Background paper

Green Infrastructure – Expert Workshop

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Ecologic Institute, Berlin

In co-operation with:

GHK Consulting

Institute for European Environmental Policy (IEEP)

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1 Introduction

1.1 Background

Ecosystems provide services and goods such as food and freshwater which are crucial for human well-being. These functions are threatened by the ongoing fragmentation and deterioration of ecosystems in Europe. Green infrastructure[1], which in a nutshell can be defined as a network of green areas and features in rural and urban landscapes, can enhance the resilience of species and ecosystems in adapting to climate change while securing multiple benefits for biodiversity and humans and ensuring the provision of ecosystem services and goods. The EU is currently developing a strategy on green infrastructure which will contribute to the EU 2020 biodiversity policy (COM(2011) 244 final)[2] and thus achieving the goals of EU biodiversity policy.

Several projects have been launched by the European Commission to support the development of the EU strategy on green infrastructure. One of these projects, "Design, implementation and cost elements of green infrastructure projects" (carried out by Ecologic institute and GHK), aims to establish a comprehensive overview of current green infrastructure projects being implemented throughout Europe. Another related project, coordinated by the Institute for European Environmental Policy (IEEP), concentrates on the effectiveness and efficiency of national and regional green infrastructure initiatives in terms of biodiversity and broader ecosystem benefits and the impact of relevant EU policies on green infrastructure. These studies offer complementary bottom-up and top-down perspectives on green infrastructure measures, assisting in the development of a clear and applicable concept of green infrastructure for future policy-making.

1.2 Aim of the expert workshop

The aim of the workshop is to discuss lessons learned from the two aforementioned projects as well as recommendations for future policy making. Experiences from green infrastructure practitioners will be shared and followed by a world cafe discussion, including relevant stakeholders, such as practitioners, scientists and representatives from the EU, national and regional administrative bodies, professional organisations and NGOs. The results of the workshop will help to strengthen green infrastructure in regional, national and EU policies and encourage green infrastructure initiatives at all spatial levels.

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[1] ***Green infrastructure*** *is the network of natural/semi-natural areas, features and/or green spaces in rural and urban, terrestrial and coastal areas, which together enhance ecosystem health and resilience, contribute to biodiversity conservation and benefit human populations through the enhancement/maintenance of ecosystem services. Green infrastructure can be defined, enhanced and conserved through strategic and co-ordinated* ***initiatives*** *that focus on the creation of new areas/features or recognize the value of and/or connect existing areas/features. (working definition of the project)*

[2] Aim of target 2 of the EU biodiversity strategy to 2020: "By 2020**,** ecosystems and their services are maintained and enhanced by establishing **green infrastructure** and restoring at least 15 % of degraded ecosystems."

1.3 Structure of the background paper

Chapter 1 gives a general introduction to the role of green infrastructure and aim of this workshop. Chapter 2 presents the first findings from the analysis undertaken in the both projects “Design, implementation and cost elements of green infrastructure projects” (led by Ecologic Institute) and “Green Infrastructure efficiency and implementation” (led by IEEP). The key questions derived from this analysis and listed at the end of each topic will be discussed with the invited participants at the workshop in six different working groups. Chapter 3 provides an overview on all questions to be discussed in the different working groups.

2 Project findings and key questions for working groups

2.1 Topic 1: Design and implementation of green infrastructure initiatives in Europe today

There are a number of factors which have been identified through the research as both impeding as well as enabling a successful implementation of green infrastructure projects. Given the breadth of possibilities in terms of project design, management structures, financing possibilities, stakeholder involvement, etc for GI projects, it follows that there is no universal formula for ensuring successful implementation. That being said, the in-depth case studies explored as part of "Design, implementation and cost elements of green infrastructure projects" have revealed several important trends.

Key barriers to the implementation of green infrastructure initiatives at the project level

Regarding impediments, a categorization of six types of barriers relevant for GI projects has been outlined, including structural, regulatory, cultural/behavioural, contextual, capacity and technical barriers (see Table 3 in the Annex for clarifications).[3] These categories are outlined below, using illustrative examples from the in-depth case studies for added clarity.

Structural barriers: In the case of the explored GI projects, changes in the management mid-project, cross-border considerations (language difficulties) and difficulties presented by mixed land ownership titles within the targeted area were encountered. For transnational projects, possible solutions recommended by the interviewees include the use of a national contact person to streamline communication and employing a professional translator to address language complications. Regarding land ownership, an increased knowledge and awareness by individuals owning land within the project area should be strived for where possible, starting with the inception phase.

Regulatory barriers: The case studies unveiled the difficulty of addressing administrative complications, for example in funding applications and the subsequent required paperwork. Interviewees from the in-depth case studies recommended making more funding available in relation to the administrative effort required or, alternatively, limiting the amount of administrative work.

Cultural/behavioural barriers: In almost all case studies in which this barrier arose, it was in relation to a low level of public acceptance stemming from (1) differing priorities/points of view or (2) ingrained thought patterns. To address this first aspect, interviewees suggest budgeting time for an increased flow of information, consultation, compensation, workshops and feedback with stakeholders throughout the project. Additionally, *benefits* for all parties

[3] These categories stem from the research project "Assessment of the potential of ecosystem-based approaches to climate change adaptation and mitigation in Europe" (DG Environment, (Contract-N° 070307/2010/580412/SER/B), project team: Ecologic Institute and Environmental Changes Institute/University of Oxford).

should be highlighted to provide incentives for financial contributions and increase the support of projects. Established ways of thinking could be broken by offering study tours to increase exposure to other perspectives and to demonstrate the success/benefits of existing GI projects.

Contextual barriers: Historical considerations often played a large role in the GI projects examined, such as landownership patterns under previous political parties and personal attachment to the area under consideration (e.g. inheritance of the land over generations). Limited windows of opportunity were also cited as a contextual barrier, referring to the small number of chances available to influence spatial plans and other long-term funding schemes, such as e.g. the revision of the CAP to support elements of GI projects. Possible solutions offered include paying special attention to and having a high awareness of relevant political considerations outside project scope, e.g. spatial plans, EU policies, regional/national elections. Furthermore, there should be a high consideration of local visions in project design and timing in order to minimize conflicts with local stakeholders and thereby maximize efficiency in implementation and ensure project continuity.

Capacity barriers: Insufficient funding and a lack of stability in financial flows were cited in the explored case studies. Ideas for addressing these barriers included ensuring adequate funding and clearly outlining expectations and activities with contractors before the projects begin. Pre-financing was also a key consideration which would enable a wider participation of smaller organizations in such projects as well as greater security during the implementation period. Insufficient knowledge and expertise (impacting management decisions and implementation efficiency) are also capacity barriers; these issues could be addressed via the use of an advisory committee or project steering group comprised of experts from relevant fields.

Technical barrier: Examples from the case studies include e.g. difficulties in harmonizing the green infrastructure activities (such as restoration of a canal) while still allowing for public use of the area. Delays in projects were also incurred in the explored case studies as a result of weather considerations, complicated installations, the breeding habits of birds occupying the site and other unavoidable environmental considerations. While some of these barriers cannot be avoided, breeding habits of relevant species and similar considerations should be incorporated into the initial implementation plans from the start of the project.

Key factors in ensuring successful implementation of GI projects

In addition to barriers, there are naturally also numerous factors which serve as enabling factors for the successful implementation of GI projects. In the following, an indicative list of factors is presented that can be relevant to the success of green infrastructure projects and which are derived from the in-depth case studies, GI project database and literature.

- In cases of **cross-sectoral cooperation**, it is important to have a diversity of beneficiaries and partners, including a **mix between public and private bodies**, to ensure that all parties have clearly outlined benefits from the project and are brought together around shared principles. It is also central to incorporate GI principles into other strategies, master plans and local development frameworks.
- It is often beneficial to have the project in question **embedded in a larger policy, project or strategy.**

- **Surrounding legislation** should incorporate GI considerations into the planning phase of grey infrastructure, not just as an afterthought; similarly, governments should prioritize the enforcement of existing spatial zoning considerations to minimize/prevent fragmentation.
- Project management structure:
    - **Appropriate number of partners**, generally trying to keep the total number as small as possible while still covering all relevant sectors and having clearly defined roles and a well-planned distribution of responsibilities between the various organizational levels
    - **Flexible project structure** to grant enough freedom to develop ideas throughout the implementation phases
    - Selection of an **experienced project manager,** both in terms of the topic being addressed as well as the size and nature of the GI project being implemented
    - A **shared aim and clear goals** of partners and stakeholders of what is to be achieved
    - Use of **steering and advisory committees** to guide the project and gain useful input across sectors from experts
    - **Targeted intervention and involvement** (enabling greater efficiency with available funds)
    - **Regular reviews** measuring the project's progress against the original plan and objectives
- **Public awareness raising and involvement of stakeholders** in the planning and implementation process to help determine priorities based on expert and local opinions and the feasibility of desired tasks; efforts to address public policy makers and general public, with events being seen as being particularly successful; importance of communication, information and consultation about the project in all phases.
- **Post-project continuity** should ensure both personnel and involvement of the local populations as well as a project management plan/outline detailing maintenance requirements to enable the continued success and implementation of the project post-project completion (where relevant). Similarly, funding sources for long-term projects should be secured that are linked to, but not embedded in, existing structures so they can survive political changes at all levels.
- Development of **strong networks and relationships** with other organizations, institutions, individuals, government bodies, etc. in the territory as well as with the local communities.

While these recommendations are likely applicable to a variety of contexts and GI projects, it should be kept in mind that there is no formula or "one-size fits all" solution for determining the right combination of factors to ensure a successful project. The diversity of aspects influencing implementation processes requires regular reassessments within the project to determine the suitability of the implementation plan and, where applicable, areas which should be revised for subsequent project stages.

Role of local/regional or national governments and European Union

When asked about the potential and necessary role of local/regional and national governments as well as the European Union for ensuring the successful implementation of GI projects, interviewees of the in-depth case studies offered clear ideas of where positive support already exists and the areas in which improvements could be made.

On a local/regional level, interviewees saw the government's role as primarily being to increase awareness about the local ecological situation and to highlight the potential of GI

projects to contribute not only regionally, but also to national and EU efforts to increase functional habitat connectivity.

Considerations involving national governments were more diverse and extensive, including their role in promoting and supporting the development of GI through e.g. national spatial plans and the establishment of policies for GI protection, enhancement and creation. Coordination among relevant agencies should also be secured to ensure complementary goals with the project. National governments should adequately enforce existing laws and standards relevant to GI and put appropriate and relevant legal frameworks in place related to environmental protection and rural development, where they do not yet exist. This will help to ensure that governance structures support the goals that GI projects are trying to achieve. Similarly, policies should require GI provision in new developments while leaving enough flexibility for regional authorities to adapt implementation around local circumstances.

Regarding financial considerations, interviewees highlighted the value of receiving basic funding for administrative work (e.g. from national governments) so that the essential functions of the project can continue beyond the project duration, thereby ensuring the long-term success of project goals. Furthermore, pre-financing should be provided where possible to enable stable financial flows for the smaller organizations playing a role in green infrastructure projects.

The financing needs presented by GI projects and the potential of governments to assist lend nicely to the enlargement of both national as well as local/regional government investments in public private partnerships (PPPs). Governments can establish the conditions necessary to support private sector investments in GI, and specifically to support the provision of certain services which could then be profitable, thereby increasing overall investments in nature. PPPs must act in a complementary fashion with the aims and objectives of the GI projects which they support in order to offer this potential added value.

At an EU level, the in-depth case study interviewees highlighted the importance of reducing administrative aspects connected with applying for and maintaining funding for GI projects. As GI projects tend to be cross-sectoral in nature, the opportunity should also be provided to combine various sources of EU funds for a single project. Increased coherency between EU policies addressing various aspects of GI is of importance to provide the maximum support for such projects and minimize avoidable barriers arising from conflicting policies or funding requirements. Finally, interviewees envisioned a platform for exchanges and sharing of best practices to help promote the value of GI.

Questions for working group 1 - Design and implementation of green infrastructure initiatives in Europe today

- What are the key barriers to the implementation of GI initiatives at project level?
- What are the key factors in assuring a successful implementation of GI projects? (project design; management structure; financing; stakeholder involvement and public consultation; public awareness, formalized PPPs)
- How can the role of the local/regional or national governments as well as the EU help to facilitate the successful implementation of GI projects?

2.2 Topic 2: Integrating green infrastructure in spatial planning, policy and strategy development at regional/national level

Green infrastructure (GI) projects do not simply emerge by themselves, but are usually embedded in specific policy frameworks which provide inter alia for fundamental target settings, basic guidelines for design and implementation of such projects and, sometimes, also for funding schemes for implementation. Such frameworks can exist on various levels, including the EU, national and regional/local level, and can be binding to different degrees. A GI project can either be a result of legislative requirements on land use or simply part of a general strategy for adaptation to climate change for a particular region.

The assessment of an overall number about 120 GI projects all over the EU showed that most projects are embedded in a regulation and planning framework and/or are based on specific strategies and plans, which are stemming from an EU/national or regional level. In this context the following instruments were identified:

Regulative instruments constitute the involvement of a political institution which, whether at the local, regional, national or European level, adopts new legislation (or revises existing legislation) for regulation of land use.[4] Such attempts often seek to avoid further deterioration of landscapes by clearly setting out how land is to be treated. Although not necessarily a core objective of the regulation, the rules can lead to an improvement or promotion of GI or at least to certain elements of it. The requirements set out in the regulation might have to be translated in local land use plans depending on the level at which they have been adopted and/or have to be considered in Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA).

Spatial planning at local, regional, national or international level, plays an important role for the development of GI.[5] When a spatial plan is created choices are made if and how to preserve or enhance GI in a certain area and in which time-span such initiatives have to be accomplished. Links between GI and territorial cohesion often exist in spatial planning instruments. Spatial planning systems are already in place in many European countries and most of them do protect some GI elements. However, they often fail to protect/ consider GI as a coherent whole.

Non-binding **strategies and action plans** play a major role in development and implementation of GI projects. Strategies and action plans can include objectives or general principles to allow for GI to be taken into account in policy-making across policy areas and governance levels (EU, MS, local) as well as in spatial planning. In other cases such plans announce concrete priorities and measures to be taken in specific policy fields (e.g. biodiversity) or geographic areas. Their prescriptive status can be characterised as “guidance with political commitment”.

The implementation of these regulations, plans and strategies is supported by financing instruments, information and public awareness and research activities

[4] Examples include inter alia the Habitats and Wild Birds Directive, EU Biodiversity Action Plan, Agenda 21-processes, Oslo forest law for water provision and Ramsar Wetland Convention

[5] Examples include integrated coastal zone management (ICZM), regional or national GI strategies, UK Shoreline Management Plans, climate adaptation strategies

In the light of embedding GI projects and initiatives in the wider programming and policy context, the cross-cutting nature of GI projects must be taken into account. Therewith, GI projects do not only serve nature conservation purposes, but rather address a variety of sectors[6] as shown in the graphic below.

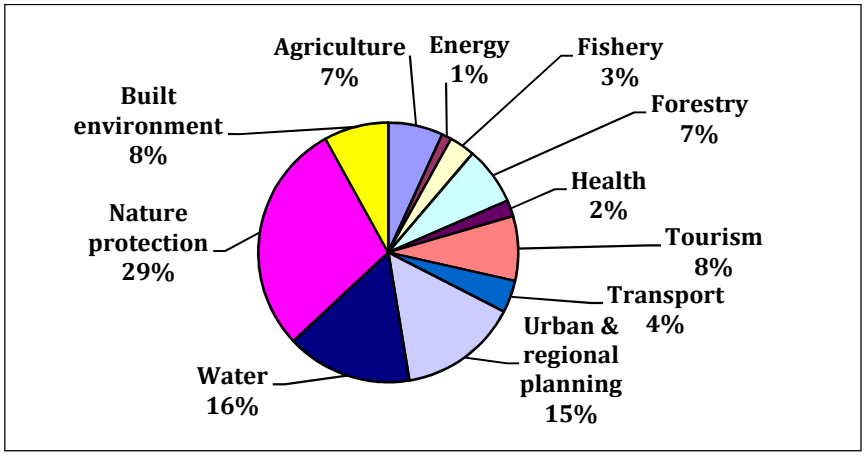

Figure 1: Frequency of sectors/areas targeted[7] by the ca. 120 GI projects analysed in the project "Design, implementation and cost elements of green infrastructure projects"

Recommendations given in the case studies by project managers highlight *inter alia* that the national government should promote and support the development of GI through the planning system. This could be done firstly through a national spatial plan highlighting GI of national importance and establishing policies for its protection and enhancement and policies for the creation of new GI features on local/regional scale. Secondly, through national policies requiring GI provision in new infrastructure and spatial development and in setting out the benefits and case studies of locally accessible GI. The local authorities should determine the details of the amount, type, use and position of GI elements within infrastructure and spatial development taken into account the local circumstances such as flood risk, existing site features and other GI assets to connect to etc.

Questions for working group 2 - Integrating green infrastructure in spatial planning and relevant policies at regional and national level

- How can GI best fit into local/regional, national and EU policy and/or planning?
- Which role should GI have with respect to spatial planning/ land use, infrastructure development, biodiversity, programming of sectoral policies?

[6] The 'Rebuilding Nature for Today and Tomorrow' project in Lithuania, for example, covered nature protection, water and tourism. The aim of the project was to reverse the erosion of the Baltic Sea coastline by reinforcing the dunes, constructing walkways and providing information on the area. This aim was achieved, and in addition, there were positive side-effects for local businesses as more tourists came to enjoy the coast. Biodiversity in the region has improved and the installation of fences has provided protection for animals, water, plants and birds

[7] The figure presented below thus reflects the frequency of each sector addressed by the projects in the database, not taking into account if it was the main or sub-sector.

- What are the current arrangements, synergies, and opportunities for embedding GI in a wider policy, strategy and planning process?
- What are the barriers that may impede the integration of GI in spatial planning and relevant policies and how can these barriers be overcome?
- What should the role of government be (on a regional and national level) in fostering the planning and implementation of GI projects and initiatives?

2.3 Topic 3: Costs and benefits of green infrastructure

Understanding the costs and benefits of green infrastructure (GI) projects is a key element in this study. Although data gaps, as well as the lack of a standard accounting of costs and differences in definitions, has meant that a full quantification and valuation has not been possible, it has been possible to identify and characterise the types of costs and benefits associated with GI projects. Evidence collected as part of "Design, implementation and cost elements of green infrastructure projects" (including a database 120 projects and the six in depth case studies) has also highlighted what are the key cost elements and sources of benefits. Essentially, the types of activities that make up a GI project has a significant impact on what costs are incurred and what the resulting benefits will be.

Costs of green infrastructure projects

The costs of GI projects include:

- **Financial costs** – the value of the resources deployed in defining, protecting, managing and developing GI, which include the costs of labour, materials, energy, equipment and other purchased goods and services.
- **Opportunity costs** – the value of economic opportunities foregone as a result of protecting GI. These may include foregone development, restrictions on resource use, restrictions in output from land management, and loss of socio-economic opportunities (e.g. use of land for regeneration or community uses).

The financial costs of GI projects are generally well understood and documented. Typically these include:

- **One-off costs** incurred in:
    - Development of GI plans and initiatives (research, surveys, mapping, studies, consultation, management plans etc.);
    - Capital works to re-create, restore and enhance GI. These may include the costs of land purchase, compensation, purchase of livestock and equipment, development or restoration of buildings and infrastructure, and the creation or restoration of habitats, features or green spaces;
- **Recurrent costs** in maintaining green infrastructure, and in ongoing monitoring, evaluation and communications activities.

Cost data compiled for 90 GI projects in the EU indicates average project expenditures of €8 million per project, with the costs of individual projects ranging widely from €0.5 million to €177 million. Across the six in depth case studies, a total of €142.8 million was spent on one-off costs, whilst recurrent costs amounted to €8 million.

One-off costs represent a large proportion of the overall costs of GI projects, with capital investments in land management and restoration works forming the largest element of these. The costs of land purchase and project management are also important. Recurrent costs typically account for only a small proportion of the costs of green infrastructure projects, with land management and project management costs being most significant. However, the costs of maintaining GI are often not fully recorded by green infrastructure projects, as these are mainstreamed into other programmes (e.g. agri-environment programmes and general budgets for public administration).

The opportunity costs of green infrastructure projects are usually poorly understood and documented, but may be significant for some projects, especially those aiming to protect green spaces in areas experiencing high rates of built development, or restoring semi-natural habitats on productive agricultural land. Opportunity costs may be included in the financial costs of green infrastructure, where these include land purchases and compensation payments.

Benefits of green infrastructure

The benefits of green infrastructure projects may be assessed by examining different indicators relating to:

- Changes in the provision of GI - the extent and quality of habitats, corridors, ecosystems, green spaces and features (measured in purely environmental terms);
- Changes in the provision of ecosystem services - e.g. volume of carbon stored, level of reduction of flood risk, number of recreational users of green space etc. (measured in the provision of the service and its use by people);
- Changes in the socio-economic value of provided ecosystem services - e.g. value of carbon storage, value of reductions in property damage due to flooding, value placed by the public on changes in biodiversity (measured in monetary terms); and,
- The economic and social impacts of GI projects, i.e. their impacts on employment, GDP and local communities (measured in terms of output and employment).

In general, evidence of the benefits of GI projects tends to be much more variable and less quantified than that for the costs. The provision of green infrastructure itself tends to be best documented; evidence of ecosystem services is limited for most projects, and attempts to value these benefits have been made for only a small minority of projects.

Comparing the Costs and Benefits of green infrastructure projects

For most GI projects, direct comparison of costs and benefits is not possible. While the costs of establishing and maintaining GI are known for most projects, the benefits are much more difficult to value. Benefits are often assessed in purely qualitative terms, or quantified only in terms of the extent of GI protected or maintained. There is much less quantitative evidence of the ecosystem services provided by green infrastructure, and of the value of these services.

However, where attempts have been made to value the benefits of GI projects and compare them with the costs, they have demonstrated that the benefits often substantially outweigh the costs. For example:

- It is estimated that the creation of the English National Forest will provide benefits 4.8 times as high as the costs over the period 1990 to 2100;
- The Mersey Forest project, also in England, has been estimated to deliver benefits 10 times as high as the costs incurred;
- The Skjern River project, in Denmark, has also yielded benefits that exceed the costs incurred;
- Assessments of the benefits of protected areas programmes in France and the UK have estimated that their benefits are 7-8 times as high as their costs.

One of the benefits of GI is in reducing the need for investments in built (or “grey”) infrastructure, such as flood defences and water treatment plant. Experience demonstrates that such benefits are delivered by some GI projects. However, most projects are designed to provide multiple benefits rather than focusing on the delivery of specific ecosystem services.

Questions for working group 3 - Costs and benefits of green infrastructure

- What are the main costs and benefits of GI?
- How can we better understand and quantify these costs and benefits?
- It has been demonstrated in most cases that GI project entail more benefits than costs in the short and longer term. What is your experience on this, can this statement be generally supported? Are you aware of cases that demonstrate the opposite?
- How can the design and implementation of GI projects contribute to their cost effectiveness?
- How can the planning, design and implementation of GI projects maximize their benefits? How to best deal with trade-offs?
- How can awareness and understanding of GI benefits be improved among stakeholders? Are there enough tools to communicate these benefits?

2.4 Topic 4: Financing green infrastructure projects and initiatives

Due to the high diversity of aims, focus and actors involved, there are a wide range of possible funding on different levels that come into consideration for green infrastructure (GI) projects. Yet, it has to be noted that there is no particular funding scheme for the development and implementation of GI projects available on EU level and rarely on national level. Whether a GI project, which is often more integrated and cross-cutting in nature, can be financed under a funding scheme depends strongly on the scope of the project and the links that can be drawn to "classical" themes (such as nature conservation, adaptation to climate change or enhancing ecosystem services) which are more often the core objectives of such funding programmes.

However, the research on GI projects unveiled some predominant funding opportunities, which were engaged by GI project implementers. Funding for GI projects can be generated from different policy levels.

A significant source for funding is different **EU funds**, most importantly LIFE+, but also relevant programmes under the European Regional Development Fund (ERDF). Both LIFE+ and ERDF channel their funds through different components and themes which can be further divided in specific topics. Depending on their thematic focus, GI projects can be found under several of such topics, namely nature protection, water, forestry, agriculture, tourism, urban and regional planning, fishery, built environment and transport, energy. However, the analysis revealed that these funds support primarily projects targeting the objectives of improving human well-being/health/quality of life as well as biodiversity conservation and climate change mitigation and adaptation, respectively.

Besides EU funding, also **national funds on Member State level** provide for programmes which are accessible for GI projects. Some projects are financed by rural development programmes (RDPs) under the second pillar of the European Common Agricultural Policy (the European Agricultural Fund for Rural Development - EAFRD), for which the EU and the Member States share expenditures (co-financing). In addition, cross national financing models can occur, mostly in Member States with only few own financial resources for environmental protection.

A third category comprises private **funds from foundations, NGOs, business and land owners**. Unlike the formalised procedures of applying for funding under the public funding schemes, no general rules how money can be obtained from private donors to implement GI projects can be derived, as volume of funds and scope very much depend on the interests of the donor. Several projects were identified where companies carried out infrastructure projects in the past and present (which resulted in damaged habitats and loss of species) and provided funding for restoration projects as form of compensatory measures.

The analysis of projects at local/regional level highlighted different barriers related to financing, which resulted in the following recommendations regarding adequate and suitable funding at the project level:

- Ensure adequate funding modalities such as pre-payments, less administrative requirements (incl. reporting) and stable funding conditions and procedures (such as long-term funding, no changes in financing requirements during a projects life-time)

- Reduce the primary focus of such projects on nature conservation and create an integrated approach combining nature conservation with recreation, climate adaptation, health, etc. in a balanced way (which would facilitate further fundraising)
- Funds should not only target 'novelty' projects, which will only be funded one time and therefore will not be eligible for similar funding in the future. Provide opportunities for follow-up financing of projects.
- Provide source for maintenance of the project at a long-term perspective
- Innovative sources need to be explored (e.g. by forming coalitions between private donors (which economically benefit from the proposed GI project) and public authorities and NGOs, who implement the project.
- The health and recreation sectors present good options for co-financing green infrastructure activities.

Questions for working group 4 - Financing green infrastructure projects and initiatives

- What are the funding needs of GI projects? (e.g. related to specific management, administration or technical activities, objectives)
- What are the pre-conditions for an adequate and suitable national/EU funding for GI?
- What role should/could local/regional, national and EU funding play?
- Do you think the private sector has a role to play in supporting GI projects? How can the private sector be motivated to participate in the financing of GI projects?
- What innovative funding mechanisms already exist /could be used for GI?
- How can the continuation/maintenance and monitoring of projects best be ensured? What will be an adequate period for planning for maintenance (10 years, 25 years, longer)?
- Could improved funding lead to a critical mass of GI projects, or will it "only" facilitate the implementation of those projects which have anyway gained acceptance and have been programmed/planned?

2.5 Topic 5: Policy tools, instruments and the EU framework

Although holistic green infrastructure strategies can only be found to a limited extent in EU Member States, a wide range of policy initiatives currently exists, relying on a variety of tools, instruments and measures to support elements of Europe's green infrastructure at various scales of governance. While some are designed to deliver one particular objective, others contribute to meeting multiple objectives at the same time. The green infrastructure concept offers an opportunity to integrate them and maximise their potential to optimise the delivery of ecosystem services while at the same time halting and reversing biodiversity loss.

The following table outlines these potential policy instruments and tools, providing relevant examples. A more detailed description of these points can be found in table 4 (see the Annex), which further provides working insights into potential GI applications. Finally, table 2 then provides an overview of the range of policy areas and sectors relevant to green infrastructure as well as the associated EU policies and instruments which should be considered for EU action on GI.

Table 1: Potential instruments and tools

Policy instruments and tools	Examples
Strategies and Action Plans	• Setting out overall strategic approach to GI provision
Information gathering and mapping	• Identification and mapping of GI elements and requirements • Monitoring of GI elements and their impact objectives • Analysis of GI benefits in view of integration into decision-making
Regulation and planning	• Regulation of land use • Spatial planning/integrated territorial development • Procedural requirements: EIA/SEA • Standards • Liability and compensation
Economic/ market instruments	• Resource pricing (e.g. taxes, charges, fees, land values) • Land management contracts/agreements (incl. PES-schemes) • Public procurement
Public investments	• EU Expenditure for GI • Land purchase • Restoration projects/programmes • GI creation projects/programmes (including reducing impacts of grey infrastructure) • Securing long-term financing/maintenance • Respond to the value of GI when setting priorities
Governance	• Institutions • Participatory decision-making processes • Reporting on implementation • Coordination of policies
Communications and advisory measures	• Awareness raising • Advice and guidance • Capacity building • Technical assistance on EU level (for policy making) • Technical assistance at MS/regional level for potential beneficiaries of EU-financed projects

Table 2: Overview policy areas and associated EU policies & instruments to be considered for EU action on green infrastructure

Policy area	EU policies & Instruments to be considered
Agriculture and rural development	• CAP Pillar 1 - Cross-compliance (Reg. 73/2009) • CAP Pillar 1 - CAP 2020 Communication • CAP Pillar 2 - EAFRD Funding • CAP Pillar 2 - Training, advice, extension services, planning provisions – Farm Advisory System
Forestry	• EU Forestry Action Plan • Green Paper on Forests
Biodiversity & Nature	• Birds Directives • Habitats Directive • LIFE+ Regulation
Water Policy	• Water Framework Directive/ River Basin Management Plans • Floods Directive • EU Drought Policy (Communication on Water Scarcity and Droughts) • Future EU Water Blueprint
Climate Change Policy	• White Paper on adaptation • 2050 Low Carbon Roadmap
Green Growth: Territorial Cohesion and innovative financing (Agenda 2020, Resource efficiency, Jobs)	• Regional Policy (Cohesion Policy) • Innovative financing • Regional Strategies, e.g. EU Strategies for the Danube Region/ EU Strategy for the Baltic Sea Region • EU 2020 Strategy • Resource Efficiency Flagship under EU 2020
Transport & Energy	• TEN-T • EU White paper on transport Impact Assessment • TEN-E • Energy Policy
Impact Assessment, Damage prevention and remediation	• EIA Directives • SEA Directive • Environmental Liability Directive
Spatial Planning	• European Spatial Development Perspective • ESPON 2013 Programme • Territorial Agenda of the EU 2020 • EC 2006 Thematic Strategy on the Urban Environment
Marine and Coastal zones Policy	• Marine Strategy Framework Directive • EU Maritime Spatial Planning Communication • 2002 Recommendation on Integrated Coastal Zone Management (ICZM) • Fisheries Policy/ EFF
Environment & Health	• Environment and Health Action Plan 2004-2010
Other	• Research Policy • EC external development cooperation

Questions for working group 5 - Policy tools, instruments and the EU framework

For the future EU Green Infrastructure Strategy:

- What do you consider to be the main tools and instruments to support or reduce adverse impacts on Europe's green infrastructure?
- What should be the key elements of a holistic EU policy framework to promote the GI approach, effectively supporting Europe's GI or reducing adverse impacts on it?
- How could these key elements be best integrated in a cost-effective way in the existing EU policy framework? Are there gaps, which need to be filled with new instruments/ measures?
- Which governance level (EU, national, regional, local) should be mainly responsible for which phase of GI (such as strategic planning, design and implementation)?

2.6 Topic 6: Identifying indicators and measuring efficiency of green infrastructure

Measuring the effectiveness of green infrastructure (GI) elements and clarifying their efficiency in delivering resilient biodiversity and ecosystem service benefits is an important prerequisite for ensuring that investments can be prioritised on the basis of cost efficiency. Indicators are needed to capture the different range of benefits that are derived from GI. The research projects consider GI as comprising 'elements' which are based on the ecological network paradigm, and consist of: core areas, restoration areas, sustainable use/ecosystem service zones, green urban and peri-urban areas, natural connectivity features, and artificial connectivity features.[8] In view of the potentially important future investments in ecosystem-based climate change adaptation, the contribution of each GI element to overall ecosystem resilience will be key. The 'Green infrastructure implementation and efficiency' project aims to identify how GI contributes to ecosystem resilience and to propose indicators for the efficiency of GI. Efficiency, with respect to this project, is understood to be the effectiveness of GI in meeting biodiversity and ecosystem services objectives (e.g. by increasing ecosystem quality/condition and resilience) per unit of cost. This work has three components:

Measuring resilience

The question of ecosystem resilience and how components contribute to resilience is a key part of the study. We understand resilience to be *"the capacity of a system to absorb disturbance and reorganise while undergoing change without losing its structure, function, identity and feedbacks"* after Walker et al (2004).[9] This definition, in common with those used by the EU 2020 Biodiversity Strategy and the Intergovernmental Panel on Climate Change (IPCC), allows for some species interchange if the new species fulfil the same ecological functions as the lost species. The resilience of an ecosystem may be considered to have the following aspects:

- Its resistance to being changed.
- How much it can be changed before losing its ability to recover – i.e. a "tipping point".
- How close the system is to such a tipping point.

Of particular interest to us are the properties of an ecosystem that increase its resilience as defined above. Certain properties are commonly seen as increasing ecosystem resilience (such as species richness, structural or functional complexity, habitat area, (meta) population size and coherence), while others are said to diminish it (such as environmental pressures) although in practice there are numerous exceptions to these assumptions in the literature. Some possible indicators of ecosystem resilience are identified in the Annex, Table 6.

[8] For more details see table 4 in the Annex

[9] Walker, B., Holling, C S Carpenter, S R & Kinzig A (2004) "Resilience, adaptability and transformability in social-ecological systems." Ecology and Society 9.2: on line.

Measuring biodiversity and ecosystem service provision from GI initiatives

In order identify the indicators to measure GI effectiveness, it is vital to consider the aspects of the ecosystem of interest. For the purpose of the EU's policy position on GI, it is clear we need to focus on the two primary functions of GI initiatives, namely the conservation of biodiversity per se (i.e. for its intrinsic value) and the maintenance and enhancement of associated ecosystem services (for their utilitarian values).[10] The question is therefore how do we measure these properties and, in particular, how do we evaluate GI's contribution to providing them? Table 7 in the Annex, provides a list of potential ecosystem service indicators identified by the project to date.

The 'efficiency' of GI in delivering its objectives

Finally, we are interested in determining how cost-effective GI initiatives and specific elements are in delivering their twin objectives of biodiversity and ecosystem service provision. This requires not only appropriate indicators to measure progress towards objectives and their cost, but an appropriate understanding of the context of the indicators (i.e. how to compare competing investment options for different management objectives such as coastal vs. uplands; water vs. carbon).

Questions for working group 6 - Identifying indicators and measuring efficiency of green infrastructure

- What would you consider to be the properties that increase ecosystem resilience, and how best to measure them?
- How can GI's contribution to ecosystem resilience be measured?
- How do we measure biodiversity and ecosystem service provision and GI's contribution to biodiversity and ecosystem service provision?
- How should we represent GI efficiency to allow decision-makers determine the cost-effectiveness of investment decisions?

[10] Such as for example food provision, climate regulation, water purification, recreation

3 Overview of questions for working groups

Topic	Key questions
1. Design and implementation of green infrastructure initiatives in Europe today	• What are the key barriers to the implementation of GI initiatives at project level? • What are the key factors in assuring a successful implementation of GI projects? (project design; management structure; financing; stakeholder involvement and public consultation; public awareness, formalized PPPs) • How can the role of the local/regional or national governments as well as the EU help to facilitate the successful implementation of GI projects?
2. Integrating green infrastructure in spatial planning and relevant policies at regional and national level	• How can GI best fit into local/regional, national and EU policy and/or planning? • Which role should GI have with respect to spatial planning/ land use, infrastructure development, biodiversity, programming of sectoral policies? • What are the current arrangements, synergies, and opportunities for embedding GI in a wider policy, strategy and planning process? • What are the barriers that may impede the integration of GI in spatial planning and relevant policies and how can these barriers be overcome? • What should the role of government be (on a regional and national level) in fostering the planning and implementation of GI projects and initiatives?
3. Costs and benefits of green infrastructure	• What are the main costs and benefits of GI? • How can we better understand and quantify these costs and benefits? • It has been demonstrated in most cases that GI project entail more benefits than costs in the short and longer term. What is your experience on this, can this statement be generally supported? Are you aware of cases that demonstrate the opposite? • How can the design and implementation of GI projects contribute to their cost effectiveness? • How can the planning, design and implementation of GI projects maximize their benefits? How to best deal with trade-offs? • How can awareness and understanding of GI benefits be improved among stakeholders? Are there enough tools to communicate these benefits?
4. Financing green infrastructure projects and initiatives	• What are the funding needs of GI projects? (e.g. related to specific management, administration or technical activities, objectives) • What are the pre-conditions for an adequate and suitable national/EU funding for GI? • What role should/could local/regional, national and EU funding play? • Do you think the private sector has a role to play in supporting GI projects? How can the private sector be motivated to participate in the financing of GI projects? • What innovative funding mechanisms already exist /could be used for GI? • How can the continuation/maintenance and monitoring of projects best be ensured? What will be an adequate period for planning for maintenance (10 years, 25 years, longer)? • Could improved funding lead to a critical mass of GI projects, or will it "only" facilitate the implementation of those projects which have anyway gained acceptance and have been programmed/planned?

5. Policy tools, instruments and the EU framework	<u>For the future EU Green Infrastructure Strategy</u>: • What do you consider to be the main tools and instruments to support or reduce adverse impacts on Europe's green infrastructure? • What should be the key elements of a holistic EU policy framework to promote the GI approach, effectively supporting Europe's GI or reducing adverse impacts on it? • How could these key elements be best integrated in a cost-effective way in the existing EU policy framework? Are there gaps, which need to be filled with new instruments/ measures? • Which governance level (EU, national, regional, local) should be mainly responsible for which phase of GI (such as strategic planning, design and implementation)?
6. Identifying indicators and measuring efficiency of green infrastructure	• What would you consider to be the properties that increase ecosystem resilience, and how best to measure them? • How can GI's contribution to ecosystem resilience be measured? • How do we measure biodiversity and ecosystem service provision and GI's contribution to biodiversity and ecosystem service provision? • How should we represent GI efficiency to allow decision-makers determine the cost-effectiveness of investment decisions?

4 Annex

Table 3: Types and descriptions of barriers arising in GI projects

Type of barrier	Description
Structural barriers	Obstacles posed by the characteristic structures and procedures of institutions and organizations. These procedures shape the way these groups function and how they identify and achieve their goals, and thus can influence against new initiatives.
Regulatory barriers	Hurdles set up by the means an organization or government has to regulate and control their members' interactions and the procedures they follow.
Cultural/behavioural barriers	Influence generated by customs, values, beliefs, interests and personalities of individuals in critical positions within a group.
Contextual barriers	Hindrances offered by external forces to which a government or organization is subject to and the priorities to which it must respond.
Capacity barriers	The lack of resources, namely technical, human, financial, or other, that can bring difficulties in the integration of a new initiative into a group's strategy.
Technical barriers	

Table 4: Potential instruments and tools and how they may relate GI

Policy tools and instruments	**Description/explanation** – *with working insights into potential GI application*
Strategies and Action Plans	
Setting out overall strategic approach to GI provision	Adoption of a non-binding forward looking, strategic document identifying the need to take measures to identify, preserve and/or invest in (new) GI. This is guidance with political commitment. This can potentially include (new) objectives (including targets) or general principles to allow for GI to be better taken into account in policy-making across all policy areas and governance levels (EU, MS, local) and in particular in spatial planning. In some cases this will announce that concrete priorities and measures will be taken in some policy areas (e.g. biodiversity) or geographic areas (e.g. Danube River Basin Strategy). We note that there are already existing GI Strategies at MS or regional level, even if they generally focus only certain components of a green infrastructure and are often not called GI strategies – e.g. biodiversity strategies, forest strategies etc.
Information gathering and mapping	
Identification and mapping of GI elements[11] and requirements	Drawing up maps both for identifying current GI elements that need to be protected and or enhanced or areas where new connectivity features, restoration measures or other GI elements are required to enhance the overall coherence and resilience of ecosystems and the delivery of ESS. This is an essential element of spatial planning fully taking GI into consideration – useful at different geographic scales, from local to continental.

[11] Green Infrastructure elements include: Core areas (e.g. Natura 2000 sites), restoration zones, sustainable use/ESS zones (eg high nature value farmland), Green urban areas, natural connectivity features (hedgerows, ponds, rivers), artificial connectivity features (e.g. green bridges).

Monitoring of GI elements and their impact objectives	Monitoring of GI elements, their quantity, quality and impacts would include the development and use of indicators in particular for the monitoring of the health of GI elements and their impacts in terms of biodiversity and ecosystem service benefits. It also includes monitoring trends in (i.e. accounting of the stock of the different GI element types over time). The development of indicators and monitoring allows to set baselines, monitor trends, inform instruments and set targets. A mix of appropriate biodiversity and ESS indicators for the quantity and quality of GI elements will be needed. They are also critical for impact objectives (eg on the resilience of ecosystems) and instrument design (e.g. PES) and for subsequent monitoring and reporting on performance.
Analysis of GI benefits in view of integration into decision-making	Analysis of GI benefits would require identification, quantification and valuation of these. Authorities may choose to contract consultants or researchers to identify and/or value the various ESS benefits GI elements deliver in a given area (e.g. a forest) and ways in which these could be secured or enhanced by integrating this value in policy-making, e.g. by setting up PES schemes or purchasing the land. This can be at the local level (e.g. city exploring the importance of its green belt) to EU level (e.g. requirement for integration into impact assessment and to duly consider value of the benefits when selecting option that will be chosen).
Regulation and planning	
Regulation of land use	This would involve a political institution, whether at the local, regional, national, or European level adopting new legislation (or revising an existing legislation) to regulate the use of land in an attempt to avoid further deterioration of the identified green infrastructure by clearly setting out how land foreseen for GI provision is to be treated, thus avoiding land use conflicts, further GI degradation and fragmentation to ensure the provision of certain ESS (e.g. water provision) and biodiversity benefits. Depending on the level at which they have been adopted These might have to be translated in local land use plans. **(**e.g. Natura 2000).
Spatial planning/integrated territorial development	Spatial planning at local, regional, national or supra-national levels, generally resulting in the creation of a spatial plan reflecting the choice to preserve or enhance GI to ensure planning decisions do not lead to a development which would further undermine the provision of ESS and biodiversity conservation objectives and aiming at a balanced development which does acknowledge the need to preserve strategic natural elements in the landscape. Links may be established between GI and territorial cohesion. E.g. integrated coastal zone management, UK Shoreline Management Plans, French Coastal Law ('Loi littoral'). It is important to note here that spatial planning systems generally already exist and most of them do protect some GI elements e.g. core areas but often fail to protect/ consider GI as a coherent whole. This is therefore as much about how the spatial planning system protects GI as about new initiatives to protect GI through spatial planning.
Procedural requirements: EIA/SEA	Setting clear procedural requirements within the EIA/SEA legislation for the consideration of impacts on the overall coherence of the green infrastructure and the delivery of their ecosystem services. Possibly also encouragement or requirement for avoidance, mitigation and off-setting measures to be taken before a certain development is authorised (for EIA) or a plan or programme adopted (SEA), to ensure "no-net loss" or "net positive gain" of biodiversity or ecosystem services. EIA and SEA already consider impacts on some GI elements but in many cases there is arguably opportunity for expanding this e.g. through additional requirements and/or guidance.
Standards	Requirements in building regulations stating e.g. that for a given surface of built/sealed land a determined share of land/space has to be dedicated to GI to facilitate the provision of ESS (be it only requiring the creation of private green spaces). This primarily encompasses, but is not limited to, building/development regulations.

Liability and compensation	Liability of operators for unauthorised environmental damage they cause through the requirement to return the environment back to its original state (e.g. before the accident occurred) and/or off-set the environmental damage caused elsewhere (possibly strategically, through habitat banking, taking into account where restoration could best contribute to overall coherence of the green infrastructure). The way in which N2K protected areas are treated in the ELD Directive could be expanded to some of the GI elements.
Economic/ market instruments	
Resource pricing (e.g. taxes, charges, fees, land values)	The pricing of certain resources is introduced in some way or another to increase the incentive to preserve GI for the ESS it provides. This might for example include introducing water pricing (or increasing the price of water) in view of introducing a PES-scheme or a tax on land use in areas identified as part of the GI (e.g. for housing developments) where the income of the tax is used to finance enhancing the GI elsewhere.
Land management contracts/agreements (incl. PES-schemes)	A **land management contract** or agreement is an agreement negotiated between the leaseholder and the land owner which guides the sustainable use of the lease land for the term of the lease. It may or may not include PES. A **PES** is defined as a voluntary transaction where well-defined ESS is 'bought' by at least one ESS buyer from at least one ESS provider if – and only if- the ESS provider secures ESS provision. This therefore involves setting up a system through which those benefitting from a particular ESS (e.g. direct beneficiaries such as water companies, irrigation authorities, etc) compensate those who provide it (e.g. foresters, farmers), thus providing them with an incentive for improving land-use and management practices in view of supplying those services. **PES-schemes** may be public and based on legal obligations or private schemes with little government involvement. Scales might also differ depending on the beneficiaries, the providers and the spatial relationship between them. There is a fine line between PES and a subsidy. e.g. PES for flood control, for management practices that support water quality, European expenditure which could also be considered PES-schemes (e.g. agri-environment schemes) will be considered "EU expenditure" under this classification.
Public procurement	There is also some scope for using public procurement to support green infrastructure. This could happen on the one hand via procurement requirements for road, rail and energy infrastructure and on the other hand, by encouraging the development of labels for and purchase of "greener products", i.e. organic, FSC, MSC, etc. As regards greening grey infrastructure - public procurement may be relevant in relation to GI where the list of criteria links to the effort of the producer to implement practices which ensure that GI elements were not determinately affected in the production of the good/service. When commissioning the building of new grey infrastructure, public authorities assess offers against criteria including the consideration of the need to preserve/enhance GI in the proposed development. Projects going beyond the sheer compensation and seizing opportunities for creation of valuable GI are considered more highly given the additional value they deliver to the community. For public procurement of certified timber, agricultural or fisheries produce, the market pull by GPP can encourage the development of greener production / greener natural infrastructure.
Public investments	
EU Expenditure for GI *(national to local and private detailed below)*	Using the different funding instruments of the EU (EAFRD, EFRD, CAP, EFF, LIFE+ etc.) to support the maintenance or enhancement of GI or supporting ecosystem based solutions rather than grey infrastructure for the delivery of certain services (e.g. water cleansing and wastewater treatment). Some of this expenditure, e.g. the agri-environment schemes, could arguably also have been included under PES-

	schemes above. Other levels: national to local and private using appropriate funds and budgets – see below.
Land purchase	Public authorities purchase land to protect or manage GI elements. Owners may be given the possibility to leave their land to the public authorities requesting that it be managed in the wider public's interest (statutory bodies e.g. UK National Trust or FR Conservatoire du Littoral may be created to manage these lands according to clear criteria).
Restoration projects/programmes	Projects/programmes may be undertaken to restore green infrastructure elements for biodiversity and ESS provision at various levels of governance and backed with the necessary funding, possibly from different sources. These will take place where valuable GI elements have deteriorated.
GI creation projects/programmes (including reducing impacts of grey infrastructure)	Projects or programmes, most probably publicly funded or NGO-driven/ funded which aim at strategically creating GI elements in certain places to ensure overall coherence/resilience of ecosystems and/or ensure that specific groups of people may benefit from the services the GI may deliver to them. Instrumental creation of nature. This would include public authorities adopting programmes or implementing projects to reduce fragmentation caused by existing grey infrastructure.
Securing long-term financing/maintenance	Public authorities commit to long-term financing of the management of GI (e.g. through creating publicly funded institutions or creating permanent jobs whose purpose is to preserve and enhance GI) or funds where proceeds pay for GI. This is a category apart as it is recognizes a specific need (e.g. around protected areas internationally).
Respond to the value of GI when setting priorities	When disbursing public funds/assessing application for grants/loans to support grey infrastructure investments/development projects/programmes, include criteria referring to green infrastructure and ensure that appropriate weight is given to these criteria, giving the value of the services delivered by GI due consideration. Having a high adverse impact on a GI element (or any impact at all, depending on the type of project) should penalise the applicant. This is also linked to the above mentioned public procurement, investments, etc.
Governance	
Institutions	Establishing an institution / a statutory body or expanding the mission statement of existing institutions covering a relevant geographical scale to allow them to take measures to preserve GI / deliver their objectives through ecosystem based approaches and allow them to allocate some of their budget to such approaches. e.g. river basin authorities, municipalities (expanding mission).
Participatory decision-making processes	Ensuring the participation of a wider range of stakeholders in decision-making processes which have implications for green infrastructure to ensure that the benefits derived from GI elements are not undervalued by only focusing on economic interests.
Reporting on implementation	Reporting on the extent to which measures which were foreseen have been implemented on the ground: e.g. money allocated to projects has resulted in their implementation/ legislation/regulation adopted at national level have resulted in effective implementation of requirements (e.g. local authorities contributing to meeting a target set for GI through their spatial planning decisions; farmers implement requirement for riparian vegetation along rivers etc.) Reporting on the state of GI as part of wider natural capital reporting, which in turn can be part of natural capital accounts and extended income accounts – eg linked to national accounts regulation *(also an issue for measurement above).*
Coordination of policies	Legislative measures leading to the amendment of existing policies and/or drafting legislative proposals to ensure a consistent approach with regard to GI across all relevant policy areas. Policies making cross-reference to how they can deliver ESS through GI in synergy with other policies. This would be best achieved by exploring the benefits supporting policy objectives across all policy areas and integrating this into the different policy areas when these could better account for the benefits they

	may deliver which would underpin the objectives in other policy areas.
Communications and advisory measures	
Awareness raising	Increase policy-maker and overall public awareness of GI benefits. Could include reform of educational programmes at schools and universities to increase awareness of GI. In higher education focus especially on disciplines which result in an increased likelihood of having to deal with GI elements (eg engineering, architecture).
Advice and guidance	Issuing of guidance documents targeted at different stakeholder groups, which may need support in implementing new requirements, or interpreting new legal provisions meant to ensure GI is preserved/enhanced and its ESS provision optimised. These may be directed at e.g. key staff members in local/regional authorities meant to implement revised planning regulations or foresters/farmers meant to change their practice on the ground to comply with new requirements.
Capacity building	Through targeted training on GI and its benefits public authorities ensure that those meant to implement GI measures are appropriately skilled and aware of the objectives they need to promote through GI. This will often be required also for staff working in the public administration who will have to change their perception with regard to the value of GI elements and the use that can be made of GI to deliver policy objectives.
Technical assistance on EU level (for policy making)	EU support to MS administration for the interpretation and implementation/transposition of new EU-level requirements in the area of GI across a wider range of policies.
Technical assistance at MS/regional level for potential beneficiaries of EU-financed projects	Support (either from EU to MS or MS to regions) to help applicants develop successful applications for projects and programmes involving e.g. delivering objectives (including objectives such as social cohesion, growth and jobs/rural development) through ecosystem based solutions. Support to potential applicants for funds (e.g. NGOs, farmers).

Table 5: GI elements

GI element	Description
Protected areas	Large areas of healthy and functioning ecosystems with minimal intervention required (e.g. national parks, forest reserves, IUCN categories I and II); smaller areas that require management intervention (e.g. Natura 2000, IUCN category IV).
Restoration zones	Reforestation zones, increased foraging areas, new areas of habitat for ecosystem services.
Sustainable use areas	Areas for improved ecological quality and permeability of landscape. Sustainable economic land uses that help maintain or restore healthy ecosystems (e.g. IUCN categories V and VI, biosphere reserves).
Green urban areas	Parks, gardens, grassy verges; green walls, green roofs.
Natural connectivity features	Ecological corridors (hedgerows, wildlife strips, stone walls) stepping stones, riparian river vegetation, etc.
Artificial connectivity features	Those features designed specifically to assist species movement (e.g. green bridges, eco-ducts, etc.).

Table 6: Possible indicators of ecosystem resilience and biodiversity:

Direct indicators	
At the species level	• Species richness (of selected groups) • Occurrence of rare species (of selected groups) • Presence of keystone species • Species' population /meta-population stability, e.g. of keystone species and threatened species
At the community level	• Saturation index to measure "intactness" of the community • Indices related to deviation with undisturbed situation: Natural Capital index, Mean Species Abundance, etc • Community diversity and other structural attributes and stability, perhaps relating to functional guilds
Indirect indicators	
	• Physical attributes, e.g. hydrology, soil condition, nutrient status. These depend highly on the ecosystem type, and therefore only some cases will be assessed. • Food webs e.g. stability, complexity and length. However, date on these are likely to be lacking • Vegetation structure (e.g. structural diversity) • Vegetation / habitat diversity • Functional habitat area, i.e. habitat patch size and functional connectivity (e.g. as assessed through various habitat fragmentation indicators) – This is a key issue being considered • Key habitat attributes (e.g. presence of deadwood in forests)

Table 7: Indicators of ecosystem services provided by Green Infrastructure

Ecosystem Service	**Indicator**
Provisioning services	
Food provision	Crop production from sustainable [organic] sources
	Area of agricultural land
	Livestock production from sustainable [organic] sources
	Fish production from sustainable [organic] sources (eg proportion of fish stocks caught within safe biological limits)
	Number of wild species used as food
	Wild animal/plant production from sustainable sources
Water (quantity)	Total freshwater resources
	Population served by renewable water resource
	Renewable water supply
	Water storage capacity
Raw materials	Forest growing stock, increment and fellings
	Felling to increment ratio
	Industrial roundwood in million m^3 from natural and/or sustainably managed forests
	Pulp and paper production in million tonnes from natural and/or sustainably managed forests
	Cotton production from sustainable [organic] resources in tonnes and/or hectares
	Forest biomass for bioenergy in million tonnes of oil equivalent (Mtoe) from different resources (e.g. wood, residues) from natural and/or sustainably managed forests

Genetic resources (for food security)	Number of crop varieties for production
	Livestock breed variety
	Number of fish varieties for production
	Number of species that have been the subject of major investment or have become a commercial product
Medicinal resources	Number of species from which natural medicines have been derived
Ornamental resources	Number of species used for handcraft work
	Amount of ornamental plant species used for gardening from sustainable sources
Regulating services	
Air quality regulation	Atmospheric cleansing capacity in tonnes of pollutants removed per hectare
	Downward pollutant flux, calculated as the product of dry deposition velocity and pollutant concentration
	Pm_{10} removal by tree cover
Climate/climate change regulation	Total amount of carbon sequestered / stored =sequestration / storage capacity per hectare x total area (Gt CO_2)
	Net Carbon Exchange
	Net Ecosystem Productivity
	Evapotranspiration rate
	Canopy stomatal conductance
Moderation of extreme events (eg storm protection and flood prevention)	Trends in number of damaging natural disasters
	Probability of incident
	Flood attenuation potential: residence time of water in rivers, reservoirs and soil
	Floodplain water storage capacity
	Soil capacity to transfer groundwater
	Wave attenuation potential
	Surface area of coastal wetlands and dunes
Regulation of water flows (e.g. natural drainage, irrigation and drought prevention)	Water infiltration capacity/rate
	Soil water storage capacity in mm/m
	Floodplain water storage capacity in mm/m
Waste treatment (especially water purification)	Water quality in aquatic ecosystems (sediment, turbidity, phosphorous, nutrients, etc.)
	Biological indicators: eg Index of Biological Integrity, European WFD Ecological Status, Wetland Biological Condition, species traits as indicators of environmental stress
	Nitrogen retention
	Nitrogen removal
Erosion prevention	Soil erosion rate by land use type
	Functional traits as proxy indicators of service provision, eg rooting depth and structure of plants
	Soil quality indicators: infiltration capacity, bulk density as indicator of compaction
Maintenance of soil fertility (resulting from soil formation)	Soil carbon content
	Species composition, aggregated in functional groups (eg biomass of decomposers, proportion of different trophic groups) as an indicator of process capability

Pollination	Abundance and species richness of wild pollinators
	Range of wild pollinators (eg in km, regular/aggregated/random, per species)
	Proximity to natural habitat
Biological control (e.g. seed dispersal, pest and disease control)	Abundance and species richness of biological control agents (eg predators, insects, etc.)
	Range of biological control agents (eg in km, regular/aggregated/random, per species)
	Changes in disease burden as a result of changing ecosystems
Noise regulation	Persons/year where defined threshold in dB is not exceeded due to natural sound absorbers
Cultural services	
Landscape and amenity values	Changes in the number of residents
	Changes in the number of visitors to a site to enjoy its amenity services
	Number of products whose branding relates to cultural identity
	Comparative value of real estate nearer to nature
Opportunities for recreation and tourism	Number of visitors to protected sites per year
	Amount of nature tourism
	Number of recreational users of green space
	Number of recreational anglers and hunters
Cultural values and inspirational services, e.g. education, art and research	Total number of visits to sites specifically related to education or cultural reasons
	Number of TV programmes, studies, books etc. featuring sites and the surrounding area
Supporting services	
Nutrient cycling	Soil organisms/functional groups
	Nutrient retention/removal rates
Primary production	Net primary production
Provision of habitat	Conservation status of habitats and species
	Number of species for which the GI element provides habitat
Maintenance of genetic diversity	Species diversity and Phylogenetic diversity