

THE FUTURE OF GREEN INFRASTRUCTURE IN THE EU: OPPORTUNITIES AND GUIDELINES

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RESUMEN

Quality of life and economic activities depend on ecosystems and the services they provide. This is especially important in urban areas where there is often a certain degree of detachment from the nature and its benefits. Nature can offer many smart and cost-effective solutions to numerous societal challenges which especially refers to challenges related to climate change, disaster management, health and well-being. When discussing nature and ecosystem services, one of the main solutions to bring the nature back to cities is the concept of Green infrastructure (GI).

When discussing the topic of nature and its benefits, especially in the context of solutions that can be planned in order to bring those benefits closer to people, it is important to note that GI is considered to be one part of a much wider concept that encompasses various individual concepts related to use of nature as a planning tool – Nature-based solutions (NBS).

The whole world, including Europe, is facing a number of challenges that arise as a result of climate change - rising temperatures, increased energy use, urban heat islands, frequent weather changes and the occurrence of extreme weather conditions, etc. At the same time, cities are still attractive places to live, and the share of residents living in them is constantly growing. This often leads to the spatial expansion of cities by occupying green areas, which at the same time contributes to the adverse impact of cities on climate change, but also weakens the resilience of cities to the effects of climate change.

There are direct environmental, ecological, economic, sociocultural benefits of Green infrastructure. Focus of the following of this paper is on initiatives and policies that were recently developed, or are in the process of developing, and have a major impact on the development of GI in the EU in the years to come – mainly the European Green Deal, Cohesion Policy, Urban Agenda for the EU, New Leipzig Charter and Territorial Agenda 2030. All of these documents and initiatives provide framework for enhancing the GI in the EU. This article processes GI and NBS in terms of European union policies and initiatives, financing opportunities and guidelines for enhancing GI and NBS.

Palabras clave: EU green policy, Nature based Solutions, climate change

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1. Introduction

Quality of life and economic activities depend on ecosystems and the services they provide.

This is especially important in urban areas where there is often a certain degree of detachment from nature and its benefits. Nature can offer many smart and cost-effective solutions

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to numerous societal challenges. This especially refers to challenges related to climate change, disaster management, health, and well-being. When discussing nature and ecosystem services, especially in the context of European urban areas, one of the main solutions in bringing nature back into the cities is the concept of Green infrastructure.

Green infrastructure (GI) has been defined in the EU Green Infrastructure Strategy 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 rather “blue”, concerning aquatic ecosystems) and other physical features in terrestrial (including coastal) and marine areas. On land, green infrastructure is present both in rural and urban settings (European Commission, 2013). Green infrastructure is considered to be a successful tool when there is a need to provide environmental, social, and economic benefits through natural solutions.

When discussing the topic of nature and its benefits, especially in the context of solutions that can be planned in order to bring those benefits closer to people, it is important to note that Green infrastructure is considered to be a part of a much wider approach that encompasses various individual concepts related to the use of nature as a planning tool – Nature-based solutions (NBS). Nature-based solutions are defined as a way to address societal challenges with solutions that are inspired and supported by nature as well as cost-effective and simultaneously providing environmental, social, and economic benefits, thereby contributing to building resilience. Such solutions bring more nature and natural features into cities, landscapes, and seascapes, through locally adapted, resource-efficient, and systemic interventions (European Commission, 2015). Green infrastructure, as well as the concepts of blue infrastructure, ecosystem-based adaptation, ecological engineering, sustainable urban drainage systems, and ecosystem services, are

often considered to be a part of a wider umbrella concept of Nature-based solutions (Eisenberg and Polcher, 2019). As many initiatives, policies and documents in the European Union often contain both concepts – NBS and GI, which are simultaneously interconnected, both concepts will also be analysed throughout this paper.

GI and NBS are often not high on the city authorities' list of priorities due to the low level of awareness of their specific environmental, social and economic benefits (e.g. positive impacts on human health, reduction of flood risks, improvement of air quality, contribution to biodiversity, improvement of quality of life, etc.). Nevertheless, these solutions play an important role in achieving sustainable urban development, especially if we consider the United Nations (2019) estimate that by the middle of this century more than 80 % of Europe's population will live in urban areas. The continuous process of urbanization, especially secondary urbanization (i.e. suburbanization) causing spatial expansion of cities, occupation of natural (green and undeveloped) areas, and intensification of energy consumption and adverse impact of cities on climate change, has led to the need to apply solutions such as GI and NBS, to strengthen the resilience of cities against the adverse effects of climate change, while mitigating the contribution of cities to them, but also to achieve the many social and economic benefits that result from the application of GI and NBS. In the EU, the awareness on the importance of these concepts and their implementation has been growing rapidly in recent years.

2. Importance of Green Infrastructure

The whole world, including Europe, is facing several challenges that arise as a result of climate change - rising temperatures, increased energy use, urban heat islands, frequent weather changes, the occurrence of extreme weather conditions, etc. At the same time, cities are still attractive places to live, and the

share of residents living in them is constantly growing. This often leads to the spatial expansion of cities by occupying green areas, which at the same time contributes to the adverse impact of cities on climate change, but also in turn weakens the resilience of cities to the effects of climate change. In addition to the above, the lack of green areas is reflected in the adverse impact on the quality of life of residents, but also on economic activity.

When considering Green infrastructure on a larger scale – i.e. that of the entire European Union, results of ESPON GRETA research (2019) show that, while most European cities encompass more than 80 % of green areas within their administrative boundaries, only three out of 500 cities that were analysed experienced an increase in urban green areas inside the core city between 2006 and 2012. Most of

these cities observed a decrease in their green areas or almost no change in the referenced timeframe. This is especially concerning when the process of continuous urbanization is considered together with increasing pressure of climate change effects (Figure 1).

Considering an increasing number of various challenges that local communities must deal with, topics related to the implementation and enforcement of GI and NBS are increasingly present in contemporary planning of urban development policies. This is due to the wide range of benefits that GI and NBS provide – such as environmental, social, and economic. It can be argued that certain types of GI can contribute to all three pillars of sustainable development.

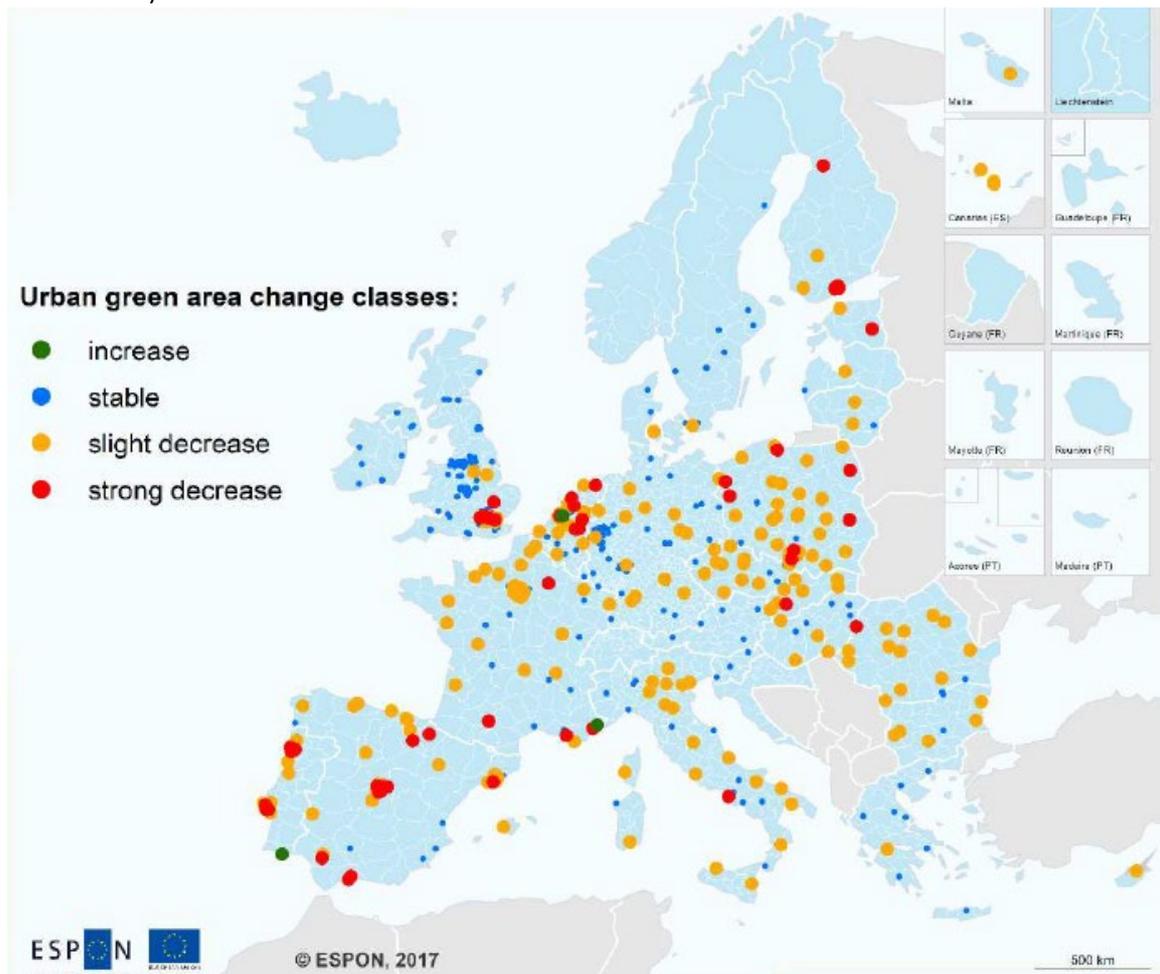


Figure 1 Changes of urban green areas inside the core city between 2006 and 2012. Source: ESPON, 2019

The direct environmental benefits of Green infrastructure are best reflected in the preservation and restoration of air, water, and soil quality. Developed Green infrastructure reduces pollution by filtering harmful airborne particles and reducing greenhouse gases, while having pronounced hydrological functions. The hydrological benefits of Green infrastructure include transport, infiltration and natural drainage, removal of pollutants from soil and water, coastal flood protection, reduction of surface flow through surface roughness and, finally, storage of water with potential for reuse. As part of runoff control, Green infrastructure works to reduce downstream erosion, improve flood control, prevent and protect against storms, improve stormwater runoff management and maintain runoff volume. The environmental benefits of Green infrastructure include enhanced environmental stability and adaptation to climate change. As part of improving environmental stability, Green infrastructure works to improve water quality and conservation, preserve terrestrial and aquatic habitats, improve air quality and reduce carbon dioxide in the atmosphere, protect biodiversity, and reduce the ecological footprint. As part of adaptation to climate change, Green infrastructure mitigates the effects of climate change and works to reduce the need for grey infrastructure. As a result of interpolation of green and water surfaces into the built urban fabric, it is possible to reduce the effect of heat islands and reduce temperatures in cities.

The effects of Green infrastructure are economically measurable. The primary economic benefit of investing in Green infrastructure stems from avoiding new and unnecessary costs. The direct economic contribution is reflected in the expected reduction of heat islands in the city, whereby decreasing the temperature in living and working spaces can lead to savings in cooling energy costs. Green infrastructure also reduces the negative impacts of extreme weather events, indirectly reducing material damage from winds, extreme rainfall, and floods. An especially important economic

benefit is the impact of Green infrastructure on improving human health and reducing investment in disease treatment. Scientific studies show an increase in the life expectancy of people in countries with a healthy urban environment. Saving on the cost of treatment of diseases caused by a polluted environment is an economically important category. Green infrastructure provides direct economic benefits also through enabling food production in urban gardens, for instance on top of buildings or in fields and greenhouses. The most visible economic effect of Green infrastructure is seen in an increase in the value of real estate.

The social benefits of Green infrastructure are directly reflected in an improvement of the quality of life in cities through spending more free time outdoors and active use of publicly available recreational, sports, cultural, health and educational facilities within or next to green infrastructure. Green infrastructure connects different social groups and encourages their interaction, serving as a countermeasure to alienation and other psychological difficulties of modern urbanity. Urban areas are becoming safer and more accessible to more sensitive or less mobile residents. City districts with landscaped and accessible parks, streets with tree-lined avenues, urban gardens and parks, in addition to green areas around residential, public, and educational buildings make everyday life more pleasant, the value of these neighbourhoods higher and more desirable for housing.

Kim and Song (2019) identify three types of GI functions: economic, sociocultural, and ecological. Within the economic function, the main type of benefit is the one of enhanced economic capacity. Within the sociocultural function they have identified several types of benefits of GI: educational opportunities, improvement of the built environment, increase in social capital and landscape aesthetics. As for the ecological function of GI, the main types of benefits are runoff control, enhanced environment soundness, and climate change adaptation.

The benefit of GI, as the basis of sustainable development, is distinguished from the three abovementioned types of functions, as it has multifunctional character (Kim and Song, 2019). (Figure 2)

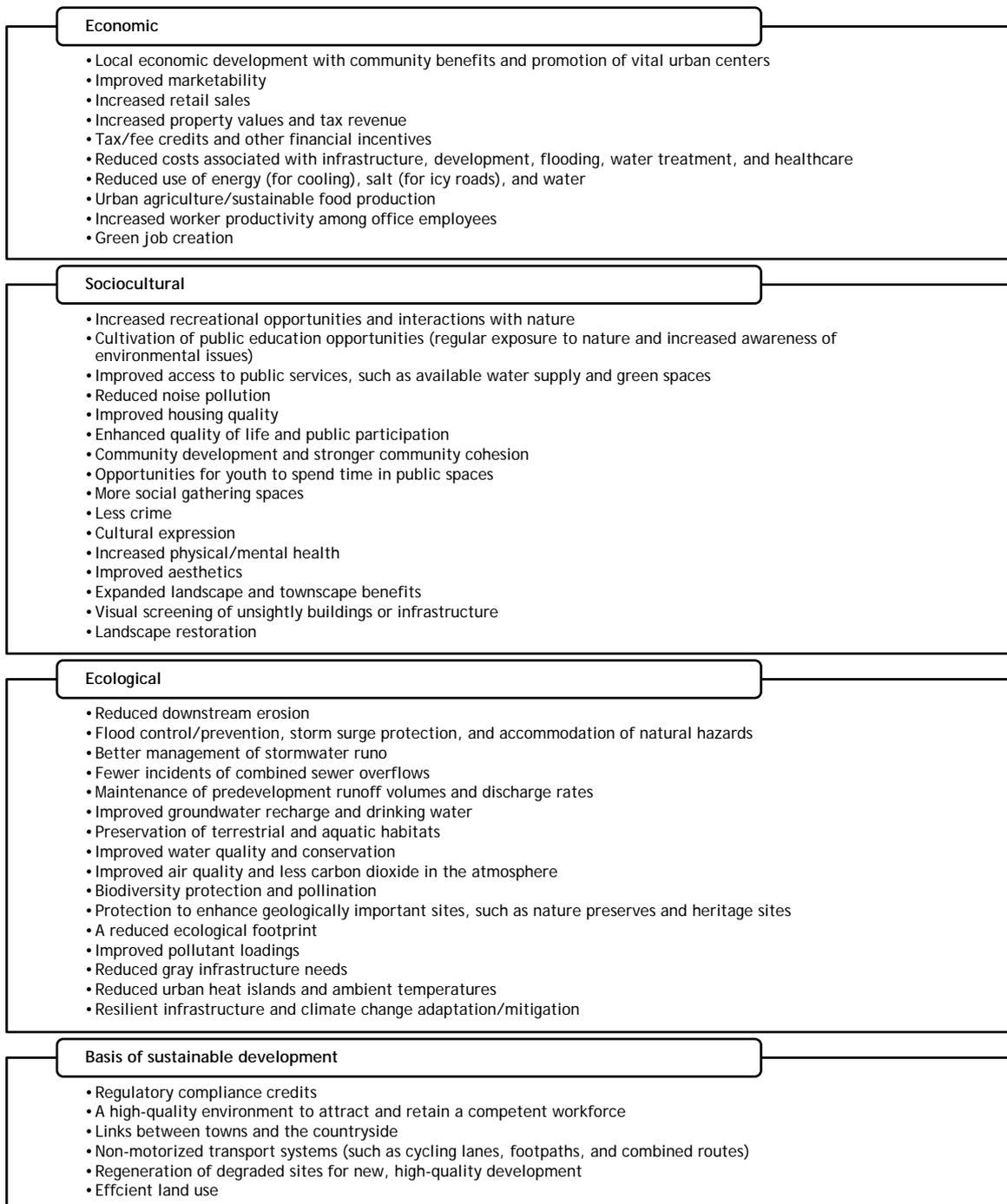


Figure 2 Benefits of Green infrastructure.

Source: Kim and Song, 2019

Due to the numerous benefits and the need to act in the direction of climate change mitigation and at the same time increase the quality of life, as well as achieve sustainable development, in the EU green infrastructure is recognized as

one of the key elements by which this can be achieved. Over the last twenty years, the presence of the concept of Green infrastructure, as well as related concepts (primarily the NBS), has been continuously growing in the EU policy

documents. At the same time, numerous programs and mechanisms for financing the implementation of green infrastructure have been developed.

A survey carried out as one of the activities aimed at developing a guide to financing the NBS under the Urban Agenda for the EU showed that 82% of the cities included in the survey have experience in implementing NBS projects. Since the concept of the NBS includes a number of other individual concepts, the respondents were asked about the type of NBS projects they have implemented so far. The results show that most projects are related to the development of green infrastructure (connecting individual green areas into a wider network), restoration of natural (green) areas in the city, mitigation of the heat island effect, projects related to sustainable drainage systems, coastal protection, rain gardens, reintegration of nature into built-up areas and arrangement of individual parks and green roofs. Here it is important to mention that many of the beforementioned types of projects were identified as the ones that have provided particularly high benefits to biodiversity (European Commission, 2020).

The most significant document regarding GI in the EU is the EU Strategy on Green Infrastructure (Green Infrastructure (GI) – Enhancing Europe's Natural Capital, 2013). The strategy promotes investments in Green infrastructure in order to restore healthy ecosystems, ensure that natural areas remain connected, and allow species to thrive across their natural habitat, with the goal of keeping the benefits that nature delivers to us. The strategy further promotes the deployment of green infrastructure across Europe as well as the development of a Trans-European Network for Green Infrastructure in Europe. Green infrastructure is a key step towards achieving success of the EU Biodiversity Strategy for 2030, the main objective of which is bringing nature back into our lives. In recent years there has been a growing num-

ber of research projects related to GI, its implementation, and benefits. These researches are largely funded through EU funding programmes, such as Horizon 2020. The results of such research projects focusing on GI lead to an increase in our knowledge of GI, and subsequently also of more intensive implementation of GI, especially in cities.

It is important to note that the Croatian presidency of the EU took place in the first part of the year 2020. The objectives of the Croatian Presidency regarding Urban Matters were to support successful implementation of the Urban Agenda for the EU and to work on the roadmap for the renewal of the UAEU. Specific topics of Croatian presidency in this regard were Green Cities – green infrastructure in urban areas and Re-use of buildings and spaces in terms of transition to a circular economy. This shows that GI is becoming more and more present in discussions at EU level.

The focus of the following sections of this paper is on initiatives and policies that were recently developed, or are in the process of being developed, and have a major impact on the development of GI in the EU in the years to come – mainly the European Green Deal, Cohesion Policy, Urban Agenda for the EU, New Leipzig Charter and Territorial Agenda 2030. All of these documents and initiatives provide the framework for enhancing the GI in the EU.

3. Green infrastructure in EU policies and initiatives

In the EU, awareness of green infrastructure is continually increasing. Most recently, the European Green Deal was adopted, which focuses on the fight against climate change and other environmental objectives in areas such as transport, energy, pollution, agriculture, circular economy, and biodiversity. The European Parliament has already stressed that the EU should cut emissions by 55% by 2030 in order to become climate neutral by 2050 and that an ambitious long-term EU budget for 2021-2027

is needed. The European Climate Law should for the first time ever include a legally binding objective of achieving a climate-neutral EU by 2050. This means emitting less carbon dioxide and removing the already emitted carbon dioxide from the atmosphere. This further requires extending the Emissions Trading System, which already helps the EU reduce emissions from the energy and industrial sectors, to other sectors. Developing cleaner sources of energy and green technologies would enable us to produce, travel, consume, and live in a more environmentally responsible way. This means developing a truly circular economy and protecting biodiversity.

Green infrastructure is a significant part of EU Cohesion Policy in the 2021-2027 period, EU's main investment policy, which defines the long-term EU budget. Furthermore, it is important to point out that we are currently in a period in which two documents of exceptional importance for urban and territorial development of the EU are being adopted. These are the New Leipzig Charter and Territorial Agenda 2030, which set the guidelines for achieving sustainable urban development and balanced territorial development at the EU level. The New Leipzig Charter is also linked to the Urban Agenda for the EU, which has been active since 2016 and has become a major initiative within the scope of which partners across Europe work together on various topics of sustainable urban development.

4. European Green Deal

The European Green Deal is a programme that was outlined in the political guidelines of the President of the European Commission, Ursula von der Leyen. It represents a new growth strategy that aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy, where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use. The

European Parliament has adopted the European Green Deal in an extraordinary plenary session on 11 December 2019.

To achieve the ambitious goals set by the European Green Deal, significant investments are needed. The magnitude of such an investment challenge requires mobilising both the public and private sector. The Commission will therefore present a Sustainable Europe Investment Plan to help meet additional funding needs. It will combine dedicated financing to support sustainable investments, and proposals for an improved enabling framework that is conducive to green investment. At the same time, it will be essential to prepare a pipeline of sustainable projects. Technical assistance and advisory services will help project promoters identify and prepare projects and access sources of finance. The EU budget plays a key role. The Commission has proposed a 25% target for climate mainstreaming across all EU programmes. The EU budget will also contribute to achieving climate objectives on the revenue side.

According to von der Leyen's political guidelines, making Europe the first climate-neutral continent is the 'greatest challenge and opportunity of our times'. The European Green Deal includes developing a new 'European Climate Law' that sets a climate-neutrality target for 2050. Pricing of carbon emissions is mentioned as a key element to ensure the contribution of every person and every sector. The Emissions Trading System (ETS) would be extended to the maritime sector, and free allowances allocated to airlines would be reduced over time. A further extension to cover traffic and construction is envisaged.

A new European Climate Pact should bring together regional and local authorities, civil society, industry and schools to agree on commitments to change the overall behaviour. Tax policies should be reformed in line with climate ambitions, which includes work on a carbon border tax and a review of the Energy Taxation

Directive. Additionally, a new Circular Economy Action Plan would promote sustainable use of resources, especially in resource intensive sectors with high environmental impact, such as textiles and construction. Europe should lead on the issue of single-use plastics, and extend the fight against plastic waste to micro-plastics.

Another objective of the European Green Deal is mainstreaming biodiversity across all policy areas and a Biodiversity Strategy for 2030, which was adopted in May 2020. Further elements of the European Green Deal include EU's zero-pollution ambition to safeguard citizens' health, and a new 'Farm to Fork' strategy for sustainable food. The European Green Deal is aligned with a new industrial strategy to render the EU a world leader in circular economy and clean technologies, and to decarbonise energy-intensive industries. The people and regions most affected by the low-carbon transition would be supported through a just transition mechanism that cuts across different funds and instruments and attracts private investment. More details on the European Green Deal are available on the following link: <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1588580774040&uri=CELEX:52019DC0640>.

European Green Deal is significant in the context of GI development, as the GI is one of the main tools that can be used to achieve the objectives outlined in the document. The European Green Deal sets out not only the priorities related to objectives that need to be achieved, but it also proposes and defines the tools which can be used to achieve the desired results. This refers to greening the national budgets and pursuing green finance and investment as well as ensuring a just transition. It is clear that the European Green Deal encourages the applica-

tion of a wide range of types of GI, as many objectives outlined in the document can be achieved only (or mostly) through increased GI implementation.

5. EU Cohesion Policy

Cohesion Policy is the EU's main investment policy and one of its most concrete expressions of solidarity. For the next long-term EU budget 2021-2027, the Commission proposes to modernise the Cohesion Policy with an emphasis on five main objectives:

1. Smarter Europe, through innovation, digitalisation, economic transformation, and support to small and medium-sized businesses;
2. Greener, carbon free Europe, implementing the Paris Agreement and investing in energy transition, renewables, and the fight against climate change;
3. More Connected Europe, with strategic transport and digital networks;
4. More Social Europe, delivering on the European Pillar of Social Rights and supporting quality employment, education, skills, social inclusion, and equal access to healthcare;
5. Europe that is closer to citizens, by supporting locally-led development strategies and sustainable urban development across the EU.²

When considering GI within the context of the EU Cohesion Policy, policy objective 2 – a greener, carbon free Europe is focused on achieving the goals which can be reached by implementing solutions related to GI. The goals of this objective are related to promoting energy efficiency and renewable energy measures, developing smart energy systems, grids and storage at the local level, strengthening of climate change adaptation, risk prevention and

² More information on the new Cohesion Policy is available at https://ec.europa.eu/regional_policy/en/2021_2027/

disaster resilience, furthering of sustainable water management and transition to a circular economy, enhancing biodiversity and spreading green infrastructure in the urban environment, and lastly, reducing pollution.

GI is an extremely important tool that can be used to achieve the abovementioned goals. More specifically, the Regulation of the European Parliament and of the Council on the European Regional Development Fund and on the Cohesion Fund (2018) proposes result indicators related to GI, where indicators on GI development are explicitly mentioned as follows: surface area of green infrastructure supported in urban areas, population having access to new or upgraded green infrastructure in urban areas, rehabilitated land used for green areas, etc. Priority objective 2 allows for integrated, cross-sectorial approaches and it provides important support/opportunities for transition towards climate neutral, circular economy.

The GI has been clearly recognized within the EU Cohesion Policy as an important tool to be used in order to achieve the objectives of the European Green Deal and other related strategies. This also means that the financial resources for GI development will be widely available through EU funding, which provides opportunities to intensify GI implementation across the EU.

5.1. Urban Agenda for the EU

The Urban Agenda for the EU was launched in May 2016 together with the Pact of Amsterdam. It represents a new multi-level working method promoting cooperation between Member States, cities, the European Commission, and other stakeholders in order to stimulate growth, liveability and innovation in the cities of Europe and to identify and successfully tackle social challenges.

The Urban Agenda for the EU focuses specifically on three pillars of EU policymaking and implementation: better regulation, better funding, and better knowledge.

From the aspect of better regulation, the Urban Agenda for the EU focuses on a more effective and coherent implementation of existing EU policies, legislation, and instruments. Drawing on the general principles of better regulation, EU legislation should be designed so that it achieves the set objectives at minimum cost, without imposing unnecessary legislative burdens. It recognises the need to avoid potential bottlenecks and minimise administrative burdens for urban authorities.

Regarding the second pillar - better funding - the Urban Agenda for the EU aims to contribute to identifying, supporting, integrating, and improving traditional, innovative and user-friendly sources of funding for urban areas at the relevant institutional level, including from the European Structural and Investment Funds (ESIF) (in accordance with the legal and institutional structures already in place) in view of achieving effective implementation of interventions in urban areas. The Urban Agenda for the EU does not create new or increased EU funding aimed at higher allocations for urban authorities. However, it draws from and conveys lessons learned on how to improve the funding opportunities for urban authorities across all EU policies and instruments, including the Cohesion Policy.

Lastly, the Urban Agenda for the EU aims to contribute to enhancing the knowledge base on urban issues and exchange of best practices and knowledge. Reliable data is important for portraying the diversity of structures and tasks of Urban Authorities, for evidence-based urban policy making, as well as for providing tailor-made solutions to major challenges. Knowledge on how Urban Areas evolve is fragmented and successful experiences can be better exploited. Initiatives taken in this context will be in accordance with the relevant EU legislation on data protection, the reuse of public sector information and the promotion of big, linked, and open data (Pact of Amsterdam, 2016). Detailed information on the Urban Agenda for the EU are available on the official

website of the UAEU: <https://ec.europa.eu/futurium/en/urban-agenda>.

In 2019 two assessment studies of the EU Urban Agenda were carried out – one by the European Urban Knowledge Network (EUKN) and the second one by the European Commission. Urban Agenda was generally marked as positive, and the future actions were supported. All recognised shortcomings of the agenda, mostly related to implementation, will be considered while creating a new roadmap for the future Urban Agenda.

The actions within the Urban Agenda are currently being finalized - 12 out of 14 Action Plans have been completed and their implementation is coming to an end. Regarding the GI within the Urban Agenda for the EU, the most significant partnership is the one of Sustainable Use of Land and Nature-based Solutions (SUL NBS). The general aim of the SUL NBS partnership is to ensure efficient and sustainable use of land and other natural resources, to help create compact, liveable, and inclusive European cities for everyone. In the Partnership's Action plan, a total of nine actions was defined, whereby concrete results are expected to contribute to solving some of the most significant challenges related to sustainable land-use and nature-based solutions. These are the following:

- Including land take and soil properties in impact assessment procedures;
- Funding and financing guide for brownfield redevelopment;
- Identifying and managing under-used land;
- Indicators of land take;
- Promoting FUA cooperation as a tool to mitigate urban sprawl;
- Better regulation to boost NBS at European, national, and local levels;
- Better financing on NBS;
- Awareness raising in the areas of NBS and

sustainable use of land (urban sprawl);

- Agreeing on common targets and indicators for nature-based solutions, urban green infrastructure, biodiversity, and ecosystem services in cities.³

The SUL NBS partnership encompasses two aspects – sustainable land use and nature-based solutions. One of the most important issues related to urbanisation in the EU is continuous consumption of agricultural and natural land by urban growth. Diffused, low-density, sprawled cities show much higher levels of GHG emissions and air pollution due to longer traveling distances, as well as more energy consumption and land take. Consequently, sustainable strategies often promote compact urbanisation and are mostly characterised by provision of green areas, improved accessibility, optimised consumption of energy and resources, reduced pollution and land consumption, affordable housing, social inclusion, and good quality of life. An identification of efficient instruments and practices is crucial to achieve sustainable land-use. Importance of the NBS is recognized within the partnership, especially in the context of contributing to sustainable land use. As already mentioned, GI can be seen as one element within the concept of NBS (it can be argued that GI is actually a dominant element within the NBS umbrella, due to its significance and extent of implementation and recognizability). Therefore, it can be concluded that GI is an important aspect of SUL NBS partnership and the Urban Agenda as a whole.

Based on the abovementioned, it is clear that the partnership has two main objectives. The first one is related to promoting the liveable compactness city model, while the second one is to mainstream and promote the NBS. The partnership focuses on the priority of supporting sustainable land use through promoting

³ Detailed information on all of the actions is contained within the SUL NBS Action Plan which is available online on the following link:

https://ec.europa.eu/futurium/en/system/files/ged/sul-nbs_finalactionplan_2018.pdf

compact city development, reducing urban sprawl, and minimising land-take, while NBS are regarded as one important tool in achieving sustainability. It is important to note that both sustainable land use and NBS have the capacity to reduce costs associated with running cities. They can boost ecological potential, support increased health and well-being of residents, and address environmental challenges.

Regarding Action plan implementation, as it can be seen from the actions presented earlier, they also focus on these two aspects - sustainable land use and NBS. In the context of GI, actions related to NBS are extremely relevant as they improve the knowledge, regulation, and information on the funding opportunities for NBS, including GI. The NBS actions aim to achieve several goals. The first one refers to both the European and national level, where actions aim to achieve a further level of integration to boost the implementation of NBS across cities in Europe. The second goal is related to the city level, where the partnership proposes to work on a review of existing funding mechanisms and on the development of appropriate minimum legal requirements, targets and indicators to be included within local strategies and planning instruments. Finally, at local level (neighbourhood, local scale), the Partnership wants to raise public awareness on NBS and their potential, and to include social issues within the design of such solutions (through co-creation with civil-society) (Sustainable Use of Land and Nature-Based Solutions Partnership Action Plan, 2018).

Several problems arise when implementing NBS into the urban structures of European cities. It can be said that, even with all the programmes and regulations, the concept of NBS has not been comprehensively integrated within the current EU legislation, which leads to issues related to the NBS' funding and financing. One of the key issues related to NBS implementation seems to be an information deficit with regard to existing financing opportunities, but also potentially higher investment

costs or perceived higher financing costs relating to NBS, with uncertainty what benefits will be seen in the long run. There are obstacles and structural barriers that complicate the blending of public and private financing and loan financing and grants. The full potential of NBS implementation in cities cannot be achieved without raising awareness and mainstreaming NBS funding options. Various challenges appear when the mentioned problems need to be solved. One of the most common challenges with NBS implementation is the bias and familiarity of authorities and local population toward existing and technically well-known solutions, patterns and routines as well as established interest and perception of higher initial investments cost in NBS that usually drives away potential investors. However, there are solutions that can be applied in order to make a great difference and improve the degree of NBS implementation in urban areas.

As NBS are not yet a standard form of solution used in urban planning, there is a need for motivation that can be achieved in different ways like financial benefits, through better visibility and familiar faces that are relatable and connected to the NBS or by legal requirement. Increased awareness about funding sources can reduce the pressure on the city on how to finance the NBS projects, which will lead to their greater implementation. One of the outcomes of the SUL NBS Partnership is also a guide that gathers all the information on available funding, methods and funding options, including both private and public funds, NBS reference framework and good practice examples of NBS projects implemented in EU cities (Sustainable Use of Land and Nature-Based Solutions Partnership Action Plan, 2018).

As it has been already mentioned, current partnerships of the Urban Agenda are finishing their work (apart from no. 2). Therefore, there is a need to ensure a coherent framework for the future urban development (as it was defined in the Bucharest Declaration - it is necessary to define the future of the Urban Agenda

and its relations to the new Leipzig Charter. Assessment results from EUKN and EC are at hand, and they can be a valuable resource of information and a starting point for drafting a new urban agenda. The European Commission identified the following key strengths and achievements of the Urban Agenda. Multi-level cooperation is seen as relevant and as qualified success. Also, stakeholders willing to invest in UAEU see it as a long-term project. The partnerships and action plans were set up in a relatively short time frame, the topics are relevant and plenty of Actions are progressing, while the UAEU has become a common framework for the EU urban policy. However, the Commission has also identified some shortcomings, such as the uncertainty of implementation of actions, heavy reliance / burden on active, engaged members with subject matter expertise, lack of involvement of some member states, certain DGs (other than REGIO) and some other stakeholders (because they perceive less benefits). Also, the guidance for the thematic partnerships and UAEU governance is widely seen as quite ineffective. There is a perceived lack of resources and a need for better cooperation across thematic partnerships and for integration in overall EU policy framework (European Commission, 2019).⁴

With these assessments at hand, we have an opportunity to improve all the identified shortcomings, and to build on good experiences. It is also important to note that the funding for the future UAEU is being prepared and there have been positive signals from the incoming new Commission regarding the new Cohesion Policy. Also, the setting for the necessary agreement on guidelines for the future UAEU is available: the German Presidency of the Council of the EU is planning to organise an informal Ministerial Meeting in Leipzig in late 2020. Therefore, a final draft of the new Urban Agenda

should be prepared by the time this meeting takes place. Furthermore, there is a need for process coordination of the Urban Agenda and the new Leipzig Charter. The new Leipzig Charter is currently being drafted, and its draft as well as the Implementation document for the new Leipzig Charter, have taken into consideration the conclusions of the assessment studies and the importance of continuing the work of the Urban Agenda for the EU. Therefore, it is expected that Urban Agenda partnerships will continue to be important aspects of urban development in the EU, including the continuation of work on the topics of NBS and GI. This presents opportunities for local, regional, and national authorities and organizations across the EU to join the partnerships and to contribute to the development of GI in urban areas.

5.2. The New Leipzig Charter

In 2007, the European Ministers for Urban Development and Regional Planning adopted the Leipzig Charter on Sustainable European Cities. The aim of the Leipzig Charter 2007 was to establish a city-wide Integrated Urban Development in order to strengthen and further develop European cities. Today, cities deal with new challenges that arose in the last 13 years, that is – since the adoption of the Leipzig Charter. German Presidency of the Council of the EU is preparing a new Leipzig Charter, where these new challenges will be recognized, and new guidelines and goals will be defined in order to continue the strengthening of the European cities.

The new Leipzig Charter is relevant not only from the aspect of its relation to the Urban Agenda for the EU, but also from the aspect of emphasizing the importance of further development of GI in urban areas across Europe. Draft of the new Leipzig Charter highlights “the green city” as one of the three dimensions of

⁴ Assessment study of the Urban Agenda for the European Union is available at: https://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/assess_uaeu_en.pdf

transformative power of European cities. It is stated that “the transformative power of cities contributes to combatting global warming and to high environmental quality for air, water, soil and land use. The development of high-quality urban environments for all includes adequate access to green and recreational spaces” (The New Leipzig Charter draft, 2020). Furthermore, the document states that well-managed and connected green and blue areas are a precondition for healthy living environments, adapting to climate change and preserving biodiversity in cities. The importance of the quality of public spaces including green and blue infrastructure as well as the preservation and revitalisation of built cultural heritage, is strongly emphasized. Additionally, the new Leipzig Charter identifies that cities need the steerability and shaping of infrastructure, including, among other, green, and blue infrastructure. GI is also emphasized in the context of wider urban regions – that is – core cities and their connection with surrounding suburban and rural areas.

Finally, when considering land use planning and land policies, one of the key elements to ensure resilient and long-term development is land-use favouring green and blue infrastructure, which will increase urban biodiversity and enable climate-neutral and environmentally sound urban development. Based on the abovementioned, it can be concluded that within the discussion on urban matters, GI is extremely important. This is largely due to the multifunctionality of GI and its numerous benefits that contribute to achieving a wide array of development objectives. It is clear that GI in urban areas is strongly supported through various documents and initiatives at the EU level, which indicates that the support when deciding to implement GI will be easier to gain.

5.3. Territorial Agenda 2030

The Territorial Agenda 2030 (TA2030) is a document which represents a continuation of work of Territorial Agenda 2011 on the topics of te-

rritorial development across the Europe. TA2030 is currently being drafted, however, due to a significant emphasis on GI and other aspects that can be achieved through GI development, the importance of TA2030 should be noted in the context of this paper. Furthermore, emphasizing the GI within the TA2030 provides a certain degree of support to stakeholders wishing to develop GI with the goals of contributing to territorial development.

To begin with, it should be mentioned that one of the two objectives of TA2030 is “Green Europe”, and the other “Just Europe”. From the very start, territorial development based on green and sustainable solutions has been promoted within TA2030. Within the objective of Green Europe three priorities have been defined: healthy environment, circular economy, and sustainable connections. Although solutions related to GI can be recognized within most of the priorities, they are explicitly mentioned within the priority of “Healthy environment”. Within this priority, it is stated that TA2030 supports the development of nature-based solutions and green and blue infrastructure networks that link ecosystems and protected areas in spatial planning, land management and other policies (Territorial Agenda 2030 draft, 2020). Document also proposes possible mitigating and adaptive actions related to climate change, which include sustainable land-use, open and public green spaces, restoration of degraded land and coast, combatting deforestation, preserving oceans and water bodies, preventing urban sprawl and urban heat islands, implementing green infrastructure, improving air quality, no net land-take by 2050, strengthening the delivery of ecosystem services, and improving the integration of terrestrial and maritime spatial planning. From the previously mentioned it can be concluded that GI, while also being explicitly encouraged, is a tool that can contribute to achieving numerous other goals that are being mentioned (e.g. Improving air quality, strengthening the delivery of ecosystem ser-

vices etc). More information on TA2030 is available at <https://www.territorialagenda.eu/home.html>.

Although it is not yet in its final form, TA2030 strongly promotes the development of GI and related concepts. GI within TA2030 will have a significant impact on overall GI development across the EU, as Member States align their policies related to spatial planning and territorial development with EU level documents such as TA2030. This will strongly contribute to sustainable development based on GI and all the benefits it provides.

6. Financing Opportunities for the Implementation of Green Infrastructure and NBS Projects

Financing opportunities for project implementation are often the most important aspect of their preparation and implementation decision. For the project to be realized in accordance with the planned design and plan, it is necessary to provide sufficient financial resources. Speaking of the NBS, it is important to point out that NBS solutions in cities are rarely implemented through stand-alone NBS projects but are more often parts of larger projects or investment programs aimed at urban renewal. For example, NBS solutions can be applied in the implementation of various types of infrastructure projects, such as revitalization of brownfield areas, improvement of transport infrastructure, landscaping, development of residential or economic zones, and the like. It is therefore important to keep in mind the importance of broad thinking when it comes to the possibilities of financing the NBS, given that they can be financed within a wide range of projects of different types. Therefore, it is extremely important to strengthen the visibility of the NBS within larger urban projects that improve various aspects of the city.

As part of a survey conducted during the implementation of the Urban Agenda for the EU action aimed at developing a guide for NBS funding, respondents (representatives of cities

across the EU) listed the financial instruments through which they financed the implementation of NBS projects. Respondents mostly highlighted the European Structural and Investment Funds (ESIF) - primarily the European Regional Development Fund and the Cohesion Fund. This was followed by own budget/funds, EES Grants, state and regional subsidies, Horizon 2020, support from private investors and funds raised through donations. It is noticeable that EU funds and related investment programs are of exceptional importance.

The analysis of existing financial instruments and mechanisms shows how NBS projects can be financed from a large number of sources, whether it is NBS financing through the implementation of an independent NBS project or as financing NBS as one element of a larger and more comprehensive infrastructure project. In accordance with the stated complexity, the structure of financial instruments and potential financing mechanisms of NBS projects is presented below, presented according to the basic characteristics, the model of functioning and the goals to be achieved by their application.

The models that can be used to finance NBS projects in cities are divided into the following types:

- Instruments and mechanisms to increase public budget funds available for investment
 - Instruments within this model are related to measures aimed at increasing a city's revenue (e.g. land value tax, tax increment financing, strategic land asset management etc.), city receiving external funding (e.g. ESIF, EU programs such as Connecting Europe Facility, Horizon 2020, Interreg etc.), and city receiving external finance (e.g. European fund for strategic investments, EIB loans, Natural Capital Financing Facility etc.).
- Instruments and mechanisms that reduce the cost of investment from the public

budget by involving private sector developers

- Instruments within this model refer to the risk and benefit sharing between a city and a private developer (eg. public-private partnership), actions of city reducing the private developer's cost of financing (loan guarantees or tax incentives), and actions where city increases the private developer's cash-flow (e.g. development fee waiver, reduction or refund, subsidies and grants etc.).
- Alternative financing models developed outside the traditional (classical) financing system
 - Alternative financing models include those mechanisms and financial instruments that have emerged relatively recently as options that have not traditionally been encountered within the financial system. These models represent additional and innovative financing options for NBS projects for city authorities and other investors (e.g. blended finance, citizen cooperatives, crowdfunding, energy performance contracting, on-bill financing, etc.).
- It is important to emphasize the importance and availability of financial instruments that support the use of often necessary technical assistance in the development and preparation of the projects themselves. Some of the instruments that provide technical assistance are European Energy Efficiency Fund (EEEF), European Local Energy Assistance (ELENA), HORIZON 2020 project development assistance, etc.

Given the large number of different instruments and models of NBS financing, a database containing a list and description of all possible NBS financing options currently does not exist. As mentioned earlier, a similar guide is presently being developed as part of the SUL

NBS partnership. However, more detailed information on a large number of the mentioned instruments can be found at <https://www.covenantofmayors.eu/support/funding.html>.

Despite a large number of financing instruments available for NBS projects, it is important to point out that there is no single combination of instruments that would suit all types and models of NBS implementation, especially if we look at the broad level of the EU and its many member states. The use of individual financial instruments, or a combination of them, needs to be defined at the level of individual projects, given their nature, complexity, investors, strength of the public budget, availability of various funds, additional sources of funding and other characteristics.

7. Guidelines on Enhancing Green infrastructure

Encouraging the further development of green infrastructure and the NBS as an umbrella concept that combines a number of approaches involving the application of nature-based solutions is extremely important for achieving several goals defined at EU and global level. Given that green infrastructure is most often developed in the context of its importance at the local or regional level, it is necessary to encourage the action of stakeholders from these levels to improve the development of green infrastructure. On the other hand, at the national level it is necessary to create favourable preconditions and a framework that enables the development of green infrastructure, i.e. the implementation of projects related to its development.

At the national scale it is important to integrate GI across policy areas, which means including GI into strategic documents, policies, and legislation. Furthermore, and related to the previous point, it is important to develop national action plans on GI development to facilitate the implementation of the EU Strategy on Green Infrastructure in the national context. ESPON

(2020) states the importance of increasing awareness about GI in the national context, as well as ensuring the availability of data related to GI and spatial planning, but also to provide training on economic evaluation of GI development. When considering lower territorial levels, such as the one of regions, here it is important to take into account synergies and trade-offs between ecosystem services. This should be done to evaluate all the positive and negative impacts that certain types of GI can have in a wider area, and to use that information to make a proper decision. At regional scale, ESPON (2020) also recommends planning for GI implementation in adaptive cycles.

When considering the implementation of GI on a local scale, it is important to adopt a GI approach in planning, which means integration of different sector policies and different levels of governance in the planning process. When considering GI implementation, it is necessary to identify existing assets and opportunities, but also to identify benefits that a certain type of GI can have on a wider area. Planners and decision-makers should identify and quantify the main benefits and challenges of implementing GI for strategic planning and development, regardless of the scale of governance. When considering funding of GI projects, they should be a sustainable investment opportunity as part of the EU's integration of sustainability into financial policy frameworks while accounting for social, environmental and governance considerations (ESPON, 2020).

As the GI is a part of a broader concept of NBS, it is useful to present the recommendations on enhancing the NBS development in order to contribute to the intensification of the implementation of the NBS and green infrastructure. It is therefore important to improve the existing knowledge base, especially regarding the benefits of the NBS. Evidence of the long-term benefits and cost-effectiveness of NBS projects helps decision-makers to choose this approach, as opposed to traditional "grey" solutions. One of the priorities in encouraging the

implementation of the NBS in cities across Europe (and the world) is the development of a common single framework for monitoring the implementation and evaluation of the benefits of the NBS. There is a need to develop a range of indicators that will cover the overall broad picture of the benefits arising from the application of the NBS. Furthermore, it is necessary to strengthen cooperation and interaction between different disciplines and to adopt a participatory approach in the development of the NBS and green infrastructure. There is a multitude of views and systems of knowledge relating to the interactions between man and nature, which are central to the NBS. Taking them into account when developing and evaluating the NBS is crucial and requires a multidisciplinary approach as well as mutual cooperation of different actors.

Since the costs of individual NBS projects and solutions can be extremely high, it is necessary to develop products and solutions that are easy to replicate and apply. If the technical performance of the NBS solution, taking into account the overall costs that occur throughout the project life cycle (installation, operation, maintenance costs), would prove competitive in the market, it would support the selection of NBS solutions compared to traditional "grey" solutions.

Dissemination of knowledge is a crucial factor for the establishment and wider application of each new concept. In other words, it is very important to inform not only all potential stakeholders important for the implementation of the NBS, but also the overall public in order to consolidate this type of solution as a common and popular practice compared to other typical and existing practices. Networking can also be crucial for the purpose of disseminating knowledge about the NBS, in particular, participation in networks, associations, and other organizations, which are related to the development and dissemination of knowledge about the NBS, can be extremely important. In addition, it is important to work continuously on the

development of new financial and business models related to the financing and maintenance of NBS projects.

Policies at different levels and between different sectors are often very fragmented. Harmonization of legislation at international, national, regional, and local levels is crucial to ensure and encourage the implementation of the NBS, but also to encourage sustainable urban development in general. It is necessary to revise the development policies at the local level and clearly direct them towards achieving the goals related to the NBS. It is also important to point out that there are conflicts and inconsistencies in regulations at different levels, especially the EU and the national levels of the Member States, and they need to be harmonized. For example, directives should be clearly systematized and should form a cohesive legislative framework. Furthermore, they should be accepted and further elaborated (specified) at the national, regional, and local levels, taking into account specific development needs and potentials. The NBS presents multidimensional projects and solutions for the preparation, implementation, and management regarding which traditional management models and systems are often insufficient. In order to

properly prepare and implement NBS projects, it is necessary to explore innovative management systems, compatible with the characteristics of the NBS as solutions that often require a multi-sectoral approach, understanding the time aspect of implementation and the benefits of NBS, numerous financing options and the like. This requires an assessment of the effectiveness of existing policies while supporting cross-sectoral approaches and cooperation between different levels of government (Somarakis *et al*, 2019).

Given the numerous and wide benefits provided by the NBS and the GI, it is necessary to continuously work in accordance with the above-stated recommendations and guidelines in order to contribute to sustainable development at all levels, from local to European. The EU has recognized the importance of these concepts and is continuously adapting and shaping funding policies and development frameworks in a way that encourages and facilitates the implementation of GI. Numerous documents and programs that exist or are currently being drafted emphasize the importance of GI, which opens up numerous opportunities for its development at the EU level.

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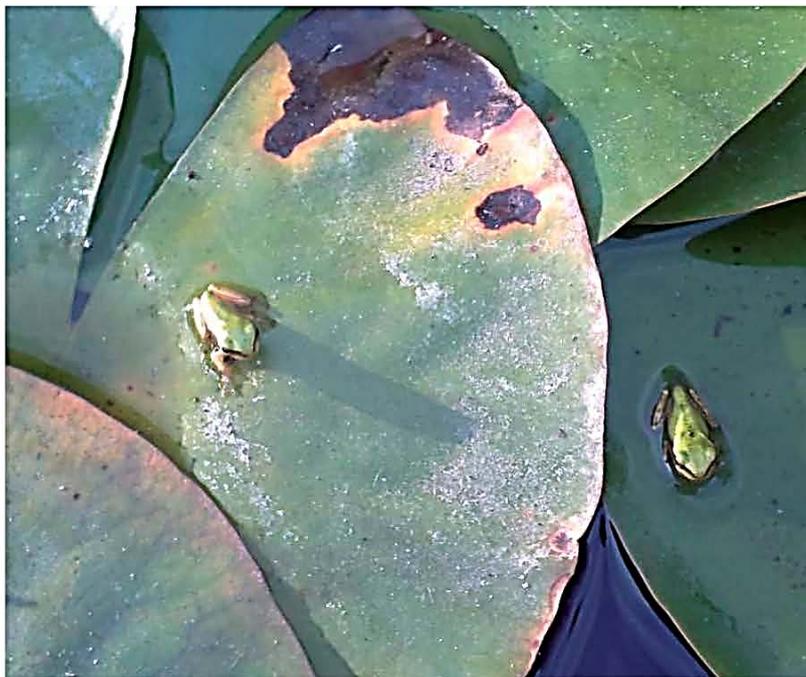
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5. Managing parks, gardens and other green spaces with sustainability and efficiency criteria, fostering biodiversity

Reducing demand for water in green areas by using groundwater resources, undertaking comprehensive pest and disease control actions, using the most suitable soils, making use of plant remains and ultimately implementing management and maintenance procedures tailored to each type of vegetation... All these actions should allow city residents to enjoy a first-class urban natural heritage. Resource efficiency and optimisation are two pivotal concepts when it comes to implementing a sustainable urban greenery management model. The following actions are envisaged:

- 5.1 To improve the management of green spaces and street trees.
- 5.2 To prepare park dossiers.
- 5.3 To develop a park and garden rehabilitation programme following rationalisation criteria.
- 5.4 To optimise irrigation carried out in green areas.
- 5.5 To implement a biodiversity-friendly pest, disease and weed management programme.
- 5.6 To replace high water consumption lawns with warm climate cespitosa plants and carpeting plants.
- 5.7 To develop a protocol of action for greenery management in the event of weather-related incidents.

Galanthus



Jardins de Mossèn Cinto Verdaguer

Barcelona green infrastructure and biodiversity plan 2020
https://ajuntament.barcelona.cat/ecologiaurbana/sites/default/files/Barcelona_a%20green%20infrastructure%20and%20biodiversity%20plan%202020.pdf