A Cross-border Review of Green Infrastructure Planning Methods and Differences

Vera Iváncsics[23] – Krisztina Filepné Kovács[24] – Klaudia Máté[25] – István Valánszki[26] – Paloma Gonzalez de Linares[27] – László Kollányi[28]

Abstract

The research presents the different practices of green infrastructure (GI) development between countries and groups of countries. The concept of GI, published in the United States in 1996 (Benedict, M. A. – McMahon, E. T. 2006), was adopted all over the world. However, the practical transposition of a complex concept at a theoretical level differs in many countries, with unique aspects focusing on the country's culture. After studying the concept of GI, the study analyses the practice of European countries based on given criteria and then characterises their practice. According to our results the integration of GI into legal system is not a common solution, rather uses the member states manuals or strategies for implementation. The objectives have been formulated according to existing nature conservation system. The existing mapping systems followed the MAES[29] Atlas. The implementation of GI is strongly connected to social initiatives; however, very few states facilitate effectively the bottom-up implementation and financial schemes. Thanks to this research, the currently developed GI implementation in Hungary can be integrated into international trends.

Keywords: green infrastructure, policy, European Union, strategy

23 Doctoral School of Landscape Architecture and Landscape Ecology, Szent István University, Hungary; vera.ivancsics@gmail.com
24 Department of Landscape Planning and Regional Development, Szent István University, Hungary; filepne.kovacs.krisztina@tajk.szie.hu
25 Doctoral School of Landscape Architecture and Landscape Ecology, Szent István University, Hungary; mate.klaudia@gmail.com
26 Department of Landscape Planning and Regional Development, Szent István University, Hungary; valanszki.istvan@tajk.szie.hu
27 Doctoral School of Landscape Architecture and Landscape Ecology, Szent István University, Hungary; paloma.gonzalez.de.linares@gmail.com
28 Department of Landscape Planning and Regional Development, Szent István University, Hungary; kollanyi.laszlo@tajk.szie.hu
29 Mapping and Assessment of Ecosystems and their Services

I. Introduction

The phenomenon of green infrastructure (GI) goes back to the concept of Benedict and McMahon, from 1996 (Benedict, M. A. – McMahon, E. T. 2006). Although the basic principle (the relationship between human society and nature (flora and fauna, biodiversity) has been formulated in the UN Biodiversity Convention from 1992. The European Union adopted the concept in the Europe 2020 Strategy: for smart, sustainable and inclusive growth (EC 2010a) and namely mentioned first in EU Biodiversity Strategy to 2020 (EC 2010b). In 2013 a Green Infrastructure Strategy was adopted 'to promote the deployment of green infrastructure in the EU in urban and rural areas', as the key step of implementation of GI. According to these documents GI is *'a strategically planned and managed network of wilderness, parks, greenways, conservation easements, and working lands with conservation value that supports native species, maintains natural ecological processes, sustains air and water resources, and contributes to the health and quality of life ...'* Of course, several other understandings exist for green infrastructure in different strategies, publications. According to our findings the new aspects of GI are the following:

- ⊕ emphasizes the interaction between natural areas and the society (Benedict, M. A. – McMahon, E. T. 2006; Communities and Local Government 2008; Natural England 2009; Jaluzot, A. et al., 2011; Naumann, S. et al. 2011; EC 2012; 2013a);
- ⊕ it's scope of examination extended for water / water surfaces (blue infrastructure), in some cases, the infrastructure of artificial elements (grey infrastructure) beyond natural elements (Davies, C. et al., 2010; Jaluzot, A. et al., 2011; Naumann, S. et al. 2011; EC 2013a);
- ⊕ thinking in network, its aim is the development of the network (Benedict, M. A. – McMahon, E. T. 2006; Communities and Local Government 2008; Natural England 2009; Davies, C. et al. 2010; Naumann, S. et al. 2011; EC 2012; 2013a);
- ⊕ high importance of environmental aspects (like air or water quality) (Communities and Local Government 2008; Natural England 2009; Siemens 2009, 2012);

- ⊕ the different scales of examination: from extensive areas to the dots can play an important role depending on their location and function (Natural England 2009).

As the 2. Target of EU Biodiversity Strategy is maintaining and restoring ecosystems and their services, namely improvement of GI, the implementation has been started in all EU Member States in the 2014–2020 programming period. As GI is strongly connected to other EU and national (environmental, urban, disaster risk reduction, marine and coastal, etc.) policies several ways of implementation have occurred. In lines with following methodology the article gives an overview of these implementation methods emphasising some examples from European countries.

II. Methodology

To bring out the overview of different implementation technologies, a literature review was made according to the following research questions:

- ⊕ How is the GI aspect integrated into the legal system?
- ⊕ What is the main objective of GI planning?
- ⊕ What kind of monitoring and mapping systems are applied?
- ⊕ What are the main tools for the implementation of GI development?
- ⊕ What typical means of realisation and financing schemes can be identified?

To have an overall picture we used the Biodiversity Information System for Europe database and collected the relevant information (homepage[30] of Biodiversity Information System for Europe). Country specific documents were also included in the research. The different aspects were analysed with the help of collected and organised information. Good or extraordinary examples were emphasised for each aspect (based on the experiences of Kollányi L. et al. 2017).

III. Results

According to the methodology our results had been summarized in the following table *(Table 1)*.

30 https://biodiversity.europa.eu/countries/gi – 2018. 04. 26.

country	characteristics of governance system	A: act about GI development activities, tools, etc.	B: metho-dological manual or recommen-dation	C: existing mapping systems	D: planning method
Austria	federal	×	×	✓	⬮
Belgium	federal	×	✓	✓	⬮
Bulgaria	unitary	×	×	✓	⬮
Croatia	unitary	×	×	✓	⬮
Cyprus	unitary	×	×	×	⬮
Czech Republic	unitary	✓	×	✓	⬮
Denmark	unitary	✓	×	✓	⬮⬯
Estonia	unitary	×	✓	✓	⬮⬯
Finland	unitary	×	×	✓	⬮
France	unitary	×	✓	✓	⬮
Germany	federal	×	✓	✓	⬮
Greece	unitary	×	×	✓	⬮
Hungary	unitary	×	✓	✓	⬮
Ireland	unitary	×	×	✓	⬮
Italy	unitary	✓	×	✓	⬮
Latvia	unitary	×	×	×	⬮
Lithuania	unitary	✓	×	×	⬮
Luxembourg	unitary	×	✓	✓	⬮
Malta	unitary	×	✓	✓	⬮⬯
Netherlands	federal	×	✓	×	⬮
Poland	unitary	×	✓	✓	⬮
Portugal	unitary	✓	×	×	⬮
Romania	unitary	×	×	×	⬮
Slovakia	unitary	×	✓	✓	⬮
Slovenia	unitary	×	×	×	⬮
Spain	unitary	×	×	✓	⬮
Sweden	unitary	×	✓	×	⬮⬯
United Kingdom	unitary (federal)	×	✓	✓	⬮⬯

Table 1: Summary about the cross boarder overview of the EU28 countries
A: y / n; B: y / n; C: existing / not found; D: top-down / bottom-up / both
Source: compilation of the authors based on the data of Biodiversity Information System for Europe and Council of European Municipalities 2011

III.1. Implementation into legal and institutional system and existing methodological framework

Of course, each European country has legislation that refers to nature conservation, biodiversity or spatial planning. According to our source (homepage[31] of Biodiversity Information System for Europe), none of the states mention the green infrastructure as a phenomenon in their legislation. Although most of the countries (17) have a strategy or manual that explicitly mention GI development. Other countries incorporated the policy goal to their existing system and implement on other levels of policy making or it is an ongoing process (like in Spain). The implementation in most of the countries is a top-down process embedded in the current regulatory and administrative system. Just in a few countries can be found consultative or bottom-up techniques, like in Denmark, Estonia, Sweden and the United Kingdom *(Table 1)*.

United Kingdom: There is no overarching or specific urban GI policy framework in the United Kingdom. In England the Department for Communities and Local Government and the devolved are responsible for the planning and water management issues. However, most of the plans and regulations related to the urban GI are relatively similar, since they have common heritage. National planning policy provides specific guidance on the integration of green infrastructure principles (homepage[32] of Biodiversity Information System for Europe – United Kingdom).

In England, the National Planning Policy Framework (2012) provides advice and guidelines for planning. In Scotland, national guidance on GI emphasizes the importance of creating distinctive and sustainable places (Scottish Government, Scottish Planning Policy, 2014 and National Planning Framework, 2014). In Wales the Environment (Wales) Act provides an overarching framework for environmental policy centred on securing the sustainable management of natural resources (Future Generations Commissioner for Wales, Well-being of Future Generations (Wales) Act, 2015). In Northern Ireland, GI is promoted through the Regional Development Strategy 2035, which provides a spatial strategy to guide the public and private sectors (Northern Ireland Executive 2012).

31 https://biodiversity.europa.eu/countries/gi – 2018. 04. 26.

32 https://biodiversity.europa.eu/countries/gi/united-kingdom – 2018. 04. 26.

Wider GI as more broadly defined in the EU GI strategy is conserved and enhanced through the biodiversity, environment, and marine plans and strategies in each of the four countries. National Biodiversity Plans and Strategies are coordinated through the UK Post-2010 Biodiversity Framework (JNCC – Defra 2012). All the strategies are supported by stakeholder's partnerships involving government, conservation agency, NGO, academic and business organizations (homepage[33] of Biodiversity Information System for Europe – United Kingdom). Many NGOs emphasize the importance of protecting and enhancing GI (e.g. Wildlife Trusts – Living Landscape initiative, UK Green Building Council, Greenspace Scotland) (homepage[34] of The Wildlife Trusts). The Green Infrastructure Partnership is a network of more than 1000 people and organizations that promote GI in the UK (Town and Country Planning Association 2018).

III.2. Objectives of the framework

The EU communications highlight the wide range of benefits of green infrastructure network from improving biodiversity to protection against climate change and other environmental disasters and the EU stresses the need of integration of GI into other policy fields (EC 2012). Despite this complexity the framework of GI development only in some countries is connected to other policy issues, like climate change, green economy, flood protection or tourism. The starting point of the GI framework in every country is the existing regulation that is always based on natural conservation systems and the already existing Natura 2000 network. In addition to this the maintenance of biodiversity, protection of the habitats is also a core element of the strategic objectives.

At the level of strategic goals ⅔ of the countries are thinking in network and aim to fill in the gaps of existing ecosystems. The importance of ecosystem services – as a new paradigm of environmental policy – is not a common objective, only 9 countries from the 28 mentioned at the highest strategic level. Landscape and spatial protection appears only

33 https://biodiversity.europa.eu/countries/gi/united-kingdom – 2018. 04. 26.

34 http://www.wildlifetrusts.org/living-landscape/our-vision – 2018. 04. 26.

in 12 countries as a priority at the highest strategic level, it is often connected to touristic interests (for example: Bulgaria, Cyprus). In some countries we see a quite strong urban and local focus in GE development objectives for instance, in the UK and Hungary.

Finland: Finland doesn't have an explicit GI regulation but the protection and the objectives related to the GI network are integrated into the traditional landscape protection policy of the country. Environmental awareness and nature protection are strong in Finland so all sectoral regulations include GI related objectives but the most important integrative tool is the spatial planning act and the national planning guidelines. The Finnish conditions form the special topics of GI, as ecologically sustainable forestry and the rehabilitation of mires and peatlands. As 76 percent of the country's territory is covered by forest and the forestry methods remain traditional, just a few percent of the forests are ecologically valuable, natural forests, so a crucial question of GI development, is to ensure the sustainable, multiple use of land by harmonizing ecological, economical and socio–cultural objectives of forest management. There is a wide range of protected areas but it is important to follow land use planning objectives, to prevent the fragmentation of unbroken natural areas. A special attention is paid to development and continuity of urban green areas (homepage[35] of Biodiversity Information System for Europe).

III.3. Mapping systems

The mapping system of GI is a core element of the monitoring fulfilment of European targets and indicators. That is why the European Commission developed the MAES Atlas and most of the countries have joined to this system (homepage[36] of MAES Atlas). In 5 countries there are only territorial maps and in 11 countries the development of a mapping system is a still ongoing process. Despite of MAES there are other examples, which exist in parallel, such as national or local mapping systems. The methodology of these fits to international standards (assessing ecosystem services, habitats, Natura 2000 territories, etc.), and only rarely can be reached on an interactive homepage. Good examples are: Germany, Poland Spain, etc. A lot of European cities are joined to the EnRoute project (Enhancing Resilience of

35 https://biodiversity.europa.eu/countries/gi – 2018. 04. 26.

36 https://biodiversity.europa.eu/maes/maes-digital-atlas – 2018. 04. 26.

Urban Ecosystems through Green Infrastructure) in the framework of MAES, e.g. Karlovo, Leipzig, Limassol or Tallinn. EnRoute aims to promote the application of urban green infrastructure at local level and delivers guidance on the creation, management and governance of urban green infrastructure *(Table 1)*.

Germany: The German methodology is a good example for green infrastructure planning. Germany has a National Green Infrastructure Concept which is a spatially defined integrated concept and it helps to incorporate existing nature conservation and landscape management concepts and models into national planning processes, such as floodplain development, national road planning, defragmentation and expansion of ecological networks (BfN 2017). The German methodology has a very strong GIS basis. The backbones of Germany's green infrastructure are the protected sites and ecological networks included the Natura 2000 sites, the national parks, the biosphere reserves (core and buffer zones), the nature conservation areas and national nature monuments. They have taken into account the ecologically valuable habitats and species and their habitat networks, axes, corridors. In particular, these axes/corridors also possess a European dimension. Their links to other countries form the foundation for the implementation of the European Commission's strategy (EU Biodiversity Strategy to 2020) (EC 2010b). They defined the bottlenecks in the habitat structure, and they filled the ecological gaps with green infrastructure elements. The German experts used the available datasets, no new data were gathered. Therefore the maps and graphics show different levels of detail (Mayer, F. – Schiller, J. 2017).

III.4. Policy tools

The implementation techniques show great variety in different countries. The common solution is the integration of green infrastructure in the already existing implementation methods, at the following fields: nature protection, agriculture, forestry, and relevant marine and coastal policy. Very different solutions exist in urban policies. They mostly depend on the administrative structure of the country and the specific needs of the cities. The relationship between spatial planning and green infrastructure planning is also a challenging task in policy making in several countries. Innovative examples are also found for

involving private partners into green infrastructure planning, like in Belgium, the Netherlands ('Green Deals') or the United Kingdom, etc.

The example is the French system, because it has a great variety of policy frameworks and programs for integrating green infrastructure planning into spatial planning schemes. These are not compulsory but reflect on different problems of cities, areas, like planning urban fringe territories *(Table 1)*.

France: In France the main green infrastructure strategy is the Green and Blue Network (GBN) (Le Grenelle de l'environnement 2010; Ministère de la Transition écologique et solidaire 2018a; 2018b). The main objective is to protect biodiversity in urban and rural areas and resolve landscape fragmentation. The communes follow the Regional Ecological Coherence Scheme elaborated by the and the state and integrate the GI plan in their local plan regulations: the Local Urban Plan (PLU) and the Framework for Territorial Coherence (SCOT). It is clearly defined that the GBN plan cannot be strictly limited to administrative boundaries as green and blue corridors cross borders. This brings neighbouring communes to build intracommunal strategy plans and agree on reconversion or development of river beds, coasts and green corridors. This can result in planning urban forests, the reconversion of agricultural lands and woodlands. Other programs can be used to act on the communal scale and the territorial scale. The Climate Plan sets goals and strategies for different topics which can be related to the green and blue corridor. The Agenda 21 sets local governance programs such as Zero Pesticides Program in urban green spaces or the Neptune Program for protection of water resources. Communes must also follow the guidelines from the SAGE and the SDAGE which are frameworks for planning within watersheds, defined by the actors in charge of the water resources in their watershed, according to the European Water Framework Directive (Nantes Métropole 2018).

III.5. Financing schemes

According to our research all of the member countries use EU funds to finance GI development. Most of these are dedicated sources to the countries, but a lot of programs are realised by international programmes, like LIFE, Transnational Programmes, Interreg Programmes. Of course, national budget also plays a great role in financing GI, not just because

of the co-financing mechanism, but because of the nature conservation activity of the state. In some cases, municipalities also devote to their GI development, like in Vienna, Munich and all the cities launched for European Green City Award. Other innovative solution which is able to integrate private capital to this issue is rare. Good examples can be found in Denmark (PPP programme), Ireland (private initiatives), Malta and the United Kingdom.

United Kingdom: In the United Kingdom the development and management of GI are financed by a wide range of public and private funds. Public funds, contribute to GI initiatives are the followings: agro–environment measures funded through EU CAP Rural Development Programmes, conservation and restoration projects through LIFE–Nature, national and state funding for environmental projects (homepage[37] of Biodiversity Information System for Europe – United Kingdom). Plenty of projects have received various national or territorial funding for GI development, e.g. The Big Tree Plant to support planting at least 1 m new urban trees (homepage[38] of Forestry Commission England), The Big Lottery Fund to improve the quality of historic parks and cemeteries (homepage[39] of Big Lottery Fund), in London The Big Green Fund to create high quality open spaces in 11 areas (homepage[40] of London Assembly).

The Natural England in the Green Infrastructure Guidance collected a wide range of innovative, alternative options for GI funding. GI funding can come from a range of government departments and public agencies, based on the policy objectives supported or delivered by GI. Some examples of multi-agency public sector grant funding are: Safer and Stronger Communities Fund (SSCF), Heritage Lottery Fund (HLF), Environmental Stewardship schemes, English Woodland Grant Scheme. Tax initiatives are good options: ring-fencing of local taxes, Business Improvement Districts (BIDs). Bonds and commercial finance possibilities are also existing e.g. endowments, voluntary sector involvement, income generating opportunities, including private sector funding (Natural England 2009).

37 https://biodiversity.europa.eu/countries/gi/united-kingdom – 2018. 04. 26.

38 https://www.forestry.gov.uk/england-bigtreeplant – 2018. 04. 26.

39 https://www.biglotteryfund.org.uk/global-content/programmes/england/parks-for-people – 2018. 04. 26.

40 https://www.london.gov.uk/what-we-do/environment/smart-london-and-innovation/big-green-fund – 2018. 04. 26.

IV. Discussion

Our paper aimed for a comparison between different implementation schemes of GI in the European Union. As GI development is strongly supported by the European Union, the implementation is monitored by European Commission and publishes the results for each member state. Thanks to this database we have the following experiences.

The implementation techniques are mostly based on existing structures of national environmental policies. Where federal or decentralised operation is institutionalised, the implementation is focused on territorial or local authorities. Apart from these schemes GI is not institutionalised in legal system although several manual or strategy helps the implementation with recommendations or methodology. As GI is a multifunctional aspect and several economic sectors are concerned the effectivity of GI development highly depend on the effectiveness of spatial planning.

At local level, especially cities tend to devote more attention to their GI infrastructure and organise their strategic framework according to this. Also, inhabitants tend to pay more attention to their neighbourhood. That is why this level of implementation can be more effective and broad partnerships could be an effective support.

At landscape or EU level the Natura 2000 network is the core element of GI development, although it does not reflect all the important aspects of GI (grey infrastructure, connection with social, urban territories). The most focus of GI development is the connection of Natura 2000 elements.

Although several policy tools exist for nature conservation, the new aspects of GI require new, social innovative solutions. The implementation is almost top-down, next to the professional bodies the activity also needs to be facilitated. The funding of GI is not a European but a territorial and local interest and it is rarely mirrored in financial schemes.

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