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Supporting material

Annex // February 2026

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Disclaimer

This document is a final report.

The information contained herein is subject to change and does not commit the ESPON EGTC and the countries participating in the ESPON 2030 Cooperation Programme.

The final version of the report will be published as soon as approved.

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1 General Annexes

The general resources constitute the supporting framework developed within ESPON GILL to complement the application of the methodology. They provide municipalities with cross-cutting guidance on key conceptual, institutional, and practical aspects relevant to GI planning and implementation. These resources are not tied to individual modules, but rather support the overall understanding, and effective use of the methodology across different local contexts.

- **Annex 1.1 - ESPON GILL Glossary:** Provides a list of related terms and their definitions used in the development of the ESPON GILL Methodology, with the aim of offering guidance on the terminology applied.
- **Annex 1.2 - Enablers and barriers:** Provides an overview of enabling factors (supportive policies, funding, and stakeholder engagement approaches) that can accelerate GI adoption, as well as barriers (regulatory constraints, financial limitations, and lack of expertise) that may hinder progress across different dimensions (institutional and organisational; engagement and coordination; political; socio-cultural; biophysical; knowledge; and financial). The document is based on practice-based knowledge and lessons learned from the implementation of the ESPON GILL Methodology in case studies.
- **Annex 1.3 - Repository of good practices:** This document presents a repository of good practices related to GI-related plans and policies, highlighting successful outcomes in informing urban planning through GI. It includes information on the type of plan, the spatial scale, the responsible authority and location, a brief description, key learning points, contact details, and access to further information.

1.1 ESPON GILL Glossary

This glossary provides a curated set of key terms and definitions that underpin the development of the ESPON GILL Methodology. Its purpose is to clarify the terminology applied throughout the methodology and to support a shared understanding among researchers, practitioners, and policymakers. By consolidating concepts related to governance, spatial planning, ecosystem services, resilience, and nature-based and green–blue infrastructure approaches, the glossary helps bridge disciplinary perspectives and policy domains. In doing so, it facilitates coherent communication, comparability of analyses, and the effective application of the methodology across different territorial contexts, planning systems, and governance frameworks. For the sake of synergy, the glossary primarily draws upon material developed by the UNP+ Project (García-Blanco et al., 2025).

Term	Description
Adaptive territorial governance and planning	A governance approach that integrates planning with the principles of adaptability and place-based coordination to manage complex and evolving urban and ecological challenges. It involves flexible, multi-level collaboration among public institutions, stakeholders, and communities, enabling continuous learning, iterative decision-making, and responsiveness to changing conditions (Mimura et al., 2014).
Co-creation	The term co-creation is used in a variety of fields and domains and refers generally to the process of shaping meanings, practices, and outcomes over time, emphasizing collective sense-making and the emergence of shared values, and the ongoing reconfiguration of relationships within socio-technical systems (Deserti & Rizzo, 2014) through key elements (Puerari, 2018). In the context of UNPs, co-creation encompasses various stages integral to urban naturing, including co-diagnostics, co-selection, co-design, co-implementation, and co-monitoring, ensuring that planning processes are inclusive, context-sensitive, and grounded in shared knowledge and values.
Ecological connectivity	Ecological connectivity is defined as the 'unimpeded movement of species and the flow of natural processes that sustain life on Earth'. This definition has also been endorsed by the Convention on Migratory Species in 2019 (CMS, 2026). This connectivity is negatively impacted by landscape fragmentation, which happens when large habitat patches or lineal features like rivers, are divided into smaller, more isolated fragments.
Ecosystem multifunctionality	Ability of an ecosystem to simultaneously provide multiple functions and services that are beneficial to both nature and humans (Hölting et al., 2019; Mace et al., 2018; Wittwer et al., 2020; Zhang, 2023). It encompasses both the biological, geochemical, and physical processes within an ecosystem and the co-supply of multiple ecosystem services relative to human demand. (Slade et al., 2017; Gross et al., 2017).
Ecosystem Services	The Common International Classification of Ecosystem Services (CICES) defines Ecosystem Services as being "the contributions that ecosystems make to human well-being, and as distinct from the goods and benefits that people subsequently derive from them" (EEA, 2026). Ecosystem Services themselves have been classified according to the Millenium Ecosystem Assessment (MEA) into four categories (World Resources Institute, 2005): provisioning, supporting, regulating and cultural services (these have been aggregated by CICES into 3 broader categories)
Ecosystem Service Provision	Quantifies what ecosystems actually provide from a biophysical perspective (Burkhard and Maes 2017).
Ecosystem Service Demand	The need for specific ecosystem services (ES) by society, particular stakeholder groups or individuals (Burkhard and Maes 2017).
Ecosystem Service Unmet Demand	When the ecosystem is unable to provide the services demanded by society, there is an unmet demand (Burkhard and Maes 2017).
Ecosystem Service Flow	When the ecosystem service potential matches with the ecosystem service demand, an ecosystem service actual flow (use) is generated (Burkhard and Maes 2017).

Term	Description
Geographical Information Systems (GIS)	GIS connects data to a map, integrating location data (where things are) with all types of descriptive information (what things are like there). This provides a foundation for mapping and analysis that is used in science and almost every industry. GIS helps users understand patterns, relationships, and geographic context. The benefits include improved communication, efficiency, management, and decision-making. (ESRI, 2026)
Governance	All government processes, institutions, procedures, and practices through which matters affecting the entire society are decided and regulated (ESPON EGTC, 2018). Territorial governance comprises the institutions that assist in active cooperation across government, market, and civil society actors to coordinate decision-making and actions that have an impact on the quality of places and their development. It specifically refers to the formulation and implementation of public policies, programmes and projects for the development of a place/territory by i) co-ordinating actions of actors and institutions, ii) integrating policy sectors, iii) mobilising stakeholder participation, iv) being adaptive to changing contexts, and v) realising place-based/territorial specificities and impacts (ESPON EGTC, 2018).
Green infrastructure	A strategically planned network of high quality natural, semi natural and cultivated areas designed and managed to deliver a wide range of ecosystem services and protect biodiversity (European Commission, 2013).
Green/blue infrastructure	Green and Blue infrastructure (GBI) encompasses strategically planned networks of functionally interconnected green and blue spaces within and adjacent to urban areas, enabling ecosystem services to provide benefits for human well-being, resilience and biodiversity while also contributing to the mitigation of urban sustainability challenges (Andersson et al., 2019; Cohen-Shacham et al., 2016; European Commission, 2013; Lafortezza et al., 2018; Lamond and Everett, 2019; Mattijssen et al., 2017).
Nature-based Solutions (NbS)	Actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits (European Commission, 2026).
Planning regulations	In the context of urban green infrastructure planning, planning regulations are considered as the legal framework within which planning rules operate. Planning regulations are included into plans and laws, and they represent a collection of norms on specific topics and could include: (i) incentives, (ii) guidelines, indications, and standards, (iii) recommendations, (iv) sanctions. They are enacted by governmental bodies and provide the authority and procedures for implementing planning rules. (García-Blanco et al., 2025)
Planning tools	Methodologies and techniques employed by planners to develop, analyse, and implement planning rules and regulations include a wide range of tools. These span from traditional approaches such as surveys and Geographic Information Systems (GIS) to advanced methods like remote sensing, satellite imagery, and more sophisticated instruments such as urban simulation models, cellular automata, and digital twins. (García-Blanco et al., 2025)
Planning systems	Spatial planning systems are the ensemble of institutions that are used to mediate competition over the use of land and property, to allocate rights of development, to regulate change and to promote preferred spatial and urban form (Nadin, 2023). Spatial planning is ubiquitous in Europe. All countries control the right to develop or change the use of land or property using a hierarchy of instruments involving multiple levels of government. But the detailed arrangements are exceedingly varied. Numerous planning systems exist around the world. The form of planning largely diverges and co-evolves with societies and their governance systems. Every country, and states within those countries, have a unique planning system that is made up by different actors, different planning perspectives and a particular institutional framework. Perspectives, actors, and institutions change over time, influencing both the form and the impact of spatial planning (Allmendinger, P. 2009).

Term	Description
Resilience	Resilience is defined as the capacity of a system to absorb disturbances, reorganise, and retain essentially the same functions over time (Elmqvist et al., 2019). This definition when applied within a social-ecological-technological systems (SETS) framework (Grimm et al., 2008; McPhearson et al., 2016a; 2016b; Markolf et al., 2018) to resilience thinking and combined with transdisciplinary knowledge co-creation processes, is useful to investigate and enhance resilience in the generation and use of diverse GBI benefits (Andersson et al., 2021). Urban resilience can also be seen from a specific lens, looking at specific properties and processes of a system and their response to change and pressures (e.g. Walker and Salt, 2012a). Specific resilience may for example relate to the ecological resilience of an urban ecosystem or the adaptive or transformative capacity of a certain group of actors. The context of specific resilience can be described in terms of drivers of change, controlling (often 'slow') variables and feedback between these and across scales (Walker et al., 2012b).
Spatial Analysis	The process of examining the locations, attributes, patterns, and relationships of features in spatial data to address a question or gain useful knowledge . (ESRI, 2026)
Spatial Planning	Spatial planning is commonly understood as a complex and broad concept in continuous evolution with a multifaceted use in practice, as a discipline, administrative technique, and public policy, that aims steering development or the use of space and managing competing interests over land, to balance development with the protection of land in the public interest. Sustainable development, environmental protection, citizen engagement, infrastructure and economic growth are commonly mentioned objectives of planning (Nadin, 2023). In general terms spatial planning is used as an umbrella term that covers both regional and urban planning. But in the literature spatial planning is more commonly used to refer to a public policy which aims to promote the rational utilisation of space and the optimal exploitation of natural resources at the regional level, striving for balanced economic development between rural and urban areas while improving living standards and respecting the identity, diversity, and solidarity among territorial groups. It also advocates to support the active management of territorial capital (Friedmann, J. 2005) with high capacity for the adoption of measures to mitigate natural disaster impacts and bolster territorial resilience to global change challenges (European Commission, 2021a; European Commission, 2020)
Spatial planning instruments	The various instruments that governments - from the local to the national level – do have at their disposal to mediate and regulate spatial development are spatial planning instruments and they include spatial plans both voluntarily prepared or formally developed through planning policy guidance or regional planning legislation. Whilst their strategic function tends to dominate at the national level and the regulative at the local level, this should not be taken for granted in all European countries, as there are different planning families and cultures (Nadin, 2023).
Urban Nature Plans	A long-term framework and a co-creation process to support local authorities to articulate, formalise and showcase interventions to create, expand, enhance, protect, or restore both natural and artificial green and blue spaces and biodiversity in towns and cities (Esmail et al., 2022, Europarc, 2023; European Commission, 2023).
Urban Planning	Urban planning is understood as the discipline and public policy guiding and directing the use and development of land, urban environment, urban infrastructure, and related ecosystem and human services, ensuring economic development, high quality of life, wise management of natural resources, and efficient operation of infrastructures (Bibri and Krogstie, 2017) under climate change.

1.2 Enablers and barriers

This document provides a structured overview of the key enabling factors and barriers influencing the adoption and implementation of GI across multiple dimensions. Enabling factors include supportive policy frameworks, targeted funding mechanisms, and effective stakeholder engagement and coordination approaches that can accelerate GI uptake. Conversely, regulatory constraints, financial limitations, and gaps in technical and institutional expertise may hinder progress. The analysis is organised across seven interrelated dimensions—institutional and organisational; engagement and coordination; political; socio-cultural; biophysical; knowledge; and financial—reflecting the multidimensional nature of GI implementation. The insights presented are grounded in practice-based knowledge and lessons learned from the application of the ESPON GILL Methodology in selected case studies, highlighting both common challenges and context-specific conditions that shape GI outcomes.

Dimensions	Enabling factors Supportive policies, funding, and stakeholder engagement approaches that can accelerate GI adoption	Barriers: Regulatory constraints, financial limitations, and lack of expertise that can hinder progress
Institutional and organisational	Multi-level governance structures (such as the NCI Nuovo Circondario Imolese) facilitate coordinated planning and technical capacity. European and national legislation provide a guiding frameworks for local policy, while specific local regulations, such as health resort zone protections in Sopot or phased comprehensive plans in Tampere, can embed measures to support GI (such as minimum green area percentages).	A primary hurdle is the lack of a formal legal definition for GI at the national level, with only references to the EU 2013 GI strategy, which leads to inconsistent interpretations. Additionally, fragmented and decentralised responsibilities across different departments or entities often slow down the standardisation of GI approaches.
Engagement and coordination	Inter-municipal structures and metropolitan coordination allow for shared priorities and large-scale projects. Locally, cities can employ participatory planning processes, including participatory budgeting, where residents directly fund local greenery as part of street design projects.	Institutional siloes prevent effective collaboration between city departments (infrastructure vs. environment). The large number of involved parties often leads to coordination challenges, and there is a recurring risk that GI delivery remains "project-by-project" rather than integrated
Political	Strong political will / mayoral leadership are crucial for prioritising GI initiatives. Some cities aim to be "green leaders" by proposing to categorise GI as "critical infrastructure" to match the status of energy or transport networks	In land-use decisions, economic investment is frequently preferred over natural capital, leading to zoning that allows construction on green areas. Furthermore, GI often lacks systematic embedding in all planning, remaining limited to specific, visible sites rather than city-wide implementation
Socio-cultural	There is a strong public demand for recreational spaces, playgrounds, and aesthetic well-being. In some regions, legal frameworks like "Everyman's rights" support recreational access to nature, while civil society organizations actively lobby for more green space	Resistance often comes from the agricultural sector and private developers who are reluctant to transfer productive land to GI. Cultural preferences for "manicured" greenery, with low ESS provision, over natural, ecological units can also hinder biodiversity goals

Dimensions	Enabling factors Supportive policies, funding, and stakeholder engagement approaches that can accelerate GI adoption	Barriers: Regulatory constraints, financial limitations, and lack of expertise that can hinder progress
Biophysical	The rehabilitation of post-industrial brownfields or abandoned land offers significant opportunities to expand GI networks. Integrating "blue and green" elements (water and nature) is also a trending approach to enhance urban resilience	Private land ownership creates major obstacles for ecological connectivity. Additionally, many urban areas face high exposure to extremes, such as flood risks and urban heat concentration, requiring GI to "perform" at a high level to be effective
Knowledge	Collaboration with research institutions supports evidence-based planning and knowledge exchange. Some cities use advanced digital management applications to monitor the condition of thousands of trees, enabling proactive risk management	There is a significant lack of technical or specialized professionals and capacity for data processing, guidance, monitoring, and networks for GI. Decision-makers often lack the specific methods or tools needed to compare the benefits of investments in GI or to monitor its actual long-term impacts. And data inconsistencies.
Financial	Access to EU funding channels (such as NRRP/PNRR, ERDF operationnal programmes) is a major driver for local projects. Some cities utilise developer obligations, making a minimum percentage of green space mandatory in private development projects	Tight municipal budgets and shrinking populations create long-term financial constraints. Funding is frequently limited to the initial project phase, with insufficient resources allocated for the long-term maintenance of growing green networks

1.3 Repository of good practices

This document presents a curated repository of best practices in GI planning and policy, highlighting successful initiatives that have effectively informed green urban development. It features a range of case studies and best practice guidelines from different regions, each illustrating how GI has been integrated into strategic plans, zoning policies, or master plans at various spatial scales, from national to regional to city. The listed good practices have been selected through a literature review, and a survey for good practices distributed through the ESPON network and the networks of the consortium partners.

Each entry includes key details such as the type of plan, responsible authority, location, a brief description, key learning points, contact information, and access to further resources. The goal is to provide practical insights and transferable lessons for urban planners, policymakers, and practitioners seeking to implement effective GI strategies that enhance environmental quality, resilience, and liveability in cities.

1.3.1 Utrecht Green Structure Plan 2017-2030

Title of Plan (and language)

Actualisatie groenstructuurplan Utrecht 2017-2030 (in Dutch)

(Utrecht Green Structure Plan 2017-2030)

Name and location of Authority

Utrecht, Netherlands

Type of Plan/ Spatial Scale

Green/green-blue infrastructure plan, City Scale

Brief Description

With a green and blue framework that supports ecosystem benefits, Utrecht aims to promote healthy urban living through an integrated and systemic approach that combines local climate regulation, noise reduction, recreation and cleaner air. Green Structure Plan actions aim at sustainable urbanisation: less and slower traffic, climate- and energy-neutral construction, efficient water management and green areas for pleasant and healthy urban living. Utrecht wants to be a city where a healthy living environment and sustainable growth are core values. The updated **Green Structure Plan** 2017-2030 aims at making better use of green and blue infrastructure and restoring ecosystems. For instance, the role of trees in improving air quality, reducing urban heat island effect, and capturing CO2; or the positive influence of living nature for a healthier city, are some of the benefits foreseen by the Plan (UGSP, 2017).

Key learning points

- Ecosystem restoration through green and blue infrastructure
- Role of GI for addressing key challenges such as urban heat and climate change
- Nature positive benefits for health

Link

https://omgevingsvisie.utrecht.nl/thematisch-beleid/groen

https://interlace-hub.com/casestudy/19453

Contact Details

Tel. 14 030

https://omgevingsvisie.utrecht.nl/thematisch-beleid/groen

1.3.2 Manchester Green and Blue Strategy

Title of Plan (and language):

Manchester Green and Blue Strategy (in English)

Name and location of Authority:

Manchester City Council, England, UK

Type of Plan/ Spatial Scale:

Green/green-blue infrastructure plan, City Scale

Brief Description:

Manchester's green infrastructure (GI) has been part of the city's success for a number of years. Five river valleys, three canals, over 160 parks, street trees, woodland, private gardens, and other areas of natural environment are familiar and well-used parts of the city's landscape. It is set within a wider landscape; that of the Greater Manchester city-region and beyond to the Pennines, Peak District and Cheshire Plains, and within easy reach of additional areas in the Lake District and Snowdonia National Parks. As the city continues to grow over the next decade, existing and new GI will need to continue to be an integrated part of this growth. This strategy has been produced to set out how this will be achieved, drawing together existing commitments on GI and progress achieved to date, to provide a framework for scaling up this good work and the basis for driving new investment over the coming decade.

Key learning points:

- How to improve the quality and function of existing green and blue Infrastructure, to maximise the benefits it delivers and to promote awareness of these.
- Use of appropriate green and blue infrastructure as a key component of new developments to help create successful neighbourhoods.
- Improving connectivity and accessibility to green and blue infrastructure within the city and beyond

Link:

https://www.manchester.gov.uk/downloads/download/6314/manchester_green_and_blue_strategy

Contact Details:

Steve Merridew, Chair Contact us | Contact us | Manchester City Council

1.3.3 Green Infrastructure Strategy Ruhr Metropolis

Title of Plan (and language):

Green Infrastructure Strategy Ruhr Metropolis (in English)

Name and location of Authority:

Regionalverband Ruhr, NRW, Germany

Type of Plan/ Spatial Scale:

Green/green-blue infrastructure plan, Metropolitan Scale

Brief Description:

The regional strategy for green infrastructure is to be established as an informal, planning basis for the further development of green infrastructure in the Ruhr area. The GI strategy is intended to achieve the further development of the Ruhr area into the 'greenest industrial region in Europe' in a participatory development process. The strategy leads to the implementation and (further) development of targeted activities and projects that are supported by all those involved. In doing so, an optimal balance is achieved between individual interests and the common good and a clear added value is achieved for the region. In addition to the regional identity of the residents of the Ruhr area, 'the greenest industrial region in Europe' is also perceived as such by outsiders.

Key learning points:

- Brings together the perspectives of nature conservation, urban and open space development, mobility, climate adaptation and climate protection and forms an overarching framework for the existing specialist strategies.
- Approaches ranging from the protection and qualitative development of existing green spaces to fresh ideas for "grey" areas in the form of conversion, partial or complete desealing and retrofitting with green infrastructure

Link:

https://www.rvr.ruhr/en/topics/ecology-environment/green-infrastructure-in-the-ruhr-metropolis/green-infrastructure-strategy/

Contact Details:

Tino Wenning, Referat Klima und Umweltschutz, Teamleiter Grüne Infrastruktur und Klimaneutralität: wenning@rvr.ruhr

1.3.4 South Dublin Green Infrastructure Strategy (in County Development Plan 2022 - 2028)

Title of Plan (and language):

South Dublin Green Infrastructure Strategy: in County Development Plan 2022 – 2028 (in English)

Name and location of Authority:

South Dublin, Ireland

Type of Plan/ Spatial Scale:

Green/green-blue infrastructure plan, City Scale

Brief Description:

This chapter of the Development Plan, alongside the associated maps, sets out the Green Infrastructure Strategy for the County which comprises the interconnected network of natural, semi-natural and artificial habitats, green spaces and ecological assets that traverse our urban and rural areas. A healthy and well-connected GI network provides a range of social, economic and ecological benefits. Protecting natural features and combating habitat fragmentation improves biodiversity, filters pollutants and helps to improve air and water quality as well as preventing flooding by helping to control surface water runoff. From a placemaking perspective, it is an asset that can raise the profile of the County, influence business decisions to invest and encourage people to live and work in the County. As an integral component of building well designed and sustainable communities it is key to the success of the overall concept of connected, compact growth avoiding the damage created to the environment and climate through urban sprawl and facilitating improved physical and mental wellbeing.

Key learning points:

- GI as a holistic approach balancing spatial, social and economic development in a way that enhances the natural environment.
- Mitigation of climate change impacts including increased flooding risk, increased frequency of summer drought conditions.
- Facilitating benefits for health and wellbeing

Link:

https://www.sdcc.ie/en/devplan2022/adopted-plan/chapter-4-green-infrastructure/

Contact Details:

Senior Executive Officer, Forward Planning Section, Land Use Planning and Transportation Department, County Hall, Tallaght, Dublin 24, D24 A3EX

Tel +353(1) 414 9000 or email: devplan@sdublincoco.ie

1.3.5 Natural England Green Infrastructure Framework

Title of Plan (and language):

Natural England Green Infrastructure Framework (in English)

Name and location of Authority:

Natural England

Type of Plan/ Spatial Scale:

Green/green-blue infrastructure planning toolkit for planners and developers (national scale)

Brief Description:

Aimed at planners and developers, the Green Infrastructure Framework is a tool designed to help increase the amount of green cover to 40% in urban residential areas. Parks and greenspaces in England deliver an estimated £6.6 billion of health, climate change and environmental benefits every year. But with 80% of people now living in towns and cities, one third of people do not have access to good quality green and blue space within 15 minutes of their home. The UK Government's Environmental Improvement Plan, published yesterday, includes a commitment that the public should be able to access green space or water, such as woodlands, wetlands, parks and rivers, within a 15-minute walk from their home. The Green Infrastructure Framework (GIF) provides a structure to analyse where greenspace in urban environments is needed most. It aims to support equitable access to greenspace across the country, with an overarching target for everyone being able to reach good quality greenspace in their local area. From parks to green roofs, and increased tree cover, the Green Infrastructure Framework will make a significant contribution to nature recovery by embedding nature into new developments. Increasing the extent and connectivity of nature-rich habitats will also help increase wildlife populations, build resilience to the impacts of climate change, and ensure our cities are habitable for the future.

Key learning points:

- As a key resource for developers and local planning authorities, the framework integrates green infrastructure tools, principles, standards and design guidance.
- The Framework is structured around five key standards: Urban Nature Recovery Standard, Urban Greening Factor (UGF) for England, Urban Tree Canopy Cover Standard, Accessible Greenspace Standards and Green Infrastructure Strategy.
- Partnerships are integral to the uptake and application of the guidance. The Institute for Civil Engineers has included the Green Infrastructure Standards in their new Manual of Blue-Green Infrastructure.

Link:

https://designatedsites.naturalengland.org.uk/greeninfrastructure/home.aspx

Contact Details:

enquiries@naturalengland.org.uk

1.3.6 Leipzig Green Masterplan

Title of Plan (and language):

Leipzig Masterplan Grün (in German)

(Leipzig Green Masterplan)

Name and location of Authority:

City of Leipzig, Germany

Type of Plan/ Spatial Scale:

Green/green-blue infrastructure plan

Brief Description:

The developing plan for Leipzig's urban green and blue spaces aims to preserve biodiversity and deliver ecosystem services whilst guaranteeing a high quality of life for citizens. The plan will identify how can green and blue infrastructure can best fulfil its diverse functions including: for health and recreation, urban climate and water retention, biodiversity and provision of green and blue active-travel corridors through the city. The plan aims to identify which specific open spaces and areas are particularly important to Leipzig and how these can be protected and managed in the future. The Green Master Plan aims to answer all these questions, focusing primarily on the five thematic areas: adapting to climate change, healthy environment and living conditions, environmental justice, conservation of biodiversity and environmentally friendly mobility. In developing the Green Master Plan, the City of Leipzig has intensively examined the functions and potential of green and blue infrastructure, using specific areas as examples. Together with the public, the City has formulated goals for securing and developing green and blue open spaces and their functionality and performance. As a development concept for green and blue infrastructure, the Green Master Plan is intended to become a politically, socially accepted and practical basis for upcoming decisions regarding the city's spatial development.

Key learning points:

- An innovative participatory process involves a series of "Green Walks" for citizens to actively discuss issues with officials.
- There is a strong emphasis upon environmental justice for all citizens.
- Benefits for biodiversity are strongly balanced with quality of life benefits for citizens.

Link:

https://www.leipzig.de/leipzig-strategie/nachhaltigkeit/masterplan-gruen

Contact Details:

Office for Urban Green Spaces and Waterways, Technical Town Hall, House A, Prager Straße 130-136, 04317 Leipzig

Franziska Gläser: Tel. 0341 123-6177

1.3.7 The All London Green Grid

Title of Plan (and language):

Green infrastructure and open environments: the all London green grid (in English)

Name and location of Authority:

Greater London Authority

Type of Plan/ Spatial Scale:

Green/green-blue infrastructure plan (metropolitan scale)

Brief Description:

The ALGG is built around four key elements. London's existing river and other key landscape corridors, including the Thames; established open spaces and identified opportunities for creating new parks, such as the Wandle Valley Regional Park; existing and proposed green connections and corridors, such as the proposed London Riverside Link; and, the designated and protected landscapes that are generally located at the boundary of London and flow across administrative boundaries to neighbouring areas and often include areas of degraded urban fringe.

The Plan promotes a shift from grey to green infrastructure to secure environmental, social and economic benefits. This connected network will improve the function, use and performance of our current green infrastructure. As with London's street pattern, the ALGG provides an arrangement of attractive green spaces and routes that link London together. By being connected, the value and function of the ALGG is significantly enhanced so that it can be used in many different ways including by pedestrians, for water management, for cooling the grey urban spaces and as an ecological corridor. To support the delivery of these outcomes the All London Green Grid (ALGG) Supplementary Planning Guidance (SPG) provides guidance on the implementation of London Plan policy. The objective of this approach is to plan and manage networks of natural and cultural landscapes and open spaces strategically so as to conserve ecosystem functions and provide a range of benefits for people.

Key learning points:

- An integrated approach across a large and complex metropolitan area.
- The importance of supplementary planning guidance to make the plan a reality.
- The significance of cultural landscapes as a key element of GI

Link:

https://www.london.gov.uk/programmes-and-strategies/environment-and-climate-change/environment-publications/all-london-green-grid

Contact Details:

City Hall, Kamal Chunchie Way, London, E16 1ZE

Tel. 020 7983 4000

1.3.8 Green Infrastructure in Zaragoza

Title of Plan (and language):

Infraestructura Verdede Zaragoza (in Spanish)

Green Infrastructure in Zaragoza

Name and location of Authority:

Zaragoza, Spain

Type of Plan/ Spatial Scale:

Green/green-blue infrastructure plan (city level)

Brief Description:

Through the GI Plan, the City of Zaragoza has committed to restoring balance and harmony between its natural surroundings and the urban area. The City Council, through the LIFE Zaragoza Project, led the initiative which has involved, strengthening existing approaches for conservation and recovery of sensitive environments (including river corridors, riparian zones, fragmented forests and ravines), whilst integrating natural processes into the urban fabric. These aim to improve the quality of life of citizens and minimize the impact that the city has on the wider Zaragoza region. Challenges addressed include the reduction in natural habits around the city, biodiversity loss in urban areas and the reduction in cultural ecosystem services. Addressing habitat fragmentation through connectivity is also a key aim of the plan. The City is committed to protecting and improving greenspaces through active measures to increase their environmental quality and natural regeneration potential. This has been accompanied by a process of dissemination which aims to increase the potential of citizens, as active agents in supporting the conservation of their cultural landscapes.

The Plan also aims to address the issue of urban sprawl across the area to create an integrated approach to development which prioritises quality of life for citizens.

Key learning points:

- The role of external funding sources (LIFE) to support GI planning processes.
- The importance of integrating urban development proposals with quality of life indicators.
- The multifunctionality of GI to address extreme weather events whilst delivering multiple ecosystem services.

Link:

https://www.zaragoza.es/contenidos/medioambiente/pivz/IVZ_doc_divulgacion.pdf

Contact Details:

https://www.zaragoza.es/sede/portal/contacto/

1.3.9 Urban Green Masterplan - Cologne Green Infrastructure

Title of Plan (and language):

Masterplan Stadtgrün Grüne Infrastruktur Köln (in German)

(Urban Green Masterplan - Cologne Green Infrastructure)

Name and location of Authority:

Cologne, Germany

Type of Plan/ Spatial Scale:

Green/green-blue infrastructure plan (city scale)

Brief Description:

The City of Cologne developed a basic framework for green infrastructure which has provided a working foundation for key challenges. However, existing city-wide urban development and regional concepts and strategies show that in the Rhine conurbation, strategic and long-term green and open space planning is essential in order to meet the continued challenges of urban growth and climate change. The Green Master Plan will serve to secure existing green belts and green corridors and to complete the green structure of Cologne, thereby improving the urban climate and enhancing the recreational and leisure opportunities for the city's population. As a first step, the existing Cologne green system is being assessed with regard to its planning protection status and existing planning concepts and protected and defined by necessary measures (landscape plan, land use plan, development plan, etc.). Areas identified in accordance with Cologne's development and agglomeration principles will be highlighted. The potential for ecological enhancement (through the biotope network) for natural retention and rainwater regulation and the urban climate significance (urban and local climate) will be incorporated and integrated into the overall concept. Furthermore, traffic arteries which are no longer necessary should be considered for their potential for regreening. Urban areas with a current deficit of green infrastructure should be taken into account when planning green corridors within the region.

Key learning points:

- The Plan builds upon existing legacy of planning processes and designations including the City's Green Belt.
- The Plan incorporates wider sustainability processes including regreening of grey infrastructure, where this can contribute to quality of life.
- Areas of GI deficit are specifically being targeted.

Link:

https://www.stadt-koeln.de/mediaasset/content/pdf67/sk_014_23_brosch%C3%BCre_masterplan_stadtgr%C3%BCn_-_barrierefrei.pdf

Contact:

Amt für Landschaftspflege und Grünflächen, Stadthaus Deutz – Westgebäude, Willy-Brandt-Platz 2, 50679 Köln. Tel. 0221 / 221-23867

1.3.10 City of Essen Master Plan for Urban Green Spaces

Title of Plan (and language):

Stadt Essen Masterplan Stadtgrün (in German)

(Master Plan for Urban Green Spaces)

Name and location of Authority:

City of Essen, Germany

Type of Plan/ Spatial Scale:

Green/green-blue infrastructure plan

Brief Description:

Since summer 2023, the city of Essen, together with the Berlin-based urban planning firm "gruppeF," has been developing the strategic green space concept, the Master Plan for Urban Green Spaces. The goal is to develop and expand the city's green spaces. Particularly in light of climate change, the loss of biodiversity and the unequal distribution of open space in cities, it is crucial to give green spaces a variety of functions. The Master Plan for Urban Green Spaces aims to lay the foundation for this and thus complements the existing climate change adaptation concept. The master plan is divided into various themes and spatial relationships. The main focus is on the following topics: Biological diversity, Networking, Multifunctionality, Greenspace provision and environmental justice, Climate and water focused city.

At the city level, objectives are developed for these key themes, which will be considered in the future development of green spaces. At the district level, concrete measures are developed and elaborated in more detail in specific focus areas. An analysis of the current supply situation, based on existing data and concepts (e.g., land use mapping or green space information systems), forms the basis for the planning. The analysis identifies areas that are not adequately served with regard to the key themes. Action is then required, particularly in districts with insufficient green infrastructure. The master plan for urban green spaces has been under development since September 2023. Completion and publication are planned for mid-2025.

Key learning points:

- Environmental justice is considered an important aspect of the Plan.
- Multifunctionality, including for climate change mitigation, is a key priority.
- Although Essen is one of Germany's greenest cities, the aspiration is to enhance the city's reputation further.

Link:

https://www.essen.de/dasistessen/leben_im_gruenen_/masterplan_stadtgruen/masterplan_stadtgruen_1.de.html

Contact Details:

Grünplanung, Telefon +49 201 88-67200

1.3.11 Leeds Local Plan Update - Green Infrastructure

Title of Plan (and language):

City of Leeds Local Plan Update - Topic 3 Green Infrastructure (in English)

Name and location of Authority:

City of Leeds

Type of Plan/ Spatial Scale:

Green/green-blue infrastructure plan

Brief Description:

The local Plan Update aims to adopt and improve policies that will help development adapt and mitigate against the impacts of climate change by creating a better more sustainable environment. With regard to Green Infrastructure the vision is as follows: Leeds will create new Green Infrastructure (GI) (including Green Space and Natural Environment) through the planning process, and identify, improve, protect and extend existing GI to address the challenges of climate change and create a healthy city. The aim is that this builds upon key Government legislation and policy guidance which includes the Environment Bill setting out how the Government plans to deliver its commitment to protect and improve the natural environment in the UK in light of evidence and public concern around biodiversity and habitat loss, climate change and environmental risks to public health and Guidance (2020) for policy and decision makers to help them to include contemporary approaches to Green Infrastructure and the value of these into policy. The main issues pertinent to the Local Plan Update are i) setting targets for improving the natural environment and people's enjoyment of it and a duty to meet and report on the targets set; ii) A new system for biodiversity and nature protection including a register of biodiversity gain sites (land which is subject to a conservation covenant or planning obligation and which is to be managed for the purpose of habitat enhancement); iii) Measuring net gain and eco-systems services at the development level vision.

Key learning points:

- The Plan takes account of latest UK Government policy developments including Biodiversity Net Gain.
- GI is firmly integrated into wider planning objectives through integration into the Local Plan.
- The main theme of the Local Plan is to tackle the Climate Emergency

Link:

https://www.leeds.gov.uk/sites/default/files/docs/local%20plan%202021.pdf

Contact Details:

Leeds Local Plan Consultation, Policy & Plans Group, Merrion House, 9th Floor East, 110 Merrion Centre, Leeds, LS2 8BB.

Email: leedslocalplan@leeds.gov.uk

1.3.12 "Urban Green Infrastructure - a foundation of attractive and sustainable cities. Pointers for municipal practice".

Title of Plan (and language):

URBAN GREEN INFRASTRUCTURE - A foundation of attractive and sustainable cities. Pointers for municipal practice (in English)

Name and location of Authority:

Federal Agency for Nature Conservation (BfN), Germany

Type of Plan/ Spatial Scale:

Green/green-blue infrastructure planning guide for municipalities

Brief Description:

Urban green infrastructure differs from traditional open space planning in that it approaches issues such as ecological networks, sustainability, climate change adaptation and mitigation as well as landscape and open space planning in a strategic and integrative manner, and thus considers nature conservation, housing development, growth policy and grey infrastructure in tandem. The aim of this brochure is to support this process. It presents strategic steps and options for implementation in municipal practice aimed at the safeguarding, planning and development of urban green infrastructure and at performing the associated maintenance and management tasks. The target audience of this brochure includes the municipal sectoral authorities in charge of environmental planning, landscape planning, open space planning, nature conservation and the maintenance and management of urban green. It is further addressed at stakeholders in areas such as urban planning, housing construction, water management and transport as well as business development and urban marketing, financial administration, municipal real estate, culture and sports, health and social affairs who can join in collaborative efforts to develop green infrastructure. Last but not least this brochure is also aimed at political decision-makers as well as civil society stakeholders whose support is indispensable to many urban green infrastructure projects.

Key learning points:

- A practical guide that specifically targets local authority staff and politicians.
- Recognises the potential contribution of civil society.
- Provides a clear and succinct overview.

Link:

https://www.bfn.de/sites/default/files/2021-10/ugi_broschuere_eng.pdf

Contact Details:

Florian Mayer, Alice Schröder. Federal Agency for Nature Conservation (BfN), Konstantinstr. 110, 53179 Bonn

1.3.13 West of England Nature Partnership Strategy 2021-30

Title of Plan (and language):

West of England Nature Partnership Strategy (in English)

Name and location of Authority:

West of England Nature Partnership

Type of Plan/ Spatial Scale:

Delivery Plan for Nature Recovery (Regional Scale)

Brief Description:

The West of England Nature Partnership (WENP) brings together local and regional government, environmental charities, water companies, regulators, health leaders and others. Working as a partnership has already enabled us to produce the country's first Local Nature Recovery Strategy; lead a pioneering Green Social Prescribing pilot and most importantly make significant progress towards nature's recovery across the region. Now we must scale up the collective action to deliver the Local Nature Recovery Strategy and achieve wider regional goals for nature, people and place such as doubling tree and woodland cover by 2050, empowering more communities to act for nature, and expanding nature-based solutions to tackle challenges like climate adaptation and health inequalities. This is a mid-point refresh of WENP's 2021–2030 Strategy. It sharpens our approach in response to a changing context and sets out how we will work together in the next phase to deliver the scale and ambition required for nature's recovery in the West of England.

Key learning points:

Key learning points:

- First local Nature Recovery Strategy in the UK
- Integrates key social aspirations such as "social prescribing" with spatial planning
- Working through a diverse network of delivery partners

Link:

https://www.wenp.org.uk/what-we-do

https://www.westofengland-ca.gov.uk/what-we-do/environment/joint-green-infrastructure-strategy/

Contact Details:

0117 980 039 info@wenp.org.uk

70 Redcliff Street, Bristol, BS1 6AL

1.3.14 Glasgow City Region Green Network Plan

Title of Plan (and language):

Glasgow City Region Green Network Plan

Name and location of Authority:

Glasgow City Region

Type of Plan/ Spatial Scale:

Green/green-blue infrastructure plan (Regional Scale)

Brief Description:

The Glasgow City Region Green Network incorporates a range of high quality greenspaces that are well-connected by off-road walking and cycling routes, and a variety of wildlife habitats, designed and managed to provide benefits to both people and nature. The Green Network is a crucial part of the Region's drive to address the twin climate and ecological crises and will make the Region a much more connected, resilient, liveable and sustainable place.

The Vision is of a sustainable and liveable place where people and wildlife can move easily through an attractive and diverse landscape. Delivery at a regional scale involves collaboration around a collective vision, an approach that is central to the work. The GCRGN's ambition is that the Green Network is easily accessible to everyone who lives and works in the Region. This would mean everyone being within a 5 minute walk of a quality greenspace, connected to the wider Green Network. Delivery at that scale requires a concerted and co-ordinated effort using a variety of delivery mechanisms. Multifunctionality is a key aspect. A high quality, multifunctional and well-managed Green Network can deliver a host of environmental, societal and economic benefits and is a key pillar in making the region: resilient and adapted to the impacts of climate change, nature friendly, reversing ecological decline, and a healthier and happier place to live, work and visit.

Key learning points:

- Delivery of multifunctional objectives through spatial planning is key.
- Links local actions across a range of spatial scales
- Emphasises practical benefits for people including health and social inclusion

Link:

https://www.gcrgreennetwork.co.uk/about-the-gn

Contact Details:

GCR Green Network, Floor 2, Room 29, 40 John Street, City Chambers East, Glasgow G1 1JL Email: enquires@gcvgreennetwork.gov.uk

1.3.15 City of Barcelona Nature Plan 2021-2030

Title of Plan (and language):

City of Barcelona Nature Plan (in English)

Name and location of Authority:

City of Barcelona, Spain

Type of Plan/ Spatial Scale:

Urban Nature Plan (City scale)

Brief Description:

The Barcelona Nature Plan 2030 is a strategic participatory tool that has the vision of a city in 2050 with a functional and ecological green infrastructure, fairly spread and accessible greenery that is connected to the urban fabric and with a green metropolitan network, in order to maximise social and environmental services, above all those of health and adapting to climate change. This urban nature network is appreciated and conserved as a natural heritage of the Earth and as a benefit for people, present and future generations, who can enjoy the connection with nature and are involved in the creation of green spaces and in the conservation and improvement of biodiversity.

An essential part in drafting the Nature Plan was the participatory process. This was carried out in several stages and served to share the diagnosis, agree on long-term goals and challenges and gather proposals on biodiversity and greenery for drawing up the action plan. The stages were divided up as follows: internal work resulting from the experience of implementing the previous plan; co-designing the new plan with various City Council's services; conducting a technical comparison of actions and projects with external experts from organisations involved; and citizen participation to enrich the entire plan.

Key learning points:

- Adopts a holistic approach linked to Urban Nature Plans
- Consolidates a legacy of previous work around biodiversity and Green Infrastructure themes
- Widely seen as a model of best practice

Link:

https://bcnroc.ajuntament.barcelona.cat/jspui/bitstream/11703/123630/3/Barcelona%20Nature%20Plan%202030%20WEB.pdf

Contact Details:

Department of Urban Ecology, Barcelona City Council

1.3.16 Public Space Manual of the Brussels-Capital Region

Title of Plan (and language):

Manuel des Espaces Publics – Draaiboek Publieke Ruimte (in French and Flemish)

"Public Space Manual of the Brussels-Capital Region"

Name and location of Authority:

Urban.brussels – Urban Planning and Heritage Administration of the Brussels-Capital Region

Type of Plan/ Spatial Scale:

Integrated strategic and operational framework for public space design (Metropolitan scale)

Brief Description:

This evolving document incorporates the various guides, standards, plans, and tools that define regional objectives for the development of public spaces. It is a practical tool that incorporates all these principles and aims to provide concrete support for the design of generic public spaces.

The role of the Manual is therefore to provide project leaders with the tools they need to design their projects with a high level of ambition, addressing all the challenges facing public spaces. To achieve this, the Manual offers a design project process with exemplary standard solutions and implementation tools.

The development of this tool is part of Urban's urban strategy, which is directly involved in the ambition to make Brussels a sustainable and resilient city. One of its main concerns is therefore to pursue the urban development of the Region by strengthening the city's attractiveness and the quality of life in Brussels.

Key learning points:

- Includes a useful online toolbox facility
- Places a strong emphasis upon quality of life for residents
- Operates across diverse governance partners

Link:

https://urban.brussels/fr/pages/le-manuel-espaces-publics-en-region-de-bruxelles-capitale

Contact Details:

Mont des Arts 10-13, 1000 Brussels

Tel. +32 (0)2 432 83 00

1.3.17 Barcelona Metropolitan Masterplan

Title of Plan (and language):

Pla director urbanístic metropolità PDUM (in Spanish)

Barcelona Metropolitan Masterplan

Name and location of Authority:

Metropolitan Administration

Type of Plan/ Spatial Scale:

Green/green-blue structure plans; spatial structure plan (Metropolitan Scale)

Brief Description:

The PDUM protects and prioritizes the natural and agricultural spaces of the metropolis. It aims to enhance their ecological value and their capacity to provide benefits to nature and people. It also proposes a network of parks and green areas that allow nature to enter the city, to improve the quality of life, regulate the temperature, and minimize air pollution. The metropolitan green infrastructure classifies open spaces into core areas, walkway connectors, agroforestry mosaic, and agricultural plain. On the other hand, it protects the blue infrastructure formed by rivers, streams, and wetlands, which are very relevant as ecological connectors and regulators of ecosystems. In urban edge spaces, between the city and open spaces, it establishes recommendations on the landscape. Also within the city, the green infrastructure forms a network of green axes and structuring and equipped parks that improve the quality of urban public space.

Key learning points:

- There is strong linkage between social issues such as housing and health whilst addressing GI connectivity issues.
- Transport and mobility across the Metropolitan Region are key themes
- The Plan is divided into complimentary thematic areas

Link:

https://urbanisme.amb.cat/descobrir/pdu-metropolita

Contact Details:

Master Plan Writing Service, Urban Policy Development Area, C/ 60, no. 19 - pl. 5 - Zona Franca - 08040 Barcelona Tel. (+34) 93.223.51.51 (ext. 5016)

1.3.18 (Ireland) Southern Regional Blue Green Infrastructure and NbS Framework

Title of Plan (and language):

(Ireland) Southern Regional Blue Green Infrastructure and Nature Based Solutions Framework

Name and location of Authority:

Irish Southern Regional Assembly

Type of Plan/ Spatial Scale:

Spatial structure plan; development plan (Regional Scale)

Brief Description:

Faced with global challenges effecting our environment and people such as biodiversity loss, climate change and health and wellbeing, it is now time to reconsider the place of nature and landscape in our lives and the way we plan for them. The Blue Green Infrastructure (BGI) and Nature-based Solutions (NbS) Framework was created by Arup who were commissioned as part of the involvement in the Interreg Europe Blue Green Cities Project. This Framework provides a resource for Local Authorities, decision makers and developers working in the Region to guide the implementation of BGI and NbS. It will enable the implementation of a network of nature-based interventions to solve local challenges in our settlements and the landscapes that they link to. The Framework is the first of its kind at a regional level in Ireland and its uptake is strongly encouraged.

Key learning points:

- First example of a regional level approach from Ireland covering a population of 17 million.
- Links strongly into the Regional Spatial and Economic Strategy
- Initiated through EU Interegg funding.

Link:

https://southernassembly.ie/rses-implementation/bginbs/

Contact Details:

Southern Regional Assembly, Assembly House, O' Connell Street, Waterford, Ireland. X91 F8PC

Phone: +353 (0) 51 860700 Email: info@southernassembly.ie

1.3.19 Urban Nature Plan: Considering quality of life, climate and biodiversity together

Title of Plan (and language):

Urban Nature Plan: Considering quality of life, climate and biodiversity together! (in English)

Name and location of Authority:

BfN - German Federal Agency for Nature Conservation

Type of Plan/ Spatial Scale:

Best practice guidelines for municipal authorities

Brief Description:

This publication provides recommendations for creating Urban Nature Plans. Proposals from the European Commission's guidelines on "Urban Nature Plans" have been translated and adapted to the German context. An expert dialogue and workshops with various municipalities were held to tailor the guidance to German cities. These events explored how the Urban Nature Plans should be interpreted for Germany and to what extent the numerous formal and informal plans and strategies of the municipalities already fulfil the plan requirements. The brochure can be used as a guide by municipalities that do not yet have any plans that address urban nature. For municipalities with relevant plans in place, this guidance supports self-assessment and provides a decision-making basis for the next steps. In addition, thematically relevant, practice-oriented literature is indicated for further reading. The realities of municipalities of different sizes are taken into account. The guidance thus aims to provide readers with suggestions for developing their own approach to Urban Nature Plans, which is tailored to their local conditions.

Key learning points:

- A practical introduction for local authorities embarking on the Urban Nature Planning process.
- Shares locally relevant knowledge and case studies.
- Adapts EU best practice guidelines to the local situation in Germany.

Link:

https://www.bfn.de/publikationen/broschuere/urbane-gruene-infrastruktur-kommunen-staerken

Contact Details:

BfN, Department II 4.1Landscape Planning, Spatial Planning and Urban Development, Konstantinstr. 110 53179 Bonn, Germany

Arne Kunkel, Florian Mayer Email: info@bfn.de

1.3.20 Strengthening Urban Green Infrastructure in Municipalities

Title of Plan (and language):

Urbane grüne Infrastruktur in Kommunen stärken (in German)

Name and location of Authority:

BfN - German Federal Agency for Nature Conservation, Bonn, Germany

Type of Plan/ Spatial Scale:

Best practice guidelines for municipal authorities (Federal scale)

Brief Description:

The urban green infrastructure approach stands for the strategic and integrated planning, protection, development, and management of urban green spaces and open areas. The goal is a networked system of green spaces and open areas that provides diverse services for cities and is therefore considered just as important as technical and social infrastructure. A conceptual basis for German municipalities was established with the brochure "Urban Green Infrastructure." The concept has been widely received and represents a holistic perspective that brings together stakeholders in open space and landscape planning and integrates social, ecological, and aesthetic requirements. Another concept for describing a city's green and open spaces and promoting their development is the concept of urban nature. The term "urban nature" sharpens the focus on the city as a biodiverse habitat and on the importance of diverse and resilient green infrastructure as a contribution to biodiversity and as a foundation for quality of life in the city.

Key learning points:

- Practical guidance for developing and enhancing Green Infrastructure
- German case studies and examples
- Taking delivery to the next level

Link:

https://www.bfn.de/publikationen/broschuere/urbane-gruene-infrastruktur-kommunen-staerken

Contact Details:

BfN, Department II 4.1Landscape Planning, Spatial Planning and Urban Development, Konstantinstr. 110 53179 Bonn, Germany

Arne Kunkel, Florian Mayer Email: info@bfn.de

1.3.21 City of Nuremberg Open space Masterplan

Title of Plan (and language):

Stadt Nürnberg Masterplan Freiraum (in German)

City of Nuremberg Open space Masterplan

Name and location of Authority:

City of Nuremberg, Bavaria, Germany

Type of Plan/ Spatial Scale:

green/green-blue infrastructure plan (City level)

Brief Description:

The Open Space Master Plan has set itself the goal of sustainably improving the green and open space situation, further developing Nuremberg as a liveable and attractive city and actively helping to shape it. It makes a significant contribution to successfully mastering the ever-increasing challenges of our urban development. The Open Space Master Plan proposes a variety of different measures to make Nuremberg greener and more attractive step by step in the coming years - and thus also adapt to the consequences of climate change. In addition to the creation of new green spaces, existing parks will be upgraded in terms of quality, made more attractive and better networked. The waters in Nuremberg will be made more tangible and accessible for all citizens. Roofs, facades and courtyards will be greened. Attractive green paths take residents of densely populated districts to the city's large and small parks and local recreation areas.

Key learning points:

- The Plan emphasises the importance of environmental justice for all the city's residents
- It balances the greenspace and health needs of citizens with biodiversity and environmental sustainability.
- Climate change adaptation through greening receives a high priority

Link:

https://www.nuernberg.de/internet/umweltamt/masterplanfreiraum.html

Contact Details:

Stadt Nürnberg, Referat für Umwelt und Gesundheit Umweltamt Lina-Ammon-Straße 28, 90471 Nürnberg

Andrea Hilker, Frau Witthuhn Tel:09112313647

1.3.22 Urban Greening 'How to' Toolkit for Local Authorities, Councillors and Officers

Title of Plan (and language):

URBAN GREENING 'HOW TO' TOOLKIT for Local Authorities, Councillors and Officers (in English)

Name and location of Authority:

Reclaim Network Plus

Type of Plan/ Spatial Scale:

Best practice guidelines for municipal authorities

Brief Description:

A strategic approach to urban greening maximises the benefits of green spaces while ensuring their long-term effectiveness. This urban greening "how to" toolkit enables local authorities and communities to harness the full potential of urban greening. This toolkit recommends specific actions involving urban greening as a potential solution to urban challenges including: air pollution mitigation, biodiversity enhancement, flood mitigation, health and well-being, heat mitigation, noise mitigation and storing carbon.

Local authorities (LA) have the capacity and directive to implement urban greening solutions. It is therefore critical that LA councillors and officers have access to a credible resource that explains urban greening fundamentals, debunks myths, and outlines do's and don'ts while covering key issues, challenges, and possible alternatives. The information contained in this toolkit is based on evidence-based and peer reviewed scientific research, much of which was conducted as part of the RECLAIM project. This toolkit therefore represents state-of-the art advice on urban greening for mitigating environmental challenges in urban areas.

Key learning points:

- The toolkit incorporates an ecosystem services perspective to focus on benefits that can be delivered.
- Guidance is provided using accessible and understandable terminology, to make it accessible for a range of audiences.
- The toolkit is attractively illustrated to clarify the principles outlined.

Link:

https://openresearch.surrey.ac.uk/esploro/outputs/report/URBAN-GREENING-HOW-TO-TOOLKIT-for/99104686570234 6/filesAndLinks?index=0

Contact Details:

Prashant Kumar, University of Surrey

https://openresearch.surrey.ac.uk/esploro/

1.3.23 Oldenburg Garden City Master plan for urban green spaces

Title of Plan (and language):

Gartengroßstadt Oldenburg Masterplan Stadtgrün (in German)

Oldenburg Garden City Master plan for urban green spaces

Name and location of Authority:

Gartengroßstadt Oldenburg

Type of Plan/ Spatial Scale:

green/green-blue infrastructure plan (City scale)

Brief Description:

The Urban Green Master Plan creates a basis for the sustainable development of urban green spaces for the next 10 to 15 years. In the future, it is intended to serve as an instrument and reference work for all those involved in urban planning processes and is considered binding and guiding action both for the work of the administration and for political decisions. In doing so, it is on an equal footing with the other strategic plans of the Building Department and must be taken into account in all decisions for future urban development.

The master plan is intended to take into account the different requirements in times of increasing extreme weather events, rising population and structural densification. The aim is to meet the diverse requirements of urban development, also against the background of climate change, and to preserve Oldenburg's appearance as a green city. Based upon this mission statement, overarching objectives are derived as a framework for the spatial development and qualification of urban greenery. On the basis of the mission statement, the current status and function of the urban green spaces across the entire urban area will be examined and a comprehensive action plan with concrete proposals for improvement for 17 'action areas' will be formulated.

Key learning points:

- The plan aims to increase provision of greenspaces in under-represented areas
- It has a high legal status comparable with other statutory planning documents
- Citizen participation in the Plan delivery is seen as being a key success factor.

Link:

https://www.oldenburg.de/startseite/leben-umwelt/umwelt/gruenes-oldenburg/masterplan-stadt-gruen.html

Contact Details:

Amt für Umweltschutz und Bauordnung, Fachdienst Stadtgrün – Planung und Neubau, Christine-Petra Schacht, Head of Building Department Tel.0441 235-4444

1.3.24 Zurich- Specialist planning for urban nature for a network of ecologically valuable habitats

Title of Plan (and language):

Fachplanung Stadtnatur Planungsgrundlage für das Netzwerk ökologisch wertvoller Lebensräume (in German)

"Specialist planning for urban nature for a network of ecologically valuable habitats"

Name and location of Authority:

City of Zurich, Switzerland

Type of Plan/ Spatial Scale:

green/green-blue infrastructure plan

Brief Description:

Urban nature conservation planning is a planning instrument designed to preserve and promote ecologically valuable habitats – and thus urban biodiversity – in the long term. The city of Zurich boasts high biodiversity: almost 11 percent of the area within settlements, 29 percent of open land, and 26 percent of forests are considered ecologically valuable. The urban nature conservation plan focuses on the built-up area because this is where the greatest need for action exists, and it specifies the objectives of the municipal master plan. The plan provides guidance – also for private stakeholders – by demonstrating how concrete measures can contribute to greater biodiversity. The aim is to demonstrate where and how the additional ecologically valuable habitats (EWIs) that will build the urban nature network can be created. This network consists of three elements: stepping stone biotopes, connecting corridors, and nature reserves. The EWIs are the central building block for this network.

Key learning points:

- Focus is very much on ecological connectivity and habitat quaulity
- There is a strong link between planning and implementation aspects
- This is part of an integrated suite of plans including urban trees, climate change mitigation and urban greening

Link:

https://www.stadt-zuerich.ch/de/umwelt-und-energie/natur/naturschutz-und-stadtoekologie/fachplanung-stadtnatur.html

Contact Details:

Bettina Tschander, Head of Urban Nature Planning, Grün Stadt Zürich Beatenplatz 2 8001 Zürich Tel. +41 44 412 27 15

1.3.25 Freiburg - Tuniberg Biotope Network Concept

Title of Plan (and language):

Biotopverbundkonzept Tuniberg (in German)

"Tuniberg Biotope Network Concept"

Name and location of Authority:

City of Freiburg, Germany

Type of Plan/ Spatial Scale:

Targeted actions and timelines;Green, blue connectivity mapping

Brief Description:

The redevelopment of the Tuniberg Biotope network plan (which was previously considered in the Freiburg Biodiversity Action Plan), has been linked to specific legislation. In addition to the legal changes and the municipal biodiversity targets, changes in land use and the quality and quantity of habitats and ecosystems on the Tuniberg have led to a reorganisation of the biotope network plan.

In addition to the legal changes and the municipal biodiversity targets, changes in land use and the quality and quantity of habitats and ecosystems on the Tuniberg require a revision of the biotope network plan. The biotope network planning is a strategic planning instrument that aims to create a network of habitats and ecosystems that is suitable for the preservation and development of biodiversity.

Key learning points:

- The key role of legislation in for reinforcing Green Infrastructure and biodiversity conservation.
- The importance of action focused on a local level which links to broader policy.
- The requirement to adapt to ongoing changes in ecosystem quality

Link:

https://ris.freiburg.de/submission?id=555150210000 4

Contact Details:

Dr. Harald Schaich, Stadt Freiburg, Rathausplatz 2-4, 79098 Freiburg

rsk-ratsbuero@freiburg.de

1.3.26 Munich – Inner City Open Space Concept

Title of Plan (and language):

Freiraumquartierskonzept Innenstadt (in German)

"Inner City Open Space Concept"

Name and location of Authority:

City of Munich, Germany

Type of Plan/ Spatial Scale:

green/green-blue infrastructure plan

Brief Description:

The framework for this development is provided by the Open Space District Concept for the City Center. It contains guiding principles and plans for various open spaces and is to be considered and integrated into all further studies and planning in the old town. The Open Space District Concept envisions a green network in Munich's city center, consisting of green spaces, squares and boulevards, as well as micro-squares, alleyways, and courtyards. Strengthening this green infrastructure is crucial for securing recreational areas. It also contributes to climate adaptation.

The concept includes planning recommendations for three selected sub-areas: Sonnenstraße, Herzog-Wilhelm-Park, and the valley. Initially, measures that are particularly important for the goals of the open space district concept will be prioritized. These include, for example, expanding the green space on Herzog-Wilhelm-Straße north of Josephspitalstraße and transforming the eastern side of Sonnenstraße into a boulevard for pedestrians and cyclists. The third focus area is the valley, which is to be converted into a pedestrian zone.

Key learning points:

- The Plan is being communicated to stakeholders through advanced simulations and the Munich "Digital Twin" to bring ideas to life.
- A radical rehaul of the greenspaces in the selected subareas is reenvisaged through the Plan.
- The Plan represents an integrated vision for climate, biodiversity and sustainability indicators.

Link:

https://stadt.muenchen.de/infos/freiraumquartierskonzept.html

Contact Details:

Gisela Karsch-Frank/ Kerstin Langer, Referat für Stadtplanung und Bauordnung Stadtplanung / Grünplanung Blumenstraße 28b 80331 München

muenchen.de/plan

1.3.27 Karlsruhe Greenspace Development Plan 2017

Title of Plan (and language):

Freiraumentwicklungsplan Karlsruhe 2017 (in German)

"Karlsruhe Greenspace Development Plan 2017"

Name and location of Authority:

City of Karlesruhe, Germany

Type of Plan/ Spatial Scale:

green/green-blue infrastructure plan

Brief Description:

The City of Karlsruhe aims to maintain and enhance the quality of life, well-being, and public spaces for all its citizens. The future-oriented theme of "Green City" encompasses measures for sustainable development, focusing on climate, nature, and health in urban areas. Quality of life and a green, health-promoting environment will be preserved for future generations. In addition, Climate neutrality, protection of natural resources, and environmentally and socially responsible consumption determine urban action. Flexibility, resilience and regenerative capacity guarantee sustainable urban development, with a shared commitment to a green city deeply rooted in the population.

The three key areas of action – climate, health, and nature – form the core of Karlsruhe's Green City initiative. Karlsruhe offers many positive developments and activities to which all its residents can contribute. The city's residents and administration are working together to initiate sustainable developments in order to achieve the goal of a climate-neutral city and the necessary adaptation to climate change. Equally important are the further development of a green and health-promoting environment, as well as the protection of natural resources and biodiversity.

Key learning points:

- Makes strong connections between health, wellbeing and the provision of GI
- Sees a strong role for the participation of citizens and civil society
- Also places a strong emphasis upon climate change mitigation

Link:

https://www.karlsruhe.de/umwelt-klima/stadtgruen-wald/freiraumentwicklung/gruensystem

Contact Details:

Helmut Kern, Gartenbauamt Lammstraße 7 a 76133 Karlsruhe

2 Annexes for methodology implementation

The annexes presented in this section provide technical, policy, and operational support for the implementation of the ESPON GILL Methodology. They are designed to complement the core methodological guidance by offering detailed background information, practical tools, and reference materials that local and regional authorities, practitioners, and analysts can directly use throughout the different modules of the methodology.

Together, the annexes support municipalities at various stages of the green infrastructure (GI) planning process, from the identification of strategic objectives and challenges, through data collection and spatial analysis, to the assessment of ecosystem services and GI performance. They address key enabling aspects for implementation, including alignment with European policy frameworks, access to harmonised European data sources, clarification of data requirements, and the selection of appropriate analytical tools and methods—particularly in contexts where local data availability may be limited.

- **Annex 2.1 - Overview of EU policies and legislation with a territorial dimension, or relevant for urban green transition:** This document provides an overview of key EU objectives related to GI, helping local authorities to (i) align their planning goals with EU priorities, (ii) decide which funding mechanisms (particularly the European Regional Development Fund - ERDF) they can ascribe to in order to support their investment needs, and (iii) identify data reporting repositories they can access to find relevant data sources.
- **Annex 2.2 - List of available European data sources:** This document provides a comprehensive list of European data sources relevant to GI and access to support the application of the ESPON GILL Methodology in municipalities with limited spatial data availability.
- **Annex 2.3 - List of data requirements for the ESPON GILL Methodology development:** This document outlines the key data requirements for developing the ESPON GILL Methodology. It identifies the types of data needed (e.g., land-use, socio-demographic information, biophysical hazards) and specifies which module they support. It also provides examples of specific datasets to be potentially used to meet those requirements.
- **Annex 2.4 - Trigger questions for challenges identification:** This document provides trigger questions to support the assessment of challenges that were preselected in Module 1. It outlines the associated data requirements and the methodologies that can be applied to address each challenge and estimate GI demand. By making data needs and methodological options explicit, this annex enables a more informed selection of challenges for further analysis.
- **Annex 2.5 - List of tools to support spatialisation of GI demand, GI provision, and GI unmet demand:** This document provides a curated list of tools that support the modelling, mapping, or assessment of GI demand, provision, and unmet demand. Each entry includes a brief description of the tool and access information.
- **Annex 2.6 - ESPON GILL GI types:** This technical annex outlines a structured classification of GI types and subtypes. GI types provide generic categories for GI, while subtypes further specify these classifications. The classification follows the widely accepted GI definition, encompassing green and blue infrastructure across terrestrial, coastal, and marine environments in both rural and urban contexts.
- **Annex 2.7 - ESS evaluation factsheets:** This document explains and provides guidance for selected methods for assessing key ecosystem services (flood regulation, carbon sequestration, recreation, and cooling). Each factsheet includes methodology or model used, units, scale, data requirements and sources, steps, degree of uncertainty, and other relevant considerations.

Each annex is linked to one or more modules of the ESPON GILL Methodology, reflecting its primary area of application. This modular association is intended to help users easily identify which annexes are most relevant to their current step in the methodological workflow, while also highlighting interlinkages across mod-

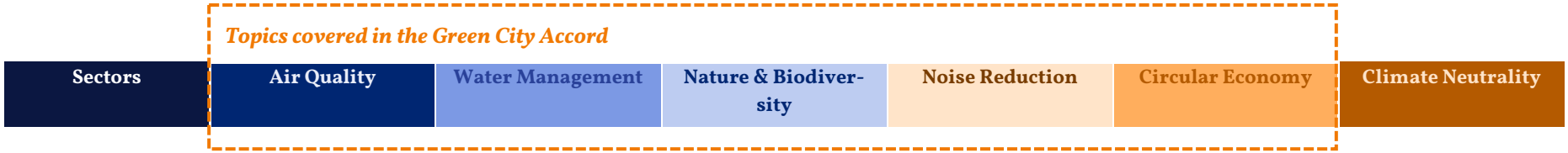
ules where applicable. The table below summarises the relationship between the annexes and the ESPON GILL Methodology modules.

Collectively, these annexes enhance the transparency, consistency, and replicability of the methodology, while offering flexibility for adaptation to different territorial contexts and planning needs.

Annex	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
Annex 2.1 - Overview of EU policies and legislation with a territorial dimension, or relevant for urban green transition	X					X
Annex 2.2 - List of available European data sources	X	X	X			
Annex 2.3 - List of data requirements for the ESPON GILL Methodology development	X					
Annex 2.4 - Trigger questions for challenges identification		X				
Annex 2.5 - List of tools to support spatialisation of GI demand, GI provision, and GI unmet demand		X	X	X		
Annex 2.6 - ESPON GILL GI types			X			
Annex 2.7 - ESS evaluation factsheets			X	X		

2.1 Overview of EU policies and legislation with a territorial dimension or of relevant for urban green transition

While the EU does not have formal competence over spatial planning (which remains primarily a Member State and local authority responsibility) as EU action in areas of non-exclusive competence must comply with the principle of subsidiarity (Article 5(3) of the Treaty on European Union), many EU regulations and policy frameworks have direct implications for local territorial development and urban governance, with 70 % (as recognised in the recent EU Agenda for cities) implemented at regional and local levels through national transposition and local action.

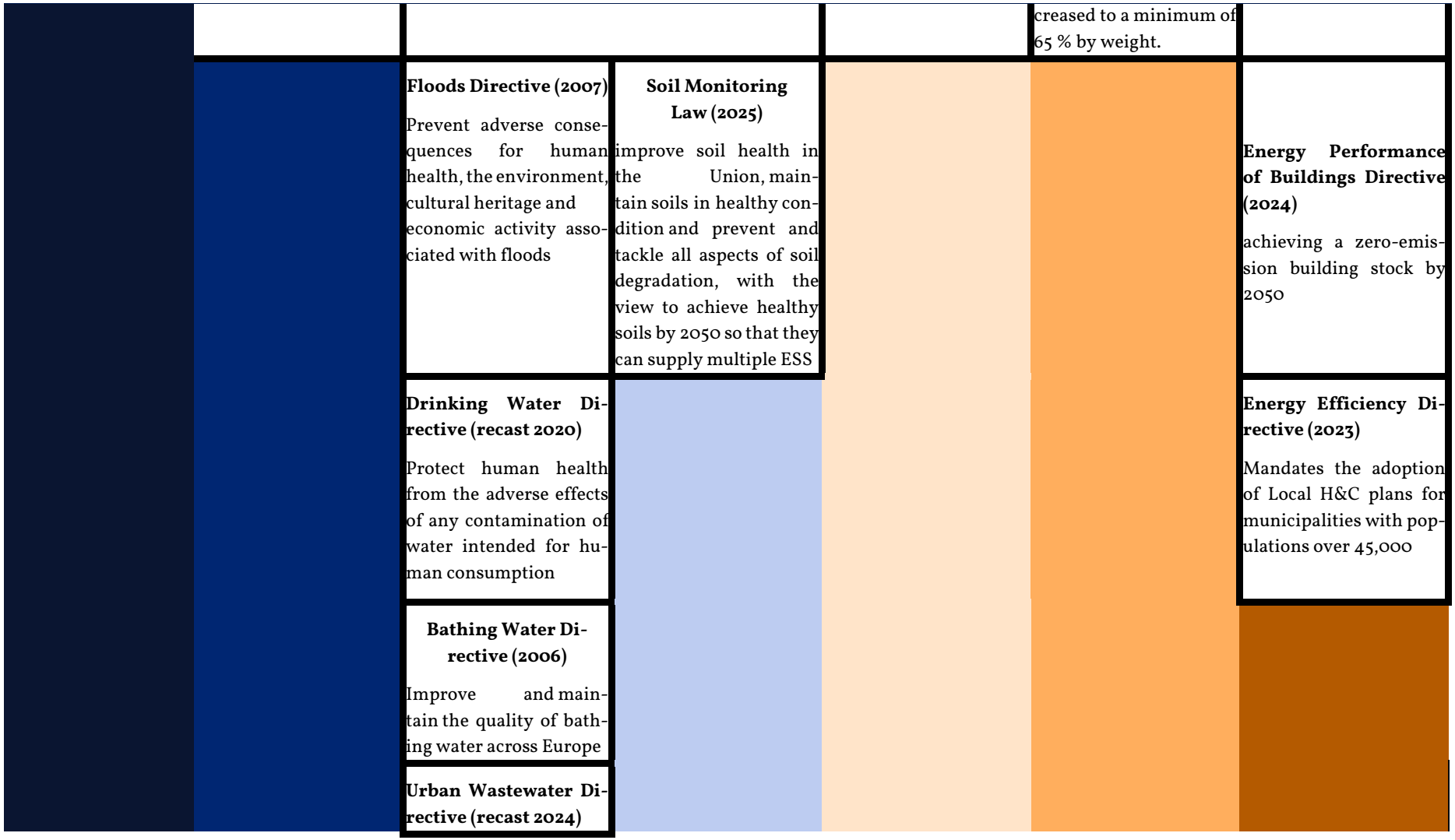


The overview is structured around key environmental and policy sectors that are particularly relevant for green infrastructure and territorial development. These sectors reflect the main domains through which EU objectives, funding instruments, and data reporting requirements influence local and regional action, namely air quality, water management, nature and biodiversity, noise reduction, circular economy, and climate neutrality. This overview is developed for Module 1 of the ESPON GILL methodology and details EU objectives relating directly or indirectly to green infrastructure, as well as which funding mechanisms, and which data reporting scheme for relevant data sources.

OBJECTIVES (non-binding)	Air Quality	Water Management	Nature & Biodiversity	Noise Reduction	Circular Economy	Climate Neutrality
	EU Green Deal					
They set the EU legislative agenda and inform the implementation of the existing EU acquis, but have no legal standing in court and preliminary ECJ rulings		**Water resilience Strategy (2025)** Restore and protect the water cycle from source to sea. Adopt water-smart practices and green infrastructure			**Circular Economy Action Plan (2020)** Reduce by 50% residual municipal waste	**Climate neutrality by 2050**
	Zero Pollution Action Plan (2021)					
	Reduce premature deaths from air pollution by 55% by 2030 compared to 2005	Achieving 'good status' under the Water Framework Directive and the Marine Strategy Framework Directive would bring the EU close to realising the zero-pollution ambition for all aquatic ecosystems.	by 25% the EU ecosystems where air pollution threatens biodiversity by 50% plastic litter at sea and by 30% microplastics released into the environment	by 30% the share of people chronically disturbed by transport noise	Reduce by 50% residual municipal waste	
		EU Soil Strategy for 2030 (2021) Land degradation Neutrality (remediation of contaminated sites), No Net Land Take (desealing), net greenhouse gas removal of 310 million tonnes CO_2 equivalent per year for LULUCF, good ecological and chemical status in surface waters and good chemical and quantitative status in groundwater by 2027. reduce soil pollution.			**Renovation Wave (2020)**	

OBJECTIVES (non-binding)	Air Quality	Water Management	Nature & Biodiversity	Noise Reduction	Circular Economy	Climate Neutrality
		EU Biodiversity Strategy for 2030 (2022) At least 30% of Europe's lands and seas into effectively managed protected areas ; restore at least 20% of the EU's land and sea areas by 2030, with all ecosystems in need of restoration targeted by 2050				

BINDING INSTRUMENTS	Air Quality	Water Management	Nature & Biodiversity	Noise Reduction	Circular Economy	Climate Neutrality
They set legally mandated objectives (mostly on Member States) *They have direct legal effect (legal standing in court and preliminary ECJ ruling)*	**Ambient Air Quality Directive (2008/50/EC and revision 2024/1203)** New EU2030 standards aligned with WHO guidelines Air Quality Plans for hotspots from 2026	**Water Framework-Directive (2000)** Prevent deterioration, protect, enhance and restore bodies of water	**Habitats (1992) and Birds (2009) Directives** Preservation, maintenance and re-establishment of biotopes and habitats	**Environmental Noise Directive (revised 2021)** For agglomerations with more than 250000 inhabitants > reduced environmental noise to which humans are exposed in particular in built-up areas, in public parks or other quiet areas in an agglomeration	**Waste Directive (revised 2024)** by 2025, the preparing for re-use and the recycling of municipal waste shall be increased to a minimum of 55 % by weight; by 2030, the preparing for re-use and the recycling of municipal waste shall be increased to a minimum of 60 % by weight; by 2035, the preparing for re-use and the recycling of municipal waste shall be in-	**EU Climate Law (2021)** Climate neutrality by 2050
		Nature Restoration Regulation (2024) by 2030: Restoration of 30 % terrestrial, coastal and freshwater ecosystems, and marine ecosystems ; no net loss in the total national area of urban green space and of urban tree canopy cover ; and increasing trends afterwards ; remove the artificial barriers to the connectivity of surface waters ; improve pollinator diversity and reverse the decline of pollinator populations				**Effort Sharing Regulation (rev 2023)** MS level GHG targets in NECP transport sector, > 40% reduction by 2030


creased to a minimum of 65 % by weight.
Floods Directive (2007)
Prevent adverse consequences for human health, the environment, cultural heritage and economic activity associated with floods
Soil Monitoring Law (2025)
improve soil health in the Union, maintain soils in healthy condition and prevent and tackle all aspects of soil degradation, with the view to achieve healthy soils by 2050 so that they can supply multiple ESS
Energy Performance of Buildings Directive (2024)
achieving a zero-emission building stock by 2050
Drinking Water Directive (recast 2020)
Protect human health from the adverse effects of any contamination of water intended for human consumption
Energy Efficiency Directive (2023)
Mandates the adoption of Local H&C plans for municipalities with populations over 45,000
Bathing Water Directive (2006)
Improve and maintain the quality of bathing water across Europe
Urban Wastewater Directive (recast 2024)

		limitation of pollution of receiving waters due to storm water overflows				
		Marine Strategy Framework Directive (2008)				
		Maritime Spatial Planning Directive (2014)				

REPORTING (for data sources)	**Air Quality**	**Water Management**	**Nature & Biodiversity**	**Noise Reduction**	**Circular Economy**	**Climate Neutrality**
	European Air Quality Index	WISE River Basin Management Plans	Natura 2000 reporting MS Nature Restoration Plan Soil Data Hub	Noise data EEA	Municipal waste by waste management operations (env_wasmun) EUROSTAT	NECP

TERRITORIAL CHALLENGES (examples)	**Air Quality**	**Water Management**	**Nature & Biodiversity**	**Noise Reduction**	**Circular Economy**	**Climate Neutrality**
	Local alignment with WHO guidelines	Manage stormwater run-offs and flood risk	Protect and restore urban ecosystems to enhance biodiversity	Reduce exposure to noise	Improve waste management of organic / biodegradable waste and wastewater	Support climate mitigation / Reduce local GHG / Carbon sequestration

GI SOLUTIONS	**Air Quality**	**Water Management**	**Nature & Biodiversity**	**Noise Reduction**	**Circular Economy**	**Climate Neutrality**

(examples)	Green roofs/walls	rain garden, wet land / flood plains, swales, ponds	Increase GI connectivity,urban green spaces, green roofs / walls, ponds	Green belt	Wetland / soil filtration systems	Wetlands

GI main-streaming opportunities *where can GI be integrated into planning instruments and funded*	**Air Quality**	**Water Management**	**Nature & Biodiversity**	**Noise Reduction**	**Circular Economy**	**Climate Neutrality**
	Air Quality Plan / roadmaps (mandatory for hotspots from 2026) *Depending on national requirements* **Local air quality plan**	*Depending on national requirements* **Integrated Water Management Plans** **Sustainable / Urban Drainage Systems (SUDS) / Water Efficiency Programme** Etc.	*Depending on national requirements* **Nature restoration strategy** **Natura 2000 Action Plan** Urban ecosystems sections of **Nature Restoration Plan**	*Depending on national requirements* **Noise monitoring and zoning**	*Depending on national requirements* **Waste Sorting & Recycling Programs**	**Sustainable Urban Mobility Plans** (GI such as green corridor, UGS along routes) **Affordable / Efficient Housing strategy** (Green roofs) **Local H&C Plans** (indirectly with Urban Heat Island effect)
			Urban Nature Plans			
	Local Climate Action Plan (mostly focused on adaptation)					
	Local Urban Development Plans / SUD strategies					
	ERDF 21/27 OP already adopted with 8 % on SUD obligation					
	Integrated Territorial Instruments (via PO5 ii)					
	PO2 “A greener Europe”					

(iv) promoting climate change adaptation and disaster risk prevention and resilience, taking into account eco-system based approaches;				(i) promoting energy efficiency and reducing greenhouse gas emissions
	(v) promoting access to water and sustainable water management;		(vi) promoting the transition to a circular and resource efficient economy;	
(vii) enhancing protection and preservation of nature, biodiversity and green infrastructure, including in urban areas, and reducing all forms of pollution;				

ERDF 28/34

ERDF 28/34 (proposal COM/2025/552 final) and NRPP (proposal COM/2025/565 final): published in July as part of MFF 28/34 proposal package > in negotiation until 2027

Policy Objective A: sustainable prosperity

I) SUD (inter alia)

X) supporting efficient water management, quality and resilience, environmental protection, climate adaptation, climate resilience and enhancing biodiversity, soil quality and natural resources, promoting circularity, bioeconomy and wider resource efficiency, strengthening pollution prevention, control and remediation, preserving and restoring nature and enhancing biodiversity and natural resources, as well as promoting the New European Bauhaus solutions in the built environment.

Policy Objective D: quality of life

V) enhancing sustainable agriculture and forestry management practices to promote resilient climate action, provision of multiple ecosystem services, supporting efficient water management, quality and resilience, the implementation of nature-based solutions, strengthening sustainable development, environmental protection, enhancing the conservation and restoration of biodiversity, soil and natural resources, and improving animal welfare.

2.2 List of available European data sources

This document presents a comprehensive overview of European-level data sources relevant to GI, with the aim of supporting the application of the ESPON GILL Methodology in municipalities where spatial data availability is limited. To ensure clarity and usability, the information is structured into two complementary tables: one focusing on qualitative information and the other on quantitative data.

- **The qualitative information table** is primarily intended to support Module 1 of the ESPON GILL Methodology. It includes official EU-level governance and policy documents (primary sources) and provides, for each entry, the name and associated links, bibliographic reference, author, the ESPON GILL module to which it contributes, and an assessment of its relevance. This table helps contextualize GI-related policies, strategies, and governance frameworks that underpin the methodological application.
- **The quantitative data table** compiles publicly available GIS-based datasets relevant to the ESPON GILL Methodology. For each dataset, the table specifies the data description and access links, the GILL module it contributes to, the data source, the latest available time series, spatial resolution, and data format. Together, these datasets support spatial analysis and evidence-based assessment within the ESPON GILL framework. All data sources included in this document are publicly accessible and suitable for GIS applications, ensuring transparency, reproducibility, and practical applicability for local authorities and practitioners.

QUALITATIVE INFORMATION

Name	Reference	Author	GILL Module	Relevance
Ambient Air Quality Directive	Directive 2008/50/EC	EU	Module 1	Definition of GI goal (air quality)
Ambient Air Quality Directive (recast)	Directive (EU) 2024/1203	EU	Module 1	Definition of GI goal (air quality)
Bathing Water Directive	Directive 2006/7/EC	EU	Module 1	Definition of GI goal (water management)
Birds Directive	Directive 2009/147/EC	EU	Module 1	Definition of GI goal (biodiversity)
Circular Economy Action Plan	COM(2020) 98 final	COM	Module 1	Definition of GI goal (circular economy)
Cohesion Policy CPR 21/27	Regulation (EU) 2021/1060	EU	Module 1	Funding
Drinking Water Directive	Directive (EU) 2020/2184	EU	Module 1	Definition of GI goal (water management)
Effort Sharing Regulation	Regulation (EU) 2023/857	EU	Module 1	National governance arrangments
Energy Efficiency Directive	Directive (EU) 2023/1791	EU	Module 1	Definition of GI goal (heating and cooling)

QUALITATIVE INFORMATION				
Energy Performance of Buildings Directive	Directive (EU) 2024/1275	EU	Module 1	Definition of GI goal (heating and cooling)
Environmental Noise Directive	Directive 2002/49/EC	EU	Module 1	Definition of GI goal (noise)
ERDF 21/27	Regulation (EU) 2021/1058	EU	Module 1	Funding
ERDF 28/35 proposal	COM/2025/552 final	COM	Module 1	Funding
Cohesion Policy CPR 28/35 proposal	COM/2025/565 final	COM	Module 1	Funding
EU Biodiversity Strategy for 2030	COM(2020) 380 final	COM	Module 1	Definition of GI goal (biodiversity)
European Soil Strategy for 2030	COM(2021) 699 final	COM	Module 1	Definition of GI goal (biodiversity)
European Biodiversity Strategy to 2020	COM(2011) 244 final	COM	Module 1	Definition of GI goal (biodiversity)
European Climate Law	Regulation (EU) 2021/1119	EU	Module 1	National governance arrangments
European Green Deal	COM(2019) 640 final	COM	Module 1	Definition of GI goal
European Adaptation Strategy	COM(2021) 82 final	EU	Module 1	Definition of GI goal
European Green Infrastructure Strategy	COM(2013) 249 final	COM	Module 1	Definition of GI goal
Floods Directive	Directive 2007/60/EC	EU	Module 1	Definition of GI goal (water management)
Green City Accord		EU	Module 1	Policy objectives for signatories
Habitats Directive	Directive 92/43/EEC	EU	Module 1	Definition of GI goal (biodiversity)
LULUCF Regulation	Regulation (EU) 2018/841	EU	Module 1	Governance and planning arrangments
Marine Strategy Framework Directive	Directive 2008/56/EC	EU	Module 1	Definition of GI goal (water management)
Maritime Spatial Planning Directive	Directive 2014/89/EU	EU	Module 1	Definition of GI goal (water management)
Nature Restoration Regulation	Regulation (EU) 2024/1991	EU	Module 1	Definition of GI goal (biodiversity)
Renovation Wave	COM(2020) 662 final	COM	Module 1	Definition of GI goal (heating and cooling ; green roofs
Soil Monitoring Law	Directive (EU) 2025/2360	EY	Module 1	Definition of GI goal (water management)
Urban Wastewater Treatment Directive	Directive 91/271/EEC	EU	Module 1	Definition of GI goal (water management)
Waste Directive	Directive 2008/98/EC	EU	Module 1	Definition of GI goal (circular economy)

QUALITATIVE INFORMATION				
Water Framework Directive	Directive 2000/60/EC	EU	Module 1	Definition of GI goal (water management)
Water Resilience Strategy	COM/2025/280 final	COM	Module 1	Definition of GI goal (water management)
Zero Pollution Action Plan	COM(2021) 400 final	COM	Module 1	Definition of GI goal

QUANTITATIVE DATA						
Data description	**Data for GILL**	**GILL Module**	**Source**	**Time series (latest)**	**Spatial Resolution**	**Format**
Adminsitrative boundaries LAU	Municipal boundary map (analysis delimitation)	Module 1	GISCO	2023		various
Natural capital in cities (FUA)	Spatial distribution of existing GI inventories (landscape level) (ecological corridors, riparian zones & buffers, etc ...)	Module 3	Copernicus Land Monitoring Service	2018	10 x 10m	vector raster
Natural capital at landscape level (GI) - Corine Land-Cover	Spatial distribution of existing GI inventories (landscape level) (ecological corridors, riparian zones & buffers, etc ...)	Module 3	Copernicus Land Monitoring Service	2018	100 x 100m	vector raster
Natural capital at landscape level (Blue infrastructure) - Riparian Zones CLMS	Riparian zones (Copernicus)	Module 3	Copernicus Land Monitoring Service	2018	10 x 10m	vector raster
N2K Land cover and land use information	N2K Land-use/Land-cover (Copernicus)	Module 3	Copernicus Land Monitoring Service	2018	10 x 10 m	vector
Protected areas: wetlands (RAMSAR sites)	RAMSAR list (RAMSAR site)	Module 3	RAMSAR	2025		shapefile

Data description	Data for GILL	GILL Module	Source	Time series (latest)	Spatial Resolution	Format
Protected areas: Areas of Special Conservation Interest (Emerald Network)	Emeral Network version 2023	Module 3	EMERALD NETWORK	2023		vector
Provision of ecosystem services: crop provision KIP INCA	KIP INCA Ecosystem servies accounts	Module 3	KIP INCA	2021	100 x 100 m	raster
Provision of ecosystem services: crop pollination KIP INCA	KIP INCA Ecosystem servies accounts	Modules 3/4	KIP INCA	2021	100 x 100 m	raster
Provision of ecosystem services: wood provision KIP INCA	KIP INCA Ecosystem servies accounts	Modules 3/4	KIP INCA	2021	100 x 100 m	raster
Provision of ecosystem services: global climate regulation KIP INCA	KIP INCA Ecosystem servies accounts	Modules 3/4	KIP INCA	2021	100 x 100 m	raster
Provision of ecosystem services: local climate regulation KIP INCA	KIP INCA Ecosystem servies accounts	Modules 3/4	KIP INCA	2021	100 x 100 m	raster
Provision of ecosystem services: air filtration KIP INCA	KIP INCA Ecosystem servies accounts	Modules 3/4	KIP INCA	2021	100 x 100 m	raster
Provision of ecosystem services: flood control KIP INCA	KIP INCA Ecosystem servies accounts	Modules 2/3/4	KIP INCA	2021	100 x 100 m	raster
Provision of ecosystem services: soil retention KIP INCA	KIP INCA Ecosystem servies accounts	Modules 2/3/4	KIP INCA	2021	100 x 100 m	raster
Provision of ecosystem services: nature-based tourim KIP INCA	KIP INCA Ecosystem servies accounts	Modules 2/3/4	KIP INCA	2021	100 x 100 m	raster

Data description	Data for GILL	GILL Module	Source	Time series (latest)	Spatial Resolution	Format
ESS - thermal regulation - Tree cover density	ESS thermal regulation and heat mitigation, urban heat island	Modules 2/3/4	Copernicus Land Monitoring Service	2018	10 x 10m	vector raster
Ecosystem condition (soil sealing) Imperviousness Density (CLMS)	Imperviousness	Module 2	Copernicus Land Monitoring Service	2018	10 x 10 m	vector raster
Ecosystem condition (soil sealing) Imperviousness Built-up (CLMS)	Imperviousness	Module 2	Copernicus Land Monitoring Service	2018	10 x 10 m	vector raster
Ecosystem condition (soil sealing) Imperviousness Change	Imperviousness	Module 2	Copernicus Land Monitoring Service	2015-2018	20 x 20 m	vector raster
Ecosystem condition (Soil properties)	Soil properties	Module 3	ESDAC	various	various	vector raster
soil erosion from rainfall	Soil properties	Module 2	ESDAC	various	various	vector raster
River flood hazard	River flooding	Module 2	JRC	2015-2024	20 x 20 m	raster
areas of potential flooding risk	River flooding	Module 2	WISE	various	various	vector
Land Surface Temperature	Thermal stress & urban heat island	Module 2	ESA CLIMATE OFFICE			
Population density GEOSTAT	Spatial distribution of population & population density	Module 4	GISCO	2021	1 x 1 km	CSV GPKG Raster
Land use Scenarios LUISA Platform REF2014	foresight scenario: others	Module 6	LUISA	2010-2050		
Air Quality Annual Statistics	Pollution data	Module 2	EEA	2023		
Air Quality Zone	Biophysical data (precipitation, temperature, soil, topography, erosion data)	Module 2	EEA	2023		vector

Data description	Data for GILL	GILL Module	Source	Time series (latest)	Spatial Resolution	Format
Surface Water Bodies	Water bodies (rivers, wetlands, lakes, aquifers...)	Module 3	WISE	2022		
Urban Noise Levels	Pollution data	Module 2	EEA	2021	1 x 1 km	

2.3 List of data requirements for the ESPON GILL Methodology development

This annex sets out the key data and information requirements for the development and application of the ESPON GILL Methodology. It identifies the main types of data and possible information required (such as land-use data, socio-demographic information and biophysical hazard data) and indicates the methodology modules they support (some data and information types may be relevant to more than one module).

The annex also provides illustrative examples of information and datasets that may be used to meet these requirements. These examples presented should be contextualised for each implementation location, taking into account data availability, accessibility and usability. These examples are intended to guide the identification of appropriate data, rather than to prescribe mandatory datasets. Data requirements may be fulfilled using different data types and formats, including qualitative and quantitative data, information derived from official documents, as well as GIS-based and statistical data sources. As the ESPON GILL Methodology is spatially explicit, the use of spatial data formats is strongly recommended wherever possible.

The development of this list reflects an iterative process informed by technical expertise, applicable models and methods, as well as lessons learned from case study implementation. It is intended to support a flexible yet robust application of the methodology across diverse territorial contexts.

Data/ information type	Data/ information example	Which Module?
Spatial plans	Urban plans	**Modules 1 & 6**
	Development plans	
	Regional plans	
	Land use and zoning plans	
GI-related strategies and plans	GI Plans	**Modules 1 & 6**
	Tree plans	
	Biodiversity plans	
	Greenspace management plans	
	Urban Nature Plans	
	Flood/Stormwater management plans	
	Agroforestry plans	
	Green space management plans	
Non-GI strategies and plans	Mobility plans	**Modules 1 & 6**
	Amenity plans	
	Public space plans	
	Housing plans	
	Circular economy and resource management plans	
	Climate Action plans	
	Public health and safety plans	
	Water supply and quality plans	
	Climate Change adaptation plans	
	Climate Action plans	

Data/ information type	Data/ information example	Which Module?
Existing city diagnosis and future trends related to GI	Population growth	**Module 1**
	Forecast analyses	
	Land use change and urbanisation processes	
	Climate change scenarios and impcacts	
	Natural resources and biodiversity	
	Technological and policy trends	
Administrative boundaries	Municipal administrative units	**Module 1**
	Local Administrative Units (LAU)	
	Rural settlements	
	Urban settlements/cores	
	Districts	
	Neighbourhoods	
	Regional/territorial administrative units	
Environmental and ecological units	Habitat units	**Module 1**
	Landcape units	
	Protected areas	
	Ecological corridors	
	Water bodies	
Information on functional areas	Mobility zones	**Module 1**
	Urban structure zones	
	Planning sectors	
	Service catchment areas	
Land-use and land-cover data	Urban fabric	**Module 1**
	Green areas	
	Agricultural land	
	Natural and semi-natural areas	
	Infrastructure footprint	
	Forests	
Biophysical statistical and spatial data	Heat stress	**Modules 2 & 4**
	Flooding	
	Biodiversity loss	
	Soil sealing	
	Air pollution	
	Landslides	
	Stormwater runoff	
	Degraded landscape/green areas	
	Water contamination	
	Soil contamination	
	Water stress	

Data/ information type	Data/ information example	Which Module?
	Carbon emissions	Modules 3 & 4
GI-related spatial data	Tree census	
	Public green spaces	
	Parks	
	Habitat maps	
	Agricultural land	
	Water bodies	
	Rivers	
	Groundwater	
	Natural and semi-natural areas	
	Forests	
	Meadows	
	Orthophotos	
ESS spatial data	Crop Pollination	Modules 3 & 4
	Stormwater retention	
	Carbon storage & sequestration	
	Recreation areas	
	Thermal comfort	
	Ecological connectivity	
	Biomass production	
	Scenic quality	
	Flood risk mitigation	
	Habitat quality	
	Nutrient delivery	
Socio-economic and vulnerability data	Poverty rate	Module 5
	Health outcomes	
	Social inclusion	
	Accessibility to green spaces	
	Green Jobs	
Regulation-related data	Land-use zoning	Module 5
	Legal/zoning restrictions	
	Parcels	
	Census data	
	Ownership data	
	Property boundaries	
	Management type data	
	Property value	
Urban morphology data	Public space inventories	Module 5
	Roads	

Data/ information type	Data/ information example	Which Module?
	Utility lines (water, sewer, gas, power)	
	Drainage systems	
	Soil permeability & infiltration rates	
	Roof type	
	Street with	
	Slope	
	Soil type and depth	
	Structural load capacity	
	Building footprints and height	
	Traffic and street network data	

2.4 Trigger questions for challenges identification:

This document presents a set of trigger questions designed to support the assessment of challenges preselected in Module 1. It outlines the corresponding data requirements and methodological approaches that can be applied to address each challenge and to estimate GI demand. By explicitly detailing data needs and available methodologies, this annex facilitates a more informed and transparent selection of challenges for subsequent analysis.

For each challenge, the document providesa trigger question to support understanding of its relevance and applicability, guidance on data inputs—including local, regional, national, and relevant European geodata sources—and an overview of methodological options for translating the challenge into a spatial definition of GI demand. Together, these elements support consistent, evidence-based decision-making in the application of the ESPON GILL framework.

Challenge	Trigger question	Data inputs		Methodologies to achieve GI demand
		Local, regional or national geodata sources	European geodata sources	
Increase thermal regulation	Are there areas with high urban heat island effects requiring mitigation through vegetation?	Local meteorological data, heat island maps, building maps	Copernicus Climate Data Store (temperature, heat stress indicators); ESA Sentinel-3 (LST); Urban Atlas (land cover/urban fabric)	Spatial overlay of LST with land cover; NDVI analysis; microclimate modelling (ENVI-met, UrbClim); participatory mapping of heat-stressed areas
	Is there a lack of shaded spaces in zones with high pedestrian activity?	Tree canopy maps, LiDAR data, street trees inventory, pedestrian flow data, land-use maps	Copernicus HRL (High Resolution Layers – tree cover density); EU-DEM; OpenStreetMap (pedestrian networks)	Green space accessibility analysis; canopy gap assessment; spatial multicriteria analysis (SMCA); workshops with residents
Improve water management	Are there recurrent flooding or stormwater management problems that GI could help mitigate?	Flood hazard maps, stormwater drainage maps, rainfall intensity data, soil permeability maps, hydrological modelling under different return periods	Copernicus Emergency Management Service (flood hazard & risk maps); EU-DEM; EEA flood risk layers	Hydrological and hydraulic modelling (HEC-HMS, SWMM); impact quantification; flood risk overlay with population/assets; stakeholder consultations

Challenge	Trigger question	Data inputs		Methodologies to achieve GI demand
		Local, regional or national geodata sources	European geodata sources	
	Is there a need to improve infiltration, reduce runoff, or enhance groundwater recharge?	Soil type maps, slope and DEM, impervious surface maps, hydrological models	EEA soil datasets (Soil Data Centre); LUCAS soil survey; Copernicus imperviousness layer	Runoff modelling; infiltration capacity mapping; scenario analysis for GI measures (e.g., permeable pavements)
Decrease landslide risk	Does the municipality have areas that are recurrently affected by landslides?	Landslide hazard maps, DEM and slope gradient data, soil stability data, historical landslide records, local rainfall datasets	Copernicus Land Monitoring Service (DEM, land cover); EEA landslide susceptibility maps; European Soil Data Centre (ESDAC)	Slope stability modelling (SINMAP, SHALSTAB); GIS-based susceptibility mapping; expert elicitation; Landslides idexes (e.g. LTI)
Increase biodiversity and ecological connectivity	Are natural habitats fragmented and in need of ecological corridors?	Land cover/land use maps, habitat distribution, protected areas boundaries, ecological corridors datasets	Natura 2000; Copernicus CORINE Land Cover; MAES datasets (Mapping and Assessment of Ecosystems and their Services)	Connectivity modelling (Graph theory, Circuitscape); habitat suitability modelling; participatory biodiversity mapping; landscape ecology statistics
	Is there demand for pollinator-friendly areas or urban biodiversity enhancement?	Vegetation maps, species distribution data (pollinators, flora), green roof/wall inventories, community garden data, orchard maps	European Biodiversity Data Centre (EBDC); GBIF (species records); Copernicus Land Monitoring	Species distribution modelling (SDM); habitat enhancement prioritization; participatory planning workshops
Increase social equity and health	Do vulnerable or underserved neighborhoods lack access to quality green spaces?	Population density maps, census socioeconomic data, accessibility analysis (network analysis to parks), health vulnerability indexes	Eurostat population & socioeconomic data; European Health Indicators datasets; Urban Atlas (green spaces)	Accessibility modelling (network analysis); equity mapping (overlay of green access with vulnerability); participatory mapping with communities; analysis of compliance with the 3-30-300 rule
Increase urban quality	Are there degraded or underutilized urban areas that could be revitalized through GI?	Brownfield/derelict land inventories, vacant lot databases, land-use/land-cover maps, municipal cadaster	Copernicus Urban Atlas; EEA land recycling datasets; JRC brownfield and land-use intensity data	GIS overlay of underused land with GI potential; multi-criteria analysis (environmental, social, economic); participatory design charrettes

Challenge	Trigger question	Data inputs		Methodologies to achieve GI demand
		Local, regional or national geodata sources	European geodata sources	
Improve economic activity related to GI	Is there potential for GI to strengthen tourism, recreation, or job creation in the city?	Tourism activity maps, recreation facilities data, land-use zoning, employment statistics	Eurostat tourism statistics; European Tourism Indicators System (ETIS); Copernicus land cover	Spatial analysis of recreation opportunities; economic valuation of ESS; participatory stakeholder mapping

2.5 List of tools to support spatialisation of GI demand, GI provision, and GI unmet demand

This document presents a curated compilation of tools designed to support the modelling, mapping, and assessment of GI demand, provision, and unmet demand. Each tool is described concisely, with details on functionality and access, facilitating their integration into urban greening strategies and GI. The selection is primarily based on the *Handbook of Tools for Informing and Monitoring Urban Greening Strategies and Nature Plans* (Remme et al., 2025). Additional tools were identified through desk-based research to fill gaps in the original compilation, with descriptions derived directly from the respective tool documentation. The tools included are selected for their capacity to enable quantitative or semi-quantitative mapping of GI demand, provision and unmet demand, and are applicable across diverse geographical contexts, supporting the modular development of integrated assessment methodologies for urban renaturing. Before selecting an appropriate tool, several considerations should be done regarding areas to be analysed, monetary and time resources, computational skills and technical knowledge and capacity, due to the fact that:

- The tools vary in analytical scale, ranging from landscape- and city-wide applications to site-specific and ad hoc analyses, and differ in their levels of technical complexity, computational requirements and time investment, often reflecting the robustness of the results produced.
- While some tools are accessible to users with limited technical expertise through automated outputs or look-up tables, others require advanced software or programming skills.
- Accessibility also varies, as certain tools depend on proprietary or licensed software, whereas others are freely available; some, such as ENVI-met, offer hybrid models with free low-resolution and paid high-resolution options.
- Although the primary focus is on ecosystem services, complementary tools drawn from landscape ecology, particularly those supporting ecological connectivity mapping (Circuitscape, Fragstats), are included to broaden and strengthen integrated assessments.

Name	Description	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
Blue Green Factor Qgis tool	The Bluegreen Factor (BGF) is a norm promoting blue-green development in municipal building zones by assesses the quality of blue-green structures, which includes water bodies like lakes and rivers (blue) and natural areas such as parks and gardens (green). The BGF norm weights blue-green structures and measures. The sum of these weighted values, divided by the area of the plot, gives the BGF value for the project. The BGF-QGIS app automates this task by allowing the user to map and digitize blue-green structure typologies and measures. It integrates a cost module which calculates the investment and maintenance cost per blue-green structure and measures as well as for the total project area.			x			

Name	Description	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
ADMS-Urban	ADMS-Urban is an urban air quality model for multiple urban source types, taking into account a range of factors regarding urban morphology. It can be linked to a regional air quality model.		X				
ENVI-Met	ENVI-met is a holistic, three-dimensional microclimate modelling software designed to simulate and analyse surface-plant-air interactions in complex urban environments. The tool is widely used in urban climate research, environmental planning, and the design of climate-adaptive cities. It allows for high-resolution, microscale simulations of atmospheric processes—such as air and surface temperature, wind flow, humidity, radiation balance, and pollutant dispersion—typically down to a spatial resolution of 0.5–5 metres and a time step of seconds to hours. ENVI-met is particularly valued for assessing the impact of urban greening, materials, and building morphology on thermal comfort, urban heat island mitigation, and overall climate resilience. It supports scenario-based analysis, enabling planners and researchers to test interventions such as tree planting, green roofs, permeable surfaces, or changes to street design. The model integrates vegetation, soil, radiation, and fluid dynamics in a unified framework, offering a realistic representation of urban microclimates.		X				
MUKLIMO	A 3-dimensional microscale urban climate model designed to simulate urban atmospheric conditions, particularly focusing on the urban heat island effect and the impact of land use changes (including changing green/grey area distribution) on local climates. The model can produce 3-dimensional wind, air temperature and air humidity fields. It simulates the intensity and spatial distribution of urban heat islands under various scenarios based on the downscaling of regional climate projections and estimates human thermal stress using indices like the perceived temperature. The thermodynamic version adds prognoses for the heat and moisture budget of the atmosphere, including a one-dimensional soil model accounting for heat and moisture fluxes and a canopy model to simulate vegetation-atmosphere interactions.		X				

Name	Description	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
Fragstats	FRAGSTATS is a tool to assess landscape structure. It is a spatial pattern analysis program for categorical maps representing the landscape mosaic model of landscape structure. The landscape subject to analysis is user-defined and can represent any spatial phenomenon. FRAGSTATS simply quantifies the spatial heterogeneity of the landscape as represented in the categorical map; it is incumbent upon the user to establish a sound basis for defining and scaling the landscape in terms of thematic content and resolution and spatial grain and extent.		X	X			
MIKE URBAN +	An integrated software platform for modelling, analysing, and managing urban water systems, including water distribution, stormwater drainage, wastewater collection, rivers, and floodplains. It provides: Hydraulic and Hydrological Modelling: Simulate water flow in distribution networks, sewer systems, rivers, and floodplains. Water Quality Analysis: Assess pollutant transport, sediment dynamics, and ecological impacts. Flood Risk Assessment: Model urban flooding scenarios, evaluate mitigation measures, and plan emergency responses. Real-Time Control: Design and test control strategies for pumps, gates, and valves to optimize system performance. GIS Integration: Leverage spatial data through integration with ArcGIS Pro for enhanced analysis and visualization.		X				
HEC-RAS	The software allows the user to perform one-dimensional steady flow, one and two-dimensional unsteady flow computations, sediment transport/mobile bed computations, stormwater pipe network modelling, and water temperature/water quality modelling.		X				
SOLWEIG	Model that simulates spatial variations of 3D radiation fluxes and the T_{mrt} in complex urban settings. It is also able to model spatial variations of shadow patterns. T_{mrt} is one of the key meteorological variables governing human energy balance and the thermal comfort of people. It is derived from summing all the radiative (shortwave and longwave) fluxes (both direct and reflected) to which the human body is exposed. In SOLWEIG, T_{mrt} is derived by modelling shortwave and longwave radiation fluxes in six directions (upward, downward and from the four cardinal points) and angular factors.		X				

Name	Description	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
Ecosystem Intelligence	The tool utilizes geospatial data to assess ecosystem services provided within a site. The following ES are included: air quality, biodiversity, carbon sequestration, soil quality and erosion, water quantity, water quality, wellbeing. The goal of this tool is to identify performance gaps to inform budgeting and design as well as use site-level data to identify interventions to maximize benefits in ecosystem service performance. The tool allows ecosystem benefits to be measured using a common unit of service hectares. The Screening module allows easy selection of land types, and the Detailed Module allows the assumptions to be replaced by site measured data.		X	X	X		
InVEST	InVEST is designed to inform decisions about natural resource management. Essentially, it provides information about how changes in ecosystems are likely to lead to changes in the flows of benefits to people. Decision-makers, from governments to non-profits to corporations, often manage lands and waters for multiple uses and inevitably must evaluate trade-offs among these uses. InVEST's multi-service, modular design provides an effective tool for exploring the likely outcomes of alternative management and climate scenarios and for evaluating trade-offs among sectors and services. For example, government agencies could use InVEST to help determine how to manage lands, coasts, and marine areas to provide a desirable range of benefits to people or to help design permitting and mitigation programs that sustain nature's benefits to society. Conservation organizations could use InVEST to better align their missions to protect biodiversity with activities that improve human livelihoods. Corporations, such as consumer goods companies, renewable energy companies, and water utilities, could also use InVEST to decide how and where to invest in natural capital to ensure that their supply chains are sustainable and secure. There are some urban-specific modules for ecosystem services in the toolkit (e.g. urban cooling, urban stormwater retention and urban flood risk mitigation).		X	X	X		
i-Tree ECO	i-Tree Eco version 6 is a flexible software application designed to use data collected in the field from single trees, complete inventories, or randomly located plots throughout a study area along with local hourly air pollution and meteorological data to quantify forest structure, environmental effects, and value to communities.		X	X	X		

Name	Description	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
ARIES	ARIES is an open-science integrated environmental modelling platform designed to help researchers, policy makers, and practitioners understand complex sustainability challenges. It uses AI, semantic modelling, and linked data to connect diverse environmental models and datasets, making them Findable, Accessible, Interoperable, and Reusable (FAIR). The goal is to support better decision-making on issues like ecosystem services, natural capital, climate risk, and conservation by enabling flexible, interoperable workflows and model reuse. ARIES is used internationally and supports a range of applications from local to global scales, with training and courses offered to help users get started.		X	X	X		
Circuitscape	Open-source connectivity modelling tool that applies concepts from electrical circuit theory to landscape ecology. It represents a landscape as a conductive surface where different features have different "resistances" to movement. By treating species movement (or gene flow) analogously to electrical current flow, Circuitscape predicts how organisms are likely to move across heterogeneous landscapes, identifying key corridors and pinch points that support connectivity. It's widely used in conservation planning, biodiversity research, and corridor design because it evaluates all possible movement pathways simultaneously, rather than just single least-cost paths.			X			
Social Values for Ecosystem Services (SolVES)	Social Values for Ecosystem Services (SolVES) is designed to assess, map, and quantify the perceived social values of ecosystem services. Social values are the perceived, nonmarket values that the public ascribes to ecosystem services, particularly cultural services, such as aesthetics and recreation. They can be evaluated for various stakeholder groups. These groups are distinguishable by their attitudes and preferences regarding public uses, such as motorized recreation and logging. SolVES derives a quantitative, 10-point, social-values metric, the "value index", from a combination of spatial and nonspatial responses to public value and preference surveys and calculates metrics characterizing the underlying environment, such as average distance to water and dominant landcover. The tool has been widely used globally, initially for areas like national parks, but in many settings now, including for a number of urban case studies. The tool was developed by the US Geological Survey.			X			

Name	Description	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
ESTIMAP recreation	The ESTIMAP recreation model measures the capacity of ecosystems to provide nature-based outdoor recreational and leisure opportunities. It is an 'Advanced multiple layer Look-Up Tables" model which measures the capacity of ecosystems to provide nature-based recreational and leisure opportunities. The model assigns ecosystem services scores to land units based on cross-tabulation and spatial composition derived from overlaying thematic maps. Ecosystem services scores for each input layer are derived from the literature and an expert-based approach. It integrates ecosystem-based potential, which estimates the potential capacity of ecosystems to support nature-based recreation activities, and human inputs, which integrates a proximity-remoteness concept in relation to road networks and residential areas.		X	X	X		
GI-Val toolkit	GI-Val is a toolkit which translates the benefits of green infrastructure into tangible, measurable data, enabling a more comprehensive understanding of their value. It is aimed at quantifying GI benefits, supporting decision-making, communicating values related to GI, and being scalable.		X	X			
Nature Value Explorer	This tool is an online, spatially explicit tool for Belgium that enables users to rapidly assess the biophysical and monetary impacts of land use changes on a range of ecosystem services. Users identify a study area and design planned green-blue interventions. Then the tool retrieves background data and calculates the changes in the provision of ecosystem services (cooling, water infiltration, air/water purification, recreation, carbon storage, and health benefits) associated with the proposed interventions. The tool supports decision-making by providing clear and rapid valuation of nature-based interventions. The tool exists in an (peri-)urban and a rural/landscape version. The online tool itself can only be used in Belgium (as it automatically imports Belgian geodata), but the tool is very well documented and many of the approaches used can be applied outside the Belgian context (particularly the qualitative assessments, and several of the methods in the urban version).		X	X			

Name	Description	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
Multilayered Vulnerabilty Assessment Handbook	Is not exactly a tool, but a well-developed methodology The Multilayered Vulnerability Assessment Handbook is not a real tool, but a handbook that describes a well-developed methodology for cities to identify and analyse urban vulnerabilities linked to climate change, biodiversity loss, socio-economic inequalities, and infrastructure gaps. Through a step-by-step, participatory approach, it guides planners and stakeholders in mapping vulnerability hotspots across environmental, social, economic, and institutional dimensions. The handbook supports resilience planning by helping cities prioritize interventions, especially those enhancing urban biodiversity and climate adaptation, such as green infrastructure or habitat protection. It also promotes continuous monitoring and evaluation to adjust actions over time. Flexible and comprehensive, the tool enables cities to integrate nature-based solutions and climate action into planning, strengthening resilience across diverse urban contexts.		X	X	X	X	
Tree EquityScore	The Tree Equity Score is a tool developed by American Forests that evaluates the distribution of urban trees in relation to community needs (based on income, employment rate, health status, race, age, heat stress, air pollution). It provides a score from 0 to 100, where a lower score indicates a greater need for tree planting and investment in that area. The score is designed to help identify neighbourhoods that lack sufficient tree cover, particularly those with vulnerable populations that are disproportionately affected by environmental hazards such as extreme heat and pollution.		X	X	X	X	

2.6 ESPON GILL GI typology

ESPON GILL uses the definition included in the EU Green Infrastructure Strategy (European Commission, 2013), where GI is defined as: *"a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services. It incorporates green spaces (or blue if aquatic ecosystems are concerned) and other physical features in terrestrial (including coastal) and marine areas. On land, GI is present in rural and urban settings."*. This definition highlights three essential aspects for its effectively integration into sectoral policies: connectivity, multifunctionality, and the integration with Spatial Planning and Management.

The GI typologies considered in the ESPON GILL Methodology are the result of a compilation from both the EU FP7 GREENSURGE project (Hansen, R. et. al. 2017) and the Biodiversity Information System for Europe (EC, 2021b) and are presented in the following table

Key GI Categories	Key sub-categories
Building Greens	Balcony green
	Ground based green wall
	facade-bound green wall
	Extensive green roof
	Intensive green roof
	Atrium
	Green pavements and green parking pavements
	Green fences and noise barriers
Urban Green areas connected to grey infrastructure	Tree alley and street tree/hedge
	Street green and green verge
	House garden
	Railway embankment
	Green playground/school ground
	Green parking areas
	Riverbank green areas
Parks and Formal Greenspaces	Large urban park
	Historical Park/garden
	Pocket Park/parklet
	Botanical garden/arboreta
	Zoological garden
	Neighbourhood greenspace
	Institutional greenspace
	Cemetery and churchyard
	Green sport facility
	Camping areas
Semi Natural Greenspaces	Forest
	Shrubland
	Abandoned and derelict areas with patches of wilderness
	Rocks
	Sand dunes
	Sand pit/ quarry/ opencast mine
Allotments and community gardens	Allotment
	Community garden
Agricultural land	Arable land
	Grassland
	Tree meadow/orchard
	Biofuel production/agroforestry
	Horticulture
Green areas for water management	Rain gardens or SUDS
	Swales/ filter strips
Blue spaces	Lake/pond
	River/stream
	Dry riverbed
	Canal
	Estuary
	Delta
	Sea coast
	Wetland/bog/fen/marsh

2.7 ESS evaluation factsheets

This document provides guidance in applying ESS mapping methods at different levels of application (urban and landscape) and method complexity (Seed Stage and Nature Master). Once the ESS for providing guidance were selected, the tools and methods for mapping them were developed based on a configuration that merged several CICES (Haynes-Young, 2023) ESS categories and aligned them with available methods and tools. This approach was chosen to ensure effectiveness across both levels of application and to incorporate a range of approaches, from basic qualitative to more advanced quantitative methods, while accounting for the diversity of municipal capacities. Each ESS combines several approaches that draw on different methods:

1. **Cooling:** This ESS is related to the regulation of temperature and humidity, including ventilation and transpiration at local scale and based on the ability of vegetation to mediate ambient atmospheric conditions (micro- and mesoclimate) through evapotranspiration.
2. **Carbon Sequestration and Storage:** This ESS is based on the ability of vegetation to regulate the chemical composition of the atmosphere and oceans through carbon sequestration. It directly and indirectly prevents the environmental and human health impacts caused by global warming, such as soil acidification.
3. **Recreation, human health and human wellbeing :** This ESS is based on the ability of vegetation to provide opportunties for recreation, nature experience and physical activities in nature; also includes positive impacts on human health and well-being (physical and mental health)
4. **Flood Mitigation:** This ESS is related to the regulation of runoff and base flows; regulation of peak flows; surge and flood wave mitigation. The ESS is based on the ability of vegetation to regulate base and peak water flows and runoff, and to store excess water in green spaces such as floodplains.

ESS compilation factsheets

For each ESS, a **briefing table** has been developed to provide clear guidance. Each table includes the ESS name, description (based on CICES), and associated CICES codes. The proposed methods are organized in **a matrix** considering two dimensions:

1. **Capacity Maturity:**
    - **Seed Stage:** Focused on fundamental technical capacities and data requirements.
    - **Nature Master:** Advanced level, requiring more sophisticated methods and data.
2. **Levels of Application:**
    - **Urban Level:** Focused on methods only applicable at urban level.
    - **Urban and Landscape Level:** Focused on methods applicable to both levels.

Users are guided to select the appropriate table depending on the scale of application and the desired complexity of the method.

ESS method factsheets

Each table includes the following information:

- **Title and Description:** Definition of the ESS and a description of the method to be applied.
- **Unit:** Expected output or unit of measurement.
- **Data Needs and Sources:** Required datasets with suggestions of possible sources or datasets necessary for applying the method.
- **Steps:** Key steps to implement the methodology.

- **Degree of Uncertainty:** Potential limitations or uncertainties arising from the application of the method.
- **References:** Links to references for deeper understanding of the methodology, data sources, and procedures.

This structured approach allows municipalities and practitioners to choose methods suited to their technical capacities, data availability, and scale of application, ensuring flexibility while maintaining methodological consistency across different ESS. Moreover, a qualitative scoring table for cooling, carbon storage and sequestration and flood mitigation has been developed to facilitate the application of seed stage methods.

Conten table

This table provides a comprehensive structure of the existing ESS method tables:

ESS Type	Level of analysis	Level of complexity	Method
Cooling	Urban level	Nature master	**MET1.01.** InVEST Urban Cooling
	Urban and landscape level	Seed stage	**MET-1.02.** Nature Value Explorer - Urban Cooling (Qualitative)
			MET-1.03. Delineating UHI based on expert insight
			MET-1.04. Cooling potential of urban green space (UK NCA)
		Nature master	**MET1.05.** Nature Value Explorer Urban Cooling
			MET1.06. UHI Delineation based on hotspot/coldspot clustering
Carbon storage and sequestration	Urban and landscape level	Seed stage	**MET-2.01.** Carbon NVE methodology (Qualitative)
		Nature master	**MET-2.02.** InVEST Carbon
			MET-2.03. Carbon NVE methodology (Quantitative)
			MET-2.04. iTree ECO
Recreation, human health and wellbeing	Urban level	Nature master	**MET-3.01.** Greenspace provision per building block (CANUE method)
	Urban and landscape level	Seed stage	**MET-3.02.** Recreational green space catchment area
			MET-3.03. Mapping green areas (NRR methodology)
		Nature master	**MET-3.04**. InVEST Urban Nature Access
			MET-3.05. ESTIMAP Recreation
	Urban level	Nature master	**MET4.01.** InVEST Urban Stormwater Retention

ESS Type	Level of analysis	Level of complexity	Method
Flood mitigation			**MET4.02.** InVEST Urban Flood Risk mitigation
	Urban and landscape level	Seed Stage	**MET4.03.** Nature Value Explorer - Water Retention (Qualitative)
		Nature master	**MET4.04.** Nature Value Explorer - Water Retention (Quantitative)
			MET4.05. iTree Avoided Run-off
Qualitative scoring table	Urban and landscape level	Seed stage	**MET-1.02. + MET-2.01+ MET4.03**

2.7.1 Cooling

	Seed Stage	Nature Master
Ecosystem service	Regulation of temperature and humidity, including ventilation and transpiration at local scales	
CICES Code	2.3.6.2.	
Description	Ecosystem service based on the ability of vegetation to mediate the ambienat atmospheric conditions (micro and mesoclimate) through evapotranspiration	
Urban level	-	**MET1.01.** InVEST Urban Cooling
Urban & Landscape level	**MET-1.02.** Nature Value Explorer - Urban Cooling (Qualitative) **MET-1.03.** Delineating UHI based on expert insight **MET-1.04.** Cooling potential of urban green space (UK NCA)	**MET1.05.** Nature Value Explorer Urban Cooling **MET1.06.** UHI Delineation based on hotspot/coldspot clustering

2.7.1.1 Cooling urban level methods

Methodology code	MET-1.01
Title	**InVEST Urban Cooling**
Description	InVEST (Integrated Valuation of Ecosystem Services and Trade-offs) is a suite of open-source software models for mapping and valuing ecosystem services. The InVEST urban cooling model estimates temperature reduction by vegetation based on shade, evapotranspiration, and albedo by vegetation, as well as distance from cooling islands (e.g. parks). The model calculates (1) the cooling capacity index per pixel, and (2) the Urban Heat Mitigation Index (representing the effect of large green spaces, > 2 ha, on the surrounding areas), and (3) the Air Temperature Estimates taking into account the impact of green infrastructure
Unit	° C

Data needs and sources	• **Land use/Land Cover (raster):** urban nature types (diverging naturalness per urban nature type can be set) from Corine Land Cover, CLCplus Backbone, OpenStreetMap or local land cover or GI map
	• **Biophysical Table:** mapping each LULC code to biophysical data:
	  ○ Crop coefficient, green area (0/1)
	  ○ Shade (%)
	  ○ Albedo (optional)
	  ○ Building intensity (optional)
	• **Reference evapotranspiration** (raster)
	• **Area of interest (vector)**
	• **Maximum cooling distance (m)** (recommended value 450 m)**:** distance over which green areas over 2 ha have cooling effects.
	• **reference air temperature (°C)**
	• **UHI effect:** magnitude of urban heat island effect (from local literature or global studies, for example, the Global Surface UHI Explorer developed by the University of Yale)
	• **air blending distance (m)** (recommended value 500 to 600 m)
	• **building footprints** (optional)
	• **Further information** about **data needs**

Steps	1. Download and install InVEST Workbench 2. Collect data and paramters, and format data (Land Use/Land Cover raster, biophysical table, area of interest) 3. Run the model 4. Process the resulting data in maps (using GIS software)
Degree of uncertainty	Due to the simplifications described above, the model presents a number of **limitations ,** described in the **limitations and simplifications section.**
Others	The model is also able to calculate a monetary value for the heat reduction, based on building energy savings and increased work productivity
References	**InVEST Urban Cooling model**

2.7.1.2 Cooling urban and landscape level methods

Methodology code	MET-1.02
Title	**Cooling effect of urban green space (Nature Value Explorer City, VITO) - Qualitative assessment**
Description	The Nature Value Explorer includes an estimation of the impact of urban green space on night and day temperatures , in relation to the type of green infrastructure, according to a 10 point scale
Unit	N/A

Data needs and sources	• **Land cover map** with detailed vegetation/green infrastructure typology. Possible sources:
	  ○ Corine Land Cover
	  ○ CLCplus Backbone
	  ○ OpenStreetMap
	  ○ Or, local land cover or GI map
	• **Qualitative scoring table** (Also in section 2.7.5. of this technical annex)

Steps	1. Define lookup table (from Green Infrastructure Typology to cooling effect, -1 to 10) using the **qualitative scoring table** from this technical annex 2. Reclassify land cover /land use map into Green Infrastructure Map 3. Convert Green Infrastructure Map in cooling map combining it with the qualitative scoring table.
Degree of uncertainty	High uncertainty, due to the qualitative approach
References	**Nature Value Explorer**

Methodology code	MET-1.03
Title	**Expert-based delineation of UHI**
Description	Approximate locations and extents of urban heat islands are defined based on the expert opinion by Climate change specialist and the presence of vegetation, infrastructure, and their respective densities
Unit	Urban landscape units

Data needs and sources	• **Layers of landscape units, green areas, waterbodies etc.** Possible sources:
	  ○ Corine Land Cover
	  ○ CLCplus Backbone
	  ○ OpenStreetMap
	  ○ or, local land cover or GI map

Steps	1. Based on expert knowledge of the city, and its green and blue areas, affected areas is are represented by a "1" (UHI present/outspoken) and the unaffected areas are represented as a "0" (UHI less outspoken). Alternatively, a Likert scale can be used (e.g., -2 to 2, from lower temperature, over average temperature to higher temperature). 2. The impact of the UHI can be weighted by the population affected or living in the urban unit (e.g. quarter or district). For example, using the following formula: Priority (i) = **AirT(i) * Population (i)** 3. With Priority (i) the priority for the quarter i, Air T(i) the mean annual air temperature in the quarter i, and Population (i) the population in the quarter (based on Nature-Based Solutions Opportunity Scan by the Worldbank).
Degree of uncertainty	• High, as this is based on assumptions. The uncertainty depends on the information available (e.g. UHI maps, average temperature maps/models etc.) and their resolution. • The degree of uncertainty can be lowered by combining this approach by the **quantitative value table** approach in MET-1.05
References	• **Multilayered Vulnerability Assessment Handbook, UN-Habitat** • **The nature-based solutions opportunity scan**

Methodology code	MET-1.04
Title	**Cooling potential of urban green space**
Description	The cooling effect of urban green infrastructure is calculated, based on the type of green space and the extent of the green space, based on the UK Urban Natural Capital Account, eftec 2017
Unit	° C

Data needs and sources	• **Green infrastructure and greenspace map.** Possible sources:
	  ○ Corine Land Cover
	  ○ CLCplus Backbone
	  ○ OpenStreetMap
	  ○ Or, local land cover or GI map

Steps	1. Define the extent of the urban green space.
	2. Apply a buffer of 100 m around parks and urban woodlands > 3 ha (buffer of 0 m around other green spaces)
	3. Cooling potential per type of green space
	  a. Parks: -0.95° C (Bowler et al., 2010: Larondelle and Haase, 2013)
	  b. Parks buffer: -0.52° C (ibid)
	  c. Urban woodlands: -3.5° C (ibid)
	  d. Urban woodlands buffer: -0.52° C
	  e. Blue space: -2.5° C
	4. Rasterize the area of interest
	5. Calculate the cooling potential of urban green space per raster cell, based on the proportional area of the green space in the raster and the and the type of green space

Degree of uncertainty	High, as this is based on assumptions (based on the literature). The impact beyond the buffer area of 100 m is existing, but difficult to quantify and as such has been reduced to 0.
Others	See method MET1-1.05 for a similar approach based on the **quantitative value table** with more greenspace types.
References	**UK Urban Natural Capital Account** (p. 33-34, full background in the annex)

Methodology code	MET-1.05
Title	**Cooling effect of urban green space (Nature Value Explorer City, VITO) - Quantitative assessment**
Description	The Nature Value Explorer includes an estimation of the impact of urban green space on night (up to -0.9 ° C) and day temperatures (up to - 3,0 °C), in relation to the type of green infrastructure. The figures are based on the UrbClim model for Flanders (De Ridder et al., 2015)
Unit	° C Wet Bulb Globe Temperature (WGBT)

Data needs and sources	• **Land cover map** with detailed vegetation typology. Possible sources:
	  ○ Corine Land Cover
	  ○ CLCplus Backbone
	  ○ OpenStreetMap
	  ○ Local land cover or GI map
	• **Quantitative value table** providing night cooling and day cooling values for each GI typology. The table is dependent on:
	  ○ Temperature (WGBT) decrease per type of land cover or green infrastructure
	  ○ Temperature (WGBT) increase per type of land cover or green infrastructure

Steps	1. Define lookup table based on the **Quantitative value table** according to existing GI types in your area of study 2. Reclassify land use map 3. Convert land cover map in cooling map If one wants to present the results as a raster map, following steps 4 to 5. (optional) 4. Rasterize the area of interest 5. Calculate the cooling potential of urban green space per raster cell, based on the proportional area of the green space in the raster and the and the type of green space
Degree of uncertainty	• The lookup table data can be difficult to compile, and will only show average values (or a range of values) based on the **quantitative value table**. The **Quantitative value table** by the Nature Value Explorer has been developed for Belgium, but is based on data for Europe and globally. This way, it is a good estimate for the overall impact of cooling by vegetation. Nevertheless, we recommend to review the **quantitative value table** or the specific look up table for the location and have it validated for the location of the assessment. • The uncertainty also depends on the quality of the land cover map.
Others	See method MET1-1.06 for an approach to include the cooling effect of urban green spaces > 3 ha.
References	**Nature Value Explorer**

Methodology code	MET-1.06
Title	**UHI delineation via hotspot/coldspot clustering** **(Multilayered Vulnerability Asessment Handbook, UN-Habitat)**
Description	Approximate locations and extents of urban heat islands are defined based on the expert opinion of Climate change specialist and the presence of vegetation, infrastructure, and their respective densities.
Unit	Urban landscape units

Data needs and sources	• **Base layers** of urban landscape units:
	  ○ Corine Land Cover
	  ○ CLCplus Backbone
	  ○ OpenStreetMap
	  ○ Local land cover or GI map
	• **Temperature maps and/or temperature models** for the area of interest (if not available, data from weather stations can be processed into a temperature map). Formats allow:
	  ○ Rasterized spatial layers
	  ○ point clouds
	  ○ model results

Steps	1. Normalise temperature values in the local authority (or area of interest) so that the highest affected areas are represented by a "1" and the unaffected areas are represented by a "0". 2. Calculate average normalised temperatures per raster or per landscape unit or district. 3. Delineate UHI through defining hotspots and coldspots. 4. In the case of point data, a buffer tool should be applied to cover the approximate affected areas. 5. Polygons should be converted to the common grid size for inclusion in the MVA.
Degree of uncertainty	High, as this is based on assumptions. The uncertainty depends on the information available (e.g. UHI maps, average temperature maps/models etc.) and their resolution.
References	**Multilayered Vulnerability Assessment Handbook, UN-Habitat**

2.7.2 Carbon storage and sequestration

	Seed Stage 	Nature Master 
Ecosystem service	Carbon storage and sequestration capacity of green infrastructure	
CICES Code	2.2.6.1.	
Description	Ecosystem service based on the ability of vegetation to regulate the chemical composition of the atmosphere and oceans through carbon sequestration, directly and indirectly preventing the impacts caused by global warming (e.g., soil acidification) on the environment and human health.	
Urban level	-	-
Urban & Landscape level	**MET-2.01.** Carbon NVE methodology (Qualitative)	**MET-2.02.** InVEST Carbon **MET-2.03.** Carbon NVE methodology (Quantitative) **MET-2.04.** iTree ECO

2.7.2.1 Carbon storage urban and landscape level methods

Methodology code	MET-2.01
Title	**Carbon storage and sequestration (Nature Value Explorer City, VITO) - Qualitative assessment**
Description	The Nature Value Explorer qualitative assessment for carbon storage and sequestration considers carbon in the soil, carbon storage in the aboveground biomass, and carbon storage in underground biomass (root systems).
Unit	N/A

Data needs and sources	• **Land cover map** with detailed vegetation/green infrastructure typology. Possible sources:
	  ○ Corine Land Cover
	  ○ CLCplus Backbone
	  ○ OpenStreetMap
	  ○ Or, local land cover or GI map
	• Qualitative scoring table (Also, in section 2.7.5. of this technical annex): carbon storage/sequestration per type of land cover, 10 point scale.

Steps	1. Define lookup table (from Green Infrastructure Typology to carbon storage, 0 to 10) using the qualitative scoring table based on the existing GI types in your study area. 2. Reclassify land cover /land use map into Green Infrastructure Map 3. Convert Green Infrastructure Map in carbon storage map combining it with the qualitative scoring table.
Degree of uncertainty	High uncertainty, due to the qualitative approach
References	Nature Value Explorer

Methodology code	MET-2.02
Title	**InVEST Carbon Storage and Sequestration**
Description	InVEST (Integrated Valuation of Ecosystem Services and Trade-offs) is a suite of open-source software models for mapping and valuing the ecosystem services. Based on a land cover map as input, the model calculates four carbon pools (aboveground biomass, belowground biomass, soil, and dead organic matter) to estimate the amount of carbon stored in a landscape at baseline or the amount of carbon sequestered over time.
Unit	ton C/ha

Data needs and sources	• **Land cover map** with detailed vegetation/GI typology. Possible sources:
	  ○ Corine Land Cover
	  ○ CLCplus Backbone
	  ○ OpenStreetMap
	  ○ or, local land cover or GI map
	• **Carbon Pools (CSV, required**) - A table that maps each LULC code to carbon pool data for that LULC type that can be retrieved from this **sources**. The table is dependent on:
	  ○ the location
	  ○ bioregion
	  ○ local climate.

Steps	1. Download and install InVEST Workbench
	2. Develop a Carbon pool lookup table based on your study area, retrieved from these suggested **sources**.
	3. Format data:
	  a. Land Use/Land Cover raster
	  b. attribute table for Land Use/Land Cover
	  c. Carbon pools CSV
	4. Run the model
	5. Process the resulting data in maps (using GIS software)

Degree of uncertainty	Limitations of the model include an oversimplified carbon cycle, an assumed linear change in carbon sequestration over time, and its dependence on the quality of the land cover map.
References	**InVEST – Carbon pools**

Methodology code	MET-2.03
Title	**Carbon storage and sequestration (Nature Value Explorer City, VITO) - Quantitative assessment**
Description	The Nature Value Explorer calculation for carbon storage and sequestration includes carbon in the soil, carbon storage in the aboveground biomass, and carbon storage in underground biomass (root systems).
Unit	kg C/m²

Data needs and sources	• **land cover map** with detailed vegetation typology**.** Possible sources:
	  ○ Corine Land Cover
	  ○ CLCplus Backbone
	  ○ OpenStreetMap
	  ○ local landcover or GI map
	• **Quantitative value table (kg C/m² of vegetation),** providing low and high values for each GI typology, completing the qualitative scoring table. The table is dependent on:
	  ○ the location
	  ○ climate.

Steps	1. Define lookup table, based **quantitative value table** considering the GI types existing in your study area definition. 2. Reclassify land use map 3. Convert land cover map in carbon storage map
Degree of uncertainty	• The lookup table can be difficult to compile, and will only show average values (or a range of values) based on the **quantitative value table**. • The **Quantitative value table** by the Nature Value Explorer has been developed for Belgium, but is based on data for Europe and globally; this table shows minimum and maximum carbon sequestration values. This way, it is a good estimate for the overall impact of Carbon storage by vegetation. • Recommended to review the **quantitative value table** or the specific look up table for the location and have it validated for the location of the assessment. • The uncertainty also depends on the quality of the land cover map.
References	**Nature Value Explorer**

Methodology code	MET-2.04
Title	**Carbon sequestration and storage (i-Tree Eco)**
Description	i-Tree calculates ecosystem services provided by trees, either for an individual tree, either based on a complete or sampled tree inventory. I-Tree Eco is a software suite that is also applicable in Europe
Unit	ton CO_2 eq./m^2

Data needs and sources	• **Tree data** for single tree(s) or,
	• **Complete tree inventory** for a group trees (forest, woodlands, parks…)
	  ○ Corine Land Cover
	  ○ CLCplus Backbone
	  ○ OpenStreetMap
	  ○ local landcover or GI map
	• **Lookup table** included in the software **(kg C/m^2 of vegetation),** The table is dependent on:
	  ○ the location
	  ○ climate.

Steps	1. Download and install iTree ECO 2. Prepare the project and the data 3. Upload **local tree inventory data.** 4. Run the model and interpret the data
Degree of uncertainty	The parameters are set per bioregion (not local) and based on average conditions, so the modelled results can deviate from the exact carbon sequestration in the field.
Others	iTree ECO provides a range of figures per area unit or stratum, including composition and structure of the forest, urban forest cover and leaf area, ecosystem services provided (air pollution removal, carbon storage, carbon sequestration, building energy savings facilitated by trees and associated reduced carbon emissions, hydrology effects including avoided runoff, air pollution removal (NO_2, SO_2, O_3, CO, $PM_{2,5}$), VOC emisisons by trees, UV effects …), structural and functiponal values of trees, monetary benefits, public health benefits)
References	**i-Tree Eco**

2.7.3 Recreation, human health and wellbeing

	Seed Stage	Nature Master
Ecosystem service	Recreation and human health and well-being provided by GI	
CICES Code	3.1.1.1. 3.1.1.2.	
Description	Ecosystem service based on the ability of vegetation to provide opportunties for recreation, nature experience and physical activities in nature; also includes positive impacts on human health and well-being (physical and mental health)	
Urban level	-	**MET-3.01.** Greenspace provision per building block (CANUE method)
Urban & Landscape level	**MET-3.02.** Recreational green space catchment area **MET-3.03.** Mapping green areas along the NRR methodology (land cover-based)	**MET-3.04.** InVEST Urban Nature Access **MET-3.05.** ESTIMAP Recreation

2.7.3.1 Recreation urban level methods

Methodology code	MET-3.01
Title	**Quantifying Greenspace Accessibility per building block (CANUE method)**
Description	The method provides an indicator for greenspace provision per building block (or raster cell in population raster maps), based on overlaying greenspace catchments at X m from a greenspace entry point.
Unit	m^2 greenspace per inhabitant

Data needs and sources	• **Accessible greenspace map.** Possible sources:
	  ○ Public green spaces based on local sources
	  ○ Corine Land Cover
	  ○ CLCplus Backbone
	  ○ OpenStreetMap
	  ○ local landcover or GI map
	• **road network map** focused on pedestrian network**.** Possible sources:
	  ○ OpenStreetMap
	  ○ local network data
	• **Population raster.** Possible sources:
	  ○ JRC-CENSUS
	  ○ Worldpop
	  ○ Local census
	• **Local administrative units**

Steps	1. Per greenspace:
	  a. calculate catchment area: based on X m walking distance between building block/raster to entry point, via road network accessible to pedestrians - in GIS software
	  b. entry points can be defined through overlaying the greenspace layer with the road network (suggested procedure)
	2. Calculate greenspace provision provided by greenspace i as total area (m^2) per inhabitant. Different units are possible:
	  a. Building block
	  b. Statistical/Censal sector
	  c. Raster in population map
	3. Sum up the greenspace provision provided by all the greenspace within X m walking distance from the building bloc

Degree of uncertainty	Quite accurate, if data available
Others	• Plugin based on land use classes from the previous version of CORINE, transformation or implementing the workflow for unprocessed maps is needed. • Greenspace maps provided by the city can be used, but pre-processing may be needed (rasterisation, recategorisation).
References	**Quantifying Nationwide Greenspace Accessibility with CANUE**

2.7.3.2 Recreation urban and landscape level methods

Methodology code	MET-3.02
Title	**Recreational green space catchment area**
Description	The methodology estimates the (urban) area having access to urban green areas for recreation, based on the WHO guideline of providing green space within 300m of every residence
Unit	1: within green space catchment, 0: outside green space catchment
Data needs and sources	• **Accessible (urban) green space,** based on a layer provided by the local authority/ies. The layer includes all publicly accessible green space within the boundaries of the municipality or the area under study. This includes public green space, public/private green areas at/around sports facilities or churchyards, forests, riverbanks, publicly accessible gardens etc. • **Urban green space managed by the municipality:** It can be used as a proxy, if a comprehensive layer is not available considering all the GI above is not available
Steps	1. Create a GIS layer with accessible green space, based on available data from the city/municipality, forest agencies, and other departments managing green space. 2. Add a 300-meter buffer around the accessible greenspaces and assign a value of 1 to these polygons. Areas outside the buffer receive a value of 0. Alternatively, the buffers are created based on real travel distances (by foot). 3. **Optional:** overlay the buffers within 300 m of accessible green spaces with a layer of residential buildings, to indicate houses with/without access to green space within 300 m
Degree of uncertainty	• High: if there is no comprehensive layer of accessible green areas, the resulting layer is an underestimation of the recreational opportunities in the perimeter. • Medium: in case of a comprehensive layer, the recreational offer tends to be overestimated, as not all public green spaces that are accessible on paper, are used. On the other hand, informal accessible green spaces (i.e. green spaces that officially are not open to the public) are not included in the layer, so their recreational offer is not included.

	• The calculation can be improved by:
	  ○ Calculating the distance from access points to the green space
	  ○ Calculating effective travel distances to the green space (by foot), including deviations needed to cross large roads, highways, railroads, waterways etc.

References	**3+30+300 rule by Datalab** **Green Infrastructure network, Accesible Greenspace Standard**

Methodology code	MET-3.03
Title	**Mapping land cover-based green areas (NRR methodology)**
Description	This is an alternative methodology to provide a base layer of green spaces (at urban or landscape level), based on European-wide data (Corine Land Cover - CLCplus Backbone) which is regularly updated. The methodology is recommended by the EC for European member states and cities to report on the state and progress of urban ecosystem areas.
Unit	1: Green space, 0: non-green space

Data needs and sources	• **CLCplus Backbone**, at high spatial resolution (pixel size 10 m x 10 m), pan-European wall-to-wall layer, with information for:
	  ○ Access and download of the data
	  ○ Instructions on download procedures

Steps	1. Define you perimeter and download the data for your area via wekeo.copernicus.eu (setting the bounding box to your region of interest)
	2. Clip the downloaded CLC data layer to the boundaries of your municipality (or the area of interest)
	3. Urban green spaces are defined by the NRR as the total area of the following classes:
	  a. trees (classes 2, 3 and 4)
	  b. bushes, shrubs (class 5)
	  c. permanent herbaceous vegetation (class 6)
	  d. lichens and mosses (class 8)
	  e. ponds and watercourses (class 10).
	4. Merge these areas to a layer with green spaces (land cover).
	5. Additionally, you can add accessibility details for every identified greenspace in the CLC layer (a threshold of for example 0,2 ha or 0,5 ha can be set)
	6. Create green space catchment areas based on 300-meter buffers (see MET-3.02)

Degree of uncertainty	• High: this layer gives an overview of the green spaces in the perimeter, based on the land cover. These green spaces can either be accessible or Unaccessible. The area can include brownfields or wasteland. This methodology is mainly used to create an initial basemap of greenspaces if such a map is not available from other sources.
References	**Methodological support on datasets to be used under Article 8 of the Nature Restoration Regulation, BISE**

Methodology code	MET-3.04
Title	**InVEST Urban Nature Supply**
Description	InVEST (Integrated Valuation of Ecosystem Services and Trade-offs) is a suite of open-source software models for mapping and valuing the ecosystem services. Urban InVESTincludes specific Ecosystem Service models for urban and peri-urban landscapes. The calculation of the Urban Nature Supply (InVEST Urban) uses the Two-Step Floating Catchment Area (2SFCA) method.
Unit	• Urban nature supply: the amount of urban nature supplied to the population residing in a pixel (m^2 green space per capita available) • Urban nature demand: the amount of urban nature required/demanded by the population in a pixel (m^2 green space per capita desired) • Urban nature balance: the difference between the urban nature supplied to a pixel and what is demanded by the population in that pixel

Data needs and sources	• **Land use/Land cover map (raster)** with detailed urban nature types (diverging naturalness per urban nature type can be set). Possible sources:
	  ○ Corine Land Cover
	  ○ CLCplus Backbone
	  ○ OpenStreetMap
	  ○ local landcover or GI map
	• **Population raster.** Possible sources:
	  ○ JRC-CENSUS
	  ○ Worldpop
	  ○ Local census

Steps	1. Download and install InVEST Workbench
	2. Format data:
	  a. Land Use/Land Cover raster
	  b. attribute table for Land Use/Land Cover
	  c. Population Density
	  d. others
	3. Run the model
	4. Process the resulting data in maps (using GIS software)

Degree of uncertainty	• Distances are euclidian distances (straight line), routing along roads or paths cannot be calculated. • The model does not take the size of greenspace into account (a potential workaround is using urban nature types that differentiate between the size of the area).

Methodology code	MET-3.04
Others	• InVEST Urban Nature Supply results can be presented per population group (relevant for equity considerations). • The InVEST original suite includes a different methodology to predict the spread of person-days of recreation (ES supply for recreation) based on user frequencies per nature area, proxied by Twitter and Flickr geotagged picture and tweets. Other social media are now more relevant, such as Strava, Instagram etc. • The InVEST Scenario Generator can be used to develop land use change scenarios for assessment.
References	**Methodological support on datasets to be used under Article 8 of the Nature Restoration Regulation, BISE**

Methodology code	MET-3.05
Title	**ESTIMAP Recreation**
Description	The ESTIMAP recreation model measures the capacity of ecosystems to provide nature-based outdoor recreational and leisure opportunities. It is an 'Advanced multiple layer lookup tables" model which measures the capacity of ecosystems to provide nature-based recreational and leisure opportunities. The QGIS plugin delivers maps of recreation potential, recreation opportunity, recreation demand, areas with unmet demand, and areas with met demand.
Unit	NA - output in ranges of potential or opportunity

Data needs and sources	• **Land use/Land cover map (raster)** with detailed urban nature types (diverging naturalness per urban nature type can be set). Possible sources:
	  ○ Corine Land Cover
	  ○ CLCplus Backbone
	  ○ OpenStreetMap
	  ○ local landcover or GI map
	• **Population raster.** Possible sources:
	  ○ JRC-CENSUS
	  ○ Worldpop
	  ○ Local census
	• **Water resources map**
	• **Infrastructure map**
	• **Protected areas**
	• **Local administrative units**

Steps	1. Download and install QGIS Plugin 2. Pre-process input maps (land use, natural areas, water, infrastructure) 3. Run the model 4. Process the resulting data in maps (using GIS software)
Degree of uncertainty	• Does not take accessibility of the greenspace into account.
Others	• Plugin based on land use classes from the previous version of Corine Land Cover, transformation or implementing the workflow for unprocessed maps is needed. • Greenspace maps provided by the city can be used, but pre-processing may be needed (rasterisation, recategorisation).
References	**Methodological support on datasets to be used under Article 8 of the Nature Restoration Regulation, BISE**

2.7.4 Flood mitigation

	Seed Stage	Nature Master
Ecosystem service	Regulation runoff and base flows; Regulation of peak flows; Surge and flood wave mitigation	
CICES Code	2.2.2.1 2.2.2.2 2.2.3.2	
Description	Ecosystem service based on the ability of vegetation to regulate base and peak water flows and runoff, and to store exess water in green spaces such as floodplains	
Urban level	-	**MET4.01.** InVEST Urban Stormwater Retention **MET4.02.** InVEST Urban Flood Risk mitigation
Urban & Landscape level	**MET4.03.** Nature Value Explorer - Water Retention (Qualitative)	**MET4.04.** Nature Value Explorer - Water Retention (Quantitative) **MET4.05**. iTree Avoided Run-off

2.7.4.1 Flooding mitigation urban level methods

Methodology code	MET-4.01
Title	**InVEST Urban Stormwater Runoff retention**
Description	InVEST (Integrated Valuation of Ecosystem Services and Trade-offs) is a suite of open-source software models for mapping and valuing ecosystem services. The InVEST stormwater runoff retention model provides information on two ecosystem services related to stormwater management: runoff retention, and groundwater recharge. Runoff retention has two aspects: runoff quantity, and runoff quality (nutrients and pollutants exported with the runoff water, not further described below). Retention, groundwater recharge, and surface runoff are estimated by the model for an annual time scale, rather than that of a single storm event. This model is intended to assess the more general hydrologic services provided by the landscape in response to a year's precipitation, in which primary planning concerns are related to surface water quality and water supply.
Unit	• V(RE,i): the retained volume (m^3/yr) for each pixel i • V(RU,i): the runoff volume (m^3/yr) for each pixel i

Data needs and sources	• **Land use/Land cover map (raster)** with detailed urban nature types (diverging naturalness per urban nature type can be set). Possible sources:
	  ○ Corine Land Cover
	  ○ CLCplus Backbone
	  ○ OpenStreetMap
	  ○ local landcover or GI map
	• **Soil Hydrologic Group map (raster),** describing the runoff potential for different types of soil : A, B, C, D categories through the following links:
	  ○ Earthdata NASA.
	  ○ Google Earth Engine HydroSoil Layers
	• **Precipitation (mm/year, raster)**
	• **Biophysical Table (CSV)**: runoff coefficient (RC) and percolation coefficient for every LULC class per soil group, see following links
	  ○ Suggestions on collecting runoff and percolation coefficients
	  ○ For RC
	• **Further information** for data needs and sources in the following link

Steps	1. Download and install InVEST Workbench
	2. Collect data and paramters, and format data:
	  a. Land Use/Land Cover raster
	  b. soil hydrologic group map
	  c. biophysical table)
	3. Run the model
	4. Process the resulting data in maps (using GIS software): stormwater retention ratio, retention volume, percolation ratio, percolation volume, runoff ratio, runoff volume

Methodology code	MET-4.01
Degree of uncertainty	Depending on the soil maps used, the resolution can be coarse
Others	The model is also able to calculate a monetary value for the avoided flooding (replacement cost of stormwater infrastructure, the water pollution in the runoff water (water quality) and the impact of connected impervious surfaces.
References	**InVEST Urban Stormwater retention**

Methodology code	MET-4.02
Title	**InVEST Urban Flood Risk Mitigation**
Description	InVEST (Integrated Valuation of Ecosystem Services and Trade-offs) is a suite of open-source software models for mapping and valuing ecosystem services. The InVEST urban flood risk mitigation model focusses on preventing and mitigating pluvial (or stormwater) flooding (so following a single event of heavy rains and stormwater). Related to stormwater flooding, natural infrastructure operates mainly by reducing runoff production, slowing surface flows, and creating space for water (in floodplains or basins). This model is intended to assess the services provided by the landscape in response to a single large ("extreme") storm event, in which flooding is the primary concern.
Unit	• Runoff values (mm) • Runoff retention value (m^3) • Runoff retention index (no unit)

Data needs and sources	• **Land use/Land cover map (raster)** with detailed urban nature types (diverging naturalness per urban nature type can be set). Possible sources:
	  ○ Corine Land Cover
	  ○ CLCplus Backbone
	  ○ OpenStreetMap
	  ○ local landcover or GI map
	• **Soil Hydrologic Group map (raster),** describing the runoff potential for different types of soil : A, B, C, D categories through the following links:
	  ○ Earthdata NASA.
	  ○ Google Earth Engine HydroSoil Layers
	• **Biophysical Table (CSV)**: curve number data for each LULC class for every LULC class per soil group.
	• **Area of interest (vector)**: areas for aggregated results (e.g. watersheds)
	• **Rainfall depth (in mm)** for the storm. Users can look up intensity-frequency-duration (IFD) tables available for their city. The storm duration is equal to the average time of concentration of the studied watersheds. Time of concentration can be derived from existing studies or from web tools.
	• **Further information** for data needs and sources are provided in the following link

Methodology code	MET-4.02
Steps	5. Download and install InVEST Workbench 6. Collect data and paramters, and format data: a. Land Use/Land Cover raster b. soil hydrologic group map c. biophysical table) 7. Run the model 8. Process the resulting flood risk service shapefiles (using GIS software)
Degree of uncertainty	• Depending on the soil maps used, the resolution can be coarse. • The model uses a simple approach (SCS-Curve Number), which introduces high uncertainties. However, the ranking between different land uses is generally well captured by such an approach
Others	• The model is also able to estimate the potential economic damage, and ecosystem service provided, to built infrastructure.
References	InVEST Urban Flood Risk Mitigation

2.7.4.2 Flooding mitigation urban and landscape level methods

Methodology code	MET-4.03
Title	**Water Retention (Nature Value Explorer City, VITO) - Qualitative assessment**
Description	The Nature Value Explorer qualitative assessment for water retention considers the ability of urban soils or surfaces to capture, store, infiltrate, and delay the runoff of rain-water, thereby reducing surface runoff into sewer systems and water bodies.
Unit	N/A

Data needs and sources	• **Land cover map** with detailed vegetation/green infrastructure typology. Possible sources:
	  ○ Corine Land Cover
	  ○ CLCplus Backbone
	  ○ OpenStreetMap
	  ○ Or, local land cover or GI map
	• **Qualitative scoring table** (Also, in section 2.7.5. of this technical annex): water retention class per type of land cover, 10 point scale.

Steps	1. Define lookup table (from Green Infrastructure Typology to water retention, 0 to 10) using the **qualitative scoring table** based on the existing GI types in your study area. 2. Reclassify land cover /land use map into Green Infrastructure Map 3. Convert Green Infrastructure Map in water retention map map combining it with the qualitative scoring table.
Degree of uncertainty	High uncertainty, due to the qualitative approach
References	**Nature Value Explorer**

Methodology code	MET-4.04
Title	**Water Retention (Nature Value Explorer City, VITO) - Quantitative assessment**
Description	The Nature Value Explorer qualitative assessment for water retention considers the ability of urban soils or surfaces to capture, store, infiltrate, and delay the runoff of rain-water, thereby reducing surface runoff into sewer systems and water bodies.
Unit	retention coefficient (%)

Data needs and sources	• **land cover map** with detailed vegetation typology**.** Possible sources:
	  ○ Corine Land Cover
	  ○ CLCplus Backbone
	  ○ OpenStreetMap
	  ○ local landcover or GI map
	• **Quantitative value table (% retention coeffiicient).**

Steps	1. Define lookup table, based **quantitative value table** considering the GI types existing in your study area definition. 2. Reclassify land use map 3. Convert land cover map in water retention map
Degree of uncer-tainty	• The lookup table can be difficult to compile, and will only show average values (or a range of values) based on the **quantitative value table**. • The **Quantitative value table** by the Nature Value Explorer has been developed for Belgium, but is based on data for Europe and globally; this table shows minimum and maximum water retention coefficient values. This way, it is a good estimate for the overall impact of Water retention by vegetation. • Recommended to review the **quantitative value table** or the specific look up table for the location and have it validated for the location of the assessment. • The uncertainty also depends on the quality of the land cover map.
References	**Nature Value Explorer**

Methodology code	MET-4.05
Title	**iTree ECORunoff & flooding**
Description	iTree calculates ecosystem services provided by trees, either for an individual tree, either based on a complete or sampled tree inventory. iTree ECO is a software suite that is also applicable in Europe. The iTree ECO software gives insight in avoided runoff by trees and shrubs
Unit	• runoff (m^3) • flooding (m^3)

Data needs and sources	• **Tree data** for single tree(s) or,
	• **Complete tree inventory** for a group trees (forest, woodlands, parks…)
	  ○ Corine Land Cover
	  ○ CLCplus Backbone
	  ○ OpenStreetMap
	  ○ local landcover or GI map
	• **precipitation data** (mainly integrated in the software for Europe)

Steps	5. Download and install iTree ECO 6. Prepare the project and the data 7. Upload **local tree inventory data.** 8. Run the model and interpret the data
Degree of uncertainty	Moderate
Others	• iTree ECO provides a range of figures per area unit or stratum, including composition and structure of the forest, urban forest cover and leaf area, ecosystem services provided (air pollution removal, carbon storage, carbon sequestration, building energy savings facilitated by trees and associated reduced carbon emissions, hydrology effects including avoided runoff, air pollution removal (NO_2, SO_2, O_3, CO, $PM_{2,5}$), VOC emisisons by trees, UV effects …), structural and functiponal values of trees, monetary benefits, public health benefits) • The iTree HydroPlus suite includes iTree Hydro, a model for simulating the effects of land cover changes on water quantity and quality - as it is a research-oriented model, it needs much more input and effort to generate the results.
References	**i-Tree Eco**

2.7.5 Qualitative scoring table

This table is a summary table of the lookup tables developed by VITO in the Nature Value explorer tool. It compiles the qualitative assessment for Carbon sequestration and storage, Cooling and Water retention. The aim of this specific qualitative table is to ease the application of the seed stage methods for these ESS, despite being available in the Nature Value Explorer documentation. This qualitative scoring table serves to the following methods:

- **MET-1.02.** Nature Value Explorer - Urban Cooling (Qualitative)
- **MET-2.01.** Carbon NVE methodology
- **MET4.03.** Nature Value Explorer - Water Retention (Qualitative)

Main categories	Paving and green measures	Cooling score	Carbon score	Water retention score
Green roofs	Extensive green roof	3	9	5
	Semi-intensive green roof	3	9	5
	Intensive green roof	4	9	7
Paving	Closed pavement	-1	0	0
	Green joints, grass grids and similar	3	1	3
	Semi-hardening (soil, wood chips, crushed fractions)	3	0	7
Water and moist/wet green types	Stagnant water	4	0	10
	Flowing water	5	0	10
	Wadi, infiltrationfield, infiltration-strip and similar	3	2	7
	Other wet green forms (banks, wetland, etc.)	3	2	7
Open (dry) green types	Bare soil	3	0	5
	Flower meadow and herbaceous plants	3	2	7
	Grass field, lawn and bedding plants	3	2	7
	Heathland	3	4	7
	Private gardens (lawn, borders, vegetable garden)	3	3	7
	Green space around businesses and other buildings	3	3	7
	Allotment gardens	3	1	6
	Other agricultural forms	3	1	6

Shrubs, hedges and wooded edges	Deciduous shrubs	9	4	7
	Coneferous/evergreen shrubs	9	4	8
	Mixed or unknown	9	4	7
Forest	Deciduous forest	10	10	8
	Coniferous forest	10	10	8
	Mixed forest	10	10	8
	Mantle and fringe vegetation (forest edge)	9	6	8
Trees (row)	Deciduous trees	9	6	7
	Coniferous trees	9	6	8
	Mixed/unknown trees	9	6	7
	Fruit trees	9	6	7
Facade and green walls		3	4	2
Built-up surface		-1	0	0

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