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Inspire Policy Making with Territorial Evidence

GRETA BRIEFING 1 //

Unpacking Green Infrastructure

August 2019

https://www.espon.eu/green-infrastructure

What is Green Infrastructure?

*The European Union defines this 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[1].* See Box 1 for key features and see Figure 1 (next page) for an illustration of green infrastructure elements and services.

Green infrastructure includes natural elements (e.g. forests, grasslands, linear vegetation elements, single trees, rivers, ponds) and artificial features (e.g. fauna tunnels and fish passes) that enable structural and functional connectivity of species and habitats.[2] On land, green infrastructure is present in urban, peri-urban and rural settings.

Box 1. Key Features of Green Infrastructure

- Connectivity – creating networked geographical areas.
- Multifunctionality – performing several functions while also providing valuable ecosystem services.
- Multi-scale approach – integrating spatial planning across urban, peri-urban and rural settings.

This briefing is a resource for those interested in understanding and integrating the benefits and challenges of green infrastructure into decision making. It is of relevance for individuals making decisions for the monitoring, planning, and development of green infrastructure at all scales - urban, peri-urban and rural settings.

[1] European Commission. 2013. Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions 'Green Infrastructure (GI) — Enhancing Europe's Natural Capital'.

[2] Structural connectivity is a property of the landscape features and their spatial arrangement, whereas functional connectivity refers to the behaviour of species and eco logical processes across the landscape. European Commission. 2012. In depth report by the DG Environment News alert Service, 'The Multifunctionality of Green Infrastructure'.

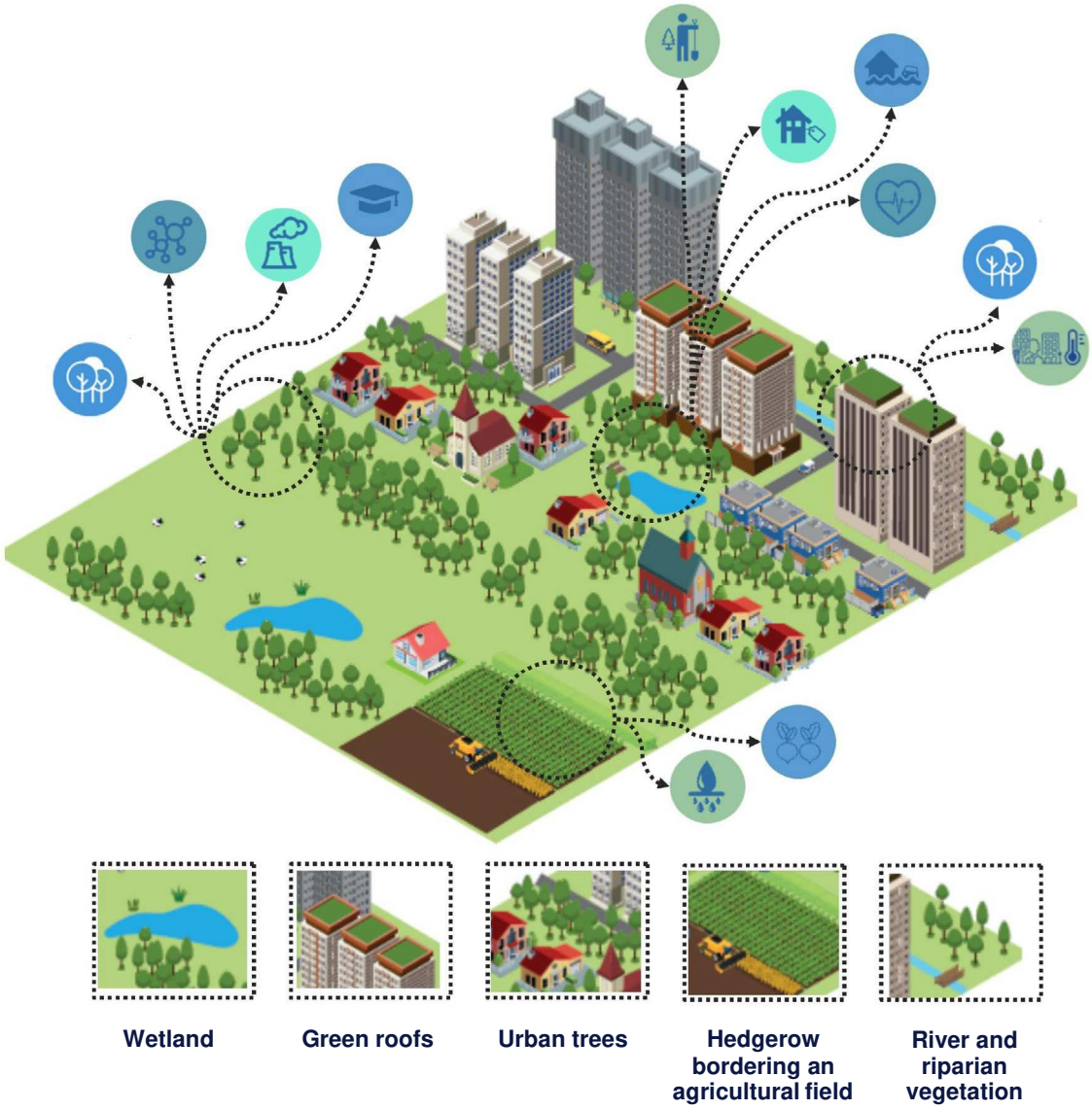


Figure 1. Illustrative example of potential components of green infrastructure and related benefits across spatial scales. Icons illustrate services provided, while the boxes present a selection of green infrastructure elements. For definition of icons please see Figure 2. This is not intended to be an exhaustive list. [*Source: Elaboration by GRETA research team.*]

Why is green infrastructure important?

In Figure 2 the benefits provided by green infrastructure are divided into environmental, social and economic benefits. As the figure illustrates, green infrastructure provides multiple benefits, for both people and the natural environment. These benefits are scale and context dependent. This means that the benefits of green infrastructure vary in importance between urban, peri-urban and rural areas. These variations in scale and context are illustrated in Figure 2. In addition, green infrastructure aims to be multifunctional in its approach - such that many of these benefits are provided at the same time.

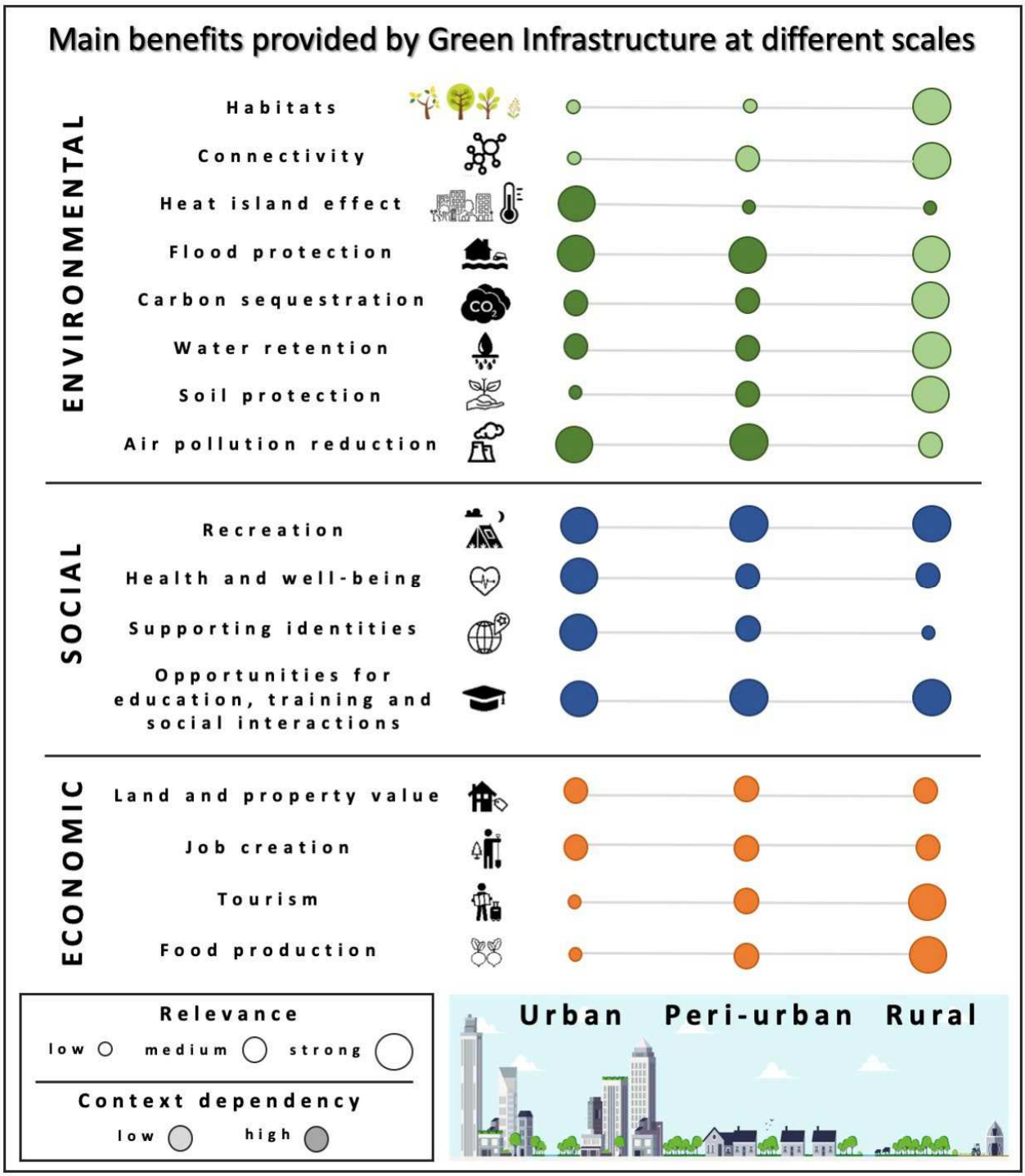


Figure 2. Main benefits provided by green infrastructure at urban, peri-urban and rural scale with indication of relevance and degree to which benefits are context dependent. The size of the circle represents relevance, and the opacity denotes context dependency. Following a literature review and consultation with stakeholders, only the environmental benefits were considered to be context-dependent. [*Source: Elaboration by GRETA research team. Icons from https://thenounproject.com/; see image credits at end of Briefing*]

What does Green Infrastructure look like in practice?

There are many different reasons for creating or enhancing green infrastructure and integrating green infrastructure activities into policy making. We provide four In Practice examples (Boxes 2-5) for inspiration of how areas around Europe are using green infrastructure. For additional good practice examples, see the GRETA final report and scientific annexes[3].

Box 2. In Practice: Blue-green network for multiple benefits

Seven Lochs Wetland Park, Scotland

[Image source: http://hornermaclennan.co.uk/posts/competition-launches-for-seven-lochs-wetland-park]

Established in 2016, the Seven Lochs Wetland Park is located between three major roadways within the peri-urban surrounds of Glasgow, Scotland. At over 16km^2, the network of lochs, ancient woodland, reedbeds and grasslands is one of Scotland's largest urban heritage and nature parks. Using a partnership model that draws funding from multiple sources and sectors, the restoration, enhancement and connectivity aims to address environmental, social and economic issues by (i) providing habitat for biodiversity conservation; (ii) management of water in an area which is expected to have hotter weather with increased number of high intensity storms under climate change scenarios; (iii) providing a place for recreation and learning to enhance health and well-being and sense of identity; and (iv) through development of visitor centers offer to opportunities for employment. [http://sevenlochs.org/]

[3] The GRETA project Scientific Annexes are found here https://www.espon.eu/green-infrastructure

Box 3. In Practice – Tailored management practices for enhanced green Infrastructure

Bratislava Karlova Ves District, Slovakia

[Image source: CEE web for Biodiversity (2018) Smart and Green: The future of Visegrad cities]

In 2016, new practices were adopted for the maintenance and management of public green spaces such as city parks and those integrated into residential areas and administrative buildings. Lawn mowing routines, especially during the summer heat and dry seasons, now include leaving some areas that are less mown than others, and flowering meadows are being formed. These actions aim to provide food, shelter and 'travel corridors' for insects and pollinators, and are considered also a valuable way to increase the visual attractiveness of the area, decrease CO_2 emissions (e.g. from mowers) and keep more humidity. Additional actions include: (i) building 'insect hotels' (wooden structures of logs and other materials with holes for nesting, hibernation, etc.); (ii) creating herb and insect spirals (walls of dry stones built in a spiral shape which helps warm and dry light soil); (iii) creating piles of boughs, stones, hay, dead leaves for hibernation of hedgehogs, and heaps of stones and sand for lizards and slow; (iv) using native species and eliminating the use of invasive species of plants and trees; (v) planting trees and providing relevant tree care; and (vi) creating wet areas and water retention and infiltration areas.

Box 4. In Practice – Wildlife corridors for linking hubs for green infrastructure connectivity

Natuurbrug Zanderij Crailoo, Netherlands

[Image source: https://www.atlasobscura.com/places/natuurbrug-zanderij-crailoo]

Wildlife crossings can act as links to reconnect fragmented habitats. The Natuurbrug Zanderij Crailoo (translated as 'sand quarry natural bridge'), located in the province of Noord-Holland near the cities of Hilversum and Brussum, connects heathland and woodland areas. It provides a 50m wide, 800m long passageway for animals such as badgers over a motorway, railway line, business park and sports complex. Started in 2002 and completed in 2006, the project cost 14.7 million euros and was initiated by the Gooi Natuurreservaat Foundation. The ecoduct connects the Gooi with the Utrecht Heuvelrug, restoring the connections and creating the second contiguous forest and heathland area in the Netherlands. The bridge also provides bicycle and horse-riding trails for multi-functional benefit. [https://gnr.nl/ de-natuur-in/gebieden/zanderij-crailoo/]

Box 5. In Practice – Urban 'hub' creation for green infrastructure

LifeMedGreenRoof Project, Malta

[Image source: https://www.timesofmalta.com/articles/view/20161028/local/a-green-valletta-one-roof-at-a-time.629285, http://www.lifemedgreenroof.org/?page_id=189]

Green roofs are roofs over buildings or other structures which are covered partially or completely with cultivated plants. They can be an important type of 'hub' for integrating green infrastructure into built-up urban areas; providing multiple benefits such as reduced localized flooding, increased wildlife habitat (e.g. for pollinators), reduced use of energy (e.g. for air conditioning). The LifeMedGreenRoof (2013-2017) project in Malta demonstrated the feasibility and benefits of green roofs in the Mediterranean context where the technology is not as wide spread as in Northern European countries. 'Best practice' guidance was developed for the construction of green roofs in Malta, including growing medium (substrate) and the types of native plants that could be used. Monitoring of the insulation properties and storm water retention provides baseline information for the performance of the technology in a hot, dry climate. The project also generated technical skills and 'know-how' for replication of the technology within Malta, and generated recommendations for how to integrate the technology into the planning system and construction industry through, for example, direct (e.g. subsidies, grants, low interest loans) and indirect (e.g. soil sealing fee) financial incentives, regulation and policy (e.g. building regulations, planning permissions). [http://www.lifemedgreenroof.org/]

Are there side effects from green infrastructure?

As with any development, green infrastructure has potential side effects that are important to be aware of, and to mitigate as much as possible. Box 6 lists common side effects, and how to avoid them.

Box 6: Green infrastructure side effects and precautionary guidance[4]

- **Eco- (or green) gentrification –** Creating new or 'upgrading' existing green infrastructure can bring new residents to the area. This can be problematic if existing residents can no longer afford to live there. Sometimes the character of a neighborhood and community changes through loss of local distinctiveness and cultural heritage.
  - **What can be Done**: To achieve equitable distribution of benefit, apply an integrated and inclusive approach by incorporating social justice principles when planning green infrastructure. Such an approach should involve including neighborhood residents in the planning process (taking care to include a wide range of economic and demographic characteristics), implementing changes gradually, and considering small-scale projects that would be implemented in neighborhoods across all urban areas. Where green infrastructure is intended to provide housing opportunities, several anti-gentrification policies can be implemented. These include the provision of affordable housing and housing trust funds, while shared equity housing projects can also allow residents to become more involved in the greening of their neighborhood.

- **Economic –** There is a common misconception that the high costs associated with initiating and maintaining green infrastructure, as well as the costs of purchasing or leasing land and properties, will lead to a net cost to society. This is often due to a lack of understanding and knowledge concerning the multiple benefits that green infrastructure provides, and the lack of ability to account for these benefits. As a result, it can be difficult to accurately calculate the benefits-costs balance of green infrastructure projects and to demonstrate that GI can provide net benefits to society. This in turn can discourage implementation at different stages (design, planning and construction) and the management process (long-term funding and maintenance).
  - **What can be Done:** Putting a 'learning-by-doing' approach into practice, based on scientific results and led by multi-disciplinary teams has been identified as key to removing these barriers and addressing economic misconceptions.

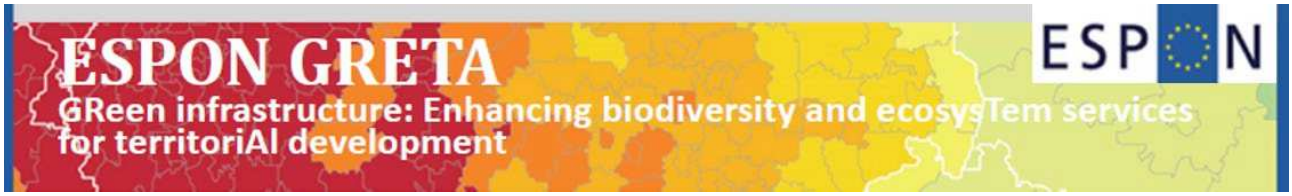
- **Ecological downsides** – Among the ecological downsides are the risk of invasion by alien species, water pollution from fertilizers and other chemical inputs, or higher levels of water consumption. Urban green spaces have contributed to the introduction of alien species, especially plants, but this is also true for other taxa. Depending on conditions, these species may spread and colonize new areas, becoming invasive. When green infrastructure is fully integrated in a network of green areas, it may act as a dispersal highway for these invasive species.
  - **What can be Done:** Use native species which are adapted to local conditions in order to reduce water use and minimize the spread of alien species. Consider selecting plants that will be adapted to the future climate.

- **Human health effects –** In a more urbanized setting, if the green infrastructure is used for food production, negative health effects can arise. Adverse effects on human health from the consumption of food produced in urban sites, via the uptake and accumulation of trace metals in plant tissues, differs according to crop type, species, and plant parts. Differences in trace metal concentrations depends on local traffic, crop species, planting style and building structures, but not on vegetable type. Additional considerations include the possibility of increased sources of allergens.
  - **What can be Done:** Strategically plan where to encourage community gardens and include provisions to 'shield' existing gardens from traffic. In this context, the presence of large buildings or masses of vegetation can act as barriers between crops and roads – reducing pollutant content. Invest in transport infrastructure to reduce pollutants from traffic, e.g. charging points for electric vehicles, bicycle lanes.

[4] These side effects and precautionary measures are mainly focused at the urban and peri-urban scales. For more detail concerning green infrastructure in rural settings, these are available in the main GRETA report.

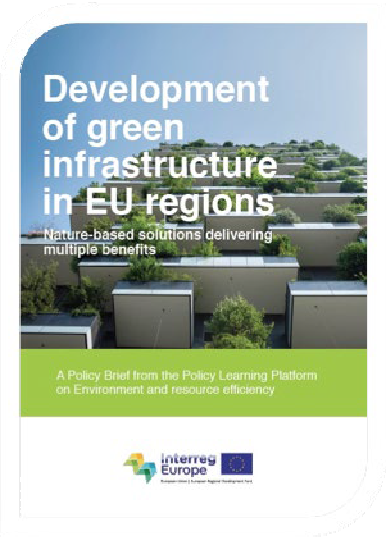
What is the importance of understanding green infrastructure?

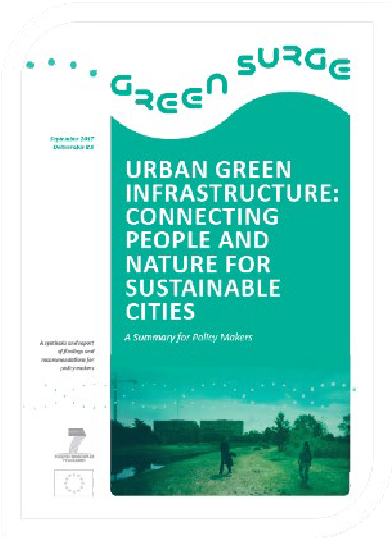
- Identifying and quantifying the benefits and challenges of green infrastructure is important for strategic planning and development of European regions and cities, providing options which link environmental, social and economic benefits within a single space, which may not be provided by traditional grey infrastructure.
- The outcomes of planning decisions can be improved using existing knowledge and data (about benefits and potential side effects) in order to quantify the multiple benefits and costs of implementing green infrastructure.
- Context matters in green infrastructure, particularly the type of infrastructure and its spatial configuration. Understanding this context improves quantification of the benefits and negative impacts, improving accuracy of planning decisions.



Resources on Green Infrastructure

The GRETA project draws from and builds upon other relevant research and policy recommendations. Three of these are highlighted here as additional resources[3]. See also GRETA Briefing 2 (Incorporating Green Infrastructure into Spatial Planning through the Strategic Environmental Assessment) and Briefing 3 (Planning for green infrastructure: Methods to support policy and decision-making).





Bridge: https://pixabay.com/photos/bridge-japanese-garden-arch-park-53769/. Icons: Connectivity Populat from Noun Project; Heat Island Effect Vectors Market from Noun Project; Flooding Adrien Coquet from Noun Project; Carbon sequestration ProSymbols from Noun Project; Water Retention Carlos Dias from Noun Project; Soil Protection Prettycons from Noun Project; Recreation Ben Davies from Noun Project; Health and Wellbeing Rediffusion from Noun Project; Supporting Identities myiconfinder from Noun Project; Education Adrien Coquet from Noun Project; Land and Property values Luis Prado from Noun Project; Job creation Dan Hetteix from Noun Project; Tourism Adrien Coquet from Noun Project; Food Production Made from Noun Project; Air Pollution Amos Kofi Commey from Noun Project

[3] - Interreg Europe. 2017. Development of green infrastructure in EU regions. Nature-based solutions delivering multiple benefits. A Policy Brief from the Policy Learning Platform on Environment and resource efficiency.

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The ESPON EGTC is a European Grouping on Territorial Cooperation. ESPON started in 2002 and have continued since then building a pan-European knowledge base related to territorial dynamics.

As part of a renewal and upgrade of ESPON for the period 2014-2020 and beyond, an EGTC has been established according to European law to act as Single Beneficiary and deliver the content envisaged by the ESPON 2020 Cooperation Programme.

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