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GreenScape CE

D.3.1.1 Using visual maps to determine possibilities for linking single GI/NBS actions in coherent network

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Abbreviations

NbS – Nature based Solution

AP – Associated Partner

CCI – Climate Changes Impacts

CE – Central Europe

CLMS – Copernicus Land Monitoring Services

EEA – European Environment Agency

GI – Green Infrastructure

GSI – Green Space Index (green space m2 per person)

GVMP – GreenScape CE Visual Mapping Platform

Inspire – Infrastructure for Spatial Information in Europe

LAP – Local Action Plan

A. Executive summary

This *Deliverable D.3.1.1 – Using visual maps to determine possibilities for linking single GI/NbS actions in coherent networks*, was prepared within the Interreg GreenScape CE project under Activity 3.1. The Activity is led by the Urban Planning Institute of the Republic of Slovenia with the support of the partners from pilot cities Milano, Ptuj, Szeged, Warsaw, and Zagreb. GreenScape CE Visual Mapping Platform (GVMP) is used to demonstrate how geoprocessing simulations, sociodemographic data, and spatial indicators can be integrated into the platform with a tool that can support the evaluation and integration of Green Infrastructure (GI) and Nature-based Solutions (NbS) into planning and stewardship processes across five Central European pilot cities. Visual outputs are designed to be accessible to both experts and non-experts, thereby enabling informed decision-making and broader stakeholder participation. The presented analyses focus on accessibility, the green space index, multifunctionality, and connectivity, following principles from the World Health Organization and the European Environment Agency.

The pilot city analyses provided concrete evidence of the importance of considering accessibility, the green space index, multifunctionality, and connectivity. In Milan, the installation of green roofs on social housing towers improved energy efficiency, reduced heat islands, retained rainwater, and engaged residents in co-design processes that fostered urban farming and social interaction. The intervention raised the GSI by 44.88% and strengthened local connectivity within a 10–50 metre radius of existing green areas. In Ptuj, the introduction of permeable pavements, rain gardens, and urban trees will improve air and soil quality, biodiversity, and community well-being, while ensuring social equity through the involvement of elderly residents and schoolchildren. The GSI will be increased by 46.47%. The connectivity index for the municipality reaches 0.4030, indicating relatively well-linked green spaces. In Szeged, the greening of transport stops with trees, vegetated roofs, and pergolas reduced heat stress, improved air quality, managed stormwater, and enhanced the attractiveness and inclusivity of public transport infrastructure; the GSI is expected to improve significantly following full implementation. Warsaw's revitalisation of Wileńska Street with bioswales, rain gardens, and pocket parks mitigates flooding risks, enhances biodiversity, and creates multifunctional and inclusive public spaces. The project, supported by strong governance and public consultation, is where connectivity remains fragmented by significant transport infrastructure. Finally, in Zagreb, the transformation of degraded sports fields into multifunctional green areas improved stormwater management, reduced the urban heat island effect, and restored biodiversity while creating recreational and educational spaces. Accessibility analysis showed that 12,836 residents live within 800 metres of the site, the baseline GSI is 80.81%, and connectivity indices revealed both strong potential (0.9996 without barriers) and significant fragmentation caused by road networks (0.3126 with barriers).

Overall, the findings demonstrate the potential of the GVMP to provide robust yet accessible analyses that support the integration of GI and NbS into planning across European cities. By combining scientific indicators with visual clarity and participatory approaches, the platform provides a transferable framework that enables cities to design, evaluate, and implement coherent green infrastructure networks. These networks strengthen biodiversity, improve public health and social equity, reduce climate risks, and foster inclusive urban development, positioning NbS and GI as cornerstones of sustainable and resilient cities in Central Europe.

B. Introduction

Deliverable D.3.1.1 Using visual maps to determine possibilities for linking single GI/NbS actions in a coherent network is part of Activity 3.1: Connecting the dots – GI landscape connectivity. The activity is led by the Urban Planning Institute of the Republic of Slovenia and started in the 2nd reporting period. Its objective is to propose an approach for evaluating and integrating GI/NbS into planning and stewardship processes. The analyses considered accessibility of green infrastructure for the population, green space index evaluation, connectivity, and multifunctionality of selected NbS across five pilot areas.

GI and NbS are vital for public health, social well-being, and sustainability. Equitable access depends on proximity, inclusive design, socioeconomic conditions, and fair distribution, ensuring that everyone can benefit. Quality green spaces promote physical activity, reduce stress, foster community spirit, improve air quality, cool urban areas, and support biodiversity (WHO, 2016).

The Green Space Index (GSI) measures the amount of public green space relative to population size and provides a tool for identifying where investment is most needed. The EU's Green Infrastructure principles reinforce the importance of connectivity—linking parks, riversides, and natural corridors to strengthen biodiversity, improve air circulation, and enhance ecosystem resilience.

Green spaces must also be multifunctional, delivering a range of ecosystem services such as carbon sequestration, stormwater regulation, cooling, and social well-being within the same area. NbS can exemplify this multifunctionality: for example, green roofs manage stormwater, reduce heat, improve air quality, and create recreational opportunities. To realise the full potential of green spaces and NbS, strong governance, integrated planning, community engagement, and systematic evaluation are required.

Tools like the Greenscape CE Visual Mapping Platform (https://GreenScape CE.visualmapping.eu/) help promote the integration of NbS and GI into policies and concrete actions. They enable geoprocessing results to be displayed on maps with clear and easily understood visualized data. The platform's geo-simulation functions, developed as part of D.T1.2.1, can assess spatial accessibility, sociodemographic data, GSI, multifunctionality, and connectivity of planned NbS. These analyses were conducted and presented by the Urban Planning Institute of the Republic of Slovenia, with support by pilot cities Milan, Ptuj, Szeged, Warsaw, and Zagreb. The analyses utilize GVMP tools, geodata, information on pilot actions from D2.2.1, and information on NbS provided for the NbS tool (Appendix 1).

C. Approach

The analyses focused on accessibility of green infrastructure for the population, GSI evaluation, connectivity, and multifunctionality of NbS across five pilot areas.

1. Accessibility to NbS

Access to green spaces is a critical factor for public health, well-being, and environmental sustainability. It refers to the ease with which individuals can reach and use green areas such as parks, gardens, and natural landscapes. This accessibility is shaped by multiple factors, including geographic distance, the quality and availability of infrastructure, socioeconomic conditions, and equity considerations. Ideally, everyone should live within a reasonable distance of natural green space, with specific recommendations varying depending on the size and type of the area. Infrastructure plays an equally important role: pathways, signage, seating, and amenities should be designed to accommodate people of all ages, cultures, abilities, and backgrounds. Socioeconomic factors, such as income and transportation costs, can also influence how easily people can make use of these spaces. Above all, equity must remain a guiding principle, ensuring that all members of a community—regardless of socioeconomic status, physical ability, or other demographic factors—have fair and consistent access to green environments.

Accessible green spaces deliver multiple benefits. Health-wise, they support physical activity, reduce stress, and enhance mental well-being. Socially, they foster connections by providing meeting places for communities. Environmentally, they improve air quality, help mitigate urban heat island effects, and support biodiversity.

The World Health Organization (WHO) recommends that urban residents have access to public green spaces of at least 0.5 hectares, located within a 300-metre walking distance from their homes (WHO, 2016). The European Environment Agency does not set a specific numerical threshold but supports the WHO’s perspective by emphasizing the importance of publicly accessible green and blue spaces within walking distance. Current estimates suggest that fewer than half of Europe’s urban residents live within 300 metres of such spaces (EEA, 2022). Similarly, the European Union’s Sustainable Development Goal 11.7 highlights the need to ensure “universal access to safe, inclusive, accessible green and public spaces” (European Union, 2015).

A broader conceptual guideline, known as the 3-30-300 rule, expands on these principles. According to this rule: Individuals should be able to see at least three trees from their home, each neighborhood should maintain at least 30% tree canopy cover, and a green space of at least 1 hectare should be located within 300 metres of every residence (Konijnendijk, 2021).

GVMP employs two accessibility methods. The first method is included in the Accessibility tool, which analyzes the population's size and structure in relation to the nearest green area within any user-defined shape—whether that be a rectangle, circle, or polygon. "Gravity" method is the second method and is part of the NbS tool. This method assesses the population's potential to be drawn to the proposed NbS based on a specified radius (in meters).

2. Green space index (GSI)

The GSI is a quantitative metric used to evaluate the availability and accessibility of public green spaces, such as parks and gardens, relative to population size. It was developed by Fields in Trust and first launched in 2019; it was the first comprehensive measure to assess local park provision across Great Britain. The GSI now features annually as Fields in Trust's barometer of publicly accessible local green space, with the fifth edition incorporating the latest national data released in May 2023. The GSI is based on three core components: the total surface area of accessible public green spaces; the resident population of the area; and the resulting ratio of green space per person, typically expressed in square metres per resident.

The GSI offers a structured, data-driven approach to assessing this across urban regions. Its primary purpose is to determine whether an urban area provides sufficient green space for its population while informing urban planning decisions, public health initiatives and environmental sustainability strategies.

The World Health Organization (WHO) recommends a minimum of 9 m^2 of green space per person, with an ideal target of 50 m^2 per capita (World Health Organization, 2010). In addition to per-capita thresholds, the WHO emphasizes the importance of both accessibility and sufficient area per person, establishing distance-based standards (e.g., access to a green space within 300 meters) alongside desirable area-based targets (WHO, 2017). Best practice therefore, involves integrating per-capita measures (e.g., square meters per person) with accessibility criteria (e.g., walking distance to the nearest green space).

Neither the WHO nor the European Environment Agency defines a formal "Green Space Index per population" with specific quantitative criteria such as square meters per person (European Environment Agency, 2020). Instead, WHO provides general accessibility guidelines (e.g., green space within 300 m of residences) in combination with per-capita area recommendations (WHO, 2017). Similarly, the EEA promotes mapping and assessing green infrastructure within its Green Infrastructure Strategy but does not specify a standardized per-capita index (EEA, 2020).

Using data from GVMP NbS tool, we can create maps showing the land cover of individual NbS solutions before and after implementation. Defining the GSI as the proportion of green areas relative to the total NbS area makes it easy to calculate the change in this index before and after the pilot action is implemented.

3. Multifuncionality

NbS are increasingly recognised for their multifunctionality—their ability to address multiple societal challenges while supporting biodiversity and human well-being. This capacity allows NbS to contribute to climate change adaptation, biodiversity conservation, and the delivery of sustainable development goals. Multifunctionality refers to the capacity of a single intervention to provide diverse ecosystem services. For example, a public park can support biodiversity by offering habitats for wildlife, improve human health and well-being through opportunities for exercise and relaxation, regulate local temperatures through shading and evapotranspiration, and foster social cohesion by serving as a gathering space for community activities.

The multifunctionality of NbS is significant because it enables interconnected solutions for complex issues such as climate change, biodiversity loss, and urban environmental stress. However, achieving multifunctionality presents challenges. NbS can be complex, requiring coordination across multiple stakeholders, spatial scales, and overlapping ecosystem services. Trade-offs may arise when optimising one function over others. Integration into existing planning and governance frameworks can be difficult, and the quantification of multiple benefits remains a technical challenge. Moving forward, the successful delivery of multifunctional NbS will require cross-sectoral collaboration, integrated planning approaches, active stakeholder engagement, and robust methods for performance evaluation. By overcoming these barriers, NbS can serve as a cornerstone of effective, sustainable, and resilient solutions to urgent societal and environmental challenges.

Multifunctionality is a central concept in European Union (EU) green infrastructure policy. The European Environment Agency identifies multifunctionality as one of the three key principles of effective green infrastructure, highlighting that green spaces should simultaneously deliver multiple ecosystem services such as improved air quality, opportunities for recreation, and contributions to climate change mitigation and adaptation (EEA, 2011).

This principle is further reflected in the EU's frameworks on Urban Green and Blue Infrastructure and Nature-based Solutions (NbS), which emphasize the development of integrated networks of green and blue spaces. These networks are designed to provide environmental, social, and economic benefits while enhancing urban climate resilience (European Commission, 2021).

Partners from the pilot cities evaluated NbS through their environmental, social, economic and social justice impacts. The GVMP NbS tool offers data on these impacts, emphasizing how multifunctional green spaces can enhance climate resilience and promote inclusive urban development.

4. Green space connectivity

Green space connectivity refers to how natural or semi-natural areas—such as parks, forests, gardens, green corridors, and wetlands—are linked within urban or regional landscapes. This important ecological and planning concept supports biodiversity, ecosystem health, and human well-being. By strategically locating and connecting publicly accessible green spaces, cities can create networks that provide equitable access for residents and safe movement routes for wildlife.

Structural connectivity involves physical links, such as green belts or tree-lined streets, while functional connectivity focuses on the movement of wildlife or people between spaces, regardless of direct contact.

Strategies to enhance connectivity include developing green corridors, installing wildlife crossings, creating green infrastructure networks, and restoring natural linkages like riverbanks and wetlands. By integrating these measures into planning and design processes, we can ensure that urban environments benefit ecologically and socially.

Connectivity is a central concept within the European Union's GI framework. GI is defined as a strategically planned network of natural and semi-natural areas designed to deliver a broad range of ecosystem services. A crucial component of this framework is ensuring that natural areas remain ecologically connected, thereby enabling species to move across landscapes and maintain viable populations (European Commission, 2013).

The European Environment Agency highlights connectivity—together with multifunctionality and strategic spatial planning—as one of the three fundamental principles of GI planning. These principles apply across multiple spatial scales, from urban to rural contexts, ensuring that ecosystems function effectively and that people benefit from the diverse services they provide (EEA, 2011).

GVMP includes two methods of assessing green space connectivity, which support the above discussions. The first method finds virtual links between individual green spaces if the length of the link is less than 100 metres. These connected green spaces are then used as green space patches in the formula index, where index = $(\sum A_i^2) / ((\sum A_i)^2)$ and A_i is the area of green space patch i. The connectivity index ranges from 0 to 1, where a higher index indicates greater connectivity of green spaces within the selected area.

D. Analyses

This chapter summarises the analyses conducted for the five pilot areas, demonstrating the usability of the GVMP in evaluating the acceptability of NbS in terms of accessibility, GSI, multifunctionality and green space connectivity.

Analyses were carried out by the Urban Planning Institute of the Republic of Slovenia and supported by the pilot cities. They cover selected NbS areas from the pilot actions in Metropolitan City of Milan (Italy), Ptuj (Slovenia), Szeged (Hungary), Warsaw (Poland) and Zagreb (Croatia).

The analyses are based on the GVMP tool. The NbS selected for the analyses in each pilot area are detailed in 'D2.2.1. Pilot Action Outline and Roll-Out Plan. Further information was taken from the questionnaire (see Appendix 1).

The analyses presented are straightforward, enabling non-experts to understand and further develop ideas for each pilot city.

1. Metropolitan City of Milan

1.1. Pilot action

Figure 1: The pilot city Milan. Source: GreenScape CE Visual Mapping Platform: https://GreenScape CE.visualmapping.eu/accessibility/Milano

One of the supportive actions of the Metropolitan Action Plan for the Metropolitan City of Milan, the "Spatial Impact Assessment of NbS Across the Metropolitan Area" plays a crucial role in shaping the Pilot Action developed within the GreenScape CE project. This assessment serves as a foundation for evaluating the effectiveness of NbS across the metropolitan area, providing essential insights for strategic planning and future interventions.

The Spatial Impact Assessment of NbS aims to evaluate the transformative effects of NbS across the 133 municipalities of the Metropolitan City of Milan (CMM). By integrating spatial data and analyzing 90 ongoing and past NbS projects, this assessment will generate a comprehensive NbS layer for the entire metropolitan area.

A key aspect of this study is the use of environmental spatial analyses developed by CMM, particularly maps assessing thermal anomalies (Urban Heat Islands) using Land Surface Temperature (LST) data, vulnerability of sensitive populations, identifying areas with higher risks due to climate factors, risk mapping, correlating heat anomalies with vulnerable populations to prioritize interventions.

The assessment will evaluate NbS effectiveness using urban indicators such as accessibility, inclusivity, environmental quality, and resilience. It will measure improvements in air pollution, flood mitigation, and urban cooling, contributing to a more sustainable and resilient metropolitan area.

The results of this assessment will support strategic decision-making by CMM, guiding future NbS investments and optimizing urban planning efforts. By fostering interdisciplinary collaboration and stakeholder engagement, the study will enhance awareness of NbS benefits among policymakers, urban planners, and local communities. This action becomes part of the Pilot Action within GreenScape CE, ensuring that NbS strategies are not only implemented but also systematically assessed for their long-term impact on urban resilience and sustainability.

A crucial first step in conducting this assessment is the thorough mapping of all existing and planned NbS across the Metropolitan City of Milan. While the CMM possesses a well-developed database, rich geospatial data, and environmental analyses, it lacks a complete and consolidated map of all NbS projects. This gap makes it essential to prioritize this mapping effort within the GreenScape CE project.

This mapping is not only fundamental for assessing NbS impact but is also a critical prerequisite for other key activities. For example, visual maps from the GreenScape CE Visual Mapping Platform (GVMP) rely on this data to identify opportunities for linking individual Green Infrastructure (GI) and NbS projects into a coherent, interconnected network. Additionally, a detailed inventory of NbS is essential for collecting evidence on large-scale benefits, such as environmental improvements and urban resilience, supporting strategic planning and decision-making for CMM.

Given the urgency and broad dependencies on this data, ensuring a comprehensive NbS mapping becomes a priority action within GreenScape CE. Moreover, this constitutes the first and integral part of Pilot Action, laying the groundwork for subsequent assessments and strategic interventions in NbS planning across the metropolitan area.

So, the pilot action for the CMM operates on a strategic, large-scale level, encompassing all 133 municipalities within the metropolitan territory. Its purpose is to provide added value to ongoing efforts by the Metropolitan City in advancing climate change adaptation and supporting its Urban Metropolitan Agenda for Sustainable Development.

The action is structured around two key levels of intervention:

1. Strategic Mapping: This involves identifying and mapping existing and planned NbS and green infrastructure across the metropolitan territory. The goal is to integrate this critical layer into the urban planning and legal frameworks, ensuring its alignment with broader territorial development strategies. This level is also supported by the visual mapping platform of the project.
2. Benefit evaluation framework: A framework will be developed to assess the benefits of NbS within the territory. This framework will enable a systematic evaluation of how these solutions contribute to environmental, social, and economic resilience, helping to build a stronger case for their implementation and scalability.

Together, these activities aim to enhance the metropolitan region's capacity for sustainable urban development and climate resilience while fostering synergies across its municipalities (Source: D2.2.1 Pilot action outline and roll-out plan, Italy, Final 02/2024, Greenscape CE project)

1.2. Selected NbS area for analysis

Figure 2: Selected analysed NbS in Milan. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/nbs/Milano.

Name national	**Tetti verdi di via Russoli (Torri RISOrsa di ALER)**
Name english	Green Roofs of via Russoli (Towers RISOrsa of ALER)
NBS	Green roof
Status	Completed
Duration	2019-2024
Objective	The RISOrsa towers, which provide social housing, have undergone a comprehensive renovation of their facades and rooftops. The main objectives of the project are to improve energy efficiency, promote environmental sustainability, and enhance the quality of life—especially for vulnerable population groups such as the elderly and those with limited financial resources.
Description	The RISOrsa towers, located at Via Russoli 18 in Milan, form a linear urban block comprising four high-rise buildings interconnected by low-rise structures. These buildings are dedicated social housing units owned by ALER Milano—the Lombardy Region's Authority for Residential Buildings—a public entity responsible for managing a significant portion of the city's social housing stock. The daily operations and coordination of the complex are also supported by a resident-led self-management board. The requalification of the RISOrsa towers began in 2010, with initial efforts focused on the removal of asbestos from the façades and roofs. Over time, the pressing need for a comprehensive energy retrofit became evident, and in 2019, a large-scale renovation project was relaunched. This initiative was led by the same management team in collaboration with the architectural firm RiceHouse, which guided the entire process. For the first time, this renovation also incorporated Nature-based Solutions (NbS) as a central design component.

	Key features of the project include: • Use of Sustainable Materials: The buildings were equipped with an external insulation system ("cappotto") made from eco-friendly materials, most notably insulation panels composed of compressed rice husks—a byproduct of local agricultural processes. • Energy Efficiency Upgrades: The intervention included the replacement of windows and shutters with high-performance units, modernization of the heating systems, installation of photovoltaic panels, and integration of devices for smart energy regulation and consumption monitoring. • Creation of Green Spaces: The flat rooftops were converted into shared green areas and gardens through the application of a "warm roof" insulation system. This approach facilitated the installation of green roofs, contributing to improved thermal performance, urban biodiversity, and resident well-being.
Climate change mitigation	The large-scale renovation of the four ALER-owned social housing towers included: • The application of natural insulation materials, particularly rice husk-based external cladding, which significantly reduces the buildings' thermal transmittance. • Replacement of windows, installation of high-efficiency shutters, photovoltaic panels, and heating system upgrades—together leading to a reduction in energy demand for both heating and cooling. • The addition of green roofs further supports thermal insulation and reduces surface heat absorption, helping mitigate the urban heat island (UHI) effect. These measures reduce building-related greenhouse gas emissions, supporting Milan's goals under its climate and energy transition plan.
Stakeholders	The co-design pathway for the green roofs of towers in via Russoli has been developed over the course of five months in which more than forty stakeholders from different fields (education-universities, private sector-supermarket, green roof and vegetation suppliers, media, start-ups, social and environmental related associations, and public institutions etc.) have been engaged.
Main beneficiaries	1. Residents of ALER social housing (primarily elderly people and low-income families) 2. Self-management board (residents directly involved in co-design and decisions) 3. Local community, benefiting from improved aesthetics, biodiversity, and microclimate 4. Municipality of Milan, as the public owner promoting energy-efficient and replicable solutions
Governance	**Owner**: ALER Milano – public regional authority for social housing. Management: Supported by a resident-led self-management board. **Facilitation & coordination:** Municipality of Milan (CdM) and facilitator partner AMBIT as well as the RiceHouse architectural studio. **Design leadership:** RiceHouse architectural studio. **Stakeholder engagement:** Extensive, including universities (IULM), local businesses (Carrefour), and green suppliers. **Funding coordination**: Managed through CdM and linked to BE2 and national Superbonus incentives.

	The governance here was multi-actor and collaborative, blending institutional, technical, and community roles through a structured co-design process.
Financing (Total cost)	The EU-funded project CLEVER Cities contributes up to 7,000 euros, with the total renovation cost of buildings around 15 million euros and the implementation of green roofs (design, administration, and construction) estimated at 1,073,306 euros. Sources include CLEVER Cities (design costs), BE2 municipal incentives covering 35% of green roof implementation including vegetation, and the national "110% Superbonus" program for eligible energy efficiency costs. Funding types consist of direct public grants (CLEVER Cities, Municipality of Milan) and tax incentives (Superbonus). Non-financial contributions involve participation of the self-management board, engagement from educational institutions (IULM), Carrefour providing space to sell products from roof gardens, and NGOs involved in co-design and implementation.
Transferability	Transferability: HIGH **Why it's transferable:** • The model of integrating NbS into large-scale energy renovations is highly relevant across Europe, especially in post-war social housing. • The use of natural, locally sourced insulation materials (e.g., rice husks) can be adapted to other bioregions with available biomass. • The financial model—blending local (BE2), national (Superbonus 110%), and EU project support—offers a replicable roadmap for public-private renovation initiatives. • Co-design processes and the involvement of self-management boards can be adapted to other social housing contexts. Conditions for replication: Clear governance roles, early structural assessments, and accessible incentive schemes..
Lessons learned	• Early and consistent stakeholder engagement is essential. The involvement of the self-management board and diverse partners (e.g., IULM, RiceHouse, Carrefour) allowed for shared ownership and smoother implementation. • Navigating multi-source financing is complex but manageable. The project successfully combined CLEVER Cities design support, municipal BE2 incentives, and national Superbonus 110%. However, coordinating timelines and procedures across these streams required strong institutional leadership. • Technical design must consider structural limits early. A similar planned intervention in Via Orsini was later cancelled due to insufficient roof load capacity—highlighting the need for early structural assessments. • Combining social and technical goals enhances impact. The green roofs improved energy performance while also providing spaces for social interaction, urban agriculture, and environmental education.
References	• CLEVER Cities Deliverable 2.4 – Summary Report: Analyzing the implementations in Front-Runner Cities. • https://www.lombardianotizie.online/torri-via-russoli/

1.3. Accessibility

To provide a more detailed definition of the applicability of NbS, we require additional information, including the number of inhabitants and the age structure of the area under consideration. Using the GVMP Accessibility tool, we found that 336 people live in the area. Their age structure is as follows: 5% are under 14 years old, 7% are aged 15 to 22, 16% are aged 25 to 39, 40% are aged 40 to 64, 18% are aged 65 to 74, and 13% are over 75 years old.

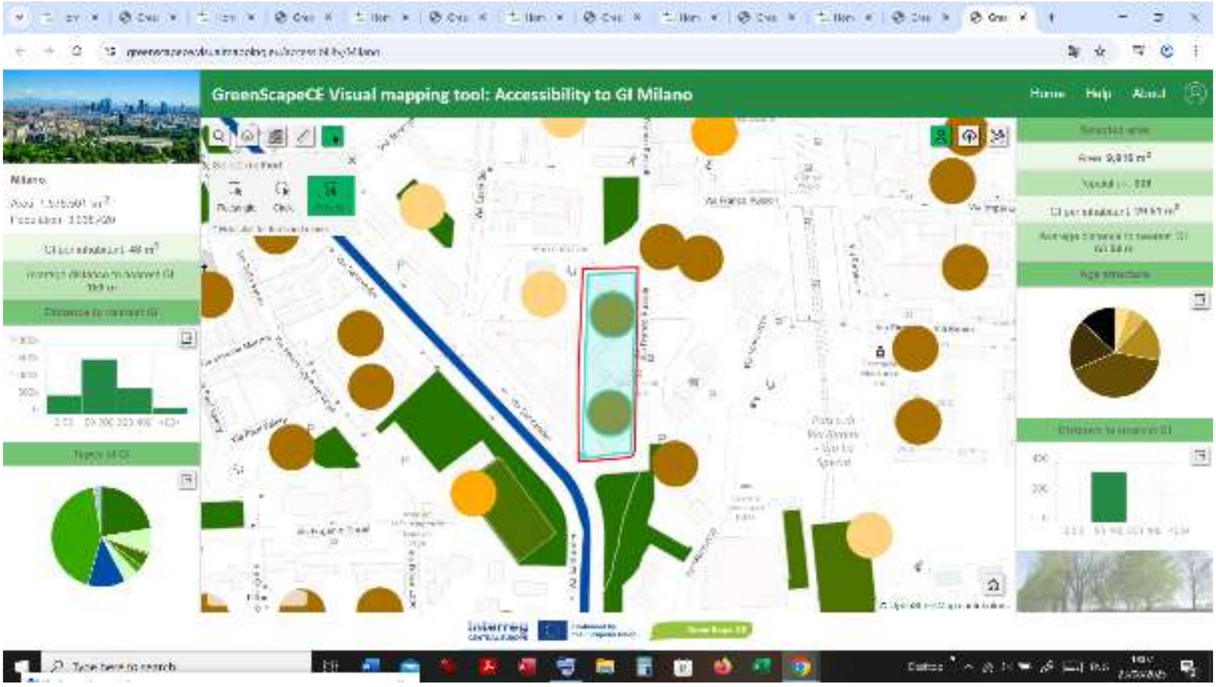

Figure 3: The accessibility tool displays population data in the selected NbS area in Milan. Source: GreenScape CE visual mapping platform (https://GreenScape CE.visualmapping.eu/nbs/Milano)

1.4. Green space index

Green roofs enhance green spaces and increase access to these areas, even if they are intended solely for the building's residents. GSI for the selected NbS area increased by 20.47% from 46.21% to 66.95% when installing green roofs (see Figures 4 and 5). The positive effects of green roofs can be felt in the surrounding area, indicating the added value of improving living conditions and socialising in the wider urban environment. Last but not least, the crops also contribute to residents' economies.

Figure 4: Selected NbS area in Milan. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/nbs/Milano

Figure 5: Selected NbS area in Milan featuring green roofs. Source: GreenScape CE visual mapping platform (https://GreenScape CE.visualmapping.eu/nbs/Milano)

1.5. Multifunctionality

During the project, the GVMP NbS tool for Milano was updated with information on the proposed NbS. The partners provided information on the environmental, social, economic, social justice, and cohesion impacts of the implemented NbS. The impacts for the NbS that are the subject of the analysis presented in the report are listed below.

Environmental impacts
Environmental monitoring is currently ongoing, with results expected to be available soon. Preliminary expectations suggest that the green roofs will significantly enhance thermal comfort in the floors directly beneath them, improve the microclimate above the rooftop areas, and contribute to effective rainwater retention.
Social impacts
Engaged more than 40 stakeholders including residents, universities (IULM), associations, and local businesses. Promoted inclusion through co-design activities with residents, helping to build a sense of ownership and empowerment. Initiated rooftop farming and community events, encouraging social interaction and collaboration.
Economic impacts
Combined financing sources made it possible the large scale buildings renovation: CLEVER Cities, BE2 municipal funds, and the national “Superbonus 110%” for energy retrofitting. Potential for local food production (sale of rooftop produce via Carrefour). Cost savings in long term expected through improved thermal insulation and energy efficiency.

1.6. Connectivity

Connectivity is an important aspect of spatial planning. The network of green spaces provides residents with equal access and enables wildlife to move safely between habitats. The blocks in Milano are surrounded by private and public green spaces. Several green spaces are located nearby, separated by roads. As shown in Figure 6, these green spaces are located between 10 and 50 metres away.

Figure 6: Connectivity lines in selected NbS area in Milan. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/connectivity/Milano

2. Ptuj

2.1. Pilot action

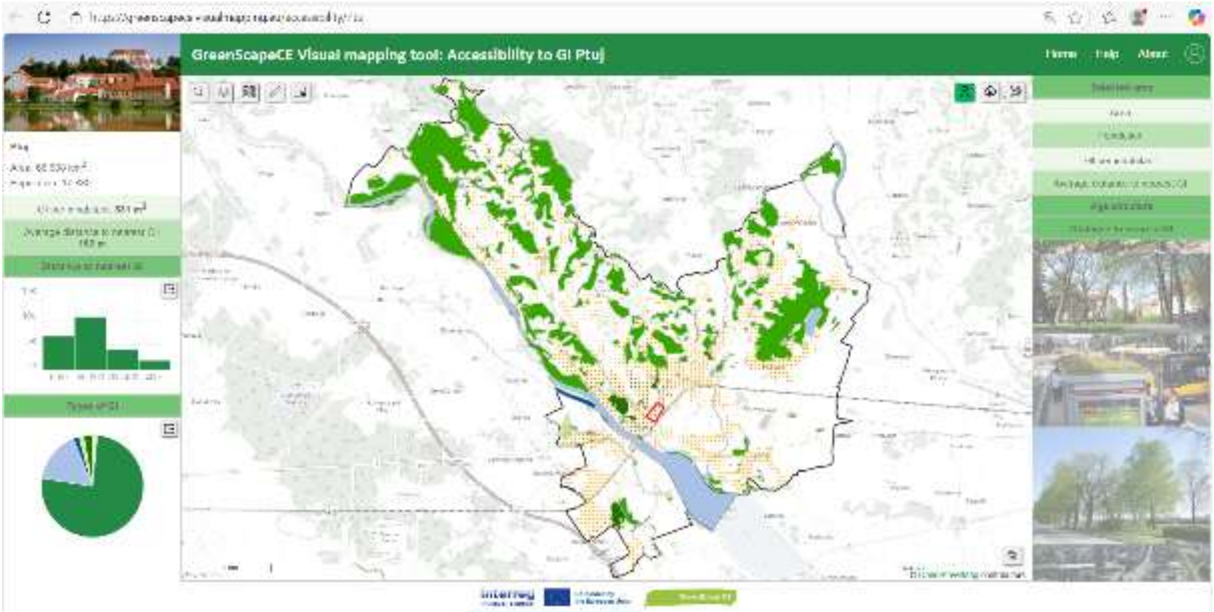

Figure 7: The pilot city Ptuj. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/nbs/Ptuj

The Municipality of Ptuj determined the locations of pilot actions – implementation of different NbS-based on analysis and collaboration with the local community and municipality. These locations include areas in both the historic city centre and residential neighbourhoods.

One of the Municipality of Ptuj's main goals is to improve living conditions in the historic city centre, where green spaces are scarce, making the urban climate particularly vulnerable to climate change. By integrating NbS, the city aims to "revitalize" its central area with greenery, creating a more pleasant urban atmosphere, lowering temperatures in the central area during hot periods, improving air quality, and fostering a more sustainable urban environment. Consequently, one of the designated NTR locations is in the historic city centre, specifically along Ulica heroja Lacka and Zelenikova ulica.

The second designated area includes residential neighbourhoods along Ciril Metodov drevored (CMD), Kvedrova ulica, Panonska ulica, and Rimska ploščad. In these neighborhoods, the municipality seeks to enhance the quality and usability of existing green and publicly accessible spaces located between apartment blocks in two defined zones. The goal is to create accessible and attractive green and blue urban infrastructure, following the principles of nature-based solutions. Accessibility will be ensured for all residents of these neighbourhoods, as well as for users of nearby educational institutions (kindergarten, primary school, secondary school) and residents of the Ptuj Retirement Home (Dom upokojencev Ptuj, enota Ptuj).

The selected NbS are implemented in both areas—the historic city centre and the residential neighbourhoods. Some solutions are specific to a particular area and address spatial issues unique to that location. In the historic city centre, where there are many paved surfaces, limited space for plant growth, and a complex network of public utility infrastructure, the most suitable NbS is the one categorized under Urban Trees – Improvement of Growing Conditions for Urban Trees – Structural Soils (No. 1A). On an unregulated surface where residents of residential neighborhoods park their cars and where water accumulation occurs, the appropriate NbS is a rain garden (No. 3), and so on (Source: D2.2.1 Pilot action outline and roll-out plan, Slovenia, Ptuj, Final 02/2024, Greenscape CE project).

2.2. Selected NbS area for analysis

Figure 8: The selected NbS area in Ptuj. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/nbs/Ptuj

Name national	**Zelene površine v stanovanjski soseski Kvedrova ulica**
Name english	Green area in residential neighbourhood Kvedrova ulica
NBS	Street Trees: • Replacement of a tree • Planting of new urban trees Permeable Pavements: • Increase in the area of common growth tree site and use of permeable pavements • Replacement of asphalt and other impermeable pavements with permeable pavement Rain garden Urban forestation • Planting coniferns • Planting fruit trees • Planting tree coridors and eco-hedges
Status	Ideation
Duration	2024-2026
Objective	Creation of new green areas, Renovation and imporvement of green areas, Transformation of previously derelict areas, Creation of pleasant urban atmosphere
Description	Among the main objectives of the Municipality of Ptuj is to improve the living conditions in the residential neighborhoods, where there are green spaces, but are poorly used, designed or maintained. The designated areas includes residential neighborhoods along Ciril Metodov drevored (CMD), Kvedrova ulica,

	Panonska ulica, and Rimska ploscad. In these neighborhoods, the municipality seeks to enhance the quality and usability of existing green and publicly accessible spaces located between apartment blocks. The goal is to create accessible and attractive green and blue urban infrastructure, following the principles of nature-based solutions. Accessibility will be ensured for all residents of these neighborhoods, as well as for users of nearby educational institutions (kindergarten, primary school, secondary school) and residents of the Ptuj Retirement Home (Dom upokojencev Ptuj, enota Ptuj). In the residential neighbourhood Kvedrova ulica new trees will be planted and tree in poor condition replaced. Impermeable paving will be replaced with permeable paving and paved areas of green parking will be arranged as well as the common growth tree site will be increased. A rain garden will be created in the part of the space where the water is stagnating. Community gardens with pergolas for residents will be created. In regard urban forestation - coniferous and fruit trees will be planted. Fruit trees will be located next to the community gardens and create a pleasant impression of urban cultivated areas.
Climate change mitigation	• Diminishing the effect of hot spots in the city. • Microclimate regulation. • Better vegetation condition. • Reduce run-off. • Increasing green urban nature for carbon storage (tree cover). • Increase amount of green open spaces for residents. • Biodiversity enrichment. • Changing image of the urban environment.
Activities	Ptuj has few green areas that incorporate the NbS concept. Detention basin, small green courtyards in the city, newer urban tree planting. The municipality wants to increase the areas with NbS - for this purpose, areas in the old town centre and in the neighbourhoods have been selected. This is a total of 37.825 m2 areas. The locations are hero Lacko Street, Zelenikova Street, and the residential neighborhoods of Ciril Metodov Drevored (CMD), Kvedrova Street, Panonska Street, and Rimska Ploscad.
Stakeholders	Municipality of Ptuj, resident, citizens, users and visitors of the city
Main beneficiaries	residents of the neighborhoods and users of nearby institutions/services etc.
Governance	The project is led by the city of Ptuj and supported by public development and research organization ZRC Bistra Ptuj.
Financing	Approx. 57,000 € (indicative, covering vegetation, green elements, and soil or site preparation). Sources include the public local authority budget and national/international project funding. Funding types consist of earmarked public budget and direct funding through grants, subsidies, or self-financed private projects. Non-financial contributions come from public authorities (land, utility services) and citizens (volunteering, tools, seeds).
Transferability	These NbSs are implementable in other cities.
Lessons learned	It is important to have active partners in the process, an interested public and a public ready to participate.

2.3. Accessibility

The number of inhabitants and the age structure of the area under consideration are required to provide optimal NbS solutions. Using the GVMP Accessibility tool, we obtained data showing that the selected NbS area covers 102,320 m² and has a total population of 687. Children (aged 0–14) account for 12% of this population, young people (aged 15–24) account for 9%, and the working-age population (aged 25–64) accounts for 53%. The proportion of people aged 65 to 84 is 17%, while the proportion of people aged over 85 is 2%.

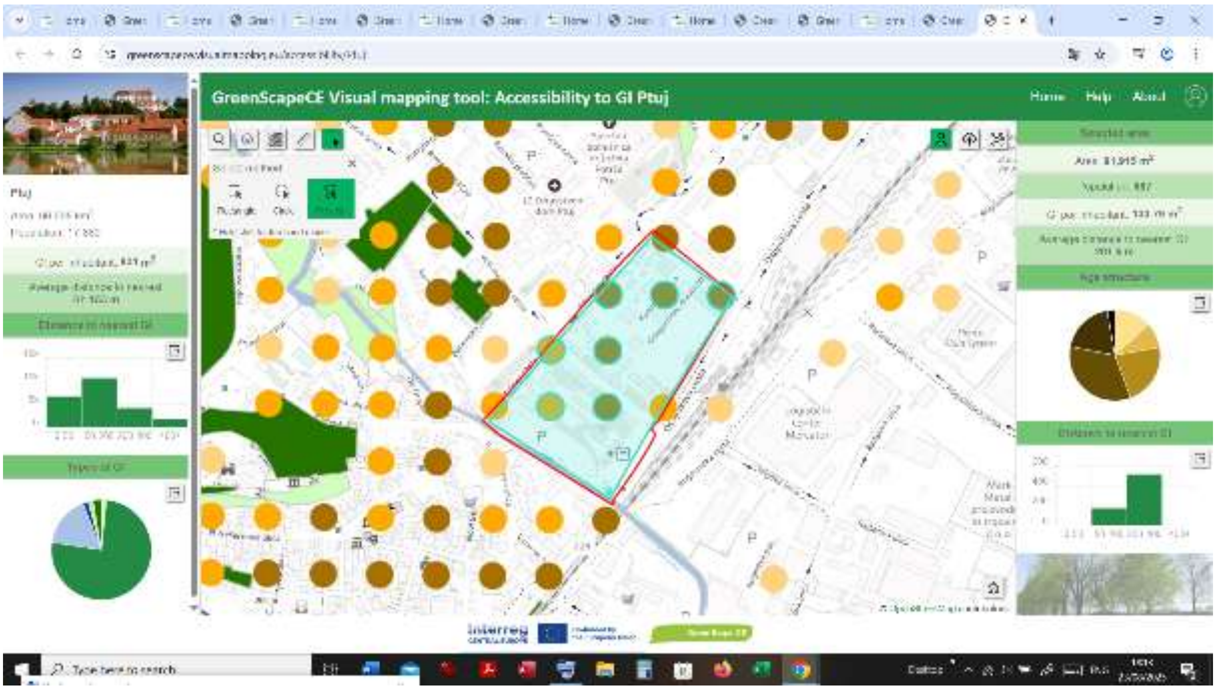

Figure 9: The accessibility tool displays population data in the selected NbS area in Ptuj. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/accessibility/Ptuj

If the solutions developed in the pilot action apply to a broader area, the gravity calculation in the GVMP NbS tool is useful. For example, if we enter a distance of 300 metres from the pilot area into the application, it calculates that a total of 1,147 residents could be attracted to the nature-based solution in question (see Figure 10).

Figure 10: Population data in the 300 m surrounding the selected NbS area in Ptuj. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/accessibility/Ptuj

2.4. Green space index

The pilot action in Ptuj plans to increase the area of green spaces in the neighborhood (see Figures 11 and 12). Using data from the NbS tool, we calculate the GSI before and after the action. The current GI per inhabitant in the analysed pilot area is 133.79 m². The GSI relatively increases by 46.47% from 41.90% to 61.37%. The assessment may be slightly biased because in some cases it only involves improvements to green areas rather than completely new green areas, and these improvements have a significant impact on climate change but are not taken into account in the index.

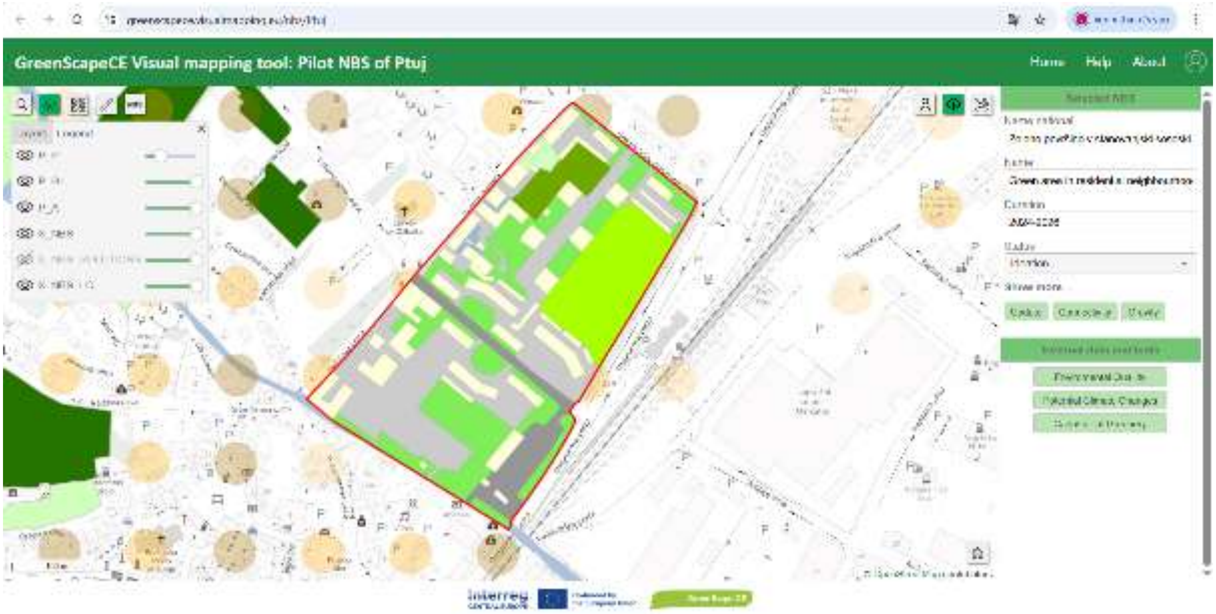

Figure 11: Existing NbS and green spaces in selected NbS area in Ptuj. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/accessibility/Ptuj

Figure 12: Proposed NbS in selected NbS area in Ptuj. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/accessibility/Ptuj

2.5. Multifunctionality

During the project, the GVMP NbS tool for Ptuj was updated with information on the proposed NbS. The partners provided information on the environmental, social, economic, social justice, and cohesion impacts of the proposed NbS. The effects for the NbS that are the subject of the analysis presented in the report are listed below.

Environmental impacts	
Climate change	Lowered local temperature Microclimate regulation Enhanced carbon sequestration
Environmental quality	Improved air quality Improved soil quality Reduce run of increasing infiltration
Green space and habitat	Increased green space area Greater ecological connectivity across urban regenerated sites Enhanced support of pollination
Social impacts	
Health and wellbeing	Improved physical health Recreational area for the population Improving mental/physical wellbeing through walking

Cultural heritage and sense of place	Improvement in people's connection to nature Meet up places Allotments
Social benefit	Increase communities' sense of ownership Increase social interaction Increase accessibility to green open spaces Increase amount of green open spaces for residents Leisure and cultural purposes (aesthetic pleasure; sense of place, inspiration) and encouraging citizen's engagement with local green initiatives
Economic impacts	
Improving the climate in a neighbourhood reduces heating/cooling costs, growing herbs or vegetables reduces the cost of buying food, reduces the cost of possible irrigation, using green spaces in residential neighbourhoods as recreational areas reduces the cost of sporting activities in the warmer months.	
Impacts on social justice and cohesion	
Improved social cohesion **Fair distribution of social, environmental and economic benefits of the NbS project** **Improved liveability** **Improved access to urban green space** **Increased visibility and opportunity for marginalised groups or indigenous peoples** **Increased involvement of locals in the management of green spaces** **Increased access to healthy/affordable food** **Increase communities' sense of ownership** **Increase social interaction**	

2.6. Connectivity

The connectivity index for the whole Municipality of Ptuj is the same with or without transport constraints, 0.4030. The municipality has a lot of green spaces. The question arises whether these are adequately equipped for the local population and if they are used. They are also well-connected. The pilot area in Ptuj is defined as a residential area in the municipal spatial plan for land use.

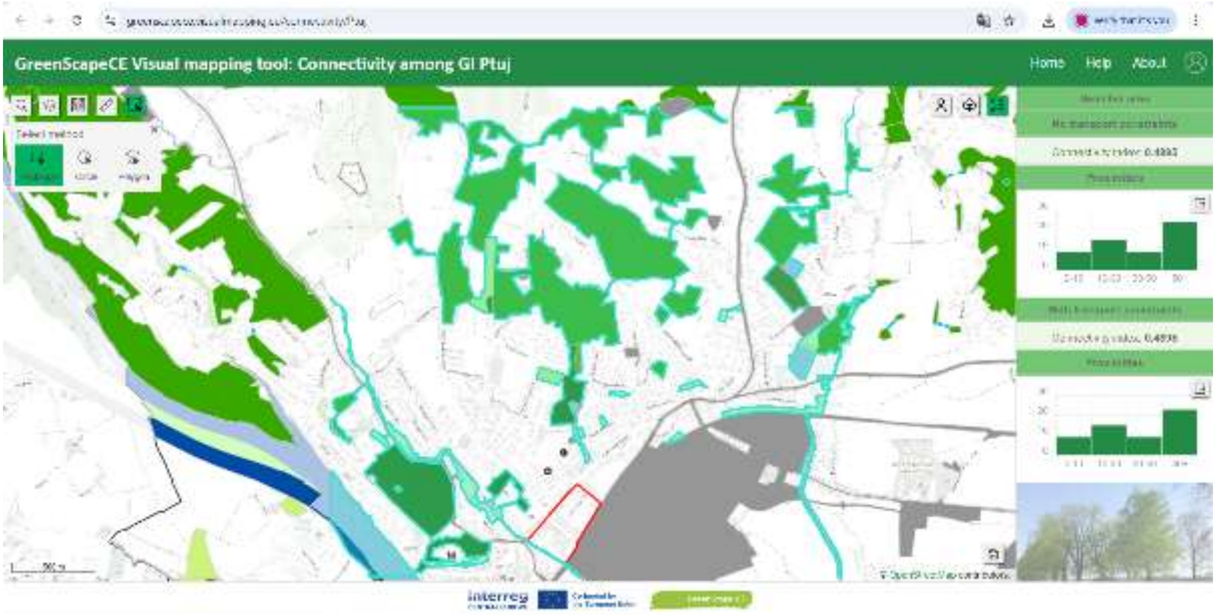

Figure 13: Connectivity among GI data for Ptuj. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/connectivity/Ptuj

Figure 14: Connectivity for selected NbS area in Ptuj. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/connectivity/Ptuj

3. Szeged

3.1. Pilot action

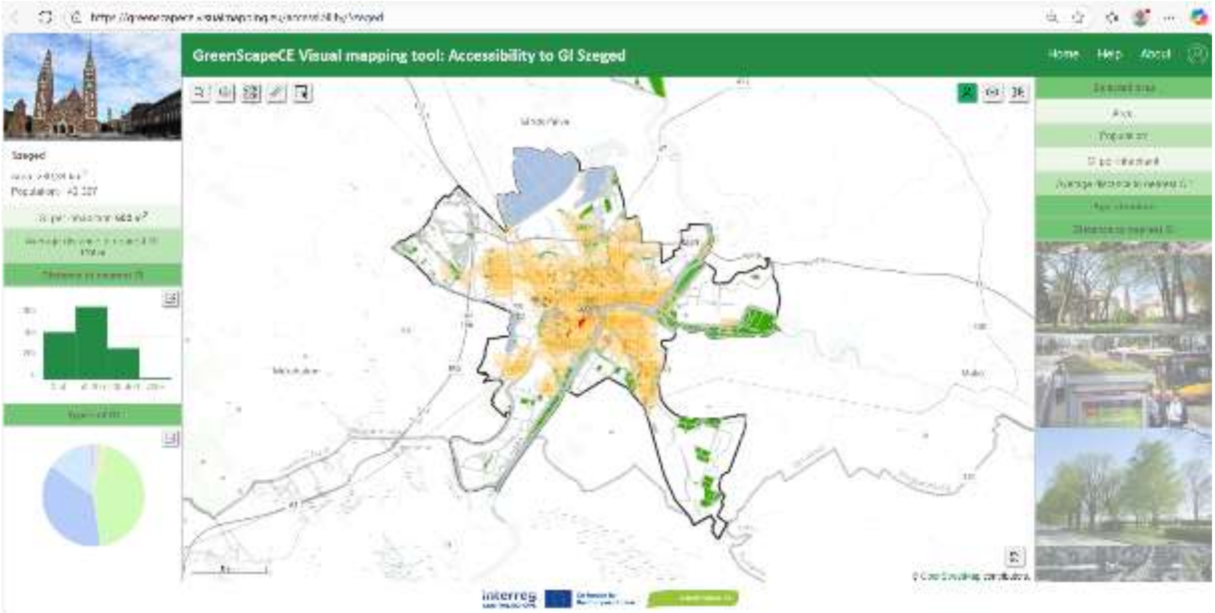

Figure 15: The pilot city Szeged. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/accessibility/Szeged

The Pilot Action for Szeged focuses on greening public transport stops. At the end of August 2024, the City of Szeged's Green Action Plan was completed, which includes several possible measures for implementation. To evaluate these actions, evaluation criteria have also been introduced to assist in prioritization and decision-making.Based on the Sustainable Energy and Climate Action Plan of Szeged and this Action Plan, the measure "Greening of public transport stops" was selected as the topic of pilot project of the GreenScape CE project. Although many stops would need greeneries and provided ecosystem services, only one of them, located in Alsóváros district became the subject of this pilot action.

The district (Alsóváros) still has several old, characteristic tenement houses standing today, alongside new family homes and apartment buildings. After the construction of the Móravárosi Boulevard, the district expanded westward, with a new residential area and a shopping centre built in the outer section of the boulevard. It is predominantly a suburban residential area with ample green spaces, where both a shopping centre and a residential park have been developed. Additionally, the zoo is also located here, in Móraváros.

In Alsóváros, residential functions continue to dominate. Along the streets that define the district (Petőfi Boulevard, Bécsi Boulevard, Boldogasszony Boulevard), as well as in the block development between Szentháromság Street and Alföldi Street, medium-rise brick-structured residential buildings can be found, most of them 40-50 years old. In the residential streets, 1-3 story pitched-roof family homes and apartment buildings dominate, with both closed-row and detached side-boundary developments present, mostly aligning with the street line. Many of these buildings are newly built or renovated. The district contains a significant number of old, outdated private and apartment buildings in need of renovation. Smaller residential blocks and streets within the area are home to socially homogeneous groups (predominantly of Roma descent), who are listed in the database of the Human Public Services Office as recipients of some form of municipal support. The main reasons for their need include low educational attainment, unemployment, and poor health conditions. These families often experience the cycle of poverty, with very few members managing to break out of this environment.

The area enclosed by Petőfi Sándor Boulevard, Faragó Street, and Tisza Lajos Streets in Szeged, as well as the public area extending from property number 54 to property number 50 on Petőfi Sándor Boulevard, including the green space between the roadway and tram tracks up to Bécsi Boulevard (see maps below).

The pilot area currently includes an operational tram stop named "Szivárvány kitérő." The building located at property registration number 20026 houses a bistro called "Vasmacska." Nearby, the Faculty of Humanities of the University of Szeged and the József Attila Study and Information Centre are situated, both of which are popular spots for university students (Source: D2.2.1 Pilot action outline and roll-out plan, Hungary, Szeged, Final 02/2024, Greenscape CE project).

3.2. Selected NbS area for analysis

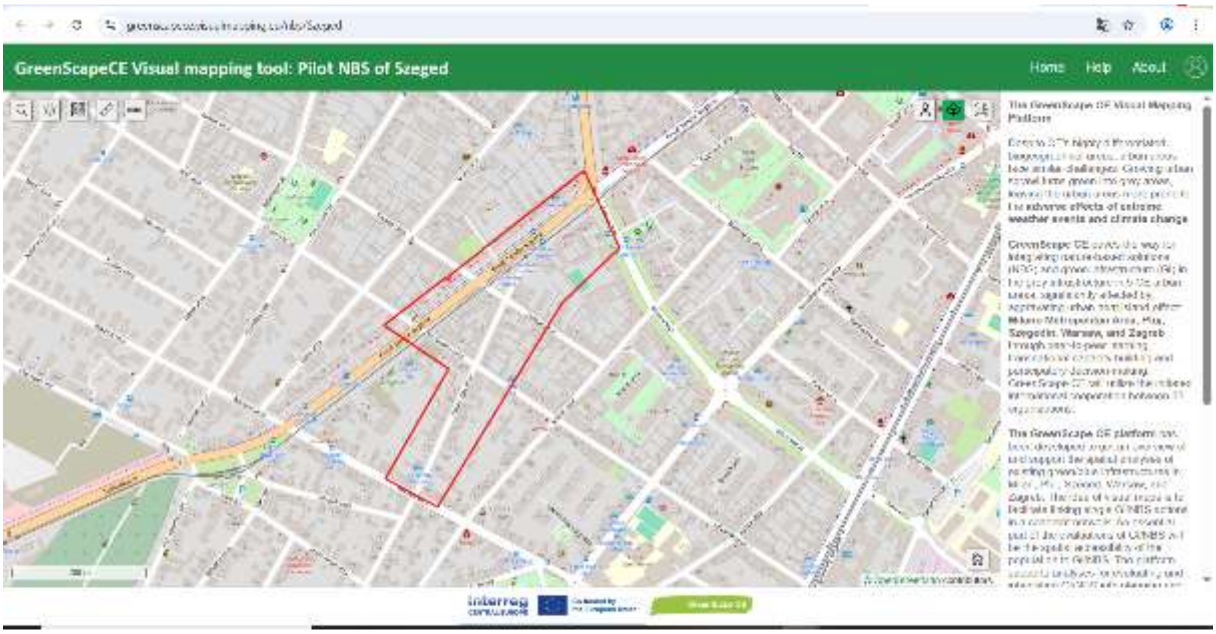

Figure 16: Selected NbS in Szeged. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/nbs/Szeged

Name national	**Városi fák a Petőfi Sándor sgt-on, Zöldterület a lakónegyedben Szivárvány kitérő, Zöld tetős megállók, Növénnyel futtatott pergola a megállóban**
Name english	Street Tree Line on Sándor Petőfi sgt., Green area in residential neighbourhood Szivárvány kitérő, Green roof on the public transport stop, Vegetated pergola in the public transport stop.
NbS	Street trees, Green roofs, Permeable pavements
Status	Planning and design
Duration	2024-2026
Objective	Street Tree Line on Sándor Petőfi sgt. Renovation and improvement of green spots in the city centre, creation of new green areas, creation of green structures in the city with ecological and visual functions.

	Street Trees: Improvement of the growing conditions for urban trees, structural soils, Improvement of the growing conditions for urban trees,mineral and organic nutrients, Replacement of a tree. Permeable Pavements: Increase in the area of common growth tree site and use of permeable pavements, Replacement of asphalt and other impermeable pavements with permeable pavement. Green area in residetial neighbourhood Szivárvány kitérő Creation of new green areas, Renovation and imporvement of green areas, Transformation of previously derelict areas, Creation of pleasant urban atmosphere. Street Trees: Replacement of a tree, Planting of new urban trees Green roof on the public transport stop The objective of a green roof on a bus stop typically includes several key environmental, aesthetic, and practical goals. These roofs help with stormwater management by absorbing rainwater, reducing runoff, and minimizing flooding risks. They also contribute to mitigating the urban heat island effect by cooling down the surrounding area, as the plants absorb sunlight and reduce the amount of heat absorbed by concrete or asphalt. Green roofs improve air quality by capturing pollutants like dust and CO_2, creating a cleaner urban environment. Additionally, they can provide insulation, making the bus stop more energy-efficient by keeping it cooler in summer and warmer in winter. Aesthetically, green roofs enhance the visual appeal of the bus stop, blending it more harmoniously with the natural environment and improving the overall experience for commuters. Vegetated pergola in the public transport stop A vegetated pergola at a public transport stop serves multiple objectives that enhance both the environment and the commuter experience. Primarily, it provides shade and shelter, making the waiting area cooler and more comfortable for passengers, especially in hot weather. This shading effect also helps mitigate the urban heat island phenomenon by lowering the temperature in the surrounding area. In addition to providing comfort, the plants on the pergola contribute to environmental sustainability by improving air quality through the absorption of CO_2 and pollutants. They also help manage stormwater by absorbing rainwater, which reduces runoff and lessens the strain on urban drainage systems. A vegetated pergola also adds aesthetic value to the transport stop, transforming a utilitarian space into a more inviting and attractive area that integrates nature into the urban landscape. Moreover, it promotes biodiversity by supporting local wildlife, such as pollinators and small birds. The pergola serves as a visible example of sustainable urban design, raising awareness about green infrastructure and encouraging a greater appreciation for nature in the city. Ultimately, it provides an eco-friendly and pleasant waiting environment while contributing to the overall well-being of the urban ecosystem and the community.
Description	Street Tree Line on Sándor Petőfi sgt. One of the main objectives of the Municipality of Szeged is to improve the living conditions in those areas, where there is a lack of green spaces, making the

city's climate particularly vulnerable to climate change. By including NbS, the city aims to "revitalise" its area with greenery, create a more pleasant urban atmosphere, lower temperatures in the area during hot periods, improve air quality and promote a more sustainable urban environment. Therefore, one of the designated NbS sites is in the city - on Sándor Petőfi sgt., where NbS street trees and permeable pavements will be installed.

Green area in residential neighbourhood Szivárvány kitérő

The greening of bus stops is an urban environmental project that serves a number of important objectives, aiming to improve sustainability, environmental quality and the well-being of road users. The greening objective is not only aesthetic, but also has practical benefits that ensure the long-term sustainability of transport infrastructure.

Greening stops can help reduce environmental problems in cities, such as air pollution, noise and the heat island effect. Plants absorb carbon dioxide and other pollutants while producing oxygen, thus improving air quality. This is particularly important at stops near busy transport hubs, where concentrations of pollutants emitted by transport vehicles can be higher.

Green roof on the public transport stop

This eco-friendly solution not only improves the appearance of the bus or tram stop but also brings several environmental, social, and practical benefits.

Vegetated pergola in the public transport stop

A vegetated pergola at a public transport stop is a sustainable design feature that combines functionality with environmental benefits. It consists of a structure with climbing plants or vines growing over it, providing shade and shelter for commuters waiting for buses or trains. This green addition helps cool the surrounding area, reducing the effects of the urban heat island phenomenon, where concrete and asphalt absorb and retain heat. The plants on the pergola also improve air quality by filtering pollutants, carbon dioxide, and dust from the air.

In addition to its environmental advantages, the vegetated pergola enhances the aesthetics of the public transport stop, transforming it into a more visually appealing and inviting space. It offers a pleasant atmosphere for passengers, making the waiting experience more enjoyable. The pergola also contributes to stormwater management by absorbing rainwater, reducing runoff, and alleviating pressure on the city's drainage system.

Climate change mitigation	Street Tree Line on Sándor Petőfi sgt. • Diminishing the effect of hot spots in the city. • Microclimate regulation. • Better vegetation condition. • Reduce run-off. • Increasing green urban nature for carbon storage (tree cover). Green area in residential neighbourhood Szivárvány kitérő. • Diminishing the effect of hot spots in the city. • Microclimate regulation.Better vegetation condition. • Reduce run-off. • Increase amount of green open spaces for residents. • Biodiversity enrichment. • Changing Figure of the urban environment. Green roof on the public transport stop Szeged has some green areas that incorporate the NbS concept. Detention basin, small green courtyards in the city, newer urban tree planting. The municipality wants to increase the areas with NbS - for this purpose, the public transport stops was the selected topic to increase the development and improvement of the stations. Diminishing the effect of hot spots in the city. Vegetated pergola in the public transport stop • Microclimate regulation. • Better vegetation condition. • Reduce run-off. • Increasing green urban nature for carbon storage (green roof). • Increase amount of green open spaces for residents. • Biodiversity enrichment. • Changing Figure of the urban environment.
Activities	Szeged has some green areas that incorporate the NbS concept. Detention basin, small green courtyards in the city, newer urban tree planting. The municipality wants to increase the areas with NbS - for this purpose, the public transport stops was the selected topic to increase the development and improvement of the stations.
Stakeholders	Municipality of Szeged, citizens, users and visitors of the city; Szeged Transport Company; Szeged Environmental Management Nonprofit Ltd.
Main beneficiaries	Citizens, vistiors of the city, people that work in the city, tourists, community groups, socio-economically disadvantaged populations
Governance	The project is led by the city of Szeged.
Financing	Total cost to be determined later. Sources rely on own funds. Funding types include earmarked public budget and direct funding through grants, subsidies, or self-financed private projects. Non-financial contributions come from public authorities and citizens (volunteering).
Transferability	Yes
Lessons learned	It is important to have active partners in the process, an interested public and a public ready to participate. New NbS technic implemented.

3.3. Accessibility

To provide the most suitable NbS solution, we need information such as the number of people living in the area and their age distribution. The only data available for Szeged is the georeferenced number of population. 439 people are living on the 67.567 m² area (see Figure 17).

Using the gravity calculation in the GVMP NbS tool, we find that a total of 10,449 people live within a distance of 800 metres from the bus stop – proposed NbS (see Figure 18).

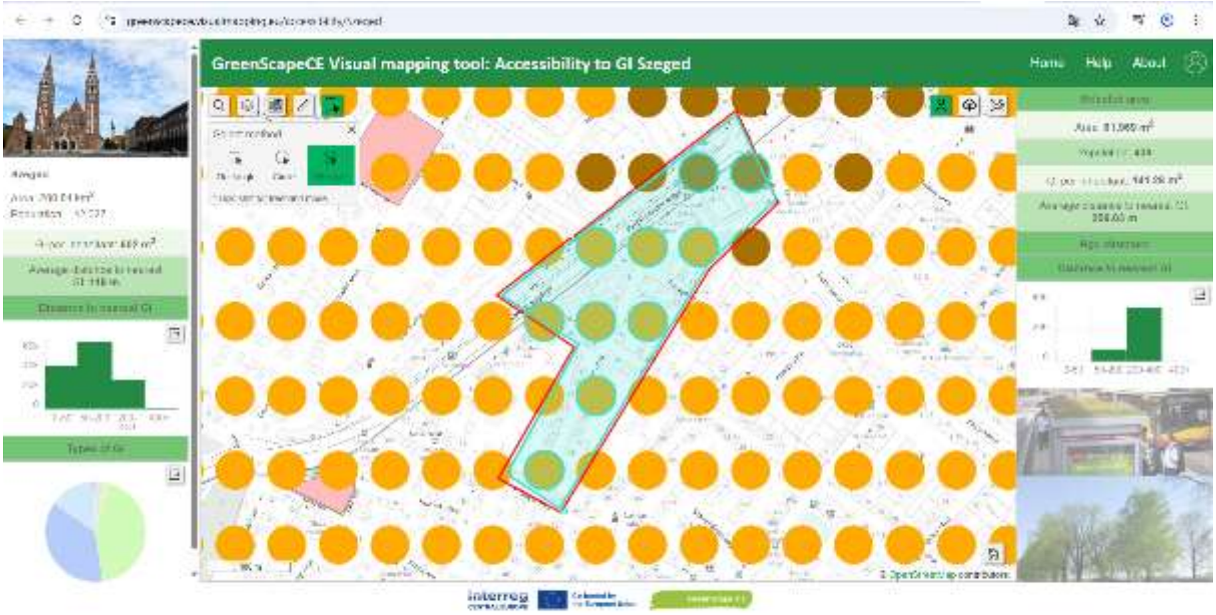

Figure 17: Accessibility tool, population data in the selected NbS area in Szeged. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/accessibility/Szeged

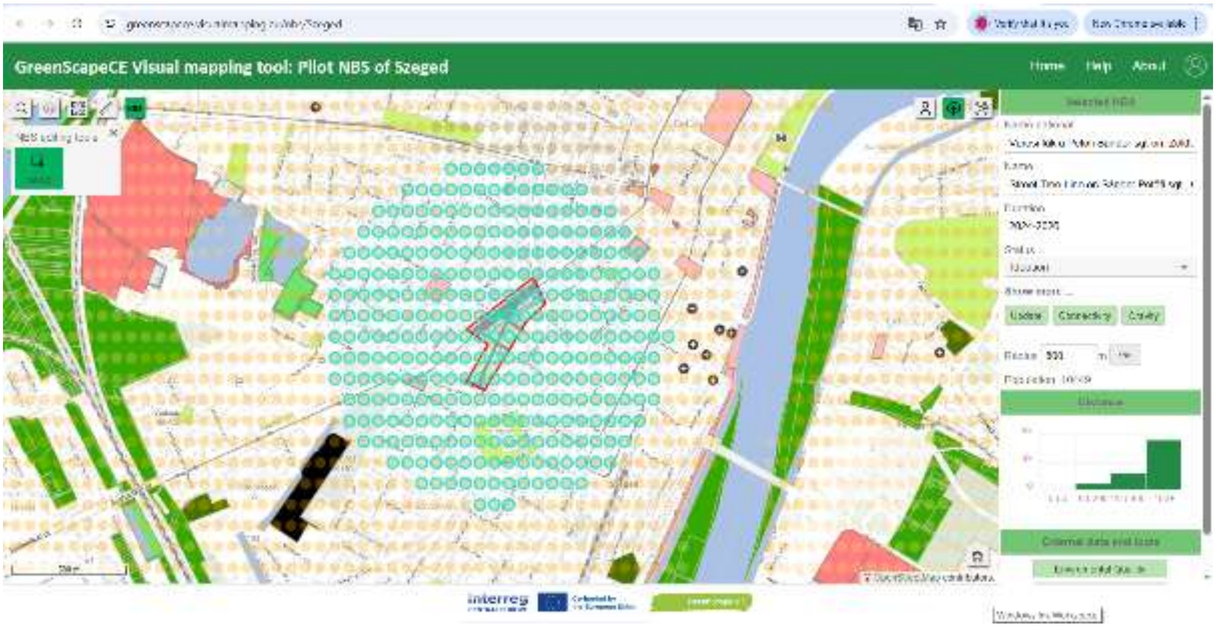

Figure 18: Population data in the 800 m surrounding the selected NbS area in Szeged. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/nbs/Szeged

3.4. Green space index

The pilot project in Szeged centres on the greening of public transport stops. The current GI per inhabitant in the analysed pilot area is 155.30 m^2. Actual GSI is 25.79%. As the planned areas cannot be spatially defined, the GSI for the planned situation cannot be calculated. However, the planned solutions along the street tree line on Sándor Petőfi Street, in the green area of the Szivárvány kitérő residential neighbourhood and on the green roof of the public transport stop will increase the amount of greenery in the area and thus mitigate the negative effects of climate change at a micro level.

Figure 19: Selected NbS with existing green spaces in Szeged. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/nbs/Szeged

3.5. Multifunctionality

During the project, the GVMP NbS tool for Szeged was updated with information on the proposed NbS. The partners provided information on the environmental, social, economic, social justice, and cohesion impacts of the proposed NbS. The effects for the NbS that are the subject of the analysis presented in the report are listed below.

Environmental impacts	
Climate change	Lowered local temperature Microclimate regulation Enhanced carbon sequestration
Environmental quality	Improved air quality Improved soil quality Reduced run off Increased infiltration
Green space and habitat	Increased green space area Greater ecological connectivity across urban regenerated sites Enhanced support of pollination
Social impacts	

Health and wellbeing	Improved physical health Recreational area for the population Improving mental/physical wellbeing through walking
Cultural heritage and sense of place	Improvement in people's connection to nature Meet up places Allotments
Social benefit	Increase communities' sense of ownership Increase social interaction Increase accessibility to green open spaces Increase amount of green open spaces for residents Leisure and cultural purposes (aesthetic pleasure; sense of place, inspiration) and encouraging citizen's engagement with local green initiatives

Economic impacts
Street Tree Line on Sándor Petőfi sgt.
Improving the climate in a neighbourhood reduces heating/cooling costs, growing herbs or vegetables reduces the cost of buying food, reduces the cost of possible irrigation, using green spaces in residential neighbourhoods as recreational areas reduces the cost of sporting activities in the warmer months.
Green area in residential neighbourhood Szivárvány kitérő
Improving the climate in a neighbourhood reduces heating/cooling costs, growing herbs or vegetables reduces the cost of buying food, reduces the cost of possible irrigation, using green spaces in residential neighbourhoods as recreational areas reduces the cost of sporting activities in the warmer months.
Green roof on the public transport stop
Improving the climate in a neighbourhood reduces heating/cooling costs, growing herbs or vegetables reduces the cost of buying food, reduces the cost of possible irrigation, using green spaces in residential neighbourhoods as recreational areas reduces the cost of sporting activities in the warmer months. Economic benefit even the increases of the property value.
Vegetated pergola in the public transport stop
Improving the climate in a neighbourhood reduces heating/cooling costs, growing herbs or vegetables reduces the cost of buying food, reduces the cost of possible irrigation, using green spaces in residential neighbourhoods as recreational areas reduces the cost of sporting activities in the warmer months.
Social justice and cohesion
Improved social cohesion **Fair distribution of social, environmental and economic benefits of the NbS project Improved liveability** **Improved access to urban green space** **Increased visibility and opportunity for marginalised groups or indigenous peoples** **Increased involvement of locals in the management of green spaces** **Increase communities' sense of ownership**

3.6. Connectivity

The land use spatial plan identifies twelve green spaces and public areas with trees within an 800-meter radius of the pilot area, which is about a 10-minute walk. The river and the green spaces adjacent to it are located 1 kilometre away. An orthophoto reveals numerous private green spaces, such as back gardens, classified as residential areas in the land use plan (refer to Figure 20). Additionally, the tram line and pavement are categorized as transportation areas, even though they are covered with grass and trees. When calculating connectivity by considering only the land use within this approximate 800-meter radius, the proximity index is 0.4751.

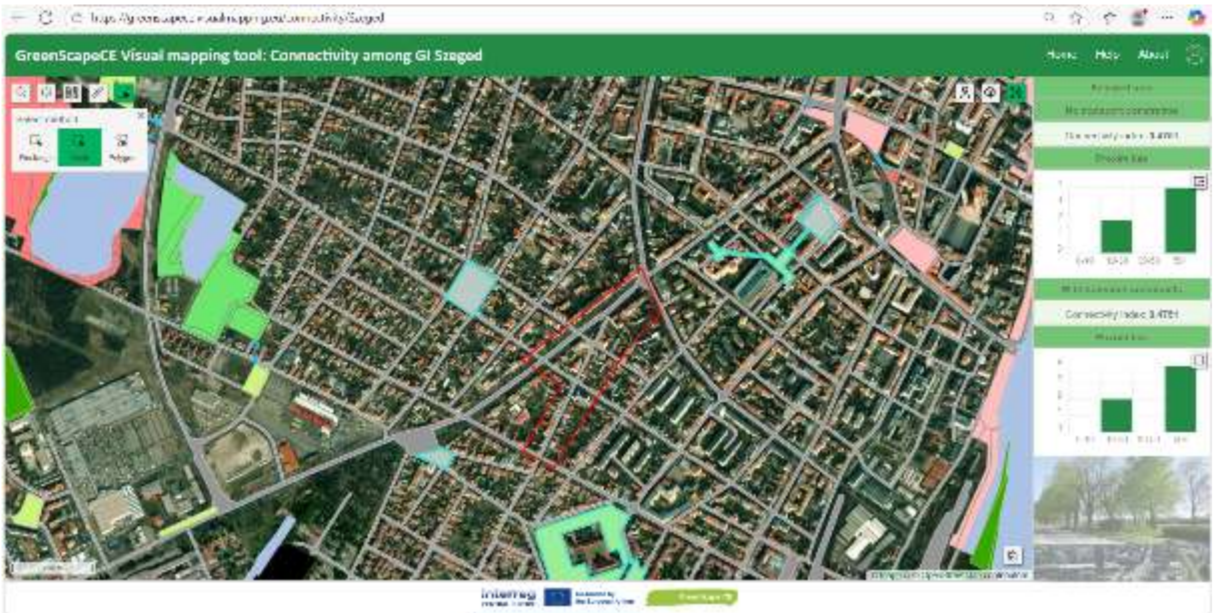

Figure 20: Proximity index, Szeged pilot area. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/connectivity/Szeged

Szeged contributed a heat map to the GVMP (see Figure 21), which can be accessed using the GVMP NBS tool. The map highlights the significant role of private green backyards in mitigating climate change. Pilot area is located on the outskirts of the heart of the heat island of Szeged (Figure 21.)

Figure 21: Heat map for Szeged. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/nbs/Szeged

4. Warsaw

4.1. Pilot action

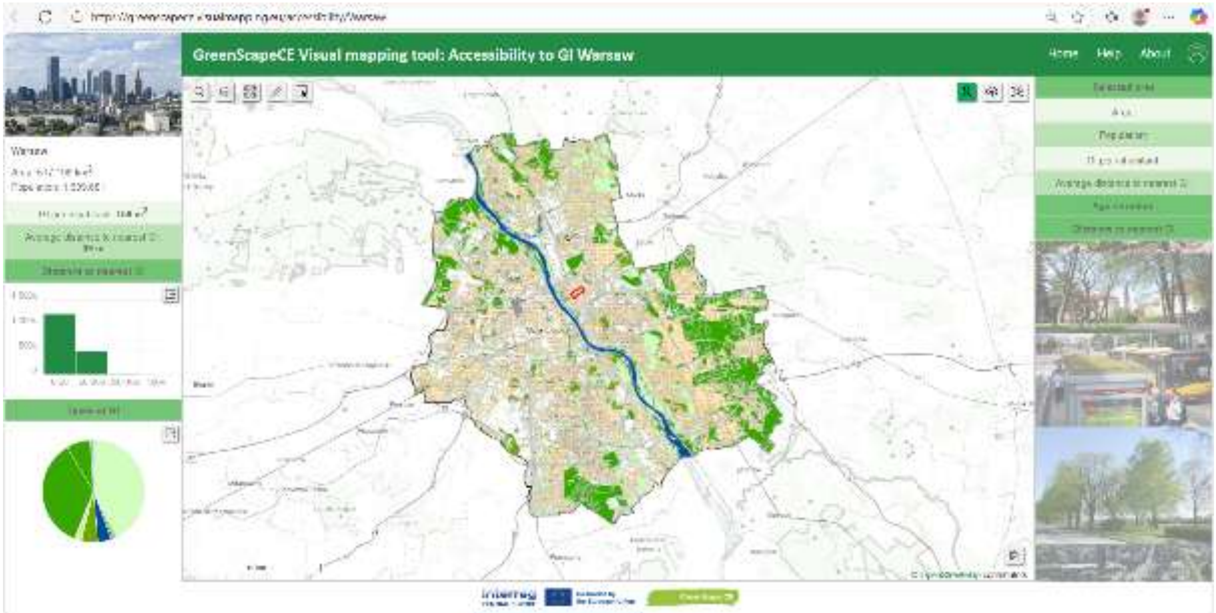

Figure 22: The pilot city Warsaw. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/accessibility/Warsaw

The pilot area Wileńska Street and the surroundings are located within the area covered by the Revitalisation Programme. The Nowa Praga sub-area, as one of priority areas, is bounded by the streets: Targowa, 11 Listopada, Stalowa, Czynszowa, and Wileńska (including: Inżynierska, Zaokopowa, and Środkowa Streets at the sections from Stalowa to Wileńska Street). The quarter occupies 11.45 ha.

Development of this sub-area is limited due to the absence of an adopted local spatial development plan. Local development plans for this area are being resolved.

From the point of view of residents, the main problem is the degradation of buildings, as well as the absence of the necessary utilities. Considering the time of construction and the contemporary standards of apartments (coal-fired stoves), many buildings have no central heating or hot water systems, and even have bathrooms inside the apartments. In the Nowa Praga sub-area, there are 63 council houses and 36 buildings owned by communities. In 2013, as many as 61 council houses (96.8%) in the Nowa Praga sub-area did not have central heating systems. Currently, the central heating network is being repaired and extended in the priority area.

Revitalisation of the Praga Północ district and the City of Warsaw aims to achieve a functional and aesthetic improvement of the urban space, and therefore to create a place where it would be interesting to live and spend leisure time, and aims to develop an incentive mechanism promoting investment in new and existing facilities in the revitalised area.

Furthermore, revitalisation is aimed at improving the standard of living of the poorest residents as a result of improved housing conditions and access to the infrastructure, including an extension of the housing offer addressed to people of various degrees of prosperity, the disabled, and the elderly, other aims are social "prevention" to work against the degradation of persons and groups at risk of marginalisation or exclusion, and "repair", namely restoring the unemployed to the labour market.

The four main objectives of the programme include:

1 socio-economic revival, improved quality of public space, and improved natural environment, according to the requirements of a low-carbon economy;

2 the development of tourism, culture, and sports based on the local identity and cultural heritage resources;

3 the prevention of and counteracting social exclusion;

4 intensified activity of residents and their active participation in various areas of the city functioning.

The progress of works within the framework of the programme is monitored and reported by the Spatial Transformations and Revitalisation Department (at the Office of Architecture and Spatial Planning of the Warsaw City Office) (Source: D2.2.1 Pilot action outline and roll-out plan, Poland, Warsaw, Final 02/2024, Greenscape CE project).

4.2. Selected NbS area for analysis

Figure 23: The pilot area Warsaw; NbS tool. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/NbS/Warsaw

Name national	**Ulica Wileńska**
Name english	Wileńska Street
NBS	Bioswales, rain gardens, rettention permeable pavements, pocket parks and parklets, vegetated pergola and pergola pathways, street trees and tree box/pits filters, green barriers
Status	Ideation
Duration	2024-2028

Objective	Complete rebuilding of the street. Creating resilient, sustainable and welcoming urban environments where road areas are transformed into vibrant green corridors that enhance ecological health, improve human wellbeing and promote climate resilience. The aim is to seamlessly integrate nature into the road infrastructure of cities, turning streets into multifunctional spaces that contribute to environmental sustainability, social equity and economic stability.
Description	The implementation of green infrastructure (GI), such as rain gardens, permeable pavements, and bioswales along roads, aims to effectively manage stormwater, reduce surface runoff and urban flooding, improve water quality, and mitigate the urban heat island effect. Additionally, these solutions contribute to better air quality and noise reduction. A key priority is the integration of nature-based solutions (NbS) and GI into all aspects of road design and planning.
Climate change mitigation	Reducing surface runoff and urban flooding, improving water quality, mitigating the urban heat island effect, enhancing air quality, and reducing noise
Activities	Planned actions include greening traffic exclusion zones, areas around pedestrian crossings, and wide pavements by removing paved surfaces—at least partially in the case of pavements—and replacing them with green spaces. Additionally, expanding and connecting tree basins by removing paved surfaces between them will create longer planting beds, enhancing tree habitats and increasing their resilience in urban conditions. Another initiative involves replacing paved central lanes with landscaped areas to further support green infrastructure development.
Stakeholders	Stakeholders are to engage at various stage of the project's lifecycle, particulary in design, implementation and maintenance phases. Among stakeholders involved are: residents, officials, business owners, employees and clients of local businesses, users of the area (passing, walking, standing), dog walkers, cyclists, local school communities, activists, cooperatives, housing communities
Main beneficiaries	residents, business owners, users of the area
Governance	The project is led by Public Roads Authority
Financing	The total cost of the investment includes analyses, concept with public consultations, final technical drawings, implementation, and later management. Estimated costs are: analyses about 100,000 PLN, concept and consultations around 50,000 PLN, technical documentation for the whole street about 1 million PLN, and implementation around 30 million PLN (currently only an assumption based on experience, to be defined after technical design). Financing sources include the Public Roads Authority in Warsaw budget, Revitalisation Programme funds, Warsaw's Participatory Budget, and Interreg CE (GreenScape CE project). Funding types are public funds and EU funds. Non-financial contributions come from public authorities (land, utility services) and citizens (volunteering, tools, seeds).
Transferability	This solutions are implementable in other areas in Warsaw as well as in other cities

Lessons learned	Establishing clear policies and regulations that mandate the incorporation of NBS/GI in new and existing road projects is essential. Collaboration with local communities, businesses, and other stakeholders is crucial to ensuring that the implemented solutions meet their needs and expectations over time. Equally important is promoting awareness and understanding of NBS/GI benefits among citizens, fostering a culture of sustainability and environmental stewardship. Encouraging innovative approaches to road design—such as the use of permeable materials, green roofs, and vertical gardens—plays a key role in achieving the desired outcomes. Additionally, implementing robust monitoring systems is necessary to track the performance of NBS/GI and make necessary adjustments to ensure their long-term success.

4.3. Accessibility

In order to conduct a more detailed evaluation of the proposed NbS, it is essential to gather various pieces of data, including information on the population size and age distribution of the area in question. According to the GVMP Accessibility tool, the area in question has a population of 7,002 and covers 407,303 m². The age distribution is as follows: 3% are under 3 years old, 7% are aged 4–10, 8% are aged 11–18, 57% are aged 19–60, and 25% are over 61.

If the solutions from the pilot action are applied to a larger region, the GVMP NbS tool - Gravity function, will be a valuable resource. By entering a distance of 800 metres, it can be determined that a total of 22,286 inhabitants would be connected to the proposed NbS.

Figure 24: Accessibility tool, population data in the selected NbS area in Warsaw; Accessibility tool. Source: GreenScape CE visual mapping platform: https://GreenScapeCE.visualmapping.eu/accessibility/Warsaw

Figure 25: Population data in the 800 m surrounding the selected NbS area in Warsaw. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/nbs/Warsaw

4.4. Green space index

The pilot project in Warsaw aims to revitalize the area both functionally and aesthetically. Warsaw has provided greenery data that has been integrated into the GVMP through the NbS tool. This greenery data includes various types such as shrubs, shrub groups, tree crowns, and lawns. For each greenery feature, detailed information is available, including exact location, type (e.g., plum, cherry, apple, or pear), health, and age. This database serves as an excellent resource that can be utilized in multiple fields, particularly in spatial planning.

In the 'Greenery' section of the NbS tool (see Figure 26), users can select an area to retrieve data such as population numbers, the amount of greenery in square meters, and a greenery index. The greenery index is calculated based on greenery per area and greenery per population. The current green space per inhabitant in the analysed pilot area is 9.90m^2. The existing GSI for the intervention area stands at 17.44%.

Figure 26: Greenery data for Warsaw. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/nbs/Warsaw

4.5. Multifunctionality

During the project, the GVMP NbS tool for Warsaw was updated with information on the proposed NbS. The partners provided information on the environmental, social, economic, social justice, and cohesion impacts of the proposed NbS. The effects for the NbS that are the subject of the analysis presented in the report are listed below.

Environmental impacts
Reduction in surface runoff and flooding, improvement in air and water quality, biodiversity enhancement
Social impacts
Design road areas to be more inclusive and accessible by integrating green spaces that ptomote social interaction and encourage physical activity
Economic impacts
Impacts on social justice and cohesion

4.6. Connectivity

The pilot area has several green spaces in the vicinity. There is also a busy street and transport hub. In the area, there are 4 green spaces - grassland vegetation and agricultural crops in the existing land use. Proposed NbS will significantly improve the situation (see Figures 27 and 28).

Figure 27: Pilot area: connectivity. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/connectivity/Warsaw

Figure 28: Pilot area: connectivity, proximity. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/connectivity/Warsaw

5. Zagreb

5.1. Pilot action

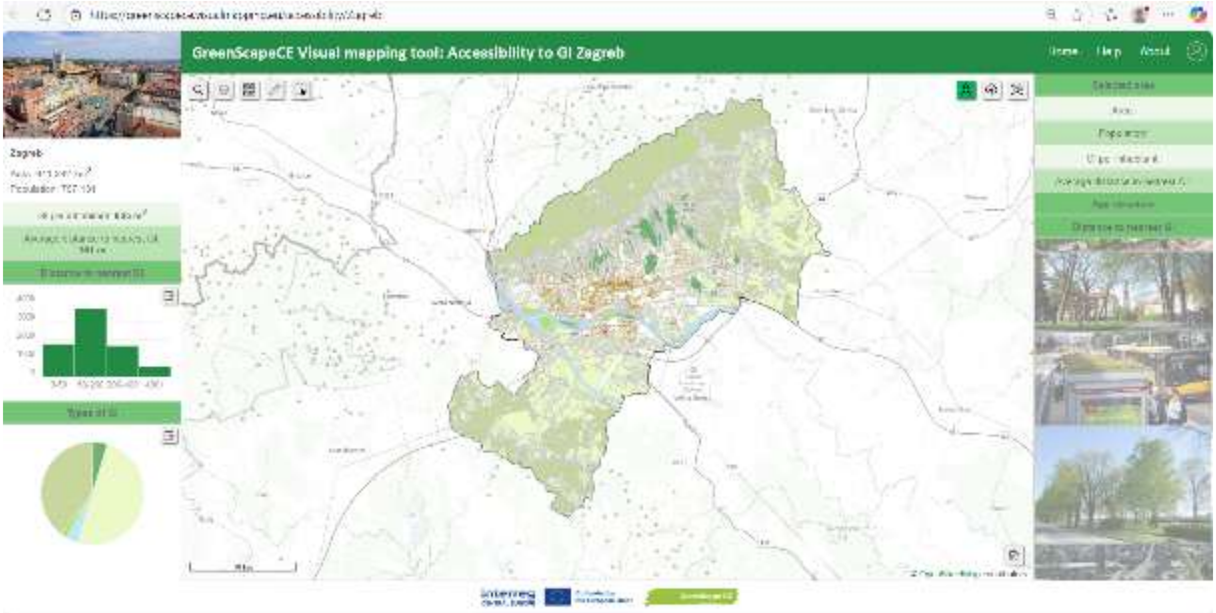

Figure 29: The pilot city Zagreb. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/NbS/zagreb

With this pilot project, the City of Zagreb aims to transform sports fields in Novi Zagreb into safe, functional and sustainable spaces for sports and recreation, using best practices and solutions adapted to local needs. The sports fields should be developed as demonstration examples of sustainable space, also serving as a pilot project for future similar initiatives. The sports fields were selected primarily for their characteristics. Although they significantly contribute to the health of citizens through the development of sports and recreation, large artificial, impermeable surfaces of sports fields increase the heat island effect and negatively affect the water regime.

For the pilot project, three locations in Novi Zagreb with different characteristics were chosen to examine the possibilities of applying different solutions based on nature, that is, situations defined by different legislative frameworks.

The locations consist of existing open sports fields of various uses, together with the surrounding area (roads, parking lots, footpaths, greenery). Sports fields are asphalt surfaces in a degraded state. The existing plant stock is mainly made up of tall vegetation, the condition of which varies from a regular habitus to a degraded stage, and irregularly distributed and sporadic groups of bushes, which are usually caused by inadequate maintenance and pruning.

The locations are optimal for implementing the pilot project of climate-resilient solutions due to their exposure to urban heat island impact, stormwater and flood issues, potential for integrating renewable energy sources, and opportunities to increase biodiversity and improve spatial quality.

The existing sports fields and supporting infrastructure are in poor condition. The asphalt surfaces do not allow for proper absorption of rainwater, which contributes to frequent water accumulation and further deterioration of the terrain. The plant population has been significantly damaged by previous interventions, and the existing greenery does not provide adequate protection from heat waves or contribute to biodiversity.

The project envisages a thorough renovation of the playgrounds with the implementation of NbS and modern sustainable technologies (Source: D2.2.1 Pilot action outline and roll-out plan, Croatia, Zagreb, Final 02/2024, Greenscape CE project).

5.2. Selected NbS area for analysis

Figure 30: Selected NbS area in Zagreb. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/NbS/zagreb

Name national	**Trnsko - klimatski otporno sportsko igralište**
Name english	Trnsko - climate-resistant sports field
NBS	Improvement of the growing conditions for urban trees - structural soils • Improvement of the growing conditions for urban trees - mineral and organic nutrients • Replacement of a tree Permeable Pavements: • Increase in the area of common growth tree site and use of permeable pavements • Replacement of asphalt and other impermeable pavements with permeable pavement • Bioritention systems/ rain gardens • Street trees • Vegetated pergola and pergola pathways • Green and living walls
Status	In progress
Duration	2025-2026
Objective	Climate adaptation; Stormwater management; Biodiversity enhancement; Community well-being

Description	The pilot project in Trnsko involves the transformation of a degraded asphalt sports playground into a climate-resilient public space through the application of nature-based solutions (NbS). The aim is to address urban heat island effects, improve rainwater infiltration, increase biodiversity, and enhance the quality of life in the neighbourhood. Measures include replacing impermeable surfaces with permeable materials, integrating vegetation such as trees, shrubs, and ground cover, and implementing rain gardens and bioswales to manage stormwater naturally. The project also promotes community participation through co-design workshops and surveys, ensuring that final features reflect the needs and preferences of local residents. The design considers shading, resting zones, ecological connectivity, and recreational opportunities. Educational elements, such as signage and QR codes, will raise awareness about climate adaptation and green infrastructure. The initiative serves as a model for replicating similar NbS interventions in other urban areas.
Climate change mitigation	Reduction of urban heat island effects through increased vegetation cover and shaded areas; introduction of permeable and absorbent surfaces for stormwater management, with the site functioning as a local infiltration zone capable of retaining excess rainwater during extreme weather events, thus reducing runoff to surrounding plots and supporting overall climate resilience of the neighbourhood.
Activities	Comprehensive transformation of a degraded asphalt playground into a multifunctional, climate-resilient green space. Activities include removal of impervious surfaces, installation of permeable pavements, creation of bioretention zones and rain gardens, planting of trees and diverse vegetation to increase canopy cover, construction of vegetated pergolas and shaded resting areas, and integration of urban furniture. The site will be designed to serve as an absorbent landscape, enabling natural infiltration and temporary retention of stormwater during heavy rainfall, thus relieving pressure on surrounding plots and drainage systems. Educational and participatory components include community workshops, surveys, and on-site interpretive elements to raise awareness about the benefits of nature-based solutions and climate resilience.
Stakeholders	City of Zagreb (including the Department for Economy, Sustainability and Strategic Planning, and the Department for Sports), local community representatives, local schools and kindergartens, urban planners, landscape architects, and utility companies. The Water and Sewerage Utility (Vodoopskrba i odvodnja - VIO) will be involved in reviewing water management conditions and ensuring compliance with hydrological regulations.
Main beneficiaries	Local residents, children and youth, elderly population, general public
Governance	Municipal-led, participatory process with involvement of local stakeholders
Financing	Estimated technical documentation cost is 18,000 €, while implementation cost will be defined after the design phase. Sources include the City of Zagreb budget, EU Interreg Central Europe (GreenScape CE), and national/international project funding. Funding types consist of earmarked public budget and direct funding (grants, subsidies, or self-financed private projects), with details to be defined through a feasibility study. Non-financial contributions involve in-kind support from city staff and community engagement.

Transferability	High – can be replicated in other urban neighbourhood playgrounds facing similar climate challenges. The City of Zagreb is already planning other pilot sites
Lessons learned	A selection process for sports playgrounds was conducted, during which it was found that identifying an ideal location is highly challenging due to a range of factors. These include complex property and legal statuses, cadastral registration issues, legality (stemming from the legacy of socialism, where playgrounds were often built without permits, complicating legal regularisation), designated land use, existing infrastructure, public concessions, and general governance structures. It was also recognised that there is a clear distinction between stakeholders involved in publicly accessible playgrounds and those located within educational institutions. Based on this multi-criteria filtering process, this site was selected out of the three proposed locations from the roll-out plan, as suitable for the implementation of the pilot project. A participatory process will be carried out to explore citizens' needs regarding desired amenities. The design brief stipulates that the designer will examine the applicability of NbS, taking into account the existing conditions and climate challenges being addressed. These challenges are particularly relevant to large impervious (asphalt) surfaces such as playgrounds, and include urban heat island effects, stormwater management, and the enhancement of biodiversity.

5.3. Accessibility

To understand how a playground is utilized and what equipment might be necessary, we need to assess the number of residents and the age distribution of the local population within two distances: 300 meters (approximately a five-minute walk) and 800 meters (around a ten-minute walk).

Using the GVMP Accessibility tool, we found that 3,545 people live within 300 meters of the playground. The age distribution of this group is as follows: 12% are children up to 14 years old; 8% are aged 15 to 24; 21% are aged 25 to 39 (the largest group); 36% are aged 40 to 64; 20% are aged 65 to 84; and 3% are older than 85 (see Figure 31).

When we extend the radius to 800 meters, the number of people who are likely to use the playground increases to 12,836. The age distribution for this larger group is as follows: 15% are children up to 14 years old; 9% are aged 15 to 24; 23% are aged 25 to 39 (again, the largest group); 35% are aged 40 to 64; 16% are aged 65 to 84; and 3% are older than 85 (see Figure 32).

Figure 31: Population data in the 300 m surrounding the selected NbS area in Zagreb. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/NbS/zagreb

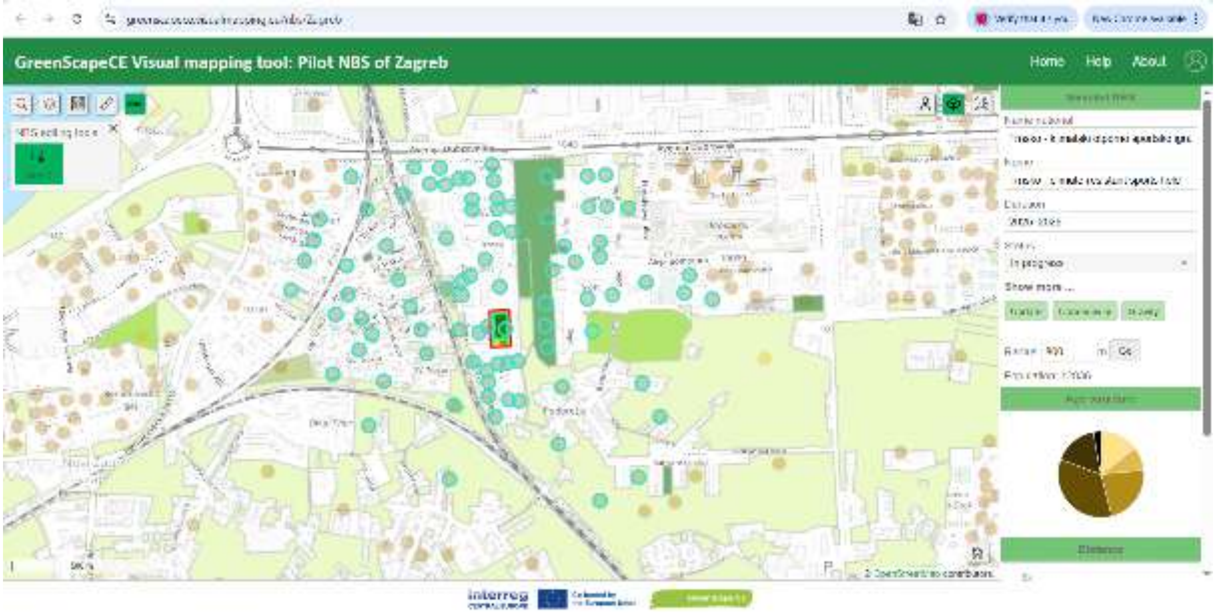

Figure 32: Population data in the 800 m surrounding the selected NbS area in Zagreb. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/NbS/zagreb

5.4. Green space index

In the pilot action, the City of Zagreb aims to transform the sports grounds in Novo Zagreb into safe, functional, and sustainable spaces for sports and recreation (see Figure 33). The area designated for this pilot action has a GSI of 80.81%, and the renovation is anticipated to enhance the greenery in the space.

Figure 33: Selected NbS area in Zagreb with different type of land use. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/NbS/zagreb

Cadaster of greenery for the Zagreb municipality is accessible online via the Zagreb Geoportal. The GVMP connects Zagreb with this Geoportal (see Figure 34), allowing users to explore greenery in detail.

Figure 34: GVMP NbS tool links to Cadaster of greenery in Zagreb GeoPortal. Source: Zagreb Geo Portal. https://geoportal.zagreb.hr

5.5. Multifunctionality

During the project, the GVMP NbS tool for Zagreb was updated with information on the proposed NbS. The partners provided information on the environmental, social, economic, social justice, and cohesion impacts of the proposed NbS. The effects for the NbS that are the subject of the analysis presented in the report are listed below.

Environmental impacts	
Improved microclimate **Better rainwater infiltration** **Lowered local temperature** **Enhanced carbon sequestration**	
Green space and habitat	Increased green space area Increased conversion of degraded land or soil Enhanced support of pollination, increased biodiversity
Social impacts	
Health and wellbeing	Improved physical health Community engagement, inclusive public space, improved recreational infrastructure
Social benefit	Increase accessibility to green open spaces Increase amount of green open spaces for residents Leisure and cultural purposes (aesthetic pleasure; sense of place, inspiration) and encouraging citizen's engagement with local green initiatives
Economic impacts	
More pleasant spaces in the city attract space users and increase the presence of people in the city at all times of the year, and consequently stimulate economic activity in the immediate surroundings. Increased property value, potential reduction in urban infrastructure costs	
Impacts on social justice and cohesion	
Improved social cohesion **Fair distribution of social, environmental and economic benefits of the NbS project** **Improved liveability** **Improved access to urban green space** **Increased visibility and opportunity for marginalised groups or indigenous peoples** **Free access to green and shaded recreational spaces for all, including vulnerable groups**	

5.6. Connectivity

The connectivity index for the selected area within a 2000 m radius around the selected NbS area with no transport constraints is 0.9996. If transport is considered in the calculation of the proximity index, then it drops to 0.3126. Results show that there are several roads wider than 25 meters that obstruct connectivity among green infrastructure.

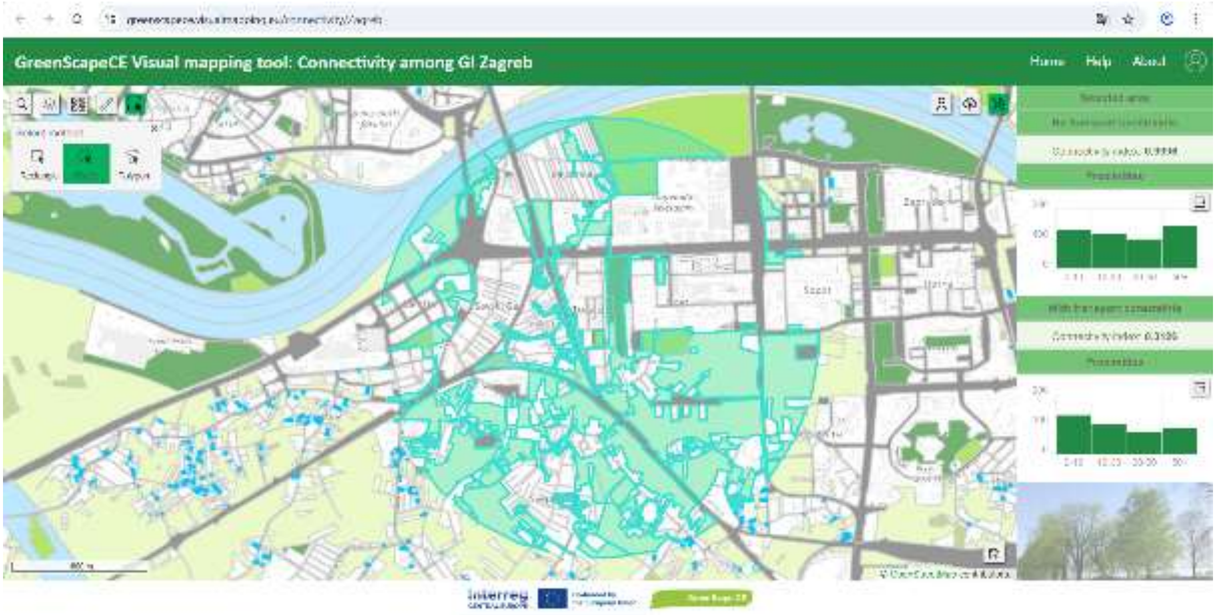

Figure 35: Connectivity index for selected area, Zagreb. Source: GreenScape CE visual mapping platform: https://GreenScape CE.visualmapping.eu/NbS/zagreb

E. Conclusions

The analyses carried out in the five pilot areas in Metropolitan City of Milan, Ptuj, Szeged, Warsaw, and Zagreb draw on deliverables in WP2 relating to pilot actions and the development of the GreenScape CE Visual Mapping Platform (GVMP). The aim was to demonstrate the applicability of the proposed NbS in terms of accessibility, GSI, multifunctionality and connectivity through simple analyses.

The conclusions from the pilot areas confirm the potential of GI and NbS to help create climate-resilient, inclusive and sustainable cities in Central Europe. They also provide a framework that can be transferred to other urban areas.

In Milan, the installation of green roofs on social housing towers has improved energy efficiency through better insulation, reduced the urban heat island effect, and enhanced the local microclimate. These measures also provide rainwater retention and lower greenhouse gas emissions. In terms of social impact, the project involved residents in a co-design process, creating opportunities for rooftop farming and community events that have strengthened social interaction and well-being. From an economic perspective, the roofs reduce energy costs and create opportunities for local food production, which is supported by a blended financing model combining EU, municipal, and national funds. An accessibility analysis shows that 336 people live within the selected NbS area, 71% of whom are aged between 25 and 74 years. The GSI relatively increased by 20.47% following the implementation of the green roofs. In terms of connectivity, green spaces are located only 10 to 50 metres away, creating functional links within the urban fabric.

In Ptuj, the introduction of new green areas, permeable pavements, rain gardens, and urban trees could significantly enhance resilience and liveability. These measures would improve air and soil quality, increase carbon storage, reduce stormwater runoff and enrich biodiversity. They also provide accessible recreational spaces, improve health and well-being, and reinforce community identity and ownership. From an economic perspective, they help to reduce energy and irrigation costs, contribute to household food production and increase property values. The interventions have also ensured social equity by engaging with people of all ages, including the elderly and students from nearby schools. The GSI would relatively increase by 46.47% following the implementation of the planned pilot actions. The connectivity index for the entire municipality is 0.4030, indicating relatively well-connected green spaces.

In Szeged, greening public transport stops with street trees, green roofs and vegetated pergolas mitigates heat stress, improves air quality and enhances stormwater management. These measures regulate the microclimate, support biodiversity, and contribute to cleaner air. They transform bus and tram stops into more attractive, shaded and comfortable spaces for commuters, thereby fostering inclusion and improving the overall travel experience. Actual GSI is 25.79%. From an economic perspective, they lower cooling costs, increase property values, and reduce long-term maintenance expenses. At the same time, they strengthen community ownership and visibility for disadvantaged groups, contributing to greater social cohesion.

In Warsaw, the revitalisation of Wileńska Street incorporates bioswales, rain gardens, pocket parks, and green corridors to create a multifunctional, climate-resilient urban environment. These measures reduce surface runoff and flooding, improve air and water quality, and enhance biodiversity. Socially, they provide accessible and inclusive public spaces that encourage recreation, physical activity and social interaction. In economic terms, the solutions offer cost-effective stormwater management and ensure the long-term resilience of urban infrastructure. The project also benefits from strong governance, having involved extensive public consultations, business participation and community engagement to ensure sustainable outcomes. The existing GSI for the intervention area stands at

17.44%. The connectivity assessment shows that there are several nearby green spaces, but a busy transport hub fragments them.

In Zagreb, degraded sports fields in Novi Zagreb will be transformed into climate-resilient green spaces that manage stormwater while improving the local quality of life. These interventions will reduce the urban heat island effect, enhance water infiltration and restore biodiversity. They will also create multifunctional recreational areas with shaded rest zones and educational features to raise awareness of climate adaptation. From an economic perspective, the transformation will revitalise neglected spaces, increase the value of surrounding land, and reduce long-term maintenance costs. The co-design approach ensures the solutions reflect residents' needs and priorities, thereby strengthening social inclusion and community well-being. An accessibility analysis shows that 12,836 people live within 800 metres of the site. The GSI for the pilot area is 80.81%, with improvements expected after renovation. The connectivity index is 0.9996 without transport constraints, but falls sharply to 0.3126 when roads wider than 25 metres are considered, highlighting potential barriers to ecological connectivity.

The findings from the five pilot cities demonstrate the GVMP's potential to provide accessible analyses that support experts and non-experts alike in planning and implementing NbS. By presenting results clearly and understandably, the GVMP enables cities to translate scientific insights into practical solutions for creating climate-resilient, inclusive and sustainable urban environments.

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G. Appendix 1: GVMP NbS tool data

The NBS data for GVMP NBS tool was contributed by project partners from Metropolitan city of Milan, Warsaw, Ptuj, Szeged and Zagreb.

GVMP NbS tool data
shp_ID
Country
City
Name national
Name english
NBS (catalogue in tab NbS, you can select more types)
Status
Duration
Objective
Description
Climate change mitigation
Activities
Stakeholders
Main beneficiaries
Impacts (environmental)
Impacts (social)
Impacts (economic)
Impacts (Social justice and cohesion)
Governance
Financing (Total cost)
Financing (Sources)
Financing (Type of funding)
Financing (Non-financial contribution)
Transferability
Lessons learned
References