Participatory Approaches in Nature-based Solution planning

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Participatory Approaches in Nature-based Solution planning:

A lesson-learned approach

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This work is dedicated to the resilient people of Sudan, including my own family, who embody strength in the face of adversity. Your spirit has left an indelible mark on this academic journey, and for that, I am eternally grateful.

Abstract (English)

The master's thesis delves into the exploration of novel solutions for urban planning, emphasizing participative and innovative approaches. The primary focus is on developing guidelines to enhance citizen involvement in Environmental and Community development projects.

In response to the escalating impacts of climate change, the imperative of climate justice in urban areas is paramount, necessitating a focus on marginalized communities, particularly those in low-income neighborhoods. Current research calls for submissions that deepen our understanding of how climate change mitigation policies align with the goals of urban social movements and address income gaps in cities. This integration of climate justice into urban planning is crucial for creating equitable solutions to climate change, prioritizing the reduction of socio-economic inequalities and aligning with the agendas of urban social movements.

The primary objective of this thesis is a comprehensive investigation into the implementation of participatory approaches within European Nature-Based Solution (NBS) initiatives. The study critically assesses the advantages and disadvantages of these approaches, distilling key insights and lessons learned, with a specific focus on a case study in Turin. The methodology employs a lesson learned and comparative analysis approach, involving preliminary research, literature review, comparative analysis of European NBS projects, and insights derived from a comprehensive review. The results underscore the importance of community engagement, long-term impacts, adaptability, and resilience in the face of challenges, collaboration across diverse sectors, educational programs, and awareness campaigns as crucial components. The programs prioritize comprehensive methods, integrating technical and non-technical interventions, considering both social and environmental factors, and emphasizing stakeholder engagement and community ownership. The findings contribute significantly to the discourse on climate justice in urban areas, highlighting the importance of participatory approaches in NBS initiatives and providing practical insights for urban planners, policymakers, and communities to address the challenges posed by climate change in urban settings.

Keywords: Participatory Approaches, Climate Change, Nature Based Solution, H2020, citizen involvement.

Abstract (Italian)
La tesi di laurea approfondisce l'esplorazione di soluzioni innovative per la pianificazione urbana, mettendo in luce approcci partecipativi e innovativi. L'attenzione principale è focalizzata sulla creazione di linee guida per potenziare il coinvolgimento dei cittadini nei progetti di sviluppo ambientale e comunitario. In risposta agli impatti in aumento del cambiamento climatico, l'imperativo della giustizia climatica nelle aree urbane è primordiale, richiedendo una focalizzazione sulle comunità svantaggiate, in particolare quelle nei quartieri a basso reddito. La ricerca attuale sollecita contributi che approfondiscano la comprensione di come le politiche di mitigazione del cambiamento climatico si allineino agli obiettivi dei movimenti sociali urbani e affrontino le disparità di reddito nelle città. Questa integrazione della giustizia climatica nella pianificazione urbana è cruciale per creare soluzioni equitabili al cambiamento climatico, dando priorità alla riduzione delle disuguaglianze socio-economiche e all'allineamento con gli obiettivi dei movimenti sociali urbani.

L'obiettivo principale di questa tesi è un'indagine completa sull'attuazione di approcci partecipativi all'interno delle iniziative europee di soluzioni basate sulla natura (NBS). Lo studio valuta criticamente i vantaggi e gli svantaggi di tali approcci, distillando insight chiave e lezioni apprese, con una specifica attenzione a uno studio di caso a Torino. La metodologia adotta un approccio basato sull'apprendimento dalle lezioni e sull'analisi comparativa, coinvolgendo una ricerca preliminare, una revisione della letteratura, un'analisi comparativa dei progetti europei NBS e riflessioni derivate da una revisione completa. I risultati sottolineano l'importanza del coinvolgimento della comunità, gli impatti a lungo termine, l'adattabilità e la resilienza di fronte alle sfide, la collaborazione tra settori diversi, programmi educativi e campagne di sensibilizzazione come componenti cruciali. I programmi danno priorità a metodi completi, integrando interventi tecnici e non tecnici, considerando sia fattori sociali che ambientali, e sottolineano il coinvolgimento degli stakeholder e la proprietà della comunità. Le conclusioni contribuiscono significativamente al dibattito sulla giustizia climatica nelle aree urbane, evidenziando l'importanza degli approcci partecipativi nelle iniziative NBS e offrendo spunti pratici per urbanisti, decisori politici e comunità per affrontare le sfide poste dal cambiamento climatico nelle ambientazioni urbane.

Parole chiave: Approcci Partecipativi, Cambiamenti Climatici, Soluzioni Basate sulla Natura, H2020, coinvolgimento dei cittadini.

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Abbreviations

CC	Climate Change
CR	Climate resilience
NBS	Nature Based Solutions
NBT	Nature-Based Thinking
CCM	Climate Change Mitigation
CCA	Climate Change Adaptation
DRR	Disaster Risk Reduction
EbA/ EbAp	Ecosystem based adaptation
ES/ ESS	Ecosystem services/ Ecosystem services solutions
UF	Urban forestry
PA	Participatory Approaches
IUCN	The International Union For Conservation Of Nature
GI	Green Infrastructure
BI	Blue Infrastructure
GBI	Green And Blue Infrastructure
Suds	Sustainable Urban Drainage Systems
EE	Ecological Engineering
Bmps	Best Management Practices
WSUD	Water-Sensitive Urban Design
LID	Low-Impact Design Solutions
ESS	Ecosystem Services Solutions
EGD	The European Green Deal
H2020	Horizon 2020
UF-NBS	Urban Forestry-Based Nature-Based Solutions

CHAPTER 01: INTRODUCTION

1.1BACKGROUND & PROBLEM STATEMENT

1.1.1 Climate change background

Climate change refers to the long-term alteration in global or regional climate patterns, primarily as a result of human activities such as burning fossil fuels, deforestation, and industrial processes. These activities release greenhouse gases into the atmosphere, leading to an increase in the Earth's average temperature, known as global warming. This increase in temperature has various impacts on the environment, including rising sea levels, more frequent and severe extreme weather events, changes in precipitation patterns, and the disruption of ecosystems. Furthermore, climate change poses significant risks to human health, food security, water resources, and economic stability. It is essential for society to address climate change urgently and take necessary measures to mitigate its effects and adapt to the changing conditions. With the increasing frequency and intensity of climate change-related events, it is crucial for individuals, communities, governments, and businesses to understand and respond to the challenges posed by climate change in order to build a more sustainable and resilient future for all. (Tomatis.,2023)

Climate change is one of the most important issues of our day. Local and global climate dynamics have been altered by human activity, and this impact is currently being felt. Temperatures have increased, weather patterns have changed, and biodiversity has been disrupted. (IPCC, 2023). It is crucial to comprehend the causes of climate change to address the issue effectively. The scientific community has reached a consensus with very high confidence that global warming is predominantly caused by human activities. The primary factor is the release of greenhouse gases, such as carbon dioxide and methane, from the burning of fossil fuels for energy, transportation, and industrial processes. Additionally, deforestation and other land-use changes contribute to the release of these gases.(Climate change, 2021).

The IPCC's 2023 report on climate change serves as the primary scientific contribution to COP28 and the Global Stock take, governments will assess the progress made towards achieving the goals outlined in the Paris Agreement. The research reaffirms that human activities are solely accountable for all global warming seen in the last 200 years, resulting in a present temperature

increase of 1.1°C above pre-industrial levels. This rise in temperature has therefore resulted to more frequent and perilous weather phenomena, causing escalating devastation to both humanity and the environment. The report emphasizes that each degree of warming will be accompanied by an increase in the frequency and intensity of extreme weather phenomena.

The research asserts that it is still possible to attain the 1.5°C limit and emphasizes the imperative need for decisive measures to be taken by all sectors and individuals at every level. The study emphasizes the urgent necessity for action that takes into account climate justice and prioritizes the creation of climate resilient strategies. It states that via the exchange of successful strategies, utilization of advanced technology, implementation of efficient regulatory measures, and allocation of adequate financial resources, any community may reduce or eliminate the use of carbon-intensive consumption techniques. To achieve the greatest improvements in well-being, it is crucial to prioritize the mitigation of climate risks for low-income and marginalized populations. (Climate change, 2023).

1.1.2 Climate change in urban areas

Climate change is an urgent worldwide problem that presents substantial difficulties for metropolitan areas and their inhabitants. The escalating frequency and intensity of extreme weather phenomena, such as heatwaves, storms, and flooding, are impacting urban areas and worsening pre-existing susceptibilities. Urban regions are more susceptible to the effects of climate change because of variables such as dense population, dependence on crucial infrastructure, and restricted resource availability. (Rosenzweig et al., 2018) High population density is a significant vulnerability of cities to climate change (Rodrigues & Santana, 2020). Consequently, a greater proportion of the population is susceptible to the hazards and consequences of climate change, encompassing heightened temperatures, inundation, and contamination. Furthermore, urban areas frequently lack the requisite infrastructure and resources to efficiently mitigate and adapt to these consequences. Moreover, metropolitan areas have a notable abundance of vital infrastructure, including transportation networks, electrical grids, and water supply systems. The running of cities and the well-being of their citizens depend on these vital infrastructures (Hu & He, 2018).

Nevertheless, they are extremely vulnerable to harm and disturbance caused by the consequences of climate change. For instance, the combination of escalating sea levels and heightened storm severity poses a significant threat to coastal towns, since it can result in floods and infrastructure deterioration. Similarly, heatwaves can exert pressure on electrical infrastructures and amplify the likelihood of power failures. The susceptibility of urban areas to the impacts of climate change is intensified by the constrained availability of resources (Croce & Tondini, 2022).

This include restricted availability of access to clean water, food, and healthcare services during severe climatic phenomena. To tackle these weaknesses, it is necessary to adopt a thorough and unified strategy (Jørgensen et al., 2014). Urban regions must formulate climate adaptation plans that take into account the distinct problems and attributes of cities (Voskamp et al., 2021). These initiatives must involve many stakeholders, such as local governments, community organizations, businesses, and people. Through collaboration, cities can strengthen their ability to sustain the consequences of climate change and increase their capacity for adaptation (Eichhorst et al., 2011).

1.1.3 Climate change Adaptation Strategies and Mitigation Measures in the cities.

The Intergovernmental Panel on Climate Change (IPCC) underlines the distinctiveness of mitigation and adaptation through its stated definitions. Mitigation has the capacity to influence the factors contributing to climate change and has been characterized as.

"*anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases*" (IPCC, 2014).

However, adaptation is aimed at decreasing the vulnerability of a specific area to the impacts of climate change and has been defined as.

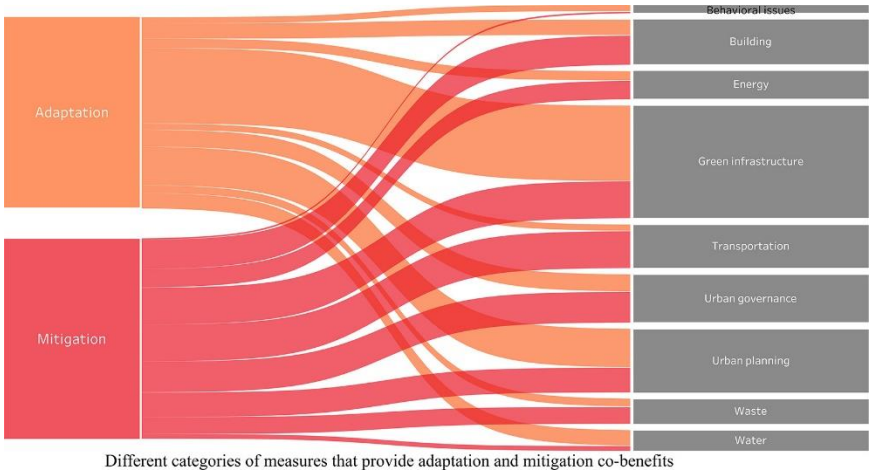
"adjustment in natural or human systems in response to actual or expected climate and its effects" (IPCC, 2014).

Based on the definitions provided, mitigation primarily focuses on addressing global, long-term issues, whereas adaptation aims to resolve local and short-term concerns.

1. Adaptation Methods: Adaptation involves adjusting social, economic, and environmental activities in order to minimize the negative effects of climate change. This include the establishment of strong infrastructure, alterations in land use planning, and the advocacy of sustainable resource management techniques. Within socio-ecological ecosystems, adaption methods may involve employing strategies such as the introduction of crops that are adaptable to climate changes, implementing steps to save water, and establishing early warning systems for predicting extreme weather occurrences. These adaptive methods directly enhance the capacity of ecosystems and communities to deal with changing climatic circumstances, guaranteeing their ability to sustain crucial activities and services.

2. Mitigation Methods: Mitigation strategies aim to diminish or avert the release of greenhouse gases in order to restrain the extent of climate change. This include shifting towards more environmentally friendly energy sources, advocating for sustainable practices in various businesses, and improving carbon sequestration by implementing afforestation or replanting methods. Within socio-ecological systems, the implementation of mitigation measures could result in indirect advantages by decreasing the total consequences of climate change. For instance, the use of sustainable land management methods may concurrently capture carbon, augment biodiversity, and bolster local livelihoods. Incorporating mitigation measures into adaptation methods effectively tackles the underlying factors of climate change while concurrently enhancing the ability to withstand its consequences. (Kongsager, 2018)

Integration of adaptation and mitigation methods might impact the overall vulnerability of socio-ecological ecosystems to climate change. Adaptation methods can specifically enhance the ability of socio-ecological landscapes to adapt and withstand challenges. (Pasimeni, 2019)



Different categories of measures that provide adaptation and mitigation co-benefits

Figure 1. 1 Co-benefits and synergies between urban climate change mitigation and adaptation measures

Consequently, enhancing adaptation in the system involves minimizing vulnerability to climate change, raising the risk threshold, mitigating negative consequences, enhancing beneficial ones, and fostering sustainable development. The ability to adapt varies significantly depending on the nations, regions, and socioeconomic demographics. The capacity to adjust is dependent upon several variables, including economic power, technological advancements, access to knowledge, institutional frameworks, and justice. In general, the process of designing and implementing adaptation methods is seen as essential and complementary to mitigation efforts. (Pinto, F. 2014)

1.1.4 Climate Justice in Urban Areas problem statement

As the effects of climate change become increasingly prominent, it is imperative to consider the concept of climate justice in urban areas. This involves recognizing and addressing the disproportionate impacts of climate change on marginalized communities, such as low-income neighborhoods and communities of color.

welcoming submissions that enhance documentation and enhance our understanding of how policies and practices aimed at mitigating climate change might be in line with the goals of emerging and established urban social movements, as well as the need to reduce income gaps in cities (Bulletin Board,2023). This approach to climate justice in urban areas emphasizes the need

to ensure that climate change mitigation efforts are aligned with the goals of urban social movements and prioritize reducing socioeconomic inequalities in cities. By integrating climate justice into urban planning and policy, cities can work towards creating more equitable and inclusive solutions to climate change. Climate justice in urban areas is essential to address the disproportionate impacts of climate change on marginalized communities, such as low-income neighborhoods and communities of color. To achieve urban climate justice, it is crucial to priorities reducing socio-economic inequalities and ensure that climate policies align with the agendas of new and established urban social movements.

"These frontline and environmental justice communities have been ringing the climate alarm bell for decades " (Bella, 2023).

If we are to heed the warnings of the international climate community within the next 11 years, we must better understand how climate change has the potential to impact each of our community members differently, and the consequences of planning for climate change without planning for climate justice. Maintaining a climate justice focus is indispensable in urban climate change planning and policy. The integration of climate justice into urban planning and policy is not only essential but also urgent. It is crucial to address the unequal impacts of climate change on marginalized communities, especially low-income neighborhoods and communities of color. By incorporating climate justice principles into urban planning and policy, cities can take significant strides towards creating more equitable and inclusive solutions to climate change.

Furthermore, it is imperative to prioritize reducing socioeconomic inequalities in urban areas and ensure that climate change mitigation policies are aligned with the agendas of both new and established urban social movements.

Additionally, it is crucial to acknowledge the longstanding efforts of frontline and environmental justice communities in raising awareness about the implications of climate change on their communities. Their voices and experiences are invaluable in informing effective climate change planning and policy that truly encapsulates the concept of climate justice.

Cities can move towards a more inclusive and equitable approach to climate change, ensuring that no community is left behind in the face of this global challenge. Climate justice activists also

emphasize regional and local action. Given how many justice issues are rooted in the process of planning and development, urban planners have the potential to seek bold and innovative pathways towards plans and policies that can protect communities from exacerbated contamination while contributing to the fight against climate catastrophe (cordova et al, 2022).

1.1.5 Lack of inclusive and climate policies in urban planning

Urban planning plays a crucial role in shaping the development and sustainability of cities (Zhao, 2015). However, there is often a lack of inclusive and climate policies in urban planning, which hinders the progress towards sustainable and resilient cities. This lack of inclusion and climate policies in urban planning results in a number of challenges. These challenges include a limited consideration of the needs and perspectives of marginalized communities, inadequate adaptation measures to address climate change impacts, and a failure to prioritize sustainable transportation and infrastructure (Aboagye & Sharifi, 2024).

This lack of inclusive and climate policies in urban planning leads to disconnection between humans and environment, fragmentation and degradation of urban areas, loss of biodiversity and ecosystem services, and increased vulnerability to climate-related calamities. Furthermore, the lack of inclusive and sustainable policies in urban planning impacts the already current gaps in society and the environment. Disadvantaged populations, who are disproportionately impacted by the effects of climate change, are frequently excluded from participating in decision-making procedures.

Figure 1. 2 goal 11 sustainable cities and communities

Furthermore, without inclusive and climate policies in urban planning, cities are not able to effectively address the challenges posed by climate change and achieve the United Nations' Sustainable Development Goal 11, which aims to make cities inclusive, safe, resilient, and

sustainable (Vicente et al., 2020). This lack of action in urban planning has significant consequences not only for the environment but also for the well-being and livelihoods of urban residents (Aboagye & Sharifi, 2024).

1.2 NATURE BASED SOLUTION

1.2.1 What are Nature-based Solutions?

Recently, there have been research and innovation projects at both European and worldwide levels to tackle the difficulties of Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR) using unconventional approaches. These initiatives use a more natural approach based on the principle of Do No Significant Harm.

The criteria for DNSH (Delayed Non-Sleepy Hypoxemia) are as follows: nature based solutions, as demonstrated by recent research (Faivre et al. 2017a), offer a range of advantages. They not only address climate change adaptation (CCA) and disaster risk reduction (DRR) like traditional methods, but also provide additional benefits such as protecting ecosystems, mitigating climate change, and promoting human health and well-being. Furthermore, these solutions are cost-effective measures.

Nature based solutions may frequently be used in conjunction with other forms of interventions. The acknowledgment of the essential function that ecosystems provide in sustaining human welfare is a core principle in the belief systems of several indigenous communities and has been demonstrated in long-standing traditional knowledge systems. (IUCN 2016)

However, it was not until the 1970s that the concept of environmental or ecosystem services gained recognition in contemporary scientific literature. By the 1990s, it became widely acknowledged that a more methodical approach was necessary to encourage the preservation, revival, and sustainable administration of ecosystems, while simultaneously considering the growing requirements for ecosystem services (Millennium Ecosystem Assessment, 2005). In the late 2000s, the term 'Nature-Based Solutions' emerged, signifying a subtle but significant change in perspective. It acknowledged that people could not only passively benefit from nature, but also

actively protect, control, or restore natural ecosystems as a deliberate and meaningful effort to tackle significant societal issues.

Nature-based Solutions definitions

In the last seven years, there has been a noticeable increase in the expression and understanding of Nature-Based Solutions (NBS), highlighting a development in the intellectual discussion on sustainable environmental practices. This period of time has seen a significant improvement and growth in the definitions of NBS (Nature-Based Solutions), including a range of environmentally conscious techniques and tactics designed to tackle complex environmental concerns.

"Nature-based Solutions refer to measures taken to protect, responsibly manage, and rehabilitate natural or modified ecosystems, with the aim of tackling Addressing social difficulties in a flexible and efficient manner, while also promoting both human well-being and biodiversity benefits".(IUCN 2016)

"NBS are living solutions inspired by, continuously supported by, and using nature. They are designed to address various environmental challenges in a resource efficient and adaptable manner and to provide simultaneously economic, social and environmental benefits' (*Habitat international" 64 2017)*

"*A pure nature-based solution is a solution (to a certain issue) that is completely based on elements and direct inputs from nature, thus not managed by mankind nor containing any human/industrial element*"(Schaubroeck, T. 2018)

"Nature-based solutions as being powered by nature and restoring natural flows in cities, create novel ecosystems that require multi-actor collaborations for their design and sustainability" (Frantzeskaki, N.2019)

Nature-based solutions (NBS) is a concept, defined as actions inspired by, supported by, or copied from nature that: (1) deploy various natural features and processes in a resource efficient and sustainable manner; (2) are adapted to local systems and (3) face social, environmental, and economic challenges, leading to multiple benefits and supporting sustainable development and resilience. (Kolokotsa, D., Lilli, A. 2020)

The term NbS has been defined and utilized in several manners. For instance, the International Union for Conservation of Nature (IUCN) and the European Commission have collaborated to create. Their respective interpretations of NbS, although generally aligned (since they both aim to tackle big social issues by utilizing ecosystems and their services efficiently), exhibit a few notable distinctions (refer to Table 1). The definition provided by IUCN highlights the importance of a properly managed or restored ecosystem as the central component of any Nature-based Solution (NbS). On the other hand, the definition given by the European Commission is slightly more inclusive and places greater emphasis on implementing solutions that not only utilize nature but are also influenced and supported by nature. (IUCN 2016)

IUCN definition	European Commission definition
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	Living solutions inspired by, continuously supported by and using Nature designed to address various societal challenges in a resource efficient and adaptable manner and to provide simultaneously economic, social and environmental benefits. (Maes & Jacobs, 2015)

Table 1. 1 IUCN's and the European Commission's definitions of NbS (IUCN 2016)

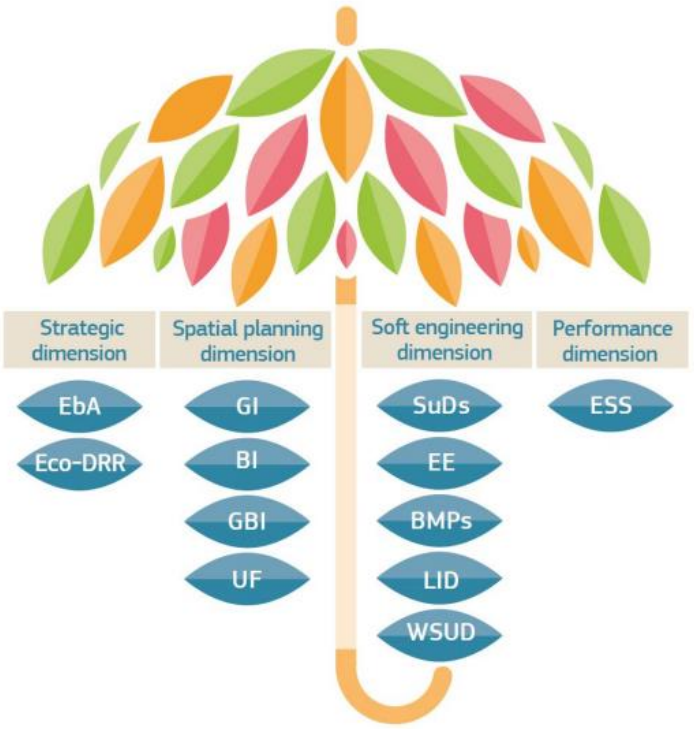


Figure 1. 3 The NBS umbrella concept (European Commission. et al. 2021)

These acts are derived from nature or imitate it, utilizing its inherent characteristics and processes, such as carbon storage and water regulation, to attain desired objectives, such as

mitigating catastrophe risk and enhancing human well-being while preserving the environment.

Social inclusion. The concept of NBS includes several strategies for adapting and building resilience in socioecological systems, with equal emphasis on social, environmental, and economic aspects. Nature-based solutions (NBS) contain all the previously employed categories that convey comparable concepts rooted in Ecosystem-based Approaches (EbA) and Ecological approaches to Disaster Risk Reduction (Eco-DRR). These solutions aim to construct and design in harmony with nature, with the objective of adapting to climate change. Based on strategic considerations, there are several dimensions of spatial planning, including urban forestry (UF), green infrastructure (GI), blue infrastructure (BI), and green and blue infrastructure (GBI). Additionally, there are soft engineering dimensions such as Sustainable Urban Drainage Systems (SuDS), Ecological Engineering (EE), Best Management Practices (BMPs), Water-Sensitive Urban Design (WSUD), and Low-Impact Design solutions (LID). Lastly, there are performance dimensions such as

Ecosystem Services Solutions (ESS). The key characteristic shared by all NBS practices is their inherent sustainability. This sustainability is manifested in three ways: natural sustainability, which involves the promotion of biodiversity and support for the CCA process; economic sustainability, which entails a return on investment through the prevention of extreme events and the creation of new employment opportunities; and social sustainability, which involves enhancing resilience to climate change impacts, improving health quality, and fostering social cohesion. (European Commission. et al. 2021)

1.2.2 The conceptual context of nature-based solution

Nature based solutions principles

The first list of principles for Nature-based Solutions (NbS) in the 2013-2016 IUCN Programme (IUCN, 2013b). It is important to incorporate a set of NbS principles alongside the NbS concept in order to achieve a comprehensive understanding.

Regarding the matter of Nature-based Solutions (NbS) for the International Union for Conservation of Nature (IUCN). The eight NbS principles that have been proposed are as follows:

Nature-based Solutions:

1. Embrace nature conservation norms (and principles)

2. Can be implemented alone or in an integrated manner with other solutions to societal challenges (e.g. technological and engineering solutions)

3. Determined by site-specific natural and cultural contexts that include traditional, local and scientific knowledge

4. Produce societal benefits in a fair and equitable way, in a manner that promotes transparency and broad participation

5. Maintain biological and cultural diversity and the ability of ecosystems to evolve over time

6. Applied at a landscape scale

7. 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

8. Integral part of the overall design of policies, and measures or actions, to address a specific challenge. (IUCN 2016)

1.2.3 Categories and examples of Nbs approaches

In framing NbS and considering its applications, it is useful to think of it as an umbrella concept[1] that covers a whole range of ecosystem-related approaches all of which address societal challenges. (Sowińska-Świerkosz, B.,2022) These approaches can be placed into five main categories (table 1.2)

Category of NbS approaches	Examples
Ecosystem restoration approaches	Ecological restoration Ecological engineering Forest landscape restoration
Issue-specific ecosystem-related approaches	Ecosystem-based adaptation Ecosystem-based mitigation Climate adaptation services Ecosystem-based disaster risk reduction
Infrastructure-related approaches	Natural infrastructure Green infrastructure
Ecosystem-based management approaches	Integrated coastal zone management Integrated water resources management
Ecosystem protection approaches	Area-based conservation approaches including protected area management

Table 1. 2 Categories and examples of NbS approaches (IUNC 2016)

[1] See Figure 1.3 The NBS umbrella concept (European Commission. et al. 2021)

Nature based solution's goals

It included in the European Union's 'Research and Innovation policy agenda for Nature-Based Solutions and Re-Naturing Cities'

The approach relies on four main goals to tackle nature-based solutions, which are:

- Enhancing sustainable urbanisation through nature-based solutions can stimulate economic growth as well as improving the environment, making cities more attractive, and enhancing human well-being.
- Restoring degraded ecosystems using nature-based solutions can improve the resilience of ecosystems, enabling them to deliver vital ecosystem services and also to meet other societal challenges.
- Developing climate change adaptation and mitigation using nature-based solutions can provide more resilient responses and enhance the storage of carbon.
- Improving risk management and resilience using nature-based solutions can lead to greater benefits than conventional methods and offer synergies in reducing multiple risks.

The European Commission and Member States are advised to pursue seven nature-based solutions acts under the category of 'Research & Innovation', in line with the four goals mentioned above (Morello, E&Mahmoud, I 2018)

- Urban regeneration through nature-based solutions
- Nature-based solutions for improving well-being in urban areas
- Establishing nature-based solutions for coastal resilience
- Multi-functional nature-based watershed management and ecosystem restoration
- Nature-based solutions for increasing the sustainability of the use of matter and energy
- Nature-based solutions for enhancing the insurance value of ecosystems
- Increasing carbon sequestration through nature-based solutions

The term NBS includes a broad range of ideas, each with its own objectives and solutions that need unique skills. Experts from several fields analyze NBS from different disciplinary perspectives. It covers several methodologies and perspectives.

Professionals involved in the production process include politicians, engineers, naturalists, botanists, geologists, urban planners, landscape designers, and other experts.

Various methods to NBS exist, each targeting different sectors and possessing the ability to address multiple social challenges concurrently.

In order to compare different types of NBS, implemented in different environments and at varying scale we need to measure the same variables, using the same methods and report these outcomes using the same units of measure. (European Commission. et al. 2021)

The 12 challenge areas elaborated herein are:

Climate Resilience: Nature-based solutions have the ability to enhance resistance to the effects of climate change by providing ecosystem services and promoting social awareness and actions to mitigate climate change. The co-benefits provided by nature-based solutions (NBS) help in both mitigating and adapting to climate change. This is especially beneficial in urban settings, since it enhances the overall quality of life in cities.

Water Management: Nature-based solutions provide a promising chance to tackle a range of problems related to human-induced effects on the water cycle. These factors include substandard water quality and the accessibility of water for extraction purposes. The topics covered include the levels of groundwater and surface water, the recharging of aquifers, the management of stormwater, the treatment of water, the management of wetland habitats, the management of soil water, and the quality of the ecosystem.

Natural and Climate Hazards: Risk is the amalgamation of both hazard and adverse outcomes. Nature-based solutions used for disaster risk reduction are anticipated to decrease the amount of risk by addressing the many components that contribute to it. Hazard or vulnerability. Simultaneously, NBS provide additional social, human, and environmental co-benefits. The expansion of this issue category was influenced by the progress made in the "Coastal Resilience"

problem area, as outlined in the impact evaluation methodology of the EKLIPSE Expert Working Group (Raymond et al., 2017). To include a broader range of climate-related and natural hazards.

Green Space Management: Green space management refers to the strategic organization, creation, and maintenance of green and blue infrastructure inside urban areas. Urban green infrastructure, often known as UGI, refers to the combination of green and blue elements in a city. Urban green infrastructure (UGI) is a special category of nature-based solutions (NBS) that focuses on the carefully planned network of natural and semi-natural ecosystems found inside urban areas. The UGI (Urban Green Infrastructure) offers a variety of environmental and societal advantages (Raymond et al., 2017)[2]. When well controlled, it helps address many issues such as air and noise pollution, heat waves, floods, and public well-being concerns (Maes et al., 2019). NBS promote the broader implementation of environmentally friendly and water-related infrastructure (EC, 2019a; EC, 2019b), therefore endorsing the EU Green Infrastructure Strategy (EC, 2013) and the EU Biodiversity Strategy for 2030 (EC, 2020).

Biodiversity Enhancement: The urgent dangers that society confronts include the depletion of biodiversity and the breakdown of ecosystems. The key factors contributing to the loss of biodiversity include alterations in land and sea utilization, as well as overexploitation. Climate change, pollution, and invasive alien species. The relationship between climate change and biodiversity loss is characterized by a feedback loop in which climate change intensifies the depletion of natural resources, which in turn significantly contributes to climate change. The NBS actively endorse the EU Biodiversity Strategy for 2030 (EC, 2020) by deliberately creating protected areas and rehabilitating damaged ecosystems. The promotion and preservation of biodiversity was taken into account as a component of the Green Space Management issue in the EKLIPSE Expert Working Group's methodology for evaluating impact (Raymond et al., 2017). In this context, we consider Biodiversity Enhancement as a separate field of concern.

Air Quality: Nature-based solutions (NBS) have a significant impact on improving air quality in human-dominated areas. They achieve this by creating, enhancing, or restoring ecosystems, which

[2] A framework for assessing and implementing the co-benefits of nature-based solutions in urban areas. Environmental Science & Policy, 77, 15-24.(2017)

effectively remove air pollutants and carbon dioxide. Additionally, NBS help reduce the air temperature, resulting in a slower rate of temperature increase. By reducing the formation of secondary pollutants and raising oxygen levels, this process contributes to an advantageous atmospheric composition that supports human existence.

Place Regeneration: Urbanization has a long-term effect on the natural environment of urban areas, which is evident not only in the deterioration of infrastructure but also in the expansion of the environmental impact caused by economic growth and unsustainable consumption habits.

Knowledge and Social Capacity Building for Sustainable Urban Transformation: Acquiring resources for sustainable urban areas can be facilitated by educational efforts that enhance knowledge and social capacity building. This problem area is an additional component to the initial ten difficulties outlined in the EKLIPSE Expert Working Group impact evaluation methodology (Raymond et al., 2017).

Participatory Planning and Governance: Nature-based solutions require planning and governance frameworks that promote access to green areas while ensuring the preservation of their quality for the supply of ecosystem services. The process of transforming urban environments is a challenging task that requires inclusive and cooperative governance, as well as strong capabilities for engaging in participatory planning.

Social Justice and Social Cohesion: Studies have found a connection between nature-based solutions and environmental justice. These studies investigate how providing equal access to green spaces in urban areas can promote social cohesion and cultural integration among typically marginalized social groups, such as the elderly, immigrants, and persons with disabilities. This is known as recognition-based justice. (Raymond et al., 2017)

Health and Wellbeing: Climate change impacts critical health determinants such as clean air, safe drinking water, adequate food, and secure shelter. Over half the world lives in. The number of urban residents is expected to rise to 2/3 by 2050. [3]Climate change and environmental challenges impact all populations but are especially severe in metropolitan regions where most people reside.

[3] https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health

Climate change, poor air quality, and other challenges can disrupt urban living and cause public health issues by affecting services like sanitation.

New Economic Opportunities and Green Jobs: The primary factors that determine the efficacy of NBS are their ability to deliver cost-effective solutions while also providing environmental, social, and economic advantages to assist the development of resilience. The adoption and implementation of Nature-Based Solutions (NBS) has the ability to provide fresh economic prospects and employment in the environmentally friendly industry. This is achieved by facilitating low-carbon, resource-efficient, and socially inclusive growth in the economy.

1.3 RESEARCH OBJECTIVES

The primary objective of this thesis is to conduct a comprehensive investigation into the implementation of participatory approaches within European Nature-Based Solution (NBS) initiatives. This study aims to critically assess both the advantages and disadvantages of these approaches. Through this evaluation, the goal is to distill key insights and lessons learned from existing projects. Additionally, the thesis will focus on the application and refinement of these insights to devise novel methodologies, particularly through an in-depth case study based in Turin. This case study will not only exemplify the practical application of participatory approaches in an NBS project but also serve as a model for their potential enhancement and adaptation in similar urban environmental contexts. the objectives are listed below:

1- Provide a comprehensive overview of all the participatory approaches concerning Nature-Based Solutions (NBS).
2- Explore the challenges and obstacles associated with inclusive approaches in addressing Nature-Based Solutions and how they make people involved.
3- Understand the lessons provided by the Eu projects and propose new ones for Turin

1.4 THESIS STRUCTURE

1.0 The chapter forms an introduction to the thesis's work.

1.1 The first section defines the background and problem statement. (1.1.1) Climate Change is one of the biggest challenge our worldwide society is facing and is going to confront for the years to come. Human activities have a crucial role in this process that has caused some irreversible impacts to nature and people, such as the loss of natural capital and biodiversity and the increase in severity and frequency in multiple climate hazards. (1.1.2 Global urban centers have pressing issues as a result of climate change, which manifests in increased occurrences of severe weather events. These challenges are exacerbated by characteristics such as high population density, reliance on key infrastructure, and limited resources. Urban areas, which accommodate a substantial worldwide population, encounter vulnerabilities such as rising temperatures, floods, and pollution, which are worsened by inadequate infrastructure and resources. Climate-induced disruptions, such as floods and power failures, pose a significant threat to vital metropolitan services, including transportation, energy, and water supply. Urban vulnerability is exacerbated by the restricted availability of resources, such as uncontaminated water, nourishment, and medical assistance, during severe weather occurrences. (1.1.3) A brief of the Intergovernmental Panel on Climate Change (IPCC) differentiates between mitigation and adaptation, defining mitigation as efforts to reduce greenhouse gas sources or enhance sinks, while adaptation involves adjustments in response to climate effects. Mitigation focuses on global, long-term issues, while adaptation addresses local, short-term concerns. (1.1.4) problem statement of Urban climate justice is crucial as climate change impacts. This includes acknowledging and tackling climate change's disproportionate impacts on low-income and minority populations. Climate change mitigation measures should support urban social movements and alleviate socioeconomic inequality. Climate justice in urban design and policy is essential for fair and inclusive climate change responses. Mitigation measures must prioritize urban social movement aims and reduce city inequities, according to this strategy.(1.1.5)1.2 a brief of the definition of the nature based solutions , principle and approaches 1.3 The research objectives: 1- participatory approaches concerning Nature-Based Solutions (NBS). 2- inclusive approaches in addressing Nature-Based Solutions how they make people involved. 3- lesson learnt .

2.0 The chapter forms an literature review of participatory approaches.

2.1 The participatory approach: what is it and why is it useful? Explored in four points (2.1.1) definition of participatory approaches through the years (2.1.2) Principles of Participation, The effectiveness of participatory development in achieving its goals depends, to some extent, on how it is carried out. (2.1.3) Degrees of Participation, a brief of the ladder of citizen participation, developed by Sherry Arnstein. (2.1.4) Participatory Approaches categories. 2.2 framework for the participatory approach, (2.2.1) Key features of participatory assessment, (2.2.2) Participatory assessment of urban NBS, five acts steps provide the operational foundation for engaging in participatory assessment of urban Nature-Based Solutions. (2.2.3) Participatory approach for NBS design, Cooperative planning in projects increases solution depth and dependability through co-design, allowing for early stakeholder participation. Co-creation, stressing local insights and democratic procedures, develops community bonds, necessitating ongoing public participation for effective Nature-Based Solutions.

3.0 The chapter shows a methodology of the thesis's work.

3.1 The methodology consists of four essential steps for a thorough investigation and extraction of significant insights on the integration of Nature-Based Solutions (NBS) and participatory approaches, with a particular focus on European Projects. 1- Research, 2- Analysis, 3- Comparison, 4- lessons learent. 3.2 Four different case studies in Turin dealing with nature based solutions projects. 3.3 Comparison table of the Nature based urban case studies.

4.0 The chapter deals with European projects.

4.1 Horizon 2020 program and horizon Europe projects, exploring 21 projects in Horizon 2020 as it is facilitating the achievement of research and innovation goals through its focus on outstanding scientific work, industry leadership, and addressing societal issues. 4.2 New European Bauhaus. is an interdisciplinary effort that focuses on environmental, economic, and cultural issues. It intends to solve climate change concerns by using sustainable design principles, which correspond with EGD targets to reduce greenhouse gas emissions by 55% by 2030. 4.3 Comparative analysis of 44 reviewed case studies.

5.0 The chapter forms a Results and Discussion of the thesis.

5.1 lessons learned and suggestions. the importance of community engagement is crucial across all efforts, including strategy, design, implementation, and on-going participation. This emphasis on community engagement is consistent with the recognition that nature-based initiatives prioritize not only immediate results but also long-term effect and sustainability. 5.2 Recommendation for Turin case study. Recommendation for what Turin projects lacks. 5.3 Guidelines for enhancing the citizen participation in environmental and community development projects.

6.0 The chapter forms a conclusion and future developments

CHAPTER 02: LITERATURE REVIEW

2.1 THE PARTICIPATORY APPROACH: WHAT IS IT AND WHY IS IT USEFUL?

2.1.1 Definition

Participatory methods and strategies have become essential tools for community development since their beginnings in the 1970s. These strategies have been utilized in several settings and sectors, such as livestock management, village health promotion, and watershed management.

Topics of expertise include: management, urban sanitation services, impact evaluations, gender awareness, and developing micro-credit groups. The promotion of participatory approaches to development is based on the belief that they facilitate efficient project execution and improve the welfare of impoverished individuals. (Duraiappah, & Parry 2005)

A participatory approach is a method or approach that emphasizes the active involvement, participation, and engagement of all actors or stakeholders in a given process or project (Chu & Luke, 2020). It considers the perspectives, experiences, and knowledge of those involved, recognizing that they hold valuable insights and expertise. Using a participatory approach allows for a broader understanding and deeper insights into complex human behavior or issues, as it takes into account the diverse perspectives and contexts of the individuals involved. Using participatory approach is important because it promotes inclusivity, collaboration, and co-creation (Wilkinson & Wilkinson, 2017). It empowers individuals and communities by giving them a voice and ownership in decision-making processes. It also increases the likelihood of project outcomes that are suitable for local circumstances, enhance community ownership, and foster societal harmony and social learning (Fahy, 2015).

Participation is a commonly used term in contemporary debate, and its meaning varies depending on the specific circumstance. During training, students derive advantages by actively engaging in the task being taught, so acquiring knowledge via practical experience. Participation in community work involves taking ownership of the whole community, including individuals who often remain silent, in making decisions that impact the community's future.

Participation implies "empowering people to mobilize their own capacities, be social actors, rather than passive subjects, manage the resources, make decisions, and control the activities that affect their lives."

(Cernia 1985)[4]

Participation is the process through which stakeholders' influence and share control over priority setting, policy-making, resource allocations and access to public goods and services.

(World Bank)[5]

The organized efforts to increase control over resources and regulative institutions in given social situations on the part of groups and movements hitherto excluded from such control.

(Pearse and Stiefel, 1979)[6]

2.1.2 Principles of Participation

The effectiveness of participatory development in achieving its goals depends, to some extent, on how it is carried out. Effective involvement must be carried out in a manner that is aware of:

- The mode of participation;
- The participants to be involved and the manner in which they should be involved;
- The institutional structure within which local people operate. (Duraiappah, & Parry 2005)

[4] International Institute for Sustainable Development (IISD), 2005
[5] World Bank. 1994. Participatory Development Toolkit. World Bank. Washingto
[6] Participatory approaches to research and development in IIED: Learning from experience, Oct. 1, 2001, pp. 7-12

Moreover, effective participation relies on observing to many fundamental principles, as outlined in Egger and Majeres (1998): [7]

- **Inclusion** – of all people, or representatives of all groups who will be affected by the results of a decision or a process, such as a development project.
- **Equal Partnership** – recognizing that every person has skill, ability and initiative and has equal right to participate in the process regardless of their status.
- **Transparency** – all participants must help to create a climate conducive to open communication and building dialogue.
- **Sharing Power** – authority and power must be balanced evenly between all stakeholders to avoid the domination of one party.
- **Sharing responsibility** – similarly, all stakeholders have equal responsibility for decisions that are made, and each should have clear responsibilities within each process.
- **Empowerment** – participants with special skills should be encouraged to take responsibility for tasks within their specialty, but should also encourage others to also be involved to promote mutual learning and empowerment.
- **Cooperation** – cooperation is very important; sharing everybody's strength reduces everybody's weaknesses.

2.1.3 Degrees of Participation

The ladder of citizen participation, developed by Sherry Arnstein, is a conceptual framework that illustrates the different levels of citizen involvement in government activities. It serves as a tool for understanding the extent to which residents can actively participate in decision-making processes and have a meaningful impact on policy development. The ladder consists of eight rungs, each representing a different level of citizen participation. At the lowest rungs of the ladder are forms of non-participation, such

[7] International Institute for Sustainable Development (IISD), 2005

as manipulation and therapy, where citizens have no real power or influence over the decision-making process.

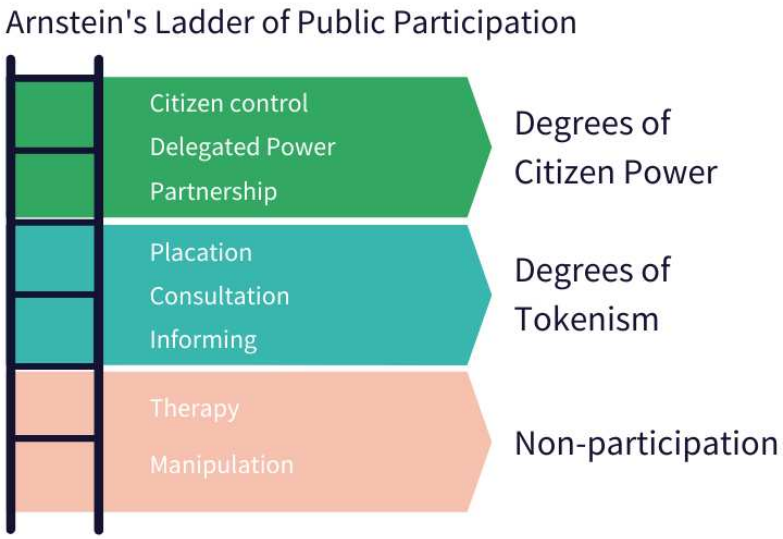


Figure 3. 1 A Ladder of Citizen Participation," Sherry Arnstein, Journal of the American Planning Association

[8]At the intermediate rungs, citizens have the opportunity to provide input and be consulted but ultimately do not have the power to make decisions. At the highest rungs of the ladder, citizens have control and decision-making power, actively shaping policies and determining outcomes (Caluwaerts et al., 2020). At the highest rungs of the ladder, citizens are involved in activities such as co-governance and citizen control, where they have a direct and influential role in shaping the decisions that affect their lives.

These levels of participation are characterized by collaboration, partnership, and mutual respect between the government and the citizens. Understanding the ladder of citizen participation is crucial for both government officials and citizens. For officials, it provides a framework for evaluating and enhancing citizen engagement practices, while for citizens, it serves as a tool for advocating for increased involvement in decision-making processes. By promoting higher rungs

[8] Arnstein's ladder, the degrees of citizen participation https://www.commonplace.is/blog/arnsteins-ladder-of-citizens-participation-explained

of the ladder, governments can ensure that policies and programs are truly reflective of the needs and desires of the people they serve. (Arnstein,1969).

1. Manipulation

Participation is orchestrated by people in authority to manipulate the public into believing that a predetermined initiative or program is superior.

2. Passive participation

Local participation is achieved through the dissemination of information on upcoming or past events. The information is derived from external "experts" who offer, exchange, and evaluate it. Hence, the information being disseminated is exclusive to foreign expertise.

3. Participation in information giving

This approach to participation is one direction, where individuals participate by responding to questions presented by extractive researchers using methods such as questionnaire surveys. Participants are notified of their entitlements. Individuals are assigned tasks and choices, but they are not provided with the chance to impact the course of events, as the results are not disclosed nor verified for correctness.

4. Participation by consultation

A two-way information flow involves local people being consulted and outsider agents listening to their perspectives. Though participants might provide advice and share opinions, concerns, their feedback may be used or not. External agents set issues and solutions, which can be adjusted based on participant feedback. A consultation procedure does not limit decision-making power and experts are not required to consider public opinions.

5. Functional participation

People create organizations to achieve initiative goals. Local participation happens later in the project, rather than before significant choices are made. cycle. Established groups rely on external initiators and facilitators but may eventually become self-sufficient.

6.Interactive participation

Active participation in collaborative analysis leads to action plans, new or strengthened local institutions. It often uses multidisciplinary methods. viewpoints and use organized learning methods. As locals acquire authority over decision-making, they have a larger stake in keeping their established institutions and traditions. A recurrent issue is that vulnerable individuals and groups often remain mute or passively consent.

7. Partnership

Negotiation fairly distributes power between locals and power holders. Equally valued workers make decisions together. pursuing a common goal and maximizing everyone's well-being. There is shared accountability and risk-taking in planning and decision-making.

8. Self-mobilization/active participation

People take system-changing initiatives without external institutions. They establish connections with other institutions for resources and technical guidance, while maintaining control. how resources are used Self-mobilization and collective action may or may not challenge unequal wealth or power distribution.[9]

[9] which originates from

-Arnstein, S. R. (1971). Eight rungs on the ladder of citizen participation. Citizen participation: Effecting community change, 66-91.

-Pretty, J. N., & Pimbert, M. P. (1995, February). Beyond conservation ideology and the wilderness. In Natural Resources Forum (Vol. 19, No. 1, pp. 5-14). Oxford, UK: Blackwell Publishing Ltd.

-Wilcox, D. (1994). Community participation and empowerment: Putting theory into practice. Rra Notes, 21(1), 78-83.

-Duraiappah, A. K., Roddy, P., & Parry, J. E. (2005). Have participatory approaches increased capabilities?. Winnipeg: International Institute for Sustainable Development.

-Bass, S., Dalal-Clayton, B., & Pretty, J. (1995). Participation in strategies for sustainable development. London: IIED.

2.1.4 Participatory Approaches

Throughout time, several participatory methodologies have been created to address the requirements of various fields, environments, and goals. Communities and organizations serve as the foundation for future achievements. (Duraiappah, & Parry 2005)

- **Rapid Rural Appraisal:** Implemented to get knowledge promptly, efficiently, precisely, and perceptively as a foundation for growth planning and implementation.
- **Participatory Rural Appraisal:** A sequence of activities that prioritizes regional expertise for rural planning.
- Participatory Poverty Assessments: Used to gain insights into poverty via the lens of many stakeholders, with a special focus on the poor themselves.
- **Participatory Action Research:** Used to empower individuals and improve cooperation, while also accelerating the acquisition of information and promoting social change.
- **Appreciative Inquiry:** The theory states that the previous achievements of people, communities, and organizations serve as the foundation for future success.

2.2 FRAMEWORK FOR THE PARTICIPATORY APPROACH

2.2.1 Key features of participatory assessment

Participatory monitoring and assessment is a process that involves the active involvement of urban stakeholders, especially marginalized voices, in a science-policy interaction. It is characterized by an iterative approach in (Van der jagt & Buijs 2023):

- Defining shared monitoring goals and objectives.
- Participatory indicator selection.
- Participatory data collection.
- Participatory data analysis and evaluation.

Participatory development of assessment approaches offers a multitude of advantages. Firstly, it facilitates evidence-based planning by promoting the use of indicators.

Furthermore, it aids in the production of novel and pertinent facts and concepts, hence enhancing the ability for organizational learning and institutional performance. Furthermore, including civil society in monitoring and assessment might effectively utilize the concepts of sense of place, social cohesion, biocultural diversity, and social learning.

Furthermore, it enhances stakeholder dedication to monitoring and fosters a collective feeling of responsibility for this process.

Also, it enhances the agency of excluded stakeholders via the acquisition of enhanced skills and knowledge, the cultivation of social capital within the community, and the adoption of a more interconnected approach to the management of local environments, taking into account the customs, traditions, and perspectives of the people involved.

Furthermore, the inclusion of local knowledge and values in the co-produced assessment indicators might enhance urban nature-based solutions (NBS) by fostering stronger public support and ultimately improving the design and management processes of NBS. (Van der jagt & Buijs 2023).

2.2.2 Participatory assessment of urban NBS

These five acts steps provide the operational foundation for engaging in participatory assessment of urban Nature-Based Solutions (NBS). Implementing the action framework will enhance the mutually beneficial connection between nature-based thinking (NBT) and contextualized and politicized assessment: (Artmann, M., and K. Sartison. 2018) (Van der jagt & Buijs 2023)

1- Participatory monitoring and assessment begins with stakeholder mapping and choosing who to involve at which level. Ideally, a fair number of stakeholders from governmental institutions, academia and research organizations, civil society organizations, community leaders, and the commercial sector should participate. A genuine approach is possible using supportive methods.

2- Creating a credible indicator portfolio linked with locally relevant societal concern areas and desired scale(s) of measurement is the next stage in participatory monitoring. This should provide basic descriptive information on necessary data, measuring process, scale, unit, and citizen science scope.
3- Based on the co-defined monitoring goals and objectives, the assessment coordinator selects a portfolio indicator first. Selection criteria are used to ensure that each indicator is (1) aligned with a locally relevant societal challenge and measurement scale(s), (2) relevant to the urban context, (3) suitable for monitoring NBS impacts within the measurement period, and (4) requiring no specialist expertise beyond (short- and long-term) organizational resource availability for monitoring and assessment. Also consider indicator data needs.
4- Public institutions, civil society, academia, and the commercial sector attend a stakeholder indicator evaluation workshop to provide comments on the pre-selected indicators used for final selection. Manage indicator numbers and minimize technical details to make this event easy.
5- The last stage, beyond any current urban NBS evaluation system, is to use politicized and contextualized assessment standards. This is done at the overall level of the (preliminary) assessment approach, which includes all indicators and measurement techniques from the indicator appraisal workshop.

2.3 Participatory approach for NBS design

The cooperative planning of a project improves the depth and reliability of its solutions. Co-design procedures can begin at different phases of a development process, enabling the early and simultaneous gathering of design input together with stakeholder mapping. During the co-design phase, it is crucial to take into account the context, objectives, and phases of the project, which allows for the use of methodologies that are most suitable for the specific project. (Mahmoud, I. H., Morello, E., Ludlow, D., & Salvia, G 2021).

Co-creation procedures provide fundamental advantages by including a wide range of knowledge sources, improving transparency, and fostering community connections during the development phase. Utilizing local insights is highly helpful for developing innovative ideas and effective solutions, building meaningful connections, and molding perceptions. Stakeholder mapping and engagement in the early phases entail soliciting input from representatives and doing extensive outreach to ensure that stakeholders are well-informed and actively participating in the process of change. The essence of co-creation is in the stages of action, placing emphasis on the process of making decisions while adopting Nature-Based Solutions (NBS). This involves concepts such as balancing power, employing democratic procedures, fostering mutual learning, and utilizing suitable technologies.

Co-design is a collaborative strategy that combines researchers, designers, and end-users working together to generate solutions that are appropriate for the specific situation. This approach encourages collective creation. Public engagement primarily takes place during the co-design phase, but it should be incorporated throughout the whole co-creation process to empower communities and strengthen their commitment to place co-management. The development of effective Nature-Based Solutions (NBS) depends on enhancing the collaborative generation of knowledge and organizational structures via continuous learning and mutual respect (Ferreira, I., Lupp, G., & Mahmoud, I 2023).

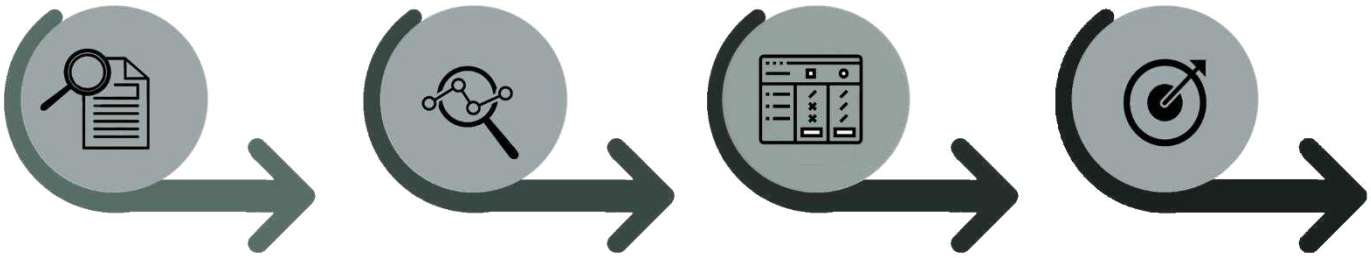
This design method often has seven phases, which include:

1- Cooperative planning of circumstances - setting the framework and engaging citizens.

2- Self-expression is a powerful tool that may inspire and empower individuals.
3- Presentation involves the effective transmission of objectives and the creation of potential situations.
4- Design/brainstorming is the process of conceiving and exploring several ideas, followed by the selection of the most suitable solutions.
5- Engage in purposeful and definitive actions - participate in conversations, dialogues, and strive to reach consensus.
6- Prototyping refers to the process of conducting experiments and tests in an actual real-world environment.
7- Systematize refers to the process of organizing and structuring tasks in order to be better prepared for subsequent iterations and upcoming stages. (Ferreira, I., Lupp, G., & Mahmoud, I 2023).

CHAPTER 03: Methodology

3.1 METHODOLOGY



The first phase	The second phase	The third phase	The fourth phase
Research	**Analysis**	**Comparison**	**lessons learent**
Literature review that was carried on both for Nature based solution projects and for participatory approaches, with a particular focus on participatory approaches used on NBS European projects.	The European projects and focused on the projects sponsored by Horizon 2020 (H2020) and innovative New European Bauhaus initiatives, reflecting a commitment to align with cutting-edge developments in urban interventions.	Consideration and a comparison table analysis of the Eu projects	Provide insights through the lesson learned approach, Validating the best practice lesson learned from Eu project on how to improve the citizen engagement on Turin case study

.

The methodology consists of four essential steps for a thorough investigation and extraction of significant insights on the integration of Nature-Based Solutions (NBS) and participatory approaches, with a particular focus on European Projects. Every phase is carefully planned to build on the preceding one, guaranteeing a comprehensive and rigorous research.

1- Preliminary research and review of existing literature in participatory approaches:

Conducted a comprehensive investigation of case studies and literature, specifically examining initiatives related to Nature-Based Solutions and participative techniques.

Acquired extensive knowledge on the use of participatory approaches in European nature-based solutions (NBS) projects, with a focus on current urban intervention strategies.

This phase established a fundamental understanding of the present condition of NBS projects and participatory approaches, and they were serving as a basis for later evaluations.

2- Comparative analysis of the European projects:

Conducted a careful evaluation of European projects, notably focusing on efforts funded by Horizon 2020 (H2020) and the innovative New European bauhaus initiatives. According to European Commission, European Research Executive Agency, (2022).[10]

The selection criteria for projects are delineated as follows:

1- Funding Source: Preference is given to projects sponsored by Horizon 2020 (H2020) and innovative New European Bauhaus initiatives, reflecting a commitment to align with cutting-edge developments in urban interventions.
2- Frontrunner cities.

[10] European Commission, European Research Executive Agency, (2022). Nature-based solutions : EU-funded nbs research projects tackle the climate and biodiversity crisis, Publications Office of the European Union. https://data.europa.eu/doi/10.2848/42098

3- Thematic Emphasis: Priority is accorded to projects addressing the pivotal themes of co-creation and social inclusivity.
   A. Climate and water resilience projects
   B. Inclusive urban regeneration
   C. International restoration and rehabilitation of urban ecosystem
   D. Improve wellbeing and health
   E. New NBS governance ,business , financing models and economic impact assessment tool
   F. Carbon neutral and improved air quality

Provided a dedication to integrating with innovative improvements in urban interventions,

demonstrating awareness of the most recent progress in the field.

3- Creating a detailed comparative analysis table to extract important insights and enhance

comprehension of the strengths and flaws identified in different projects, The analysis applies to a total of 20 initiatives and 44 pilot projects from 157 pilot.

Based on what type of nature based solution (NBS) Approach used , Ecosystem type, The main objective of the Project, Challenges faced the projects, outcomes, What is impact on the environment, and how the community engagement involves in the project.

4- Provide insights through the lesson learned approach:

Developed definitive conclusions from a comprehensive review of European initiatives, extracting significant insights learned.

Applied a method that centered on extracting important lessons from past experiences to provide well-informed recommendations for integrating effective strategies from EU initiatives into the special circumstances of Turin, Italy.

This phase not only acts as a result of the study but also enhances the actual implementation of lessons learned from successful European efforts in the Italian context, therefore improving the importance and efficiency of NBS and participatory methods in Turin- Italy.

This technique guarantees a comprehensive examination of NBS initiatives and participatory approaches in the Italian urban setting by following a structured evolution of three phases. It ultimately provides practical insights and recommendations for successful implementation.

3.2 CASE STUDIES

3.2.1 The Living Lab: Mirafiori Sud.

ProGlerg – Turin Italy

The Mirafiori Sud neighborhood of Turin will serve as the project's Living Lab. With 40,000 residents and a diversity of socioeconomic classes, it was once a working-class neighborhood situated on the Sangone River. Because of its vibrant local associations, rich cultural legacy, and vacant industrial buildings that may be used for new community projects, the neighborhood has a lot of promise for urban regeneration.The creative ideas are being tested and implemented in all of Mirafiori Sud's schools. Families and locals will be able to actively participate in the development of their own neighborhood through this.

Figure 3. 2 Mirafiori sud district with sangone river - the pictures from the ProGIreg website (proGIreg project 2022)

The Mirafiori district shows risks as well as significant opportunities that might be crucial in its transformation through the effective application of various Nature-Based Solutions (NBS). The essential characteristics of the Living Lab may be simply described as follows:

1- The district has strong community ties, nevertheless, concerning patterns are emerging that threaten this social unity.

2- The existence of community foundations and citizen groups is crucial in stopping the further decline of the local social structure.
3- The limited population density and availability of empty land caused by a decrease in industrial activity impede interactions, communication, and linkages between citizens, companies, and associations.
4- The location faces a higher incidence of many diseases, including cardiovascular and respiratory disorders, chronic stress, and mental health problems. Moreover, there is a significant prevalence of solitary old adults who are undergoing psychological discomfort.
5- The district faces significant issues due to a high young unemployment rate of over 50% and typically poor education levels.
6- There is a limited amount of local enterprises, with the bulk of the workers employed in the service industry.
7- The district's low real estate values and plenty of unoccupied rooms may serve as an attractive element for attracting new inhabitants, so facilitating revitalization efforts.

Co-design activities

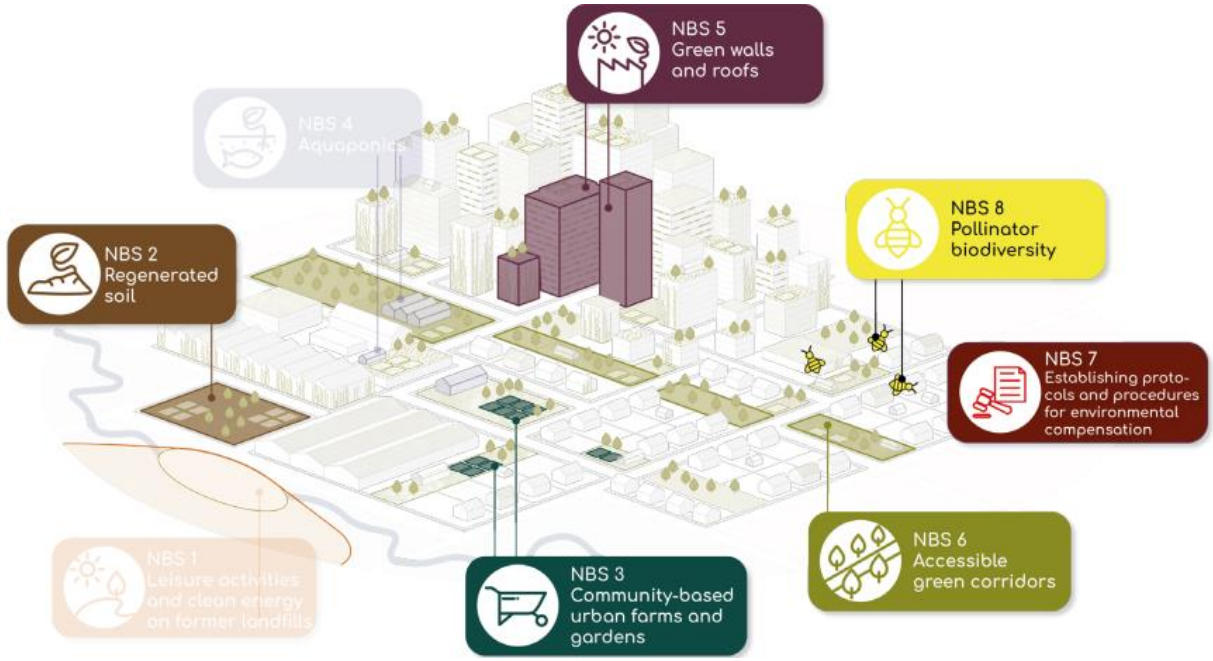


Figure 3. 3 implemented progireg nbs in the turin living lab- the pictures from the ProGIreg website (proGIreg project 2022)

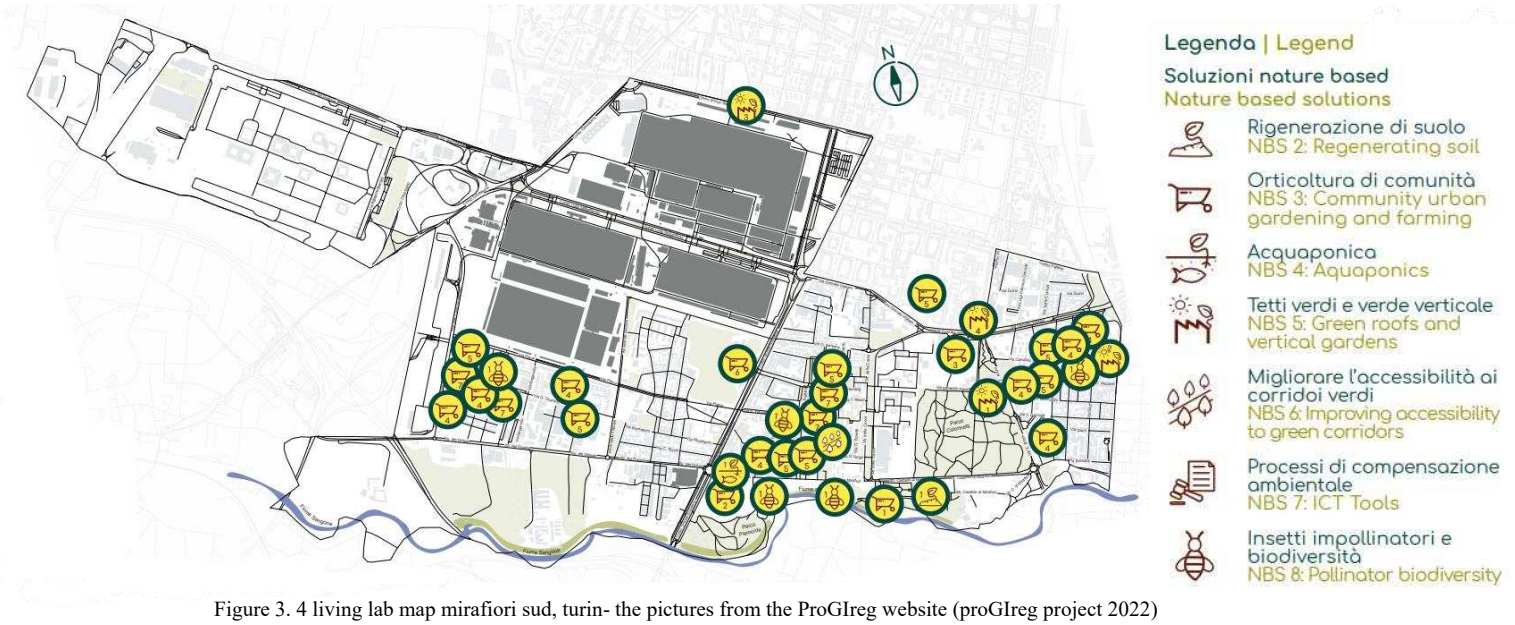


Figure 3. 4 living lab map mirafiori sud, turin- the pictures from the ProGIreg website (proGIreg project 2022)

NBS 2 New generated soil for urban forestry and urban farming: creation of an urban forest by applying "New Soil," or regenerated soil made from excavated debris, along the Sangone Riverbanks. by adding zeolites, compost, and cutting-edge biostimulants to the substance. Both the nearby control field and the New Soil region were home to a diversity of plant species. Throughout the implementation phase, growth analysis was carried out to track the effect of the freshly deposited soil on plants.

Figure 3. 7 NBS 2 (proGIreg project 2022)

NBS 4 Aquaponcis as soil-less agriculture on polluted sites: installation of aquaponics systems that are affordable, reliable, and simple to use. The practice of growing fish (aquaculture) in conjunction with hydroponics tanks combined with hydroponically grown plants without the need of soil in a symbiotic ecosystem where the nutrients required to nourish the plants are obtained from the waste products of the fish.

Figure 3. 6 NBS 4 (proGIreg project 2022)

NBS 3 Community-based urban farming and gardening on post-industrial sites: Orto WOW is made up of fifteen garden boxes filled with melliferous and fragrant plants that draw pollinating insects. Orto Wow was Installed in the courtyard of an abandoned building dubbed WOW in the Living Lab in Mirafiori Sud. The region has a weekly farmers market organized by the farmer group Coldiretti. The concept is around establishing a "green square" in the courtyard by the placement of boxes, so enabling public events that are accessible to everybody (such educational programs, open forums, social gatherings, etc.).

Figure 3. 5 NBS 3(proGIreg project 2022)

NBS 3 Community-based urban farming and gardening on post-industrial sites: The "OrtoMobile" urban laboratory, which consists of micro gardens in boxes and is supported and executed by ITER - City of Turin, is a component of the "Educational co-designing board" educational approach established for proGIreg. It brings together multiple stakeholders with active engagement of the local educational system: school communities, groups of people (organized or not) involved in communication, training and co-designing in an approach of lifelong learning and peer education. Six schools in the Mirafiori Sud district have placed the user-friendly OrtoMobile gardens for all ages, which encourage social contact both at home and in the classroom. Co-implementation of easy-to-implement interior and outdoor area installations in schools is made possible by strong collaborative attitudes.

Figure 3. 9 NBS 3 (proGIreg project 2022)

Figure 3. 10 NBS 5 (proGIreg project 2022)

NBS 5 Green roofs and walls: Two green walls have been installed as part of the NBS in the Mirafiori Sud district:

1. A 20 square meter indoor green wall in the atrium of the Cairoli Elementary School is illuminated by big roof windows.

2. An 80 m² outdoor green wall of a self-sustaining homeless shelter run by a social cooperative and owned by the City of Turin Planning location-based educational events and hands-on learning to spread knowledge and increase awareness of the advantages of green walls for both students and the shelter's hosts.

Figure 3. 8 NBS 3 (proGIreg project 2022)

NBS 5 Green roofs and walls: construction of a big green roof on top of a public building that is now abandoned and located in the Mirafiori Sud neighborhood's WOW district. The 140 square meter green roof was created by mixing seeds from stable meadows in northern Italy in order to create a "natural lawn." It is possible to calibrate these seeds for usage in both lowlands and mountainous regions. There will likely be more extensions.

Figure 3. 11 NBS 5 (proGIreg project 2022)

Locals were involved with the site through a variety of visits, events, and activities. This has sparked a feeling of attachment and identity and will encourage community ownership and care even more.

NBS 6 Accessible green corridors: A section of road was turned into a green corridor by this NBS, which connected Piemonte Park and the Mirafiori Castle to the residential neighborhood. The Alongside the building activity, there was a strong engagement process, planting of trees, shrubs, and grasses, as well as the placement of landmarks and signage that provided site information.

Figure 3. 12 NBS 6 (proGIreg project 2022)

NBS 7 Establishing protocols and procedures for environmental compensation: The NBS supported the municipality of Turin in identifying, gathering, and showcasing practical tools and specific instances to enhance administrative practices. Management of municipally-owned public green infrastructure.

Green areas ought to be regarded as "urban commons". In modern cities, shared administration facilitates the connection between many domains, fostering the development of a communal bond among local people and shared duties. Moreover, including the business sector facilitates the establishment of environmentally friendly spaces that might offer mutually beneficial outcomes.

[11]

NBS 8 Pollinator diversity improvement and citizen project: The University of Turin researchers supported this NBS program to educate those afflicted with mental illnesses in becoming scientific communicators.

Implement project operations in specific areas of the Mirafiori district, including the establishment and maintenance of pollinator gardens, the observation and documentation of butterfly species, the management of a website, the breeding of caterpillars, participation in public events, and engagement in educational activities in schools and social housing.Locals were involved with the site through a variety of visits, events, and activities. This has sparked a feeling of attachment and identity and will encourage community ownership and care even more.

Figure 3. 13 NBS 8 (proGIreg project 2022)

Figure 3. 14 NBS 8 (proGIreg project 2022)

[11] Bibliography:
ProGIreg eight nature based solutions. All the pictures of the pervious pages are from the ProGIreg website (proGIreg project 2022)ProGIreg project. 2022. “ProGIreg Webpage.” 2022. https://progireg.eu/.
Torino city lab webpage: https://www. torinocitylab.it/it/progireg
Hanania, Serene, Barbara Anton, Deliverable No, Author Serene Hanania, Co-Author Vasileios Latinos, Bettina Wilk, Rieke Hansen, Axel Timpe, and Riccardo Saraco. 2019. “Co-Designing NatureBased Solutions in Living Labs, Deliverable 2.4 on Workshop Round 2 in Frontrunner Cities (Dortmund, Turin, Zagreb).” www.proGIreg.eu.

3.2.2 Valdocco Vivibile

Conexus – Turin italy

The project under consideration is centered on the Valdocco region, a historically important neighborhood in the city of Turin. Valdocco is located within the Aurora district and is under the authority of District 7.

The main goal of the research program is to redefine the rules that determine how urban space is used, with a particular focus on the existing dominance of vehicles traffic. The research addresses the urgent need for interventions that prioritize the allocation of additional space for pedestrians, promote walking, and, importantly, foster the development of urban landscapes of superior quality. Within this framework, "quality" refers to the supply of parking facilities, the promotion of social contacts and exchanges, and the improvement of the general pleasantness of urban environments, including streets. The initiative was initiated in response to changes in garbage collection techniques in the region. The elimination of street-side rubbish collection bins provided a chance to implement spatial changes without requiring the loss of parking spots. As a result, various measures were taken to introduce environmentally friendly and porous infrastructure, with the main goal of renewing the area and promoting the growth of a "climate-resilient neighborhood" that can effectively reduce the impact of climate-related vulnerabilities.

The primary aim of the research project is to conduct experimental studies on various strategies aimed at reducing the urban heat island effect and efficiently managing stormwater. This comprehensive strategy aims to foster a more sustainable urban environment. Moreover, the project aims to develop a flexible framework of intervention options that can be easily repeated in similar metropolitan areas within the city to effectively tackle emerging climatic situations.

Currently, the study site lacks green areas, since only around 10% of the public area is designated for vehicles, including traffic lanes, large crossroads, and traffic islands that are abnormally large compared to the surrounding region. These circumstances unintentionally promote fast-moving vehicle transportation. Furthermore, the region has significant issues with excessive traffic

congestion and exploitative parking practices, since it allows unregulated entry into the restricted traffic zone of the city center, hence avoiding the corresponding entrance charges.

The research initiative is in line with the overall goals outlined in the Torino 2030 Action Plan. This plan aims to create a city that offers a high quality of life, prioritizes cleanliness, preserves public spaces, and promotes mobility strategies that improve well-being and give residents more freedom to move around. The research study is carefully adjusted to align with the objectives and standards outlined in the Climate Resilience Plan. This strategic alignment seeks to increase the presence of green infrastructure and create urban settings that are skilled at reducing the many impacts of climate change.[12]

The participatory process in the Valdocco Vivibile pilot:

Torino is experiencing local extreme weather events as a result of climate change, which is causing more frequent and intense heat stress and floods. Due to the interconnected nature of the hazards linked to climate change, effective actions to mitigate these risks need a comprehensive and coordinated strategy that involves several disciplines and incorporates decision-making at all levels, as well as coordination with higher-level institutions. The Torino Urban Lab has created a welcoming and inclusive platform in the Valdocco Vivibile pilot project, facilitating dialogue and fostering a collaborative community among local stakeholders.

This participatory approach serves various objectives that aid the execution of the Valdocco Vivibile pilot project and city-wide initiatives. It also helps the Torino Administration's planned nature-based solutions (NbS) efforts to adapt other areas to climate change. The objectives encompass: disseminating information to citizens regarding the initiatives and strategic framework implemented by the city to mitigate climate change hazards; promoting consciousness about climate change risks; enhancing communication between stakeholders and the local government; engaging residents and other stakeholders in public discourse; and overseeing the administration of Nature-based Solutions (NbS) and other urban infrastructure integrated within NbS interventions.

[12] Bibliography:
The Torino Vivibile website PianoResilienzaClimatica_TORINO.pdf (torinovivibile.it)
Conexus website Turin — Conexus (conexusnbs.com)

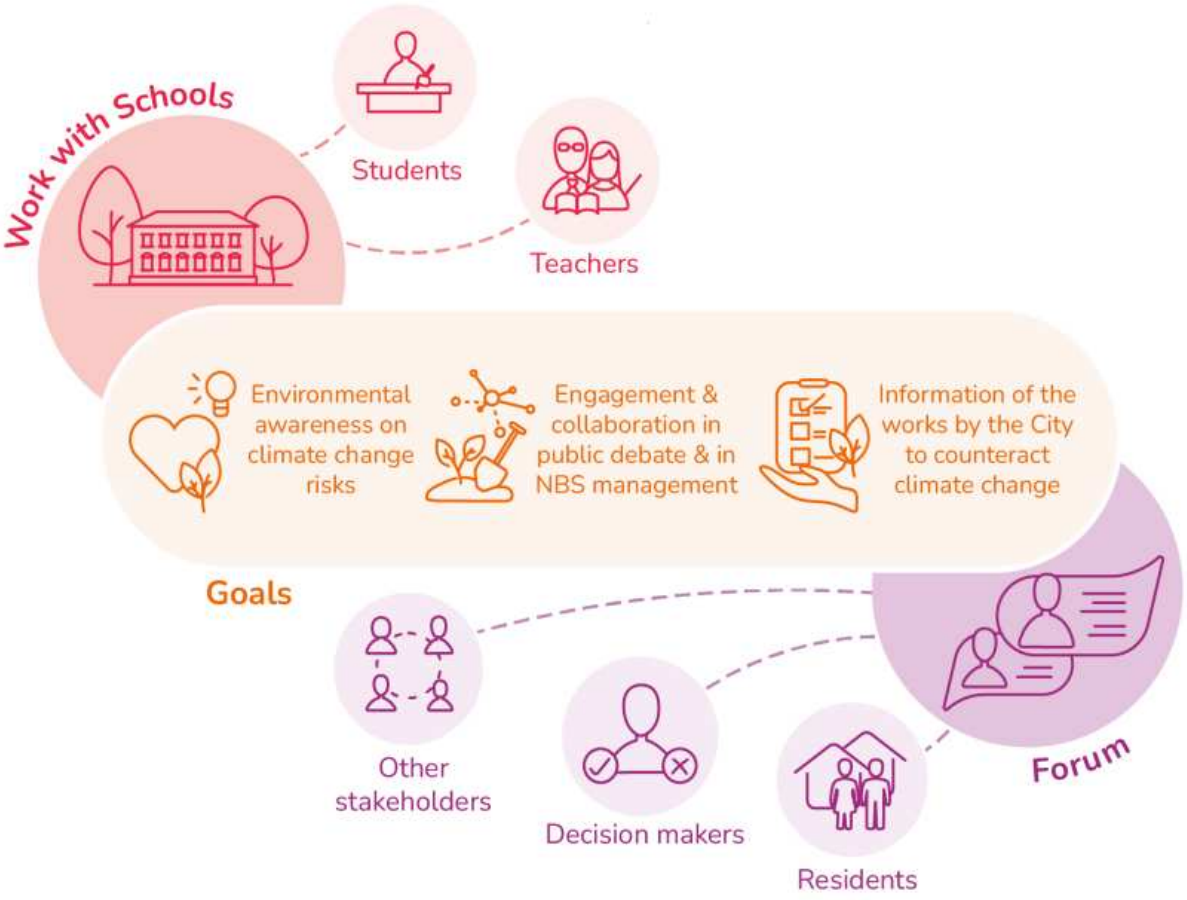


Figure 3. 15 The participatory process (conexsnbs.com)

The participative method associated with the pilot project primarily focuses on engaging students and teachers from schools located within the working region of the Valdocco Vivible.

By focusing on this specific demographic, the aim to educate and encourage in future citizens an understanding of the significance and advantages of nature within urban environments. The aim is to cultivate a sense of responsibility and appreciation for nature and public places. The activities were collaboratively planned with instructors to align with the students' active involvement in ongoing educational programs throughout the academic year.

The Valdocco vivible integrated instructional and consciousness-raising programs with hands-on exercises to impart academics with a comprehension and practical understanding of the natural world.

Inclusive solutions

1- The strategic reconfiguration of major intersections, involving the introduction of sweeping curves designed to effectively channel vehicular traffic into designated lanes, alongside the simultaneous expansion of sidewalks to create pedestrian-friendly resting areas outfitted with permeable and verdant elements. These multifunctional zones are also meticulously designed to facilitate the collection of rainwater from adjacent streets, thereby mitigating runoff during episodes of heavy precipitation.

Figure 3. 16 Green street furniture Torino Vivibile website

2- The construction of traffic islands at minor intersections to facilitate pedestrian crossings, coupled with the incorporation of green spaces engineered to manage stormwater effectively.

Figure 3. 17 Rainwater garden Torino Vivibile website

3- The expansion of sidewalks proximate to educational institutions to establish secure reception zones catering to students and parents alike.

4- Initiatives aimed at de-impermeabilizing asphalted surfaces, followed by their transformation into green infrastructure installations, thus affording shaded spaces that also contribute to cooling effects.

Figure 3. 18 Student School Square (Via Stradella car park) Torino Vivibile website

5- The installation of an array of diverse green urban furniture, strategically positioned to promote opportunities for relaxation and social interaction within welcoming, green, urban spaces.[13]

Figure 3. 19 Local public transport green stops Torino Vivibile website

6- The establishment of shaded pathways designed to encourage sustainable modes of mobility and facilitate pedestrian connectivity with other urban precincts.
7- The deliberate deployment of materials capable of reflecting solar radiation, thereby ameliorating the urban heat island effect.
8- The introduction of climate-resilient public transportation stops, replete with green coverings, aimed at enhancing the overall sustainability and climate resilience of transit infrastructure.[14]

Figure 3. 20 Green railway tracks of Corso Giulio Cesare Torino Vivibile website

[13] Valdocco Vivibile: a livable district, All the pictures from the Torino Vivibile website Interventi di adattamento per una città più vivibile | Torino Vivibile

[14]Bibliography:

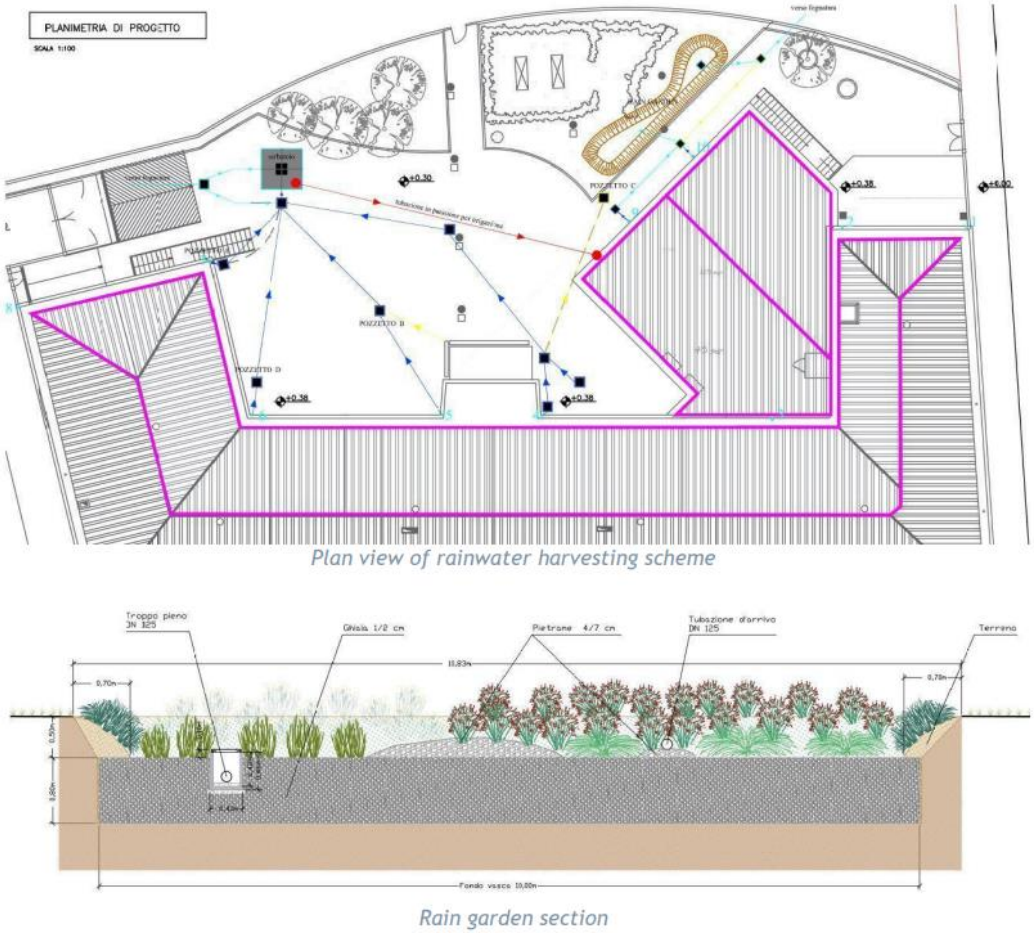
The Torino Vivibile website PianoResilienzaClimatica_TORINO.pdf (torinovivibile.it)
Valdocco Vivibile: a livable district, the pictures from the Torino Vivibile website Interventi di adattamento per una città più vivibile | Torino Vivibile

3.2.3 CWC Pilot Actions

Rainwater recovery rooftop garden and aeroponic greenhouse in Turin

The study case project seeks to experimentally verify the effectiveness of rainfall retention and attenuation techniques by implementing a variety of Nature-Based Solutions (NBSs) specifically designed to solve rainwater management issues in an urban environment. Moreover, it aims to promote the progress of a rooftop farming model as a flexible solution suitable for the resilient cities of tomorrow. This pilot project provides a foundation for Turin and other local authorities to develop innovative strategies for "Green and Blue Infrastructure," which will guide the future versions of the "Local Environmental Adaptation Plan" for Turin.

The study location includes "Open 011," a youth hostel facility that was first built as part of the infrastructure for the 2006 Winter Olympics in Turin. It was cleverly transformed from a factory



Plan view of rainwater harvesting scheme

Rain garden section

Figure 3. 21 Rainwater roof garden interreg-central.eu website

that was built in the 1940s. The City of Turin now owns this facility under a concession deal with the cooperative DOC. The arrangement lasts for 25 years, starting in 2019. Significantly, the hostel has a large terrace facing the south that is specifically designed to be used as a rooftop garden, accompanied by a connected aeroponic greenhouse. The rainwater collected from this rooftop is used for irrigation. The excess rainfall is carefully diverted to nurture a strategically placed rain garden located at the entryway of the building. The building possesses an EU ECOLABEL accreditation and has been outfitted with Information and Communication Technology (ICT) devices to monitor its environmental performance in real-time. These devices include a temperature monitoring system and a weather station.

The study involves quantitatively collecting and reusing rainwater from over 325 square meters of rooftop surfaces. The collected rainwater serves two functions: it is used for irrigating the rooftop garden and sustaining the aeroponic system in the greenhouse. The surplus rainfall, which exceeds the capacity of these devices, is effectively directed into the strategically located rain garden for irrigation purposes. It is important to mention that Turin receives an average yearly precipitation of 993 millimeters, as determined using an eight-year average dataset.

The participatory process:

This pilot effort includes interactive activities specifically created to engage and involve the student community of the youth hostel. This strategic approach not only promotes community involvement but also improves the educational and information sharing capabilities of the project.

Figure 3. 22 Rain garden interreg-central.eu website

The pilot project consists of the following components:

1- A new, extensive green roof covering an area of around 180 m2.
2- An aeroponic system implemented on the green roof for cultivating food.
3- A rain garden with a surface area of about 6 m2, designed to collect and gradually absorb a portion of the gathered rainfall.

Figure 3. 23 Rain garden interreg-central.eu website

Figure 3. 24 Aeroponic system for urban farming to be placed on the terrace of the building .interreg-central.eu website

The pilot project incorporates a rainwater harvesting system for the entire roof area, which measures approximately 520 m2. The system includes the following components:

1- Rainwater from a section of the Youth hostel Open011 roof, covering an area of about 230 m2, is collected and stored in an underground tank with a capacity of 13 m3. The harvested rainwater is then used for irrigating the green roof.

Figure 3. 25 The process of rain garden .interreg-central.eu website

2- Another section of the Youth hostel Open011 roof, spanning approximately 180 m2, also collects rainwater. This water is stored in a tank with a capacity of 350 liters and is reused for aeroponic irrigation.

Figure 3. 26 The process of rain garden .interreg-central.eu website

3- Rainwater from the green roof, covering an area of about 180 m2, as well as the excess water from the aeroponic storage tank, is accumulated and directed to a rain garden. The rain garden has a surface area of approximately 21 m2 and a storage volume of about 10 m3. This system is designed to handle a rain event of around 20 mm, which typically occurs every 5-10 years.[15]

[15] Bibliography: interreg-central.eu website Green roof and pubic space in Turin - Interreg (interreg-central.eu)

3.2.4 Lombricoltura in Parco dell'Arrivore (AgroBarriera)

Rete ONG

The "AgroBarriera" program was established through a collaborative effort with RE.TE. Ngo and other associations, specifically Parco del Nobile, the Institute for Environment and Education Scholè Futuro Onlus, and Volontarinrete. They successfully obtained the "grow Barriera" contract, which was approved by the Agency of Urban Development, with the objective of rejuvenating the Barriera di Milano region. The aim of this change was to provide a shared area that is suitable for group activities and promotes inclusive urban agriculture. This was accomplished through civic, social, and sustainable agricultural efforts.

Figure 3. 27 AgroBarriera different locations (reteong.org)

The specified region is divided into 20 individual gardens, which are assigned to people through a competitive selection procedure. Additionally, there is a separate area specifically designated for communal gardens, which are made available to local schools and associations.

The participatory process:

Project Origin and Collaborators:

- The "Agricultural Barrier" project is a cooperative initiative backed by the VolTo volunteer service center.
- The coordination of efforts included the collaboration between the volunteer organizations Volontarinrete and RE.TE, overseeing the administration of an organic urban horticulture site in Barriera di Milano.

Space and activities currently accessible:

- There is a total of 2,000 square meters of space specifically designated for horticultural operations.
- 50% of the area is allocated to communal gardening, instructional gardens, gathering, and socializing areas.
- Equipped spaces are specifically designed to accommodate instructional programs, training sessions, and recreational games.

Objective of Network Partners:

- Establish an advantageous environment for the nearby population.
- Encourage communal urban farming initiatives that are both socially beneficial and environmentally sustainable.
- Inform and educate individuals on the significance of urban agriculture in fostering social cohesion.

Figure 3. 28 AgroBarriera volunteer (reteong.org)

Figure 3. 29 AgroBarriera volunteer (reteong.org)

Figure 3. 30 AgroBarriera volunteer (reteong.org)

Figure 3. 31 AgroBarriera volunteer (reteong.org)

Participation in volunteer activities:

- Creation of a cohort of 20 individuals who will collaborate in the administration of a communal garden and participate in associated training activities.
- Strive to cultivate a dynamic and engaged civic fiber within the community.

Roles for volunteers:

- Volunteers will act as advocates and instructors of environmentally-friendly and sustainable agricultural methods inside the urban area.
- They will actively participate in community outreach, providing support to those who are interested in establishing small-scale vegetable gardens either at their residences or in condominiums.
- Training Facility and Data Dissemination refers to the act of spreading or distributing information, knowledge, or ideas to a wider audience.
- The public garden area will function as a teaching facility for the dissemination of practical knowledge.
- Volunteers will disseminate essential knowledge about home gardening to the general public.

Creation of manuals using online platforms:

- The initiative seeks to provide a brief online guidebook for ecological and sustainable urban agriculture.
- This guidebook will function as a tool to assist comparable initiatives that extend beyond the project's boundaries.[16]

[16] Bibliography:
All the pictures of the pervious pages are from the RE.TE organization website Agrobarriera - RE.TE. ngo (reteong.org)
Agricultural Barriera - RE.TE. ngo (reteong.org)

3.3 COMPARISON TABLE OF THE NATURE BASED URBAN CASE STUDIES:

	Mirafiori Sud	Valdocco Vivibile
Objectives	To revitalize a post industrial area in Turin by implementing Nature-Based Solutions (NBS). Enhancing the resilience of the community, promoting the overall welfare of its members, and stimulating the local economy.	To relocate urban space from automotive traffic to pedestrians and enhance the overall quality of urban areas, Mitigate climate change risks and strengthen urban resilience.
Challenges	Population decline, aging demographics, social issues	Lack of green spaces, traffic congestion, parking challenges
Implementation Strategies	Introducing Nature-Based Solutions (NBS) such as regenerated soil, urban farms, and green walls, Establishing easily accessible pathways for ecological connectivity and improving the diversity of planting biodiversity, Promoting active involvement and collaborations within the community.	Revamping key crossroads to create pedestrian-friendly areas, Establishment of environmentally -friendly areas and covered walkways, Implementation of climate-resilient infrastructure for public transit stations.
Outcomes	Improved community well-being, partnerships, potential revitalization	Pedestrian-friendly spaces, urban resilience, reduced congestion
Impact on the Environment	Mitigation of the heat island effect and enhancement of biodiversity, Enhanced stormwater management using Nature-Based Solutions (NBS), Improved air quality and decreased pollutants.	Decreased urban heat island effect, Enhanced stormwater control and mitigation, Advancement of urban landscapes that are both sustainable and robust to climate change
Community Engagement	Strong community participation in the process of designing , Involvement of nearby educational institutions and associations, fresh identity	Involvement of the student community at the youth hostel, Potential for education and diffusion of knowledge.

Table 4. 1 Comparison table of the Nature based urban case studies

	Rainwater recovery rooftop garden	AgroBarriera
Objectives	Create a rooftop farming model and communicate it to guide future adaption strategies	Advance social integration and foster sustainable urban agriculture, Establish public areas for collaborative endeavors and participation in community affairs.
Challenges	Urban rainwater management, climate-induced vulnerabilities	Social inclusion, sustainable agriculture in the Barriera di Milano district
Implementation Strategies	Utilization of rainwater for irrigation and food cultivation through collection and subsequent reuse. integration of an aeroponic greenhouse with a rain garden, Involvement of the student community at the youth hostel.	Implementation of long-term strategies for rainwater management and rooftop farming that are environmentally friendly and can be maintained over time, Possibility of duplicating tactics in different metropolitan environments.
Outcomes	Sustainable rainwater management, rooftop farming, replication	Enhanced social inclusion, urban agriculture, communal spaces
Impact on the Environment	Effective rainwater harvesting and recycling, Decrease in water wastage and improved management of stormwater.	Advancement of agroecological methods, Establishment of environmentally-friendly urban areas.
Community Engagement	Involvement of the student community residing in the youth hostel, Involvement of educational and knowledge dissemination capacity	Participation in civic activities by means of community gardening, Promoting integration, consciousness, and active citizenship via the practice of sustainable urban agriculture.

Comparison of Turin Nature based urban case studies:

In Turin, a collection of case studies are being researched to address urban difficulties by implementing Nature-Based Solutions (NBS). Mirafiori Sud aims to revitalize a former industrial zone by implementing Nature-Based Solutions (NBS) such as urban farms and green walls. This initiative seeks to improve community resilience, well-being, and the local economy.

The goal of Livable Valdocco is to revitalize urban areas by decreasing the focus on automobiles, addressing the hazards associated with climate change, and enhancing the overall quality of the city.

The Rainwater Collection rooftop garden integrates rainwater management and rooftop farming, engaging students in developing sustainable techniques for urban contexts.

The CWC Pilot for AgroBarriera promotes social cohesion and sustainable urban agriculture by establishing community and individual gardens. In general, these projects actively include communities, tackling local problems and supporting the creation of sustainable and resilient urban environments.

CHAPTER 04: EUROPEAN PROJECTS

4.1 HORIZON 2020 PROGRAM AND HORIZON EUROPE PROJECTS

Horizon 2020 serves as the financing mechanism for executing the Innovation Union, which is a key program of Europe 2020. The primary goal of this effort is to ensure that Europe remains globally competitive.

Horizon 2020 is seen as a tool to stimulate economic expansion and generate employment opportunities, receiving support from Europe's leaders and the Members of the European Parliament. They reached a consensus that research is a valuable expenditure for our future and so made it a central component of the EU's plan for intelligent, sustainable, and inclusive development and employment.

Horizon 2020 is facilitating the achievement of research and innovation goals through its focus on outstanding scientific work, industry leadership, and addressing societal issues. The objective is to guarantee that Europe generates top-tier scientific research, eliminates obstacles to innovation, and facilitates collaboration between the public and private sectors in order to achieve innovation.[17]

The NBS projects are organized into many subject Task Forces in order to collaborate and share NBS-related information. These Task Forces include Data Management and NBS information Repository, NBS Impact Evaluation Framework, Governance, Business Models and Financial Mechanisms, NBS Communication, and Co-creation for NBS.[18]

Climate and water resilience projects:

1- Connecting Nature

The European Commission's Horizon 2020 Innovation Action Programme has provided €11.4m in funding for Connecting Nature, a five-year initiative. The project consists of 30 partners from various sectors including industry, local authorities, local

[17] European Commission website- What is Horizon 2020? | Horizon 2020 (archive-it.org)
[18] European Commission, European Research Executive Agency, (2022). Nature-based solutions : EU-funded nbs research projects tackle the climate and biodiversity crisis, Publications Office of the European Union. https://data.europa.eu/doi/10.2848/42098

communities, NGO's, and research institutions. These partners are spread throughout 16 countries, with additional hubs located in Brazil, China, Korea, and The Caucasus (Georgia and Armenia). Our objective is to establish Europe as a prominent figure in the global arena for developing and executing nature-based solutions by the conclusion of the project.

The aim to establish a community of cities that promotes peer-to-peer learning and capacity building. This community will consist of front runner cities (Glasgow, Burgas, Poznan) that have extensive experience in implementing large-scale nature-based solutions, as well as fast follower cities (A Coruna, Bologna, Burgas, Ioannina, Malaga, Nicosia, Sarajevo, Pavlos Melas) that are eager to implement such solutions but lack the necessary expertise. As our knowledge and expertise expand, our community will also grow to incorporate new members, known as multiplier cities.

The primary goals include:

Create an urban planning approach that will dismantle barriers between different sectors, foster and support social, business, and governance advancements, and prioritize the expansion of nature-based solutions in cities.

Create an innovative master planning method that expedites the expansion of nature-based solutions in urban areas by aligning policy and market demands and transforming obstacles into opportunities for advancements.

Create a systematic approach to identify funding and financial methods that validate nature-based solutions as effective strategies for creating sustainable and resilient cities that are prepared for climate change. Additionally, aim to enhance the value of knowledge and market mechanisms related to scaling nature-based solutions, in order to stimulate the market for new innovations.

Present and disseminate knowledge gained from the expansion, duplication, and incorporation of nature-based approaches in urban development, specifically in leading cities.

Execute comprehensive masterplans in the rapidly developing cities, which involve collaboration, the exchange of successful strategies, practical demonstrations, measurable proof, interdisciplinary cooperation, and involvement with stakeholders.

Involve the rapidly developing cities in developing their capabilities and gaining practical experience by leveraging successful knowledge exchange and mentoring practices between leading cities and rapidly developing cities, as well as utilizing established curatorial planning methods.

Obtain sufficient financing to implement city accelerator masterplans for the expansion of nature-based solutions in the fast-follower cities.

Establish a long-term and environmentally friendly framework to support innovation, utilization, and business growth by utilizing successful nature-based solutions implemented in leading cities and adapting them to the unique environmental, organizational, and financial circumstances of other cities.

The acquired experiences and information will be included into the reference framework for nature-based solutions.[19]

2- Grow Green

Creating environmentally sustainable cities that prioritize climate and water resilience, promote sustainable economic growth, and ensure the well-being of citizens.

GrowGreen's objective is to foster the development of cities that are both climate and water resilient, as well as healthy and livable. This is achieved through the implementation of nature-based solutions (NBS) which involve investing in natural elements. Incorporating nature into the urban living environment enhances the overall well-being of all residents and promotes economic prosperity. Superior green areas and water systems offer inventive and motivating resolutions to significant metropolitan predicaments, like flooding, heat strain, drought, inadequate air quality, and unemployment, while also fostering biodiversity in frontrunner cities (Manchester (UK), Valencia (Spain), Wroclaw (Poland) and Wuhan (China). follower cities Brest (France), Modena (Italy) and Zadar (Croatia)

[19] Connecting Nature website Cities | Connecting Nature

The Grow Green alliance aims to incorporate nature into urban planning and development by collaborating with cities and professionals in Europe and globally. This collaboration will focus on implementing solutions that provide social, environmental, and economic advantages. Utilizing green practices will enhance public health, mitigate climatic effects, and establish an appealing setting for residents, tourists, and economic ventures.

The primary goals include:

1. Enhance the existing body of evidence on nature-based solutions in urban areas, focusing on cost-effective and reproducible methods to improve urban climate and water resilience. This research aims to support the development of policies related to nature-based solutions and the worldwide market for such solutions, while also considering the social, environmental, and economic advantages.

2. Create a user-friendly and scalable method to assist in the creation and execution of NBS strategies in urban areas, in accordance with the current priorities of the city.

3. Facilitate the establishment of necessary circumstances to promote, propel, and facilitate the execution of city NBS strategies through the dissemination of knowledge and enhancement of capabilities in cities worldwide. This includes assisting in the formulation of appropriate policy frameworks, investment business models for NBS, and the global market for NBS.

The central focus of this five-year initiative is the generation of value by urban administrations through the advancement of nature-based solutions, with the active participation of residents, businesses, and public-private collaborations in local communities and throughout cities. GrowGreen aims to facilitate the dissemination, exchange, and duplication of nature-based solutions and strategies created in its partner cities. Additionally, it will collaborate with other pertinent networks, projects, and initiatives to establish a worldwide movement towards a sustainable urban future.[20]

[20] Grow Green website Home - GrowGreen (growgreenproject.eu)

3- URBAN Greenup

URBAN GreenUP is a project that receives funding from the European Union's Horizon 2020 programme. The primary goal of this project is to implement and duplicate Renaturing Urban Plans in various European and non-European cities. The purpose is to reduce the impact of climate change, enhance air quality and water management, and promote sustainability in urban areas by implementing innovative nature-based solutions.

The URBAN GreenUP technique will be validated and shown in three runner cities: Valladolid (Spain), Liverpool (UK), and Izmir (Turkey). Five following towns, namely Mantova (Italy), Ludwigsburg (Germany), Medellin (Colombia), Chengdu (China), and Binh Dinh-Quy Nhon (Vietnam), will develop their own Renaturing Urban Plans based on their previous experience. These plans aim to emulate the URBAN GreenUP strategy and its green economic approach.

The project will incorporate a range of nature-based solutions that address several interrelated aspects of urban life and infrastructure. The categories include of re-naturing urbanization, water interventions, unique green infrastructures, and non-technical interventions. The planned initiatives include the establishment of eco-friendly bike and pedestrian paths, the creation of parks and urban farming facilities, the utilization of intelligent soils and bio pollutant filters, and the introduction of sustainable drainage systems to mitigate flood impact and aid in irrigation.

URBAN GreenUP strives to achieve a range of environmental and socio-economic consequences by implementing highly technology nature-based solutions in large-scale districts. For instance, the upcoming installation of a new cycle lane and parking green pavements in Valladolid would effectively mitigate the emission of about 200 tons of CO_2 equivalent and lower summer temperatures by 5 degrees Celsius. In contrast, Liverpool's sustainable drainage system has a capacity to store 1500 m3 of rainwater during storms, while the smart soils employed in Izmir have the ability to capture carbon from the atmosphere and utilize it for self-fertilization. These are a limited number of the anticipated effects resulting from the adoption of nature-based solutions in the three cities.[21]

[21] URBAN Greenup website Urban GreenUP

4- Urban nature labs

The UNaLab project, which is supported by the EU, seeks to create more intelligent, inclusive, resilient, and sustainable societies by implementing innovative nature-based solutions (NBS). The UNaLab Consortium consists of 28 partners from 10 cities in Europe and other regions, encompassing municipalities, research institutions, businesses, and industries. The member cities of UNaLab are dedicated to tackling urban concerns related to climate and water through an innovative and citizen-driven approach.

The three leading cities, Eindhoven, Tampere, And Genova have established Urban Living Lab (ULL) demonstration areas. These areas are being used to experiment, demonstrate, and evaluate various nature-based solutions that aim to address climate change mitigation and adaptation, as well as the sustainable management of water resources. These solutions have been collaboratively developed with and for local stakeholders and citizens.

The leading cities engage in active collaboration and exchange of knowledge with our five European following cities - Stavanger, Prague, Castellón, Cannes, And Başakşehir. They provide assistance to these cities in developing their own NBS roadmaps using a co-creation method. The cities of Hong Kong and Buenos Aires, which are not located in Europe, along with our two observers, Guangzhou and the Brazilian Network of Smart Cities, actively acquire knowledge from the European NBS method. This will facilitate the establishment of a worldwide NBS marketplace.

The extensive network of cities involved in the UNaLab project facilitates the generation of collective knowledge, allowing for the incorporation of various urban socio-economic contexts, variations in urban population size and density, local ecological attributes, and climate conditions into the project's outcomes. The project outcomes will facilitate the creation of a European NBS Reference Framework that focuses on the advantages, cost-effectiveness, financial sustainability, and ability to be replicated of nature-based solutions. [22]

[22] Unalab website Home | UNaLab

Inclusive urban regeneration

5- CLEVER cities

Revitalizing urban areas through the integration of natural elements Hamburg, London, and Milan front runner cities are implementing nature-based interventions in strategic sectors of their cities as part of their urban regeneration efforts. The CLEVER Cities project seeks to promote a novel kind of nature-based urban transformation for sustainable and socially inclusive cities across Europe, Latin America, and China. This will be achieved through intercity exchange, inclusive collaboration, and multidisciplinary learning.

CLEVER Cities are characterized by their community-driven nature. Local teams including of residents, companies, educational collaborators, and municipal authorities have been established in Hamburg, London, and Milan. This cooperative framework will guarantee that the process of urban change is transparent, encompassing, and customized to the specific requirements of the local community.

Follower cities Belgrade, Larissa, Madrid, Malmö, Sfântu Gheorghe, and Quito collaborate with London, Hamburg, and Milan to exchange knowledge and expertise on the implementation of nature-based interventions in urban areas worldwide.

Ecological interventions within Nature-based solutions (NBS) refer to the strategic incorporation of natural elements, such as trees, plants, and green spaces, into urban planning and design to effectively tackle urban difficulties.

Given that three quarters of the European Union's populace resides in urban areas, it is common for underprivileged sections of these cities to lack high-quality green spaces. CLEVER Cities aims to promote nature-based solutions as a method of enhancing public health, fostering social unity, ensuring citizen safety, and creating more economic prospects in these areas.

The presence of natural elements in urban areas enhances the ecological conditions, fosters economic prospects, and contributes to the overall well-being of city dwellers. Green spaces foster

social cohesion, enhancing community resilience and bolstering urban adaptability to climate change.

The primary goal include:

Enhance and enhance local understanding of nature-based solutions, showcase the effectiveness of greener cities for individuals and communities, provide statistics and information for EU policy development, and ultimately encourage and facilitate the use of nature-based solutions in urban design globally.[23]

6- Edible City Solutions for a better world

The EdiCitNet Consortium comprises a global team of specialists from several socioeconomic areas and scientific fields associated with Edible City Solutions (ECS). The entire consortium comprises 32 partners, including delegates from local municipal administrations, Non-Governmental Organizations (NGOs), Small and Medium Enterprises (SMEs), and other Edible City Solutions from various countries.

The concept revolves around an interconnected network of metropolitan communities throughout Europe, Africa, Latin America, and East Asia collaborating to construct a more prosperous world for all individuals residing in cities.

It is a project supported by the European Commission that aims to integrate edible city solutions for socially, resilient, and sustainable cities, in collaboration with an international consortium and an expanding community of edible city lovers worldwide, is developing and executing urban food innovations and sustainable urban planning strategies to create greener, more edible, and ultimately more livable cities. (EdiCitNet) aims to enhance the livability of cities worldwide by implementing and integrating Edible City Solutions within their institutions.

[23] Clever cities website CleverCities •• The project

Edible City Solutions (ECS) include various methods of sustainable food production, distribution, and utilization inside urban areas. These methods include neighborhood gardens, urban beekeeping and sheep farming, green facades, high-tech indoor farming, cooking and eating events, as well as the incorporation of locally farmed urban food in restaurants.

The primary goals include:

Enhance the health, sustainability, and livability of urban areas.

Foster the development of environmentally friendly enterprises and employment opportunities.

Enable local communities to address and overcome socioeconomic challenges.

The Edible Cities Network is an unconventional research project. This is an innovation initiative that is financially supported by the European Commission's Executive Agency for Small and Medium-sized Enterprises (EASME). This implies that we are operating in authentic circumstances with genuine individuals, actual difficulties, and tangible resolutions. From the outset, we engage in rigorous testing, demonstrating, piloting, and implementing ECS in collaboration with local residents. Our aim is to enhance the quality of life in their urban areas.[24]

7- ProGIreg

ProGIreg employs natural elements to revitalize urban areas in collaboration with and for the benefit of inhabitants.

This project is financially supported by the European Commission as part of the Horizon 2020 program. It is scheduled to commence in June 2018 and will continue until 2023. ProGIreg is an acronym that stands for 'productive Green Infrastructure for post-industrial urban regeneration'. It focuses on using nature to revitalize and rejuvenate urban areas that were previously industrialized.

Living Labs are established in post-industrial zones in four leading cities: Dortmund (Germany), Turin (Italy), Zagreb (Croatia), and Ningbo (China). These cities serve as hubs for innovation, where nature-based solutions are created, experimented with, and put into action. Global cities collaborate in a concerted effort Cascais (Portugal), Cluj-Napoca (Romania), Piraeus (Greece),

[24] Edible City network website Edible Cities Network - to make cities a better place! (edicitnet.com)

and Zenica (Bosnia and Herzegovina) actively monitor the advancements in Living Labs and participate in intercity exchanges to duplicate nature-based solutions.

Productive green infrastructure:

Within our leading cities, a total of eight distinct nature-based solutions will be implemented to establish efficient green infrastructure. This infrastructure will not only enhance living conditions and decrease susceptibility to climate change, but also yield quantifiable economic advantages for residents and business owners in urban areas that were previously reliant on industry.

MOOC - Nature-based urban regeneration:

The proGIreg MOOC on edX consolidates the most effective methodologies from the proGIreg Living Labs onto a single platform. The course focuses on the cooperative development, execution, and assessment of nature-based solutions (NbS) for the revitalization of urban areas, in conjunction with local communities. Collaborative development for the revitalization of urban areas Local communities, governments, corporations, NGOs, and institutions collaborate to conceive and implement nature-based solutions.

Self-sustaining business models:

ProGIreg creates self-sufficient business models for nature-based solutions, utilizing scientific evaluation of the various advantages they offer for social, ecological, and economic revitalization.[25]

8- URBiNAT

URBiNAT's main objective is to revitalize and incorporate neglected urban areas. The project interventions prioritize the improvement of public spaces and the collaborative development, in partnership with locals, of new social and nature-oriented connections within and among various neighborhoods. URBiNAT aims to create a Healthy Corridor by adopting a comprehensive approach that considers the overall physical, mental, and social well-being of citizens. This

[25] Proglreg website https://progireg.eu/

innovative and flexible nature-based solution (NBS) incorporates numerous micro NBS that arise from community-driven design processes.

URBiNAT is comprised of a global collaboration of academic and business partners located in 7 European locations. Every URBiNAT city will serve as a Living Lab to apply Healthy Corridor solutions. Local partners, associations, research centers, European centers, universities, and industries provide support to cities.

Partners are collaboratively working on building a participatory approach, an NBS catalogue, and a Healthy Corridor. They are also monitoring the impacts and spreading and promoting the outcomes. They create an inclusive community of practice (CoP) by working together with partners from Iran and China, as well as NBS observers situated in Brazil, Oman, and Japan.

Partners share their unique experience in nature-based solutions, utilizing a variety of transdisciplinary knowledge, approaches, and instruments. This is enhanced by intelligent digital tools, active participation of citizens, collective support and initiatives in the social economy sector, innovative approaches to create value, support for the growth of businesses through incubation, and platforms for governing information and communication technology. The URBiNAT Observatory will assess and duplicate the social, economic, and urban effects.

The Healthy Corridor Concept:

The Healthy Corridor concept and approach rely on the aggregation of nature-based solutions, which are chosen through a collaborative process of co-design and co-creation including local communities.

In the URBiNAT project, a Healthy Corridor is understood as more than just a group of urban green infrastructure elements designed to enhance the urban environment and reduce climate-related hazards.

A Healthy Corridor is a social and cultural infrastructure that has been collaboratively developed by people and stakeholders to enhance the well-being of the community and have a beneficial influence on health.

URBiNAT aims to expand the use of nature-based solutions by incorporating participative and social and solidarity economy solutions.

Every URBiNAT Healthy Corridor incorporates and connects several Nature-Based Solutions (NBS) created by project collaborators, utilizing NBS listed in the URBiNAT NBS Catalogue and suitable techniques and instruments for monitoring and assessment.

This is accomplished by prioritizing the welfare of citizens in regards to energy, water, food, nature, mobility, participation, behavioral modification, digital democracy, social unity, and the economy based on solidarity.

International restoration and rehabilitation of urban ecosystem

9- Clearing House

The focus of our project is to tackle a worldwide issue that brings together cities in Europe and China. The aim is to enhance the resilience of cities and create societies that are more livable, ultimately leading to improved human wellbeing. We primarily concentrate on tree-based green infrastructure, which serves as the foundation for "urban forests as nature-based solutions."

Urban Forests, also known as nature-based solutions (UF-NBS), are a specific type of nature-based solutions that utilize tree-based urban ecosystems to tackle societal issues. They offer both ecosystem services for human well-being and advantages for biodiversity. Urban and peri-urban forests encompass wooded parks, tiny woodlands within metropolitan areas, and trees found in both public and private settings.

The primary goals include:

Examine current understanding of NBS

The project aims to gather, assess, and establish links between the current knowledge about the development, management, and monitoring of Nature-Based Solutions (NBS) and Urban Forest-Nature-Based Solutions (UF-NBS). Additionally, it will examine the governance, institutional, and economic structures, as well as the public opinions and expectations in China and Europe.

Conduct case studies that examine the relationship between China and Europe

The project aims to examine case studies of UF-NBS (Urban Forest-Nature Based Solutions) in China and Europe, focusing on their effects on urban society, their cost-effectiveness, and their potential for replication in other situations.

Enhance the process of acquiring knowledge and skills

The initiative aims to enhance a cooperative learning process on UF-NBS by linking practitioners, businesses, policymakers, and scientists from China and Europe to create and implement novel knowledge on UF-NBS.

Create and design instruments or devices

The project aims to create decision support tools and guidelines for efficiently controlling and managing Nature-Based Solutions (NBS) in general, with a specific focus on Urban Forest-Nature Based Solutions (UF-NBS). The goal is to enhance urban resilience and improve human wellbeing.

Enhance the level of awareness of the National Bureau of Statistics (NBS).

The project aims to enhance awareness regarding the advantages of Nature-Based Solutions (NBS) in general, with a specific focus on the benefits of using Ultrafiltration Nature-Based Solutions (UF-NBS).

The clearing house project unites 26 partners from Europe and China. Its objective is to offer evidence and tools that simplify the utilization of urban forest-based solutions (UF-NBS) to revitalize, reconnect, and restore urban ecosystems.[26]

10- REGREEN

REGREEN aims to enhance the evidence and tools necessary for promoting the co-creation of nature-based solutions (NBS) in urban areas, implementing decision support systems for planning and governance, and developing business models for implementing NBS that offer various ecosystem services and

[26] Clearing House website Clearing House H2020 – Trees are the solution (clearinghouseproject.eu)

improve wellbeing. This will be achieved by understanding the drivers and pressures that challenge future urban sustainability.

It will employ sophisticated socio-spatial and land-use models, along with ecological expertise, to effectively address both the quantity and quality of solutions for re-greening selected cities. Additionally, it will utilize experiential information gained from big data to establish the most optimal solutions for re-greening. Furthermore, REGREEN aims to enhance the documentation of both non-monetary and monetary benefits that systemic and locally tailored nature-based solutions (NBS) interventions and ecosystem services can provide to individuals and society in peri-urban and urban regions of Europe and China.

Utilizes Urban Living Labs (ULLs) as the core components of the project, facilitating the collaborative generation of knowledge among local residents, schools, enterprises, organizations, and public administrations to foster novel forms of urban innovation. The ULLs will serve as a platform for testing and implementing general tools, scientific findings, innovative concepts, and methodologies in a practical setting. This leads to innovative guidelines and standards for the development and implementation of urban Nature-Based Solutions (NBS) at a comprehensive and strategic level. REGREEN prioritizes the needs of vulnerable groups, including young children, gender considerations, and socially disadvantaged individuals.

Regreen not only focuses on scientific dissemination but also includes a robust outreach component that specifically targets urban planners, businesses, and the general public. REGREEN will establish networking arrangements to facilitate the exchange of experiences among a wider range of European cities, and when feasible, among Chinese cities as well. These arrangements will include workshops, webinars, and field excursions. REGREEN emphasizes the significance of linking Nature-Based Solutions (NBS) with the business and start-up community. It arranges accelerator programs and investigates inventive business scenarios, all with the objective of enhancing the future NBS market.[27]

[27] Regreen website Home - REGREEN (regreen-project.eu)

11- Conexus

Nature-based solutions and ecosystem restoration possess the capacity to help cities tackle their common issues, while also delivering environmental, social, and economic advantages. Before allocating resources to nature-based solutions and ecosystem restoration, cities and communities require concrete proof of their long-term sustainability. The Conexus project aims to offer pertinent facts regarding the impacts and sustainable feasibility of various approaches.

Conexus is a four-year initiative aimed at disseminating accessible information on the restoration of natural ecosystems, enhancing the quality of life in urban areas, and fostering collaboration between Latin America and Europe. The project has been granted financing from the European Union's Horizon 2020 research and innovation initiative. Discover additional information regarding our affiliated initiatives, which are also financially supported by the European Union's Horizon 2020 research and innovation program.

Objective CONEXUS aims to showcase the capacity of nature-based solutions to counteract the detrimental consequences of urbanization by revitalizing and optimizing the performance of urban and peri-urban ecosystems and their associated services. The initiative aims to demonstrate the efficacy of nature-based solutions in reestablishing the connection between humans and the natural environment.

The basic principles of the Conexus approach are:

Nature-based thinking refers to the concept of considering nature-based solutions as independent entities rather than just installations, hence enhancing their resilience and sustainability.

A place-based approach emphasizes the significance of nature-based solutions in three key aspects: place-making (developing nature-based solutions), place-keeping (sustaining them over time), and place-prescribing (implementing policies and programs to involve people).

Co-production involves actively involving project partners and communities in the process of developing and implementing policies and nature-based solutions.

Mosaic governance models involve the formation of adaptable teams with individuals from many sectors and hierarchical levels, who collaborate on specific issues and initiatives.

Nature-based solutions can be implemented and assessed at several dimensions, including macro (such as city-wide initiatives and strategic networks), meso (such as river corridor restoration and food production), and micro (such as school grounds and common areas).[28]

12- INTERLACE

Urban communities are becoming more aware of the benefits of nature-based solutions and are making efforts to restore, safeguard, and enhance access to green spaces within cities. INTERLACE facilitates the achievement of these goals by employing NBS to repair, rehabilitate, and reconnect ecosystems along the boundary between urban and rural areas. INTERLACE will enhance the existing knowledge, develop capabilities for cohesive urban planning, and promote communication and cooperation on regenerative nature-based solutions. The INTERLACE project facilitates efforts to revive, repair, and establish connections between ecosystems. Ecological systems are perceived as intricate, interconnected systems in which humans and nature are inherently interconnected. INTERLACE embraces the intricacy of this through its 'Nature-Places-People' idea. This approach prioritizes not only the interconnectedness of ecosystems, but also the more extensive interconnectedness of natural and social processes and locations.The objective of the INTERLACE project is to enhance the capabilities and resources of European and CELAC cities to successfully restore and rehabilitate (peri)urban ecosystems, with the goal of creating cities that are more livable, resilient, and inclusive.

The primary goals include:

Enhance collaboration between European and CELAC communities of practice for the restoration and rehabilitation of (peri)urban ecosystems.

Encourage active involvement to collaboratively create and encourage ownership of guidelines, decision support systems, and tools for the planning, building, and monitoring of affordable restorative nature-based solutions.

[28] Conexus website Conexus (conexusnbs.com)

Utilize the existing knowledge, experiences, and successful methods from European Union (EU) and Community of Latin American and Caribbean States (CELAC) cities to enhance the restoration and rehabilitation of urban ecosystems.

Enhance the ability of local governments to effectively carry out comprehensive and environmentally sound urban planning and governance strategies that address their specific requirements and problems.

Utilize current European and CELAC city and regional networks to motivate and assist in continuous two-way learning and exchange regarding restorative nature-based solutions.

Promote knowledge and comprehension of the advantages of healthy (peri)urban ecosystems for social, cultural, and economic well.[29]

Improve wellbeing and health

13- EuPOLIS

EuPOLIS' strategy links Nature Based Solution initiatives for public areas with the requirements of citizens for enhanced public health and well-being.

The primary concept and categories of NBS are :

To effectively implement a cutting-edge urban planning approach that utilizes Blue Green Solutions (BGS) to create favorable spatial and functional conditions that improve both the Public Health and Well Being of citizens, as well as the overall urban metabolism, social cohesion, and resilience of cities in the face of Climate Change (CC) and natural disasters.

To construct a liveability model focused on intervention, based on the specific requirements of the community and involving the different capabilities of the community. We shall adopt a tripartite strategy: 1) Ensuring the interventions are tailored to meet the specific requirements and preferences of the communities. 2) Incorporating the input and opinions of residents/users in the

[29] Interlace website Frontpage | INTERLACE (interlace-project.eu)

planning process. 3) Promoting the long-term sustainability of project outcomes by building a sense of ownership among citizens/users.

The objective is to create and execute the euPOLIS platform, which will facilitate and improve participatory processes in the redesign and transformation of public spaces. This will involve reevaluating the jurisdictions and functions within cities, as well as considering the actual needs of citizens through multi-level co-governance and co-ownership. Additionally, new financing models, such as crowdfunding, will be explored.

The objective is to create and execute tailored spatial solutions for each specific case study (Front Runner -FR- cities of Belgrade, Lodz, Piraeus, and Gladsaxe). Subsequently, the aim is to observe and evaluate the effects of these solutions on Public Health and Well Being, as well as on social and environmental outcomes. The study will employ a mixed-method approach, integrating conventional questionnaires, ethnographies, and interviews with quantitative data obtained from wearable devices, behavioral games, and mobile questionnaires. Remote sensing and sensor networks will be employed to observe and track microclimate, biodiversity, pollution, Urban Heat Island (UHI), and other related factors.

To reproduce the benefits of euPOLIS innovations, we will provide mentorship and coaching to the cities that are following the project, namely Palermo, Limassol, Trebinje, Bogotá (Colombia), and Fengxi New City (China).

To create enduring data platforms that safeguard comprehensive and consistent data on the effects of implemented strategies, particularly in relation to Public Health and Well Being. These platforms will also guarantee compatibility with other pertinent data infrastructures, enabling efficient public consultation, exchange, and sharing of practices and experiences.

The objective is to identify robust business models that can be easily replicated in different markets and to develop innovative strategies for activating additional resources.

In order to efficiently and extensively share project outcomes with diverse audiences, it is crucial to employ targeted strategies, collaborate with similar projects and initiatives, and strive to promote the euPOLIS concept.[30]

[30] Eupolis euPOLIS – Integrated NBS-based Urban Planning Methodology (eupolis-project.eu)

14- GoGreenRoutes

GoGreenRoutes is a project supported by the European Union with a budget of €10.5 million. Its goal is to promote a stronger connection between people and nature throughout Europe, Latin America, and China.

The consortium consists of 40 organizations from various disciplines. They are combining participatory approaches and citizen science with Big Data analyses and digital innovation to collaboratively create "Urban Well-being Labs" in six cities: Burgas (Bulgaria), Lahti (Finland), Limerick (Ireland), Tallinn (Estonia), Umeå (Sweden), and Versailles (France).

These innovative urban areas are adopting "nature-based solutions" such as green corridors, linear parks, pocket parks, and shared walkways to improve the physical and mental well-being of their city dwellers. By optimizing the utilization of public space, individuals can engage in more active movement throughout the city, make the most of their leisure time, and foster social interactions. Additionally, this approach allows for the restoration of ecologically significant areas.

The GoGreenRoutes intergenerational 360-Health strategy is a comprehensive and multifaceted idea that is in line with the United Nations Sustainable Development Goals, namely Goal 3 - Good Health and Well-being. Promoting the well-being of individuals throughout all generations in terms of their biological, psychological, social, and environmental health is crucial for achieving sustainable development.

The 360-Health approach incorporates various health domains and encompasses the perceptions, attitudes, and behaviors associated with each of them. GoGreenRoutes prioritizes mental health, physical exercise, nutrition, sleep, cognition and performance, social health, human-nature interaction, and sustainability in urban nature.

GoGreenRoutes will create a dedicated 360-Health indicator set to evaluate many aspects of health, evaluate the effects of nature-based interventions on the health of city dwellers, and facilitate cost-benefit assessments of these treatments.

Nature-based solutions implemented through the 360-Health approach will create chances for mutual benefits for both citizens (such as addressing health needs) and the environment (such as mitigating climate change). A comprehensive urban 360-Health toolbox will be developed to assist decision-makers in effectively implementing nature-based solutions that will significantly improve all aspects of long-term health.[31]

15- IN-HABIT

Inclusive health and well-being "IN-HABIT" is an EU Horizon 2020 project that seeks to identify innovative and comprehensive strategies to enhance inclusive health and wellbeing in small and medium-sized cities. The project will examine how the utilization of underappreciated resources, such as culture and heritage, food, human-animal connections, and art and environment, can enhance health and wellbeing in each of the four pilot cities. The project will specifically emphasize gender, diversity, equity, and inclusion.

What is the reason for inhabiting?

By 2030, over 80% of the European population is projected to reside in urban regions.

• Within Europe, 65% of the urban populace resides in cities that have a population of less than 500,000 individuals.

• SMSCs encounter significant challenges in obtaining research and innovation (R&I) as well as attracting and mobilizing resources.

• Cities play a crucial role in the shift towards a sustainable society.

• Health and wellbeing are distinct aspects of urban development.

The primary goals include:

[31] Go green roats website GGR | Home (gogreenroutes.eu)

Cities have a crucial role in leading the shift towards a sustainable society and in addressing and reducing socioeconomic disparities in the availability of health and well-being resources for urban residents.

The urban population in Europe is predominantly concentrated in cities with a population size of less than 500,000, accounting for 65% of the total. Nevertheless, the majority of urban research and innovation (R&I) and resources are concentrated in Central and Nordic nations as well as in large cities. Conversely, the most urgent urban concerns are typically encountered in the periphery and in Small and Medium-Sized Cities (SMSCs). Europe is currently confronted with significant research and innovation shortages that need to be addressed in order to meet the needs of smaller cities.

General Aim

The aim of IN-HABIT is to study the health and wellbeing of marginalized communities by utilizing local resources that are often overlooked, such as culture and heritage, food, human-animal relationships, environment, and art. This will be achieved through innovative and comprehensive solutions that are created, developed, and managed collaboratively by local residents and relevant stakeholders.

Explicit Objectives

During the course of the project's five-year timeframe, IN-HABIT will endeavor to achieve the following precise objectives in order to promote comprehensive health and wellness in small and medium-sized urban areas

IN-HABIT aims to enhance understanding of the research and innovation requirements related to the health and wellbeing of peripheral SMSCs. It will establish guidelines for gathering data at a city-wide level and analyze this data to track the development of cities and evaluate the effects of policy measures. The findings will augment our comprehension of the practical functioning of peripheral SMSCs.[32]

[32] In-habit website IN-HABIT Inclusive health and wellbeing in small sized cities | IN-HABIT (inhabit-h2020.eu)

16- VARCITIES

Amidst the growing urbanization of our planet, cities encounter several problems and risks as they strive to present viable urban prospects and fresh possibilities for their residents. VARCITIES is a bold initiative that prioritizes the residents and "human communities" as the focal point of future cities' vision. It advocates for future cities to be completely centered around human needs and well-being.

The project commenced in September 2020 and is scheduled to conclude in February 2025. The Consortium consists of 25 partners, with Telecommunication System Institute (TSI) as the leading organization. Seven Pilot Cities will trial and execute a range of pioneering nature-based initiatives.

Vision:

The goal of VARCITIES is to actualize innovative and forward-thinking concepts and enhance the worth by creating enduring frameworks for enhancing the health and welfare of individuals: females, children, adolescents, adults, and seniors, who encounter various climatic circumstances and difficulties in and around Europe. VARCITIES aims to promote innovation in urban environments by maximizing the use of nature-based solutions from digital, social, and cultural perspectives. Public spaces are conceptualized as human-centric environments that foster innovation, inclusiveness, well-being, and contentment for the populace.

Objectives

The project has the following precise goals:

Create innovative nature-centric solutions that actively contribute to the development of future urban areas and enhance the overall welfare of residents in seven European cities.

Evaluate and measure the long-term viability and influence of interventions using sophisticated KPIs (Key Performance Indicators) for health and well-being.

Enhance the sustainable shift towards intelligent and forthcoming cities by establishing a structure of regionally customized GBF (Governance, Business, Financing) models.

Engage several stakeholders in the collaborative design process and foster the development of environmentally-friendly and adaptable smart cities for the future.

Facilitate the sharing of information, attract the highest possible funding from the European Union, and make progress that surpasses the current level of development by collaborating with other European initiatives and platforms.

Facilitate the transfer, expansion, and long-term maintenance of successful strategies from VARCITIES by establishing a Healthy Cities Helix.[33]

NEW NBS GOVERNACE ,BUSNIESS , FINANCING MODELS AND ECONOMIC IMPACT ASSESSMENT TOOL

17- Naturvation

The NATure-based URban innoVATION project is a 4-year initiative supported by the European Commission. It brings together 14 institutions from various European countries specializing in urban development, geography, innovation studies, and economics. We aim to enhance our comprehension of the capabilities of nature-based solutions in urban areas, explore methods to encourage innovation in this field, and collaborate with communities and stakeholders to fully harness the potential of nature-based solutions in addressing urban sustainability challenges.

The NATURVATION project has produced a range of outcomes including strategies for integrating sustainability into mainstream practices, as well as identifying critical milestones and pathways towards achieving this goal.

Given the challenges posed by climate change and the growing strains on the environment, economy, and society, cities in Europe and worldwide have recognized sustainable development

[33] Varcities website Varcities – Future Cities

as a crucial strategic concern. Sustainability has transitioned from being an optional extra to an essential component of our approach to climate change, as well as a key factor in promoting economic, security, and social well-being.

Promoting sustainability

Nature-based solutions are considered very promising for facilitating the urban shift towards sustainability. They possess the capacity to offer several advantages in addressing various sustainability concerns in urban areas, including as mitigating floods and promoting enhanced health outcomes for diverse segments of society. They provide adaptability in response to a dynamic climate.

Collaboration

Six cities, namely Barcelona, Utrecht, Leipzig, Malmö, Győr, and Newcastle, are collaborating in the NATURVATION project. These cities will establish urban-regional innovation partnerships (URIPs) including key stakeholders such as local government, businesses, and civil society organizations. The URIPs will offer valuable insights into the many applications of nature-based solutions in various urban environments. Discover the process of cultivating urban nature and gain insights from the experiences of the Urban Nature Restoration Initiatives (URIPs).

Exploring further

Aside from the six locations designated as Urban-Related Innovation Platforms (URIPs), the NATURVATION project is also conducting research and organizing study tours to six cities inside Europe and an additional six cities globally. Discoveries and understandings can be obtained from Melbourne, Athens, Tianjin, Sofia, Edinburgh, Mexico City, Boston, Cape Town, Athens, Dublin, Montpellier, and Winnipeg.[34]

18- Nature4Cities

Nature4Cities is an EU-funded Research & Innovation project under the Horizon 2020 program. Its objective is to

[34] Naturvation website About | NATURVATION

develop a complete reference Platform for Nature Based Solutions (NBS). This platform provides technical solutions, methodologies, and tools that enhance the decision-making process in urban planning. This will aid in tackling the current environmental, social, and economic difficulties encountered by European cities.

We want to reintegrate Nature into the processes of creativity, planning, and execution, prioritizing a mindset motivated by ecological considerations. This innovative technical and governance approach involves collaborative models led by people, researchers, policy makers, and industry leaders. It relies on participatory processes and the exchange of best practices.

The primary goals include:

Enhance the incorporation of Natural Based Solutions (NBS) into urban and spatial planning.

Establish a novel and dynamic community network centered around NBS.

Provide advanced decision-support tools for enhancing the natural environment in urban areas.

Create a comprehensive evaluation methodology for Natural Building Systems (NBS).

Create a comprehensive repository of information on NBS (Natural Building Systems) and facilitate the exchange of Best Practices.

Suggest novel governance, business, and financial frameworks for the implementation of NBS.[35]

CARBON NRUTRAL AND IMPROVED AIR QUALITY

DivAirCity H2020

19- DivAirCity

DivAirCity is a 4-year initiative supported by the European Commission under the H2020 program. The project aims to contribute to the Sustainable Development Goals by promoting diversity and social inclusion. Its objective is to create an innovative, creative, and environmentally friendly metropolitan civilization that is free from carbon emissions.

[35]Nature website Publications | nature4cities

The aims to tackle the correlation between social inequality, health issues, and urban air pollution. The project encompasses 24 EU organizations and 68 external players from all five continents. It aims to establish repeatable pilot initiatives in 5 EU cities.

The recent Covid-19 outbreak has highlighted the correlation between urban regions with high levels of air pollution and their impact on health and well-being. Furthermore, it has revealed that a pandemic does not equalize society but rather highlights the influence of social disparities in urban areas. The interrelationship of air pollution, biodiversity, social disparities, and urban areas poses a pressing concern that requires prompt intervention.

The cities included are Aarhus in Denmark, Bucharest in Romania, Castellon in Spain, Orvieto in Italy, and Potsdam in Germany.

The objectives

An initiative that acknowledges, embraces, and commends the variations present in cities, transforming them into a genuine asset to combat the urgent issues of air pollution and climate change.

Revolutionizes the urban paradigm by recognizing the value of human variety as an asset in creating new services and models for culturally-driven environmentally-friendly cities. The initiative centers on the interconnection between individuals, locations, peacefulness, economic advancement, and their influence on air quality and the reduction of carbon emissions.[36]

JUST—NATURE **20- JUSTnature**

The aim is to enhance the ability of various players to shape their surroundings by identifying different types of governance skills and potential actions. These will be tested through the CiPeLs to provide fair access to Low carbon | High air quality Nature-based Solutions (NbS).

[36] Dive air city website https://divaircity.eu/

To stimulate the development of local innovation ecosystems, we will initiate a grassroots entrepreneurial exploration process for Low carbon | High air quality Nature-based Solutions (NbS) in the CiPeLs.

In order to evaluate the consistency and efficiency of interventions, we aim to create a comprehensive monitoring and evaluation framework that covers the entire life cycle. This will involve enhancing monitoring systems and utilizing advanced data analytics techniques to go beyond traditional key performance indicators (KPIs) and develop a more inclusive and integrated set of indicators for assessing low-carbon living conditions.

The JUSTNature project tackles four primary obstacles:

Income and wealth disparities, together with discriminatory practices, contribute to the emergence of geographical inequalities in metropolitan areas.

Scattered and secluded urban features with significant biodiversity value.

Affected in distinct ways by urban change processes.

The environmental and climate impacts are not uniformly distributed.

The primary goal of JUSTNature is to implement nature-based solutions (NbS) by guaranteeing a fair transition to low-carbon cities, founded on the premise of the right to ecological space.

This specifically pertains to the entitlement to unpolluted air and optimal indoor/outdoor temperature conditions for the purpose of promoting human health and overall well-being, as well as fostering diverse and flourishing ecosystems. It also pertains to the obligation of not limiting the ecological capacity of others, especially with regards to the mitigation of climate change and the implementation of steps to decrease greenhouse gas emissions.

The objective is to aid in the development of low-carbon cities by creating a series of practice labs in six European cities, focused on implementing nature-based solutions (NbS) that promote both low carbon emissions and high air quality.

In order to implement Low carbon | High air quality Nature-based Solutions (NbS) effectively, it is necessary to drive the co-design, co-creation, and co-decision of supporting interventions across

four innovation dimensions in the CiPeLs. These dimensions include: 1) effective governance, 2) long-term maintenance and operation of NbS systems, 3) development of social and innovative business models, and 4) utilization of efficient technologies and applications.

To facilitate a fair transition, it is necessary to enhance the overall understanding of the potential for nature-based solutions to reduce carbon emissions and improve air quality, both at a general level and in specific urban contexts.[37]

21- UPSURGE

UPSURGE facilitates the use of Nature Based Solutions for the regenerative growth of cities, with a specific focus on reducing air pollution and achieving climate neutrality. It connects existing knowledge with practical implementation strategies.

Our primary objective is to redirect urban areas and accelerate their transition towards regeneration by utilizing the potential of Nature Based Solutions (NBS).

UPSURGE is a program designed to address the issues that cities face in their attempts to minimize the effects of urban living on climate change, alleviate air pollution and its associated health consequences, and lower climate change stressors.

UPSURGE aims to facilitate the transition of European cities towards regenerative practices. It will establish an EU Urban Regenerative Lighthouse as a model and a network to expedite, transfer, and expand the adoption of Nature-Based Solutions (NBS) and integrate them into urban policy agendas. This will be achieved through collaborative processes involving citizens and other stakeholders.

offer tailored solutions for addressing the challenges of NBS (Nature-Based Solutions) by providing digital tools and governance strategies for urban space regeneration. These solutions will be implemented and evaluated in five European locations through real-life demonstrations.[38]

[37] JUSTNature | Driving a just transition towards low carbon cities (justnatureproject.eu)
[38] UPSURGE Project – The European Union Regenerative Urban Lighthouse Project (upsurge-project.eu)

4.2 NEW EUROPEAN BAUHAUS

The New European Bauhaus (NEB) is an ecological, economic, and cultural initiative that aids in the achievement of EGD goals. Its design phase started in January 2021. The core principles of this initiative are sustainable development, aesthetics, and social participation. The objective of the design phase, scheduled for the first half of 2021, is to explore and determine the ultimate form of the project. This project will be implemented in five European countries in subsequent stages and ultimately promoted within the European Union and internationally. The NEB is set to embark on a novel way to address the paramount problem of our era—the disaster of climate change. The NEB should be based on the ideals of the Bauhaus school, highlighting the significant ideological connection between the two. Today, after a century, the difficulties confronting society have evolved, but the approach to addressing them remains universal and, crucially, comprehensive. It involves the collaboration of experts from several disciplines to transform the technology, economics, and culture of Europe in alignment with the goals of the European Green Deal (EGD).

Objectives of the European Green Deal in the Context of Sustainable Design

The European Green Deal (EGD), a legislative effort of the European Commission, seeks to align the climate, energy, transport, and tax policies of the EU with the objective of lowering net greenhouse gas emissions by at least 55% by 2030, in comparison to the levels recorded in 1990. In order to meet the imminent deadline, European countries must implement decisive actions, as outlined by the European Commission. These actions primarily involve decarbonizing the construction sector, renovating existing housing stocks, enhancing the energy efficiency of buildings (achieving a reduction of 36-39% in final and primary energy consumption), and increasing the utilization of renewable energy sources (up to 40%). Furthermore, on 14 July 2021, the European Commission approved a set of recommendations known as Fit for 55, which consolidates the aforementioned initiatives and provides them with a more precise legislative structure. Furthermore, alongside the aforementioned objectives for 2030, additional targets were included, which include:

• Ensuring that renewable energy sources constitute a minimum of 49% of the energy utilized in buildings;

• Incrementing the utilization of renewable energy for heating and cooling purposes by 1.1% year;

• Implementing a yearly increase of 2.1% in the utilization of renewable energy in district heating and cooling systems.

• Achieving a yearly decrease of 1.7% in energy consumption within the public sector.

• Primary energy usage decreased by 39%. • Final energy consumption decreased by 36%.

• Annual refurbishment of 3% of public buildings (Sadowski, K. 2021).

An analysis of the placement of the New European Bauhaus as a transversality approach is conducted using a visual tool called CATI. The acronym CATI, derived from Spanish, represents the following concepts: ciencia (science), arte (art), tecnología (technology), and innovación (innovation). These fundamental principles are regarded as the pillars of sustainable engineering and manufacturing. The terminology utilized in the tool is in English, with 'C' representing science and 'I' representing sustainability and innovation. The latter is situated at the concealed vertex of the alternate plane. The CATI tool places sustainability at the core, serving as a novel point that introduces a third dimension and expands the scope to encompass social, environmental, and cultural concerns. (Rosado-García, M. J., Kubus, R., Argüelles-Bustillo 2021)

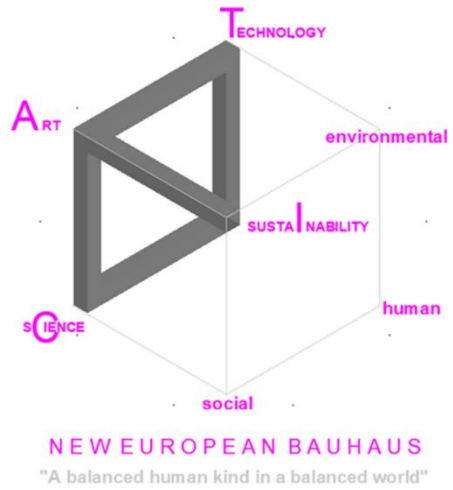


Figure 4. 4 New European Bauhaus for a culture of transversality and sustainability .
(Rosado-García, M. J., Kubus, R., Argüelles-Bustillo 2021)

4.3 COMPARATIVE ANALYSIS OF REVIEWED CASE STUDIES

In order to advance urban interventions and align with cutting-edge advances, a thorough evaluation of European projects has been conducted, in the analysis of 44 pilot projects from 157 pilot with a particular emphasis on efforts financed by Horizon 2020 (H2020) and the breakthrough New European Bauhaus attempts. The European Commission and the European Research Executive Agency (2022) have established strategic selection criteria for these projects. The principal factors include a preference for Horizon 2020 (H2020)-sponsored projects and creative New European Bauhaus efforts that demonstrate a strong commitment to being at the forefront of urban intervention innovations.

Furthermore, the assessment criteria include the identification of frontrunner cities and a focus on co-creation and social inclusiveness. This thematic focus is expressed by programs that target critical subjects such as climate and water resilience, inclusive urban regeneration, international restoration and rehabilitation of urban ecosystems, improved wellbeing and health, as well as the development of new governance models, business strategies, financing approaches, and economic impact assessment tools for Nature-Based Solutions (NBS). In addition, initiatives that contribute to carbon neutrality and improved air quality receive special attention.

This dedication to incorporating new advances into urban interventions demonstrates a thorough grasp of the most recent advancements in the industry. By following to these rigorous selection criteria, the assessed projects hope to not only address present urban development demands but also make a substantial contribution to creating the future of sustainable and inclusive urban environments.

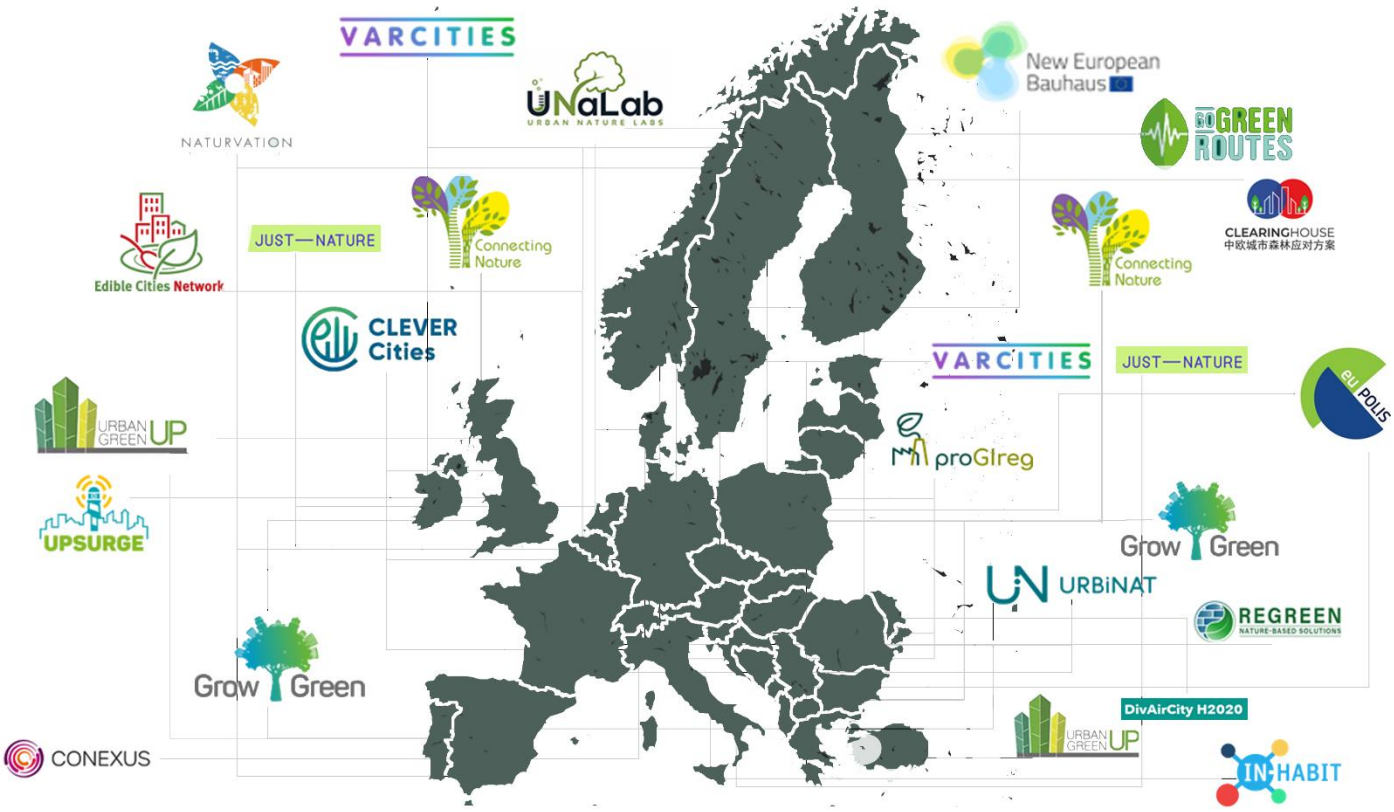


Figure 4. 5 Eu projects around Europe – elaborated by author 2024

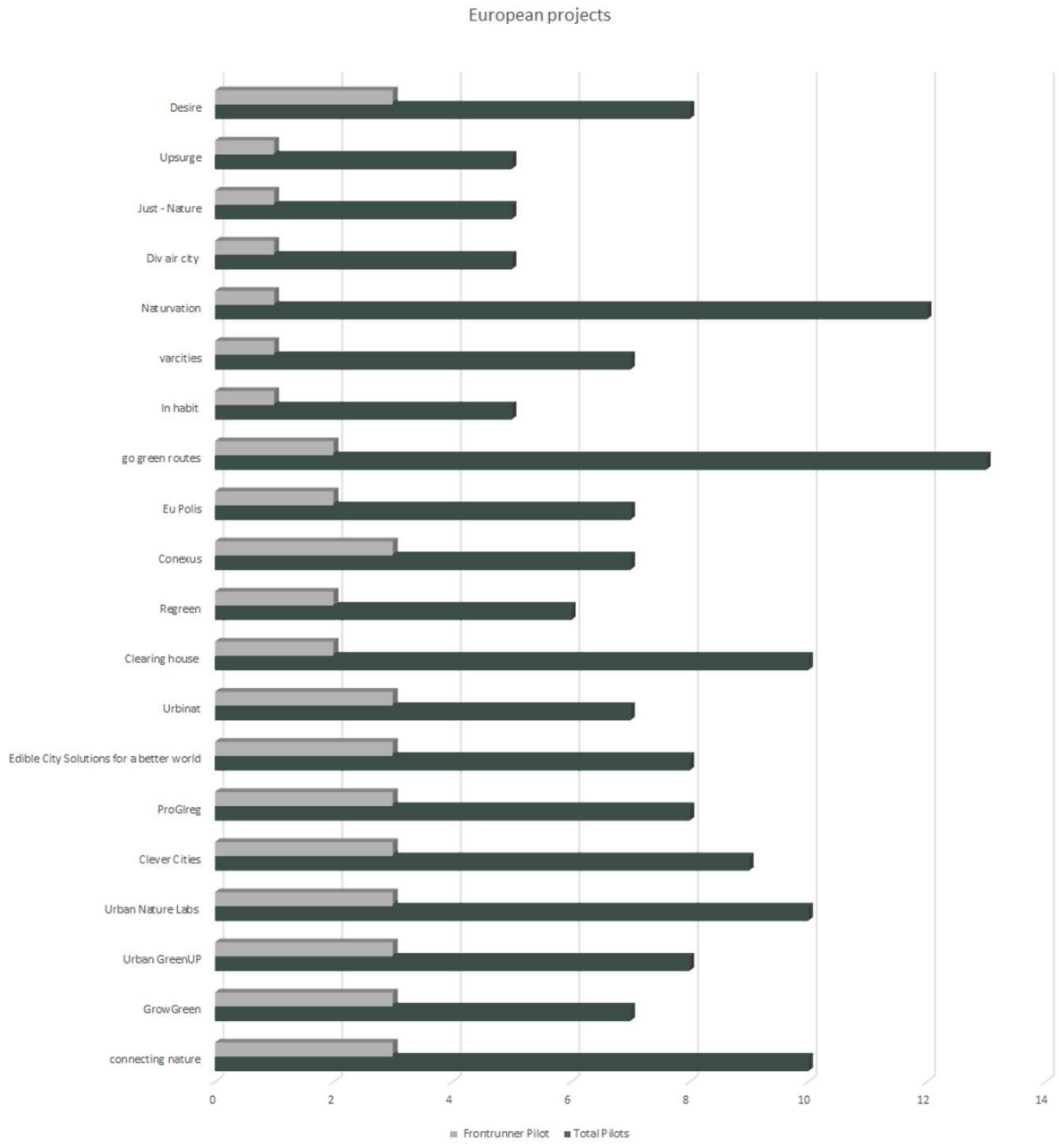


Figure 4. 6 The analysis of 44 pilot projects from 157 pilot – Elaborated by author 2024

			Objective	challenges	outcomes	impact on the enviroment	community engagements	ref
1	**Pilot**	Glasgow-uk Lambhill Stables	implement the Open Space Strategy (OSS) and Local Context Analyses (LCAs) with the aim of creating a well-managed, well-located, and well-connected network of open spaces	Coordination and Integration, Community Engagement, Climate Change Adaptation, Multifunctional Space Development	Greater Awareness and Protection, Partnership Working	Green Infrastructure, Air Quality Improvement, Climate Change Adaptation	community participation in decision-making processes, Inclusive Access, Health and Well-being by Improving mental health and contributing to social cohesion	City of Glasgow and the Open Space Strategy exemplar | Connecting Nature
	Project	City of Glasgow and the Open Space Strategy						
	NBS Approach used	Ecosystem-based adaptation &mitigation Ecosystem						
	Type	Urban						
2	**Pilot**	Burgas - bulgaria	The objective of the project is to restore the neglected Park of St Teresa in the heart of Burgas, transforming it into a nature-based solutions. The restoration aims to protect biodiversity, provide social and economic opportunities, and address environmental challenges such as flooding, particulate matter, and overheating in the city.	Flooding – particularly heavy rains in winter, Some areas of Burgas are disused and unattractive, Engagement with young population	Creation of pocket gardens adapted to the needs of local communities,Harvesting rainwater for green spaces to reduce flood risk, Increased awareness about NBS through local media and schools, Initiatives for bird habitat preservation and creation of green corridors, Integration of NBS in the construction of public buildings and rural areas.	Reduction in particulate matter in the city, Mitigation of overheating in specific areas, such as city squares and pedestrian zones, Cleaner air and water in the lakes and sea, contributing to improved wildlife habitats, Development of expertise in harnessing water and solar energy.	Fundraising efforts for bird habitat island, Initiatives to involve SMEs and citizens in discussions, implementation, and monitoring of NBS, Active participation of youth and citizens through media channels and schools.	Burgas | Connecting Nature
	Project	Park of St Teresa Restoration						
	NBS Approach used	Ecosystem-based adaptation &mitigation						
	Type	Urban						
3	**Pilot**	Poland- Poznan	create nature-oriented playgrounds, transforming traditional playgrounds into vibrant "play gardens."	engaging residents in ecological and social revitalization efforts within the city space, Creating floating gardens on the Warta River to introduce greenery to the city center,	Workshops and activities promoting green solutions, creating a connection between residents and nature,fostering ecological education.	Bee Population Increase, improved air and water quality in the city center, Urban Nature Experience.	Open Workshops, Collaboration with the Onwater Foundation for the creation of Floating Gardens involves residents in the process, fostering a sense of community engagement, creating a platform for dialogue through events and online channels	Poznań | Connecting Nature
	Project	social gardens						
	NBS Approach used	Ecological restoration						
	Type	Park						

			Objective	challenges	outcomes	impact on the enviroment	community engagements	ref
	Pilot Project	Valencia - Spain	implement nature-based solutions to enhance sustainability, promote environmental conservation, and improve the quality of life for the community.	Technical challenges related to the design, construction, and maintenance,Ensuring active community participation and engagement,Adaptation to Climate Conditions.	A participatory process called #MésVerdBenicalap (#GreenerBenicalap) engages citizens in designing and implementing, collaborative workshops, The GrowGreen app was launched in March 2020.	Biodiversity Enhancement, Reduced Urban Heat Island Effect, Sustainable Construction Practices	Citizen Participation, fostering a sense of ownership, Educational Workshops, The Green Civic Centre provides an inclusive space for community activities.	Catalogue of nature-based solutions in Valencia, https://growgreenproject.eu/wp-content/uploads/2022/03/Catalogue-Nature-based-
		VERTICAL ECOSYSTEM, GREEN ROOF,BENICALAP GREEN SPACE						
4	**NBS Approach used**	Ecosystem-based adaptation &mitigation						
	Type	Urban						
	Pilot Project	Wroclaw's	implement nature-based solutions to enhance sustainability, promote environmental conservation, and improve the quality of life for the community.	Addressing the 36% flooding risk despite existing flood protection measures, Heat Waves and Drought, Designing solutions suitable for a varied socio-economic landscape in the Olbin district.	Seven renovated courtyards and a green street, During heavy rainfall, raingardens and swales effectively stored runoff, validating their functionality,Community Co-Design.	Improved habitat with birdhouses and insect hotels, Creation of a 'green street' supporting various forms of greenery.	Residents, community members, and stakeholders participated in project designs, Detailed information boards and a media campaign enhanced local understanding of NBS benefits.	Wroclaw - GrowGreen (growgreenproject.eu)
		Nature-Based Solutions Demonstration in Wroclaw, Poland						
5	**NBS Approach used**	blue/Green infrastructure						
	Type	Urban						
	Pilot Project	Mancheste - UK	The project aims to demonstrate the effectiveness of these solutions in reducing flood risk while also providing additional co-benefits	Aging sewer system and culverted rivers contribute to the city's flooding issues, Large areas of impermeable surfaces due to urban growth exacerbate surface water flooding.	Community Engagement, Plans to reduce flood risk in the city's river valleys, the 'park that drinks water,' opened in West Gorton in July 2020.	Air and Water Quality, The park design, including meadows and woodlands, contributes to increased biodiversity in the area,Water Retention.	Engaging citizens through campaigns like Our Rivers Our City promotes awareness	Manchester - GrowGreen (growgreenproject.eu)
		A Strategy for Revitalising Manchester's River Valleys and Urban Waters- park that drinks water						
6	**NBS Approach used**	Green infrastructure						
	Type	Park						

			Objective	challenges	outcomes	impact on the enviroment	community engagements	ref
	Pilot Project	Izmir - Turky	Implement European re-naturing strategies in the urban context of Izmir, Address challenges related to climate change, water management, coastal resilience, green space conservation, air quality, urban regeneration, participatory planning, social justice, public health, and economic opportunities, Focus on creating green corridors, reducing urban temperatures, and mitigating environmental threats such as air pollution, heat island effect, and flooding.	Climate mitigation and adaptation, Water management, Green space management (including enhancing/conserving urban biodiversity), Air/ambient quality, Participatory planning and governance, Potential for new economic opportunities and green jobs	Community Engagement, Renaturing Urbanization, Water Interventions.	Resting Areas: Provide shaded areas in selected locations, Carbon Capture and Storage: Capture 36 tons of CO2 equivalent per year, increase biodiversity, Sustainable Drainage Systems (SUDs): Capture 165 tons of water per year, Flood Actions: Prevent flash floods, increase water retention, and add 300,000 new urban dwellers per year.Flood Actions: Prevent flash floods, increase water retention, and add 300,000 new urban dwellers per year.	Educational Activities: Improve well-being of around 90,000 citizens, attract 150,000 citizens to the Bio-boulevard, educate on urban biodiversity and climate change. Engagement: Direct engagement with citizens, including knowledge transfer, supporting farmers' welfare, and organizing events with specific engagement numbers., City Coaching: Raise awareness among 500,000 recipients on ecological reasoning and intelligence., Support Activities: Establish a platform for monitoring Nature-Based Solutions (NBS) in the city, engage citizens through a mentoring strategy.	Izmir (urbangreenup.eu)
	7	Green Izmir						
	NBS Approach used	Green infrastructure						
	Type	Urban						
	Pilot Project	Liverpool - UK	aims to address challenges related to urban development, economic growth, and environmental sustainability	Urban Form Densification: Balancing economic growth with maintaining an attractive city for residents and visitors, Connectivity Issues: Poor connectivity for pedestrians and cyclists between different parts of the city, Environmental Threats: Degraded urban environments posing threats to human health and quality of life.	Community Engagement, Renaturing Urbanization, Water Interventions.	Improved accessibility, connectivity, air quality, and safety on green routes, Reductions in water flow and volume during wet weather, Creation of innovative ecosystems like pollinator roofs and floating gardens, Installation of green walls and elevated green walls for biodiversity and air quality.	Wide engagement of local residents and partners, Improved mental health and well-being through direct interaction and co-creation, Educational opportunities through Forest Schools.	Liverpool (urbangreenup.eu)
	8	Singular green infrastructur, Water Interventions, Naturing urbanization						
	NBS Approach used	Green infrastructure						
	Type	Urban						

			Objective	challenges	outcomes	impact on the enviroment	community engagements	ref
	Pilot	Valladolid - spain	The project aims to address environmental challenges in Valladolid, including disconnection among green areas, heat island effect, poor air quality, and flooding. The overarching goal is to mitigate the impact of environmental changes on the city, and adopt the "Sustainable Urban Development Strategy" by enhancing connections between the city's green areas.	Environmental Issues: Valladolid faces challenges such as high levels of disconnection among green areas, heat island effect, poor air quality, and periodic flooding from the Esgueva River, Urban Risks and Environmental Problems: The urban dominant model in Spain has led to increased urban risks, soil consumption, energy consumption, water scarcity, and air pollution.	Renaturing Urbanization: Creation of an 8 km green corridor, and the benefit to over 200,000 citizens, Water Interventions: Installation of sustainable drainage systems, floodable park, water treatment, and irrigation, leading to the avoidance of irrigation needs and flood damage, and production of 45,000 m3 of water per year, Singular Green Infrastructure: Implementation of various green paths, pollinators, smart soils, vertical and horizontal green infrastructures, pollutant filters, and urban farming, resulting in improved air quality.	Renaturing Urbanization: Reduced carbon emissions, improved air quality, increased biodiversity, and promotion of sustainable mobility, Water Interventions: Efficient rainwater management, increased water retention, and prevention of surface puddles, Singular Green Infrastructures: Reduction of environmental pollution, oxygen production, particle retention, CO2 capture, increased energy efficiency, and enhanced biodiversity.	Educational Activities: Environmental awareness raised among young people, Engagement: Anticipated participation of 50,000 people in 200 sponsor activities, City Coaching and Support Activity: Involvement of 250,000 recipients in engagement activities and 40,000, 250, and 50 recipients for platform, complimentary projects/actions, and city mentoring, respectively.	Valladolid (urbangreenup.eu)
URBAN GREEN UP	**Project**	Singular green infrastructur, Water Interventions, Naturing urbanization						
9	**NBS Approach used**	Green infrastructure						
	Type	Urban						
	Pilot	Tampere- finland	The main objective of the project was to encourage local stakeholders and citizens in the Vuores area of Tampere to take the initiative in planning and implementing small-scale nature-based solutions (NBS). The City of Tampere aimed to empower residents to co-design and co-implement NBS projects that would enhance the local environment and community well-being.	Mobilizing citizen participation in planning and implementing NBS projects, Ensuring diverse and sustainable nature-based solutions that cater to the specific needs of the community, Managing financial and logistical aspects of the projects effectively.	Two garden areas near residential housing were developed, Residents actively participated in the construction work,Increased accessibility to outdoor activities, particularly through the horse park, addressing financial and social barriers.	Enhanced green spaces through the implementation of NBS projects, Increased biodiversity in the community horse park, Sustainable features like rainwater harvesting contributing to environmental conservation.	An official information session was organized for interested citizens, Information was disseminated through the city's communication channels,Residents actively participated in the planning and implementation of the projects.	City of Tampere | UNaLab
UNaLab URBAN NATURE LABS	**Project**	Innovation Vouchers to Encourage Citizens' NBS Initiatives - URBAN GARDENS						
10	**NBS Approach used**	Green infrastructure						
	Type	Park						

			Objective	challenges	outcomes	impact on the enviroment	community engagements	ref
	Pilot	Eindhoven - The Netherlands	The primary objective of Eindhoven's NBS demonstrations is to implement and showcase nature-based solutions (NBS) in various locations within the city center. The project aims to address urban challenges related to flooding, heat stress, air quality, and biodiversity. Additionally, the project seeks to engage the community and create a Community of Practice for Nature-based Solutions.	Urban Flooding: Managing stormwater runoff in paved areas, Heat Stress: Mitigating heat stress through increased green spaces, Air Quality: Improving air quality by reducing traffic and enhancing green areas, Biodiversity: Enhancing biodiversity through watercourse daylighting and fauna migration.	Reduced Flooding Risk: Less pavement reduces water channeling into sewers, minimizing the risk of flooding, Mitigated Heat Stress: Increased green spaces provide shade and enhance water evaporation, reducing heat stress, Improved Air Quality: Traffic reduction and revamped green areas contribute to better air quality, Enhanced Biodiversity: Fauna migration enabled by watercourse daylighting leads to increased biodiversity, Community Engagement: Collaboration with citizens in implementing green spaces, tree planting, and workshops.	Positive Water Management: Water retention areas and nature-based techniques contribute to sustainable stormwater management, Increased Green Spaces: Transformation of paved areas into green spaces positively impacts the urban environment, Fauna Migration: Daylighting the Grote Beek watercourse enhances fauna migration and biodiversity, Reduced Heat Island Effect: Green roofs and increased vegetation help mitigate the urban heat island effect.	Citizen Involvement: Residents participated in implementing green spaces in the Nutsbedrijven Regio Eindhoven area, Co-creation Workshop: The city hosted a co-creation workshop during the ENoLL Open Living Lab Days, engaging participants in the application of NBS, Community of Practice: Series of workshops aimed to form a Community of Practice for Nature-based Solutions, The Game of Nature-based Solutions: A workshop in Geneva involved participants playing with actual NBS cases from Eindhoven, promoting interactive learning and discussion	City of Eindhoven | UNaLab
	Project	Eindhoven's NBS Demonstrations						
	NBS Approach used	Green infrastructure						
11	**Type**	Urban						
	Pilot	Genova - Italy	The main objective of the project is to transform the Gavoglio area in Genova into a sustainable and nature-based urban park that addresses the challenges of residential pressure, lack of infrastructure, public services, and open spaces in the Lagaccio neighborhood. The project aims to use nature-based solutions (NBS) to create accessible open spaces, green areas, and recreational facilities, improving the quality of life for residents and promoting environmental sustainability.	Topography and Urban Setting: The project faced challenges related to the topography and urban setting of the Gavoglio area, requiring innovative solutions to integrate nature-based elements into the landscape, Former Military Barrack Site: The site's history as a former military barrack presented challenges in terms of site preparation, including the removal of a 1-meter deep soil layer and addressing potential hazardous materials like asbestos and unexploded devices, Pandemic-related Slowdown: The COVID-19 pandemic caused a	replacing former military buildings with accessible open spaces, playgrounds, porous pavements, rain gardens, retention ponds, green roofs, showcases the potential for sustainable urban development.	Environmental Renewal: The project contributed to the environmental renewal of the Lagaccio district, replacing dense urbanization with green spaces and promoting ecological balance, Rainwater Management, impacts on local biodiversity.	Co-Creation Workshops: The Municipality of Genova organized co-creation workshops involving citizens, Local Association Involvement: such as Casa Gavoglio and La Casa nel Parco, played a key role in building ties with stakeholders, organizing workshops, and facilitating community integration, Public Awareness.	City of Genova | UNaLab
	Project	Gavoglio Park						
	NBS Approach used	Green infrastructure						
12	**Type**	Urban						

			Objective	challenges	outcomes	impact on the enviroment	community engagements	ref
13	**Pilot**	Hamburg - Germany	The primary goal of the CLEVER Cities project in Hamburg is to implement Nature-Based Solutions (NbS) through a co-creation pathway. This involves addressing urban regeneration challenges related to human health, sustainable economic prosperity, social cohesion, environmental justice, and citizen security	rapid population growth, varied social and economic situations, and the need for sustainable urban development in the district of Neugraben–Fischbek (NF).	Community gathering and celebration event, Active participation of residents in various activities.	Biodiversity Enhancement, Improved Microclimates,Reduced surface runoff, minimized flooding risks, and improved water quality through natural filtration.	Stakeholder analysis, power-interest matrix, and active involvement in all phases.	ARLATI, Alessandro, et al. Stakeholder participation in the planning and design of nature-based solutions. Insights from CLEVER cities project
	Project	Hamburg's CLEVER Action Lab: Neugraben-Fischbek						
	NBS Approach used	Green infrastructure						
	Type	Urban						
14	**Pilot**	Milan - Italy	The project aims to bring nature into the everyday lives of residents, improve urban nature, enhance air quality, decrease runoff, and promote citizen well-being. Additionally, the project focuses on innovative business, finance, and governance models to engage private actors in the design and implementation of green interventions.	Building awareness of the co-benefits of green roofs and walls among stakeholders,Ensuring a collaborative approach with residents, the private sector, and professional associations,Implementing a co-design process to involve all interested stakeholders in the development of green interventions.	Identification of common barriers to nature-based solutions and development of strategies to overcome them, Subsidization of 35% of the costs of building green roofs/walls as part of the public bid "BE2 – Building Energy Efficiency.	Improved urban nature and increased green spaces in the city, Enhanced air quality due to the presence of green roofs and walls, Decreased runoff contributing to better water management.	Collaborative approach with residents, private sector, and professional associations, Stakeholder engagement meetings to build trust and facilitate networking, Inclusion of building owners, residents, and other interested stakeholders in the co-design process.	Mahmoud, Israa & Morello, Eugenio. (2020). Are Nature-based solutions the answer to urban sustainability dilemma? The case of CLEVER Cities CALs within the Milanese
	Project	co-design pathway to spread green roofs and walls throughout the city"Rinverdiamo Milano"Giambellino 129"Tibaldi Train Stop"						
	NBS Approach used	Green infrastructure						
	Type	Park						
15	**Pilot**	London- Britin	Creation of an edible garden, developed in collaboration with local residents, with the broader goal of addressing community needs and fostering a sense of collaboration and community engagement.	Balancing the interests and preferences of residents of different age groups and backgrounds.	Successful delivery of the South Thamesmead Garden Estate edible garden, Community gathering and celebration event, Active participation of residents in various activities.	local biodiversity and sustainable food production, Potential positive impacts on air quality and overall environmental well-being.	Anticipation of ongoing local resident support for the management of the space.	https://clevercities.eu/news/?c=search&uid=9fppPQxL - Wilk, B., Säumel, I., & Rizzi, D. (2021). Collaborative governance
	Project	South Thamesmead Garden Estate project						
	NBS Approach used	Green infrastructure						

			Objective	challenges	outcomes	impact on the enviroment	community engagements	ref
	Pilot	Living Lab Dortmund-Huckarde, Germany	enhance the quality of the Gustav-Heinemann-Park in Dortmund-Huckarde, transforming it into a vibrant space that encourages physical activity and social interaction	Political Approval, Community Concerns, Dealing with another city department responsible for the design and planning process posed challenges	Increased Park Utilization, Social Control, Positive Public Reception	Biodiversity Enhancement, with flowering meadows, promoting pollinator diversity.	Stakeholder Involvement, Citizen Meetings.	proGIreg •• Leisure activities and clean energy on former landfills
16	**Project**	Exercise Park in Huckarde						
	NBS Approach used	Green infrastructure						
	Type	Park						
	Pilot	Living Lab Turin- italy	To revitalize a post-industrial neighborhood in Turin through Nature-Based Solutions (NBS),Addressing vulnerabilities, improving community well-being, and boosting local economy.	Population decline and aging demographics, Neglected green spaces, social segregation, and poverty, High unemployment and low education levels, Health issues and an aging population.	Improved community well-being and social inclusion ,Enhanced green infrastructure and urban environments ,Strengthened community bonds and partnerships, Economic , revitalization potential.	Reduction of heat island effect and promotion of biodiversity, Improved stormwater management through NBS, Enhanced air quality and reduced pollution.	Strong community involvement in design and implementation, Participation from local schools and organizations, Development of a fresh, environmentally conscious identity.	proGIreg •• Tur
17	**Project**	The Living Lab: Mirafiori Sud						
	NBS Approach used	Green infrastructure						
	Type	Park						
	Pilot	Living Lab Zagreb, Croatia	to enhance the physical and mental well-being of individuals with disabilities by providing a specially designed outdoor space. The project aims to foster social inclusion, promote equality, and reduce discrimination based on various characteristics such as disabilities	Ensuring acceptance and support from local stakeholders and residents, Managing the diverse needs of different target groups, including people with autism, war veterans, and individuals with physical and mental disabilities.	Successful implementation of the therapeutic garden providing a beneficial outdoor space, Promotion of social inclusion within the community of healthy individuals.	Increased biodiversity through the planting of 550 different tree and shrub saplings, Preservation of the gene pool of trees, specifically cloning two centuries-old linden trees.	Involvement of local stakeholders, attracting financial donations from companies and organizations.	proGIreg •• Zagreb
18	**Project**	Therapeutic Garden Sesvete						
	NBS Approach used	Green infrastructure						
	Type	Park						

			Objective	challenges	outcomes	impact on the enviroment	community engagements	ref
	Pilot	Berlin - Germany	transform the city into an Edible City by promoting and supporting urban gardening initiatives. The project aims to enhance the quality of life, foster social cohesion, and address social challenges within the city by encouraging the cultivation of edible plants, creating community gardens, and implementing a nutrition strategy.	Diverse Initiatives: Managing and coordinating numerous grassroots ECS initiatives spread across the city, Community Engagement: Ensuring active participation of residents and stakeholders in gardening activities, Sustainability: Developing self-supporting structures to sustain the impact of the project beyond its duration, Integration: Integrating urban gardening into the social fabric and daily life of the city, Logistical Complexity: Coordinating with local offices, Neighbourhood Management Teams, and 32 Neighbourhood Councils.	Online Platform: Development of an online platform to showcase and provide information about urban gardens in Berlin, Nutrition Strategy: Completion of a comprehensive nutrition strategy to guide and support ECS projects, Social Cohesion Support: Several ECS projects have received support from the Social Cohesion Programme, Community Interest: High interest and engagement from civil society in gardening and healthy food practices.	Biodiversity: Creation of zones for biodiversity through the establishment of numerous garden communities, Green Metropolis: Contribution to shaping Berlin as a growing green metropolis, Environmental Awareness: Promotion of environmentally sustainable practices through urban gardening.	Local Offices and Teams: Utilization of local offices, Neighbourhood Management Teams, and 32 Neighbourhood Councils as contact points and communication centers, Direct Democracy Elements: Promotion of community involvement and the use of direct democracy elements through Neighbourhood Councils, Social Cohesion Programme: Integration of EdiCitNet into the Social Cohesion Programme to activate and engage residents and local stakeholders.	Housing / State of Berlin , https://www.edicitnet.com/wp-content/uploads/Teamposter%20-%20Berlin.pdf
Edible Cities Network	**Project**	Edible City Solutions (ECS) in Berlin						
19	**NBS Approach used**	Green infrastructure						
	Type	Park						
	Pilot	Oslo - Biligum	Transform a public park in a troubled neighborhood into a thriving community project by implementing pop-up urban gardening activities. Provide summer jobs for local youth to engage them in the project.	Addressing issues in the troubled neighborhood, Ensuring active participation of local youth, Transforming the park into a positive and sustainable space	Improved community engagement, Transformation of the park into a lively and green space, Creation of summer jobs for local youth.	Increased green spaces in the troubled neighborhood, Positive effects on local biodiversity.	Involving local residents and youth in the planning and execution, Encouraging community participation in the pop-up gardening activities	PowerPoint-Präsentation (edicitnet.com)
	Project	Pop-up Urban Gardening Activities in a Troubled Neighborhood Park						
20	**NBS Approach used**	Green infrastructure						
	Type	Park						

			Objective	challenges	outcomes	impact on the enviroment	community engagements	ref
Edible Cities Network	**Pilot**	Andernach - Germany	transform urban spaces into edible green areas, fostering collaboration among citizens, small and medium-sized enterprises (SMEs), and non-governmental organizations (NGOs). The project seeks to integrate edible greenery into public spaces, encourage citizen engagement, and provide opportunities for experimentation and collaboration in urban gardening.	Reimagining urban spaces to incorporate edible greenery, Promoting collaboration among citizens, SMEs, and NGOs, Sustaining long-term engagement and participation in community gardening, Addressing social issues, such as education of children and integration of different social groups.	Establishment of city center edible greenery, permaculture area on Andernach outskirts farmed by Perspektive gGmbH, community garden by the youth center for citizen participation, sale of permaculture products at a city center shop. Integration of urban gardening into Andernach's Green Strategy, enhancing public spaces with more edible greenery. Free citizen access to harvest from unfenced public green spaces, collaboration with Perspektive gGmbH providing gardening employment for long-term unemployed, and incorporation of beehives for pollination, honey production, and cultural significance.	Increased greenery in urban spaces, contributing to environmental sustainability, Promotion of organic farming practices in the permaculture area, Positive impact on local biodiversity through the presence of beehives, Reduction of food miles by selling locally produced organic products.	Active involvement of citizens in the maintenance and harvesting of edible green spaces, Collaboration with SMEs, NGOs, and the EdiCitNet Project to strengthen community ties, Community garden near the youth center providing a space for experimentation and project initiatives, Social focus on inclusion, education of children, and integration of diverse social groups through the Living Lab of Andernach.	PowerPoint-Präsentation (edicitnet.com)
	Project	Edible City of Andernach						
	NBS Approach used	Green infrastructure						
	Type	Urban						
	21							
URBiNAT	**Pilot**	Sofia - Bulgaria	The main objective of the Green Corridor for Health project is to address urban fragmentation in the intervention area by creating a linear urban park with four areas of focused and thematic interventions. The project aims to connect two parks and public transport stops, providing a convenient, illuminated, and high-quality urban green infrastructure accessible to all residents. The focus is on promoting active and passive recreation, fostering community engagement, and revitalizing unused public spaces.	Urban Fragmentation: Addressing spatial isolation caused by physical barriers such as railway lines, warehouses, multilevel junctions, and a lack of pedestrian-friendly crossings, Co-diagnostic Stage Challenges: Identifying and engaging diverse groups, including political representatives, municipal technicians, citizens, and stakeholders, in the co-diagnostic stage to understand local participatory culture, Covid-19 Impact: The need for equipment and internet access, especially for vulnerable populations, emerged during the pandemic.	Creation of a Healthy Corridor: The project resulted in the establishment of a linear urban park serving as a pedestrian connection between parks and public transport stops, Revitalization of Public Spaces: Renovation of unused and empty public spaces through community involvement, Thematic Interventions: Four areas with thematic interventions, including passive and active zones modeled after Nature-Based Solutions (NBS) – Urban Park, Improved Accessibility: Enhanced accessibility for all residents, including children, adults, pensioners, and people with disabilities	Green Infrastructure: Creation of a sustainable and well-designed green infrastructure, Biodiversity Enhancement: Incorporation of Nature-Based Solutions to promote biodiversity and environmental sustainability, Renewal of Unused Spaces: Positive environmental impact through the revitalization of unused public spaces.	Co-creation Process: Involvement of diverse groups through co-diagnostic and co-design stages, including political representatives, municipal technicians, citizens, and stakeholders، Public Workshops: Organization of open-air workshops to engage the community and gather input for the project، Stakeholders Advisory Board: Creation of a Stakeholders Advisory Board with remote participatory actions during periods of restrictions	SOFIA - Urbina
	Project	Healthy Corridors						
	NBS Approach used	Green infrastructure						
	Type	Urban						
	22							

				Objective	challenges	outcomes	impact on the enviroment	community engagements	ref
URBiNAT		Pilot	Porto living laboratory - Portogal	The project aims to address the urban regeneration of peripheral areas by developing healthy corridors as drivers of social housing neighborhoods. It focuses on co-creating social, environmental, and marketable nature-based solutions (NBS) to promote well-being for the communities and to create an innovative and democratic public space.	The project addresses the fragmentation of social housing neighborhoods and explores a co-creation methodology to support inclusive urban regeneration and social innovation.	The project will develop the concept of healthy corridors and explore a co-creation methodology to support inclusive urban regeneration and social innovation.	Ecological principle of continuum naturale to promote biodiversity in urban environments.	co-creation process with communities, citizens, stakeholders, municipality technicians, companies, and researchers to develop solutions for new urban challenges.	RASSEGNA DI ARCHITETTURA E URBANISTICA Anno LIV, numero 158, maggio-agosto 2019 | Year LIV, number 158, May-August 2019. https://urbinat.eu/cities/porto/
		Project	Healthy Corridors for the Fragmented Modern City, Campanhã						
	23	NBS Approach used	Green infrastructure						
		Type	Urban						
		Pilot	A Living Lab for Nantes Nord - France	to address urban fragmentation in the intervention area by creating a linear urban park with four areas of focused and thematic interventions. The project aims to connect two parks and public transport stops, providing a convenient, illuminated, and high-quality urban green infrastructure accessible to all residents. The focus is on promoting active and passive recreation, fostering community engagement, and revitalizing unused public spaces.	Physical exercises for health Technical support for sport practise,Accessibility & connectivities (within the district, Access to healthy food Social cohesion	Provide to inhabitants' access to affordable fruits and vegetables, Develop active mobility for travels within the neighbourhood, Favor children physical activity, Provide new outdoor community spaces in public spaces Green and public spaces.	Ecological principle of continuum naturale to promote biodiversity in urban environments.	co-creation process with communities, citizens, stakeholders, municipality technicians, companies, and researchers to develop solutions for new urban challenges.	RelatorioNANTES_2021-09-21.pdf (basecamp.com)
		Project	The Nantes Healthy Corridor						
		NBS Approach used							
	24		Green infrastructure						
		Type	Urban						

			Objective	Challenges	Outcomes	Impact on the enviroment	community engagements	ref
25	**Pilot**	Barcelona, Spain	The project emphasizes collaboration between regional administrations, research institutions, municipalities, NGOs, and citizens to develop locally appropriate NBS and enhance the ecological and social resilience of the area.	Lack of a well-defined governance model for planning, design, and management. water availability, periods of drought, and urban conservation measures. Knowledge gaps in biodiversity, data on riparian forests and river pollutants. Urbanization of the landscape, low phreatic level, challenges posed by exotic species, landscape fragmentation, and agricultural intensification.	Prioritization of ecosystem services in the area. Facilitated networking among diverse stakeholders. Positioning it as a future Living Lab and base for co-design sessions. Georeferenced outcomes introduced in an online viewer for easy visualization and sharing.	Preservation and connection of riparian forest patches to increase landscape connectivity and favor biodiversity. Recognition of the strategic value of agricultural activity in the Agrarian Park metropolitan area for local food production, water cycle, landscape complexity, ecological functionality, biodiversity, and circular economy.	Importance of collaboration between regional and local administrations, research institutions, municipalities, NGOs, and citizens. Co-creation workshops and collective activities fostered knowledge sharing.	_
	Project	Llobregat&Co Collaborative Project						
	NBS Approach used	Green infrastructure						
	Type	Urban forst						
26	**Pilot**	Krakow, Poland	The development of business models for the implementation of Urban Forest Nature-Based Solutions (UF-NBS). The Drwinka River Park serves as a focal point, facing challenges in maintaining urban green spaces crucial for biodiversity preservation.	Governance Planning and Policy Landscape including conflicts with private stakeholders, differing resident opinions, and urbanization pressures. Urban Forest Management in a Built-Up Area: Drwinka River Park faces challenges in maintaining urban green spaces in a heavily built-up area , balancing the need for biodiversity preservation with urban development pressures.	Formal Protection Measures, protecting 40 hectares of green areas. identified 700 species, fostering nature-based solutions prioritizing wild nature over traditional urban park norms. The project successfully modified a pipeline route to safeguard valuable aquatic habitats of the park. Educational Initiatives to raise awareness about the ecological value of the park and the importance of green spaces in urban areas.	Preservation of Green Areas. Ecological Connectivity: The project fostered ecological connectivity through the Green Ring of Podgórze concept. Protection of areas designated as aquatic ecological corridors, vital for maintaining the city's ecosystem.	Local community engagement led to the formation of the Drwinka River Association. Stakeholder collaboration, with both formal and informal institutions. Participatory Governance	Barcelona – Clearing House H2020 (clearinghouse project.eu)
	Project	Kraków River Parks						
	NBS Approach used	Green infrastructure						
	Type	Urban forst						

			Objective	Challenges	Outcomes	Impact on the enviroment	community engagements	ref
	Pilot	Paris - france	The project aims to implement Nature-Based Solutions (NBS) to improve water cycle management, regulate temperatures, and enhance biodiversity in both urban and rural areas. Key goals include making impermeable surfaces permeable again, re-naturalizing rivers, increasing vegetation cover in streets and squares, and educating the community about the importance of nature in urban living.	Urban Heat Islands: Mitigating the risk of urban heat islands exacerbated by dense urban fabric, heavy traffic, and lack of vegetation, Flooding Events: Addressing riverine and pluvial flooding events, associated with intensive farming, lack of green infrastructure, and heavy traffic, Biodiversity Depletion: Tackling the significant decline in biodiversity, especially in agricultural areas and urban parks, Land Take: Managing the substantial annual consumption of rural areas by urbanization, leading to a decrease in green spaces	Improved Water Cycle Management: Implementing NBS to regulate the water cycle and reduce the risk of flooding, Temperature Regulation, Increased Green Spaces: Expanding green spaces through green roofs, squares, and urban agriculture, Community Education: Raising awareness and educating both children and adults about the importance of nature-based solutions in urban development.	Biodiversity Enhancement: Re-naturalizing rivers and increasing vegetation cover to support biodiversity, Reduced Urban Heat Islands: Implementing impermeable surface transformations and increasing green spaces to regulate temperatures, Flood Risk Reduction: Addressing flooding events through NBS, such as permeable surfaces and increased green infrastructure, Air Quality Improvement	Children's Education: Testing interventions to develop children's knowledge and awareness of nature as a vital resource for urban living, Adult Awareness and Training: Raising awareness, educating, and training adults, including professionals and elected representatives, in NBS design and management, Technician Training: Assisting technicians from cities in designing NBS based on solid biodiversity and ecosystem knowledge.	Paris - REGREEN (regreen-project.eu)
	Project	REGREEN - Paris Urban Development & Natural Resources						
	27							
	NBS Approach used	Ecosystem-based adaptation &mitigation						
	Type	Urban						
	Pilot	Velika Gorica - Croatia	to address environmental pressures, enhance sustainability, and improve the quality of life in the urban area. The focus is on implementing Nature-Based Solutions (NBS) to mitigate flooding, reduce pollution, combat the urban heat island effect, and promote biodiversity. The project aims to involve the community through participatory boards and awareness-raising initiatives.	Urbanization Pressures, Pollution Sources: High traffic, wood and oil heating, and agricultural activities contributing to pollution, Flooding Issues: Inefficient rainwater management causing flooding downstream, Climate Change Impact: Increased frequency of flooding events and heatwaves, Biodiversity Conservation: Balancing urban development with the preservation of high woodland biodiversity.	Green Roofs Implementation, Solar Power Integration, Renaturalization of Rainwater Canals: Development of a new recreational area and cycling/hiking/horseback riding lanes through renaturalization of rainwater channels, Street Tree Planting, Biodiversity Mapping, Social Inclusion	Reduced Flooding: Improved rainwater management to mitigate downstream flooding, Air Quality Improvement: Street trees contribute to dispersing and catching pollutants, leading to improved air quality, Temperature Regulation: Afforestation and green roofs combat urban heat island effects, regulating local temperatures, Biodiversity Enhancement: Expansion and management of green areas contribute to the preservation and enhancement of urban biodiversity.	Green Startups Incubation: Incubation of "green" startups in Velika Gorica's new business incubator, Participatory Boards: Inclusion of citizens, institutions, and various stakeholders in participatory boards to identify NBS sites, Awareness-Raising Events: Events targeting citizens, especially children and youth, to emphasize the importance of biodiversity and natural surroundings, Educational Materials: Production of educational materials for the general public, schools, and pre-school children.	https://www.regreen-project.eu/urban-living-lab/velika-gorica/
	Project	Velika Gorica Urban Development & Natural Resources						
	28							
	NBS Approach used	Ecosystem-based adaptation &mitigation						
	Type	Urban						

			Objective	Challenges	Outcomes	Impact on the enviroment	community engagements	ref
CONEXUS	**Pilot**	Turin- italy	To reallocate urban space from vehicular traffic to pedestrians and improve the overall quality of urban spaces, Address climate change vulnerabilities and enhance urban resilience	Lack of green spaces and excessive focus on vehicular traffic, Traffic congestion and parasitic parking practices	Increased pedestrian-friendly spaces and interactions, Enhanced urban resilience to climate change, Reduction in traffic congestion.	Reduction of urban heat island effect, Improved stormwater management, Promotion of sustainable and climate-resilient urban environments.	Engagement of the youth hostel's student community, Educational and knowledge dissemination potential.	Turin — Conexus (conexusnbs.com) , https://www.torinovivibile.it/aree-tematiche/valdocco-vivibile/
	29 **Project**	Valdocco Vivibile						
	NBS Approach used	Green infrastructure						
	Type	Urban						
	Pilot	Lisbon - portigal	The project focuses on social inclusion, demonstrating place-keeping principles, and enhancing ecological connectivity in the city's urban districts. Additionally, the goal is to trial low-cost and low-maintenance nature-based solutions, specifically the Miyawaki-based Fast Forests, tailored to local climate and soil conditions.	Water scarcity, Lack of funding and reliance on volunteers to commit long-term, Securing the continuity of the Nature-based Solution implementation	Biodiversity Restoration: Successful implementation of Miyawaki-based Fast Forests to restore biodiversity in deprived urban districts, Social Inclusion: Fostering social inclusion through active participation of local communities in the project, addressing urban loneliness, Climate Change Mitigation: Contributing to climate change mitigation through tree planting and environmental education.	Ecological Connectivity: Enhancing ecological connectivity in urban districts, forming part of the Eastern Green Corridor, Climate Resilience: Implementing meadows with strong resilience to water scarcity and promoting tree planting to mitigate extreme climate events.	Participatory Approach: Actively involving local communities through a participatory approach in the implementation and maintenance of nature-based solutions, Place-Keeping Principles: Demonstrating place-keeping principles to ensure the solutions meet the needs and wishes of local people, Private/Public Sector Partnership: Fostering a unique private/public sector partnership between the NGO Urbem and the Lisbon City Council, involving private actors like PLMJ to support the project financially and administratively.	Lisbon — Conexus (conexusnbs.com)
	30 **Project**	Renatura						
	NBS Approach used	Ecosystem-based adaptation &mitigation						
	Type	Urban						
	Pilot	Barcelona - Spain	1- Develop strategic, international city networks to share and shape green infrastructure strategies and biodiversity plans, 2- Re-green dense urban and deprived neighborhoods through urban food and amenity interventions, demonstrating improved biodiversity and environmental performance, 3- Establish the Urban Agriculture Observatory to create a database of environmental and social aspects of urban allotments and their benefits, 4- Position Barcelona as a reference in urban agriculture policies.	Provide management tools and support to the city administration, Create a space for communication and participation.	improved biodiversity and environmental performance in urban allotment gardens, Development of a guidance manual for nature-based solutions management, Creation of a public web platform for sharing data on urban agriculture, Increased knowledge and awareness of the benefits of urban agriculture.	Positive impacts on biodiversity through re-greening initiatives, Improved environmental performance in urban areas, Increased cultivated biodiversity through participatory workshops, Potential reduction in pollutants through phytoremediation efforts.	Involvement of citizens in participatory activities around urban agriculture, Eight defined actions to implement the Urban Agriculture Observatory, including conferences and seed exchange workshops, Creation of the Urban Agriculture Observatory Website as an exchange platform for users, Positioning urban allotments as spaces for recreation, social interaction, and nature experience.	Barcelona — Conexus (conexusnbs.com)
	31 **Project**	Barcelona Green Infrastructure and Urban Agriculture Initiatives						
	NBS Approach used	Green infrastructure						
	Type	Urban						

			Objective	Challenges	Outcomes	Impact on the enviroment	community engagements	ref
	Pilot	Belgrade, Serbia	address various health and social challenges faced by the city due to aging infrastructure, leading to air, water, and soil pollution, as well as other environmental issues. The primary objective is to improve the quality of the city's environment by introducing nature-based solutions (NBS) in public areas, mitigating climate change effects, and enhancing the well-being of residents.	Poor air quality, including high concentrations of PM2.5, leading to an estimated 1,700 premature deaths per year, Incomplete infrastructure contributing to environmental pollution, noise, and stress-related aggressive behavior, Limited access to water, green spaces, and public areas for a significant portion of the population, High unemployment rate, brain drain, and challenges related to the presence of asylum seekers, refugees, and migrants.	Planting 20 specific trees with properties to mitigate respiratory, cardiovascular, and other health disorders, Introduction of a micro-climatic park on Zemun quay near the Old Railway Station pillars, Implementation of nature-based solutions to regenerate biodiversity and create a healthier urban environment, Development of an eco-edu hub demonstrating urban wastewater management and vertical farming solutions, Engagement of local residents in monitoring activities and health status through biometrical wristbands.	Mitigation of climate change effects through the introduction of trees with cooling and health-promoting properties, Regeneration of biodiversity by selecting plants with specific characteristics, Demonstration of a clean and sustainable urban wastewater management system, Promotion of vertical farming as an eco-friendly solution for urban agriculture.	Involvement of local expert teams from the Faculty of Civil Engineering, Belgrade, En Plus Company, and Mikser Organization, Collaboration with the City of Belgrade's public utility company Gradsko zelenilo (City Greenery), Engagement of residents through the use of biometrical wristbands for monitoring activities and health status, Creation of an eco-edu hub designed to attract, educate, and befriend local residents and experts.	City of Belgrade – euPOLIS (eupolis-project.eu)
32	**Project**	Belgrade pocket park, liner park						
	NBS Approach used	Green infrastructure						
	Type	Park						
	Pilot	Lodz, Poland	the project focuses on addressing environmental issues, such as air pollution, water shortages, soil degradation, heatwaves, floods, and the risk of raw sewage overflows. The project aims to introduce a paradigm shift in urban planning, emphasizing the synergy of NBS to enhance local microclimate conditions and encourage sustainable urban development.	High air pollution in the urbanized center of Łódź, Shortage of water and soil degradation, Heatwaves and floods, Lack of green and attractive public spaces, Poor technical condition of many buildings, Unfriendly and unsafe conditions in the Łódź demo location, Low digital literacy levels among residents, hindering the implementation of monitoring equipment.	Implementation of NBS technologies to address environmental challenges, Engagement with local citizens through biometrical wristbands for monitoring and participation in transforming urban spaces, Improved physical health and social cohesion in designated testing locations, Transformation of urban spaces through the introduction of NBS, Increased sense of ownership of public spaces among residents, Inclusive decision-making processes for urban planning, Creation of linear parks and green spaces to enhance the overall well-being of residents.	Reduction in air pollution through NBS interventions, Mitigation of water shortages and soil degradation, Alleviation of heatwaves and floods in urban areas, Improved microclimate , conditions Retention of rainwater through the creation of linear parks, Increased green areas for biodiversity.	Close collaboration with local citizens wearing biometrical wristbands, Monitoring of activities and health status of residents during testing, Transformation of urban spaces with the involvement of residents, Workshop sessions and expert discussions to foster inclusive engagement, Involvement of stakeholders, including local government, youth activists, participation experts, and researchers, Collection of opinions from residents on the current state of the linear park and preferences for interventions, Brainstorming exercises to generate practical recommendations.	https://eupolis-project.eu/city-of-lodz/
33	**Project**	Nature-Based Solutions for Urban Well-being						
	NBS Approach used	Green infrastructure						
	Type	Urban						

			Objective	Challenges	Outcomes	Impact on the enviroment	community engagements	ref
34	**Pilot**	Burgas, Bulgaria	The primary objectives include creating green urban spaces for well-being, exercise, recreation, and fostering a connection with nature. The project focuses on spatial planning, incorporating plants, seating, recreational spaces, and greener parking solutions.	Balancing urban development with environmental conservation, particularly in a city surrounded by natural features and biodiversity, Ensuring inclusivity and accessibility for all residents, including those with disabilities, Garnering community engagement and support for the project, Aligning with the ambitious goals of the Green City Accord in the areas of air quality, water conservation, nature and biodiversity, waste management, and noise	Revitalized urban areas in Bratya Miladinovvi and Gurko street/Oborishte, Improved spatial planning, incorporating green elements for well-being and recreation. Creation of green meeting spaces, recreational facilities, and pathways. Integration of sustainable features like green parking spaces, bike racks, and accessibility for people with disabilities. Enhanced community well-being through increased access to nature within the city	Increased green spaces contribute to improved air quality and biodiversity, Restoration of green connections facilitates sustainable movement within the city, Creation of habitats for local wildlife, supporting biodiversity conservation, Adoption of eco-friendly practices in urban planning and development.	Stakeholder engagement activities involving citizens, small businesses, medical institutions, and social service providers. Concept presentations to local stakeholders, including citizens, at the 'seedbed intervention.' Involvement of city councillors and local media, demonstrating widespread interest in connecting citizens to nature in the urban sphere.	GGR | Burgas (gogreenroutes.eu)
	Project	Urban Revitalization in Burgas						
	NBS Approach used	Green infrastructure						
	Type	Urban						
35	**Pilot**	Lahti, Finland	The project focuses on the development and piloting of a "health forest" concept in the Kintterö nature conservation area, specifically aimed at supporting the healthcare center staff, patients, and visitors. The project aims to leverage nature as a resource for promoting health and well-being, emphasizing inclusivity and user-driven co-design of nature-based services.	Ensuring inclusivity and accessibility of nature-based solutions for all segments of the population, Implementing user-friendly platforms to help individuals locate restorative spots in the health forest, Exploring the integration of virtual nature to enhance the interactive experience, Addressing , the growing differences in well-being among various population groupsPromoting intersectoral cooperation and breaking down internal silos in city management practices.	Establishment and piloting of the "health forest" concept in the Kintterö nature conservation area. Integration of more inclusive and multifunctional nature-based solutions into Lahti's public spaces. Development of user-friendly platforms for locating restorative spots in the health forest. Exploration and potential inclusion of virtual nature to enhance the overall experience. Improved cooperation among stakeholders, including the Päijät-Häme Joint Authority for Health and Well-being, regional universities, sport associations, non-profit organizations, and local enterprises.	Preservation and sustainable use of Lahti's natural resources. Increased awareness and appreciation of the ecosystem services provided by the Salpausselkä ridge and diverse biotopes. Integration of nature-based solutions to promote environmental sustainability and green infrastructure.	Collaboration with a wide range of stakeholders, including healthcare authorities, universities, sport associations, non-profit organizations, and local enterprises. Involvement of Lahti citizens in utilizing the health forest and providing feedback on their experiences. Promotion of community awareness regarding the importance of nature in supporting health and well-being.	GGR | Lahti (gogreenroutes.eu)
	Project	Lahti health forest.						
	NBS Approach used	Green infrastructure						
	Type	Forst						

				Objective	Challenges	Outcomes	Impact on the enviroment	community engagements	ref
IN-HABIT	36	**Pilot**	Lucca - Italy	The aim of the IN-HABIT project in Lucca is to collaboratively develop and implement a smart city that revolves on the interactions between humans and animals. The main objective is to improve public health in public areas by implementing nature-based solutions, with a special focus on the human-animal connection. The project's objective is to establish Lucca as the first animal-friendly city in Europe by developing "animatables" - 15-kilometer pathways across the city and public areas. These pathways will facilitate the development of bonds between people and animals, as well as encourage a deeper connection with the natural	Achieving a balance between promoting human-animal connections and preserving the city's majestic, naturalistic, and landscape beauty with little disruption. Fostering inclusion and diversity in the participative process by taking into account various viewpoints on the interaction between people and animals. Incorporating inventive concepts, such as establishing Animal Lines and safeguarded areas, into the current urban infrastructure. Resolving any obstacles that may arise from the lack of synchronization between political and technical administration and the participatory process.	The construction of a 15-kilometer pathway designed for animated creatures, with visible signs, animal-friendly seats, garbage receptacles supplied with bags for animal excrement, and water fountains suitable for animal consumption. Creation of three designated areas aimed at fostering interactions between humans and animals, strategically positioned across the city. Stakeholders from several sectors, such as schools, trade, tourism, social concerns, veterinarians, and dog educators, actively participate. Generating novel concepts to enhance public awareness of animals, constructing a comprehensive map of pet-friendly services, and establishing an integrated system for pet services.	Non-intrusive measures that preserve the city's grandeur and natural aesthetics without causing any adverse effects. Improvement of public places to facilitate human-animal interactions while minimizing environmental impact. The establishment of pet-friendly infrastructure enhances the sustainability and inclusivity of urban environments.	Engaging involvement of stakeholders in the participative process, demonstrating excitement and a wide range of ideas. The participation of around sixty stakeholders from many sectors, facilitating cooperation among educational institutions, business, tourism, social matters, and the corporate sphere. Facilitate inclusive engagement for people who are interested and take into account all creatures that interact with humans in the urban environment.	Granai, G., Borrelli, C., Moruzzo, R., Rovai, M., Riccioli, F., Mariti, C., ... & Di Iacovo, F. (2022). Between Participatory Approaches and Politics, Promoting Social Innovation in Smart Cities: Building a Hum–Animal Smart City in Lucca. *Sustain ability*, *14*(13), 7956. https://www.in habit-h2020.eu/lucca -2/
		NBS Approach used	Green infrastructure						
		Type	urban						
VARCITIES	37	**Pilot**	Castelfranco Veneto- Italy	To estimate the therapeutic effect of green and blue areas on the health and wellbeing of elderly individuals and those affected by Alzheimer's Disease.	Accessibility, inclusion, and fruition for some the categories of users, Lack of awareness on the benefits coming from green and natural spaces among the local citizen and stakeholders.	The project is expected to include improved health and wellbeing for the elderly and individuals affected by Alzheimer's Disease.	increased awareness of the benefits of green and natural spaces	The project aims to engage the community through inclusive access, awareness campaigns, and collaboration with various stakeholders.	https://varcitie s.eu/pilot-cities/castelfra nco-veneto-italy/ , https://varcitie s.eu/resources/ deliverables/d 4-2-varcities-cocreation-strategy/
		Project	A Healing Garden for young and elderly people, and people suffering from dementia						
		NBS Approach used	Green infrastructure						
		Type	Urban						

			Objective	Challenges	Outcomes	Impact on the enviroment	community engagements	ref
	Pilot	Barcelona - Spain	The objective of the Barcelona Green Corridor project was to transform protected areas within the urban region and green spaces within the urban core into nature-based solutions (NBS). The aim was to address the recreational demands of the urban core while ensuring multi-functionality, biodiversity conservation, and addressing climate adaptation needs, such as adaptation to droughts, fires, heat island effect, coastal erosion, evapotranspiration of green areas, and more frequent and extreme heavy rainfall.	Balancing recreational demands with multi-functionality and biodiversity conservation. Adapting to climate change impacts such as droughts, fires, heat island effect, and heavy rainfall. Managing conflicts between ecosystem service benefits of NBS and ecological/sustainability priorities. Integrating nature-based solution thinking into institutional structures. Promoting socio-environmental awareness for effective NBS implementation. Ensuring early civil participation for future engagement in NBS implementation.	Redevelopment of 'Passeig de Sant Joan' into one of the first green corridors in Barcelona.Increased ecological and social connectivity within the city.Implementation carried out by the city council's 'Ecology, Urban Planning and Mobility Area' in collaboration with district offices.	Enhanced biodiversity and ecological connectivity, Improved resilience to climate change impacts. Creation of green spaces contributing to overall environmental health. Mitigation of urban heat island effects. Protection of water bodies and coastal areas.	Early civil participation in the project implementation process. Collaboration with public and private organizations through the Barcelona Urban-Regional Innovation Partnership (URIP). Recognition of the importance of involving key stakeholders for the promotion and uptake of NBS. Integration of environmental justice, human health, and well-being considerations in the project vision.	Barcelona | NATURVATION
	Project	Barcelona Green Corridor						
	NBS Approach used	Green infrastructure						
	Type	Urban						
Naturvation	38							

			Objective	Challenges	Outcomes	Impact on the enviroment	community engagements	ref
DivAirCity H2020	39	**Pilot**	Bucharest-Rromana	To enhance the social integration among diverse social communities and enhance well-being through improved air quality by reducing vehicular traffic and increasing the presence of green spaces.	Tackling elevated levels of air pollution, particularly at periods of maximum intensity. Developing engaging and beneficial recreational and transportation options for marginalized populations (minorities, elderly individuals, disabled individuals, LGBTQ+ community). Promoting social integration in a heterogeneous community. Raising public awareness regarding air quality, climatic conditions, and biodiversity.	Improved air quality within the targeted region. Development of increased social integration among diverse populations. Creation of engaging and beneficial recreational and transportation options for marginalized populations. Enhanced biodiversity and carbon dioxide sequestration achieved through environmentally friendly changes. Advancement of sustainable techniques in urban development.	Reduced air pollution by implementing interventions in public spaces and implementing environmentally friendly changes. Enhanced biodiversity and formation of intricate ecosystems. Enhanced atmospheric conditions and decreased release of gases that contribute to the greenhouse effect. Promoted environmentally friendly transportation by including mobile green features. Enhancing urban green areas and promoting environmental sustainability.	Co-creation activities engaging individuals of the local community in the process of creating something together. Public space interventions such as "Open streets for citizens" and bio-agricultural markets are implemented to actively include the community. Creation of an urban food garden to serve as a communal gathering area. Advancement of social innovation (SI) via means of community engagement. Ensuring the participation of marginalized populations in the development and implementation of initiatives.	Bucharest - DivAirCity H2020
		Project	Bucharest Living Lab					
		NBS Approach used	Green infrastructure					
		Type	urban					
JUST—NATURE	40	**Pilot**	Leuven - BELGIUM	The project seeks to tackle the difficulties caused by the intense demand for land in the historic city center, expand areas accessible to the public, and boost the city's ability to cope with the effects of climate change. The main goals are to encourage environmentally friendly transportation, reduce the covering of soil with impermeable materials, lessen the impact of urban heat islands, enhance the well-being of residents both physically and mentally, improve coordination between different government departments regarding nature-based solutions, and facilitate a collaborative design process involving various stakeholders, with a specific emphasis on engaging citizens, especially those who are socially disadvantaged.	Limited Space in city: The medieval city center's significant demand for land usage presents a difficulty in establishing public and urban areas. When it comes to adapting existing buildings, like Constantin Meunierstreet, which were originally constructed mainly for automobile traffic, it is necessary to employ new methods. Inmate Well-being: The correctional facility at Leuven Central has difficulties in offering green areas to inmates who have restricted access.	Increased Green Spaces: Transformation of grey areas into green spaces, contributing to the city's goal of +40 hectares of public green space. Improved Climate Adaptivity: Enhanced resilience to climate change impacts, including reduced flood risk and improved rainwater management. Sustainable Mobility Promotion: Increased active and sustainable mobility, leading to improved air quality. Health and Well-being Benefits: Positive impacts on the physical and mental health of inhabitants through exposure to nature.	Enhancing Biodiversity: The implementation of Nature-Based Solutions (NBS) helps to preserve biodiversity and provide support to local ecosystems. The reduction of the city's carbon footprint may be achieved through the implementation of increased green areas and the promotion of sustainable mobility.	Citizen Engagement: Proactively involve individuals in the design and decision-making processes, guaranteeing their contribution in the creation of habitable environments. Inclusion of Vulnerable Social Groups: Emphasis placed on including vulnerable social groups into the planning and design process to address problems related to fairness and equality.	Leuven | JUSTNature (justnatureproject.eu)
		Project	Leuven - BELGIUM					
		NBS Approach used	Green infrastructure					
		Type	Urban					

			Objective	Challenges	Outcomes	Impact on the enviroment	community engagements	ref
UPSURGE	**Pilot**	Belfast – Northern Ireland	The primary objective of the project is to implement Nature-Based Solutions (NBS) for sustainable urban agroecology and soil recarbonization in Belfast. The initiative aims to transform an unused, derelict site within Belfast Botanic Gardens into a vibrant urban agroecologic area. The project addresses the challenges of disconnected neighborhoods, marked by "peace walls," and leverages the city's strategic framework, "The Belfast Agenda," for peace-building and community development.	Overcoming the physical and social barriers created by "peace walls" to foster community integration. Repurposing a derelict site in Belfast Botanic Gardens to promote urban agroecology. Implementing sustainable agricultural practices in an urban environment. Engaging diverse communities and fostering social cohesion. Educating and mentoring communities, citizens, schools, and undergraduate students on sustainable urban agroecology.	Development of tailor-made urban soil promoting organic urban agriculture and soil recarbonization. Deployment of community gardens using recycled materials that support plant growth and are bioreceptive. Repurposing and regenerating an unused part of the urban area, creating community agroecology gardens, green spaces, and recreational areas. Establishment of participatory co-creative processes for successful agroecology community building. Implementation of educational and mentoring activities for communities, citizens, schools, and undergraduate students.	Enhanced biodiversity and ecological services within the designated project area. Improved soil quality with the implementation of organic urban agriculture and recarbonization techniques .Reducing the environmental impact by using recycled materials into community gardens. Enhanced air and water quality within the surrounding habitat. Contribution to the mitigation of climate change via the implementation of sustainable practices.	Engaging in cooperative involvement in the creation of community gardens and environmentally friendly areas. Engagement of nearby schools, individuals, and communities in educational and mentoring endeavors. Enhancing social cohesiveness and integration by utilizing communal areas and involving individuals in participatory procedures. Enhanced community cohesion and interpersonal connections via collaborative endeavors in agroecology programs. Enhanced awareness and comprehension of sustainable urban agroecology across various community groups.	Belfast – Northern Ireland – UPSURGE Project (upsurge-project.eu)
	Project	Belfast Urban Agroecology and Soil Recarbonization Initiative						
	NBS Approach used	Green infrastructure						
	Type	Urban						
	41							
New European Bauhaus desire an irresistible circular society	**Pilot**	Turin- italy	managing rainwater in an area prone to both flooding and drought	Climate Variability, Community Engagement, Urban Regeneration	Implementation of nature-based solutions, Educational Workshops, Community Activators: fostering a sense of responsibility and stewardship.	Improved Biodiversity, Climate Change Mitigation, Sustainable Urban Practices	Youth Involvement, Collaboration with Local Organizations	Cascina Falchera, Turin, Italy - Desire (irresistiblecircularsociety.eu)
	Project	Cascina Falchera Water Saving Camp						
	NBS Approach used	Green infrastructure						
	Type	Park[5]						
	42							

			Objective	Challenges	Outcomes	Impact on the enviroment	community engagements	ref
	Pilot	Amstrdam - The netherland	The project aims to empower the residents of Wildemanbuurt, a socially vulnerable neighborhood in Amsterdam, by fostering a sense of ownership, belonging, and agency. It focuses on citizen-led initiatives, including urban farming, waste handling, and circular economy startups, to address community-identified issues such as poverty, unemployment, crime, and the need for green public spaces.	Combating poverty and unemployment, Addressing crime in the neighborhood, Creating green public spaces owned by citizens, Supporting the local economy, Navigating the transformation of public green spaces amid housing demands	Formation of design groups with their own agendas and budgets, Citizen-led initiatives addressing, waste management and circular economy startups, Increased community engagement through events, talks, and dinners, Development of proposals for transforming public green spaces, Involvement of experts to create business plans for local startups	Potential transformation of paved areas into urban farming spaces, Promotion of circular economy practices to handle waste, Exploration of energy transition solutions, including improved insulation and solar panels	Facilitation of citizen groups for open dialogue and idea sharing, Co-creation of visions for an equitable and sustainable future, Initiatives like the coffee cart to encourage community interaction, Involvement of residents in the design process for their living environment	Wildemanbuurt, Amsterdam, Netherlands – Desire (irresistiblecircularsociety.eu)
	Project	Empowering Wildemanbuurt for Inclusive and Sustainable Living						
	NBS Approach used	Green infrastructure						
	Type	Urban - neighbourhood						
	43							
New European Bauhaus desire an irresistible circular society	**Pilot**	Ziepju, Riga, Latvia	Renovation and Energy Efficiency: Renovate Ziepju Street 11, a derelict Soviet-era housing block in Riga, into a multi-apartment residential building for social housing. Integrate energy efficiency improvements to contribute to a sustainable and green urban environment. Community Engagement: Involve local stakeholders, social workers, and future inhabitants in the renovation process. Facilitate participatory workshops to gather ideas and suggestions for creating an attractive, green urban space around the building.	**Changing Mentality:** The project faces the challenge of changing the mindset of the population, encouraging them to actively engage in the green transition and take ownership of their living spaces. **Ownership Structure**: With privately owned apartment blocks and a lack of interest in renovation, the project addresses the challenge of mobilizing residents to form owners' associations for collective renovation efforts. **Cultural and Social Barriers:** Overcoming the historical tendency of people keeping to themselves, especially during the Soviet era, poses a significant challenge in fostering community engagement and collaboration.	**Renovated Residential Building**: Ziepju Street 11 will be transformed into a fully renovated residential building, providing housing for vulnerable families with physical and mental disabilities. **Green Urban Space**: The outdoor area around the building will be converted into an attractive, green urban space, serving as a meeting place for the community and promoting a sense of belonging. **Community Participation:** The project will set a precedent for involving citizens in the renovation process, encouraging collaboration and active participation in shaping their living environment.	**Energy Efficiency:** Implementation of energy efficiency improvements contributes to reducing the environmental impact of the housing block. **Green Infrastructure:** The creation of a biodiverse landscape around the building enhances the city's green infrastructure, addressing climate change-induced challenges and improving overall environmental conditions.	**Workshops and Collaborative Design:** Participatory workshops involve diverse groups, including existing and future inhabitants, children, young people, adults, and the elderly, in the design process for the outdoor area. **Inclusivity:** The project promotes inclusivity by considering the needs and wishes of sensitive groups, such as individuals with physical and mental disabilities, ensuring that the renovated space caters to diverse community needs.	Ziepju, Riga, Latvia – Desire (irresistiblecircularsociety.eu)
	Project	Ziepju Street 11 Renovation and Community Engagement						
	NBS Approach used	Green infrastructure						
	Type	Urban - neighbourhood						
	44							

CHAPTER 05 : Results and Discussion

5.1 LESSONS LEARNED AND SUGGESTIONS

The importance of community engagement :

The importance of community involvement is emphasized in all initiatives, including activities such as planning, design, execution, and continuing participation.

Long-Term Impacts:

There is a consensus that nature-based programs are successful not just in achieving immediate outcomes but also in prioritizing long-term effect and sustainability.

Adaptability and Resilience:

The initiatives demonstrate the necessity of being adaptable, particularly in the face of unforeseen obstacles like the COVID-19 epidemic. They exhibit resilience while conquering challenges.

Collaboration across different disciplines:

Many initiatives emphasize the significance of collaboration among diverse sectors, including residents, local government, enterprises, and various stakeholders to attain comprehensive and innovative solutions.

Education and awareness:

Educational programs and awareness campaigns are regularly acknowledged as crucial components for cultivating environmental stewardship and advocating sustainable behaviors.

Comprehensive Methods:

The programs prioritize the efficacy of comprehensive strategies, integrating technical interventions with non-technical remedies and taking into account both social and environmental factors.

Engaging stakeholders and promoting ownership:

Projects commonly emphasize the significance of involving stakeholders, establishing partnerships, and cultivating a feeling of ownership within the community.

Evaluating the quantifiable effects and tracking progress:

The programs emphasize the need of clearly describing, quantifying, and overseeing the effects of interventions to evaluate their efficacy and guide future decision-making.

Innovation and Adaptation to Challenges:

Recurring themes include the utilization of innovative methods, the capacity to adapt to unforeseen problems, and the flexibility to modify strategy depending on feedback.

Engagement with local media organizations and institutions:

Establishing collaborations with local media, schools, companies, and other organizations is considered a good approach to augment the awareness and success of the initiative.

Acknowledgment of Variability:

Acknowledging the wide range of tastes among inhabitants and discovering inclusive methods to integrate different design concepts is a common lesson.

Approaches that start from the smallest or most basic components and build up to a larger or more complex system.

Multiple cases highlight the efficacy of bottom-up methodologies, which involve empowering local populations and utilizing grassroots activities to achieve long-lasting results.

Importance of Public Awareness Campaigns:

Public awareness programs are widely acknowledged as essential for altering attitudes and cultivating a sustainable mindset within the community.

5.2 RECOMMENDATION FOR TURIN CASE STUDIES

Digital Engagement Platforms:

lesson: Implementing remote participation measures can effectively sustain public involvement notwithstanding limits.

Recommendation: Create digital platforms for citizen involvement to enable remote participation, particularly in times of unexpected difficulties like as the COVID-19 epidemic.

Empowering the Community:

Lesson: Providing residents with authority and autonomy promotes long-lasting effects and self-sustaining systems.

Recommendation: Enact measures that enable the community, such as the establishment of communal gardens, to foster a feeling of ownership and encourage active engagement

The art of narrative and the active involvement of media:

Lesson: The utilization of storytelling and media engagement may have an essential effect on generating awareness and fostering interest.

Recommendation: Create a captivating storyline about the project and utilize media interaction to expand the target audience and motivate community participation.

Recognition and acknowledgment:

Lesson: Acknowledging the efforts of the community has a beneficial effect on involvement.

Recommendation: Foster a sense of satisfaction and success by publicly recognizing and celebrating community efforts through prizes, gatherings, and public acknowledgments.

Participatory Decision-Making:

Lesson: Project success is enhanced by inclusive decision-making procedures.

Recommendation: It is important to guarantee that the methods used to make decisions are inclusive, transparent, and reflect the varied viewpoints of the community in order to establish confidence and gain support.

5.3 GUIDELINES FOR ENHANCING THE CITIZEN PARTICIPATION IN ENVIRONMENTAL AND COMMUNITY DEVELOPMENT PROJECTS

1- Clearly Define Project Objectives:

- Cite particular objectives of green infrastructure like air quality enhancement and also climate change resilience.
- It is so important to clearly communicate how the elements of the project contribute not only to environmental impact but also community welfare.

2- Stakeholder Involvement:

- Perform a comprehensive stakeholder analysis to determine the main actors.
- Ensuring active participation by the locals, community members, youth and also relevant organizations.

3- Community Participation in Decision-Making:

- Developing approaches that promote the participatory decision-making is very important.
- Utilize various platforms such as the open workshops, public meetings and also online channels to seek feedback.
- Promote the citizen's discussion on, implementation and also monitoring of NBS.

4- Education and Awareness:

- Provide educational programs to diverse age groups such as pre-school, school and also adult learners.
- Organize campaigns to raise awareness about the urban biodiversity, climate change and advantages of NBS.
- Create informational resources and also events to distribute the information about the project.

5- Collaborative Design and Co-Creation:

- It should promote collaboration in the project design and implementation.
- Arrange co-creation workshops with various community or groups.

- Design nature-based solutions involving the citizens, stakeholders and also experts.

6- Inclusive Access and Health and Well-being:

- Prioritize the availability of green space to be accessible by all the citizens.
- Consider aspects of health and well-being including mental heath and also social inclusion.
- Carry out the projects that increase the quality of life for all residents in general.

7- Promote Sustainable Practices:

- Foster practices such as green infrastructure, sustainable construction and also organic farming with the aim of being environmentally friendly.
- Highlight the many implications of eco-friendly measures for urban development.

8- Utilize Digital Platforms:

- Utilize online platform for citizen engagement, in particular during the constraints.
- Build interactive websites or apps to periodically offer project information, and also elicit feedback, and facilitate communication.

Figure 5. 1 Guidelines brochure for enhancing citizen participation in environmental and community development projects -elaborated by the author 2024

CHAPTER 06: Conclusion and Future Development

In conclusion, the collective experiences of these 20 diverse nature-based projects offer valuable insights and lessons that can shape the direction of sustainable urban development in the future. The significance of citizen interaction is underscored as a major concern, highlighting its crucial role in the achievement, longevity, and flexibility of these programs. The initiatives prioritize the profound impact of involving communities from the outset, fostering a collaborative mentality that endures beyond the completion of the physical solutions.

A crucial shared insight is the indispensability of adaptability and the acknowledgment that challenges are an inherent element of the intricate realm of urban development. The initiatives exhibit resilience in the face of unforeseen challenges, emphasizing the importance of flexible strategies and transparent communication to maintain public trust.

Education and awareness activities play a crucial role in shaping communities that are environmentally conscious. The initiatives demonstrate the effectiveness of knowledgeable and engaged individuals in leading positive changes, using methods such as collaborative design workshops and interactive educational programs.

Furthermore, the initiatives facilitate the implementation of comprehensive approaches, removing obstacles and encouraging collaboration across different disciplines. The recognition of the significance of including all individuals within a society in decision-making procedures and granting them authority is widely accepted as a means to attain enduring impacts. It is acknowledged that every community possesses unique requirements and preferences.

As we consider the future, these lessons highlight the importance of improving citizen engagement methods. Sustainable and inclusive urban development results are more probable when projects prioritize accessibility, continuous communication, and community-centric design. By integrating these ideas into future undertakings, we may aim to create cities that thrive not just in their capacity to survive environmental difficulties, but also in the active participation and responsible governance of their residents.

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