *Ecological indicators 70*, 586-596.

Konijnendijk, Cecil C., Kjell Nilsson, Thomas B. Randrup, and Jasper Schipperijn. 2005. In *Urban forests and trees*. Springer.

Livesley, S.J., Mcpherson, E.G., Calfapietra, C. 2016. The urban forest and ecosystem services: impacts on urban water, heat and pollution cycles at the tree, street and city scale. In *Journal of Environmental Quality 45*, 119-124.

Lokale Agenda. Accessed: 18 May, 2019. https://www.agendadonaustadt.at/blog-detail/die-obststadt-waechst-weiter.htm.

Municipality of Óbuda-Békásmegyer. *Közösségi Faültetés.* 2019. Accessed: 28 June, 2019. https://obuda.hu/blog/hirek/kozossegi-faultetes-ismet-lehet-regisztralni/.

NASA. 2016. Accessed 02 June, 2019. *July 2016 Was the Hottest Month on Record.* https://earthobservatory.nasa.gov/images/88607/july-2016-was-the-hottest-month-on-record.

Oke, T.R. 1982. The energetic basis of the urban heat island. In *Quarterly Journal of the Royal Meteorological Society, 108(455),* 1-24.

Pearlmutter, D., Calfapietra, C., Samson, R., O'Brien, L., Krajter Ostoić, S., Sanesi, G., Alonso del Amo, R. 2017. *The Urban Forest, Cultivating Green Infrastructure for People and the Environment.* Cham. Springer International Publishing.

*Reseach methodology.* Accessed: 24 May, 2019. https://research-methodology.net/sampling-in-primary-data-collection/snowball-sampling/

Gomm, R., Hammersley, M., & Foster, P. 2000. *Case study method.* London: Sage Publications.

Toxopeus, H. S., & Polzin, F. H. J. 2017. *Characterizing nature-based solutions from a business model and financing perspective.*

United Nations, Department of Economic and Social Affairs, Population Division. 2018. *World Urbanization Prospects: The 2018 Revision.* Accessed: 25 May, 2019. https://esa.un.org/unpd/wup/

USDA Forest Service, Davey Tree Expert Company, Arborday Foundation, Society of Municipal Arborists, International Society of Arboriculture, Casey Trees, and SUNY College of Environmental Science and Forestry. *i-tree Eco tools.* Accessed: 29 June, 2019. https://www.itreetools.org/tools/i-tree-eco.

Van Ham, C., & Klimmek, H.. 2017. Partnerships for nature-based solutions in urban areas–showcasing successful examples. In *Nature-Based Solutions to Climate Change Adaptation in Urban Areas.* p. 275-289. Cham. Springer.

Whitehead, I., Hansmann, R., Lohrberg, F., Živojinović, I., Bernasconi, A., and Jones, N. 2017. The Role of Partnerships and the Third Sector in the Development and Delivery of Urban Forestry and Green Infrastructure. In *The Urban Forest. Future City*, by Pearlmutter D. et al. Cham. Springer.

Willis, Jerry. 2007. *Foundations of qualitative research : interpretive and critical approaches.* California, the United States of America: Sage publications.

World Health Organization. 2005. *Assessment Millennium Ecosystem. Ecosystems and human well-being.* Vol. 5. Washington DC. Island Press.

—. 2019. *Climate Change and Health.*Accessed: 25 May, 2019. https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health.

World Resources Institute. *Cities4Forests.* Accessed 30 May, 2019. https://www.wri.org/our-work/project/cities4forests.