Supporting the Implementation of Green Infrastructure

Final Report

Contract details:
European Commission, Directorate-General for the Environment
ENV.B.2/SER/2014/0012
Service Contract for "Supporting the Implementation of Green Infrastructure"

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Rotterdam, 31 May 2016

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Executive summary

The EU Green Infrastructure Strategy adopted in May 2013 foresees a number of actions to be carried out under the lead of the European Commission in the following years. They include, for example, integrating green infrastructure (GI) into key policy areas, improving the knowledge base and encouraging innovation in relation to GI, and assessing opportunities for developing a trans-European GI network (TEN-G).

The service contract reported on in this Final Report aimed at supporting the implementation of these actions, in particular actions which require new knowledge. This report presents the outputs of the five distinct tasks conducted during this service contract, namely:

- *Task 1: Ensuring a more effective promotion of GI at all relevant levels;*
- *Task 2: Capacity building, training, education for GI;*
- *Task 3: Improving information exchange mechanisms;*
- *Task 4: Assessing technical standards and innovation possibilities;*
- *Task 5: Assessing costs and benefits of TEN-G*.

Task 1: Ensuring a more effective promotion of GI at all levels

The first task (summarised in Chapter 1 of this Final Report) aimed to raise awareness of GI among the general public, Member States and a range of relevant sectors through the development and dissemination of GI information material. The project team produced factsheets regarding the implementation and potential of GI in ten selected Member States, as well as six factsheets presenting the costs and benefits of GI to specific sectors (i.e. finance, industry, transport, energy, public health, and water). In addition, four thematic factsheets were produced, portraying GI in relation to the construction of buildings, abandonment of rural areas, job creation, and climate change adaptation. The project also contributed to the dissemination of GI knowledge and awareness through three sectoral workshops. Finally, Task 1 included activities to support meetings of the Green Infrastructure Implementation and Restoration Working Group (GIIR WG).

Task 2: Capacity building, training, education for GI

Chapter 2 of this Final Report reports on the second task, which focused on capacity building and training in relation to GI. It developed and implemented training modules for two 'train the trainers' workshops, one on GI and wetland restoration and one on better linking GI with existing operational programmes. The task also resulted in material for a Massive Open Online Course (MOOC) on GI, aimed at disseminating GI training material to a broader audience across Europe and beyond.

Task 3: Improving information exchange mechanisms for GI

Task 3 presented in Chapter 3 of this Final Report evaluated the current visibility of GI information on the digital platforms of several EU policy sectors and stakeholders, and considered means of improving the content of and access to digital information on GI. In a first step, the task identified the platforms relevant for disseminating GI information and considered how such information can be (better) integrated. For eight selected platforms, the accessibility and type of GI information was evaluated. Three platforms – Biodiversity Information System for Europe (BISE), Natural Water

Retention Measures (NWRM) and Climate-ADAPT – were further chosen for a more detailed analysis of the accessibility and user-friendliness of the GI information they contained. For these three platforms, the team assessed the technical and governance requirements for implementing a series of recommendations and discussed the feasibility of the recommendations with the officials responsible for their implementation.

Task 4: Assessing technical standards and innovation possibilities

Task 4 presented in Chapter 4 of this Final Report examined how technical standards, particularly in relation to physical building blocks and methodologies and procedures, could increase the deployment of GI. The study covered nine sectors: finances, buildings, water, transport, public health, industry, climate, rural abandonment and energy. It explored the extent to which GI is currently covered in the standards of these sectors and assessed the need for (further) harmonising, adapting or developing GI-related standards. A series of sector-specific sheets were developed, including concrete recommendations concerning the need for harmonisation between standards, the potential for including or strengthening the concept and principles of GI in different standard categories (performance, procedure, methodology), and the interoperability between technical standards applied in different project phases (planning, design, and construction). A number of cross-sectoral recommendations were also formulated.

Task 5: Exploratory work on a TEN-G

Finally, Task 5 presented in Chapter 5 of this Final Report included all exploratory work related to the potential introduction of a Trans-European Network for Green Infrastructure (TEN-G).

The overall objective of the EU's GI related policy ambitions is to have an EU network of green infrastructure in optimal condition to deliver essential ecosystem services throughout Europe. However, in practice priorities will need to be identified. To promote sustainability, recovery and maximum effectiveness, there should be an interlocking, coherent and co-ordinated approach across the different spatial scales (local, regional, national, EU) to the mapping and assessment of the ecosystem condition and to the identification of priorities for GI intervention/investment.

At the level of the EU, a TEN-G would involve the promotion of strategic investments in the EU network of Green Infrastructure motivated by:

1. the need to protect, restore and enhance the overall quality of the network and to maintain certain minimum quality levels to ensure the continued delivery of ecosystem services;
2. the need to protect, restore and enhance the delivery of priority ecosystem services in identified geographic locations at a scale which transcends administrative boundaries, taking into account in particular trans-boundary impacts; and
3. social and/or cultural considerations that transcend administrative boundaries (e.g. the Green Belt initiative following the line of the "iron curtain" or the pilgrimage route to Santiago de Compostela).

To this end, Chapter 5 of this Final Report captures the analysis and results from the TEN-G exploratory work that has been carried out under the service contract. Chapter 5.1 first summarises what we can learn from existing trans-European infrastructure networks (energy and transport) in terms of the possible design options of a TEN-G. As a second step (as presented in Chapter 5.2), the team developed a baseline

estimating the current EU funding levels for GI under the existing GI policy and funding structures in order to compare and contrast the expected costs and benefits of a TEN-G to a situation without it.

The **key outputs** for the **GI baseline scenario** can be summarised as follows:

- **During the 2014 – 2020 programming period, we estimate that green infrastructure will likely receive EU finance amounting approximately to €6,397 million by public EU funds** through various funding mechanisms, namely: LIFE+; the European Regional Development Fund (ERDF), the European Social Fund (ESF) and the Cohesion Fund[1]; the European Agricultural Fund for Rural Development (EAFRD); and the European Fisheries Fund (EFF)[2]. This is an average of **approximately €915 million** per year.
- Although in monetary terms the fund contributing most to GI by far appears to be the agriculture fund EAFRD, less than 1% of its total budget (**€418 billion**) was allocated to GI between 2014 and 2020. That accounted for **€4,967 million** (**77%** of the total EU-funded GI). In fact, proportionally speaking, LIFE is the biggest contributor to GI implementation. For 2014-2020, funding from LIFE would amount to **€1,248 million** (**19%** of the total EU-funded GI), which means that **36%** of the total LIFE budget is allocated to activities that can be considered GI.
- In terms of the distribution of funding across the various GI components, current funding is primarily allocated to finance the conservation of green areas (**€5,010 million** of all GI funding; **78%** of all GI funding) and restoration of green areas (**€78 million** of all GI funding; **12%**). By contrast, connectivity issues, sustainable use green zones and green urban and peri-urban areas are underfunded in the baseline situation, as these building blocks receive only approximately **1%, 4% and 4%** of all EU funds allocated to GI projects respectively. Investments in greening urban and peri-urban areas are mostly spent on green roofs, city parks, urban forestation and the like. Connectivity mostly funds fish passes and animal corridors while there is no indication of financing having been provided to projects dealing with other connectivity-related GI such as eco-ducts, green bridges, areas along energy and transport networks.
- Against this backdrop, **TEN-G could focus on promoting projects that enhance natural and artificial connectivity, as this is an underfunded area under the current set-up** and could also contribute to reducing fragmentation.

Building on this baseline, the team implemented a **first-phase assessment of costs and benefits of a potential TEN-G versus continuing the current GI policy and funding structures**. It should be noted that the assessment carried out did not focus on finding out the best design set-up option for a TEN-G, but rather provides initial evidence on whether or not the costs of introducing and running a TEN-G would be outweighed by the expected economic, social and environmental benefits delivered via such a network. This means that the assessment first established knowledge on the current status quo scenario, the GI baseline. As a next step, the cost-benefit assessment focused on comparing the different proposed GI components in terms of what can deliver the greatest level of benefit if promoted under a Trans-European network structure. The results therefore can be used for informing policy discussions and next steps with regards to developing a TEN-G framework, the most relevant ambition level, component focus, etc.

[1] These three funds present their project beneficiaries together, without specifying which amounts come from CF, ERDF and ESF.
[2] For the period 2014-2020, the EFF is replaced by so-called European Marine and Fisheries Fund (EMFF)

Whilst the assessment process is high level and subject to a number of uncertainties, the **findings indicate** that **a TEN-G has the potential to provide greater benefits per € invested than the current GI policy implementation and funding allocation** (as described under the baseline scenario). Considering only the top five ranked components in the assessment, the benefit-cost ratio (BCR) for TEN-G is more than double the BCR under the current funding allocation. If the goal is to maximise the BCR (as opposed to focusing on particular environmental or social priorities), then the top five priority components that could make up a TEN-G network are: Natura 2000 sites, Extensive agricultural landscapes, Regional and National parks, Multi-functional sustainable managed agricultural landscapes, and Wilderness zones. The ranking of priority components changes when the aim is to maximise the level of environmental or social benefits delivered.

A TEN-G network based on the components that were ranked in the top ten at least twice in this assessment (based on benefit-cost ratio, level of qualitative benefits, based on social priorities or based on environmental priorities) alongside those that could generate sufficient benefits to attract private funding would include[3]:

- Natura 2000 sites
- Regional and National parks
- Multi-functional sustainably managed agricultural landscapes
- Wilderness zones
- High nature value farmland
- Ecological networks with cross-border areas
- Local nature reserve
- Sustainable forest management
- Multi-use forests (such as watershed forests)
- Water protection areas
- Restored landscape systems covering a substantial part of agricultural/forestry areas
- Allotments and orchards
- Storm ponds and sustainable urban drainage
- City reserves
- Metropolitan park systems
- Wildlife strips

[3] The following components reached the Top10 list due to their suitability for private funding: Water protection areas; Restored landscape systems covering a substantial part of agricultural/forestry areas; Allotments and orchards; Storm ponds and sustainable urban drainage; City reserves; Metropolitan park systems; Wildlife strips.

The following components could also be included in the Top10 list if only focusing on one of the prioritisations: Extensive agricultural landscapes; Functional riparian systems; Transboundary landscape features on river basin; Substantial share of structure-rich agricultural, forestry or natural landscapes; Supra-regional corridors; Sustainable coastal and marine management zones related to the respective sea basin; Restored areas which were before fragmented or degraded natural areas; Protection forests (against avalanches, mudslides, stonefalls, forest fires); Natural buffers such as protection shorelines with barrier beaches and salt marshes; Mountain range level (sustainable use zones).

The above list of potential priority components for a TEN-G incorporates a range of different types of components, thus would be suitable for implementation in a variety of areas across the EU.

Other findings of the assessment include:

- Overall, the results indicate that directing money towards components already known for their high environmental value (e.g. Natura 2000 sites) can result in benefits. However, if the **list of components funded** is extended to consider the top components in terms of maximising the BCR, contributing to social priorities and contributing to environmental priorities, the results show that a wider variety of components should be prioritised under a TEN-G.
- **Operating at an EU scale** rather than at Member State level enables the network to focus on those components that will provide the most benefits to Europe for the money invested, since the area of land available for implementation of such components is far greater than that available to one Member State. Therefore, at a theoretical level, the overall benefits of setting up a TEN-G would outweigh the costs, since the network could focus on implementing those components that provided the greatest benefits. At a practical level, considerations other than space would need to be taken into account to ensure that the TEN-G was comprehensive and inclusive, and shared benefits across the EU-28. However, such a network could still be far more cost beneficial than the current allocation of funding across the various GI components. Factors to take into account in the development of TEN-G would include the existing spread of GI components across the EU (to avoid imbalances between Member States), the condition of existing components, and the location of settlements and their current access to GI components (which affects the value of some of the benefits provided).
- Furthermore, the location of components in combination with the types of benefits they are expected to provide is likely to affect the **level of private investment** the components may attract. Components that provide marketable services (e.g. crops, livestock) are likely to attract private investment, whereas those which provide universal but non-exclusive services (e.g. regulating services related to air quality, climate regulation) may be more reliant on public investment.

While restricted by certain limitations, the first-phase cost-benefit assessment of the potential environmental, social and economic advantages of introducing a TEN-G versus continuing the status quo has generated food for further thought and discussion on the matter. In the next follow-up steps it will be important to start looking in more detail into the possible design options including potential locations where components could be implemented, realistic ambition levels in terms of funding for TEN-G, that could be taken forward by DG Environment.

Introduction

Context

Target 2 of the EU Biodiversity Strategy[4] aims to ensure that "by 2020, ecosystems and their services are maintained and enhanced by establishing Green Infrastructure and restoring at least 15% of degraded ecosystems." Action 6b of the Strategy contains a pledge by the European Commission to develop a Green Infrastructure Strategy, a commitment which was also recalled in the *Roadmap to a Resource Efficient Europe.*[5] The Commission delivered on this commitment in May 2013 by adopting the Communication *Green Infrastructure (GI) – Enhancing Europe's Natural Capital.*[6] The GI strategy aims to create an enabling framework in order to promote and facilitate GI projects within existing legal, policy and financial instruments.

Defined as "a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services",[7] GI can contribute to the effective implementation of a range of policy areas, including regional policy, climate action, disaster risk management, water policy, health policy, and the Common Agricultural Policy. Indeed, one of the key attractions of GI is its multifunctionality, i.e. its ability to perform several functions and provide several benefits on the same spatial area, in contrast to its 'grey' counterparts, which tend to be designed to perform only one function such as transport or drainage. The functions of GI can be environmental, such as conserving biodiversity or adapting to climate change, social, such as providing water drainage or green space, and economic, such as providing jobs and raising property prices.[8]

What is Green Infrastructure?

Green Infrastructure (GI) is 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.

GI is a tool for providing ecological, economic and social benefits through natural solutions. It helps avoid relying on 'grey infrastructure' that is expensive to build when nature can provide cheaper, more durable alternatives.

European Commission (2013) *Green Infrastructure (GI) – Enhancing Europe's Natural Capital*

[4] Communication from the European Commission to the European Parliament, the Council, the Economic and Social Committee and the Committee of the Regions: Our life insurance, our natural capital: an EU biodiversity strategy to 2020, COM (2011) 0244 final.
[5] Communication from the European Commission to the European Parliament, the Council, the Economic and Social Committee and the Committee of the Regions: Roadmap to a Resource Efficient Europe, COM (2011) 0571 final.
[6] Communication from the European Commission to the European Parliament, the Council, the Economic and Social Committee and the Committee of the Regions: Green Infrastructure (GI) – Enhancing Europe's Natural Capital, COM (2013) 249 final.
[7] Ibid.
[8] European Commission (2012) The Multifunctionality of Green Infrastructure. *Science for Environment Policy*. In-depth report. Available at http://ec.europa.eu/environment/nature/ecosystems/docs/Green_Infrastructure.pdf

The GI Strategy foresees a number of actions to be carried out under the lead of the Commission in the following years. They include, for example, integrating GI into key policy areas, improving the knowledge base and encouraging innovation in relation to GI, and assessing the opportunities for developing an EU TEN-G initiative (i.e. trans-European priority axes for GI in Europe, similar to the trans-European networks in grey infrastructure sectors including TEN-T for transport and TEN-E for electricity infrastructure). To support the implementation of these new actions – particularly with regard to actions which require new knowledge – the Commission launched the present service contract in 2014. This final report brings together the outputs of the five tasks conducted during the service contract, as outlined below.

Approach and objectives

The service contract was structured around five independent tasks:

1. Ensuring a more effective promotion of GI at all relevant levels;
2. Capacity building, training, education for GI;
3. Improving information exchange mechanisms;
4. Assessing technical standards and innovation possibilities;
5. Assessing costs and benefits of TEN-G.

The results of each task are included as separate chapters in this Final Report. Below, we present an overview of the objectives and outputs per task.

Task 1: Ensuring a more effective promotion of GI at all relevant levels

The contract's first task was aimed at raising awareness of GI among the general public, Member States, and a range of relevant sectors, via the development and dissemination of GI information material.

As part of this task, the project team produced **ten country factsheets** aimed at providing Member States with a promotional tool which they could use in their own GI promotion efforts, as well as informing economic policy activities at European level, such as greening the European Semester process. Given this purpose, the country factsheets include information on the aims of the EU Green Infrastructure Strategy and related actions, figures on costs and benefits of investing in GI relevant for Member States' policy priorities, as well as good practice examples from the respective country. The selection of countries sought to target (a) Member States with a currently low level of GI awareness or commitment, (b) country involvement in the European Semester process, as well as (c) an adequate geographical coverage across Europe. Thus, factsheets were developed for: Denmark, Germany, Italy, Latvia, Malta, Poland, Portugal, Romania, Slovenia, and Spain.

A further action under this task was the preparation of **six sector factsheets** presenting the costs and social, economic and environmental benefits of GI to six specific sector groups with further GI uptake potential. The factsheets covered the following sectors: finance, industry, transport, energy, public health, and water (water supply and waste water treatment). In addition, **four thematic factsheets** were produced, focusing on GI in relation to the construction of buildings, abandonment of rural areas, job creation, and climate change adaptation. The factsheets are intended to serve stakeholders in the respective sectors, as well as policy-makers.

The country-specific, sectoral and thematic fact sheets are included in Annex 1.

In addition to the factsheets, the project also contributed to the dissemination of GI knowledge and awareness through the implementation of **three sectoral workshops**, held in:

- Lecce, Italy – focused on GI and the health sector;
- Arad, Romania – focused on GI and various sectors faced with green/grey infrastructure decisions; and
- Helsinki, Finland – focused on GI and businesses.

Finally, Task 1 also included activities to **support meetings of the European Green Infrastructure Implementation and Restoration Working Group (EU WG GIIR)** – namely, the 3rd and 4th GIIR WG meetings and the joint meeting with the MAES Working Group – through the preparation of background materials and follow-up deliverables assisting the client with its contributions to the group. The team also presented preliminary findings of all tasks during each of the sessions, inviting participants to provide feedback and suggestions.

Task 2: Capacity building, training, education for GI

The contract's second task focused on capacity building and training in relation to GI. In particular, the goal was to 'train the trainers' and therefore provide the necessary background material and toolset to 'pass on the message' about GI in Europe and to ensure a continuation in the efforts to increase GI uptake beyond the timeframe of this service contract. To this end, the task developed training material that can be re-utilised in various combinations to create tailored training modules for different stakeholders.

In a first step, the project team conducted a **'quick scan' of existing trainings and awareness raising initiatives across the EU-28** in order to gain a better understanding of the current availability and the types of training workshops which could be developed under this service contract. The resulting training database can be seen as a living document that could be updated by representatives of the EU WG GIIR on an annual basis.

As a next step, training material was developed, based on other tasks in this service contract. The developed training material was subsequently 'test-run' in **two workshops** which were selected based on opportunities to link up with an already planned event. The two workshops were:

- A training on GI & Wetland Restoration as part of CEEWeb's Academy event on Building Blue-Green Infrastructure: Restoring and protecting wetlands and their ecosystem services in Budapest, Hungary.
- A training on better linking GI with existing operational programmes, as part of an event organised in Arad, Romania on 'Implementation of the Strategy for Green Infrastructure in Romania: Nature – our health our wealth'.

In addition to the two workshop events, it was agreed with the client to develop material for a broader **Massive Open Online Course (MOOC) on GI** in order to make training more widely available for a larger audience across Europe (and

beyond). The developed lectures (7 in total) can also be easily amended or complemented with lectures on additional GI topics in the future. It should be noted that this contract only developed the lecture scripts, not the actual video material to deliver the MOOC.

The MOOC lecture scripts are included in Annex 7.

Task 3: Improving information exchange mechanisms

Task 3 evaluated the current visibility of GI information on digital platforms of European policy sectors and other stakeholders and considered means of improving the content of - and access to - digital information on GI.

This part of the study was structured around four subtasks:

- **Exploring the current digital GI information landscape and identifying the policy sectors and stakeholder platforms that are relevant for disclosing GI information at an EU level:** this included identifying priority policy sectors and stakeholders for which GI information should be available and identifying the linked communication and information exchange platforms. It also included describing what may be the ideal platform and how it could be implemented. Furthermore, the team examined how the existing platforms are organized and how GI information could best be integrated and made available.
- **Evaluating the accessibility of GI information among a selection of eight platforms and the type of information available (such as data, indicators, maps, libraries, etc.):** this assessment evaluated which GI content the selected platforms provide or do not provide, whether its visibility can be improved and whether the information available can be linked to the European Biodiversity Information System (BISE). This exercise led to recommendations on how to improve the content and visibility of GI information.
- **Determining the technical or governance requirements for implementing recommendations for a subset of three shortlisted platforms:** the aim of this subtask was to provide a file for each of the three selected platforms – i.e. BISE, Natural Water Retention Measures (NWRM) and Climate-ADAPT – where a description of the technical specifications and properties for the platform are elaborated. After outlining the technical details, an analysis and proposal was made to conduct the necessary adjustments to receive data, process the data and finally publish the data targeted to the existing governance and technical processes. Proposals, processes, approaches and recommendations were discussed with the technical and administrating levels of the selected platforms, in order to assess and estimate the most suitable mechanisms and procedures for sharing GI-relevant information.
- **Discussing with the representatives of the EU information systems to what extent the recommendations provided in the report can be implemented:** with respect to content, deliverables of the other tasks within this contract, in particular outputs from tasks 1, 2 and 4, may allow for material being ready to use and available for being uploaded directly. It remains the responsibility of the respective services to actually upload and incorporate the information received.

The task resulted in a series of recommendations related to the various platforms examined, as well as more general recommendations for improving the online visibility of GI.

As a final step, the analyses and recommendations made in this report were distributed to the responsible services of BISE, NWRM and Climate-ADAPT. In an iterative process, the team explored with them how to succeed in implementing the recommendations made.

Task 4: Assessing technical standards and innovation possibilities

The objective of Task 4 was to support the Commission's assessment of how (and under which circumstances) technical standards, particularly in relation to physical building blocks and methodologies and procedures, could increase the deployment of GI.

The study covered nine sectors, namely, finances, buildings, water, transport, public health, industry, climate, rural abandonment and energy. For these sectors, we assessed how technical standards in use by each of these sectors could increase the deployment of GI. This included an exploration of the extent to which GI is currently covered in the standards of these sectors, as well as an identification of the gaps, i.e. areas where GI is insufficiently covered in the standards. We thereby investigated in depth the need for (further) harmonising, adapting or developing GI-related standards.

The research combined desk review and interviews with representatives of the different sectors. In addition to the evaluation of the nine sectors, representatives of the Joint Research Centre and the Institute for Environmental Protection and Research were interviewed with regard to ongoing initiatives related to GI and standardisation. Where relevant, these initiatives were included in the sector fact sheets or in the general outcomes of the report.

Based on the various inputs, sector sheets were developed clarifying the current state for the sector and commenting on the possible way forward. These sector sheets include concrete recommendations regarding:

- The need for harmonisation between standards;
- The potential for including or strengthening the concept and principles of GI in the different standard categories (performance, procedure, methodology);
- The interoperability between technical standards applied in different project phases (planning, design, and construction).

A series of cross-sectoral recommendations were also identified and discussed.

Task 5: Assessing costs and benefits of establishing a TEN-G

The objective of Task 5 was to carry out TEN-G exploratory work, in particular focusing on a first-phase assessment of costs and economic, social and environmental benefits of establishing a Trans-European Green Infrastructure Network.

The first part of this task **reviewed the existing Trans-European Networks for transport (TEN-T) and energy (TEN-E)** since these networks may potentially provide valuable feedback from existing experience for the establishment of a TEN-G in terms of governance and financing mechanisms. The lessons learnt from this review are reported for consideration when deliberating on the most suitable set-up options of a TEN-G for Europe.

Building on this review, the remainder of the task consisted of a **first-phase assessment of costs and benefits of a potential TEN-G versus continuing the current GI policy and funding structures**. It should be noted that the assessment carried out did not focus on finding out the best design set-up option for a TEN-G, but rather provides initial evidence on whether or not the costs of introducing and running a TEN-G would be outweighed by the expected economic, social and environmental benefits delivered via such a network. This means that the assessment first established knowledge on the current status quo scenario, the GI baseline. As a next step, the cost-benefit assessment focused on comparing the different proposed GI components in terms of what can deliver the greatest level of benefit if promoted under a Trans-European network structure. The results therefore can be used for informing policy discussions and next steps with regards to developing a TEN-G framework, the most relevant ambition level, component focus, etc.

The first step during the assessment was the **development of the status quo scenario, the current GI baseline** of what the existing GI policy and funding approach already delivers in terms of GI initiatives and how much these cost (across the various funds). This step involved identifying the costs and benefits associated with different GI components. Existing funds that have been allocated to each of the GI components have been estimated using the projects that have been funded under LIFE+, the European Regional Development Fund (ERDF), the European Social Fund (ESF), the European Agricultural Guarantee Fund (EAGF), the European Agricultural Fund for Rural Development (EAFRD), the European Marine and Fisheries Fund (EMFF) and the Cohesion Fund. This information was then used in combination with identified data on the costs of each GI component (in € per ha) to estimate the area of each component delivered, and hence the ecosystem service benefits under the existing situation (the current baseline). The assessment in the next step then looked at whether a TEN-G would provide greater benefits than those estimated under the current baseline.

As mentioned above, the **cost-benefit assessment** then focused on comparing the potential additional European added value a TEN-G could theoretically deliver compared to the baseline scenario. This involved comparing the benefits of the various GI components against their costs to identify which offered the best 'value for money' if promoted on a European scale, and hence to prioritise where funding might be allocated under a TEN-G. Under a theoretical prioritisation exercise for TEN-G funding, those GI components with the highest benefit-cost ratio were ranked highest, so more funding was allocated to those components that delivered a higher level of benefits for

every € spent. The GI components were also ranked in terms of the non-monetary benefits that they could provide. As well as ranking on all ecosystem service benefits, the GI components were compared with how they performed against existing social and environmental priorities, such as the ones identified by the 7th Environmental Action Programme.

It should be noted that the narrative provided in this Final Report is supported with the developed Excel calculation sheets and a technical methodological report as annexes.

1 Task 1 – Ensuring a more cost-effective promotion of GI at all levels

Chapter summary

In the bigger picture of supporting the implementation of Green Infrastructure via this contract, Task 1 is aimed at raising awareness on a general level – via the development and dissemination of information to a broad audience from various backgrounds (= catered to 'the wider audience' to gain further attention and buy-in from non-experts). In order to make the information material more accessible, the material and workshops are geared towards various target groups, namely: 10 Member States with little GI information available, 6 sectors with further GI uptake potential, and 4 topic areas offering interesting linkages to other policy areas to gain attention and link policy debates with other 'hot topics'.

20 Factsheets: The development of the 20 factsheets (10 countries, 6 sectors, 4 topics) has generated additional information as regards the status of implementation, good practice cases, and the level of awareness for those selected countries, sectors and topics. However, the development process has also highlighted some challenges as regards the availability and accessibility of GI information for specific countries, sectors and/or topics. Feedback received for the factsheets has been very positive, with requests whether such factsheets will be made available for additional countries and sectors/topics.

Sectoral workshops: In addition to the factsheets, another avenue for supporting DG ENV with the dissemination of GI knowledge and awareness was the implementation of three sectoral workshops. In addition to raising awareness, the workshops were also used to 'test-run' the relevant sector (and topic/country) factsheets. The three workshops were held as part of on-going workshops/events in order to maximise participation. The three sectoral workshops were as follows:

1. Lecce, Italy – focused on GI and the health sector;
2. Arad, Romania – focused on GI and various sectors faced with green/grey infrastructure decisions; and
3. Helsinki, Finland – focused on GI and businesses.

Key generalised lessons learned from the sectoral workshops are:

- **Content:** Participants really appreciated the wealth of usable information provided. As a next step, the client could possibly provide access to all workshop material via their website, BISE, etc. Additionally, further workshops of this type could be implemented in the future.
- **Organisation:** Low attendance and other organisational challenges can primarily be associated with the fact that we were dependent on the 'hosting' event. A lesson learnt here is that it might be better to organise future sessions independently, taking the risk of lower attendance rates (which are also not guaranteed when linking up with an existing event, see Helsinki).
- **Status of GI awareness:** All three workshops have shown that there is an urgent need to further raise awareness and build capacity on the linkages between GI and other sectors. While some steps have been taken, further efforts are needed to present good examples and provide training on how to include GI elements in other policy areas. For example, the sector factsheets can be used as an information source and further promoted not only in Romania but also in other Member States facing similar problems. Another major barrier to GI that has become very apparent during the workshops is insufficient understanding amongst stakeholders of the way natural ecosystems function which often results in an underused potential for GI development. Better use of integrated spatial planning processes, improved capacity of decision-makers and better institutional cooperation are important elements to address this challenge.

Supporting the EU WG GIIR: The contractor has supported the client with the preparation, hosting and follow-up of all WG GIIR meetings throughout the duration of the contract. This close interaction between the contractor and the WG GIIR has allowed maximisation of cross-fertilisation of ideas and sharing of knowledge on both sides.

Introduction

The key objective of Task 1 was to ensure a more cost-effective promotion of GI at all levels. This translated into three main support tasks the team was asked to implement throughout the duration of the service contract.

The first sub-task focused on supporting the promotion of GI in Member States via the development of promotional materials, namely GI factsheets. Similarly, the communication towards sectors (both policy-makers and private actors) of costs and benefits of GI as compared to grey alternatives within their respective fields has been deemed as an area that needed improvement. The team also developed sectoral and thematic factsheets, which can now be used as GI promotional material.

Finally, via interactions at sectoral workshops, but also during the various EU WG GIIR meetings, the team was able to gather valuable feedback on current barriers to further GI take-up, engage in discussions and test-run developed promotional materials.

The outputs of these activities are captured in the remaining sections of this chapter.

1.1 GI promotion in Member States

1.1.1 Development of country fact sheets

As part of this task we have produced ten country factsheets whose aim is two-fold:

- To serve MSs, which can use the sheet as a promotional tool for their GI efforts;
- To feed information into MS-specific information delivered to the EC for the Semester process.

Given this purpose, the country factsheets include information on the aims of the EC GI Strategy and actions, figures on costs and benefits of investing in GI relevant for Member States' policy/topic priorities, good practice examples in the country of concern.

The selection of Member States has been based on the following selection criteria (in order of importance):

- Low level of GI awareness i.e. we should focus on those countries we do not hear/know about;
- Inclusion mainly of those countries with low level of GI commitment;
- Country involvement in European Semester process;
- Geographical spread (to the extent possible).

In coordination with the representatives present during the inception meeting, the following Member States were selected for the production of country factsheets:

Table 1 MS selection for Task 1.1

#	Member State	Selection reason	Geographical Coverage
1	Poland	Pilot case	East
2	Romania	Semester process; planned national GI conference in 2015	East
3	Slovenia	Semester process	East
4	Italy	Semester process	South
5	Germany	Semester process	West
6	Latvia	2015 Presidency	North
7	Denmark	Little info known to EC	North
8	Portugal	Little info known to EC	South
9	Malta	Island state	South
10	Spain	High vs low commitment regions	South

The draft factsheets were developed by the project team and reviewed by the client. At a second iteration, they were also reviewed by country experts and circulated amongst the EU WG GIIR for comments. After the progress call held on 5 August 2015, all the factsheets have gone through a final thorough grammar and spelling check by an English native speaker from our consortium partner Stella Consulting. An additional check has been done to enhance the readability of the factsheets in a way that the message can get across in a clear and effective way. Further, we have adjusted all factsheets to include pictures tailored to each country and type of GI measure.

All final country factsheets can be found in Annex 1.

1.1.2 Insights and lessons learnt from developing the country factsheets

Looking back at the process of developing the factsheets, the content development and review by country experts ran smoothly. The decision to include 'standardised' paragraphs introducing the concept of GI as well as the European policy context for each factsheet, followed by a common structure to be filled with country-specific information and illustrative cases worked well not only for the development of content, but also for visual unity across all promotional sheets.

We have tested and distributed the factsheet to various types of users within the national context and received very positive feedback as regards the usefulness of the content, as well as the visual 'attractiveness' of the material, which entices the reader to study the contents.

The Italian and Romanian sheets, in particular, have also been included as part of the workshops delivered as part of Tasks 1.2 and Task 2 in Lecce, Italy and Arad, Romania respectively. Participants had been asked to give feedback on the usefulness of the factsheets. Commentary has been very positive, with requests on whether such factsheets will be made available for additional countries and sectors/topics.

1.2 Communication of costs and benefits of GI to sector groupings

The outputs of Task 1.2 concerned the production of 10 sector and thematic factsheets and the implementation of sectoral workshops with the aim of disseminating green infrastructure knowledge and awareness across selected sectors.

1.2.1 Production of 6 sector factsheets and 4 topic factsheets

We have created 10 factsheets which provide GI information relevant for selected sectors and topics. The sectors and topics have been selected and agreed upon together with the client during the inception phase of the project:

- In addition to the sectors proposed by the European Commission (finance, industry, transport, energy and public health), a sector sheet for the water sector (water supply, waste water treatment) has been produced. This choice has been driven by the fact that water supply companies often manage large infiltration areas with large GI potential (i.e. GI-based alternative waste water treatment) and the fact that water-related ecosystems often deliver multiple benefits.
- The thematic sheets deal with GI in relation to the construction of buildings, abandonment of rural areas, job creation, and climate adaptation.

The factsheets are aimed to serve sector actors as well as policy-makers. These factsheets contain information about the aims of the EC GI Strategy and actions (similar to the country factsheets). Furthermore, they include indications on costs and benefits of investing in GI for the specific sector/topic and good practice examples.

Similar to the country factsheets, the study team took the lead in developing draft content for the sector and topic sheets. Drafts were then reviewed by the client, relevant sector experts, as well as circulated amongst the EU WG GIIR representatives. It should be noted that (as agreed during the 21 May 2015 progress meeting) the finance, energy, public health, jobs, and climate adaptation sheets have been reviewed and updated based on a second round of expert feedback. After the progress call held on 5 August 2015, all the factsheets have gone through a final thorough grammar and spelling check by an English native speaker. An additional check has been done to enhance the readability of the factsheets in a way that the message can get across in a clear and effective way. Further, we have adjusted all factsheets to include pictures tailored to each sector and the specific illustrative examples.

All final sector and thematic factsheets can be found in Annex 1.

1.2.2 Sector workshops

As a second step for increasing the awareness about GI among sectors, the study team was asked to run three sectoral workshops. As agreed during the inception phase of the project, these workshops would be 'hooked onto' an existing sectoral event in order to maximise the number of participants and to encourage engagement with other organisations running relevant sectoral workshops.

The project team has run the following three sector workshops:

- IEREK – Urban planning and architecture design for sustainable development (14-16 October 2015) http://www.ierek.com/events/urban-planning-architecture-design-sustainable-development/, Lecce, Italy.
- Implementation of the Strategy for Green Infrastructure in Romania: Nature – our health our wealth (29-30 October 2015), Arad, Romania. (Combined sector workshop & train-the-trainer event).
- CBD Business Forum (11-12 November 2015) https://www.cbd.int/business/bc/2015forum.shtml, Helsinki, Finland.

We now elaborate on the summary of each workshop, present the lessons learnt and suggest next steps accordingly.

1.2.3 IEREK – Urban planning and architecture design for sustainable development

Summary of the workshop

The sector workshop was organised for an IEREK conference called Urban Planning and Architectural Design for Sustainable Development (UPADSD), organised in Lecce, Italy. Our audience mainly consisted of urban planners, architects and technical engineers. Some sessions were very specific on e.g. green roofs, but many of them were not about nature based solutions at all.

Unfortunately, due to logistical issues, our well prepared interactive workshop had to be transformed into a (although quite interactive) presentation. On our arrival, we were informed that the schedule was very much delayed and that they could offer us a slot on the day after. Due to our travel schedule, that was not an option for us.

Consequently, we were offered a room when one of the parallel sessions finished a bit early. Our time slot was reduced to no longer than 20 minutes. To make matters worse, our workshop had to start before the scheduled moment and in an unknown room, so participants came in only during the presentation. However, given that the presentation started slowly, with extra emphasis on the first introduction slides, late comers did not miss substantial parts. Although we had prepared a wonderful presentation with internet voting and interaction by Mentimeter[9] (so that the audience would answer different questions by choosing options, or scaling the importance of different types of GI), as a consequence of the limited time we were granted from the organisers, we decided to skip the interactive slides. Although the speaker interacted with the audience verbally, given the poor ability of many participants to express themselves in English, the interaction was less informative than the Mentimeter polls would have been.

Although the audience in the beginning consisted of approximately 20 people, by the time the workshop came to an end the room was filled with about 60-80 people. We decided to go on and take considerably more time than the 20 minutes we had been given. The audience only grew, nobody left the room and participants became very engaged and asked many questions, both during the session and afterwards (for example, during lunch some of the session's attendees engaged with us in a discussion about green/nature-based solution for cooling school yards, for climate change adaptation and storm water management). Most participants came from the Mediterranean countries and experienced different problems than the north-western European examples we presented.

The 30 sets of factsheets we brought printed with us were gone in a few moments and many people asked for the digital versions. We provided a link to them in the presentation, so that participants could download them.

Lessons learnt

The concept of a sector workshop worked well. Even though the audience was quite diverse and mostly originating from other climatic zones, many of them recognised the urban examples and discussed the solutions Green Infrastructure could offer.

[9] Service to create interactive presentations online that allow the audience to vote with smartphones during the presentation.

The presentation we prepared was targeting primarily urban planners and architects. The replicability of the workshop is not straightforward for other sectors and would need some adjustments to the presentation, for instance new examples. The structure of the presentation and the Mentimeter questions need less changes.

The factsheets were useful in preparing the presentation and raised a wealth of interest. We mentioned many examples addressed in those and in this way we were able to refer to the sheets during the session.

It was unfortunate that our workshop time had to be reduced, but the interactive Power Point presentation developed for the workshop could be used for other events.

All workshop materials (presentations and pictures) can be found in the accompanying Annex 2 '**Task 1.2 - Lecce Workshop Material'**.

1.2.4 Arad Workshop – GI implementation in Romania

Summary of the workshop

The workshop was held within the two-day conference "Implementing the Green Infrastructure Strategy in Romania - policy and practice." The conference was organized by Excelsior NGO in partnership with CEEweb for Biodiversity, supported by the Arad Municipality and took place on 29-30th October 2015 in Arad City Hall.

The purpose of the conference was to promote the implementation of the EU Green Infrastructure Strategy, and to identify the means of integrating the strategy in national development plans, financing options and sectors including environment, agriculture, forestry, transport and territorial development. The event was attended by representatives of the European Commission, Romanian ministries and authorities. Attendants had the opportunity to present their experience with respect to GI implementation, exchange views and ideas on how to tackle challenges.

The sectoral workshop on green infrastructure implementation was designed to be in line with the overall objectives of the conference. Specifically, the workshop aimed to highlight the wider benefits of GI and stimulate a discussion on mainstreaming GI in a number of sectors considering the Romanian context. The topics of the workshop complemented other themes addressed during the conference such as: vision and state of play of EU Green Infrastructure strategy, financing GI and opportunities for businesses, GI aspects in Romanian OPs for transport, CBC OP between Romania and Hungary, etc. In addition, the workshop served as an opportunity to inform the participants about the ongoing DG Environment contract on supporting the implementation of the GI Strategy and how they can benefit from its outcomes and deliverables.

Presentations

The presentation on mainstreaming GI into projects financed under ESI Funds (2014-2020) was delivered by Venelina Varbova from the REC and outlined the linkages between GI and the following policy areas: climate adaptation, transport, agriculture, industry, energy. The important role of GI for job creation was also highlighted. The presentation included a host of examples for different sectors that were mostly taken from the sector factsheets prepared under the DG Environment contract on supporting the implementation of the GI Strategy.

Kristin Faurest, external expert to the REC, gave a presentation on the multiple benefits (social, ecological and economic) of Green Infrastructure. The presentation also focused on GI as an integrated solution and highlighted the value of and approaches to stakeholder mapping. Kristin Faurest also presented three European green infrastructure case studies at the regional landscape, local institutional and neighbourhood level: 1) Landscape Park Rems (Landscape Park Stuttgart Region); 2) Miskolctapolca spa complex, Hungary; and 3) Ekostaden Augustenborg (urban regeneration initiative), Malmö, Sweden. The examples provided further insight into cross-sectoral cooperation, multidisciplinary approach, broad spectrum of benefits designed to solve existing social, environmental and economic problems.

The presentations were very well received by the participants and aimed to provide a basis for the subsequent group break-out sessions.

Group break-out sessions

Due to the reduced number of participants, three group break-out sessions were held instead of the originally planned six. The participants were split into three groups, as follows:

- Green Infrastructure and adaptation to climate change;
- Green Infrastructure and transport;
- Green Infrastructure and agriculture.

The groups were asked to consider the following key questions:

- What are the underused resources for GI development in Romania?
- What are the opportunities and challenges?
- Identify ideas for GI projects in Romania;
- Identify opportunities for incorporating GI as a part of other projects.

As an output the groups were requested to formulate policy ideas for development of GI in Romania. A representative of each of the working group presented the outcomes of the group work and discussions in plenary.

Working group: Transport and green infrastructure

Underused resources, opportunities and challenges with regards to GI and the transport sector:

- The underused resources for GI development are also opportunities.
- Romania possesses rich diversity of nature, but it is not considered from the transport point of view.
- There is potential in integrating GI solution in public transport (e.g. introducing green tram lines).
- Local communities are not sufficiently engaged in GI development.
- There is a need to build capacity of state administrations with regards to GI opportunities and implementation.
- There is a need to consider GI in local development plans.
- There is a need for incorporating GI in transport master plans.
- There is insufficient funding for GI solutions.

- There is a need for better institutional cooperation with regards to applying GI solutions in the transport sector.

Suggestions for policy improvement:

- Mapping existing GI (ecological corridors);
- Development of cycle network across borders;
- Integration of GI into transport policy at national and regional level;
- Analysis of the Impact of GI on the development of metro infrastructure, e.g. with regards to underground water system, drainage, greening of metro stations;
- Provide sufficient Institutional resources for the development of GI.

Working group: Agriculture and green infrastructure

Underused resources:

- There is non-utilized agricultural land/structures (e.g. canals);
- Much land is under small-scale biodiversity-rich and culturally valuable cultivation;
- The local products are not promoted enough;
- Traditional landscapes and opportunities for tourism;
- Heterogeneous landscape – allows for cultivating different types of crops.

Problems:

- There is no access to financing for high quality products;
- There is insufficient national financial support for product certification;
- There is erroneous or lack of support for small-scale farmers;
- Lack of farmers' cooperatives/associations;
- Depopulation of villages;
- Invasive species on abandoned land.

Opportunities exist with regards to:

- Agri-environmental schemes (eco-conditionality);
- Greening agricultural practices;
- Empowering local action groups;
- Limiting excessive fertilization.

Suggestions for further interventions:

- More investments in nature protection are needed.
- There is a need to revive water mills and canals.
- There is a need to develop short producers-buyers chains.
- Support needs to be provided to learning farms.
- There is a need to develop a database with information about local traditions.

Working group: Adaptation to climate change and green infrastructure

The following suggestions for policy actions have been outlined:

- There is a need to stimulate biomass production and use.
- There is a need to eliminate waste pollution from canals.
- The focus should be on the implementation of the WFD.
- Funding is needed for refurbishment of old buildings with focus on green roofs/walls. Such funding can come from OPs or municipal budgets.
- There is a need to raise awareness about the linkages between GI and adaptation to climate change.

Lessons learnt

Feedback on the quality of presentations, presented examples and facilitation of the workshop was positive. The group discussion was lively, and the participants were stimulated to think about GI development and what policy actions are needed to address challenges and unlock potential for GI implementation in Romania. Some of the ideas that resulted from the group work were quite innovative and could be further developed in a future working session.

We understood that the wider benefits of GI are poorly understood among authorities who are not dealing directly with nature conservation. The workshop was an opportunity to raise their awareness of economic and social benefits that GI projects deliver and the collaborative and multidisciplinary approach needed to achieve these goals.

All workshop materials (presentations and photos) can be found in the accompanying **Annex 3 'Task 1.2 – Arad Workshop Material'**.

1.2.5 Helsinki Sector Workshop - CBD Business Forum

Summary of the workshop

This sector workshop was attached to the CBD business and biodiversity forum in Helsinki on 11 and 12 November 2015. Communication was started early with the organisers. However, we only received green light to give the presentation a couple of weeks before the event.

In addition, while our aim was to have the session as a parallel session during the forum (to attract a large set of the 270 registered participants), our session was at the very last minute re-scheduled to take place right after the forum on 12 November 2015, later afternoon. Many participants were already flying home or were satisfied

with having had 2 full days of presentations and discussions. Unfortunately, this led to only 3 participants attending the session on GI.

Despite the low turn-out rate, the session was very lively, with good sharing of expertise and discussions on aspects relating to what was shown in the presentations. The feedback from participants was also very positive:

> *"The session was an excellent opportunity to get us thinking and discussing about GI, and in particular the following points:*
>
> - *Monitoring of GI: there is a tendency to assess GI from a quantitative perspective (e.g. number of hectares implemented), whereas the quality of the infrastructure itself is key and also needs to be assessed and monitored over time.*
> - *New sets of skills are required to ensure the maintenance of GI. Training a wide range of stakeholders – from architects to gardeners - to managing GI will be critical to ensure success of the projects.*
>
> *I have found the EC approach of embedding GI as a solution in different European platforms an interesting one. At the moment, the WBCSD is developing a specific and distinct project on "Natural Infrastructure for Business", and we should also start considering infusing GI in different existing WBCSD projects, such as the Climate Change or Sustainable Cities ones."*
>
> *(Violaine Berger, World Business Council on Sustainable Development)*

> *"Interesting and inspiring session on Green Infrastructure. The movie on green infrastructure (third movie) showed very clearly the different options and benefits. Clearly presented with enthusiasm which helps to deliver the message. The work for the EC is interesting but not as interesting as the first and last part of the presentation. Good to show the report from 2013, I will definitely have a look.*
>
> *Company example at the end is interesting but maybe a bit too long/detailed (end of the day...). Maybe too detailed on the methodology of biodiversity assessment. Would be good to see if you can capture this story in two slides using pictures of the area and putting the numbers in the picture or using infographics. Also good to show/indicate the results from an ecosystem services perspective and the beneficiaries. This also allows you to end with something which is a bit closer to the concept of green infrastructure (focus last part is now very much on biodiversity)."*
>
> *(Wijnand Broer, Crem)*

The presentation was shared with the participants by e-mail after the event. Afterwards, it was also agreed with the hosts of the CBD business and biodiversity forum that they would share the GI presentation with all participants to the forum by including it in the Forum materials made available on the Forum's webpages: www.ym.fi/BBDF2015. (The Forum materials include: Discussion paper, Added Value from Nature to Sustainable Business, presentations - PDF and web-stream recordings.) In this way, we hope for a wider dispersal and usage of the prepared information.

Lessons learnt

One of the key lessons learnt from this session relates to the fact as to how best to communicate with the private sector. Business agendas are typically quite full and

people's targets relate to turnover. They are very careful attending meetings if they do not see direct benefits on their end. To this end, it is important to locate the right outlet for such information to be disseminated. Additionally, the information should be as tailored as possible to the individual participants so as to maximise the benefit they can get out of the session.

All workshop materials (presentations and pictures) can be found in the accompanying **Annex 4 'Task 1.2 – Helsinki Workshop Material'**.

1.3 Supporting key actions of GIIR WG

The consortium has been present during the 3rd and 4th GIIR WG meetings, as well as the joint day with the MAES working group. The team has delivered draft minutes for these meetings as well as provided various requested preparatory and follow-up deliverables assisting the client with its contributions to the group. In addition, the team has presented preliminary findings of all tasks during each of the sessions, inviting participants to provide feedback and suggestions.

The separate file entitled **'Annex 5: Task 1.3 – WG GIIR support documents**' contains all draft minutes, presentations, edited documents, etc. created during the course of the project.

Lessons Learnt

The participation in the WG GIIR has been a very valuable experience for the team. The participation has allowed us to gain insights into the current debates on GI across Europe, as well as direct access to the main representatives per Member State, sector organisations and NGOs. From our perspective, we have maximised these insights and direct networking opportunities in order to improve deliverables via sharing ideas, asking for feedback and giving exposure to the overall contract amongst the relevant stakeholders.

From the perspective of the WG GIIR participants, we have gathered that they have appreciated the involvement of the contractor as part of the WG GIIR as this showed them the European Commission's deep commitment to the group and to delivering progress across various topics the WG is engaged in. Various members have acknowledged that the facilitation of drafting documents and the continuous updates regarding the status of this contract have been highly appreciated.

From the perspective of the client, the request for involvement in the WG GIIR has delivered positive results in terms of having had support for preparatory actions, during the events, as well as with follow-up action points. In addition, the client and contractor were able to maximise lessons learnt and the cross-nurturing of thought processes / developments between this project and ongoing work of the WG.

2 Task 2 – Capacity building, training, education for GI

Chapter summary

In the bigger picture of supporting the implementation of Green Infrastructure via this contract, Task 2 is targeted at a deeper level of understanding and more focused target group (in comparison to Task 1). The goal of this task is to 'train the trainers' and thus provide the necessary background material and toolset to 'pass on the message' about GI in Europe and – in turn – ensure a continuation in the efforts to increase GI uptake beyond the timeframe of this project. This was also highlighted during the inception meeting, where the client emphasised that Task 2 was included in the service contract to try and fill a missing link between the existing trainings on various relevant topics and the inclusion of 'GI' considerations within existing sectoral trainings.

To this end, the task contains the preparatory research and development of training material that can be re-utilised in various combinations to create tailored training modules for different sectors, Member States, etc. The first sub-task focused on gathering a brief overview of existing trainings and awareness raising initiatives across the EU-28 in order to gain a better understanding of the current availability and what types of training workshops could be developed under this service contract. The resulting training database can be seen as a living document that could be updated by representatives of the EU WG GIIR on an annual basis.

The two workshops to 'test-run' developed training material were chosen based on opportunities to link up with an already planned event. Material was then tailored to the level of GI knowledge of the audience as well as to the sector/theme covered by the broader conference.

In addition to these tailored workshop modules, the team had agreed with the client to develop one broader GI module that can be accessed by a wider range of audience as an online training course. This MOOC (Massive Open Online Course) material could be a tool to reach and train many people from across the EU-28 (and beyond) on GI. The developed lectures (7 in total) can also easily be amended with lectures for additional GI topics in the future.

Introduction

Task 2 of the contract focused on capacity building, training and education in relation to GI. On the one hand, the task set out to identify the existing initiatives that already exist across Member States and NGOs/educational institutions. On the other hand, the task also included steps to generate new training material to be 'test-run' in workshops.

To achieve these overall goals, the team first conducted a 'quick scan' of existing training and awareness raising initiatives in the EU-28. As a next step, training material was developed (based on other tasks in this service contract) and tailored to the two events where the training workshops were held. In addition to the two workshop events, it was agreed with the client to develop the material for a broader GI MOOC (Massive Open Online Course) to make training more widely available for a larger audience across Europe (i.e. not event dependent).

2.1 EU-28 Quick Scan of existing training and information initiatives

As part of Task 2, we have reviewed existing training programmes across the EU-28 Member States. The aim of this quick-scan was to identify a short-list of measures (activities in this case) which are particularly relevant to enhancing capacities for GI.

The 'EU-28 quick-scan' was presented in an Excel sheet to the Commission in April 2015 with name, target area, target group, short description of measure, and entity responsible for the measure. The result was a list of 20 existing training programmes / facilities. This list was circulated amongst the WG GIIR members in order to gather any additional initiatives the team may not have been aware of. The final EU-28 Quick Scan (document entitled "EU-28 Quick Scan final.xls") can be found in Annex 6. The exercise should be seen in combination with some of the inventory relevant for training/awareness that has been gathered in parallel as part of the WG GIIR (see Annex 6 for Task 2, document entitled "MTR_target 2_GI_31032015.xls").

Conclusions from this scanning exercise have indicated that there is a need for a greater availability of tailored GI information sessions that can teach decision-makers the practical application of 'green options' as an alternative to their traditional grey infrastructure solutions. To this end, it was agreed to develop two train-the-trainer workshops and test-run them as a parallel session linked to an existing event in order to draw sufficient participants.

In addition to these tailored sector- and/or country/city/region- specific trainings, it was agreed with the client that a broader GI course available for a wider public throughout Europe could help those interested in the topic gain the necessary knowledge to then teach/inform others. To this end, it was agreed to develop the content for a freely accessible Massive Open Online Course (MOOC) that could eventually be run by a university, NGO or another European institution via commonly known platforms, such as COURSERA or edX.

In practice the above has materialised into:

- Preparatory documents for a **Massive Open Online Course** (MOOC) on GI
- A training on GI & Wetland Restoration as part of CEEWeb's Academy event on Building Blue-Green Infrastructure: Restoring and protecting wetlands and their ecosystem services **in Budapest, Hungary**.

- A training on better linking GI with existing operational programmes, as part of an event organised in **Arad, Romania** on 'Implementation of the Strategy for Green Infrastructure in Romania: Nature – our health our wealth' (combined sector workshop & training event).

These three trainings are further explained in the remaining chapters of this Task 2 report.

2.2 Development of a Massive Open Online Course (MOOC) on GI

The development of a so-called Massive Open Online course (MOOC) on GI included the conceptualisation of what content information would be suitable to be conveyed in this type of training format, what type of target audience the material should be designed for, and the preparation of all scripts for the MOOC sessions. The actual implementation (launching and running) of the online course on GI was not within the scope of the service provided. The documentation that has been produced as a final deliverable can, however, be picked up by a professor/facilitator (e.g. University of Wageningen), recorded and easily transformed into the online MOOC once a hosting organisation has been found. During the preparatory work for the MOOC the team had close contact with the ATENS Resource Centre in France, as well as CEEWeb in Hungary who are both interested in participating in the implementation of such an online training opportunity.

As regards the target audience, the MOOC was developed to appeal to a wide range of individuals: from trainers to practitioners in the field, to local decision-makers, to architects, urban designers and planners, etc.

The format of the training module should resemble online courses in platforms such as 'Coursera'. The format we propose reads as follows:

- The course would run for 7 weeks;
- The course would consist of a total of 6 lectures, one per week;
- Lectures would be in the form of videos and text in English (videos have not been developed within this contract);
- Each week there will be a piece of homework given to students, in the form of a practice-driven assignment based on the lecture;
- Each lecture includes a quick test in the form of a quiz;
- The course should offer the possibility to obtain a certification upon request, when all assignments have been completed and tests passed;
- There will be a support email for content related questions.

We have developed all the materials that would together compose a full-fledged online course on GI, namely:

- 1 syllabus incl. a brief overview of the course; and
- Written lecture scripts (7 sessions), including short exam/test quizzes for each lecture, as well as recommended readings.

Aside from these materials, depending on the chosen MOOC hosting organisation, the organisers may want to consider adding a final exam and certificate to acknowledge the successful completion of the course.

The final MOOC materials can be found in Annex 7 under the name **"MOOC GI"**.

2.3 "Train the trainers" workshops

This chapter provides summarised overviews of the two training workshops and lessons learnt as regards their implementation. The material for each workshop has been developed by a team of experts based on existing knowledge and preliminary outputs of other tasks under this service contract so as to maximise the cross-feeding of information material. It should be noted that the information has been specifically tailored to match the events that the trainings were 'hooked onto'. As such, they cannot be replicated in the same manner elsewhere. However, much of the information and presentations can be adjusted for new settings with relatively minimal efforts, given the trainer team is aware of the context (e.g. country, sector, theme) it needs to be tailored to.

2.3.1 Training on GI & Wetland Restoration in Budapest, Hungary

Workshop Summary

The workshop was fun, everyone seemed to have a good time, working in the role play worked really well and the evaluation gave rise to some interesting cases and examples some of the participants could provide.

We had about 18 participants, which allowed us to create three groups. As the room was small, it would not have been possible to fit in more participants. The schedule of the morning programme was very much delayed, so we only started after lunch, but by merging some of the presentations and shortening the time for some of the assignments, we could finish right on time (by the time the energy level dropped and everyone got hungry).

Since the group consisted mostly of ecologists, the programme worked well. We did not have to explain the concept of Green Infrastructure, but they were very much interested in working with stakeholders. The session involved a mix of working and listening; Kristin Faurest, external expert to the REC, gave an inspiring presentation about multi-functionality after some intensive discussions within the groups, to give some new insights.

Lessons Learnt

We provided an evaluation sheet and asked participants to give their opinion about three parts of the workshop. The roleplay was evaluated in a short plenary moment. Most participants' feedback was positive; they know their own role as an ecologist, but now had to think from a different perspective and negotiate with other stakeholders, some of which may not be in favour of 'all green'. As some of the participants said, that was a very inspiring part of the workshop. Other reactions included the observation that stakeholders need to be involved in the process, not only informed. Especially the stakeholders that can provide financial or political support should not be forgotten in the early stages of the process.

By the time the workshop took place, the factsheets were not yet finalised and available in print. We provided a link to the digital set of factsheets. It is not clear how many participants actually downloaded and used them.

Although the presentation was good and informative, the timing of the workshop (right after lunch) and the crammed room made it difficult for some participants to stay awake. Although we had planned a speed-date, the room did not allow for that.

All workshop materials (presentations and photos) can be found in the accompanying file under Annex 8 **'Task 2 – Budapest Workshop Material'**.

2.3.2 Training at the event 'Implementation of the Strategy for Green Infrastructure in Romania: Nature – our health our wealth'

Workshop summary

The workshop was held within the two-day conference "Implementing the Green Infrastructure Strategy in Romania - policy and practice. The conference was organized by Excelsior NGO in partnership with CEEweb for Biodiversity, supported by the Arad Municipality and took place on 29-30th October 2015 in Arad City Hall.

The purpose of the conference was to promote the implementation of the EU Green Infrastructure Strategy, and to identify the means of integrating the strategy into national development plans, financing options and sectors including environment, agriculture, forestry, transport and territorial development. The event was attended by representatives of the European Commission, Romanian ministries and authorities. Attendants had the opportunity to present their experience with respect to GI implementation, exchange views and ideas on how to tackle challenges.

The sectoral workshop on green infrastructure implementation was designed to be in line with the overall objectives of the conference. Specifically, the workshop aimed to highlight the wider benefits of GI and stimulate a discussion on mainstreaming GI in a number of sectors considering the Romanian context. The topics of the workshop complemented other themes addressed during the conference such as: vision and state of play of the EU Green Infrastructure strategy, financing GI and opportunities for businesses, GI aspects in Romanian OPs for transport, CBC OP between Romania and Hungary, etc. In addition, the workshop served as an opportunity to inform the participants about the ongoing DG Environment contract on supporting the implementation of the GI Strategy and how they can benefit from its outcomes and deliverables.

Presentations

The presentation on mainstreaming GI into projects financed under ESI Funds (2014-2020) was delivered by Venelina Varbova from the REC and outlined the linkages between GI and the following policy areas: climate adaptation, transport, agriculture, industry, energy. The important role of GI for job creation was also highlighted. The presentation included a host of examples for different sectors that were mostly taken from the sector factsheets prepared under the DG Environment contract on supporting the implementation of the GI Strategy.

Kristin Faurest, external expert to the REC, gave a presentation on the multiple benefits (social, ecological and economical) of Green Infrastructure. The presentation also focused on GI as an integrated solution and highlighted the value of and approaches to stakeholder mapping. Kristin Faurest also presented three European green infrastructure case studies at the regional landscape, local institutional and neighbourhood level: 1) Landscape Park Rems (Landscape Park Stuttgart Region); 2) Miskolctapolca spa complex, Hungary; and 3) Ekostaden Augustenborg (urban regeneration initiative), Malmö, Sweden. The examples provided further insight into cross-sectoral cooperation, multidisciplinary approach, broad spectrum of benefits designed to solve existing social, environmental and economic problems.

The presentations were very well received by the participants and aimed to provide a basis for the subsequent group break-out sessions.

Group break-out sessions

Due to the reduced number of participants three group break-out sessions were held instead of the originally planned six. The participants were split into three groups, as follows:

- Green Infrastructure and adaptation to climate change;
- Green Infrastructure and transport;
- Green Infrastructure and agriculture.

The groups were asked to consider the following key questions:

- What are the underused resources for GI development in Romania?
- What are the opportunities and challenges?
- Identify ideas for GI projects in Romania;
- Identify opportunities for incorporating GI as a part of other projects.

As an output the groups were requested to formulate policy ideas for development of GI in Romania. A representative of each of the working groups presented the outcomes of the group work and discussions in plenary.

Working group: Transport and green infrastructure

Underused resources, opportunities and challenges with regards to GI and the transport sector:

- The underused resources for GI development are also opportunities.
- Romania possesses rich diversity of nature, but this is not considered from the transport point of view.
- There is potential in integrating GI solution in public transport (e.g. introducing green tram lines).
- Local communities are not sufficiently engaged in GI development.
- There is a need to build capacity of state administrations with regards to GI opportunities and implementation.
- There is a need to consider GI in local development plans.
- There is a need for incorporating GI in transport master plans.
- There is insufficient funding for GI solutions.
- There is a need for better institutional cooperation with regards to applying GI solutions in the transport sector.

Suggestions for policy improvement:

- Mapping existing GI (ecological corridors);
- Development of cycle network across borders;
- Integration of GI into transport policy at national and regional level;
- Analysis of the Impact of GI on the development of metro infrastructure, e.g. with regards to underground water system, drainage, greening of metro stations;

- Provide sufficient institutional resources for the development of GI.

Working group: Agriculture and green infrastructure

Underused resources:

- There is non-utilized agricultural land/structures (e.g. canals);
- Much land is under small-scale biodiversity-rich and culturally valuable cultivation;
- The local products are not promoted enough;
- Traditional landscapes and opportunities for tourism;
- Heterogeneous landscape – allows for cultivating different types of crops.

Problems:

- There is no access to financing for high quality products;
- There is insufficient national financial support for product certification;
- There is erroneous or lack of support for small-scale farmers;
- Lack of farmers' cooperatives/associations;
- Depopulation of villages;
- Invasive species on abandoned land.

Opportunities exist with regards to:

- Agri-environmental schemes (eco-conditionality);
- Greening agricultural practices;
- Empowering local action groups;
- Limiting excessive fertilization.

Suggestions for further interventions:

- More investments in nature protection are needed.
- There is a need to revive water mills and canals.
- There is a need to develop short producers-buyers chains.
- Support needs to be provided to learning farms.
- There is a need to develop a database with information about local traditions.

Working group: Adaptation to climate change and green infrastructure

The following suggestions for policy actions have been outlined:

- There is a need to stimulate biomass production and use.
- There is a need to eliminate waste pollution from canals.
- The focus should be on the implementation of the WFD.
- Funding is needed for refurbishment of old buildings with focus on green roofs/walls. Such funding can come from OPs or municipal budgets.

- There is a need to raise awareness about the linkages between GI and adaptation to climate change.

Lessons learnt

Feedback on the quality of presentations, presented examples and facilitation of the workshop was positive. The group discussion was lively, and the participants were stimulated to think about GI development and what policy actions are needed to address challenges and unlock potential for GI implementation in Romania. Some of the ideas that resulted from the group work were quite innovative and could be further developed in a future working session.

We understood that the wider benefits of GI are poorly understood among authorities who are not dealing directly with nature conservation. The workshop was an opportunity to raise their awareness of economic and social benefits that GI projects deliver and the collaborative and multidisciplinary approach needed to achieve these goals.

All workshop materials (presentations and photos) can be found in the accompanying file under Annex 3 **'Task 1.2 – Arad Workshop Material'**.

3 Task 3 – Improving information exchange mechanisms

Chapter summary

Green infrastructure (GI) is a successfully tested tool for providing ecological, economic and social benefits through natural solutions. GI helps to understand the value of the benefits that nature provides to human society and to mobilise investments to sustain and enhance them. It also helps avoid relying on infrastructure that is expensive to build when nature can often provide cheaper, more durable solutions. GI is based on the principle that protecting and enhancing nature and natural processes, and the many benefits human society gets from nature, are consciously integrated into spatial planning and territorial development. Compared to single-purpose grey infrastructure, GI has many benefits. It can sometimes offer an alternative, or be complementary, to standard grey solutions.

GI has ties with agriculture, forestry, nature, water, marine and fisheries, regional and cohesion policy, climate change mitigation and adaptation, transport, energy, disaster prevention and land use policies. Further, GI information may range from content on policy, to costs and benefits of measures and very technical input serving designers and engineers. Also, GI-relevant information might vary in its format: e.g. maps, indicators, articles, web pages, published documents, etc. In this report, the current visibility of GI information on digital platforms of European policy sectors and other stakeholders has been evaluated. The availability of solutions for improving access to digital information on GI has also been addressed.

Four subtasks have been distinguished in this work:

- **Exploring the current digital GI information landscape and identifying the policy sectors and stakeholder platforms that are relevant for disclosing GI information at an EU level.** This included identifying priority policy sectors and stakeholders for which GI information should be available and identifying the linked communication and information exchange platforms. It also included describing what may be the ideal platform and how it could be implemented. Further, it was researched how the existing platforms are organized and how GI information could best be integrated and made available.
- **Evaluating the accessibility of GI information among a selection of eight platforms and the type of information available (such as data, indicators, maps, libraries, etc.).** This assessment evaluated which GI content they provide or do not provide, whether its visibility can be improved from a GI perspective and whether the information available can be linked to BISE (the European Biodiversity Information System). This exercise led to recommendations on how to improve the content and visibility of GI information.
- **Determining the technical or governance requirements for implementing recommendations for a subset of three shortlisted platforms.** The aim of this task was to provide a file for each of these three platforms, where a description of the technical specifications and properties for the platform are elaborated. After outlining the technical details, an analysis and proposal was made to conduct the necessary adjustments to receive data, process the data and finally publish the data targeted to the existing governance and technical processes. Proposals, processes, approaches and recommendations were discussed with the technical and administrating levels of the selected platforms, in order to asses and estimate the most suitable mechanisms and procedures for sharing GI relevant information.
- **Discussing with the representatives of the EU information systems to what extent the recommendations provided in the report can be implemented.** With respect to content, deliverables of the other tasks within this contract, in particular outputs from tasks 1, 2 and 4, may allow for material being ready to use and available for being uploaded directly. It remains the responsibility of the respective services to actually upload and incorporate the information received.

The **recommendations** that were given are split over three time horizons:

- Recommendations that can be implemented in the short term: i.e. can be realized during the duration of the contract;
- Recommendations that can be implemented in the mid-term: i.e. can be initiated during the duration of the contract but will require final efforts shortly following the finalization of the contract; and
- Recommendations that can be implemented in the longer term, i.e. recommendations which need to be aligned with the technicalities and governance the different platforms have (however, it is not a request to dig deep into the governance of the various platforms).

For the first subtask, from a policy sector perspective, platforms were searched at the EU level relating to nature, water, climate, agriculture, health and consumers, disaster risk management, mobility and transport, and regional and cohesion policy. In addition, GI may be important to a variety of stakeholders that are either involved in working on infrastructure and design of open space or otherwise are users of open space. For the first group, stakeholder groups that will have large impact through their activities on the environments-we-live-in are landscape architects, building professionals and spatial planners. Focusing on the users of open spaces, relevant groups to consider are land owners, foresters, farmers, fishermen, hunters, nature NGOs and businesses. For each of the digital platforms that were identified, a brief description was provided of the available GI information. Next, for each of the platforms an evaluation was made of the GI information that is available.

For platforms hosted by the European Commission's policy sectors, the evaluation shows the relatively weak availability of GI information. The GI information that is available across the studied EC platforms is relatively dispersed and not presented in a coherent way. A common aspect for the reviewed platforms is that there is a lot of information that is highly relevant to GI but not defined and labelled as such. With respect to the available policy information, GI is only visible on a limited number of EC-related websites and platforms. Much progress therefore can be made by having the concept, its relevance for the sector and a link to the GI section on BISE integrated across the relevant policy sectors.

Based on the stakeholder platforms that were evaluated, it was found that except CEEweb none of them qualifies as an information or knowledge sharing platform. It may be explored whether links can be made from BISE to CEEweb and vice versa. Next to CEEweb, FACE and WBCSD are best in class with limited but clear and inspiring information on GI. On some other platforms GI is mentioned, however very little could be retrieved. Also for those platforms that have related information (biodiversity, ecosystem services, nature-based solutions, etc.), the link to GI is made in some documents. However, GI is not included on these platforms in a dedicated manner. Altogether, the visibility of GI on platforms and websites at the EU scale of stakeholder groups for which GI is considered very much relevant can be considered poor. A future 'ideal world' could be one where GI visibility has increased substantially for a large selection of the platforms hosted by stakeholders.

It is evident that if constructed appropriately, portals can positively contribute to distributing relevant information to the public and to various end-users. A major question is where to disclose information and how to make information accessible such that end-users can locate what they search for in a straightforward and easy way. Thus, the link has to be made between the "what" and "why" of information with the "where" and "how".

- Therefore, it is necessary to gain thorough insights in where end-users may be assisted by specific information.
- Further, it has to be acknowledged that end-users will not necessarily look for GI related information from a GI perspective. Indeed, for example, a farmer may simply be looking for ways to diversify and thereby be aided by knowing that a GI focus can be one option.
- Knowing which end-users may need GI-related information and understanding the online paths they may choose to reach that information can aid in providing the required information at the places where end-users are likely looking for it.
- This concerns information available from various departments at the EU and the national level, but also the information provided at regional and local levels.
- Different groups of end-users have very different ways in which they interact with GI and many of them will not be inclined or have a natural tendency to go and dig into technical information provided on a website dedicated to GI, for example under BISE.
- The web portals they usually visit (for example about support to agriculture or industries) should point towards the websites providing relevant GI information.

For the second subtask eight platforms were selected to be explored in more depth and addressing which of the content that is presented or can be presented relates to GI. Also, we explored in more depth the accessibility and user friendliness of the platform in general and from a GI perspective more specifically for three of the eight platforms: BISE, NWRM and Climate-ADAPT. For each of the eight platforms, the analysis addressed the end-users and their expectations, what is available on GI and what is lacking, whether there is potential to connect across platforms and how to improve the visibility of GI.

The following conclusions could be drawn regarding the three major platforms that were researched (BISE, NWRM and Climate-ADAPT):

- With respect to BISE, although not labelled as such, most information of the BISE platform is highly relevant from a GI perspective as preserving biodiversity is an important result and building block of GI measures, because ecological networks are GI and because it concerns ecosystem services for delivering goods and services. One of the key conclusions from the analysis is that the GI relevant sections need to be made more visible, including through better labelling of the many sub-sections that have GI relevance. Moreover, by providing further interlinkages between the various GI-related sections, the usefulness of BISE for the end-users would increase, and a more holistic picture will be given. The platform hosts the nice feature of the GI library which has a lot of potential to be further developed into a rich source of information. The library, however, needs to be made more visible and accessible to be able to provide its full potential. There is a lot of GI relevant information available on BISE, but its coherence, visibility and user-friendliness needs to be improved. By structuring the information, increasing interlinkages, extending the integration of other GI platforms, BISE could become a good source of GI information. The GI information available should be extended to encompass policy aspects as well as greater depth with regard to the different GI options and measures that are available. These aspects need to be addressed before BISE can claim to be a user friendly, exhaustive source of GI knowledge in Europe.
- NWRM (Natural Water Retention Measures) is all about GI. It is well-placed under WISE and only needs to be indicated on BISE with a link and short explanation. In other words, no integration into BISE is necessary and only a connection should be established. Considering the NWRM platform from a GI perspective, it could be improved by better introducing and integrating the GI concept and the strong supportive relationship of GI and NWRM, as this is currently missing. All information on the website is highly relevant to GI as NWRM per se are green infrastructure solutions. The information is however not labeled as such and the user might not be aware that this is in fact GI. This aspect should be given further attention to make the context clear for the end-users. Currently, there are not many linkages made to external sources, and it would be useful to have many more links to other GI platforms and sources of information. A technical challenge is how to integrate NWRM into WISE. The NWRM platform, which is entirely GI, could serve as inspiration for setting up/renewing other GI-related platforms such as BISE or the new platform on sustainable cities that will be organised. The structure of the measures section, and to some extent the case studies section, can be used as an illustrative example of how to create interlinkages within a platform and how it is making links to the relevant case studies, benefits etc.
- In the context of climate, GI is among the most widely applicable, economically viable and effective tools to support climate change adaptation. The integration of GI into climate adaptation management, also called ecosystem-based adaptation, contributes to achieving the EU climate adaptation goals. The Climate-ADAPT platform contains a few references to GI, however not sufficiently to reflect its significance. A clear introduction of GI is missing. In its current state the few GI references are scattered across the platform. These aspects are making the GI relevant information on the platform difficult to locate resulting in a low usefulness for the user. The website contains knowledge which would be highly relevant to GI and that could provide useful information and guidance on sectors, measures, processes etc. relevant for GI, and in particular GI measures supporting climate adaptation. Presenting the GI concept in a visible and structured way is needed. The available information related to GI should be highlighted as GI relevant. It would also be important to increase the interlinkages across the platform to provide a fuller overview of GI and to help the user to find their way to the information. It would be beneficial to create a separate section on GI and adaptation which could present all these aspects in a coherent and visible way. These improvements would be necessary to establish links with other platforms, such as BISE.

Very specific recommendations have been made for the various platforms researched as well as more general recommendations for improving the online visibility of GI, including:

- In the short-term, BISE should be developed into a GI information hub, while considering it will and should not be the only access point for GI knowledge. Therefore, it is a crucial aspect to decide on which GI information to make available through BISE, and which through other platforms (such as, for example, NWRM or Climate-ADAPT). For GI information disclosed through other platforms it requires attention to assure this to be connected to BISE such that it is accessible also for end-users that do access through BISE. In addition, there is a rather weak presence of both the term GI and the information that relates to GI across platforms linked to either the EC or to stakeholders. In fact, many platforms that can be considered as relevant do not contain any reference at all to the concept of GI. Much progress therefore can be made by having the concept, its relevance for the sector or stakeholder group and a link to the GI section on BISE integrated across the relevant policy sectors and stakeholder platforms.
- In the mid-term, it was discussed that the 'ideal' future situation has GI information made available through the different websites/platforms linked to specific policy sectors/stakeholder groups. It will be important to consider end-user needs when deciding where to disclose which GI information. Another

challenge is to connect the different sources available on the various platforms. For end-users, rather than having to search for GI information on various platforms, it may be beneficial to have user-relevant GI information become available through a single search or from a single page with convenient links to where other information is available. To improve user access to GI information, a search function in combination with a single repository where all GI related information is centralized, would be the most effective solution. However, the feasibility of this option is rather low, as it is very unlikely that all platforms involved would be willing to share all information in an agreed manner. This brings us to a long-term recommendation: machine to machine communication.

- While most websites have some degree of structure, the language in which they are created, HTML, is oriented towards structuring textual documents rather than data. As data is intermingled into the surrounding text, it is hard for software applications to extract snippets of structured data from HTML pages. Linking data distributed across the Web requires a standard mechanism for specifying the existence and meaning of connections between items described in this data. "Structured data markup" is a standard way to annotate your content so machines can understand it. When your web pages include structured data markup, Google (and other search engines) can use that data to index your content better, present it more prominently in search results, and surface it in new applications like voice answers, maps, and Google Now. A more generic approach to making structured data available on the Web are Web APIs. Web APIs provide simple query access to structured data over the HTTP protocol.

As a final step, the analyses and recommendations made in this report were distributed to the responsible services of BISE, NWRM and Climate-ADAPT. In an iterative process it was explored with them how to succeed in implementing the recommendations that were made.

Introduction

The overall purpose of this task report is to look for very pragmatic solutions for improving the digital information sharing/presentation on green infrastructure (GI). In short, solutions are needed for making relevant digital content on GI more visible.

Before further considering where GI information should be digitally present, we feel the need to concisely consider what GI is. A challenge is that GI is not a sector and that the language can be different in the various sectors where it is relevant. Indeed, GI is a concept not easily defined, with broad ties to a variety of sectors and policy fields (see BOX 1 and the glossary developed by the expert Working Group on Green Infrastructure Implementation and Restoration (WG GIIR)[10]).

More specifically, GI has ties with agriculture, forestry, nature, water, marine and fisheries, regional and cohesion policy, climate change mitigation and adaptation, transport, energy, disaster prevention and land use policies. Therefore, GI information may need to be dispatched through all these channels. In addition, GI information may range from content on policy, to costs and benefits of measures and very technical input serving designers and engineers. Therefore, GI information should not only be present in a variety of disciplines, but also serve a variety of needs (decision makers, designers, engineers, businesses, users, etc.). GI-relevant information may also vary in its format: e.g. maps, indicators, articles, web pages, published documents, etc. Considering the relevance of GI to a variety of sectors and stakeholders, determining the most relevant sectors and platforms for providing information on GI at the EU level needs to be prioritized.

At this moment there is a lack of a coherent availability of digital GI information to the relevant stakeholders. Experience shows that clearing house mechanisms and other means of experience sharing and information hosting are not dedicated to GI or the relevant context has not been targeted towards the needs of GI stakeholders, and therefore is only of limited use for GI implementation. Indeed, target groups which are important for GI implementation in the field, such as land owners, project developers and businesses, are only informed to a very limited degree about benefits and trade-offs in using GI, ways to get GI measures approved and implemented, funding possibilities, etc. Therefore, the European Commission aims to better integrate GI-relevant issues into existing or planned platforms visited by stakeholder groups. In this context it is relevant to note that there will not be a central repository where all GI information will be available. The aim is to identify the different repositories that are available (i.e. locating the main GI information on a European scale today) and connecting these.

[10] http://ec.europa.eu/environment/nature/ecosystems/docs/green_infrastructures/GI%20webpage%20glossary.pdf

Box 1 What is GI?

Many definitions of GI have been developed[11]. In its 2013 Green Infrastructure strategy[12], the European Commission defines Green Infrastructure as "a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services. It incorporates green spaces (or blue if aquatic ecosystems are concerned) and other physical features in terrestrial (including coastal) and marine areas. On land, GI is present in rural and urban settings."

In addition, many countries may have had a form of GI in place for many years, but do not label it 'GI' or see the need to evaluate it as such. For example, in their report on the design, implementation and cost elements of GI, Naumann and colleagues[13] found that out of the 127 GI initiatives that they assessed only 20% explicitly identified themselves as GI. In the report, GI is defined as the network of natural and semi-natural areas, features and green spaces in rural and urban, and terrestrial, freshwater, coastal and marine areas, which together enhance ecosystem health and resilience, contribute to biodiversity conservation and benefit human populations through the maintenance and enhancement of ecosystem services. GI can be strengthened through strategic and coordinated initiatives that focus on maintaining, restoring, improving and connecting existing areas and features, as well as creating new areas and features. Further, many initiatives might cover specific purposes (e.g. re-connecting areas with high biodiversity values, restoring riparian forests to protect against floods, promoting green roofs in cities for water retention, planting hedgerows in agricultural areas for landscape enhancement/pollination/erosion control/preventing floods …). They do not, however, fully consider its many benefits for other sectors and citizens, which the very same structure could offer if properly planned and managed. The multi-purpose character of GI therefore is in these instance not acknowledged or communicated.

Owing to its multifunctionality, there is no single science or discipline responsible for GI[14]. The nearest integrative scientific discipline accountable for its evolution is 'landscape planning'. GI relies on the theories and practices of numerous scientific and land planning professions, such as conservation biology, landscape ecology, urban and regional planning, geographic analysis, information systems and economists.

GI is widespread in spatial scales as its application can range from individual buildings to neighborhoods and cities to entire regions, even across countries (see Natura 2000 network or European Green Belt). Further, benefit groups are also different at the respective scale of consideration: e.g. carbon storage by peatlands has beneficiaries worldwide; whilst the water retention function of the same peatland is felt locally.

The features or elements are not always simple to define and descriptions of GI can change depending on the stakeholder[15].

Related terms are landscape planning, natural infrastructure (US nomenclature), nature-based solution, ecosystem services, natural capital, etc. among many others.

Given the wide span of definitions of GI, and the wide range of the components and parts of the GI, we may define GI as the spatial structure delivering multiple ecosystem services, which might include 'grey' or hybrid elements (such as green roofs or fauna passages).

Through the adoption of the Green Infrastructure strategy in 2013, the common understanding of terminology and purpose of GI has made significant progress. However, the need for information sharing and communicating about Green Infrastructure will probably go up along with the increased deployment of GI in the EU.

[11] Green Infrastructure and territorial cohesion. European Environment Agency (2011). Technical Report No 18/2011. See also http://ec.europa.eu/environment/nature/ecosystems/docs/Green_Infrastructure.pdf
[12] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52013DC0249
[13] Naumann, S., McKenna D., Kaphengst, T. et al. (2011). Design, implementation and cost elements of Green Infrastructure projects. Final report. Brussels: European Commission.
[14] Benedict, M.A. & McMahon, E.T. (2002) Green Infrastructure: Smart Conservation for the 21st Century. Renewable Resources Journal. 20(3: 12-17.
[15] Horwood, K. (2011) Green infrastructure: reconciling urban green space and regional economic development: lessons learnt from experience in England's north-west region. Local Environment 16(10):963-975.

3.1 Problem analysis and objectives of Task 3

As introduced, the goal of task 3 is to look for very pragmatic solutions for improving the digital information sharing/presentation of GI. Task 3 consists of four parts. It concerns (1) identifying platforms and selecting the most useful ones, (2) evaluating the potential for increasing GI visibility among selected platforms, (3) making recommendations for improving GI visibility, and (4) making progress towards having recommendations for the main European-level information systems implemented by the responsible services, facilitated by technical assistance given by this contract. A more detailed description of these four subtasks is provided below:

1. Exploring the current digital GI information landscape and identifying the policy sectors and stakeholder platforms that are relevant for disclosing GI information at an EU level.
    a. Identify priority policy sectors and stakeholders for which GI information should be available and identify the linked communication and information exchange platforms.
    b. Consider what platform may be ideal and how to implement it, and then consider how to work with what is available. Which platforms are there, how are they organized, and how can GI information be best integrated?

2. Assessing for a selection of eight platforms how accessible the GI information is and what sort of information is available (such as data, indicators, maps, libraries, etc.). Specifically, it will be evaluated which GI content they provide or do not provide, whether its visibility can be improved from a GI perspective and whether the information available can be linked to BISE[16] (see BOX 2). This exercise will lead to recommendations on how to improve content-wise the visibility of GI information. Note, however, that the analysis of this set of eight platforms does not include evaluating what the implementation of recommendations requires from a technical or governance perspective.

3. For three of the eight selected platforms, this last step will be undertaken; for each of the recommendations given, the technical or governance requirements for their implementation will be evaluated. The aim is to provide a file for each of these three platforms where a description of the technical specifications and properties for the platform will be elaborated. After outlining the technical details, an analysis and proposal will be made to conduct the necessary adjustments to receive data, process the data and finally publish the data targeted to the existing governance and technical processes. Proposals, processes, approaches and recommendations will be discussed with the technical and administrating levels of the selected platforms, in order to asses and estimate the most suitable mechanisms and procedures for sharing GI relevant topics. This will result in the development of an implementation file including a roadmap, technical advice, recommendations on budget needed, entry points, web design and risks.

4. It will be discussed with the owners of the EU information systems to what extent the recommendations provided in the report can be implemented. With respect to content, deliverables of the other tasks within this contract, in particular outputs from tasks 1, 2 and 4, may allow for material being

[16] http://biodiversity.europa.eu/

ready to use and available for being uploaded directly. It remains the responsibility of the responsible services to actually upload and incorporate the information received.

The recommendations will be split over three time horizons:

- Recommendation can be implemented in the short term: i.e. can be realized during the duration of the contract;
- Recommendation can be implemented in the mid-term: i.e. can be initiated during the duration of the contact but will require final efforts shortly following the finalization of the contract; and
- Recommendation can be implemented in the longer-term, i.e. recommendations which need to be aligned with the technicalities and governance the different platforms have (however, it is not a request to dig deep into the governance of the various platforms).

Box 2 BISE - the Biodiversity Information System for Europe

The "Biodiversity Information System for Europe" (BISE), a portal owned by DG Environment and hosted by the EEA, has the objective to provide a single entry point for accessing the best available information to support the implementation of the EU 2020 Biodiversity Strategy and the CBD Strategic Plan for Biodiversity 2011-2020. The main focus of this integrative platform is to better integrate available outcomes from reporting and monitoring from different sources and consolidate the knowledge base for biodiversity-related policies in Europe in a coherent and co-ordinated way.

The general objective of BISE is not to duplicate but to integrate and upgrade existing tools and develop new ones as necessary to be shared within the EKC. In short, the aim of BISE is to 'strengthen the knowledge base in support of the implementation of the EU Biodiversity Strategy to 2020'. The system is following and implementing the principles of the 2007 EC Directive establishing an Infrastructure for Spatial Information in the European Union (INSPIRE)[17] as well as the 2008 EC Communication concerning a Shared Environmental Information System (SEIS)[18]. It integrates any relevant content from Environmental Data Centres[19] as defined in the EU Environmental Data Centre (EDC) arrangement. Interoperability with thematic data centres and similar portals supporting requirements under other environmental legislation (e.g. WISE[20], Climate-ADAPT[21]) is a main goal to be achieved by 2018.

BISE is a partnership between the European Commission DG Environment - Directorate B and the European Environment Agency, supporting the knowledge base for the implementation of the EU 2020 Biodiversity Strategy. It also serves as the Clearing-House Mechanism for the EU within the context of the United Nations Convention on Biological Diversity (CBD) and as such it is supported by the collaboration of the European CHM network and the CBD Secretariat.

BISE is a process. Its content and services are being developed in collaboration with key users and information providers so that it meets the information needs of the EU Biodiversity Strategy to 2020 and of the global Aichi Targets.

BISE will facilitate the integration of facts and figures on biodiversity, ecosystems and ecosystem services, making links to related policies, interconnecting with environmental data centres, supporting harvesting assessments and research findings from various sources. More generally, it will contribute to strengthening the knowledge base for biodiversity policy and better informed decision-making on biodiversity.

The BISE website is complemented by the so called BISE-Catalogue. This catalogue hosts a dedicated library on GI with currently 230 documents being online that can be searched through free search or e.g.

[17] Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) http://eur-lex.europa.eu/JOHtml.do?uri=OJ:L:2007:108:SOM:EN:HTML http://www.ec-gis.org/inspire/home.html
[18] Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions - Towards a Shared Environmental Information System (SEIS) COM/2008/0046 final.
[19] http://biodiversity.europa.eu/data
[20] http://water.europa.eu/
[21] http://climate-adapt.eea.europa.eu/

language/country options. Even if this tool is accessible and usable, it is not fully operational now.

Currently BISE is organising information under six main entry points:

1. **Topics**: state of species, habitats, ecosystems and their services, genetic diversity, threats to biodiversity, impacts of biodiversity loss, policy responses;
2. **Policy**: policy, legislation and supporting activities related to EU directives, EU biodiversity policy developments, pan- European and global policy frameworks;
3. **Data**: data sources, statistics and maps related to land, water, soil, air, marine, agriculture, forestry, fisheries, tourism, energy, land use, transport;
4. **Knowledge**: important EU-wide research projects or peer-reviewed literature related to biodiversity and ecosystem services, improving the science-policy interface;
5. **Countries**: national biodiversity reporting activities and information; country profiles based on officially published and regularly updated information from Member States;
6. **Networks**: sharing by networks across national borders.

Under the umbrella of the entry point 'Topics' a thematic part of BISE is dedicated to Green Infrastructure: http://biodiversity.europa.eu/topics/green-infrastructure
Next to the topic section, information on GI is also available through the 'policy' section, Biodiversity Strategy (there through information on Target 2 in general and on Action 6b in particular).

3.2 The digital GI information landscape

3.2.1 Policy sectors

To answer the question of which digital platforms GI information is or should be available we need to identify the policy areas which might be relevant in relation to GI.[22] The following may be possibly relevant areas, although this list is not exhaustive and other areas (for example the area of biodiversity and businesses) can also be considered:

- Agricultural policy with the Common Agriculture Policies (CAP) and its funding possibilities;
- Forestry policy with the Forest Action Plan;
- Biodiversity & Nature with the EU 2020 Biodiversity Strategy, the Birds and Habitats Directive and the Life+ programme;
- Water policy with the Water Framework Directive, the River Basin Management Plans, the Floods Directive, the EU Drought policy, the EU water Blueprint;
- Soil policy and the protection of soil;
- Climate change policy with the 2050 Low Carbon Roadmap and the programme to adaptation;
- Territorial Cohesion and innovative financing with the regional or cohesion policy and examples such as the EU Strategies for the Danube Region and for the Baltic Sea Region;
- EU 2020 & Resource Efficiency Flagship: EU 2020 Strategy and Resource Efficiency Flagship under EU 2020;
- Transport & Energy: TEN-T, TEN-E, energy policy, Connecting Europe Facility;
- Impact assessment and damage prevention and remediation: EIA and SEA Directives, Environmental Liability Directive;
- Spatial planning: European Spatial Development Perspective, ESPON 2013 Programme, Urban Strategy, Territorial Agenda of the EU 2020;

[22] See also: http://ec.europa.eu/environment/nature/ecosystems/studies.htm#implementation

- Marine and coastal zones policy: Marine Strategy Framework Directive, Fishery policies, EU Maritime Spatial Planning Communication;
- Environment & Health: Environment and Health Action Plan 2004-2010;
- Research Policy/ Horizon 2020, Framework programme for research and innovation;
- EC external development cooperation.

To further build on this, the European Commission indicated in a communication[23] to the Parliament and the Council "that GI can make a significant contribution in the areas of regional development, climate change, disaster risk management, agriculture/forestry and the environment. For promoting GI in the communication, focus was made on the following main policy areas through which GI should be promoted: regional or cohesion policy, climate change and environmental policies, disaster risk management, health and consumer policies and the Common Agricultural Policy, including their associated funding mechanisms".

From a policy sector perspective, in our analyses on where GI information is or should be available we therefore focussed on searching for platforms at the EU level (EC websites and related agencies) for the following eight themes:

1. Nature-linked platforms such as biodiversity, forest, marine, Natura 2000
2. Water-linked platforms
3. Climate adaptation linked platforms
4. Agricultural linked platforms
5. Health and consumer linked platforms
6. Disaster risk management linked platforms
7. Mobility and transport linked platforms
8. Regional or cohesion linked platforms

In what follows, for each of these eight themes we report our findings on the selected platforms and provide a brief description of the available GI information. Next, for each of the platforms we have made an evaluation of the GI information that is available, its accessibility and its usefulness towards end-users (see 3.3).

Policy sector priorities and identified related EC platforms

A. Nature-linked platforms:

- DG Environment GI[24]: The DG ENV GI site gives a good introduction to GI from a policy perspective. The policy context is described well and links are provided to the EC communication on GI. The information on the website is nevertheless brief and there is limited practical information on economic and technical aspects etc. However, further information can be found through available links to a number of relevant studies. The reports and studies include best practice examples. The site also provides links to other EC websites, e.g. the DG ENV biodiversity site, CIRCABC and BISE. Maps and standards and classifications are for instance available through a link to the BISE platform. No specific information for the different relevant audiences is available. On 06/08/2015 the DG ENV GI web site has been updated, in particular the conference section, new study uploads, working groups, better links to climate adaptation, research, water policies and

[23] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52013DC0249
[24] http://ec.europa.eu/environment/nature/ecosystems/index_en.htm

business/financing possibilities such as the B&B/NCFF. It is recommended to transfer all knowledge-based information from this webpage to BISE (the DG ENV web page should be limited to policy-relevant information) once BISE is fully operational (see also 3.5.1).

- EC CIRCABC website[25]: The CIRCABC website library on GI provides a range of information giving a general introduction to GI, the policy framework, best practice examples as well as information on financing.
- European Environmental Agency[26]: There is no specific section for GI on the EEA website. The existing GI information is scattered and can be found under various sections such as land use, biodiversity, agriculture, urban environment. Information relevant to GI is in many cases not labelled as such. Three reports on GI have been produced by the EEA containing some policy background: Exploring nature-based solutions — The role of green infrastructure in mitigating the impacts of weather- and climate change-related natural hazards (September 2015); Spatial analysis of green infrastructure in Europe (2014); and Green infrastructure and territorial cohesion (2011).
- BISE[27]: The amount of GI information on this platform is rather disappointing. There is a separate section on GI, organized under 'Topics' where a definition and background is provided. The policy context is briefly described and links are included to a number of policy studies. There is no practical information regarding GI technical standards. No specific information for the different relevant audiences. Some of the data on the platform such as the implementation of the Biodiversity Strategy would be relevant from a GI perspective (e.g. the MAES data) but this information is not linked from the GI section of the BISE. Existing and new information can be uploaded on the BISE GI section but it has to be further linked to other existing tools to guarantee the best use of existing knowledge sharing possibilities. There is a GI library in the BISE catalogue, but it is relatively hidden for the user and not easily found as it is not linked from the GI section.
- FISE - the Forest Information System for Europe[28]: This is a good source of information on GI in terms of nature connectivity. There is a subsection dedicated to 'Patterns and Fragmentation' which is directly linked to GI, although not labelled as such. GI is mentioned in the text. Links are provided to EC GI strategy. Models (one developed by JRC themselves), indicators and maps for connectivity assessments are available. Links to examples from MS and relevant projects are also provided. Information with regards to GI connectivity related to CAP and WFD is available.
- Natura 2000 Communication Platform[29]: No information on GI. A link is provided to BISE and to the Eionet platform on biodiversity.

B. Water-linked platforms:

- WISE[30]: There is no GI information available.
- NWRM[31]: Natural Water Retention Measures (NWRM) are measures representing GI in the water sector, and the website is therefore highly relevant and contains

[25] https://circabc.europa.eu/w/browse/76df6314-a37c-4cc9-9fc6-2d9c9d6889fe
[26] eea.europa.eu/
[27] http://biodiversity.europa.eu/topics/green-infrastructure
[28] http://forest.jrc.ec.europa.eu
[29] http://ec.europa.eu/environment/nature/natura2000/platform/index_en.htm
[30] http://water.europa.eu/
[31] http://www.nwrm.eu

valuable information in terms of water related GI. There is no easily accessible link to information on the fact that NWRM are GI. That being said, the definition of GI is included in the glossary (http://nwrm.eu/node/3835) and also when doing a search of GI the concept appears in a number of search results. The website contains rich information with regards to the policy framework, selection, design and implementation of measures, a wide catalogue of possible measures (ID cards). The ID cards are a way of presenting the measures in a synthesised way but the catalogue of measures online has a lot of information which can be also downloaded in pdf. The catalogue of measures includes information on biophysical impacts, ecosystem services, how the measures impact the achievement of different policy objectives, financing, costs, design and governance aspects. The website also includes 125 case studies. This information is available directly on the website and more extensively in the online guidance, ID cards of the measures and synthesis documents. The platform is linked to a Linkedin discussion group.

- OURCOAST - the European portal for ICZM[32]: No specific information on GI. There are a number of case studies related to green and blue infrastructure available in the database, searchable by themes, key approaches or free text. New information and case studies can be uploaded to the website. There is a link to the ICZM Assistant which is an online tool supporting project leaders, policy makers and water professionals to integrate the ICZM principles in projects and plans. A number of case studies and documents are available in the ICZM assistant, although not directly labelled as GI.

C. Climate adaptation linked platforms:

- Climate-ADAPT[33]: There is no specific section on GI and the available information is relatively sparse. However, the concept and the term is mentioned briefly on a few occasions with regards to 'Cities and towns' and 'Urban adaptation support tool'. Although very little information is labelled as GI, the platform is highly relevant and provides useful information and guidance on sectors, measures, processes etc. relevant for GI, and in particular GI measures supporting climate adaptation. A number of adaptation options presented can be linked to GI, such as green roofs, green spaces and corridors, riparian buffers etc. The tools presented have information on cost-benefit, legal aspects, success factors etc. A link to the EC communication on GI is available. Link to best practice on green and blue infrastructure (Grabs project) is available. New information could be uploaded to Climate-ADAPT for users with EIONET account. It was discussed with the responsible services that next to Climate-ADAPT there is also Mayors Adapt (http://mayors-adapt.eu/). However, it was indicated by the responsible services that this is intended to be more of an outreach website than a platform, wherefore it was decided not to be included in the review under the current task.

D. Agricultural linked platforms:

- CAP for our roots/ DG Agriculture and Rural development[34]: No information on GI and no suitable knowledge sharing platform could be located other than the EC website. However, there are more potential places where GI could possibly be made visible. The role of agriculture in GI should be recognised and further enhanced within the CAP. Agriculture can, for example, assist in watershed management, the protection of habitats and biodiversity as well as in the

[32] http://ec.europa.eu/ourcoast/index.cfm?menuID=3
[33] http://climate-adapt.eea.europa.eu/home
[34] http://ec.europa.eu/agriculture/cap-for-our-roots/index_en.htm and http://ec.europa.eu/dgs/agriculture/index_en.htm

maintenance and restoration of multifunctional landscapes. With regards to DG Agriculture and Rural development platform, GI could be highlighted in the policy areas (especially the section on Agriculture and Environment, Forest Resources, and Rural Development), the monitoring and implementation of the ecological focus areas (where the Green Infrastructure Strategy should be taken into account).

- Rural Development Gateway 2014-2020, European Network for Rural Development[35]: The platform contains information such as the policy background and support to ecosystems within RDP programming and implementation. There is no direct information on GI. There is a section on forestry which includes information on the multifunctional role of forests and the section Environmental Services also has relevance and provides several useful documents on Delivering Environmental Services using Rural Development Policy. Some of the priorities (Especially priority 3: Ecosystems), related measures and thematic information sheets of the RDP have some relevance to GI but it is not clear from the information provided on the platform. There is a database with RDP projects, but it is difficult to find any GI related information there. This section could potentially include much more information on GI. For instance GI could be highlighted among the Focus Areas, examples of RDP implementation and in the theme of Environmental Services. In addition, it would be relevant to include GI as a key word in the searchable project database.

E. Health and consumer linked platforms:

- EC Public Health Website[36]: No information on GI and no suitable knowledge sharing platform could be located other than the EC website. The contribution of GI to human health is a beneficial outcome that results from the healthy functioning of ecosystems. Ecosystems provide a variety of services which promote basic human survival, for example, by limiting the spread of disease or reducing air pollution but also in terms of improving general wellbeing and quality of life by e.g. improving the access to green areas in urban environments benefitting both individuals and communities. With this background, it would be relevant to include GI in the section on Health in society/healthy environments.
- European Food Safety Authority[37]: No information on GI and no suitable knowledge sharing platform could be located other than the EC website. Food production is an important component of green infrastructure and can provide opportunities e.g. through urban food production, multi-purpose farms and how innovative food production methods can benefit the natural landscapes. Reference to GI would therefore be relevant to include in the food related EU platforms.
- EC Food Safety Website[38]: No information on GI and no suitable knowledge sharing platform could be located other than the EC website.

F. Disaster risk management linked platforms:

- Disaster risk management portal[39]: The purpose of the portal is to provide a collaborative working space for JRC and its partners in the field of Disaster Risk Reduction (DRR). There is no information related to GI. GI has vast potential for alleviating disaster risks such as floods, landslides, avalanches, forest fires and

[35] http://enrd.ec.europa.eu/en/policy-in-action/cap-towards-2020/rdp-programming-2014-2020
[36] http://ec.europa.eu/health/index_en.htm
[37] http://www.efsa.europa.eu/
[38] http://ec.europa.eu/food/safety/index_en.htm
[39] http://drr.jrc.ec.europa.eu/

droughts which are threatening infrastructure, cost human lives and are the cause of billions of EUR of damage each year in the EU. GI solutions that boost disaster resilience of infrastructure form an integral part of the EU policy on disaster risk management. It would be beneficial to have a better visibility of the benefits GI has on disaster risk management, as well as information on various GI options and measures for disaster preventions and it would therefore be advised to include information and links to GI information from the EU's portal. This could be done, for example, by providing a link not only to BISE but also to the Climate-ADAPT and NWRM platforms as they are strongly linked to risk management where GI plays an important role. In this context, it would also be relevant to make a link to the recent EEA report "Exploring nature-based solutions — The role of green infrastructure in mitigating the impacts of weather- and climate change-related natural hazards."[40]

G. Mobility and transport linked platforms:

- DG Mobility and Transport[41]: No information on GI and no suitable knowledge sharing platform could be located other than the EC website. GI is an important instrument for the overarching goal of European transport policy: to reduce the carbon footprint of transport, mitigate the negative effects of land uptake and fragmentation, and boost opportunities to better integrate land use, ecosystem and biodiversity concerns into policy and planning. Avoiding or mitigating the fragmentation impacts of transport infrastructure on nature is a well-established GI strategy in the transport sector. Fragmentation of nature networks may be minimised by choosing specific GI design solutions, e.g., tunnels, or viaducts which minimise land-take or by allowing watercourses, including natural banks, to continue under the structure. Developing GI adjacent to infrastructure has the potential to deliver many ecosystem services. Against this background, it is very relevant to include a short introduction and links to further readings on GI and its links to the transport sector on the DG platform on Mobility and transport. A link should therefore be made to the BISE platform where additional information is available.

H. Regional or cohesion linked platforms:

- InfoRegio[42]: No direct information on GI. There is one Thematic Guidance Fiche on biodiversity, green infrastructure, Ecosystem Services and Natura 2000 and one Guide for investments in Nature and green infrastructure available. The policy learning database includes one project example on GI.
- DG Environment Urban Environment[43]: No information on GI. There is one link to an EC report on peri-urban natural spaces which has some GI relevance.
- Reference Framework for European Sustainable Cities[44]: Online toolkit designed to help cities promote and enhance their work on integrated sustainable urban development. It offers practical support in integrating sustainability principles into local policies and actions. The full version is not available to view for unregistered users. No specific GI information seems to be available. Show-case examples are available to view, but only few of them are relevant.

[40] http://www.eea.europa.eu/publications/exploring-nature-based-solutions-2014
[41] http://ec.europa.eu/transport/index_en.htm
[42] http://ec.europa.eu/regional_policy/en/
[43] http://ec.europa.eu/environment/urban/home_en.htm
[44] http://app.rfsc.eu/

Evaluation of GI on EC-related platforms
In our evaluation of the aforementioned platforms we compared the current digital GI information availability with the GI information that would ideally be available in the future for each of the identified platforms.

In doing so we have distinguished six different sorts of GI information that may serve different end-users and purposes:

1. GI policy aspects
2. GI technical aspects (data, maps, standards)
3. GI economic aspects (cost/benefits, funding)
4. GI methodological and implementation aspects
5. Best practices and lessons learned
6. Network and discussion groups

For each of these six sorts of information we scored the current presence of GI and the 'ideal world' future disclosure of GI information on a scale of green, orange or red:

- Green: information is available and substantial;
- Orange: information is available, however, basic; and
- Red: information is not available or very limited.

In addition, each of the platforms/websites were scored for its usefulness for stakeholders/target groups:

- Green: information is available and substantial, high usefulness;
- Orange: information is available, however, basic; and
- Red: information is not available or very limited, low usefulness.
- White: not applicable, considering the absence of GI information.

A last scoring of the platforms/websites was for the accessibility of the GI information:

- Green: information easily found on front page or after one-two clicks;
- Orange: information found after several clicks; and
- Red: information difficult to find.
- White: not applicable, considering the absence of GI information.

Table 2- Evaluation of GI on EC-related platforms

Platform	GI information current situation						GI information 'Ideal world'							
	Policy	Technical	Economic	Methodological	Best practices	Network	Policy	Technical	Economic	Methodological	Best practices	Network	Usefulness	Accessibility
DG Environment GI														
EC CIRCABC website														
European Environmental Agency														
BISE														
FISE														
Natura 2000 Communication Platform														
DG Environment Urban Environment														
WISE														
NWRM														
OURCOAST - the European portal for ICZM														
Climate-ADAPT														
CAP for our roots														
EC Public Health Website														
European Food Safety Authority														
EC Food Safety Website														
Disaster risk management portal														
DG Mobility and Transport														
European Network for Rural Development														
InfoRegio														
Reference Framework for European Sustainable Cities														

Interim conclusions

In this section an interim conclusion is made on how the visibility of GI information can be improved for the platforms and websites explored. For DG Environment GI, BISE, WISE/NWRM, Climate-ADAPT and the sustainable cities platform we refer to the section 'Increasing GI visibility for selected platforms', where a more in-depth analysis will be done for these platforms. For the DG Environment part of the website dedicated to GI, the aim of the European Commission is to have only policy relevant GI information being provided here. All other GI information should be moved to BISE. This is also considered in the next section of this report.

From Table 2 it is obvious that the "ideal world" and the current situation on GI disclosure in the various platforms are very much dissimilar. In what follows we comment on the potential of increasing GI disclosure for the websites/platforms that were evaluated:

1. Table 2 shows the relatively weak availability of GI information on the analysed platforms. Many platforms, that can be considered as relevant, do not contain any reference at all to the concept of GI such as WISE and the Natura 2000.
2. The GI information that is available across the studied EC platforms is relatively dispersed and not presented in a coherent way. A common aspect for the reviewed platforms is that there is a lot of information that is highly relevant to GI but not defined and labelled as such.
3. With respect to the available policy information, GI is only visible on a limited number of EC-related websites and platforms. The current available information is relatively scattered, and in principle only DG ENV can be considered to have the policy aspect appropriately covered (this would be ok, but then appropriate links should be provided).
4. Much progress therefore can be made by having the concept, its relevance for the sector and a link to the GI section on BISE integrated across the relevant policy sectors. The policy aspects would deserve to be briefly explained on all

EC catered platforms that were researched here, this at least with a link directing the user to more information. More restricted it could be done only for these platforms/websites that in Table 2 are marked green for the "ideal world" situation. Ideally this would be done in a language and vocabulary that considers the specific sector. Exactly this approach was taken under Task 1 of this contract where factsheets were produced on the GI relevance for a variety of sectors. Next steps therefore would include identifying who to contact for reaching GI disclosure through the EU websites/platforms on sectors such as agriculture, health and consumer, mobility and transport, and disaster risk management.

5. Across DG ENV linked platforms by the EC and the related agencies again there is much potential for improving GI visibility. For example, typically these platforms have much information on nature and biodiversity for example in a Natura 2000, forest, or marine context. However, in many instances it is not made explicit that this information links to GI and is GI relevant. One example is the NWRM website which is all about GI but which is not immediately apparent or clearly highlighted on the website. This makes the knowledge search on GI difficult for the end-users and also risks that a lot of useful information for the GI stakeholders is left unseen. Therefore, with an ambition to having GI becoming a more used vocabulary and its linked information becoming more broadly and widely disclosed much can be done on platforms and websites within the immediate reach by DG ENV. For example, for FISE information under ecosystem services can be indicated to be GI relevant and GI visibility could be improved by more strongly labelling GI relevant information, potentially even including a dedicated section on the platform to GI (*cf*. the BISE example).
6. The CIRCA website provides a good collection of relevant GI literature sorted under different categories. This source should be used when further developing the GI library on the BISE catalogue. The resources available on the CIRCA website should be cross-linked (integrated) with the GI library, ensuring that the GI library contains all GI information produced in the EC framework up to date. Meanwhile, all relevant documents of the CIRCABC library have been transferred to the BISE GI library, wherefore it has become obsolete and is not updated anymore. It remains a possibility that a section with restricted access will be kept active on CIRCABC to allow to share 'grey literature' and non-official or sensitive information. The CIRCABC site also hosts publically available information of the Working Group on Green Infrastructure Implementation and Restoration.
7. A methodological problem with CIRCABC was its strict hierarchical order, i.e. no cross-links for documents covering more than one topic was possible. When moving the information towards the BISE library, the documents 'lost' their attribution to a topic as it is using a 'google-style' search engine. However, all documents are indexed/tagged and key terms are indicated, which could make up partly for this loss (this means that if a document is tagged as relevant for 'forest', a search through the free search field with 'forest' will list all GI-relevant documents which either contain the term 'forest' in its text or have been tagged as forest-relevant, even if the term 'forest' does not appear in the document itself).
8. The available information on technical, economic and methodological aspects is poor. This is catered for only by the EC CIRCAB library and to some extent by the NWRM, which however only cover water related GI measures. For NWRM the entry point is on water retention but there are many measures (53) that initially one would not think have an effect in water resources, or which would

be just categorised as GI with little information on the impacts on water. There are 13 measures for example for the agricultural sector with information on costs. These aspects should also be better covered and it should be indicated and linked on the key platforms where further information could be found.

9. Further use of best-practices would be important across the platforms as a way to provide real life examples on implementation and inspiration for selection of measures etc. This is an aspect that would be needed for most of the thematic platforms. There are already a significant number of case studies spread out over the analysed platforms. These should be interlinked and a best practices/case studies on GI catalogue could be built in the framework of the GI catalogue with options for detailed filtering according to the users need. I.e. Climate-ADAPT would have a link to the climate change adaptation relevant case studies.
10. The accessibility of the GI information on the reviewed platforms is in general not particularly good. As mentioned, GI is often not placed in a central place on the homepage. Rather, the information can be found a number of clicks away. This is the case, for example, on BISE. The GI information is there, but it is not immediately apparent to the user. The situation is worse on Climate-ADAPT where the user has to search closely to be able to find the available GI information.
11. There are only a few available networks for GI stakeholders. Except the working groups relating to NWRM the others are not facilitated through platforms. One workgroup was set up to contribute to the development of a European Green Infrastructure policy (2011) and provided concrete recommendations. The revised Working Group on Green Infrastructure Implementation and Restoration (2014) will develop documents supporting Green Infrastructure in particular on national and regional levels. Further, there is a dedicated discussion group on LinkedIn which was developed in the context of the NWRM pilot project initiative launched in October 2013 by the EC. The forum is aimed at supporting the development of networks of experts and practitioners on NWRM. In addition, the WG on Programmes of Measures and the WG on Floods under the Common Implementation Strategy of the WFD and FD worked extensively on NWRM between 2013 and 2014 to develop the Policy Document on NWRM[45]. WG Floods and the Strategic Coordination group will continue sharing information and experiences on its implementation in the next work programme of the CIS.

It is clear that if constructed appropriately, portals can positively contribute to distributing relevant information to the public and to various end-users. A major question is where to disclose information and how to make information accessible such that end-users can locate what they search for in a straightforward and easy way. Thus, the link has to be made between the "what" and "why" of information with the "where" and "how".

- Therefore, it is necessary to gain thorough insights in where end-users may be assisted by specific information.
- Further, it has to be acknowledged that end-users will not necessarily look for GI related information from a GI perspective. Indeed, for example, a farmer may simply be looking for ways to diversify and thereby be aided by knowing that a GI focus can be one option.

[45] https://circabc.europa.eu/sd/a/2457165b-3f12-4935-819a-c40324d22ad3/Policy%20Document%20on%20Natural%20Water%20Retention%20Measures_Final.pdf

- Knowing which end-users may need GI-related information and understanding the online paths they may choose to reach that information can help in providing the required information on the places where they are likely looking for it.
- This concerns information available at the various departments at the EU and the national level, but also the information provided at regional and local levels.
- Different groups of end-users have very different ways in which they interact with GI and many of them will not be inclined or have a natural tendency to go and dig into technical information provided on a website dedicated to GI, for example under BISE.
- The web portals they usually visit (for example about support to agriculture or industries) should point towards the websites providing relevant GI information.

3.2.2 Stakeholders

GI may matter to a whole variety of stakeholders that are either involved in working on infrastructure and design of open space or otherwise are users of open space. For the first group stakeholder groups that will have large impact through their activities on the environments-we-live-in are landscape architects, building professionals and spatial planners. Focussing on the users of open spaces, relevant groups to consider are land owners, foresters, farmers, fishermen, hunters, nature NGOs and businesses. In the following section we collect information about these various audiences and the platforms they have at the EU geographic scale and evaluate to what extent GI is visible on these platforms. We first provide an overview of EU-scale platforms for the various stakeholder groups. Secondly, we indicate some national and international platforms while searching for where GI information is provided and how this is done. For each of the organisations we also provide a short explanation of their coverage and end-users.

Stakeholder priorities and identified EU scale platforms

Landscape architects:

- International Federation of Landscape Architects[46]: Umbrella organisation for professional landscape associations (38 organisations from 33 CoE nations, > 10,000 professional practitioners + students and associates, c. 180 accredited academic courses, The European arm of IFLA's global network). GI is not highly visible on this platform. Using the search box only 6 hits resulted when entering GI. The most significant hit is that in the 'About' section where it is indicated that landscape architects consider green, nature and habitats.
- International Council of Landscape Architecture Schools[47]: ECLAS exists to foster and develop scholarship in landscape architecture throughout Europe by strengthening contacts and enriching the dialogue between members of Europe's landscape academic community and by representing the interests of this community within the wider European social and institutional context. From their website GI is not visible, with just a few instances where it is mentioned if green is entered in the search tool. However, for members, ECLAS is having a member-only accessible platform where GI information is available http://www.le-notre.org/. The original LE:NOTRE Projects were co-funded by the European Union's Socrates and Lifelong Learning Programmes. With funding ceasing, to maintain the gathered information alive it was decided to make this member-only accessible.

[46] http://iflaeurope.eu/
[47] www.eclas.org

Building professionals:

- World Green Building Council[48]: The World Green Building Council is a network of national green building councils in more than one hundred countries, making it the world's largest international organisation influencing the green building marketplace. They have specific information for each region, including with a focus on Europe: http://www.worldgbc.org/regions/europe. Green in this context should be understood as sustainable and not being limited to working with GI. There is no indication on the webpages on GI, neither is there a sitemap or search box allowing for quick access to possible GI information. One specific aspect that is mentioned is the benefits in terms of health, wellbeing and productivity thanks to views of nature. We could not find GI being mentioned anywhere upfront.
- European Federation of Green Roof Associations (EFB)[49]: The ten associations promote and encourage the uptake of green roofs in their countries to help address issues related to climate change, ecosystem services, green infrastructure and lack of green space in the built environment. While it is clear from this first statement and the further information provided on the website pages that EFB cares about GI and ecosystem services, the website is not a hub for information on GI relating to green roofs.

Spatial planners:

- European Council of Spatial Planners[50]: Umbrella association (1985) of 25 professional planning associations and institutes from 23 European countries as well as corresponding members. In total representing c. 40,000 planning professionals, ECTP-CEU focuses on planning practice, it engages in dialogues with local, national and European governments, identifies, and rewards good practices (European Planning Awards), Charter of European Planning. Entering GI or green did not lead to GI relevant hits. They have a working group on climate, but no information could be located on a working group or pages being dedicated to GI or related terms such as nature or ecosystem services.

Land owners:

- European Landowners' Organization (ELO)[51]: ELO is committed to promoting a sustainable and prosperous countryside and to increasing awareness relating to environmental and agricultural issues. ELO represents a large number of rural family business and enterprises as well as individual actors in Europe involved in activities such as farming and agriculture, forestry and cork, wine production, hunting and fishing as well as water and waste treatment. They have a large set of links to other organisations. Under the topic section, they cover N2000. GI information could not be retrieved.

Foresters:

- European State Forest Association (EUSTAFOR)[52]: Their members represent one third of the EU forest area, including large, protected areas (established in 2006, currently 29 members from 21 European countries, total land area managed ~ 49 million ha (~ 30% of EU forests), total forest area managed ~ 42 million ha (including French overseas departments and territories), protected and protective forests ~ 16 million ha). Under the publications entry there are 2 reports on

[48] http://www.worldgbc.org/
[49] http://www.efb-greenroof.eu/
[50] http://www.ectp-ceu.eu/index.php/en/
[51] http://www.europeanlandowners.org/
[52] http://www.eustafor.eu/

ecosystem services and 1 on N2000. Using GI in the search box did not give any results.

- Confederation Européenne des Propriétaires Forestiers/Confederation of European Forest Owners (CEPF)[53]: This is the umbrella association of national forest owner organizations in Europe. It works as the representative of family forestry in Europe, by promoting the values of sustainable forest management, private property ownership and the economic viability of the forest holding. CEPF serves the interests of the approximately 16 million forest owners. They are private individuals, families and cooperatives who take care of about 60% of the forest area within Europe. They indicate on their website that Environment / Natura 2000 and Forest ecosystem services are among the main policy areas and processes CEPF is currently following. GI information could not be located on the platform.
- European Forest Network (EFN)[54]: This is an unofficial network of national forest societies and associations of Europe. The main goal is to promote the exchange of information relevant to forests, forestry and forest policy among its members. There is very little information on the website and no information on GI.
- Forest-based Sector Technology Platform (FTP)[55]: FTP was established in 2005 as the very first initiative in which European forest owners, woodworking industries and pulp & paper industries came together to share one common goal: to advance the competitiveness of the whole sector. In their vision and strategy documents they consider forest ecology and ecosystem services. They also have the FTP Research and Innovation Portal (http://www.forestplatform.net) which is an advanced and comprehensive Internet database of EU-funded projects involving the forest-based sector. For that portal there were no results matching the query GI.
- European Forest Institute[56]: They are an international organisation, established by European States (25 European States have ratified the Convention on EFI, c.120 Associate and Affiliate Member organisations in 35 countries). EFI's Virtual Library contains a variety of free services and materials (databases, publications, information services). The query GI rendered 34 results where GI is mentioned in reports or in news items. There is no direct information or topic on GI.

Farmers:

- The European farmers (COPA) and the European agri-cooperatives (COGECA)[57]: COPA is made up of 60 organisations from the countries of the European Union and 36 partner organisations from other European countries such as Iceland, Norway, Switzerland and Turkey. This broad membership allows COPA to represent both the general and specific interests of farmers in the European Union. Since its inception, COPA has been recognised by the Community authorities as the organisation speaking on behalf of the European agricultural sector as a whole. COGECA, now called the "General Confederation of Agricultural Cooperatives in the European Union", currently represents the general and specific interests of some 40,000 farmers' cooperatives employing some 660,000 people and with a global annual turnover in excess of three hundred billion euros throughout the enlarged Europe. Since its creation, COGECA has been recognised by the European Institutions as the main representative body and indeed the spokesman for the entire agricultural and fisheries cooperative sector. In line with

[53] http://www.cepf-eu.org
[54] http://www.forestrysocieties.eu/
[55] http://www.forestplatform.org/
[56] http://www.efi.int/portal/
[57] http://www.copa-cogeca.be/

the recent European Union enlargements, COPA and COGECA have together further reinforced their position as Europe's strongest farming representative organisations. On the homepage there is a direct link to Environment information. This information concerns statements on various issues by COPA-COGECA-, but the statements are not available. Entering GI in the search box did render 11 hits, including a brochure on farming biodiversity. Certainly GI information is not easily accessible and GI is only sparsely mentioned in brochures or statements.

Fishermen and hunters:

- European Anglers Alliance (EAA)[58]: This is a pan-European organisation for recreational angling, which defends European recreational anglers' interests at the European level and beyond. There are about 3 mill. affiliated members to EAA's 18 member organisations and affiliates (2014) from 17 European nations. There is no highly visible GI information, neither a related-term entrance through the sitemap. Entering GI in the search function rendered no results. However, some relevant information on GI was found such as http://www.eaa-europe.org/positions/small-scale-hydropower-2013.html or http://www.eaa-europe.org/topics/eel.html.
- European Federation of Associations for Hunting & Conservation (FACE)[59]: Established in 1977, it represents the interests of Europe's 7 million hunters as an international non-profit-making non-governmental organisation. FACE is made up of its Members: national hunters' associations from 36 European countries including the EU-28. They have a webpage dedicated to GI: http://www.face.eu/nature-conservation/green-infrastructure. From this page there is a link to the EC pages on GI and also a statement and perspective on GI by the hunting association. The page on GI is accessible though the higher level called "nature conservation" to be found in the banner.

Nature NGOs:

- Birdlife Europe[60]: This is a global Partnership of independent organisations working together as one for nature and people. While in the top menu several entries are GI relevant, for someone looking for GI information there is no dedicated page or information section on GI. Entering GI in the search box gave 35 hits.
- International Union for Conservation of Nature (IUCN)[61]: IUCN is the world's oldest and largest global environmental organisation, with more than 1,200 government and NGO Members and almost 11,000 volunteer experts in some 160 countries. In the top menu GI is not mentioned and there is no dedicated page to GI. Under priorities there is a direct link to nature-based solutions and under 'work by topic' there are many more teams directly relating to GI. Entering GI in the search box rendered 214 hits.
- World Wildlife Fund (WWF)[62]: WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by: conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable and promoting the reduction of pollution and wasteful consumption. Entering GI in the search box gave 3 hits, none of which to a dedicated page on GI on the WWF website.

[58] http://www.eaa-europe.org/
[59] http://www.face.eu/
[60] http://www.birdlife.org/europe-and-central-asia
[61] http://iucn.org/about/union/secretariat/offices/europe/
[62] http://www.wwf.eu/

- Eurosite[63]: This is a network of site managers, non-governmental and governmental organisations, and individuals and organisations committed to create a Europe where nature is cared for, protected, restored and valued by all. They do this by providing practitioners with opportunities to network and exchange experience on practical nature management. There is no direct information or topic on GI. GI entered in the search box resulted in 12 hits.

Businesses:

- World Business Council on Sustainable Development (WBCSD): This is a CEO-led organization of forward-thinking companies that galvanizes the global business community to create a sustainable future for business, society and the environment. The WBCSD has been working on ecosystems issues for 15 years and a formal Focus Area on Ecosystems was established in 2007. They have a dedicated part of the platform on GI (here called natural infrastructure)[64] with a definition, the business cases, challenges and opportunities, events, a case example and 3 reports.[65] In addition, since December 6, 2015 the Natural Infrastructure for Business platform has been launched.[66] The aim of this platform is to strengthen the business case for investing in natural infrastructure. It has entries on the business case, tools, case studies and resources.

Further relevant stakeholders:

- ICLEI (Local Governments for Sustainability)[67] is the only network of sustainable cities operating worldwide. The organisation facilitates local government input to United Nations (UN), processes such as the UN Framework Conventions on Climate Change, and Biodiversity. In partnership with the UN and other organisations, as well as national governments, ICLEI puts in the groundwork for more ambitious and more responsible international commitments - and seeks global recognition and support for local action. In Europe ICLEI has dedicated pages on biodiversity, climate adaptation and water. On the biodiversity page GI is not specifically mentioned. Among the ICLEI activities are Greensurge (Green Infrastructure and Urban Biodiversity for Sustainable Urban Development and the Green Economy; http://www.greensurge.eu/) and URBES (Urbanization, Biodiversity and Ecosystem Services; http://urbesproject.org/index.html).
- CEEweb for Biodiversity[68] is a network of non-governmental organizations in the Central and Eastern European region working for 20 years in 20 countries. Our mission is the conservation of biodiversity through the promotion of sustainable development. They have part of their platform dedicated to GI: http://www.ceeweb.org/work-areas/priority-areas/green-infrastructure/. This part of the platform has inspiring YouTube fragments on GI and also they have a colourful board on Pinterest with pictures of great GI projects, various elements of GI, GI street-art or do it yourself GI. Further on the GI page they have an online course on GI, a GI training manual, a news and events section on GI, a section on experts also including a LinkedIn community – the European Green Infrastructure Practitioners' Network and a section on funding. The platform is not rich in providing access to literature on GI or in providing links to other platforms that have information on GI.

[63] http://www.eurosite.org/
[64] http://www.wbcsd.org/naturalinfrastructure.aspx
[65] http://www.wbcsd.org/
[66] Accessible through http://www.naturalinfrastructureforbusiness.org/
[67] http://www.iclei-europe.org/
[68] http://www.ceeweb.org/

- Infra Eco Network Europe (IENE)[69] is a network of experts working with various aspects of transportation, infrastructure and ecology. The network was initiated in 1996 to provide an independent, international and interdisciplinary arena for the exchange and development of expert knowledge – and with the aim to promote a safe and ecologically sustainable pan-European transport infrastructure. IENE arranges international conferences, workshops and symposia, initiates collaboration projects and helps answering questions that require a joint international expertise. The platform links to a discussion and a mailing list and a forum. Information on conferences, workshops and meetings. Under the project section information is available on the COST 341 Action, "Habitat Fragmentation due to Transportation Infrastructure" and also on a project on Planning and Applying Mitigating Measures to Green Transport Infrastructure in Myanmar and Thailand. The platform has a literature section which unfortunately is empty.
- European Network of Environmental Professionals (ENEP)[70] represents 22 European Environmental Organisations and over 45,000 individual professionals. ENEP is the leading environmental professional networking organisation across Europe. ENEP believes environmental professionalism is one of the essential prerequisites for achieving sustainability, so they have created a Platform to help build a professional community which promotes knowledge sharing, cross-border integration and an arena to positively influence and implement policy, science and education. The platform includes a link to the European Green Week and a word cloud in tags[71] which includes ecosystem services, green procurement and green capital, but not GI; further, they have a working group on biodiversity and one on climate-proof cities to which access is available through the members' area. One of the reasons for having created the biodiversity working group was to encourage the use of GI, ecosystem and catchment approaches and tools. The working group has discussed in detail the Commission's strategy on GI. For the working group on climate-proof cities they indicate that adaptation measures are essential and could include increasing the area and attractiveness of 'green' (nature, parks, trees) and 'blue' (water) in and near cities (increasing the water storage capacity and reducing the heat stress), energy-saving buildings and new sustainable energy technologies, such as solar cells or thermal energy storage.

Evaluation of GI at stakeholder platforms

Only FACE, WBCSD and CEEweb have dedicated pages on GI.

- For FACE, GI information is available at: http://www.face.eu/nature-conservation/green-infrastructure. From this page there is a link to the EC pages on GI and also a statement and perspective on GI by the hunting association. Together, this is clear, however, limited information on GI that is made available.
- For the WBCSD, where GI is referred to as natural infrastructure, http://www.wbcsd.org/naturalinfrastructure.aspx, a definition, the business cases, challenges and opportunities, events, a case example and 3 reports are provided. Although clear in structure and providing a good view on GI, the information altogether is limited and rather to be called providing GI information and not being a knowledge or information hub on GI. In addition, since December 6, 2015 the Natural Infrastructure for Business platform has been launched and is accessible through http://www.naturalinfrastructureforbusiness.org/.

[69] http://www.iene.info/
[70] http://www.efaep.org/
[71] http://www.efaep.org/md-taxonomy/page/1

- For CEEweb, GI information is available at http://www.ceeweb.org/work-areas/priority-areas/green-infrastructure/. This part of the platform has inspiring Youtube fragments on GI and also they have a colourful board on Pinterest with pictures of great GI projects, various elements of GI, GI street-art or do it yourself GI. Further on the GI page they have an online course on GI, a GI training manual, a news and events section on GI, a section on experts also including a LinkedIn community – the European Green Infrastructure Practitioners' Network and a section on funding. The platform is not rich in providing access to literature on GI or in providing links to other platforms that have information on GI.

At the ECLAS platform, GI is not very much visible. More on GI may be available under http://www.le-notre.org/ which is a member-only accessible platform hosted by ECLAS. The EFB emphasises the link between green roofs and GI strongly, however, the platform cannot be considered a hub on GI information.

For all other platforms and websites of the various organisations that were researched, no or very little could be retrieved on GI. This indicates that there is large potential for increasing GI visibility, however, at the same time this indicates there is only limited information that is easily available on these platforms to connect to BISE.

Interim conclusions

Based on the organisations and platforms that were evaluated, the conclusion is that except CEEweb and the new platform on natural infrastructure by the WBCSD, none of them qualify as an information or knowledge sharing platform. It may be explored whether links can be made from BISE to CEEweb and WBCSDs dedicated platform on natural infrastructure and vice versa. Next to CEEweb and WBCSD, FACE is best in class with limited, but clear and inspiring information on GI. On some other platforms GI is mentioned, however, mostly nothing could be found. Also for those platforms that have related information (biodiversity, ecosystem services, nature-based solutions, etc.) in some documents the link is made to GI, however, GI is not included on the platforms in a dedicated manner. Altogether, the visibility of GI on platforms and websites at the EU scale of stakeholder groups for which GI is considered very much relevant, is considered poor. A future 'ideal world' could be one where GI visibility has increased substantially for a large selection of the platforms that were mentioned. In the introductory section, we have indicated which types of GI information can be distinguished. Further consultations with the representatives and the end-users of the various platforms (or a selection) can provide insight on what type(s) of GI information they consider useful to be disclosed.

It must be mentioned here that the Green Infrastructure Network (GreenInfraNet) is a EU co-funded partnership of 11 regions from across Europe. The partners are working together to promote the development and implementation of GI in EU regions.[72] One of the aims of this project is to create a permanent European Network for Green Infrastructure Knowledge and Experience (ENGINE), which will enable GI stakeholders across Europe to capitalise on project achievements and continue to exchange and transfer experience, expertise and good practices after the end of the GreenInfraNet project. Possibly, this could become a needed central hub for GI information and knowledge. In this case, information from this platform can be connected to others where less information on GI is provided. Also, in recent years the partnership had regular communication with DG ENV (specifically with Marco Fritz) indicating the aim of ENGINE closely collaborating with the GI section on BISE.

[72] http://www.greeninfranet.org/

3.2.3 National and international platforms on GI

On the national and international level there are examples of hubs where GI information is disclosed in a more exhaustive manner. These may provide inspiration on how to disclose GI information and/or may provide sources of information to be linked to BISE. In what follows we only provide some inspirational examples. An extensive survey of available national or international (outside of the EU) platforms on GI or relating to GI is not within the scope of the current exercise. Because this is a limited exercise, for national platforms, we focussed on English platforms (UK and Ireland) in order to provide examples that any reader of this document most likely can understand (from a language perspective). This does not suggest that there are no good examples on GI platforms in other EU Member States.

The platforms on the national scale that we would like to introduce are the following two:

- Green Infrastructure North West[73]: This is a UK website disclosing GI information organised in projects (4 examples), resources, contact, links, glossary and partners. They also provide information on the benefits and values of GI, the key opportunities, the challenges and the complementarity.
- Green Infrastructure Partnership (GIP)[74]: GIP brings together a network of over 300 stakeholder organisations and individuals. It provides a platform for members to share their research, news, and best practice and to co-ordinate influencing key decision makers about the value of GI. This could be mainly seen as a social network on GI with newsletters, twitter and a calendar as main items.

The platforms on an international scale that may provide inspiration are:

- Green Infrastructure Collaborative: The Green Infrastructure Collaborative consists of more than 20 organizations in the US committed to advancing the adoption of green infrastructure as a means of supporting water quality and community development goals. This broad group of signatories includes academia, non-governmental organizations, and the private sector. In the top bar they have entries on the basics, tools, case studies, research and a library.[75]
- Green4Cities[76]: This is an international centre of excellence for GI in urban areas. With experience in research, development, education and installed projects, the platform provides signposts to guide cities towards resilience to climate change.

We would suggest including the three platforms mentioned here in the section on BISE GI on networks. This section on networks could steadily grow by also including examples of GI platforms from other Member States or continents. Also, the platforms indicated here may provide perspective on how to organize the section on BISE GI. For example, a combination of how the GI North West and the GI Partnership disclose GI information and connect to a community would cover much of the needs of many GI end-users.

In case the desire is to have information that is available on the above indicated platforms to also be uploaded or connected to BISE there are three immediate options for this:

[73] http://www.greeninfrastructurenw.co.uk/
[74] http://www.gip-uk.org/
[75] http://water.epa.gov/infrastructure/greeninfrastructure/gi_partners.cfm
[76] www.green4cities.com

- The easiest one is to link to the information from BISE and to provide guidance on BISE to the user on what to expect when visiting either of the other platforms or sections within.
- A second possibility would be to upload information manually (copy/paste procedure). This is because the various platforms have different technicalities (for example, BISE is based on Plone).
- For a last, however more challenging option, we refer to the recommendation section, in particular where we comment on machine-to-machine communication.

3.3 Increasing GI visibility for selected platforms

For each of the eight platforms we will explore in more depth which GI content is or could be presented. Three platforms (BISE, NWRM and Climate-ADAPT) were further chosen for a more detailed analysis of the accessibility and user friendliness of each platform in general and from a GI perspective more specifically. The following set of questions were considered:

1. Who are the end-users of the platform and what sort of information do they expect?
2. Are these end-users provided with information/explanation on GI?
3. For each division/subdivision of the platform, it will be evaluated whether the information is GI relevant or not. This will be approached through the sitemap.
4. Are there ideas on GI information that are lacking and could enrich the specific platform?
5. Is the GI information presented easy to be located (for this see also further)?
6. Is this information on GI similar to other information on other platforms and therefore relevant to be integrated with that other information?
7. Is this information that is also relevant to be integrated available through BISE, or only through a link, or not at all? For BISE this question will be answered from the perspective of linkage to NWRM and Climate-ADAPT.
8. Which recommendations can be made to improve the visibility of GI?

For an end-user it is important not only that information is available, but also that it is easy and straightforward to find the information that suits users' needs. Therefore, accessibility and user friendliness are important. In what follows we will explore in more depth for the different platforms the following five overall performance dimensions (for more detail, see Box 3), each time approached from a general perspective and a GI specific perspective:

- Ease of navigation, inter-operability and user friendliness for finding GI information;
- Structure allowing to navigate easily for finding GI information;
- Searchability and geo-referencing;
- Accuracy, objectivity and historical depth;
- Coverage and coherence.

In Annex 9 we include the specific set of questions that will be answered for each of these performance dimensions. Considering that for platforms of stakeholders there was little information available on GI we have not conducted this detailed survey on accessibility and user friendliness. If GI information would become more abundant on these platforms the principles that are indicated here and the evaluations of BISE, NWRM and Climate-ADAPT may provide guidance and inspiration.

Box 3 Accessibility and user-friendliness of the studied platforms

Ease of navigation, inter-operability and user friendliness for finding GI information
These aspects are linked and highly important for the effective dissemination of information. Even if a portal contains a lot of information, the manner of presenting the information determines whether the users will ever find the correct GI data. An element that can greatly increase the ease of navigation is the presence of a sitemap, providing information on the structure and content of the portal. Simplifying the website to make it more inter-operable and increase user friendliness is highly important. The structure is for instance simplified by including menus that show dropdown attributes once they are selected. To improve the navigation through the portal, presenting the users' location through a so-called breadcrumb trail is highly effective. Visual properties of the portal are highly supportive in making the portal more user friendly and attractive. Both the provision of intuitive pictures and an interactive homepage can aid the user in understanding the content of a specific page or part of the portal. For navigation purposes it is often convenient to have fixed items or an explanation of the structure of the portal on the homepage.

Structure allowing to navigate easily for finding GI information
A clear and logical structure of a website supports the effective dissemination of information. If the structure is not logical or comprehensive, this will have a direct impact on the user search effectiveness. This starts already with whether the first level subdivision of the website is intuitive and logical. For the structure of the website it is also important to get quick access to either new information items or to other relevant GI portals.

Searchability and geo-referencing
For finding relevant information with regard to GI, the search functions on a portal are of great importance. If the search bar is not easily located or the search engine is not sufficient, then this could significantly hamper the visitors in achieving the relevant information. The presence of a simple search box on the home page is important for the user to perform a quick search for relevant information. The further content and properties of the search engine are also important. When the quick search results are for instance not sufficient, then the potential for an advanced search could greatly increase the chance for finding the desired information. Besides the advanced search option, the results could also be presented in categories. This helps the user in distinguishing between different types of information of his search. Besides specifically searching for information, the portal could also present information via an interactive map.

Accuracy, objectivity and historical depth
Providing inaccurate information or erroneous links could hamper users to find the relevant information. For an accurate portal it is first of all important to be regularly updated. Objectivity is often supported with scientific information. It is therefore important to have evidence or research based results supporting statements on portals. Also relevant is that data are provided in a standardized format or manner.

Coverage and coherence
In considering the envisioned end-users, a major question is whether the portal gives an overall coverage of relevant information. Further, as a portal can be seen as a center for providing further directions, it is expected that a portal will contain many references to other websites.

3.3.1 BISE

Before discussing the standard set of questions on content and accessibility, the reader may wish to refer back to Box 2 for more details on the BISE platform. The results of the nine analysis questions relating to the content of this platform are provided below:

1. Who are the end-users of the platform and what sort of information do they expect?

The end-users are policy-makers, practitioners (both national, local and regional governance levels) in Europe working with or interested in strengthening the knowledge base in support of the implementation of the EU Biodiversity Strategy to 2020.

1. Are these end-users served by GI information/explanation?

Yes, there is a separate section on GI, organised under 'Topics'. It provides a definition, a brief background on why GI is important, provides a reference to the EC GI strategy, links to further reading as well as links to relevant EC and JRC sites.

2. For each subcategory the question needs to be asked as to which information is GI relevant, which not.

Before answering the question, it is important to note that the platform is difficult to navigate. The platform's sitemap often does not correspond to the actual pages, drop down menus or sub-sections of the different sections. The analysis provided here is departing from the sitemap but in several cases it was necessary to divert from that and consider what is the logical overview of the content and categories of the platform.

In the table below (Table 3) we comment on the GI relevance of the available information for each of the divisions/subdivisions on BISE. In the column on relevance this is indicated through categories (High – high GI relevance, Medium – some aspect relevant to GI, Low – low GI relevance), while in the comment section further explanation is provided:

Table 3: GI relevance of the divisions/subdivisions on BISE

First level heading	Second level heading	GI Relevance	Comments and recommendations
HOME			
TOPICS	**General**	Medium	The site structure is not so clear. There are quick links on the left column, links presented in the main text and a drop down menu which overlap with each other. Some of the links are missing. E.g. GI appears only under 'quick links' but not under 'Responses' as is outlined in the sitemap, and in the dropdown menu.
	Climate change	Medium/high	No reference to GI. The page describes the threat and impact of climate change on biodiversity and have relevance as GI is one instrument to apply to mitigate and adapt to changes. Link is provided to Climate-ADAPT platform.
	Ecosystem services	High	This page should be interlinked to the GI section, in both directions. Both from the GI section site as ecosystem services are mentioned on the GI site (A hyperlink would be easily added). Link should also be provided from this site to the GI section. Link could also be provided to NWRM.
	Ecosystems habitat	Medium/high	Link should be provided to GI site. Contains subsections which in general have some GI relevance: Cropland and grassland, coastal, woodland and forests (Link should be added to FISE), heathlands and scrubs, sparsely vegetated land, islands, wetlands (link should be added to NWRM), marine, mountains, urban, GI concept is introduced. (Link should be provided to GI site. A link to the Climate-

			ADAPT page on cities and towns should be added) croplands, rivers and lakes (link should be added to NWRM).
	Fragmentation	High	Add link to GI, as a response measure.
	Genetic resources	Low	
	Green Infrastructure	High	This section could be further strengthened by extending the currently available material. Add internal links to LIFE+, policy site and the interactive presentation on the Biodiversity strategy on BISE. Add links to Climate-ADAPT, NWRM. Links could be provided directly to the relevant sites on the above mentioned platforms such as to case studies and the catalogue of measures. See further recommendations below.
	Invasive species	Low	
	Land use change	High	GI concept is introduced. The link to the GI site is not working
	LIFE+ Nature and Biodiversity projects	High	
	Overexploitation	Medium	No reference to GI. Is relevant as background.
	Pollution	Low/Medium	
	Protected areas	High	Add link to GI site.
	SEBI	Medium	Good source of biodiversity indicators that can be useful for GI stakeholders.
	Species	Low/Medium	Divided into sub-categories of selected species groups.
	Tipping points	Low/medium	
POLICY	**Policy, general page**	High	Relevant, although GI is not directly linked. The site structure is not clear and it is difficult to navigate. Sitemap, drop down menu and the general page does not correspond. Overview of the EU biodiversity strategy. Especially Target 2 is GI relevant. Add link to GI site.
	Global	High	References and links to UN Convention on biodiversity, Ramsar Convention
	Pan European	High	Links to Pan European Initiatives and European conventions.
	Interactive presentation of EU Biodiversity Strategy overview	High	Good and easy overview of the EU strategy

DATA	**DATA**	Medium/High	The section gathers selected entry points to data and information related to Biodiversity; the EEA's Biodiversity data centre (BDC) as well as to other environmental data centers from the EU. The scope is set to information infrastructure supported by the EU.
KNOWLEDGE	**Knowledge**	Medium/high	Has GI relevance, but not as specified and difficult to navigate. Collection of links to science-policy interfaces, key research funding, networks, relevant bodies and projects related to biodiversity. Clearer division of categories is needed and GI should be better highlighted.
COUNTRIES		Medium/low	EU Member State national reports related to biodiversity and information related to indicators organized by country. No specific information on GI, but still with some GI relevance
NETWORKS		High	Information on networks supporting the current developments of BISE and their products relevant to the EU biodiversity strategy.
BISE CATALOGUE		High	There is a GI catalogue available. It is however difficult to find. Link from GI site needed. It does not appear in sitemap, search results and needs to be connected through the search function as well as included in sitemap.

3. Are there ideas on GI information that are lacking and could enrich the specific platform?

See recommendations below.

4. Is the GI information presented easy to be located (for this, see also further)?

Relatively. All GI information is gathered in one section which is beneficial. However, with increasing GI information becoming available, it will be important to maintain this easiness to locate by the end-user searching for information. The interlinkages between the different sub-sections on BISE are currently not so strong, which would need to be addressed to further ease the access to GI information for the end-user.

5. Is this information that is similar to other information on other platforms and therefore relevant to be integrated with that other information?

The information is similar to the information on the DG ENV GI site. As the European Commission indicated a desire to have much of the DG ENV GI information moved to BISE, with only policy-relevant GI information being disclosed through the DG ENV GI location. The BISE GI site could be strengthened by the information on DG ENV.

6. Is this information that is also relevant to be integrated available through BISE, or only through a link, or not at all? For BISE this question will be answered from the perspective of linkage to NWRM and Climate-ADAPT

The information on BISE is highly GI relevant and also very relevant in the context of the themes covered on Climate-ADAPT and the NWRM platform. Further integration of the three platforms would be desirable.

7. Which recommendations can be made to improve the visibility of GI?

Short-term

- Ease the navigation to and increase the visibility of the GI section on the BISE platform. As the general ease of navigation on the platform is difficult, it also makes it difficult to easily access the GI section. It is not immediately apparent where it is to be found. A more visible link to GI should be offered on the home page; in the short term, under 'BISE highlights', but in the long run through a separate box or similar.
- Enrich the current GI section on BISE. The information available needs to be enhanced to provide a fuller picture, e.g. the policy aspects should be strengthened, as they are currently only described by a reference to the EC Communication on GI. Information on GI measures and links to case studies should also be added to further strengthen the section.
- Increase the attractiveness and user-friendliness of the website. The section would benefit, for example, from separating the text with headings or using textboxes or similar to make it more user-friendly. Links to case studies, measures, etc. should be added.
- Enable the user to quickly find its way to the right reports/links by grouping them under themes such as "Making the case for GI", GI and "green economy", GI and Climate change", etc.
- Add a calendar of events and a news section.
- It would be important to give toolkits and guidance materials a more central place and highlight them on the website. Gathering the available practical support tools for developers would also make it easier to define the need for additional ones to be developed.
- Further increase the interlinkages between relevant sections across the BISE platform. Many of the sections would benefit from a link to the GI section and this would also allow to accentuate the potential gains GI applications could provide. Currently, only on a few occasions there is a link to GI. Vice-versa, additional links should also be provided on the GI site, e.g. to the Biodiversity Strategy sections as well as to the many sections that contribute to understanding the background and current situation with regards to GI (for example, such as relevant indicators etc.). Please see table above for additional comments on the interlinkages.
- Further increase the integration of other GI platforms such as Climate-ADAPT, NWRM, FISE on the website, on the GI section and across the BISE platform. Links should be added to relevant case studies, primarily from NWRM and Climate-ADAPT. Please see table above for further details on links.
- Further promote and visualize the GI library on the BISE catalogue. The library has more than 220 documents and is a good source of GI information that can be filtered down to match the users' need, according to geographical region, topic, or specific year. However, the library is not easy to find for the user as there is no reference at all to the library on the GI relevant sections. It does not appear in the sitemap either. A highly visible link should be provided from the GI section, as well as in all other relevant sections. Linkages between the GI library and the

CIRCAB catalogue on GI should be explored. This recommendation may also be extended to other platforms where it would beneficial to link to the GI catalogue.

Mid-term

- Consider applying all of the above in creating a separate section for GI on BISE to further streamline the GI information on the website and to develop it into an accessible, useful and inviting knowledge hub for GI. However, given that the expert Working Group on Green Infrastructure Implementation and Restoration (WG GIIR) has concluded that there will not be a separate repository dedicated to GI and serving as a central gateway, it will be essential from a governance point of view to decide on which information to centralize on BISE and for which information to limit the linkage to cross-referring across platforms.
- Much of the information on BISE is relevant to GI but is not labelled as such. To support the above points, the website needs to be reviewed and the information which can be related to GI should be identified and highlighted as such. This could provide a good example for other GI platforms where a similar need has been identified.
- It would be helpful to make the GI section (and the platform itself) more inviting. This could be achieved by e.g. introducing interactive presentations and illustrations. One inspiring example is provided by NWRMS's interactive illustration of sectoral measures which after clicking on a chosen measure presents more detailed information and links to potential benefits of measures and case studies (http://nwrm.eu/urban).

Long-term

- Establish a network for GI practitioners and experts for which BISE provides the platform. Synergies should be sought with ENGINE (the European Network for Green Infrastructure Knowledge and Experience). Inspiration could also be taken from the the Green Infrastructure Partnership (GIP) set up by Defra, UK (http://www.gip-uk.org/).
- Enable a knowledge sharing function where users could upload best practice examples or new reports. This would facilitate the BISE GI section to stay up to date with the continuous development of GI information and help to build BISE into a relevant knowledge base.
- Define the end-users and conduct an assessment among them to define their needs and expectations of the GI section on BISE to see what type of information and/or functions they are expecting or missing from the platform.
- Consider developing the use of social media to reach out to a wider audience but also to keep the end-users informed about news, developments and updates. NWRM use of Linkedin might provide inspiration.
- Consider to develop a GI newsletter.

Answers to the specific questions of Annex II on accessibility and user friendliness are included in Annex III and have been covered in the recommendations provided under 8.

Concise summary

Although not labelled as such, most information of the BISE platform is highly relevant from a GI perspective as preserving biodiversity is an important result and building

block of GI measures, because ecological networks are GI and because it concerns ecosystem services for delivering goods and services. Some of the key conclusions from the analysis is that the GI relevant sections need to be made more visible, which includes that the many sub-sections that have GI relevance should be better labelled as such. Moreover, by providing further interlinkages between the various GI related sections the usefulness of BISE for the end-users would increase as well as a more holistic picture will be given. The platform hosts the nice feature of the GI library which has a lot of potential to be further developed into a rich source of information. The library however needs to be made more visible and accessible to be able to provide for its full potential.

There is a lot of GI relevant information available on BISE but its coherence, visibility and user-friendliness needs to be improved. By structuring the information, increasing interlinkages, extending the integration of other GI platforms, BISE could become a good source of GI information. The GI information available should be extended to also encompass policy aspects. In addition, a deeper dive in the different GI options and measures that are available would be needed. These aspects need to be addressed before BISE can claim to be a user friendly, exhaustive source of GI knowledge in Europe.

3.3.2 NWRM/WISE

Today there is no GI information available at the Water Information System Europe (WISE). This is despite the fact that including GI information on the WISE site is very relevant as 'blue infrastructure' is an important physical building block of GI. GI contributes to achieving and maintaining healthy water ecosystems and offers multiple-benefits to the water sector including providing regulation of water flows, water purification and water provisioning, i.e. significantly contributes to achieving the objectives of the EU water related directives. It would thus be suitable to have information on technical standards and on how to design and construct biodiversity friendly waterways and water bodies on WISE. However, today there is no GI information available on this platform. Neither are any links to external GI platforms provided.

The Natural Water Retention Measures (NWRM) platform, on the other hand, contains a great deal of relevant GI information. This platform was initially thought to be part of WISE but is currently separate. Therefore, for evaluating which GI information is available and how the visibility can be improved, focus has been placed not on WISE but on NWRM. It is a possibility to explore how NWRM can be integrated into WISE in the long-term.

The stated objective of the NWRM platform is to gather and provide information at the EU level. The platform was developed within a DG ENV project with the objective to develop a sound and comprehensive European (web-based) knowledge base on NWRM in order to improve the uptake of these measures in the 2nd and 3rd River Basin Management Plans under the WFD and the Flood Risk Management Plans. The platform was set up after the first cycle on River Basin Management Plans were reported by the Member States. The knowledge base structures available information on technical, environmental, socio-economic, governance and implementation aspects of NWRM, mobilizing existing practical experiences, studies and stakeholders' knowledge. During the second cycle of reporting (to be done by March 2016) more information on GI/NWRM will be included. NWRM are defined as one of the key type measure to be reported under the Programmes of measures of the River Basin Management Plans (RBMPs). GI or NWRM may also be included under other key types

of measures. This reporting will provide an updated picture of the measures planned to be implemented by MS in the upcoming years.

1. Who are the end-users of the platform and what sort of information do they expect?

The platform is targeted to all parties interested in the design and implementation of NWRM in the context of the planning process of the Water Framework Directive (WFD) or the Floods Directive, the development of a climate change adaptation strategy or the establishment of sustainable urban plans, such as:

- practitioners who are or have been involved in the design and practical implementation of NWRM in different sectors (urban, agriculture, forestry…);
- managers involved in the development of River Basin Management Plans (RBMPs) or Flood Management plans;
- technical service staff (for example, from a large city engaged in a "sustainable city" initiative);
- representatives from funding agencies that can support NWRM implementation;
- representatives from economic sectors that can implement NWRM;
- environmental NGOs; researchers and independent experts, etc.

In short, the end-users are existing and future NWRM practitioners and stakeholders looking for practical examples for implementing NWRM measures and recommendations on how to select and prioritise measures.

2. Are these end-users served by GI information/explanation?

The relation between NWRM and GI is explained in the 'About the project' section as well as throughout the information available, such as the practical guide, the synthesis documents, the ID cards, measures etc. There is also a GI definition provided in the Glossary and in the Relations graph. This information is however not easily accessible and it is not immediately clear for the user that NWRM is GI. The user needs to have some background knowledge and know what to search for in order to find the information.

3. For each subcategory, the question needs to be asked as to which information is GI relevant, which not

Table 4: GI relevance of the divisions/subdivisions on NWRM

First level heading	Second level heading	GI Relevance
HOME		High
IMPLEMENTING NWRM	The Practical Guide	High
	The ID Cards	High
	Communication material	High
	Synthesis documents	High
CATALOGUE OF NWRM	NWRM per sector	High
	NWRM per benefits	High
	Benefits tables	High
CASE STUDIES		High
GLOSSARY	Relations graph	High
ABOUT THE NWRM PROJECT	About	High
	The regional networks	High

4. Are there ideas on GI information that are lacking and could enrich the specific platform?

   It would be useful to add a section on the GI concept and the links between GI and NWRM. It should include a GI definition and provide a more holistic overview of GI and the water sector, include links to other platforms and information sources. A sentence on GI as a concept and the links to NWRM should be included on the home page introduction to immediately catch the attention of the user.
   The Policy section on NWRM is not so strong, as the user has to go to the Guidance or to additional documents to get the full picture. See further recommendations below.

5. Is the GI information presented easy to be located (for this, see also further)?

   All information on the website is related to GI, as NWRM per se are green infrastructure solutions. The information is however not presented as such and the user has however to be aware of that as it is not immediately, explicitly mentioned on the front page of the platform. The specific GI references are dispersed and spread out in the online guidance and in other documents (available as pdf documents). Otherwise, the website has a logical and clear structure.

   In the NWRM catalogue/NWRM per type of benefit, there is an option to filter NRWMs according to policy objective, and here it is possible to choose the priority of "Better protection of ecosystem and more use of Green Infrastructure". But also here, the user has to search specifically for GI to be able to find it.

6. Is this information that is similar to information on other platforms and therefore relevant to be integrated with that other information?

   This is the most detailed information resource with regards to water related GI among the EC GI platforms. Some of the NWRM measures supporting climate

change adaptation could be linked to Climate Adapt. Also the ones related to habitats could be linked to the Biodiversity Strategy.

7. Is this information that is also relevant to be integrated available through BISE, or only through a link, or not at all?

   This information is highly relevant to BISE and an overview of the NWRM information should be integrated to BISE in addition to clear and visible links to the in-depth NWRM information.

8. Which recommendations can be made to improve the visibility of GI?

Short-term
To enhance and facilitate the end-users' understanding of the GI concept and the strong supporting relationship to NWRM by:

- Adding an introduction on GI as a concept and its links to NWRM on the home page.
- Adding links to related information and external information portals for further relevant readings on GI, such as BISE, Climate-ADAPT, DG ENV GI and FISE page would increase the coverage of the GI concept and would enable users interested in GI to find additional information, beyond NWRM. In particular, stronger links should be made to Climate-ADAPT and the sections on e.g. water management and urban sector to benefit from the capacity of NWRM to contribute to climate change adaptation. The links should be made easily accessible and appear in sections where related information is presented (in the future, ideally on the suggested separate GI section). E.g. targeted links to Climate-ADAPT should appear under the adaptation section in the NWRM catalogue/NWRM per type of benefit provided as well as in the Case Study. Links to BISE should appear in the section on Biodiversity under the NWRM catalogue.
- Organise case studies in a similar way as with the NWRM measures, i.e. according to benefits and sectors to facilitate finding the most relevant ones for the specific user.
- Establish deep links with WISE; there should be a clear and visible link to the NWRM platform from WISE.

Mid-term

- Adding a separate section on GI to highlight the links between GI and NWRM where a definition and an overall introduction to the GI concept is provided. This section could possibly be added under 'About the project' or ideally by creating a new sub-section on GI.
- It should be ensured that the information material from the NWRM is available through the GI library on BISE.

Answers to the specific questions of Annex 9 on accessibility and user friendliness are included in Annex 10 and have been covered in the recommendations provided under 8.

Concise summary

NWRM is all about GI. It is at its place under WISE and only needs to be indicated on BISE with a link and short explanation. In other words, no integration into BISE is necessary and only a connection should be established.

Considering the NWRM platform from a GI perspective, it would be helpful to improve the platform by better introducing and integrating the GI concept and the strong supportive relationship of GI and NWRM, as this is currently missing. All information on the website is highly relevant to GI as NWRM per se are green infrastructure solutions. The information is however not labeled as such and the user might not be aware that this is in fact GI. This aspect should be given further attention to make the context clear for the end-users.

Currently, there are not many linkages made to external sources, and it would be useful to have much more links being made to other GI platforms and sources of information, thereby considering to not flood it such that its attractiveness in making available what is needed is not being lost. A technical challenge is how to integrate NWRM into WISE.

The NWRM platform, which is entirely a GI, could through the way it has been set-up serve as inspiration for setting up/renewing other GI related platforms such as BISE or the new platform on sustainable cities that will be organised. The structure of the measures section, and to some extent the case studies section, can be used as an illustrative and good example on how to create interlinkages within a platform and in how it is making links to the relevant case studies, benefits etc.

3.3.3 Climate-ADAPT

The European Climate Adaptation Platform (Climate-ADAPT) aims to support Europe in adapting to climate change. It helps users to access and share information on i.e. adaptation case studies and potential adaptation options, etc. It is obvious that GI plays a crucial role in climate change adaptation.

More in detail, Climate-ADAPT is a partnership between the European Commission (DG CLIMA, DG Joint Research Centre and other DGs) and the European Environment Agency.

Climate-ADAPT aims to support Europe in adapting to climate change. It is an initiative of the European Commission and helps users to access and share data and information on:

- Expected climate change in Europe
- Current and future vulnerability of regions and sectors
- National and transnational adaptation strategies
- Adaptation case studies and potential adaptation options
- Tools that support adaptation planning

The platform includes a database that contains quality checked information that can be easily searched.

1. Who are the end-users of the platform and what sort of information do they expect?

The end-users are policy-makers, practitioners (national, local and regional governance) in Europe working with or interested in adapting to climate change.

2. Are these end-users served by GI information/explanation?

There is no specific section on GI and no proper background overview of the concept is provided. The GI concept is mentioned briefly on a few occasions with regards to 'Cities and towns' and 'Urban adaptation support tool' as well as being mentioned in a number of case studies.

3. For each subcategory question needs to be asked as to which information is GI relevant, which not

Table 5: GI relevance of the divisions/subdivisions on Climate-ADAPT

First level heading	Second level heading	GI Relevance	Comments
HOME		High	Introduction to the platform. Link to BISE and WISE is available.
ADAPTATION INFORMATION	**General**	Medium	There is no specific GI information. Recommendation: Include general introduction of benefits of applying GI for adaptation to increase the relevance. The information should be accompanied with links to relevant GI platform and information sources such as DG ENV GI site, BISE and NWRM.
	Observations and scenarios	High	The sub-section is further divided in 6 categories. Each category contains links to selected indicators, relevant reports and links. In particular the sections on Water Systems, Terrestrial biosphere, Urban areas and Health are relevant to GI. Recommendation: Link to NWRM should be added under Water system sector (if possible directly to the relevant sections of adaptation on NRWM, i.e. case studies, benefits tables). A link should be made to the NWRM guidance in the report section. A link to BISE should be made available in the Urban areas and health and terrestrial biosphere sections.
	Vulnerabilities and risks	Medium	Not directly relevant to GI, but interesting background for GI stakeholders.
	Adaptation options	High	Some adaptation options presented are highly relevant, such as: - Improved water retention in agricultural areas, - Adaptive management of natural habitats - Agro-forestry and crop diversification - Dune construction and strengthening - Green roofs and walls - Adaptation or improvement of dikes and dams - Water sensitive urban and building design - etc. Recommendation: Link should be provided to NWRM website and reports and BISE. Include GI as an adaptation sector to be applied in the search function.
	Adaptation strategies	Low	
	Research projects	Medium	There is a link to the Curriculum Adaptive Water Management which is relevant to GI.

			Recommendation: current or future projects on GI and adaptation could be included here.
	Uncertainty guidance	Medium	The guidance has some relevance for handling uncertainty issues when using GI for adaptation measures.
EU ADAPTATION POLICY	**EU adaptation policy and funding**	Medium	Link to the EC communication on GI information is provided.
	EU Adaptation Strategy	Medium	Although not addressing GI specifically, it can serve as background for GI stakeholders.
	EU sector policies	High	The section is organised into 9 sectors. Some of the sectors are more GI relevant than others, such as biodiversity, forestry, water management, coastal areas, urban areas, infrastructure, disaster risk reduction. Recommendation: Green infrastructure could potentially be added as a separate section to increase the visibility of GI and enable easy access to GI information. Synergies could be established with the NRWM sections on sectors (in particular the water management and coastal areas) by providing visible links between the two websites. For Forestry link should be provided to FISE. Link to BISE should be added to biodiversity, water management.
	EU funding of adaptation	Medium	There is a reference under the LIFE funding section for Climate Action where green infrastructure is cited as a potential action to be funded.
COUNTRIES, REGIONS, CITIES	**General**	Low/medium	
	Countries	Low/medium	
	Transnational regions	Low/medium	
	Cities and towns	High	The site contains some information on GI and its co-benefits for tackling climate change, including improved air quality, support for biodiversity and enhanced quality of life. Funding opportunities for urban mitigation and adaptation are presented which have some relevance to GI stakeholders, although not directly targeted to GI. Recommendation: - The information on GI could be enhanced, potentially as a separate section. - The text should also highlight the capacity of GI to contribute to adaptation, not only mitigation. - The relevance would be increased by including links to active links to other GI platforms (would be easily done by including hyperlinks in the text where GI is mentioned).
TOOLS	**General**	Medium	Have some relevance for GI measures supporting adaptation. E.g. a link is provided to the Grabs toolkit for adaptation using green and blue infrastructure. The visibility would be increased if it was highlighted as a tool for GI.
	Adaptation	Medium/high	Tool could be relevant for selecting GI relevant

	support tool		measures and drafting strategies. Relevant links to e.g. GRABS guidance and PLUREL Xplorer.
	Case study search tool	High	Several case studies on GI could be find. Recommendation: Make GI searchable by adding GI as an adaptation sector.
	Map viewer	Low	
	Uncertainty guidance	Medium	See above
	Guidelines for project managers	Medium	Have relevance for project managers and developers of physical assets and infrastructure and could thus be relevant for GI project managers.
	Urban vulnerability map book	Medium	Pilot version. Good illustration on some issues such as floods and droughts. Could be relevant for planning GI measures.
	Urban adaptation support tool	High	Provides practical guidance and knowledge support on urban adaptation. Includes several references to GI. Offers links to case studies and adaptation options. Recommendations: The introduction could indicate that the link and relevance of the tool to GI.
	Time series tool		Gives good illustration of the development of some climate indicators such as land-use and water stress. Could be relevant for planning GI measures.

4. Are there ideas on GI information that are lacking and could enrich the specific platform?
   A visible and coherent presentation of GI and its relevance to climate change adaptation is not available on the platform. Such section would enrich Climate-ADAPT. See further recommendations below.

5. Is the GI information presented easy to be located (for this, see also further)?
   The specific GI relevant information to be found is relatively scattered and not easy to locate.

6. Is this information that is similar to other information on other platforms and therefore relevant to be integrated with that other info?
   Yes, the information is relevant to other information platforms and the Climate-ADAPT would benefit from a further integration with related platforms such as DGENV GI site, BISE, NWRM and FISE.

7. Is this information that is also relevant to be integrated available through BISE, or only through a link, or not at all?
   Part of the information would be highly relevant to BISE, however the GI information on Climate-ADAPT needs to be made more coherent and visible in order to provide meaningful linkages from BISE. Ideally, an overview of the GI information available on the Climate-ADAPT should be integrated to BISE in addition to clear and visible links to the most relevant, in-depth, GI information on Climate-ADAPT.

8. Which recommendations can be made to improve the visibility of GI?

Short term

- Increase the integration with other platforms on GI by making links across the Climate-ADAPT platform to relevant sections of external GI platforms such as the

DGENV GI site, BISE, NWRM and FISE. Please see Table 5 above for additional specifications on the linkages.

- Consider adding GI as a sector under 'EU Sector Policies'. As the integration of GI into climate adaptation management, contributes to achieving the EU climate adaptation goals it would be relevant to include it.
- Add GI to the 'Glossary'.

Mid-term

- Increase the accessibility and coherence of GI on the Climate-ADAPT platform to highlight the significance and benefits of GI as an effective measure for climate change adaptation. This could preferably be achieved by adding a separate section on GI and adaptation where a short overview and its high relevance for climate change is provided. This section would in addition to the overview also interlink the climate change options related to GI, the relevant case studies as well as links to further reading e.g. at DG ENV GI page, BISE and NWRM, i.e. also gather the relevant links which are already available across the platform but in most cases not presented as GI. This could possibly be placed in the 'Adaptation Options' section, or in the section on 'Cities and Towns' to further strengthen the short reference to GI which is already available there. Streamlining the GI information in such way would also increase the possibilities for creating synergies and integration of Climate-ADAPT GI relevant information with other GI relevant platforms, thus contributing to the awareness raising of GI and its possibilities. See http://www.greeninfrastructurenw.co.uk/climatechange/ for further inspiration.
- Review the information in the database to increasingly label case studies etc., with the key word GI to make them searchable. Currently, only a couple of case studies and adaptation options are identified as GI.
- To further refine the 'Search the Database' function and to add GI as an adaptation sector used as a search filter would facilitate the search and enable the users to more easily find the relevant GI information and increase the visibility of GI as a valid adaptation measure. Such improvements would improve the search function on several sections on the platform, such as the Adaptation Options', the 'Case Study Search Tool' and the 'Map viewer'. See also http://www.greeninfrastructurenw.co.uk/climatechange/search_start.php for inspiration on how GI filters can be used in a search function.
- It should be made sure that the information material from the NWRM is available through the GI library on BISE.

Long-term

- Assess the need for new materials to be developed and consider developing targeted guidance material or toolkit on GI and climate change adaptation.

Answers to the specific questions of Annex 9 on accessibility and user friendliness are included in Annex 10 and have been covered in the recommendations provided under 8.

Concise summary:
GI is among the most widely applicable, economically viable and effective tools to support climate change adaptation. The integration of GI into climate adaptation management, also called ecosystem-based adaptation, contributes to achieving the EU climate adaptation goals.

The Climate-ADAPT platform contains a few references to GI, however not sufficiently to reflect its significance. A clear introduction of GI is missing. In its current state, the few GI references are scattered across the platform. These aspects are making the GI-relevant information on the platform difficult to locate resulting in a low usefulness for the user. The website contains knowledge which would be highly relevant to GI and that could provide useful information and guidance on sectors, measures, processes etc. relevant for GI, and in particular GI measures supporting climate adaptation. Presenting the GI concept in a visible and structured way is needed. The available information which is related to GI should be highlighted as GI relevant. It would also be important to increase the interlinkages across the platform to provide a fuller overview of GI and to help the user to find its way to the information. It would be beneficial to create a separate section on GI and adaptation which could present all these aspects in a coherent and visible way. These improvements would be necessary to establish links with other platforms, such as BISE.

3.3.4 Sustainable cities platform

The DG REGIO Sustainable Cities platform is currently under reconstruction due to expired software. We can therefore not evaluate it from a GI perspective. A new platform will be set up. For that new platform we provide guidance here from a GI perspective on how to populate it.

GI use has much potential for urban areas. Indeed, boosting GI in cities and towns has large capacity to contribute to sustainable urban development as it has numerous co-benefits, including improved air quality, support for biodiversity and enhanced quality of life. In addition, it has big potential in mitigating and adapting to the effects of climate change and can deliver benefits such as flood alleviation, strengthening ecosystems resilience, carbon storage and sequestration, mitigation of urban heat island effects, disaster prevention (e.g. storms, forest fires, landslides), among others.

For the platform to be constructed we consider the following recommendations:

- Add a separate section on GI, where the concept is defined and a short background including policy aspects, implementation aspects highlighting the wide range of possibilities and benefits GI has for urban development.
- Make apparent and visible links to:
    - BISE GI section
    - BISE GI library
    - Climate-ADAPT platform, and in particular the section on Cities and towns.
    - NWRM, highlighting the urban related NWRM measures having climate change mitigation and adaptation as key benefit.

With regards to content:

- Provide user-oriented materials that can support the practical work, such as toolkit and guidance, etc. for local planners as GI should be a key consideration in planning, developing and maintaining sustainable cities.
- GI standards, targets and performance indicators.
- Information on funding opportunities.
- Catalogue of measures. It would be beneficial to take inspiration from NWRM and its catalogue of measures in presenting GI options.

- Catalogue of relevant case studies. Plenty of case studies could be collected/linked from the DG ENV GI, NWRM and Climate-ADAPT.

3.3.5 International Council of Landscape Architecture Schools

The European Council of Landscape Architecture Schools (ECLAS) exists to foster and develop scholarship in landscape architecture throughout Europe by strengthening contacts and enriching the dialogue between members of Europe's landscape academic community and by representing the interests of this community within the wider European social and institutional context. In pursuit of this goal ECLAS seeks to build upon the Continent's rich landscape heritage and intellectual traditions to:

- Facilitate the exchange of information, experience and ideas within the discipline of landscape architecture at the European level, stimulating discussion and encouraging co-operation between Europe's landscape architecture schools through, amongst other means, the promotion of regular international meetings, in particular an annual conference;
- Foster and develop the highest standards of landscape architecture education in Europe by, amongst other things, providing advice and acting as a forum for sharing experience on course and curriculum development, and supporting collaborative developments in teaching;
- Promote interaction between academics and researchers within the discipline of landscape architecture.

Provided these goals and the relevance of GI for the landscape planning it is rather surprisingly that from the ECLAS website GI is not visible, with just a few instances where it is mentioned if "green" is entered in the search tool.

For members, ECLAS has a member-only accessible platform where GI information is available at http://www.le-notre.org/. The original LE:NOTRE Projects (2002-2013) were co-funded by the European Union's Socrates and Lifelong Learning Programmes. The project web site provides a richly interactive platform for communication and the sharing of information between all project members. With funding ceasing, to maintain the gathered information alive it was decided to make this member-only accessible. www.le-notre.org is the web site of the LE:NOTRE Thematic Network Project in Landscape Architecture. It is a key tool for sharing information and communicating within this global network. The LE:NOTRE Directory comprises a series of inter-linked databases providing a European 'Who is Who' information of universities and other organisations involved in landscape architecture teaching research and practice. The LE:NOTRE channels collect and view information of various fields of interest and identify each member as a member of 12 sub-communities. These sub-communities include the entries 'vegetation' and 'infrastructure'. From these sub-communities it is not clear, however, how well information on GI is presented and how well practitioners of GI are linked to each other. The Resource databases represent a growing collection of user-editable databases which are developing into a common resource where Network members can enter and share a wide range of information.

We recommend that once the GI section on BISE has been further developed that from www.le-notre.org users easily will find their way to the information on the BISE platform. Also, with the information on BISE growing, it may be beneficial to explore in more depth the information available on GI at LE:NOTRE and the way it is presented. Potentially, in the long-term, this may provide an opportunity for having a win-win realized in the information sharing of these two platforms. For the ECLAS

website we would recommend having a minor section on GI being included, covering issues such as definition, advantages/disadvantages, relevance and a link to BISE.

3.3.6 World Green Building Council

The World Green Building Council is a network of national green building councils in more than one hundred countries, making it the world's largest international organisation influencing the green building marketplace. They have specific information for each region, including with a focus on Europe: http://www.worldgbc.org/regions/europe. "Green" in this context should be understood as sustainable and not being limited to GI only. This is very clear also from the cases that illustrate the report on the "Business case for green building."[77]

There is no indication on the webpages on GI, neither is there a sitemap or search box allowing for quick access to possible GI information. One specific aspect that is mentioned is the benefits in terms of health, wellbeing and productivity thanks to views of nature. We could not find GI being mentioned anywhere upfront. Nevertheless, there are several points of entry which encompass GI despite not mentioning it directly. For example, with the Sustainable Cities Initiative (SCI) the WGBC supports national green building councils (GBCs) in their relationships with local governments around the world, with the aim of creating greener, more sustainable cities everywhere.

We do not think that the platform is waiting for GI to be put in the picture. Therefore, the best way to bring more attention to GI would be to first integrate it better in different sectors of EU policy. With GI becoming a more widely used term, as has been the case with climate or sustainability, then it will likely be covered more specifically on the WGBC's platform. It is relevant in this context that the WGBC's website is mainly aimed at facilitating a network and less so at providing content.

3.3.7 Green Roof Association

The ten associations promote and encourage the uptake of green roofs in their countries to help address issues related to climate change, ecosystem services, green infrastructure and lack of green space in the built environment. While it is clear from this first statement and the further information provided on the website pages that EFB cares about GI and ecosystem services, the website is not a hub for information on GI relating to green roofs.

Links are provided to the websites/platforms of each of the 10 member associations. Although these national websites vary in the information offered, in several instances they provide much more content on the green roof industry (producers and suppliers), on the pros and cons of green roofs, guidance (such as on http://greenrooftraining.com/the-guide/). Also, newsletters and connection to blogs on green roofs, and information on funding are provided for some of the national associations. On several occasions also a library is included, for example http://www.aivep.it/bibliografia. While some of this information may be rather country specific or only available in the country's language, there certainly is potential to further disclose some of the available information among countries.

Therefore, we recommend to make http://www.efb-greenroof.eu/index.html a central hub on GI information that is relevant to be shared across countries. In particular, we would recommend having the platform become "the" one-stop-shop for information on green roofs and the pros and cons this GI element provides. Providing a link from

[77] http://www.worldgbc.org/activities/business-case/case-studies

BISE, NRWM and Climate-ADAPT to the EFB's website would allow practitioners to directly find what they need. In the links section on the EFB website, a link should also be made to BISE, NRWM and Climate-ADAPT to provide end-users with the broader picture on GI and building with nature.

3.3.8 European Council of Spatial Planners

ECTP-CEU is the umbrella organisation for spatial planning institutes in Europe. From a networking perspective, it is an achievement and benefit that the services ECTP-EU provides include a register of experts from across Europe specifically on planning issues. Specifically, planning practitioners all over Europe are increasingly confronted with new challenges. Globalisation, environmental problems, accessibility of urbanised areas, immigration and social tensions, identity and cultural heritage, natural heritage, water management and climate change, all affect spatial development of cities and regions. Different European regulations and processes deal with these challenges differently and devising integrated approaches or balancing development with sustainability can be a problem. ECTP-CEU experts offer their knowledge, insight and experience in these issues to individuals and organisations all over Europe looking for guidance in these fields. This may be an opportunity to easily bring GI to attention and to create a community of practice or working group on GI. Also, this provides an opportunity for involving such experts in a network of experts that would be created as part of the GI section on BISE. In fact, the ECTP-EU has working groups on specific teams already, including a group on climate. They have an url-entry,[78] however, little information is available on the topic.

The current work of the ECTP-CEU includes:

- Dissemination of the revised New Charter of Athens on planning European cities in the 21st century;
- The design of a Vision enhancing the quality and efficiency of cities and urban life in Europe;
- The production of a guide to spatial planning and territorial cohesion;
- The publishing of the proceedings of major conferences on European spatial development and the preparation of forthcoming conferences;
- The preparation of the European Urban and Regional Planning Awards.
- There is a member only area on the platform at http://www.ectp-ceu.eu/index.php/en/members-area

From this work description it is clear that the ECTP-EU does not aim to be a content hub, but rather aims at bringing attention to major approaches and outcomes of events such as conferences. Therefore, our recommendation is not to have a specific content-rich section included on the platform that deals with GI. Rather, we would recommend having a minor section on building with nature, where the possibilities and benefits of GI and making use of nature are brought to attention. In addition, for this section it would be beneficial to also include a selection of inspiring examples on spatial planning and GI and include visible links to the GI section on BISE and to the NWRM and Climate-ADAPT platform.

[78] http://www.ectp-ceu.eu/index.php/en/about-us-2/working-groups-19/climate-change

3.4 Technical and governance aspects of BISE, NWRM and Climate-ADAPT

3.4.1 BISE

The server signature for BISE is Zope/(2.13.21, python 2.6.6, linux2) ZServer/1.1. BISE is running on top Plone. The CMS correct version of Plone could not be identified. In other words, it is unclear on what version of Plone BISE is built. Further technical specificities of BISE features are that:

- On BISE most of the content is based on data presentation of simple text using WYSIWYG mechanisms exposed by standard "Add Page" functionalities. More information on how to add a Page with content in Plone is available at: http://docs.plone.org/working-with-content/adding-content/adding-pages.html
- Other web resources such as Images, Links, files, are done with the help of standard content processing mechanisms (see: http://docs.plone.org/working-with-content/adding-content/index.html).
- The map under countries (http://biodiversity.europa.eu/countries) is a standard map found under the EC maps portofolio. For other maps in the EC portofolio, see: https://webtools.ec.europa.eu/fusionmapsxt/Tools/GUI/FusionMapsGUI.html or http://www.eea.europa.eu/data-and-maps/data/biogeographical-regions-europe-1.

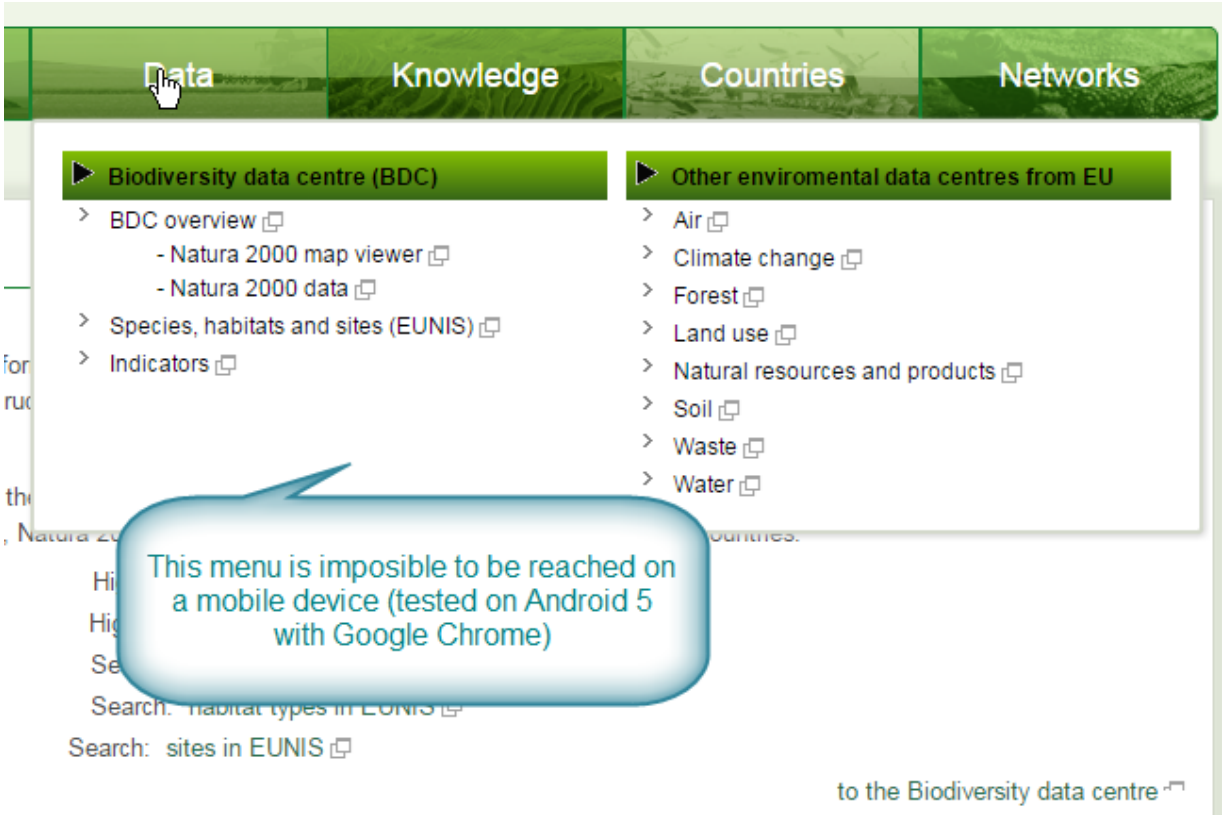
We could not identify any modules present that are facilitating communication with citizens in order to gather data for further processing or for presentation of data such as news and/or newsletters. Where there is a hint of such mechanisms, they are rather poor in presentation or difficult to read; i.e. the "BISE - Clearing House Mechanism (CHM) network of Europe" page (http://biodiversity.europa.eu/chm-network) does not present data categorised by language and the order of news should be descending.

Figure 1 - Unordered news and hard to identify relevant information between different languages.

The "Knowledge" page is a rather poor page in design, presenting a group of links into a simple page. Most of the links are outside of the biodiversity.europa.eu domain.

The menu on top in BISE cannot be reached on a mobile device.

Figure 2 - Submenu on Data section may not be reached on mobile device



The result of searches are not relevant. For example, searching for "Fragmentation" renders 5 pages with links where the title of the page is the only information presented to the user that needs to make a choice on how to proceed. Clearly, this is not very user-friendly in terms of using key words and having rapid access to the relevant pages or information.

In what follows we provide recommendations on how to technically improve the functioning of BISE such that GI information can become easily available to end-users of the BISE platform.

Short-term recommendations:

- Make the BISE portal HTML5 compatible and change its presentation based on a responsive design[79]. Opening the application on a mobile device, this would give a user a better experience together with an easiness of navigation. There are different themes with responsive mechanism available on the plone.org website: https://plone.org/products/plonetheme.diazo_responsivetheme

[79] Responsive web design (RWD) is an approach to web design aimed at crafting sites to provide an optimal viewing and interaction experience—easy reading and navigation with a minimum of resizing, panning, and scrolling—across a wide range of devices (from desktop computer monitors to mobile phones).

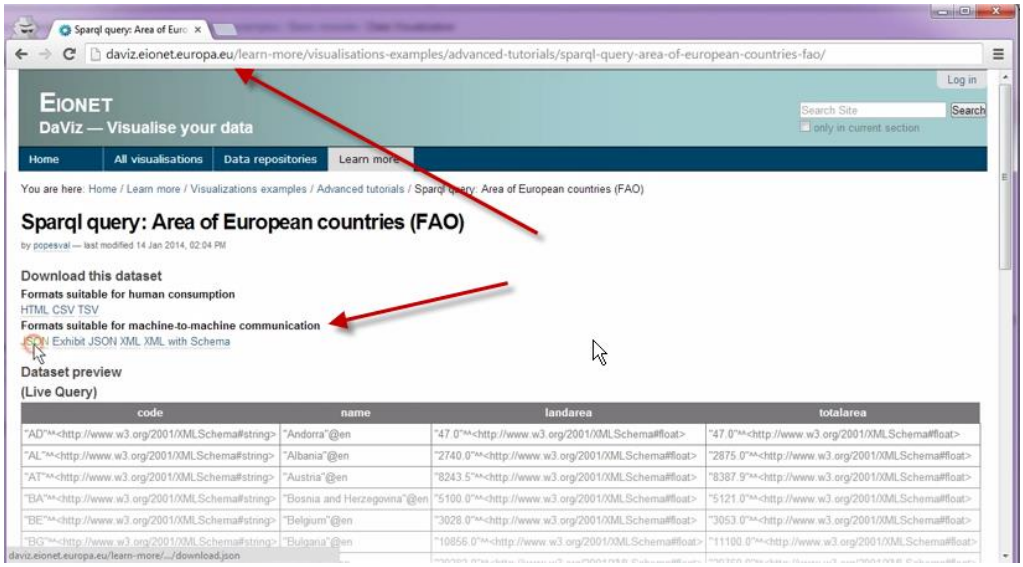
- A better order of events has to be achieved by presenting upcoming events in an ascending order and past events in descending order. For News items the standard is in descending order.
- Improve the Knowledge page by adding categories and lists with different sections to improve information visibility and the finding of information.
- For easy technical maintenance of BISE, we recommend to have the modules and vulnerability fixes updated (currently the most recent version of Plone is 4.3.6).
- Improve the search function by showing under the main link or title the context part of the paragraph where the search word is found. There does not seem to be a search engine on offer in Plone modules, however an open source search engine that delivers a better experience by searching is http://sphinxsearch.com/.

Figure 3 - A search in Google reveals a better way of presenting of the found expression

Long-term recommendations:

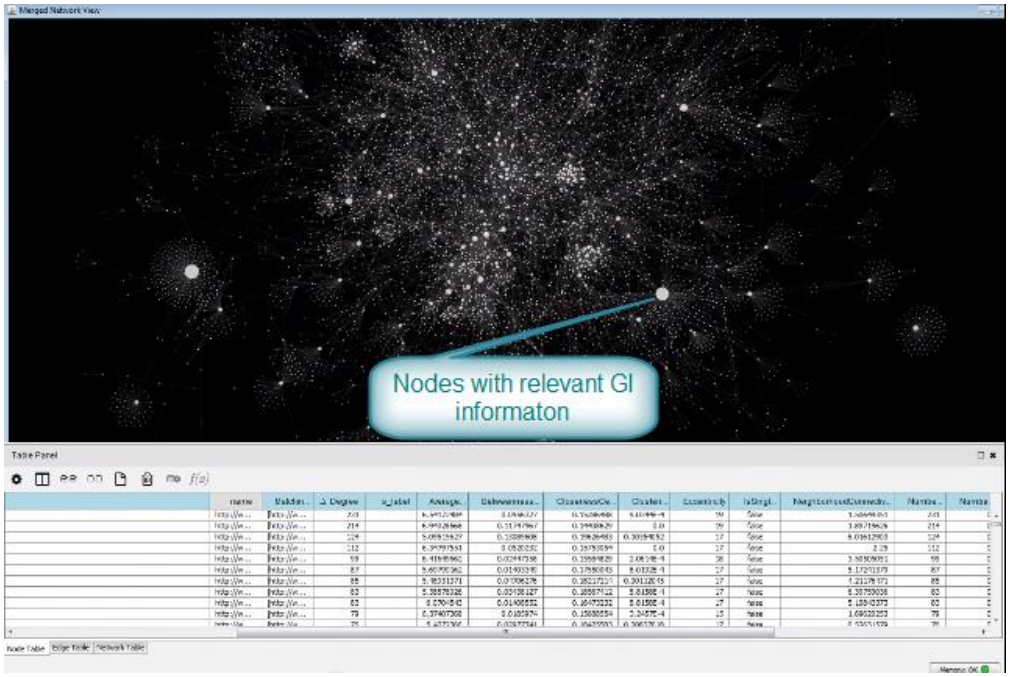
- On plone.org there are multiple plugins for Plone including one developed by EEA in order to facilitate machine to machine communication: https://plone.org/products/eea.daviz

Figure 4 - DaViz plone module app facilitating machine-to-machine communication



- It is recommended to create a data warehouse exposing data in RDF format with immediate availability to SPARQL queries; Data may be visualized in different formats such as Interactive charts, dashboards, tables, URLs. A way of doing this may be to gather a warehouse with GI related information in RDF format. Such data can then be analysed with tools like Cytoscape (cytoscape.org).
- Cytoscape is an open source software platform for visualizing complex networks and integrating these with any type of attribute data. A lot of Apps are available for various kinds of problem domains, including bioinformatics, social network analysis, and semantic web.

Figure 5 - Cytoscape LOD modelling



3.4.2 NWRM

The nwrm.eu website uses Drupal 7 (http://drupal.org) as a development platform, hosted on an Apache/2.2.15 (CentOS) server powered by PHP 5.3.5.

Drupal is an open source content management platform powering millions of websites and applications. It is built, used, and supported by an active and diverse community of people around the world.

Drupal is powerful in the availability of modules allowing a high degree of website customisation. See https://www.drupal.org/project/project_module for a full list of modules (i.e., more than 17000). On that page, tools are available to allow filtering for specific types of modules.

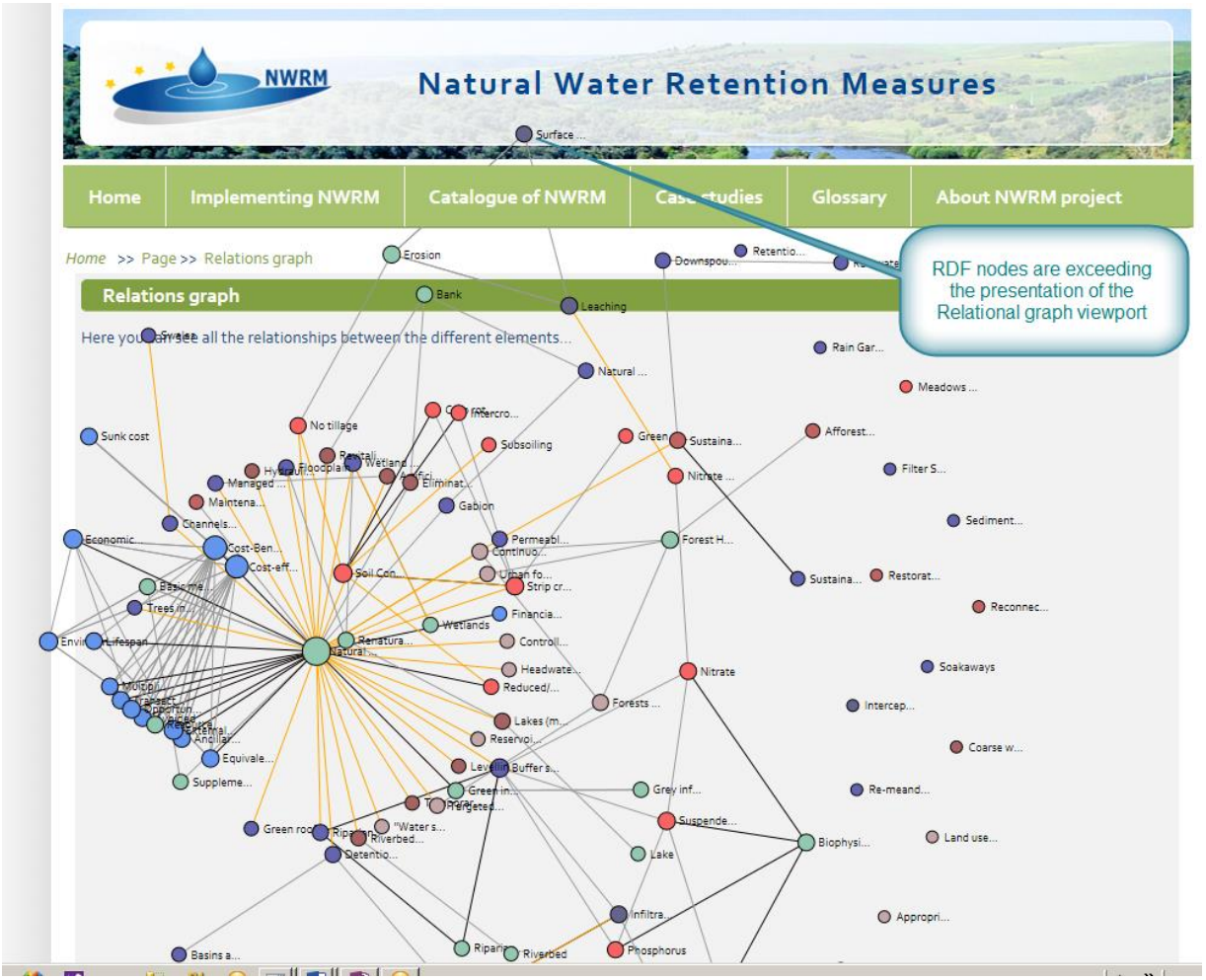
We noticed some problems with the presentation to users of the NWRM platform depending on the browser/device used. These are issues that would best be fixed in the short-term to provide the best experience to users of the platform. We have included an overview of our experiences in Annex 11.

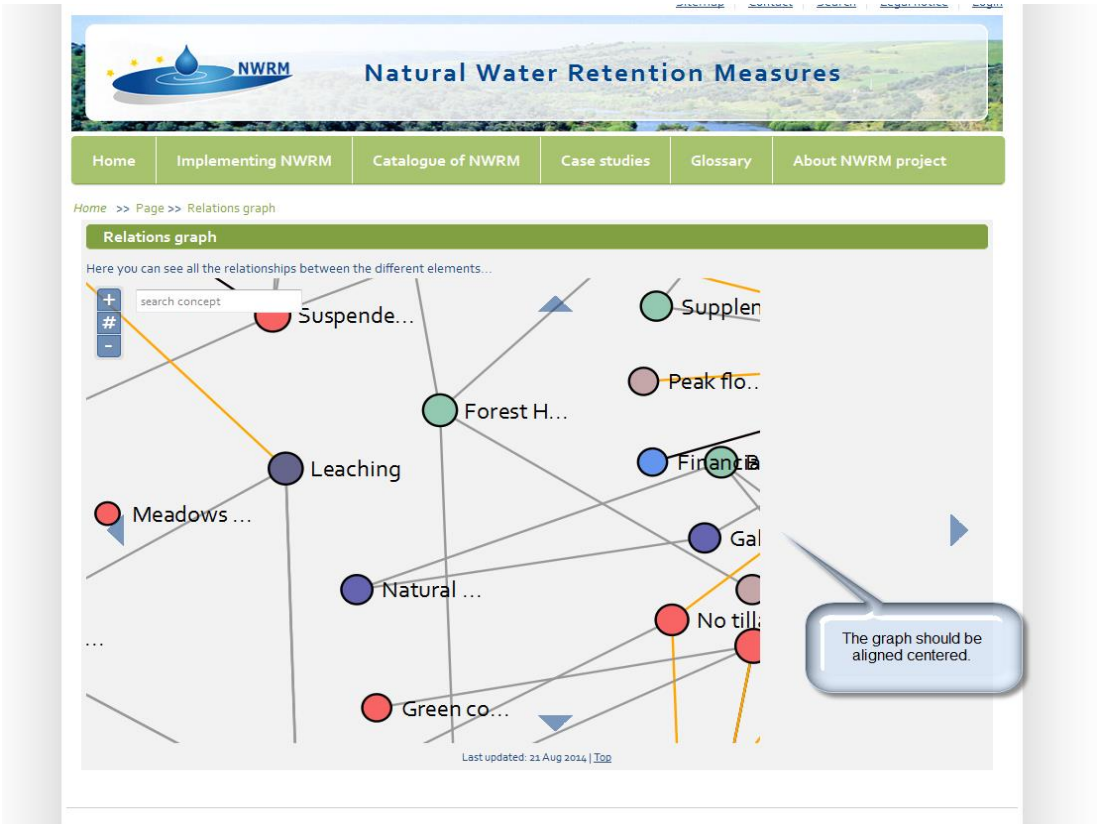
Most of the pages on the NWRM platform that display text data have links to either flash applications, pdf documents or, in most cases, simple text.

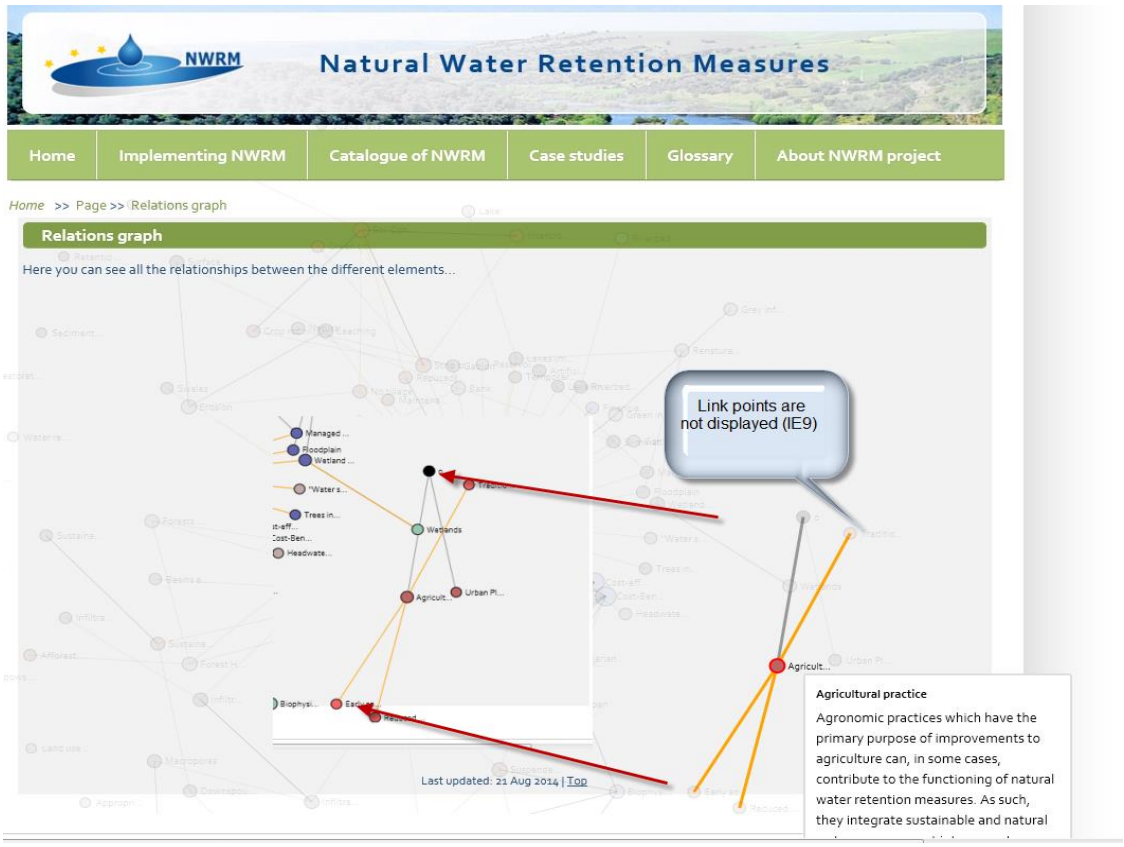
With regard to machine to machine communications, Drupal offers various modules allowing exchange of information with other Sites, Systems, Data and APIs. A list of modules is available at https://www.drupal.org/node/627270.

Drupal has support for RDF format content: https://www.drupal.org/project/rdfx. An introduction to this in Drupal is https://www.drupal.org/node/219862. A SPARQL module is also available at https://www.drupal.org/project/sparql. Simple RDF (https://www.drupal.org/node/1393378) automatically maps values of Drupal objects (e.g. nodes) to RDF properties. Simple RDF provides RDF mapping configuration for the node, user, and term object types per classification, such as content type in the case of nodes. However, simple RDF has been stopped with development of Drupal 6 level. More on RDFx module for Drupal 7 is available at https://www.drupal.org/project/rdfx. Simple RDF also comes with an RDF document display module: Simple RDF View. This module publishes the RDF document for an object on a configurable path under the object's path, e.g. `node/123/rdf. In NWRM, RDF visualization is present; see http://nwrm.eu/page/relations-graph. This page shows RDF data (it is however not clear if data presented in these nodes are limited to the NWRM website only). For browser presentation some fixes are needed (see Figure 6): nodes are exceeding the presentation (IE, the graph should be aligned centered (FireFox and Chrome), and connection points are not visible (IE9).

Figure 6 – RDF visualisation on the NWRM websites with IE

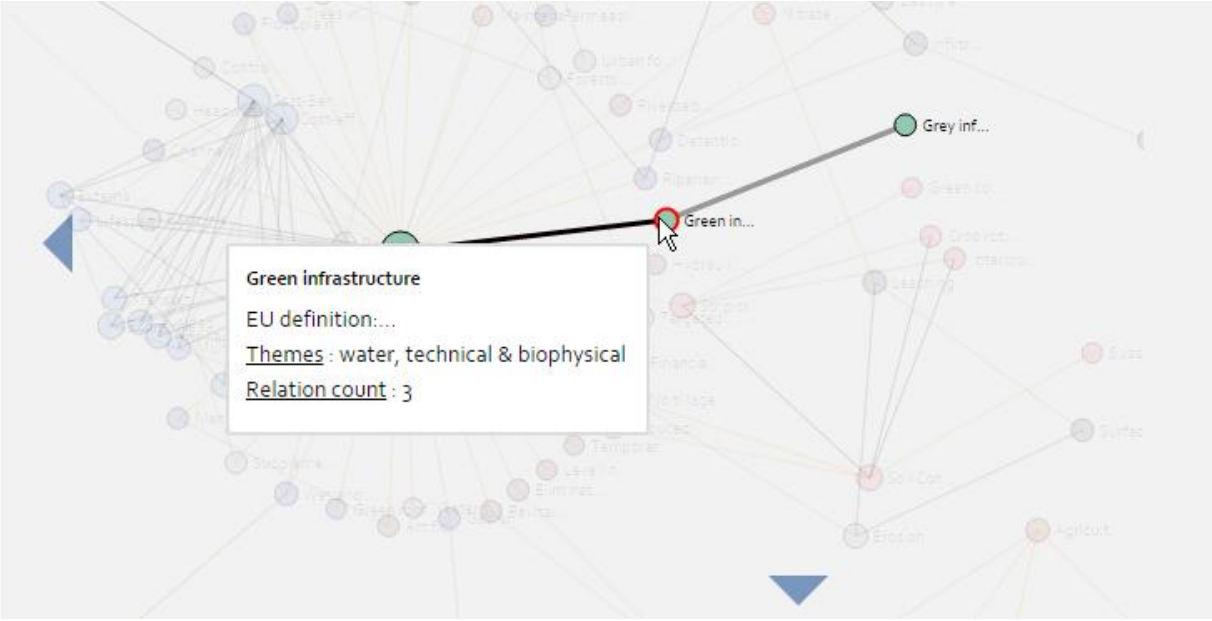



Natural Water Retention Measures
Home
Implementing NWRM
Catalogue of NWRM
Case studies
Glossary
About NWRM project
Home >> Page >> Relations graph
Relations graph
Here you can see all the relationships between the different elements...
search concept
Suspende...
Supplen
Peak flo...
Forest H...
Leaching
Meadows ...
Natural ...
Green co...
The graph should be aligned centered.
Last updated: 21 Aug 2014 | Top


Natural Water Retention Measures
Home
Implementing NWRM
Catalogue of NWRM
Case studies
Glossary
About NWRM project
Home >> Page >> Relations graph
Relations graph
Here you can see all the relationships between the different elements...
Link points are not displayed (IE9)
Wetlands
Agricult...
Urban Pl...
Agricultural practice
Agronomic practices which have the primary purpose of improvements to agriculture can, in some cases, contribute to the functioning of natural water retention measures. As such, they integrate sustainable and natural
Last updated: 21 Aug 2014 | Top

Specifically with respect to GI a node is displayed under Glossary->Relations graph (see Figure 7). It was not entirely clear from the research how this graph is generated. This was either by using GraphAPI (https://www.drupal.org/project/graphapi) or the JIT (http://philogb.github.io/jit/).

Figure 7 - GI RDF node present in graph



Short-term recommendations:

- Fix the layout issues encountered with the different browsers.
- Implement a responsive design theme allowing mobile users to properly experience the NWRM platform. In fact, there are several themes available out-of-the-box on the Drupal website or alternatively other low-priced commercial ones. For example:

  - AdaptiveTheme - https://www.drupal.org/project/adaptivetheme;

  - Zen - https://www.drupal.org/project/zen

  - AdaptiveTheme - http://adaptivethemes.com/
- Improve the size of thumbnails (small pictures links) on the platform. A maximum size of 15-20KB for this would be more suitable.
- The page at http://nwrm.eu/catalogue-nwrm/benefit-tables needs revision. Pictures need to be resized and it would be more convenient if by clicking on the links the big image would be loaded on another page. Also, use can be made of a free and open source picture library slider from http://bxslider.com. Many other similar libraries are available on the internet. For example, another recommended free open source library is: http://www.jssor.com/download.html.
- Open links that are not part of nwrm.eu in another window.

Long-term recommendation:

- Choose for a mechanism to display the already existing RDF data (or existing mechanism in Drupal for generating RDF content) in a more formatted way. The graph visualization of LOD (http://nwrm.eu/page/relations-graph) may be useful to display the complexity of link relations, but may not be the best way of

showing data to the final users. This would allow for all GI related data and information to be presented in a structured way. With the help of Drupal RDF modules, all pages and information may be exposed easily to RDF related warehouses on the EEA servers. Further, these data may then be immediately available to other publishing engines like BISE, Climate- ADAPT, WISE, etc.

3.4.3 Climate-ADAPT

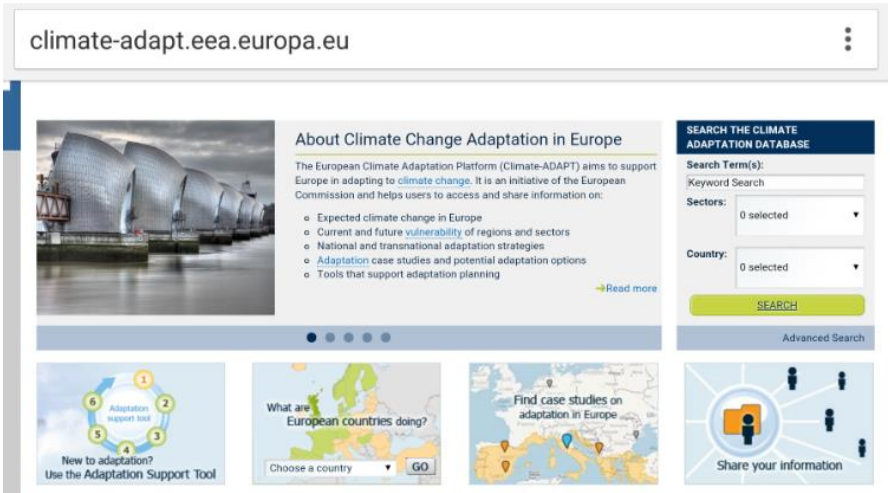
Climate adapt is built on top of the Liferay community edition CMS available at http://www.liferay.com (but to be changed to Plone in 2015). The version of the portal is Community Edition 6.2.0 CE GA1 (Newton / Build 6200 / November 1, 2013). Liferay contains a lot of modules that may be used to enrich content such as Web Content, Documents and Media, Message Boards, Dynamic Data Links, Pools, Categories etc. On the continuous integration EEA platform http://ci.eionet.europa.eu/ it can be researched which portlets (modules) have been used with Climate-ADAPT. Also, Liferay is strong on social network connectivity. More information is available at: https://dev.liferay.com/discover/portal/-/knowledge_base/6-2/social-networking.

On Climate-ADAPT most of the content is based on data presentation of simple text using WYSIWYG mechanisms exposed by standard Web Content functionalities. More about web content management is available at: https://dev.liferay.com/discover/portal/-/knowledge_base/6-2/web-content-management. Data on Climate-ADAPT is well presented, based on categories and lists with different filters easing the information search. The map under adaptation - http://climate-adapt.eea.europa.eu/adaptation-strategies - is a standard map found under the EC maps portfolio. For other maps in the EC portfolio, see: https://webtools.ec.europa.eu/fusionmapsxt/Tools/GUI/FusionMapsGUI.html or http://www.eea.europa.eu/data-and-maps/data/biogeographical-regions-europe-1.

We encountered two minor issues that need to be solved:

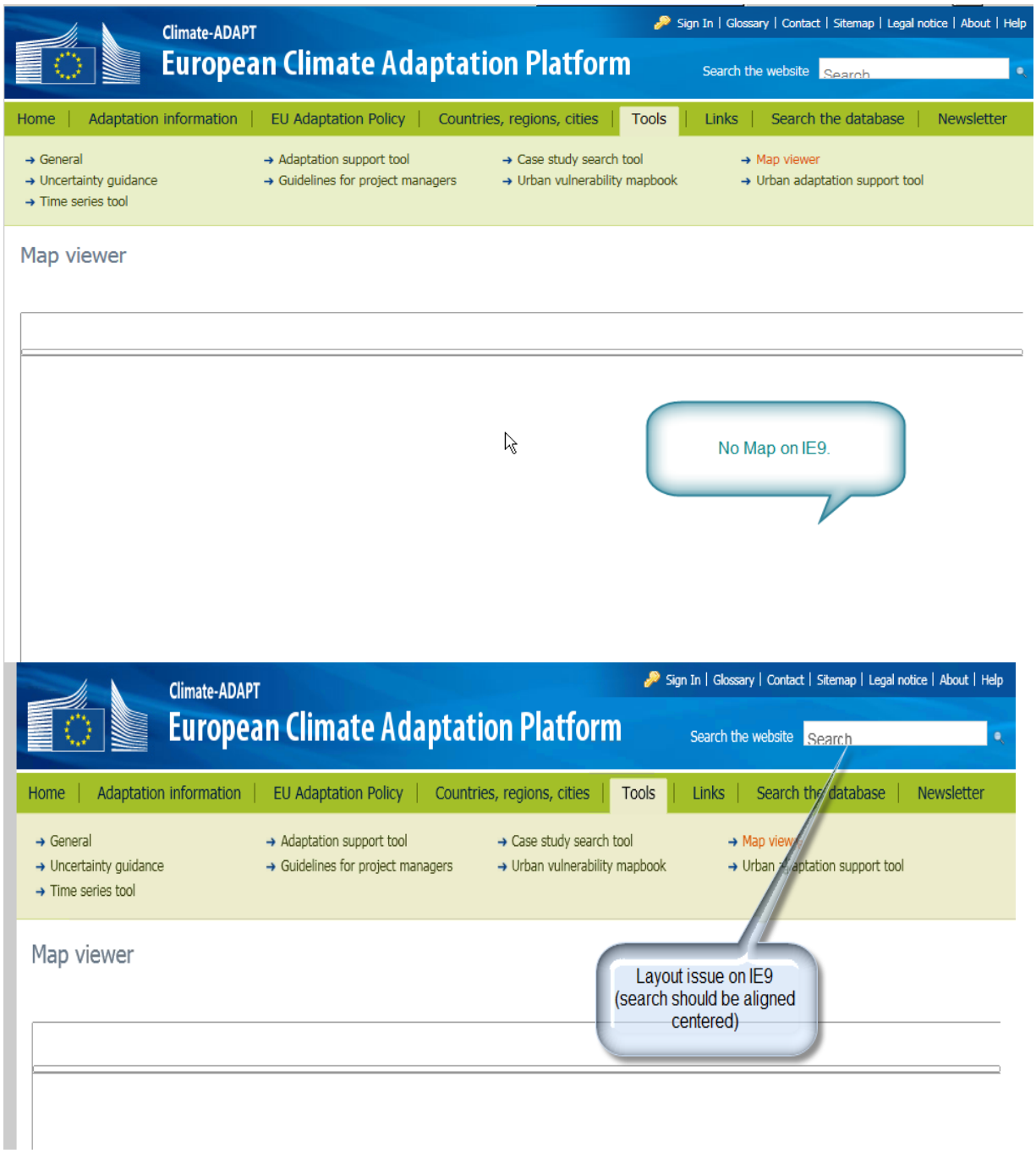
1. On Android 5 with Google Chrome there is no website header and top menu (see Figure 8). With Firefox and Chrome, the page is loaded well.

Figure 8 - Android 5 view of the climate-ADAPT homepage



2. Browsing with IE9 the map under http://climate-adapt.eea.europa.eu/tools/map-viewer does not appear at all (see Figure 9). With Firefox and Chrome the page is loaded well. The responsible services of Climate-ADAPT indicated more problems have been reported for IE9.

Figure 9 - Uses experience on IE9 for the map-viewer on Climate-ADAPT

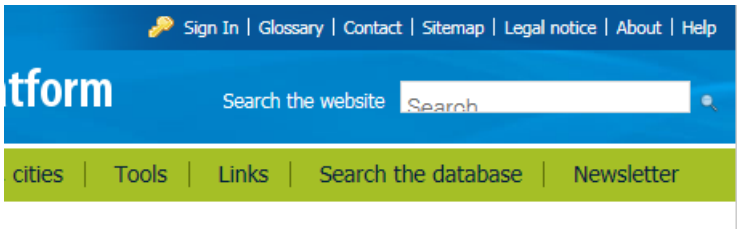


Short-term recommendations:

- Implement a responsive layout for the correct display of the climate-ADAPT website to mobile users. This can, for example, be done though the theme available within the Community edition of Liferay: AlloyUI 2.0 TagLib and

Bootstrap Migration https://dev.liferay.com/develop/tutorials/-/knowledge_base/6-2/alloyui-2-0-taglib-and-bootstrap-migration .

- Some small layout fixes such as the search textbox where "Search" is not properly aligned and the search icon has an improper size; see:



3.5 Recommendations

Based on the previous chapters we are now in the position to provide general recommendations for improving the online visibility of GI. This chapter will not bring together all the previous, sometimes very specific recommendations which have been made throughout this document. Therefore, we recommend to also consult the previous chapters in taking up actions for improving the GI visibility for the various platforms that have been researched. Specifically, for BISE, NWRM and Climate-ADAPT the preceding sections provide detailed information on actions that can or need to be done in the short-, mid- or long-term for improving the online visibility of GI.

As in previous chapters, we distinguish between short, mid and long-term timelines for implementation. Some of the recommendations entail a combination of actions, starting with actions that can be addressed in the short-term, followed by actions to be taken in the mid- and long-term time horizon.

In each of the recommendations below, we comment on the 'why', 'what', 'how', 'when', 'who', technical advice, governance, roadmap and risks. Only for the long-term recommendations we do not follow this structure and provide our insights on how progress can be made on increasing the online visibility and interconnectivity of GI information.

Short-term

3.5.1 BISE to become a GI information hub

The amount of GI information on this platform today is rather disappointing. In the previous sections it has been extensively discussed which actions can be taken. In making BISE a GI hub it needs to be considered that the Commission prefers not to create a central repository on GI but to use existing facilities: e.g. BISE covering the biodiversity aspects, WISE/NWRM the water aspects, Climate-ADAPT the climate aspects etc. Therefore, it is crucial to decide on which GI information to disclose through BISE, and which through other platforms (such as NWRM or Climate-ADAPT). GI information disclosed through other platforms should be connected to BISE such that it is also accessible for end-users who access through BISE. In practical terms, GI information will be more visible on BISE than on other platforms, as currently the GI file is hosted by the Biodiversity Unit of DG ENV, which has a steering role in BISE (but less on water and climate policies). While this approach may work well for linking to NWRM and Climate-ADAPT, it may need to be reconsidered when GI uptake is also increasing in other policy sectors. The reason is that other sectors are not necessarily familiar with terminology used on BISE or inclined to search for information on a

'nature' platform. Therefore, evaluation may be needed on how GI information needs to be provided (e.g. language, setting) to attract users that relate to these other policy sectors.

- Why?: BISE should become an inspirational and exemplary platform on how to optimally provide online GI information and connect this to other platforms.
- What?: See sections 'Increasing GI visibility for selected platforms' and 'Technical and governance aspects of BISE, NWRM and Climate-ADAPT'.
- How?: A combination of improving content, paying particular attention to user friendliness and accessibility, and establishing good connections at least to NWRM and Climate-ADAPT, and by extension to other platforms or sources of GI information (see national or international - outside the EU - examples).
- When?: See sections 'Increasing GI visibility for selected platforms' and 'Technical and governance aspects of BISE, NWRM and Climate-ADAPT'.
- Who?: DG Environment and the EEA have a key role.
- Technical advice: See 'Technical and governance aspects of BISE, NWRM and Climate-ADAPT' and corresponding longer term recommendation (3.5.5).
- Governance?: This requires DG Environment and the EEA to agree on how to bring this forward.
- Roadmap: Drafting a detailed roadmap is suggested to be a first action after the governance issue has been settled.
- Budget: Budget needs for implementing this short-term recommendation are low. With increasing time horizons and considering the ambition levels that are decided on, budget needs will be higher, andnot only for DG Environment and EEA. When working towards recommendation 3.5.5, several organisations and initiatives may be connected.
- Risks?: Similarly as for budget, the first steps to take have little risks, however, for implementation of longer-term recommendations budgets are required and also several parties have to agree on how to proceed and on how to structure the information on their platform.

3.5.2 GI as a common vocabulary across platforms

There is a rather weak presence of both the term GI and the information that relates to GI across platforms linked to either the EC or to stakeholders. In fact, many platforms that can be considered relevant do not contain any reference at all to the concept of GI. Much progress therefore can be made by having the concept, its relevance for the sector or stakeholder group and a link to the GI section on BISE integrated across the relevant policy sectors and stakeholder platforms.

- Why?: To create a community and connect across policy sectors and stakeholders, having a common terminology and understanding can be a catalyst for GI information to become labelled as such, disclosed and, most importantly, applied.
- What?: GI information may be present at a variety of websites/platforms, however, it will often be available as very specific information and not necessarily named GI. Therefore, it is not evident to retrieve all the available information by using the term GI. Indeed, often other search terms (such as ecosystem-based adaptation, nature-based solutions, natural capital, ecosystem services, etc.) are needed or in use for GI related information.

- How?: (1) Introduce the concept where it is not present today and link it to the expectations/language of the end-user (see also the fact sheets on GI that were produced in task 1 for various policy sectors). (2) Identify which information is GI relevant and take the necessary actions to label it as such. (3) Provide at least a link to BISE and possibly to other platforms relevant for that sector.
- When?: This can start now with a focus on BISE, NWRM and Climate-ADAPT, then further extended across EC websites and platform (mid-term) and ultimately lead to GI visibility also on many stakeholder platforms or information hubs (long-term).
- Who?: DV ENV will need to facilitate this until a community has been built that may start doing this.
- Technical advice: There are no real challenges from a technical perspective, unless ambition is to cater for this also more directly through recommendations 3.5.3, 3.5.4 and 3.5.5.
- Governance: Not each representative may welcome the idea to have GI as a common label and to indicate where it links to related information.
- Roadmap: (1) Step 1 would be to have BISE as a representative platform on GI such that it can be an inspiration and that links can be provided. (2) Step 2 would be to have GI become commonly used and more visible on NWRM and Climate-ADAPT, such as to illustrate how connections can be made. (3) Step 3 would involve the same for other platforms/websites of EU policy sectors. (4) Step 4 would involve the same for stakeholder platforms.
- Budget: Efforts to be mainly expressed in terms of manpower to discuss this with representatives of the various organisations and a limited effort of each in terms of providing the information on the various platforms.
- Risks: See 'Governance'.

Mid-term

3.5.3 Have GI relevant information made available to the end-users of the various platforms

For the majority of the studied platforms there is limited availability of GI information. In Chapter 3 we have indicated the 'ideal' future situation on the way GI information could be made available through the different websites/platforms linked to specific policy sectors. For the stakeholder platforms, the exercise that was made for the policy sectors can provide inspiration. However, to define exactly which GI information to disclose is something that is best considered in terms of the needs of end-users and of the platform's function for end-users (for example, is it included in the aims of a specific platform to also provide technical information?).

- Why?: Various end-users have different needs for GI information. Also, not each end-user may be expected to search for GI information on BISE, which is a platform on biodiversity.
- What?: Provide end-user oriented GI information. Distinguish between information on policy, techniques, economics, methods, best practices and network/discussion groups, and consider for each information type which needs end-users may have and whether these can best be satisfied through the platform for which this analysis is being made or by connecting to other platforms/sources of information (for example BISE).

- How?: After or parallel to recommendation 3.5.2, identify which GI information needs to be disclosed where.
- When?: This can start now with a focus on BISE, NWRM and Climate-ADAPT, then further extended across EC websites and platforms (mid-term) and ultimately lead to GI information also being shared on many stakeholder platforms or information hubs (long-term).
- Who?: DG ENV will need to facilitate this process and likely stay involved for a longer-term.
- Technical advice: Depending on the long-term ambitions, this may directly be catered for also through starting implementation of the long-term machine-to-machine recommendation described below.
- Governance: It will need to be discussed with the various representatives of the different platforms whether they agree on providing GI information. An alternative decision could be to go for recommendation 3.5.2 and not for 3.5.3. In the latter case, connecting from the platform to BISE may still satisfy end-users' needs. In this case, the way information is provided on BISE and whether that appeals to end-users, different policy sectors or fields of expertise will be critical.
- Roadmap: 1) Step 1 would be to make BISE a representative platform on GI such that it can be an inspiration and that links can be provided to the available information. (2) Step 2 would be to render GI information more visible on NWRM and Climate-ADAPT and well-connected to BISE. (3) Step 3 would involve doing the same for other platforms/websites of EU policy sectors. (4) Step 4 would involve doing the same for stakeholder platforms.
- Budget: Further budget needs will depend on how much GI information will be disclosed and on how much effort will be made in catering the information towards the end-user. However, in case BISE, NWRM and Climate-ADAPT further grow to be strong sources for GI information, this may also provide an opportunity for a rapid start on other platforms. When catering for specific end-users, efforts will be needed to collect and disclose GI information in an adequate way with respect to the different categories of GI information (policy, technical, economic, methodological, best practices and network/discussion groups).
- Risks: See 'Governance'.

3.5.4 Stronger connect across platforms

The GI information that is available across the studied EC platforms is relatively dispersed and not presented in a coherent way. By introducing the GI concept (3.5.2) and providing end-user specific information on the various platforms (3.5.3) much more GI information is expected to become available. A challenge then becomes to connect the different sources of information (for example for green roofs there may be very technical information on the digital platforms for the construction sector, e.g. on how to construct these, while more information on their biodiversity values may be on BISE, more information on the water buffering capacity on NWRM and more on the climate consequences and calculations on Climate-ADAPT. For some end-users it may be desirable to make such information available through a single search or from a single page with convenient links to where other information is available. To improve user access to this information, a search function in combination with a single repository where all GI related information is centralized, would be a most effective solution. However, the feasibility of this option is rather low, as it is very unlikely that all platforms involved will be happy to share all information in an agreed manner. A different option is provided under recommendation 3.5.5. A different approach (less

preferable) is indicated here and would involve the manual connection of all the different types of information through deep links (for example, not simply from BISE to NWRM, but from BISE green roofs to NWRM green roofs).

- Why?: Connecting platforms would assist in GI becoming more broadly and widely disclosed.
- What?: Create and extend connection across the analysed platforms as this is not properly done.
- How?: This can be done by creating separate entries on GI on the different platforms and by streamlining the disclosure of GI information. Start this process with connecting between BISE, NWRM and Climate-ADAPT.
- When?: Mid-term for BISE, NWRM and Climate-ADAPT, more long-term for other platforms.
- Who?: At the onset, DG ENV and EEA. For the long-term, representatives of the other platforms.
- Technical advice: Considering this is a manual option, technical advice is not applicable.
- Governance: For each platform, agreement is needed on doing this and also on who will be doing this (budget-wise). For example, a connection can be made from BISE to a variety of other platforms. The vice versa operation will require approval and efforts by the other organisations.
- Roadmap: This could be something that grows, with mid-term efforts for connecting BISE, NWRM and Climate-ADAPT and more long-term efforts for other platforms. It is not sufficient to have this as a one-time investment. Indeed, this action requires follow-up and maintenance of the links that are established.
- Budget: If many deep links are installed and require maintenance, this will result in a long-term budget need. Also, it needs to be addressed who will cover the costs.
- Risks: When a platform is redesigned or pages are differently located, links will need to be renewed. In short, there is a high risk that links will not function after some time.

3.5.5 Long-term: machine to machine communication

Linking data distributed across the Web requires a standard mechanism for specifying the existence and meaning of connections between items described in this data. This mechanism is provided by the Resource Description Framework (RDF).

Key is that RDF provides a flexible way to describe things in the world – such as people, locations, or abstract concepts – and how they relate to other things. These statements of relationships between things are, in essence, links connecting things in the world.

While most websites have some degree of structure, the language in which they are created, HTML, is oriented towards structuring textual documents rather than data. As data is intermingled into the surrounding text, it is hard for software applications to extract snippets of structured data from HTML pages.

To address this issue, a variety of microformats (http://microformats.org/) have been made. Microformats can be used to publish structured data describing specific types of entities, such as people and organizations, events, reviews and ratings, through

embedding of data in HTML pages. As microformats tightly specify how to embed data, applications can unambiguously extract the data from the pages. Weak points of microformats are that they are restricted to representing data about a small set of different types of entities; they only provide a small set of attributes that may be used to describe these entities; and that it is often not possible to express relationships between entities, such as, for example, that a person is the speaker of an event, rather than being just an attendee or the organizer of the event. Therefore, microformats are not suitable for sharing arbitrary data on the Web.

One of the most important implementations of the micro formats technology is in the Google search engine that has called this Structured Data Markup. "Structured data markup" is a standard way to annotate your content so machines can understand it. When your web pages include structured data markup, Google (and other search engines) can use that data to index your content better, present it more prominently in search results, and surface it in new experiences like voice answers, maps, and Google Now.

Structured data markup makes your content eligible for two kinds of Google features:

- Enhanced Presentation in Search Results: By including basic structured data appropriate to your content, your site can enhance its search results with Rich Snippets, Breadcrumbs, or a Sitelinks Search Box.
- Answers from the Knowledge Graph: If you are the authority for certain content, Google can treat the structured data on your site as factual and import it into the Knowledge Graph, where it can power prominent answers in Search and across Google properties. Features are available for authoritative data about organizations, events, movie reviews, and music/video play actions.

More about Google Structured data markup is available here: https://developers.google.com/structured-data/

The example of Structured Data service from Google may provide a means to expose data on GI to other machines. This would involve:

- To create a microformat standard library covering as much as possible GI data and relations between data entities;
- Enrich the pages on all considered GI platforms/websites, i.e. markup each page;
- Explore websites and expose data in data warehouses with slight modifications of existing RDF based technologies in use by EEA. These modifications would relate to grabbing the microformat data markups of the pages.
- When immediately available in data warehouses, this data may be exposed as a service to other websites to be consumed via, for example, SPARQL endpoints.
- Having an SQPARQL endpoint with GI data, users may use, for example, already implemented Drupal mechanism to query and expose this information. There are a series of YouTube presentations of how to do this:
  https://www.youtube.com/watch?v=RwY_2kmOgUc
  https://www.youtube.com/watch?v=AsWPm0vpmoI

A more generic approach to making structured data available on the Web are Web APIs. Web APIs provide simple query access to structured data over the HTTP protocol. High profile examples of these APIs include the Amazon Product Advertising API (http://docs.amazonwebservices.com/AWSECommerceService/latest/DG/) and the Flickr API (http://www.flickr.com/services/api/). The site ProgrammableWeb

(http://www.programmableweb.com/) maintains a directory containing several thousand Web APIs.

On the Amazon website the following comment is provided: "*Amazon has spent over ten years and hundreds of millions of dollars developing a world-class web service that millions of customers use every day. As a developer, you can build Product Advertising API applications that leverage this robust, scalable, and reliable technology. You get access to much of the data that is used by Amazon, including the items for sale, customer reviews, seller reviews, as well as most of the functionality that you see on www.amazon.com, such as finding items, finding similar items, displaying customer reviews, and product promotions. In short, Product Advertising API operations open the doors to Amazon's databases so that you can take advantage of Amazon's sophisticated e-commerce data and functionality. Build your own web store to sell Amazon items or your own items.*"

From this regard, although more generic, WebAPI may not be considered a pragmatic approach but a very long term recommendation.

For more on linked data we recommend the following key references:

- http://ec.europa.eu/isa/ready-to-use-solutions/index_en.htm; in particular the section on Highly reusable semantic standards
- http://linkeddatabook.com
- https://www.youtube.com/watch?v=OM6XIICm_qo
- http://www.ted.com/talks/tim_berners_lee_the_year_open_data_went_worldwide

3.6 Further steps for BISE, NWRM and Climate-ADAPT

The analyses and recommendations made in this report were distributed to the responsible services of BISE, NWRM and Climate-ADAPT. In what follows we provide a log of what will be next steps and which of the recommendations seem feasible to be implemented on either of the three platforms. Also, when applicable we have indicated how issues may be solved or how progress can be made. Before going into the specifics for each of the three platforms, we also provide here an overview of the deliverables of the GI contract and make suggestion on how these products can be displayed on all of the platforms that were reviewed under this task.

TASK	DELIVERABLE	DISSEMINATION LEVEL
1a	20 Factsheets on GI	Broad dissemination for stakeholders across policy levels, sectors, etc. The sector sheets provide basic backgrounds on GI and its relevance for the specific sectors and can be linked to the policy sectors and also to specific stakeholder groups. The country sheets can have similar purpose, however, with a focus on the national level.
1b	Workshop documentation (PDFs, etc.) of 3 sector workshops	Broad dissemination, but with the question on the format and on which of the included information to disclose.
1c	Various edited docs of the EU WG GIIR; Minutes of WG meetings	Internal WG (EC has to decide on broader dissemination).
2	- Workshop documentation (PDFs, etc.) of 3 thematic workshops - MOOC (documentation for running an online course on GI)	• Dissemination should best be targeted in accordance with the themes and audience of the workshops they were aimed for. That being stated, the presentations are meant to be presented and there is a question of whether they have similar value when just providing them to be read. • In theory the information is interesting for people also to just read; but it is meant to be presented as an online course. Possibly the course can be provided to targeted audiences or at targeted times.
3	Final Task Report	Internal use across various EC services. Use for external purposes when connecting to stakeholders. This can mainly be seen as a reflection on the current state of GI disclosure and a working document for increasing GI visibility.
4	Final Task Report	Broad dissemination, but also to specific audiences considering that nine sectors were explored and evaluated independently. The report can be disclosed through BISE; the sector sheets may have value also for the policy sectors or stakeholder groups relating to each of the sectors.
5	• Baseline of current EU GI spending • TEN-G Assessment	• Possibly a wide dissemination for the EC to show what is already being done. • TEN-G assessment: it is up to the EC whether to keep this for internal use or to communicate it at a later stage.

3.6.1 BISE

For BISE, since the first analysis, this platform has already increased in the information that is provided and the aim is for this platform to grow further in terms of disclosing GI information. Further, as a service provider hosting the BISE infrastructure, for EEA there is no conflict from an architectural point of view with respect to the generic improvement proposals to BISE in sections 3.4 and 3.5.

3.6.2 NWRM

For NWRM most of the recommendations made to the NWRM platform can easily be done in the next few months. Specifically, in autumn 2015 changes can be made such as adding an introduction on GI, adding links to external and related information such as BISE and Climate-ADAPT, fixing the layout and other technical recommendations. For example, it is also planned during 2015-2016 to:

- Improve the following aspects of the platform: fix layout issues for IE 8 to IE 11 users, improve the size of the thumbnails, open documents and external links in separate windows and improve the search functions.
- Improve the accessibility of the data by implementing the INSPIRE Directive by adding a shapefile with case studies and download service using xls format.

- Include clear references to Green Infrastructure (GI) and climate change adaptation activities (BISE and Climate Adapt platforms).

Also, NWRM responsible services agree with the recommendations in the report for BISE and Climate Adapt on the need to make the links with the information included in the NWRM platform. In this regard it is planned to update the text in the water pages on Climate-ADAPT by adding these links, which does not prevent from making further changes as proposed.

With respect to the long-term recommendations made, resources are currently lacking and the amount of resources needed to successfully make these changes would also need to be evaluated. Proceeding with this recommendation only starts making sense when other relevant platforms have also decided to move forward similarly.

The integration of the information on the NWRM platform into WISE should be considered in the long-term. Information on the planned implementation of measures coming from the 2nd RBMPs and 1st FRMPs would add to the existing information.

3.6.3 Climate-ADAPT

For Climate-ADAPT we have included full comments by the responsible services attached in Annex 12 to this report. It has been agreed to have a DG Clima, EEA, DG ENV meeting to further discuss how to move forward from recommendation to implementation. Among the various recommendations to be discussed, this may include looking into how to link GI to ecosystem-based adaptation on the Climate-ADAPT platform, and vice versa for BISE. Perhaps as a first step one could link the searches "green infrastructure" and "ecosystem-based adaptation" (EbA). Both keywords should lead to all the information on both GI and EbA. However, such retagging may be challenging and also needs to be considered with respect to EEA migrating the Content Management System of the platform from Liferay to Plone.

From Annex 12 it is clear that several of the recommendations can be implemented by the responsible services for Climate-ADAPT. It was requested to provide text and link proposal to the responsible services for Climate-ADAPT. This was done and the input is included in Annex 13 to this report.

4 Task 4 - Assessing technical standards and innovation possibilities

Chapter summary

Green infrastructure (GI) is a successfully tested tool for providing ecological, economic and social benefits through natural solutions. GI helps to understand the value of the benefits that nature provides to human society and to mobilise investments to sustain and enhance them. It also helps avoid relying on infrastructure that is expensive to build when nature can often provide cheaper, more durable solutions. GI is based on the principle that protecting and enhancing nature and natural processes, and the many benefits human society gets from nature, are consciously integrated into spatial planning and territorial development. Compared to single-purpose grey infrastructure, GI has many benefits. It can sometimes offer an alternative, or be complementary, to standard grey solutions.

GI is therefore very much relevant for a whole set of sectors. Here, a study was conducted for nine sectors, namely, finances, building, water, transport, public health, industry, climate, rural abandonment and energy. For these sectors, we have assessed how technical standards in use by each of these sectors could increase the deployment of GI. This included an exploration of the extent to which GI is currently covered in standards of these sectors, as well as an identification of the gaps, i.e. areas where GI is insufficiently covered in the standards. We thereby investigated in depth the need for (further) harmonising, adapting or developing GI-related standards.

For technical standards, we distinguished:

- Standards on the **performance** of physical building blocks, be it a building, a local park or an international river basin. These standards often work with a scoring system. Well-known examples include BREEAM, LEED, DGNB, HQE or the Biotope Area Factor.
- Standards on the (development) process or **procedure**. This type of standard offers a roadmap, a standardised way of working resulting in a set of actions to achieve a pre-defined outcome. Examples are the SEA, EIA and AA procedures in different Member States (MS). Another example is green procurement by administrations.
- Standards on the **methods** one can use to integrate or enhance GI. Technical guidance and codes of conduct in general are part of this category.

The point of departure for the work was the idea that today we are at the start of GI becoming used broadly and that the available information and uptake of GI is very fragmented. Therefore, the output of the work addressed what is happening (overview of initiatives) and what needs to be done (by providing recommendations).

When assessing the extent to which GI is included in the standards of the nine sectors, it is expected that GI is often covered as part of sustainability. For several of the sectors GI may be a rather novel concept, indeed. However, all sectors are familiar with sustainability and with standards on sustainability. These standards on sustainability may be the most logical entry for considering inclusion of GI in the standards in use by a sector. Further, for some sectors 'green' may have a different connotation. For example, the green in green building refers to sustainable building rather than specifically referring to making use of GI or considering natural or green elements. Therefore, when exploring standards for the nine sectors this broader sustainability spectrum was considered.

As for our methodology, a combination was made of literature study, web searches and interviews with representatives of the different sectors. In addition to the evaluation for the nine sectors, it was considered that several initiatives are ongoing. Therefore, representatives of the Joint Research Council and the Institute for Environmental Protection and Research were interviewed on ongoing initiatives. Where relevant, these initiatives were included in the sector fact sheets or in the general outcomes of the report.

Based on the various inputs, sector sheets were developed clarifying the current state for the sector and commenting on the possible way forward for the sector. These sector sheets include concrete recommendations regarding:

- The need for harmonization between standards;
- The potential for including or strengthening the concept and principles of GI in the different standard categories (performance, procedure, methodology);
- The interoperability between technical standards applied in different project phases (planning, design,

and construction).

Following the sector sheets, also cross-sectoral recommendations were identified and discussed.

In what follows we first comment on four identified cross-sectoral recommendations. Secondly, we highlight for each of the nine sectors the major findings.

- **Integrated spatial planning**: Several sectors (such as climate adaptation, water, land abandonment and infrastructure) have indicated that the implementation of GI would benefit from integrated spatial planning early in the planning process. Also, it has been increasingly recognized that it is necessary to work at the landscape level to ensure that sectors can capture the benefits of GI and to maintain biodiversity and ecosystem services. A landscape approach can contribute to bringing together sectoral economic development plans and national action plans on biodiversity conservation, water management and climate change.
- **Green procurement**: Europe and the Member States' public authorities are major consumers. By using their purchasing power to choose environmentally friendly goods, services and works, they can make an important contribution to sustainable consumption and production. Therefore, the way GI is included in Green Public Procurement (GPP) will have a major impact on how GI will be considered in activities and businesses. GPP therefore will be key to ensure GI procurement. What may be needed is to develop and establish a GI Public Procurement (GIPP) to include in public tenders the use of GI as innovative solutions presenting a real alternative to traditional grey infrastructure.
- **Finding the appropriate standard**: There is no obvious, simple and non-time consuming way of understanding which standards are most suitable to meet needs. Therefore, users require assistance in finding the 'needle in the haystack' standard that matches their needs. A way forward therefore would be to investigate ways to facilitate the search and access to appropriate standards. There could be a role here for sectorial organisations to facilitate for their members the search for appropriate standards and to provide guidance on what can be achieved with which standard. This is indeed already practiced to some extent and shown by several of the references included in this report. In addition, it may be considered to also work on this with the standards-making bodies. Here, possibilities could be explored for a collaborative interactive database with a hierarchical tree facilitating finding appropriate standards and gaining insight into what can be done with shortlisted standards.
- **Harmonization across infrastructure sectors**: Each of the infrastructure sectors (e.g. buildings, transport, energy, water) have their own standards on performance, procedure and methodology. In the past, each of these sectors was mainly operating in isolation from the other sectors. However, over recent years, integrated approaches have become more common. Therefore, it may be seen as an opportunity that the sectors we reviewed have large potential for improving on the way GI is included in standards. Indeed, rather than each sector working on improving the way GI is included there is potential for collaborative action and harmonization across sectors on including GI into standards on performance, procedure and methodology.

Major findings for each of the nine sectors:

- **Financial sector**: Whilst direct lending for biodiversity projects by financial institutions accounts for a limited proportion of financial markets, retail and investment banks as well as institutional lenders are increasingly applying sustainable investment criteria to their loans that incorporate impacts and dependencies on biodiversity and ecosystem services. However the focus is mainly on conservation and restoration of biodiversity values affected by project developments, rather than actively promoting the deployment of GI as part of these project developments. Even the substantial benefits of GI in the field of climate change adaptation (such as flood risk reduction) are until now largely undervalued by financial and insurance companies. As a consequence, there is substantial room for improvement, starting with increased efforts in awareness raising of the sector, in particular about the long-term financial benefits of GI. Other opportunities are the uptake of GI in performance standards applied by the sector.
- **Building sector**: There is a plethora of sustainability standards in the buildings sector across Europe with varying levels of requirement. Few are known to be legally required but they can often be mandated at country, region, city or local level. Building sustainability standards focus primarily on materials and energy performance and where biodiversity requirements exist they are often not mandated, carry little weight and do not promote high levels of biodiversity. Where GI is integrated into buildings, it often is limited to green roofs, with little focus on other elements of the building or surrounding area to integrate GI. Building standards have an architectural focus with GI almost as an afterthought. Developments that have taken place in the context of green roofs may provide inspiration for broader inclusion of GI in the building process.
- **Water sector**: In the water sector procedural standards for sustainable water management in Europe are available through the Water Framework Directive. In the private sector there is a growing

awareness for proactive investment in sustainable management water in the catchment in which companies operate. Although GI is not always explicitly mentioned, the application of GI fits well in the ecosystem and catchment based approaches. As a way forward for the implementation of GI it is important to incorporate both 'green', 'grey', and also hybrid solutions in the initial assessments of options in such a way that actors can compare and make the best choice for their situation. At the moment, there are often already established criteria to evaluate the performance of the more conventional grey options, but not so for GI or for comparing across grey and green options. This forms a barrier for the wider implementation of green options.

- **Transport sector**: Transport infrastructure, in particular road and railway systems, form widespread networks with varying density all over the EU. They have tremendous impacts on biodiversity, both at a local and regional scale. Most visible impacts are collisions with animals. Yet more consequential are the indirect effects of transport infrastructure, including habitat loss and reduced habitat quality (e.g. increased noise levels), habitat fragmentation and barrier impacts. As these impacts often occur simultaneously, the cumulative effects on wildlife populations can be very significant. There is a significant quantity of guidance and good practice on how to address fragmentation and barrier effects by means of overpasses or fauna tunnels etc., which in some cases are supported by GI measures. Also at a landscape level GI offering improved habitat connectivity is often applied as part of wildlife and landscape management, and increasingly incorporated into regional spatial planning. However, guidance on how to reconcile transport networks with ecological networks at a regional scale is very scarce. The same goes for guidance on how to optimize the ecosystem services provided by GI to mitigate impacts of transport infrastructure on biodiversity.
- **Public health sector**: In the public health sector there are many standards, guidelines and protocols outside the scope of the GI/health domain. Examples are safety standards (toxic species, allergenic species, risks of falling branches, pesticide use etc.). Accessibility standards that recommend the availability of GI for citizens form an exception. However, there is a growing body of literature linking GI to human health and wellbeing, but the underlying mechanisms are poorly understood and the knowledge tends to remain in the green sector, not penetrating the health sector. Exceptions are some SMEs and bottom-up local initiatives bridging the gap between the green sector and the health sector. There is a large potential for GI standards for the health sector, but before standardization can take place, the evidence base has to grow stronger, and the results must be dissipated within the health sector rather than only in the green sector.
- **Industry sector**: The industry sector is very familiar with sustainability standards. Although biodiversity, as part of sustainability, has been a rather neglected issue for a long time, the recent increase in specific biodiversity guidance for industry shows a growing interest in the field of 'business and biodiversity'. However, when zooming in on the topic of GI within this growing amount of biodiversity standards, it's clear that there is room for improvement. Particular issues which deserve more attention are costs and benefits of GI in an industrial context, as well as guidance on how to implement GI.
- **Climate sector**: Many examples of tools, guidelines and best practices already exist on how to apply GI, or nature-based solutions, in the context of climate change adaptation. Performance standards, which are common practice in for instance the building world, are not a useful way forward in the climate adaptation sector. The reason for this is that the local situation is always too specific. The multi-functionality of GI is a benefit but it makes planning and implementation of GI at the same time very difficult. Integrating a GI framework into Environmental Impact Assessments might be a way forward, as this would guarantee that the potential of GI in landscape planning is considered.
- **Rural abandonment**: GI can offer solutions for both the prevention of farmland abandonment and for minimizing the negative impacts when farmland is already abandoned. There are no specific GI standards in the context of rural abandonment. An indirect way to stimulate GI in rural abandonment areas is for instance through the Common Agricultural Policy (CAP) funding scheme or European structural funds.
- **Energy sector**: Terrestrial energy infrastructure consists of energy production facilities (hydropower, windfarms, gas and coal based power plants, nuclear power plants) as well as the energy transmission infrastructure (oil and gas pipelines, electricity grid). As a consequence, possibilities for developing GI are quite diverse and rather specific for each type of energy infrastructure. The energy sector is under full development and is characterized by increasing investments in renewable energy as well as in electricity transmission infrastructure in the EU. But also existing energy infrastructure is being revitalized. The energy sector might benefit from investments in GI for various reasons, ranging from reducing risks (operational, reputational) to grasping opportunities (cost reduction, reputational), depending on the type of investments. Due to the variety of energy infrastructure generic GI standards for the energy sector are not available, but there are a number of specific standards available.

Introduction

This project aimed to assess how technical standards (see Box 4), particularly in relation to **performance**, **methodologies** and **procedures**, could increase the deployment of Green Infrastructure (GI). This included an exploration of the extent to which GI is currently covered in standards, as well as an identification of the gaps, i.e. areas where GI is insufficiently covered in standards. We thereby investigated in depth the need for (further) harmonising, adapting or developing **GI-related standards**. In line with the deliverables that have been completed under Task 1 of this contract, our work was mainly focused on exploring standards and GI for the different sectors covered under Task 1: namely, finance, buildings, water, transport, public health, industry, climate, rural abandonment and energy. Job creation is not included here, considering that it is not a sector, but a topic across sectors.

Expected outputs of the work were:

a) An insight into the current uptake of GI in standards applied by the various sectors;

b) Overview of possibilities for improving technical standards, including harmonization and interoperability between technical standards applied in different project phases (planning, design, and construction).

Box 4 Terminology

GI in the context of this contract is defined as follows: Green Infrastructure "is a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services. It incorporates green spaces (or blue if aquatic ecosystems are concerned) and other physical features in terrestrial (including coastal) and marine areas. On land, GI is present in rural and urban settings."[80] Linked together, these strategically planned networks of green elements are able to provide multiple benefits in the form of supporting a green economy, improving quality of life, protecting biodiversity and enhancing the ability of ecosystems to deliver services such as disaster risk reduction, water purification, air quality, space for recreation and climate change mitigation and adaption.

Standards on performance, procedure and methodology are distinguished:

- **Performance**: Standards on the performance of physical building blocks[81], be it a building, a local park or an international river basin. These standards often work with a scoring system. Well-known examples include BREEAM, LEED, DGNB, HQE or the Biotope Area Factor.
- **Procedure**: Standards on the (development) process. This type of standard offers a roadmap, a standardised way of working resulting in a set of actions to achieve a pre-defined outcome. Examples are the SEA, EIA and AA procedures in different Member States (MS). Another example is green procurement by administrations.
- **Methodology**: Standards on the methods one can use to integrate or enhance GI. Technical guidance and codes of conduct in general are part of this category.

[80] Communication from the European Commission to the European Parliament, the Council, the Economic and Social Committee and the Committee of the Regions: Green Infrastructure (GI) – Enhancing Europe's Natural Capital, COM (2013) 249 final.

[81] According to the Technical Document supporting the Communication on GI 'physical building blocks' are the network of green spaces in which and through which natural functions and processes are sustained

4.1 Problem analysis and objectives of Task 4

One of the actions of the GI Strategy as outlined in the Communication on GI is 'Improving information, strengthening the knowledge base and promoting innovation'. More specifically "by 2013, the Commission will assess the need and the opportunities in the context of Horizon 2020 to (…) develop and encourage innovative technologies and approaches to facilitating the development of GI. It will also assess the contribution technical standards, particularly in relation to physical building blocks and procedures, could make to 'growing the market' for GI-friendly products." Task 4 aimed to cover this part of the action described above. In particular, under task 4 it was assessed how and under which circumstances technical standards could increase the deployment of GI.

Including GI in technical standards may create a huge leverage effect in the deployment of GI on the ground. In this context, technical standards not only apply to design specifications of physical elements (such as green roofs, eco-ducts, etc.) but also to methodologies such as spatial planning, and to procedures such as (if applicable) SEA, EIA and AA. Incorporating attention to GI from the very early planning phase (SEA, spatial planning) to the project design phase (including EIA, technical standards for buildings, water infrastructure, etc.) and final project approval (permitting phase) will contribute substantially to GI implementation, and as such to new GI markets.

The point of departure for the work in this task was the idea that today we are at the start of GI becoming used broadly and that the available information and uptake of GI is very fragmented. Therefore, the output of the work addressed what is happening (overview of initiatives) and what needs to be done (by providing recommendations).

Under this task, nine sectors (finances, buildings, water, transport, public health, industry, climate, rural abandonment and energy) were explored in more detail, in particular with regard to the extent GI is included in the standards they use and the actions that can be taken to further strengthen the uptake of GI. With respect to the latter this included (1) determining best practices, (2) identifying promising fields to make progress and (3) addressing how to implement improvements. Also, the repercussions and possible bottlenecks of using GI in relation to issues such as legislation and safety issues were assessed.

A distinction was made between three types of standards: standards on performance, procedure and methodology (see Box 4 on how these are defined in the context of this study). When evaluating these standards it is clear that a wide spectrum of GI developments are covered, from small local projects (e.g. a green roof) to large-scale cross-border projects (e.g. ecological corridors). Indeed, the types of physical features that contribute to GI are diverse, specific to each location or place and very scale-dependent. On the local scale, biodiversity-rich parks, gardens, green roofs, ponds, streams, woods, hedgerows, meadows, restored brown field sites and coastal sand-dunes can all contribute to GI and may deliver multiple ecosystem services. Connecting elements are for example green bridges and fish ladders. On the regional or national scale, large protected natural areas, large lakes, river basins, high-nature value forests, low intensity agricultural areas, extensive dune systems and coastal lagoons are just a few of many examples. On the EU scale, transboundary features such as international river basins, forests and mountain ranges are examples of the EU's supranational GI.

4.2 Setting

4.2.1 Advantages and disadvantages of working with standards

A standard is a repeatable, harmonised, agreed and documented way of doing something. Standards contain technical specifications or other precise criteria designed to be used consistently as a rule, guideline, or definition. They help to make life simpler and increase the reliability and the effectiveness of many of the goods and services we use.[82] Standards result from collective work by experts in a field and provide a consensus at the time when the standards are developed. As standards in the international arena are established on a consensus and broad stakeholder basis, they represent what can be agreed upon. A published standard is therefore the harmonised synthesis of what the group is prepared to publish. International standards bring technological, economic and societal benefits[83]. They help to harmonize technical specifications of products and services, making industry more efficient and breaking down barriers for international trade. Compliance to international standards in the field of environment helps to reassure consumers that products are good for the environment. Over the years the International Organization for Standardization (ISO) has made significant efforts to provide proof on the benefits that standards bring to organizations and, more generally, to citizens and society[84]. To illustrate, we indicate some advantages and disadvantages of working with standards (Table 6). The following sections describe in more detail which strengths and weaknesses can be identified in relation to the way GI is covered in standards applied by different sectors.

Table 6: Examples of benefits and disadvantages of working with standards

Benefits of working with standards	Disadvantages of working with standards
They set the recognised level of quality	The implementation of standards may remove the creative element
May lead to reduced market risks	Standards may force people to change their methods
May lead to market growth for new and emerging technologies	Standards reduce productivity by forcing unnecessary actions
May lead to reduced development time and costs and increased productivity and enhanced efficiency	Registration requires an amount of money, time and paperwork
Facilitation of common language and understanding of what the product or service is or is not.	Standards do not prevent bugs

4.2.2 Broader context: sustainability

When assessing the extent to which GI is included in the standards used by the identified nine sectors, it is expected that GI is often covered as part of sustainability. For several of these sectors GI may be a rather novel concept. However, all sectors are familiar with sustainability and with standards on sustainability. These standards on sustainability may be the most logical entry for considering including GI in the standards in use by a sector. Also, for some sectors green may have a different

[82] Amended from BSI website: What is a standard? http://www.bsigroup.com/en-GB/standards/Information-about-standards/what-is-astandard/
[83] http://www.iso.org/iso/home/standards/benefitsofstandards.htm
[84] http://www.iso.org/iso/home/standards/benefitsofstandards/benefits_of_standards.htm

connotation. For example, the green in green building refers to sustainable building rather than specifically referring to making use of GI or considering natural or green elements. Therefore, when exploring standards for the nine sectors this broader sustainability spectrum was considered.

4.3 Methodology

To approach the work in Task 4 a combination was made of literature study, web searches and interviews with representatives of the different sectors. The literature study and web searches were both supporting the preparation of the interviews, the contextual framing of the outcomes and the formulation of recommendations. The preparatory work in advance of the interviews included the collection of information on standards applied by a sector as well as a first evaluation of the extent to which GI is included in these standards. As mentioned before, for this evaluation a distinction is made between standards on performance, procedure and methodology. Following this preparatory work, sector representatives were interviewed. The purpose of these interviews was to find out if well-placed sector representatives could confirm the outcomes of the preparatory work and to gain additional insights, for instance on the potential for including GI more strongly in future updates of the standards. Based on the literature study, web searches and the interviews, sector sheets were developed clarifying the current state of the sector and commenting on the possible way forward for that sector. These sector sheets include concrete recommendations regarding:

- The need for harmonization between standards;
- The potential for including or strengthening the concept and principles of GI in the different standard categories (performance, procedure, methodology);
- The interoperability between technical standards applied in different project phases (planning, design, and construction).

As the aim was not to carry out a statistical study, but rather a qualitative study with useful recommendations on how including GI within standards can improve the deployment of GI, interviews did not necessarily follow identical questions for each sector or organisation. Outputs from interviews that took place in an early stage guided later interviews. Nonetheless, as interviews were done by several people, it was decided to prepare a standard set of questions (see Box 5), and to use this set as a guidance for conducting the interview, rather than as a strict scheme to be thoroughly followed. Further, when arranging for the interview, representatives were informed on what GI is and how we defined the different standards on performance, procedure and methodology. This introduction to essential terminology was done by sharing the content of Box 4 and by verifying whether this content was clear when starting the interview.

Box 5 Type of questions (non-limitative) to be covered during the interviews

1. Does your sector make use of standards and do these standards include GI?
2. Which are the most important standards in your field of work (if possible on performance/procedures/methodologies)? Do they yet include GI and to what extent? If not, would these benefit by GI being included? Why?
3. What is the importance of standards in your line of work (very high, high, moderate, low, and very low) (overall + for performance/procedures/methodologies)? Why?
4. Have you experience with standards having a positive impact on GI (yes/no). Why?
5. What are the key elements of a good standard for GI according to you?
6. Do you have suggestions on examples of good GI standards?
7. Do you have examples on GI standards that are not so effective?
8. Are there in your opinion instances were GI currently is not included or covered in standards and could be a welcome addition?
9. Are you aware/involved in initiatives to harmonize GI standards over the sector? For which

standard(s)?
10. Have you experienced a situation where the harmonization of standards on GI would have been beneficial to GI development?
11. What are the main benefits of harmonisation according to you? What exactly should the standard/harmonisation exercise tackle?
12. What are the threats of harmonization of standards according to you?
13. What are the main steps to be taken in the context of GI standards in your opinion (regional or national level)? (short, mid, long-term)
14. What are the main steps to be taken in the context of GI standards at the EU level? (short, mid, long-term)
15. Do you have final recommendations on GI standards?
16. Optional: share a table on the different standards resulting from the literature review and web search and work on that during or following the interview.

Prior to the interview a working table was made based on the literature and web search on the extent GI is covered in standards in use by each sector. During the interview the working table was verified and the scoring adjusted (see Table 7). When finalised, the table will provide insight in how strongly GI is included today in standards on performance, procedure and methodology applied by the different sectors.

Table 7: Working table for interviews

Sector	Performance	Procedure	Methodology
Finances			
Building			
Water			
Transport			
Public health			
Industry			
Climate			
Rural Abandonment			
Energy			

[Note: For each of the nine sectors it is indicated as a working hypothesis to what extent GI is included in standards on performance, procedure and methodology (green: fairly well covered; orange: rather basic; red: little or lacking).]

For each sector the aim was to interview at least one representative, and when possible to have 2-3 interviews in total. In Table 8 we indicate the different sector representatives that were included in the interviews. For each of the interviews, a small report is included in Annex 14.

Table 8: Overview of sector representatives that were interviewed in the context of GI and standards

Sector	Representatives
Finance	Gavin Templeton (Green Investment Bank)
Buildings	Dusty Gedge (European Federation of Green Roof Associations)
	Maarten Dansen (Dutch Green Building Council)
Water	Maija Bertule (UNEP-DHI Partnership)
Transport	Carme Rosell (Infra Eco Network Europe (IENE))
	Philip Charles – Operations Director and Ian Nicholson – Technical Director (Civil Engineering Environmental Quality Assessment and Award Scheme (CEEQUAL))
Public health	Patrick Ten Brink (Head of the Green Economy Programme of the Institute for European Environmental Policy (IEEP) and project leader of the Health and Social Benefits of Nature and Biodiversity Protection project for DG Environment)
	Jasperina Venema (green entrepreneur and advisor specialized in urban green and health)
	Sjerp de Vries (senior scientist green health, Alterra Wageningen University and

	Research Centre)
Industry	Violaine Berger (World Business Council on Sustainable Development)
Climate	Stefan Kleeschulte (Managing Director of Space 4 Environment)
Rural abandonment	No interview was taken considering that rural abandonment not really qualifies as a sector. The opposite, intensified agriculture indeed is a sector, but falls outside of the scope here.
Energy	Simon Devoghele (LIFE Elia)

In addition to the evaluation for the nine sectors, it was considered that several initiatives were ongoing and related to the current project on GI. Therefore, representatives of the Joint Research Council (JRC) and the Institute for Environmental Protection and Research (ISPRA) were interviewed on ongoing initiatives. Where relevant, these initiatives were included in the sector fact sheets or in the general outcomes in the report. Highlighted initiatives by JRC and ISPRA included:

- Green Procurement and road construction;
- Standards for constructions and structural design;
- Resource efficiency indicators for buildings, with a potential to include GI indicators;
- Safety in relation to including GI.

Furthermore, the European Commission indicated to consider ecosystem services (MAES working group (Mapping and Assessing Ecosystem Services)), climate change adaptation (the European Commission's Directorate General on Climate) and defragmentation measures for road development (IENE, see also contact for transport in Table 8).

By combining the information gathered during the literature, web search and interviews, uniform sectorial fact sheets were produced (see template in Box 6).

Box 6 Template for sector sheets

Page 1 covers the following five elements:

- Major findings/conclusion on the extent GI is included today and the possible steps forward (3-4 lines).
- Table with examples of standards. The aim was not to provide an exhaustive overview of standards, but rather to show a selection of representative examples of standards on performance, procedure and methodology.
- Major outcomes of the interview(s): 3-5 highlights.
- The extent GI is integrated in standards and the potential, with a focus on the potential.
- Recommendations on the way forward for the sector

Next page(s): major outcomes with respect to GI and standards on performance, procedure and methodology. Here, there is room to provide more detail on the standards that are included in the table on the first page. This section should be a summary overview of the standards and where they apply and the way GI is included or can be included. Understanding the scale and status of the standards is also important, as well as the uptake/market share of the standards and whether the standards compliment/contradict/elevate requirements beyond applicable regulations.

In the final section, we conclude with highlighting some major cross-sector recommendations, i.e. recommendations that are considered more general and not specific to a single sector.

4.4 Overview of standards for GI for different sectors

4.4.1 GI standards and the financial sector

Whilst direct lending for biodiversity projects by financial institutions accounts for a limited proportion of financial markets, retail and investment banks as well as institutional lenders are increasingly applying sustainable investment criteria to their loans that incorporate impacts and dependencies on biodiversity and ecosystem services. However, the focus is mainly on conservation and restoration of biodiversity values affected by project developments, rather than actively promoting the deployment of GI as part of these project developments. Even the substantial benefits of GI in the field of climate change adaptation (such as flood risk reduction) are until now largely undervalued by financial and insurance companies. Consequently, there is substantial room for improvement, starting with increased efforts in awareness raising of the sector in particular about the long-term financial benefits of GI. Other opportunities are the uptake of GI in performance standards applied by the sector.

Table 9: Examples of standards applied by the financial sector with indication on the degree of GI coverage (green: GI well covered; orange: GI moderate to basically; red: GI hardly or not covered)

Type	Standard	Key aspects	
Performance	Natural Capital Declaration (NCD)[85]	This is a commitment by a limited number (+/- 40) of finance and insurance companies to work towards integrating natural capital and biodiversity criteria into their products and services. The NCD was born out of the insight that financial institutions could benefit from greater guidance to embed specific aspects of environmental, social and governance (ESG) factors in their management, due diligence, loans, investments and insurance activities. While GI is not mentioned it is highlighted that the services nature provides underpin productivity and the global economy. It is open for new signatories since 2012 but apparently the number of signatories is not increasing.	
	Equator Principles[86]	The Equator Principles is a risk management framework, adopted by financial institutions, for determining, assessing and managing environmental and social risk in projects. It is primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making. The Biodiversity for Banks (B4B) program is designed to help financial institutions overcome the challenges of incorporating risks associated with biodiversity and ecosystem services into their lending decisions. Here links are provided to a variety of initiatives linked to biodiversity conservation and valuing ecosystem services, however, leaving it to the user to be explored and interpreted. Considering its focus on risks, the framework could be improved by also considering the opportunity perspective of ecosystem services and how working with nature can drive business performance.	
	International Finance	This is a standard for 'Biodiversity Conservation' and 'Sustainable Management of Living Natural Resources' adhered	

[85] http://www.naturalcapitaldeclaration.org/the-declaration
[86] http://www.equator-principles.com/

	Corporation Performance Standard 6[87]	to by several major financial institutions. Performance Standard 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. In essence the standard is mainly on risks and impacts and only to a limited extent considers GI and the ecosystem services that go with it provide as a business opportunity.	
	The European Investment Bank Statement on Environmental and Social principles and Standards[88]	The Statement outlines the standards the EIB is imposing on projects that it finances, and the responsibilities of the various parties. It provides a great sense of urgency about the problems of climate change and gives great recognition to the importance of biodiversity. However the emphasis is on conservation or restoration of biodiversity (according to the mitigation hierarchy), rather than promoting GI as an opportunity to enhance biodiversity and deliver ecosystem services. As the EIB is periodically reviewing this standard to align with new developments under the EU environmental policy and legislation, there might be a chance that future versions put more emphasis on GI.	
Procedure	Triodos Bank[89]	The Netherland's Triodos Bank has established a leadership position in Europe as a provider of retail banking services with a focus on sustainable investment. Triodos Bank has lending criteria for companies operating in sectors with a high risk of negative effects on biodiversity. This approach ensures that businesses have a policy to identify and manage these risks. The list of these companies is published on Triodos' website. Company performance is reviewed periodically and companies can be removed from this list where they do not meet sustainability criteria. At the same time, Triodos Bank focuses on financing enterprises that protect and encourage biodiversity.	
	ASN Bank Biodiversity approach[90]	The ASN Bank has elaborated investment criteria for biodiversity in its issue paper Biodiversity, which it applies for all its investment policies. Sectors that have a negative impact on biodiversity are excluded or are required to show more engagement. ASN Bank's investment policy also enables them to improve the conservation of species and ecosystem services, for example by investing in the establishment of new forests or even new nature reserves, which is nothing else than investing in GI. The bank has not yet established a policy which takes into account the positive impact of companies on biodiversity. The ASN Bank wishes to develop such a policy together with other financial institutions interested in making a positive impact on natural capital.	
	Natural Capital Financing Facility[91]	This is a new financial instrument with a focus on risk-pooling of Natural Capital projects in the areas of PES, GI, biodiversity offsetting and pro-biodiversity business. A key criterion for inclusion of projects within the NCFF Pipeline is that the project design needs to demonstrate either a viable revenue stream or cost savings to the beneficiary, which will to support repayment of the finance provided.	
	The Environment Bank Ltd.[92]	This is a UK company which acts as a broker and delivery agent in emerging markets for environmental assets, in particular biodiversity offsetting. It has developed a unique and innovative business model in this respect. EBL is currently operational in the UK but is looking to extend its business operations to other European countries. Research for the Ecosystem Markets Task Force estimated that biodiversity offsetting could deliver 300,000 ha of ecological	

[87] www.ifc.org
[88] http://www.eib.org/attachments/strategies/eib_statement_esps_en.pdf
[89] https://www.triodos.com/
[90] https://www.asnbank.nl/web/file?uuid=760e2f4f-c742-40c9-82dc-f7d4204f9d0b&owner=9ccef6a9-c451-451a-963a-e931fe46c086&contentid=2214
[91] http://ec.europa.eu/environment/biodiversity/business/assets/pdf/ncff.pdf
[92] http://www.environmentbank.com/

		creation/restoration over 20 years in England alone.	
Methodology	WBCSD Business Guide to Natural Infrastructure	The WBCSD is preparing a business guide on natural infrastructure (= GI) including the financial institutions as a target audience. This guide will include the business case, case studies, fact sheets on existing tools, decision tree and check list. GI is thereby seen as a cost-effective investment opportunity and solution to benefit from a range of ecosystem services for issues material to companies.	
	Swiss Re	Swiss RE is one of the globally leading re-insurance companies. They are very aware of the risks related to natural disasters as a consequence of climate change and are developing decision-support tools to pro-actively manage total climate risk. The 'economics of climate adaptation' methodology as implemented in Climada[93] provides decision makers with a fact base to understand the impact of climate on their economies - and identify actions to minimize that impact at the lowest cost to society. Using state-of-the-art probabilistic modelling, it estimates the expected economic damage as a measure of risk today, the incremental increase from economic growth and the further incremental increase due to climate change. It then builds a portfolio of adaptation measures (including ecosystem based ones), assessing the damage aversion potential and cost-benefit ratio for each measure. The adaptation cost curve illustrates that a balanced portfolio of prevention, intervention and insurance measures allows to pro-actively manage total climate risk. This methodological approach is underpinned by the climate change adaptation benefits of GI.	

Interview highlights

An interview took place with Gavin Templeton, Head of Sustainable Finance of Green Investment Bank (GIB). The following issues can be highlighted:

- GIB only invests in sustainable projects (until now £2.1 billion investments in the private sector), such as biomass, energy efficiency, wind energy. They call it 'green' infrastructure projects, but it has a completely different meaning than what is covered under the GI definition as described in the EC Green Infrastructure Communication. In fact, although the projects they are investing in are indeed very sustainable, they have not invested yet in GI.
- GIB's 7 Green Investment Principles (Positive contribution to a recognised green purpose; Reduction of global greenhouse gas emissions; Enduring green impact; Clear and firm investment criteria; Robust green impact evaluation; Effective covenants, monitoring and engagement; Transparent reporting) ensure a commitment to working in an open and transparent way so that investors can be assured in their investment. Therefore, standardisation of standards can only assist and encourage use of GIB.

Extent GI is integrated in standards and the potential

The links between financial services, risk and biodiversity (and also climate change) have, to date, been weak. Resource scarcity, loss of biodiversity and degradation of ecosystem services such as freshwater availability have, however, started to present financially material risks and opportunities for bankers, investors and insurers. This is particularly the case with financial institutions that have a large exposure or client base in industries directly dependent on biodiversity and ecosystem services, such as fisheries, agriculture, forestry and tourism, and industries with major biodiversity footprints, such as the extractive sectors.

[93] Climada - the open-source Economics of Climate Adaptation (ECA) tool: https://github.com/davidnbresch/climada/wiki

At present many financial institutions do not sufficiently understand, account for and therefore value, the risks and opportunities related to natural capital in their financial products and services (loans, investments and insurance products) and in their supply chains. If biodiversity is considered, it is mainly within the philanthropic and sponsoring domain. Some financial institutions, however, have started to systematically look into the ecological footprint and exposure to disruptions within the supply chain, and some banks have developed specific expertise in this area (e.g. Triodos Bank).

The overall conclusion is that, despite a number of very interesting initiatives (e.g. Natural Capital Declaration), the uptake of natural capital as a material issue by the private financial sector is rather poor. Standards related to biodiversity do exist, but they are only applied by a very limited number of financial companies (e.g. NCD) or only applied by the International Financial Institutions (IFIs), such as the World Bank and the EIB. As a result the standards listed in the table above cannot be considered as standards with a widespread uptake by the financial sector, but – on the contrary – as standards applied by a minority of the financial sector. And even within this minority group the promotion of GI as a business opportunity is largely lacking. Exceptions are the Natural Capital Financing Facility and a number of green banks (such as Green Investment Bank) and insurance companies. Insurance and re-insurance companies face huge risks due to the expected increased frequency and severity of extreme weather hazards, enhanced by climate change. Therefore the preservation of healthy ecosystems with natural storm regulatory capacities is also in their interest (e.g. coral reefs and mangroves that mitigate the impact of storm waves on coastal areas, natural flood areas along river systems).

Way forward

As impacts of climate change and ecosystem degradation will increasingly affect business performance, it can be expected that financial institutions will pay more attention to the natural capital impacts and dependencies of companies. Financial institutions will start realizing that companies with a strong biodiversity policy have less financial risk and are also performing better on financial and reputational (e.g. Dow Jones Sustainability index) indices. This is confirmed by the WBCSD, who signals an important role for banks and accountants as change agents in the transition to the incorporation of natural and social capital in the governance of companies. The importance of GI as an effective solution to mitigate the impacts of extreme weather events and natural hazards due to climate change is already acknowledged by some re-insurance companies. But there is still a way to go to enhance the uptake of GI by the financial sector as a tool for decreasing business risks. The Natural Capital Financing Facility of the EIB is a major step forward, as it aims to explore viable business models of ecosystem restoration, acknowledging the important role of GI.

On a longer term – considering the variety of initiatives – it would be beneficial to increase the harmonization of lending or investment criteria against recognized standards to add credibility and accelerate GI uptake. This may be promoted by a wider input from the financial community (alongside the conservation community) in the development and refinement of standards.

Major findings on standards for performance elements

- A number of biodiversity related performance standards have been developed and are applied by the financial sector. However these standards mainly focus on biodiversity conservation and restoration of biodiversity damage rather than on actively promoting the deployment of GI. A second observation is that these standards are not widely applied within the financial sector. Apart from the international financial institutions and some niche banks profiling themselves as

green banks, the vast majority of the private financial sector does not take biodiversity into account in its lending and investment operations.

- Non-financial reporting is now mainstream among large companies with the majority regularly providing reports on their environmental impacts and performance. This improved reporting informs rating agencies on these companies' risks, helping investors to better steer their investment portfolio. However, reporting on biodiversity and ecosystem services, and even more so on GI, is relatively underdeveloped in this regard.
- Various elements of the financial sector have different roles to play in championing biodiversity. The development of common standards rewards 'first movers' in the financial sector providing support or advisory services to pro-biodiversity business. At a higher level, forward-thinking organizations are increasingly grouping together within associations to promote greater transparency within and between financial institutions relating to biodiversity, whilst a number of major stock market indices are launching specialist biodiversity metrics so as to better inform investors on the exposure of their investments to biodiversity related risk.

Major findings on standards for procedures

- Several green banks have established procedures for screening companies and projects in the framework of their lending and investment operations. For this purpose they have set up a number of biodiversity related criteria. Analogous to performance standards the focus is rarely on opportunities to invest in GI. There are a few exceptions such as the Natural Capital Financing Facility and the Environment Bank.
- The Natural Capital Financing Facility, financed by the EIB and the EU LIFE fund, has been created exactly to cover the current gap in possibilities provided by financial institutions in the field of investing in ecosystem restoration, amongst which investing in GI. Hopefully the pilot projects which will be supported with advantageous loans in the coming years, will demonstrate the financial benefits of investing in GI, and as such open up the market for it in the coming decades. Because the benefits of GI are usually shared between the public and private sectors, and provide long-term, relatively low-risk returns on investment, there is a strong case for public-private partnership models of delivery, whereby risk and returns are spread over time.
- A specific type of banking is habitat banking, and this is the field of play of organizations such as The Environment Bank. If the concept of habitat banking exceeds the purely obligatory biodiversity offsets and achieves to create additional nature, it would definitely enhance the further deployment of GI.

Major findings on standards for methodology

- Financial institutions are active mainly on standards that relate to performance and to some extent also on procedure. They are usually not involved in developing handbooks or manuals on how to include GI into business or governmental activities. An exception is the recently developed Climada tool by Swiss Re. Another example is the WBCSD guidance on Investing in Natural Infrastructure, which is also intended for use by financial institutions. It contains a well elaborated business case, as well as case studies and tools which can support decision-making by businesses.

4.4.2 GI standards and the building sector

There is a plethora of sustainability standards in the buildings sector across Europe with varying levels of requirement. Some are known to be legally required but they can often be mandated at country, region, city or local level. Building sustainability standards focus primarily on materials and energy performance and where biodiversity requirements exist they are often not mandated, carry little weight and do not promote high levels of biodiversity. Where GI is integrated into buildings it is often limited to green roofs, with little focus on other elements of the building or surrounding area to integrate GI. Building standards have an architectural focus with GI almost as an afterthought. Developments that have taken place in the context of green roofs may provide inspiration for broader inclusion of GI in the building process.

Table 10: Examples of standards for the building sector with indication on whether green infrastructure (GI) is thoroughly included (green: GI well covered; orange: GI moderate to basically; red: GI hardly or not covered)

Type	Standard	Key aspects	
Performance	Building Research Establishment Environmental Assessment Methodology (BREEAM)[94]	BREEAM assessments use recognised measures of performance, which are set against established benchmarks, to evaluate a building's specification, design, construction and use. The measures used represent a broad range of categories and criteria from energy to ecology. GI is covered under the section of 'Land Use and Ecology', which addresses value, protection, enhancement and management.	
	DGNB system[95]	The DGNB system is an integrated evaluation of economic and environmental aspects and user comfort. GI is covered under the sections of 'Local Environmental Impact' and 'Biodiversity and Interaction'.	
	PassiveHaus[96]	Passivhaus is an energy performance standard focusing on thermal performance, airtightness and ventilation. It does not address wider sustainability issues such as biodiversity or GI.	
	HQE[97]	HQE is an environmental assessment methodology that pursues sustainable performance objectives while considering impacts on health, personal comfort and the indoor environment. Biodiversity is covered in the section Ecosystems and Biodiversity	
	ISO 21931	ISO 21931 is an international standard aimed at improving environmental performance. Environmental impacts are addressed at local, global and interregional level	
	Standard Assessment Procedure[98]	The Standard Assessment Procedure (SAP) is the UK Government's recommended method system for measuring the energy rating of residential dwellings. It does not factor broader sustainability requirements such as biodiversity or GI.	
	Biotope Area Factor[99]	Biotope Area Factor (BAF) is a calculation undertaken by Berlin city to secure green qualities. BAF targets are applied to various developments and structures to safeguard and improve microclimate and atmospheric hygiene; safeguard and develop	

[94] http://www.breeam.org/
[95] http://www.dgnb.de/en/
[96] http://www.passivhaus-institut.de/
[97] http://assohqe.org/hqe/
[98] http://www.bre.co.uk/sap2012/page.jsp?id=2759
[99] http://www.stadtentwicklung.berlin.de/umwelt/landschaftsplanung/bff/index_en.shtml

		soil function and water balance; create and enhance quality of plant and animal habitat; and improve the residential environment.	
Procedure	The Town and Country Planning Association (TCPA)[100]	The Essential Role of Green Infrastructure: Eco-towns Green Infrastructure Worksheet - The Worksheet is designed to provide clear guidance on how to design, incorporate and operate green infrastructure. It is intended to support the emergence of green infrastructure networks that, in terms of their quality, extent and capacity, deliver the widest range of environmental, social and economic benefits.	
	The London Plan	Policy 5.10 Urban Greening – Requires development proposals to include green infrastructure. Elements can include tree planting, green roofs and walls, and soft landscaping. Policy 5.11 Green Roofs and Development Site Environs – Requires major developments to include roof, wall and site planting, especially green roofs and walls where feasible to deliver; adaptation to climate change, sustainable urban drainage, mitigation of climate change, enhancement of biodiversity, accessible roof space, improvements to appearance and resilience of the building, and growing food.	
Methodology	International Green Roofs Policies[101]	Details of a number of green roof policies from around the world are detailed here, which include a number of German, US & Chinese cities; as well as Basel, London, Toronto, Singapore and Australia. These cities are actively promoting GI and it is included at the policy level.	
	European Federation of Green Roof Associations (EFB)[102]	The EFB brings European green roof associations together which promote and encourage the uptake of green roofs. The majority of green roof associations have standards based on the German FLL standard, which addresses waterproofing, soils, vegetation, treatment, installation, procedures and maintenance.	
	Designing for Biodiversity: A Technical Guide for New and Existing Buildings[103]	This book advises on how to incorporate provision for biodiversity within building developments. Focus is largely on building features, but also limited information is provided on how to increase biodiversity and include green infrastructure in the building surroundings.	
	Putting the Green in the grey[104]	UK guide on creating sustainable grey infrastructure by considering GI. A guide for developers, planners and project managers. It is intended to provide a framework that can be used to identify the additional environmental benefits that projects primarily focussed on delivering economic outputs can deliver at the same time.	
	Demystifying GI UK GBC[105]	This report consolidates existing information on Green Infrastructure (GI) for those working in the built environment, providing a simple, accessible guide. It helps to define the topic and its scope, and crucially attempts to highlight the business case for creating and maintaining GI – aimed primarily at the developer and client.	

Interview highlights

The interviews - with Dusty Gedge, European Federation of Green Roof Associations (EFB) and Maarten Dansen (Dutch Green Building Council) - revealed the following interesting findings:

[100] http://www.tcpa.org.uk/pages/green-infrastructure.html
[101] http://livingroofsworld.com/page22.php
[102] http://www.efb-greenroof.eu/
[103] http://products.ihs.com/cis/Doc.aspx?AuthCode=&DocNum=304592
[104] http://www.greeninfrastructurenw.co.uk/resources/6b4_Guide.pdf
[105] http://www.ukgbc.org/sites/default/files/Demystifying%20Green%20Infrastructure%20report%20FINAL.pdf

- Standards are important in the construction industry to ensure reliability and consistency – however, they are often also used in a policy context. Performance criteria and not construction criteria/techniques should dictate policy.
- Policy change is required. Cities drive the market and they have the ability to drive quality – codes and standards generally are the lowest common denominator – good policy leads to good green roofs. Current codes and standards are about how they are constructed – not what they deliver.
- Dusty recommends the Commission works on policy guidelines that are separate but refer to industry codes. They are two different beasts. Unfortunately a lot of policies are written with too much reference to industry codes because of architects. Policy codes should be written and considered by sustainability officers and planning officers, not by suppliers and installers.
- How GI is included in standards shows much heterogeneity: sometimes focus is more on the process, the framework and the expertise of an ecologist, while in other instances focus is on the species and the ticking of a checklist.
- Project developers are positive on having green being considered early in the process for two reasons. One is that by having an early analysis, risk is minimized that species protected by law are only discovered at a later stage during the building process and then cause the (temporary) halting of the project. The other is that they also showcase with the green that is included in the projects they conduct. In fact, enthusiasm is such that GI could be included even more strongly.
- A challenge is how to decide whether an ecologist is credible. Criteria now include that either the person can be considered an ecologist due to education (e.g. biology degree), profession (being an ecologist in a consultancy) or because of active involvement in nature protection and being an active member of a nature organization. It is another challenge to have ecologists that are sufficiently familiar with building specifications and that can provide relevant input when at the table with the building designer's team.

Extent GI is integrated in standards and the potential

The level of GI integration in building standards is extremely varied. There can be none at all, such as the Standard Assessment Process (SAP); some inclusion such as the Building Research Establishment Environmental Assessment Methodology (BREEAM) that addresses land use and ecology as part of the assessment; or completely dedicated to GI, such as the European Federation of Green Roof Associations that ensures a robust methodology in engineering green roofs and maximizing biodiversity value.

Where the standards include elements of GI, the requirements are minimal, focusing on the protection of features and simple enhancement. There is little requirement to create GI of value and this is never mandatory.

Standards dedicated to GI, such as the FLL for green roofs, ensure that the GI created has a high standard, creating value in both biodiversity and the wider sustainability benefits such as reducing pollution, buffering storm water, increasing well-being and productivity for employees, students, etc.

Way forward

- The European Federation of Green Roof Associations (EFB) is an excellent example of an association bringing together similarly minded organizations to promote and encourage best practice. Members have recognized the German FLL

as a leader in the field and have used it as foundation to create their own country specific standards that suppliers can become registered to, helping spread use of a common standard.

- Harmonization of standards is seen as necessary but should be done so via associations and common policy, rather than by legislation. Best practice should be identified and shared amongst the Member States via associations and experts in their field.
- Discussing how to move forward should be led by leaders in their field in collaboration with buildings experts to ensure integration and to maximize the benefits of GI at both the building and larger development level.

Major findings on standards for performance elements

- Building performance standards are generally voluntary but can be enforced through local policy, planning or funding requirements. This is often seen as bureaucratic box ticking with additional expense and no added value. Greatest value is achieved where companies want to be leaders in sustainability and recognize the true value of GI.
- The standards have an architectural bias with little consideration for GI. For example, BREEAM weighs Ecology at 10% but only mandates 1%.
- Some methods are well established, such as BREEAM and LEED. These schemes can be used on different types of buildings (new vs. existing; residential vs. non-residential; etc.) and cover different stages (design, post construction, and operation). The main target group of such a certification scheme are real estate companies, investors or property owners. Their motivation is to have a label demonstrating both the greenness of their buildings and to have a credible assessment that their building has a low energy demand; as well as adding a 'green' premium to sale and rental prices.
- The market for voluntary building certification schemes is young. However, it is important to note that there are differences between European regions. The western EU countries, many of which have their own national voluntary leading schemes, e.g. BREEAM in the UK, DGNB in Germany or HQE in France, all report a steady rise in certification. Furthermore, it appears that in Western Europe certification of new buildings is considered more or less mandatory for certain types of development. In contrast, other parts of Europe have only recently started using the rating schemes.
- Many of the building assessment schemes are very similar and can be applied to any country across Europe creating confusion across the building sector.
- Main drivers for using a green building rating schemes are the desire to improve performance, marketing and competitive advantage. The only significant reason to not use such rating system is the cost and length of time that it takes for certification[106].
- Another German example, this time at the local scale, can be found in Berlin. The city uses the concept of 'biotope area factor' (BAF). The BAF gives an indication of the quantity of Green infrastructure available at a certain site. In Berlin the BAF is established in landscape plans as an ordinance. This concept has created an increase in green roofs, permeable surfaces and living walls in the city. These

106 http://www.worldgbc.org/files/8613/6295/6420/World_Green_Building_Trends_SmartMarket_Report_2013.pdf

types of procedures, with high potential to be replicated, are very valuable in the European context.

Major findings on standards for procedures

- Embedding GI in regulations is incentivizing the GI market significantly. Since 1998, the German construction law with § 9 (1) no.25a (The German Federal Building Code) provided a clear opportunity to set requirements for green roofs, which are used widely in Germany.
- Very specific types of procedures apply to taxation and subsidies. There are many different 'green taxes' across Europe. One relevant example for GI is the taxation of sealed surfaces and water run-off[107]. There is a taxation in place in Sweden, France, England and Germany. In the Czech Republic there is a similar system for industry only.
- One third of German cities has a so-called 'rainwater tax' (Berlin, Stuttgart, etc.). This tax is based on surface sealing. Taxpayers can receive a reduction if they provide water retention and/or filtration. This system is in part responsible for the amount of green roofs in the cities which has increased from 10 million m² in 1995 to 84 million in 1999.
- In Stockholm (Sweden) the tax can be reduced by 50% if there is reduced or attenuated run-off of rainwater to the urban drainage system. If the building is autonomic and has no need for the public drainage system, one can receive a 100% reduction.
- Many subsidies operate at the local scale, such as the green-roof subsidy in the city of Ghent[108], paying 31 euro/ m² per green roof.
- Under UK legislation the Greater London Authority has set out an overall strategic plan for London setting out an integrated economic, environmental and social framework for the development of London over the next 20-25 years. It brings together a number of areas including a range of environmental issues such as climate change (adaptation and mitigation), air quality, noise and waste. It recognizes the key benefits of Green Infrastructure (climate change adaptation & mitigation, improving water quality, flood mitigation, sustainable urban drainage, appreciation of landscapes and cultural heritage, enhancement of biodiversity), thereby encouraging buildings to include green roofs & walls as well as the use of soft landscaping.[109] Approximately 47% of London is green and is continuing to be 'greened' by the addition of green roofs, walls and other green infrastructure.

Major findings on standards for methodology

- Best practices and leaders in their field are recognized and their approach adopted or used as a framework to develop local methodologies.
- Excellent examples of this are the German FLL standard for Green Roofs which has gone on to be adopted or influence the development of standards in the Netherlands, Poland, Czech Republic, Hungary, Italy, UK, Sweden, Austria and Switzerland.

[107] http://livingroofsworld.com/page22.php; ARCADIS (2012), Comparison of cost price of water/ waste water/ rain water for users in different EU Member States (Flemish Environmental Agency); Science for environment policy (2012), Soil Sealing, in depth report, European commission
[108] http://www.gent.be/eCache/THE/1/32/953.cmVjPTQzNzc0.html
[109] http://www.london.gov.uk/priorities/planning/london-plan/further-alterations-to-the-london-plan

- This has also been greatly assisted by the support of the European Federation of Green Roof Associations (EFB) and that of experts in their field to lobby and encourage policy change at the city level.
- Methodologies such as the FLL, covered by the EFB, and the TCAP worksheet are holistic, thorough and are developed by collaborative efforts by leaders in their field
- The sheer volume and complexity of guidance that exists promoting GI can be bewildering. This is often challenging for the non-specialists within the construction industry, particularly clients and developers, to understand which information and guidance they should be following.
- Many of the methodologies and guides detail the benefits and risks of green infrastructure and how they can be integrated into the design of buildings and the surrounding infrastructure. For example, the 'Demystifying GI UK GBC' report details how GI is not only green roof and walls, but also includes sustainable drainage, city parks, reed beds, swales, urban wetland and urban woodland; and how these can be used to assist planning applications, reduce installation costs, flood attenuation, reduced management costs, community and employee engagement, health & wellbeing, improved air quality, increased land & property value and crime reduction to mention a few.

4.4.3 GI standards and the water sector

In the water sector, procedural standards for sustainable water management in Europe are available through the Water Framework Directive. In the private sector there is a growing awareness for proactive investment in sustainable management of water in the catchment where companies operate. Although GI is not always explicitly mentioned, the application of GI fits well in the ecosystem and catchment based approaches. As a way forward for the implementation of GI it is important to incorporate both 'green', 'grey', and also hybrid solutions in the initial assessments of options in such a way that actors can compare and make the best choice for their situation. Currently, there are often already established criteria to evaluate the performance of the more conventional grey options but not so for GI or for comparing across grey and green options. This forms a barrier for wider implementation of green options.

Table 11: Examples of standards for the water sector with indication on the extent to which GI (GI) is included (green: GI well covered; orange: GI moderate to basically; red: GI hardly or not covered)

Type	Standard	Key aspects	
Performance	The Alliance for water stewardship (AWS) has developed the International Water	This is a globally-consistent framework that outlines the expectations of responsible water stewardship. The standard is one of the first examples of a landscape-based approach to certification, focusing on the health of the entire watershed and balancing the needs of different water users and managers to ensure freshwater use that is socially and economically beneficial as well as environmentally sustainable. Although GI	

	Stewardship Standard[110]	is not explicitly mentioned, it would fit well within the objectives of sustainable water stewardship.	
	European Water Stewardship Standard[111]	Growing awareness of water as a reputational risk to the private sector is spurring proactive investment by a number of companies. The European Water Stewardship Standard, a production site voluntary standard that encourages water users to engage with the wider challenges and opportunities of the catchment in which they operate, has been implemented at sites across the EU by large multinationals such as BASF and Coca-Cola. The Standard is independently verified and a performance-based certification scheme can be used in marketing and communication activities in the manner of the Forest Stewardship Council label.	
Procedure	Water Framework Directive[112]	The EU Water Framework Directive, adopted in October 2000, is an important piece of EU environmental legislation which aims at improving the water environment. This Directive establishes a framework for the protection of all waters including rivers, lakes, estuaries, coastal waters and groundwater, and their dependent wildlife/habitats under one piece of environmental legislation.	
	GI & Water Framework Directive in the Association of Greater Manchester [113]	The Association of Greater Manchester Authorities (AGMA) supports the use of GI interventions as part of its wider strategy for sustainable growth. Recommendations where GI interventions could potentially be targeted, to address WFD and flood risk as a priority but also contribute to reducing other risk factors contributing to climate resilience.	
	WANI water and Nature initiative[114]	WANI, has worked over the past decade towards managing and protecting water reserves and heritage for the future benefit of all. Stretching across 5 continents in 12 river basins, WANI works with governments and local communities to use and manage water resources more sustainably. WANI aims to help reduce poverty and protect the environment by helping people to access and manage river flows. Although GI is not explicitly mentioned, GI fits well within the ecosystem based approach.	
Method ology	European Natural Water Retention Measures Platform (NWRM)[115]	This platform contains rich information with regards to the design and implementation of measures, a wide catalogue of possible measures (ID cards) including financing and costs aspects and case studies. This information is available directly on the website and more extensively in the online guidance, ID catalogue and synthesis documents. The measure presented are all on GI in the context of water.	
	Water for business[116]	This online guide by the WBC-SD is specifically designed for businesses to help them manage water more sustainably by providing them with an overview of water tools and initiatives which they can use or engage with. Biodiversity is mentioned but detail is very limited. There is no mention of GI and how it may provide solutions.	
	GI guide for water management[117]	UNEP, UNEP-DHI Partnership, IUCN, WRI guidance on GI solutions, tools for quantification and valuation of benefits, barriers and the possible ways ahead.	

[110] http://www.allianceforwaterstewardship.org/
[111] http://www.ewp.eu/activities/ews/
[112] http://ec.europa.eu/environment/water/water-framework/info/intro_en.htm
[113]http://www.salford.gov.uk/corestrategy/iw/QA-QA10-Joint-Green-Infrastructure-Project-GI-and-the-Water-Framework-Directive.pdf
[114] http:// www.waterandnature.org
[115] http://www.nwrm.eu
[116] http://www.wbcsd.org/waterforbusiness3.aspx
[117] http://www.unepdhi.org/-/media/microsite_unepdhi/publications/documents/unep/web-unep-dhigroup-green-infrastructure-guide-en-20140814.pdf

Interview highlights

The interview with Maija Bertule (program advisor at UNEP-DHI Partnership) revealed the following interesting findings:

- The application of GI in the water sector is still in the phase of building the evidence base on the efficiency, costs and co-benefits over time. This knowledge base is crucial in establishing any kind of standards.
- It would be quite complicated to develop common standards for GI in the water sector, as the green options are highly variable from small urban elements to large watershed measures. There will always be site-specific elements that cannot be accounted for in general guidance, such as interaction of the local climate and geography with vegetation types, etc.
- Nevertheless, common standards or guidance covering some of the key aspects of GI, e.g. cost and benefit analysis and performance measurements (including performance of delivery of co-benefits), could be useful. These could be in the form of recommendations, as opposed to binding standards, as there is a lot of variation in what can be acceptable and desired depending on the local circumstances. Case study examples of best practices are also an effective way of sharing experience and establishing 'best practice'.

Extent GI is integrated in standards and the potential

Although the application of GI fits well in the ecosystem and catchment based approaches, GI is not always explicitly mentioned in standards. A large potential for the further uptake of GI lies in the private sector, where awareness is growing for proactive investment in sustainable water management in the catchment in which companies operate.

Way forward

A growing number of initiatives are linking GI investments to water management needs through an integrated catchment management approach. A number of large EU water utility companies have pioneered the approach of linking agri-environmental schemes to water source protection measures.

Major findings on standards for performance elements

Several initiatives exist for performance standards, such as the Alliance for Water Stewardship, that have developed the International Water Stewardship Standard. Although GI is not explicitly mentioned, it would fit well within the objectives for sustainable water stewardship.

Major findings on standards for procedures

- In the water sector, procedural standards for sustainable water management are available through the Water Framework Directive and the Floods Directive.
- The implementation of GI would gain from a stronger focus on integrated spatial planning, taking the wide range of ecosystem services related to water and flood management into account.
- A main condition for wider implementation and success of ecological practices is the systematic integration of biodiversity in investment pathways supported by policy and funding.
- The more widespread use of a cost-benefit analysis that considers the valuation of ecosystem services could serve as a lever to demonstrate that green, nature-based solutions are in fact often more cost-effective than traditional infrastructure. However, this may not be sufficient to include biodiversity concerns

into water management, as the monetary values that relate to ecosystem services are generally low, except in densely-populated urban areas.

Major findings on standards for methodology

- Several methodology standards for GI in sustainable water management already exist, such as the guidelines and methods of the European Natural Water Retention Measures Platform (NWRM) or the GI guide for water management developed by UNEP, UNEP-DHI Partnership, IUCN and WRI on GI solutions, tools for quantification and valuation of benefits.
- In the private sector there is still a need for awareness raising, for instance among water and waste water treatment companies about GI-based alternatives or hybrid solutions (combination of green and grey) to traditional grey infrastructure investments. An increased use of NWRM would be advantageous in this context.
- It is important to find ways to incorporate 'green', 'grey' and 'hybrid' solutions in the initial assessments of the options in such a way that actors can compare and make the best choice for their situation. At the moment, there are often already established criteria to evaluate the performance of the more conventional grey options but not for GI. This forms a barrier for the wider implementation of green options.

4.4.4 GI standards and the transport sector

Transport infrastructure, in particular road and railway systems, form widespread networks with varying density all over the EU. They have tremendous impacts on biodiversity, both at a local and regional scale. The most visible impacts are collisions with animals. Yet more consequential are the indirect effects of transport infrastructure, including habitat loss and reduced habitat quality (e.g. increased noise levels), habitat fragmentation and barrier impacts. As these impacts often occur simultaneously, the cumulative effects on wildlife populations can be very significant. There is a significant quantity of guidance and good practice on how to address fragmentation and barrier effects by means of overpasses or fauna tunnels etc., which in some cases are supported by GI measures. Also at a landscape level GI offering improved habitat connectivity is often applied as part of wildlife and landscape management, and increasingly incorporated into regional spatial planning. However, guidance on how to reconcile transport networks with ecological networks at a regional scale is very scarce. The same goes for guidance on how to optimize the ecosystem services provided by GI to mitigate impacts of transport infrastructure on biodiversity.

Table 12: Examples of standards for the transport sector with indication on whether GI (GI) is thoroughly included (green: GI well covered; orange: GI moderate to basically; red: GI hardly or not covered)

Type	Standard	Key aspects	
Performance	Civil Engineering Environmental Quality Assessment (CEEQUAL)[118]	CEEQUAL is an environmental assessment methodology for clients, designers and contractors to deliver improved project specification, design and construction of civil engineering projects. It is an integral part of UK construction industry contribution to support UK government strategy towards sustainable development. Section 6 of the method covers impacts on sites of high ecological value, protected species, surveys conservation & enhancement, habitat creation measures, monitoring and maintenance. Focus therefore is on impact mitigation, but not on making use of the multi-functionality of GI. CEEQUAL is a commercial tool requiring payment.	
	INVEST[119]	INVEST was developed by the Federal Highway Administration, United States. It is an assessment system that provide a list of sustainable factors best practices to be incorporated into transportation project and is designed to address sustainability throughout the project stages. The INVEST sustainability factors consist of noise quality, ecology and biodiversity, visual impact, waste management, energy and carbon emissions, erosion and sediment control, flora and fauna, health and safety, life cycle cost, cultural heritage, public access and intermodality of transport. Ecological connectivity (PD-09) is covered from a wildlife perspective, but not considering the ecosystem services GI may provide.	
	The European Investment Bank Statement on Environmental and Social principles and Standards[120]	The Statement outlines the standards the EIB is imposing on projects that it finances, and the responsibilities of the various parties. It provides a great sense of urgency about the problems of climate change and gives great recognition to the importance of biodiversity. However the emphasis is on conservation or restoration of biodiversity (according to the mitigation hierarchy), rather than promoting GI as an opportunity to enhance biodiversity and deliver ecosystem services. As the EIB is periodically reviewing this standard to align with new developments under the EU environmental policy and legislation, there might be a chance that future versions put more emphasis on GI.	
Procedure	Habitats Directive	Highly relevant from a procedural point of view are the following articles: ▪ Art 10: The Habitats Directive includes specific measures to maintain or restore the coherence of the Natura 2000 network. In particular, Article 3(3) of the Habitats Directive states that 'where they consider it necessary, Member States shall endeavour to improve the ecological coherence of Natura 2000 by maintaining, and where appropriate developing, features of the landscape which are of major importance for wild fauna and flora, as referred to in Article 10.' Article 10 states that 'Member States shall endeavour, where they consider it necessary, in their land-use planning and development policies and, in particular, with a view to improving the ecological coherence of the Natura 2000 network, to encourage the management of features of the landscape which are of major importance for wild fauna and flora. Such features are those which, by virtue of their linear and continuous structure (such as rivers with their banks or the traditional systems for marking field	

[118] http://www.ceequal.com/
[119] https://www.sustainablehighways.org/
[120] http://www.eib.org/attachments/strategies/eib_statement_esps_en.pdf

		boundaries) or their function as stepping stones (such as ponds or small woods), are essential for the migration, dispersal and genetic exchange of wild species.' ▪ The less known article 12.4: "Member States shall establish a system to monitor the incidental capture and killing of the animal species listed in Annex IV). (..) shall take further research or conservation measures as required to ensure that incidental capture and killing does not have a significant negative impact on the species concerned". As a consequence transport infrastructure planning, design and maintenance should include appropriate measures to avoid or mitigate incidental killing of animals. Appropriate design of Green Infrastructure offers at least part of the solution. This should be reflected in the planning and permitting processes and conditions for new infrastructure (e.g. TEN-T project applications for funding must demonstrate that the project respects all EU legislation such as the Nature and Water directives and the impact assessment directives (SEA and EIA)), but in practice a lot more can be done.	
	SEA/EIA	The process ensures a detailed assessment of adverse and beneficial environmental effects for a range of alternative solutions, either at the planning stage (SEA) or the project stage (EIA). While the focus is on the assessment of impacts, an important part of these assessments is dedicated to mitigation measures. Although this offers an excellent opportunity to promote GI, the multi-functionality of it or its societal benefits are often poorly described.	
	Multi-Annual Defragmentation Programme, the Netherlands[121]	In 2004, the Multi-Annual Defragmentation Programme was adopted with the aim to remove during the period 2015-2018 the most important barriers for the National Ecological Network formed by the country's dense road and rail infrastructure as well as major waterways. Relevant defragmentation projects include wildlife passages and crossings, specifically looking at fauna tunnels, green bridges, fish ladders, oversized viaducts and wildlife-friendly verges and river banks. This initiative focuses on ecosystem resilience and improved functional habitat connectivity for targeted species. A guidance has been published (see below under 'Methodology').	
Methodology	Wildlife and Traffic: A European Handbook for Identifying Conflicts and Designing Solutions[122]	The COST action 341-project has elaborated a handbook (Wildlife and Traffic: A European Handbook for Identifying Conflicts and Designing Solutions, 2003) with detailed ecological solutions to minimise or mitigate wildlife and traffic conflicts, but not on the benefits that can be derived from making us of GI. In annex 5 of the handbook an overview is given of handbooks and guidelines per country.	
	SAFEROAD – 'Safe Roads for Wildlife and People' (CEDR Transnational Road Research Program 2014-2016)[123]	This ongoing project aims to publish a guidance by end of 2016, i.e. the 'European WILDLIFE Road Maintenance Guidelines'. Preliminary findings are the fact that currently Road Maintenance Guidelines (RMG) in most EU countries include only short information about wildlife topics (in sections about fencing, road wildlife awareness signs, road verge management, bridges, drainage, and – exceptionally - wildlife passages). The aim is to bring evidence-based knowledge from road and wildlife experts together to identify new strategies, practices and technologies to reduce conflicts and costs. As the focus is road safety and biodiversity conservation, GI and its full range of societal benefits will be covered only to a minor extent.	

[121] http://www.mjpo.nl/
[122] http://www.iene.info/wp-content/uploads/COST341_Handbook.pdf
[123] http://www.saferoad-cedr.org/en/saferoad.htm

	Leidraad Natuurtechniek – Ecologisch wegbermbeheer (2011, Flemish Ministry)[124]	This guidance provides recommendations on how to enhance biodiversity values of road verges and waterway verges. The concept of GI is not explicitly mentioned, neither the multi-functional role of these verges in terms of ecosystem services. However, LNE has prepared two follow-up studies on valuation of ecosystem services provided by road and waterway verges (prepared by Arcadis).[125]	
	Leidraad Faunavoorziening en bij infrastructuur (2013, Multi-Annual Defragmentation Programme, The Netherlands)[126]	This guidance provides recommendations on how to enhance biodiversity values of road, railway and waterway verges. The concept of GI is not explicitly mentioned, neither the multifunctional role of these verges in terms of ecosystem services.	
	Vilda djur och infrastruktur – en handbok för åtgärder (2005, Swedish Road Administration)[127]	This guidance provides recommendations on how to enhance biodiversity values of road verges. The concept of GI is not explicitly mentioned, neither the multi-functional role of these verges in terms of ecosystem services.	
	Restoring ecological networks across transport corridors in Bulgaria[128]	The main objective of this project (2006-2007) was to develop a long-term programme for defragmentation measures at transport corridors in Bulgaria in order to restore ecological networks and preserve biodiversity. It is not covered what the multi-functional benefits can be from an ecosystem services and GI perspective.	
	The ecology of transportation: managing mobility for the environment[129]	This volume brings together international experts from a variety of disciplines to review the ecological effects and their causes in terms of road, rail, ship and aircraft transport. Focus ranges from identification of threats and amelioration of damaging effects through to future design of transport systems to minimize environmental degradation. As with many of the other examples in Table 5-7 coverage is limited to evaluating impact and considering mitigation, however, not taking opportunity to also highlight the potential of including and making use of GI and the ecosystem services it provides.	
	Green Stormwater Infrastructure Strategies for Airports[130]	This recent work (2015) presents a synthesis of information that can be valuable in assisting airport decision-makers and professionals responsible for managing the stormwater programs and for the planning and project development of conventional grey infrastructure and new green infrastructure related to stormwater management. Airports urgently need resilient and affordable solutions to address stormwater quantity and quality issues and to promote the triple bottom line of sustainability. Recent years have seen increasing use of green stormwater infrastructure (GSI) strategies at airports. GSI solutions (e.g., bioretention systems, rain gardens, vegetated filter strips, permeable asphalt or concrete pavement, drainage wells, and amended topsoil) are designed to supplement or replace conventional grey infrastructure (e.g., impermeable pavements and curbs, inlets and pipes) that inhibit water filtration or infiltration and related natural treatment and flow attenuation processes. This work aims to	

[124] http://www.lne.be/themas/milieu-en-infrastructuur/Leidraad%20natuurtechniek%20-%20ecologisch%20bermbeheer.pdf

[125] http://www.lne.be/themas/beleid/milieueconomie/kosten-batenanalyses/literatuur-over-mkba

[126] http://www.mjpo.nl/nieuws-publicaties/publicaties/leidraad/

[127] http://www.lansstyrelsen.se/stockholm/SiteCollectionDocuments/Sv/miljo-och-klimat/tillstandet-i-miljon/Sjoar-och-vattendrag/Vilda-djur-och-infrastruktur.pdf

[128] http://www.ecnc.org/uploads/2012/10/final-report-restoring-ecological-networks-across-transport-corridors-in-bulgaria.pdf

[129] http://www.springer.com/us/book/9781402045035

[130] Shi, X., Beutel, M., Long, T., Hellenthal, A., and Bristoll-Groll, C. (2015) Green Stormwater Infrastructure Strategies for Airports: Challenges and Opportunities. Environmental Sustainability in Transportation Infrastructure: pp. 1-13. doi: 10.1061/9780784479285.001

		provide a brief overview of the GSI strategies for airports, followed by a discussion of challenges and opportunities in balancing airport priorities in environmental, economic, and social values and operational constraints. The airport challenges in implementing GSI strategies mainly include those related to wildlife attraction, climate change, anti-icing/de-icing compounds, and land use limitations. A research project on this issue is underway in the United States.[131]	

Interview highlights

The interview took place with Carme Rosell. Apart from being an expert associate of Minuartia (a consultancy in Catalonia) and University of Barcelona, she is a Board Member of Infra Eco Network Europe (IENE)[132]. IENE is a network of experts working with various aspects of transportation, infrastructure and ecology. The network was initiated in 1996 to provide an independent, international and interdisciplinary arena for the exchange and development of expert knowledge with the aim to promote a safe and ecologically sustainable pan-European transport infrastructure. IENE arranges international conferences, workshops and symposia, initiates collaboration projects and helps answering questions that require a joint international expertise. Main focus is on defragmentation solutions and solutions to avoid or reduce animal collisions. She is involved in the SAFEROAD project (see Table 5-7).

The interview revealed the following interesting findings:

- In the transport sector there is a lot of guidance and standards for building and maintenance, but GI is poorly covered. Topics related to GI are mainly focusing on defragmentation measures (e.g. design and maintenance of wildlife passages), and on this issue several EU countries have developed their own guidance. Other GI related topics are road and waterway verges, drainage systems, water retention ponds, resting areas, and green areas in airports. Sometimes this guidance is very fragmented in different types of standards.
- If GI is covered it is related to new developments (construction). GI in relation to maintenance is hardly covered, which is a pity since the extensive network of old infrastructure (railways, roads) offers a lot of opportunities in the field of maintenance. The Saferoad project (see Table 5-7) aims to cover this gap.
- Most countries have drawn up handbooks on wildlife issues (with some information about maintenance). However the information is often not included in general 'Road Maintenance Guidelines' (RMG), or in contracts to road maintenance companies or PPP agreements. Experience shows that if it is not in the contract, it is not applied. The DBFM (Design, Build, Finance, Maintain) type of contracts for building and maintenance of roads offers opportunities as conditions can be imposed to consortia on improving ecological connectivity and on deploying GI.
- Key elements of a good standard for green infrastructure are the following:
    - The standard should be produced in cooperation between transport experts and ecologists, and preferably with experts from different countries;
    - Standards need to be evidence based (monitoring), e.g. on the use of fauna passages;
    - Standards should build on best practices and be promoted (raising awareness);

[131] http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3835
[132] http://www.iene.info/

  - Standards need to adapt to country specificities (different climate, different animals, …); be careful with general requirements;
  - Standards should not only focus on ecological benefits, but also on economic and social factors; this fits very well with the GI philosophy, e.g. airports preventing bird strikes by means of habitat management measures which attract less birds but might be very suitable for other biodiversity, e.g. insects; this reduces costs for preventing bird strikes.
  - Many standards are only available in the country language. Good standards should include at least a summary in English or French.
- An interesting observation is that the wording of 'green infrastructure' might be confusing to civil engineers and non-ecologists in general. Even biologists within building and construction companies are often not aware. They often confuse its use with 'sustainability' e.g. reducing waste, emissions, etc. (like 'green policy'). Therefore the first task is to explain the concept (e.g. by means of material provided by the EC). The concept of 'natural infrastructure' is sometimes better understood.

Extent GI is integrated in standards and the potential

There are many standards on transport infrastructure construction and maintenance, but until now GI is poorly covered. Main links are guidelines and prescriptions on defragmentation measures and anti-collision measures for wildlife, as well as guidelines on how to enhance biodiversity values of road and waterway verges. However, transport infrastructure offers enormous opportunities for deploying GI and its associated range of societal benefits. As nowadays the planning and permitting of new transport infrastructure roads often faces societal resistance, a smart combination of grey and green infrastructure (integrated solutions) accompanied with clear communication of the societal benefits of GI might increase societal acceptance (license to operate) and overcome resistance. Key elements of these integrated solutions should include the creation of large GI areas (over-compensation of biodiversity loss due to construction works is recommended) designed according to the expectations of different stakeholder groups, and safeguarding the ecological connectivity of the wider landscape. With regard to existing transport infrastructure an opportunity is to create GI in order to mitigate negative health impacts created by transport infrastructure (noise reduction, regulation of air pollution, aesthetics). Translating these opportunities into standards which have an obligatory character would be a major step ahead, both for biodiversity and for human health.

Way forward

As described above there is a tremendous opportunity for deploying GI both in the field of new transport infrastructure developments as well as in the field of existing transport infrastructure. Regional and local spatial planning processes as well as dedicated standards on how to link GI to transport infrastructure in order to maximize biodiversity and societal benefits are key instruments to make this happen.

Major findings on standards for performance elements

- Only a few performance standards in relation to GI and transport infrastructure have been identified, and even in these cases the full concept of GI is not taken into account. The only link is the mitigation and compensation of biodiversity impacts, but the multi-functionality of GI, i.e. its full range of societal benefits next to biodiversity benefits, is hardly covered.
- Transportation sustainability is largely being measured by transportation system effectiveness and efficiency as well as the environmental and climate impacts of

the system[133]. Opportunities for including GI are often overlooked and as a consequence the biodiversity and societal benefits of it (ecosystem services) do not show up in most sustainability performance measurement systems for transport infrastructure.

- Sustainability performance across the life cycle of construction projects is a crucial aspect in achieving the goal of sustainable development.
- Based on methodologies for the transport sector, the basic philosophy is that prevention is better than cure in avoiding the negative effects of habitat fragmentation. Where avoidance is impossible/impractical, mitigation measures should be designed as an integral part of the scheme. Where mitigation is insufficient or significant residual impacts remain, compensating measures should be considered as a last resort. In most large scale transport infrastructure projects compensatory measures are required. This provides opportunities for creating GI.

Major findings on standards for procedures

- Specific transport infrastructure sector related procedural standards, i.e. standards on how to include GI in planning and permitting processes for new transport infrastructure, are poorly available. There is however plenty of generic spatial planning guidance which increasingly takes into account the concept of ecosystem services and as such includes links to GI.
- SEA provides a perfect instrument to cover GI when comparing alternative routings or locations for new transport infrastructure, while EIA serves as an excellent tool to fine-tune the most suitable options at a more detailed level. However, the concept of GI in SEA and EIA is mostly limited to its biodiversity and landscape functions, while the full potential of its wide range of positive societal benefits (ecosystem services) is often only covered to a minor extent. As a consequence, the opportunities provided by GI e.g. in terms of human health benefits, are not fully exploited. Initiatives promoting the uptake of the ecosystem services concept in environmental impact assessment, including the development of guidance on this issue, would be very beneficial to enhance the uptake of GI in plans and projects at local or regional level.
- A challenge is to reconcile transport infrastructure policies with national or regional policies on ecological connectivity. The Pan-European Biological and Landscape Diversity Strategy (PEBLDS) promotes the concept of 'ecological networks' (i.e. connections between habitats via ecological corridors). This has been specifically identified as an effective strategy for addressing habitat fragmentation as it promotes the integration of biodiversity conservation into land use planning procedures. Consideration of these 'ecological networks' in the planning of roads, railways and waterways may help to avoid critical bottlenecks in habitat connectivity and identify where mitigation measures are required. The Dutch Multi-Annual Defragmentation Programme is an excellent example, as it guarantees that within each spatial planning process for new transport infrastructure ecological connectivity is safeguarded.
- Transport infrastructure related procedural standards for including GI in the maintenance or upgrading of existing transport infrastructure is generally lacking, apart from the fact that in many countries it is recommended to use existing methodological guidance in preparatory studies (e.g. EIA) related to a new development (e.g. building of a fauna overpass on an existing road). We are not

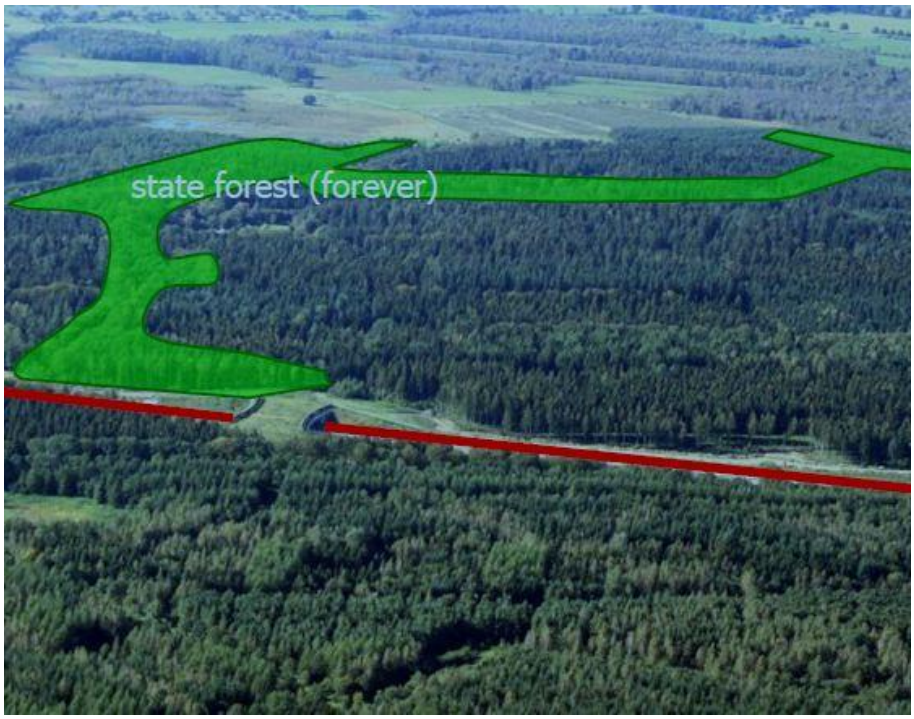
[133] http://center.sustainability.duke.edu/sites/default/files/documents/transportation_indicators.pdf

aware of any legal obligation, embedded in national or regional legislation, to use existing GI standards. Art 10 and art. 12.4 of the Habitats Directive however require that appropriate measures are taken.

Major findings on standards for methodology

- Many standards are available on defragmentation measures and measures to avoid animal collisions, i.e. with an exclusive focus on biodiversity conservation and road safety. Quite some standards are also available on how to improve biodiversity values of road and waterway verges, water retention basins, etc. Methodological standards on how to enhance societal benefits with GI associated to transport infrastructure are far less available. Developing methodological guidance on how to include GI as a mitigating or compensation measure to reduce or offset the adverse environmental impacts of transport infrastructure and to turn them into societal benefits would be very beneficial.
- GI can also be applied to reduce costs, or as a climate change adaptation measure. An example is the article on Green Stormwater Infrastructure Strategies for Airports, which provides an excellent overview of the benefits of nature-based solutions compared to traditional grey infrastructure.
- An issue that deserves particular attention in these methodological standards is governance e.g. how to involve stakeholders, how to organize the financing and maintenance, how to ensure the long-term effectiveness of wildlife corridors (see Figure 10 below). Very often methodological standards are limited to technical aspects.

Figure 10: Example of sustainable GI solution in the field of transport infrastructure



[Source: adapted from Schulz et al[134]]

[134] Björn Schulz1, H. Reck2, M. Böttcher3. How to reconnect biodiversity across motorways? Practical experiences of establishing ecological hinterland connections of fauna passages in a highly fragmented

4.4.5 GI standards and the public health sector

In the public health sector there are many standards, guidelines and protocols outside the scope of the GI/health domain. Examples are safety standards (toxic species, allergenic species, risks of falling branches, pesticide use etc.). Accessibility standards that recommend the availability of GI for citizens are an exception. However, there is a growing body of literature linking GI to human health and wellbeing, but the underlying mechanisms are poorly understood and the knowledge tends to remain in the green sector, not penetrating the health sector. Exceptions are some SME's and bottom-up local initiatives bridging the gap between the green sector and the health sector. The health sector demonstrates large potential for GI standards, but before standardization can take place, the evidence base must grow stronger, and results must be dissipated within the health sector rather than only in the green sector.

Table 13: Examples of standards for the public health sector with indication on whether GI (GI) is thoroughly included (green: GI well covered; orange: GI moderate to basically; red: GI hardly or not covered)

Type	Standard	Key aspects	
Performance	The Natural England Accessible Natural Greenspace Standards (ANGSt) [135]	ANGSt recommends that everyone, wherever they live, should have accessible natural greenspace: ▪ of at least 2 hectares in size, no more than 300 metres (5 minutes walk) from home; ▪ at least one accessible 20 hectare site within two kilometre of home; ▪ one accessible 100 hectare site within five kilometres of home; and ▪ one accessible 500 hectare site within ten kilometres of home; plus ▪ a minimum of one hectare of statutory Local Nature Reserves per thousand population.	
	Accessibility guidelines in Germany [136]	Berlin aims at providing at least 6 m² urban green per person while Leipzig aims at 10 m² per capita. Berlin's Department of Urban Development and the Environment recommends that every resident should have access to urban green of minimum 0.5 ha within a 500 m distance from home.	
	WHO green space standard[137]	The WHO is cited to have proposed a standard of 300m maximum distance to green space for every citizen, and or that every city should have a minimum of 9 m^2 of green space per person. An optimal amount would sit between 10 and 15 m^2 per person.	

northern German landscape 1 Schleswig-Holstein State Foundation for Nature Conservation, 2 University of Kiel, 3 Federal Agency for Nature Conservation.

[135] http://webarchive.nationalarchives.gov.uk/20140605090108/http:/www.naturalengland.org.uk/regions/east_of_england/ourwork/gi/accessiblenaturalgreenspacestandardangst.aspx

[136] GREENSURGE project: compiled in (http://greensurge.eu/working-packages/wp3/files/MS24_update_13022015.pdf)

[137] http://www.euro.who.int/en/health-topics/environment-and-health/Housing-and-health/publications/2010/urban-planning,-environment-and-health-from-evidence-to-policy-action

	Accessibility guideline in the Netherlands[138]	75m^2 per household within 500m is used as a guideline.	
	UK National Playing Fields Association's six acre standard, now the Fields In Trust (FIT)'s recommendations on Planning and Design for Outdoor Sport and Play [139]	The six acre standard suggests that for each 1000 residents there should be 2.4 hectares (6 acres) as follows: 1.6 hectares (4 acres) for outdoor sport and recreation space (including parks); 0.8 hectares (2 acres) for children's play, with about 0.25 ha of this equipped playgrounds. The new FIT publication continues to uphold the original recommendation that 6 acres of recreational space is required for every 1000 people and also provides a detailed framework relating to quantity, quality and accessibility of outdoor facilities for sport and play and the importance of local assessments and standards.	
Procedure	Managing Risk in Play Provision: Implementation guide[140]	The Play Safety Forum has produced Managing Risk in Play Provision to help strike a balance between the risks and the benefits of offering children challenging play opportunities.	
Methodology	HEAT[141]	Developed by WHO (World Health Organisation) to estimate the economic savings resulting from reductions in mortality as a consequence of regular cycling and/or walking. It enables users to estimate the value of new infrastructure to health policies or programmes.	

Interview highlights

- Patrick ten Brink, Head of the Green Economy Programme of the Institute for European Environmental Policy (IEEP) and project leader of the Health and Social Benefits of Nature and Biodiversity Protection project for DG Environment came up with the "teaspoon of dirt a day" notion for healthy immune system development in kids. Evidence is gathering that a certain amount of dirt is good[142]. Nature play is a great way to get an ample amount of dirt and germs and stimulate the immune system. Recently, enhanced immune functioning emerged as one promising candidate for a central pathway between nature and human health (Kuo 2015[143].)
- Jasperina Venema, green entrepreneur and advisor specialized in urban green and health came up with the disease-resilient landscapes concept: GI can prevent the spread of infectious disease between farms and from farm animals to humans, or from wild animals to farm animals. Of course every disease is unique (One health, FAO[144]). No standards or guidelines exist yet.
- Sjerp de Vries, Alterra scientist and green health expert is worried about the standard recently proposed by the WHO of 1 ha green space within 300 m from home. The possible impact of this: large apartment blocks around one ha of green space. If one of the purposes is to allow people to experience peace and quiet to reduce their stress levels and improve their mood, it would be better to introduce an area per 1000 inhabitants instead of only an absolute area and distance measure.

[138] http://www.compendiumvoordeleefomgeving.nl/indicatoren/nl0299-Beschikbaarheid-van-groen-in-de-stad.html?i=13-46
[139] http://www.fieldsintrust.org/Product_Detail.aspx?productid=dc291578-50c5-49c5-b0d7-3c376db6b801
[140] http://www.playengland.org.uk/resources/managing-risk-in-play-provision-implementation-guide.aspx
[141] http://www.heatwalkingcycling.org/
[142] Callahan, G. N. (2003). Eating dirt. *Emerging infectious diseases*, *9*(8), 1016-1021.
[143] Kuo, M. (2015). How might contact with nature promote human health? Promising mechanisms and a possible central pathway. Frontiers in psychology, 6.
[144] http://www.fao.org/ag/againfo/home/en/news_archive/2010_one-health.html

Extent GI is integrated in standards and the potential
GI is still hardly integrated in the public health sector, with the exception of standards for the accessibility of GI for citizens. There is a large potential for GI standards for the health sector, but before standardization can take place, the evidence base has to grow stronger, and the results must be dissipated within the health sector rather than only in the green sector.

Way forward
A gap exists between the green sector and the health sector; the health sector by large ignores GI. Many initiatives are bottom-up initiatives of patients, caretakers, and freelancers or small SME's rooted mostly in the green domain rather than the medical domain. There is a growing evidence base on the health benefits of GI, but the causal relationships and effect size remain largely unknown. It is important to first demonstrate and quantify causal relations between health and GI.

Major findings on standards for performance elements
Performance standards for GI in the health sector so far focus on standards for the accessibility of GI for citizens in urban areas.

Major findings on standards for procedures
- Safety regulations for natural playgrounds are an issue. The safety standards/safety requirements for play equipment are too strict for outdoor playing and in conflict with children's right to play (http://www.righttoplay.com). A careful risk inventory/risk assessment can be used instead.
- Since the health sector is largely unaware of the health benefits of GI, no standardized procedures exist yet.
- There are some guidelines for procedures regarding the construction and use of e.g. community gardens, gardens surrounding hospitals or other care facilities ("healing gardens", therapeutic gardens) or care farms, but these are only shared locally or in national platforms, there are no widely accepted or commonly used guidelines.

Major findings on standards for methodology
- In the health sector, there are certain standards for research design, such as the randomized control trial (RCT[145]), the "gold" standard for intervention studies, and other standards, checklists and guidelines on how to do sound scientific research. These also apply to GI impact assessments.
- Guidance on how to include GI in urban planning do not go beyond accessibility guidelines on area of green space per 1000 inhabitants (or per household) within a certain diameter. A national guideline has only been adopted in the UK; in other countries general recommendations are more common.
- No standards on how to include GI in design of care facilities exist (care gardens, therapeutic gardens or care farm). What happens in practice are mainly bottom-up initiatives not based on any guidelines or standards.

[145] http://www.consort-statement.org/ http://www.fao.org/ag/againfo/home/en/news_archive/2010_one-health.html

4.4.6 GI standards and the industry sector

The industry sector is very familiar with sustainability standards. Although biodiversity, as part of sustainability, has been a rather neglected issue for a long time, the recent increase in specific biodiversity guidance for industry shows a growing interest in the field of 'business and biodiversity'. However, when focussing on the topic of GI within this growing amount of biodiversity standards, it is clear that there is room for improvement. Particular issues which deserve more attention are costs and benefits of GI in an industrial context, as well as guidance on how to implement GI.

Table 14: Examples of standards for the industry sector with indication on the extent to which GI (GI) is included (green: GI well covered; orange: GI moderate to basically; red: GI hardly or not covered)

Type	Standard	Key aspects	
Performance	Global Reporting Initiative G4[146]	GRI is an international independent organization that helps businesses, governments and other organizations understand and communicate the impact of business on critical sustainability issues. Biodiversity is specifically covered under the environmental dimensions (see G4-EN11 to G4-EN15), but also has links with for example water (G4-EN9, G4-EN26). However, most biodiversity indicators describe impacts on biodiversity while only one (G4 – EN13 'Habitats protected or restored') links to active GI implementation, which is very limited.	
	BBOP Standard on Biodiversity Offsets[147]	The Standard enables project developers to manage biodiversity related risks by providing an auditable approach to no net loss, as well as enabling auditors and assessors to determine whether an offset has been designed and subsequently implemented in accordance with the BBOP Principles.	
Procedure	Natural Capital Protocol (NCP)[148]	Currently, companies that measure and value their impacts and dependencies on natural capital do so in a myriad of different ways. This prevents comparability, consistency and mainstream adoption of these approaches. The overall vision of the NCP is to transform the way business operates through understanding and incorporating their impacts and dependencies on natural capital. Biodiversity as part of natural capital is included in this guidance. The NCP is under preparation.	
	EIA and AA[149]	For many industrial activities, as part of the permitting process, an EIA is carried out (and in case Natura 2000 protected habitats and species might be affected, an AA is required). While the focus is on the assessment of biodiversity impacts, an important part of these assessments is dedicated to mitigation measures. However, although this offers an excellent opportunity to promote GI, the multi-functionality of it or its societal benefits are often poorly described.	
	Environmental Management System -	Many companies operate environmental management systems, often certified to ISO 14001 or EMAS. However, biodiversity issues are frequently neglected or even omitted,	

[146] https://www.globalreporting.org/
[147] http://bbop.forest-trends.org/pages/guidelines
[148] http://www.naturalcapitalcoalition.org/natural-capital-protocol.html
[149] AA: Appropriate Assessment according to Habitats Directive Art 6(3) and 6(4)

	European Biodiversity Standard (EBS)[150]	despite their importance. The EBS provides a process to use in companies, to measure, improve and demonstrate publicly their ecological performance. EBS is a commercial tool requiring payment.	
	Environmental Management System - Biodiversity Benchmark (BB)[151]	BB is a standard for assessing and certifying an organisation's system for achieving continual biodiversity protection and enhancement on its landholdings and their implementation. BB can complement existing environmental management systems such as ISO14001 and EMAS by integrating biodiversity into the systems of an organisation. Alternatively it can operate as a stand-alone system. Using the BB requires payment.	
Methodology	Cross-sector guide for implementing the Mitigation Hierarchy (CSBI)[152]	Provides practical guidance, innovative approaches and examples to support operationalizing the mitigation hierarchy effectively. As such it contains guidance on restoration and offsetting measures, and it offers insight into comparing costs and savings.	
	WBCSD Business Guide to Natural Infrastructure	The WBCSD is preparing a business guide on natural infrastructure (= GI). This guide will include the business case, case studies, fact sheets on existing tools, decision tree and check list. GI is thereby seen as a cost-effective investment opportunity and solution to benefit from a range of ecosystem services for issues material to companies.	
	WBCSD Eco4BiZ[153]	Eco4Biz "Ecosystem services and biodiversity tools to support business decision-making" is a structured overview of existing tools and approaches. Tools are identified as primarily focusing on either ecosystem services or biodiversity. The aim is to help companies make better-informed decisions about which tool they could apply when assessing and managing their ecosystem impacts and dependencies, in order to ultimately lower risk. However it provides only limited information on the business case of GI and how to implement it.	
	Specific GI guidance documents within individual companies	A limited number of businesses (often multinational companies in amongst others the Oil and Gas sector and the Mining sector) have developed their own internal guidance on when and how to implement GI.	

Interview highlights

The interview (Violaine Berger, WBCSD) revealed the following interesting findings:

- There is a need for raising awareness in the business sector, in particular on the business case for GI (costs and benefits). Businesses still only look for grey infrastructure solutions e.g. for waste water treatment and flood protection, while nature-based solutions such as engineered wetlands and natural or semi-natural flood protection might be cheaper and might create additional societal benefits.
- There is a general lack of suitable guidance for the industry sector on how to identify suitable GI solutions and how to implement them.
- Checklist - type standards (performance) often do not deliver added value, as they do not provide any information on the benefits of GI.
- There is a need to develop the 'proof of evidence' by means of demonstration projects.

[150] http://www.europeanbiodiversitystandard.eu/node/4
[151] http://www.wildlifetrusts.org/biodiversitybenchmark
[152] http://www.csbi.org.uk/tools-and-guidance/mitigation-hierarchy/
[153] www.wbcsd.org/eco4biz2013.aspx

Extent GI is integrated in standards and the potential

At this moment the industry is increasingly focusing on biodiversity, as it is more and more acknowledged as a material sustainability issue. As a result there is a rapid growth in the number of industry standards related to biodiversity. The majority of these standards, however, deal with methods to identify and assess business impacts and dependencies on biodiversity, and contains only limited information on methods to implement mitigation measures. It is clear that creation of GI is an excellent way to mitigate or to compensate biodiversity impacts. Specific guidance on the mitigation hierarchy and the concept of No Net Loss (and Net Positive Impact) is provided by the BBOP and the CSBI (see Table 14). There are very few standards with a clear focus on GI. Specific guidance is currently being developed by the WBCSD (see Table 14). There is a huge potential for GI uptake in existing business related biodiversity standards by including information on how to identify GI solutions, on the business case for GI and on how to implement GI.

Way forward

In 2013, experts from The Dow Chemical Company, Shell, Swiss Re, and Unilever, working with The Nature Conservancy and a resiliency expert, evaluated a number of business case studies, and developed a white paper with recommendations. The paper[154] illustrates the growing awareness and knowledge among the industry sector on the benefits and potential of GI. The paper provides a number of critical success factors for implementation of GI solutions, for example:

- Employ a more comprehensive economic and environmental footprint analysis to more accurately compare green versus grey infrastructure;
- Engage with the engineering community (utilities/process technology/waste stream management, etc.) to build organizational capacity and expertise in green or hybrid infrastructure engineering. Develop learning modules that focus on the identification of GI opportunities and on the evaluation of typical failure modes of GI solutions in order to develop internal skill sets;
- Establish an external network from academia, R&D institutes and contractors to facilitate knowledge sharing and skill transfer activities;
- Engage with the project community early on in the project development process to ensure GI solutions are being considered as part of the early field planning process.

As mentioned in Table 14, the business community is developing specific GI guidance (WBCSD), which will be promoted amongst all industrial sectors. The fact that this guidance covers issues such as a decision tree guiding companies throughout the decision process on GI, a set of case studies which will be regularly updated on a dedicated webpage, and demonstrating the business case for GI is very promising.

Major findings on standards for performance elements

- Current GI performance standards mainly focus on biodiversity offsets and how to measure No Net Loss. This, however, is only part of the GI business applications.
- A performance standard related to the multi-functionality of GI, i.e. including societal benefits, seems to be missing. Societal benefits could be measured and valued by means of ecosystem services indicators, but again, these are lacking in the investigated GI performance standards.
- GRI indicators tend to focus mainly on biodiversity impacts, while efforts to enhance biodiversity e.g. by implementing GI, are only to a limited extent reflected by GRI indicators.

[154] http://www.nature.org/about-us/the-case-for-green-infrastructure.pdf

Major findings on standards for procedures

- Substantial progress could be achieved by putting specific emphasis on GI in EIA for industry projects and in environmental management systems such as ISO 14001. At this moment some commercial certification systems are established (see Table 14). Environmental Impact Assessment is typically associated with the exploration and feasibility stages of project developments, whereas Environmental Management Systems are more closely associated with operations.
- The Natural Capital Protocol is expected to boost standardization of measuring and valuing approaches of business natural capital impacts and dependencies, as it provides a framework for a uniform way of natural capital measurement and valuation based on key principles and a step-by-step approach. It will also provide ways to deal with biodiversity and will refer to GI as part of the solutions.

Major findings on standards for methodology

- Innovative industries integrate nature into their thinking and understand its value and potential services. This can lead to higher resilience for these companies, more effective risk management, better relationships with customers and suppliers and strengthening their image and reputation.
- Industry needs to have access to specialist guidance, professional advice and toolkits on GI and in particular concrete technical solutions for GI, and their financial costs and benefits. The most appropriate guidance is company specific, and some companies are developing their own GI guidance material, based on combined in-house engineering and ecological expertise. The WBCSD business guide on GI – under development – is also expected to be very concrete. It will include a decision-tree supporting companies to identify and to decide on the use of GI and the most suitable type of GI for their specific business applications. It will contain case studies representing a range of sectors and both aquatic and terrestrial GI solutions.

4.4.7 GI standards and climate adaptation

Many examples of tools, guidelines and best practices already exist on how to apply GI, or nature-based solutions, in the context of climate change adaptation. Performance standards, which are common practice in for instance the building world, are not a useful way forward in the climate adaptation sector. The reason for this is that the local situation is always too specific. The multi-functionality of GI is a benefit but it makes planning and implementation of GI very complex. Integrating a GI framework into Environmental Impact Assessments might be a way forward, as this would guarantee that the potential of GI in landscape planning is considered.

Table 15: Examples of standards for the public health sector with indication on whether GI (GI) is thoroughly included (green: GI well covered; orange: GI moderate to basically; red: GI hardly or not covered)

Type	Standard	Key aspects	
Performance	Climate, Community and Biodiversity Standards (CCB Standards)[155]	The CCB Standards identify land management projects that deliver net positive benefits for climate change mitigation, for local communities and for biodiversity. The CCB Standards have a two-step process: (1) Validation demonstrates good project design to generate significant climate, community and biodiversity benefits. Successful CCB validation can help build support for the project among stakeholders and investors. (2) Verification is a rigorous independent endorsement of the quality of project implementation and the delivery of multiple benefits. Successful CCB Verification enables the addition of a 'CCB label'.	
	Climate Bond Standard Community and Biodiversity Standards (CCB Standards)[156]	The Climate Bonds Standard issues certificates which are a screening tool for investors and governments which allows them to easily prioritize climate and green bonds. Recently a new Climate Bond Standard was developed for Agriculture, Forestry and Other Land Uses. Appropriate and responsible investments in these sectors can help developed and emerging economies transition to more sustainable growth pathways, especially where these investments help to increase adaptation capacity and resilience to climate change. Examples include GI: for instance protecting or enhancing natural buffers in coastal and riverine zones (e.g. mangroves, sea grass, corals) and restoring wetlands to reduce impacts of sea level rise, flooding and storm events.	
	CEN and CENELEC Adaptation to climate change coordination group (ACC-CG)[157]	The EU Strategy on Adaptation to Climate Change (COM(2013) 216 final) has invited European Standardization Organizations to contribute to the European efforts aiming to make Europe more climate-resilient. The ACC-CG group coordinates standardization activities and fosters collaboration in standardization work in the field of adaptation to climate change. The focus is on transport infrastructure, energy infrastructure and buildings / construction sector.	
Procedure	UNEP Ecosystem based adaptation guidance;	The UNEP uses the term ecosystem-based adaptation instead of GI. The goals for these two terms are similar. The benefits of ecosystem-based adaptation as a sustainable adaptation	

[155] http://www.climate-standards.org/ccb-standards/
[156] http://www.climatebonds.net/standards
[157] http://www.cencenelec.eu/standards/Sectors/ClimateChange/Pages/default.aspx

	Ecosystem-Based Adaptation Decision Support Framework [158]	approach are highlighted. In addition to protection from climate change impacts, also the many other benefits to communities are highlighted, for example through the maintenance and enhancement of ecosystem services crucial for livelihoods and human well-being, such as clean water and food.	
	Integrating climate change into EIA and SEI[159]	An EC guidance document on how to integrate climate change and biodiversity as a standard procedure in 'Environmental Impact Assessment' (EIA) and 'Strategic Environmental Assessment' (SEI). Although the guidance focuses on the terms biodiversity and climate change, the recommendations are also valuable for GI.	
Methodology	Learning Framework for IUCN's work on Ecosystem Based Adaptation [160]	The IUCN has developed a learning framework for the successful implementation of Ecosystem based adaptation to climate change. Among other activities they have developed a database of all project and activities that embrace EBA.	
	EBA Ecosystem Based Adaptation Program [161]	Methodologies and tools how to make use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people adapt to the adverse impacts of climate change. Examples of ecosystem based adaptation are available for agricultural landscapes mountains, coastal areas, river basins, urban and wetlands.	
	Adaptation support tool European Climate Adaptation Platform [162]	Many support tools exist how to successfully implement GI or ecosystem based adaptation measures. This website gives examples of guidance and tools for the different phases of implementation.	
	Exploring nature-based solutions; the role of GI in mitigating impacts of weather- and climate change-related natural hazards[163]	A practical methodology is proposed for screening (rather than assessing) ecosystem services in areas where GI may contribute to reducing current (or future) weather- and climate-related natural hazards. The report addresses landslides, avalanches, floods, soil erosion, storm surges and carbon stabilisation by ecosystems.	

Interview highlights

The interview with Stefan Kleeschulte (Managing Director Space 4 Environment) revealed the following interesting findings:

- In the climate adaptation sector we are not in the phase of developing GI standards yet, but more in an exploring phase of how GI, or nature-based solutions, might contribute to the resilience against extreme weather events.
- Performance standards, which are common practice in, for instance, the building world, are not a useful way forward in the climate adaptation sector. The reason for this is that the local situation is always too specific. You need to assess the specific risks, the ecosystems present, the other ecosystem services that might be required, etc. Too narrowly defined standards could in fact become problematic, as flexibility is required to adapt to the specific situations.

[158] www.unep.org > Climate Change Adaptation > EbA
[159] http://ec.europa.eu/environment/eia/pdf/EIA%20Guidance.pdf./
[160] *https://www.iucn.org/about/work/programmes/ecosystem_management/climate_change/eba/*
[161] *http://www.ebaflagship.org/*
[162] *http://climate-adapt.eea.europa.eu/adaptation-support-tool*
[163] *http://www.eea.europa.eu/publications/exploring-nature-based-solutions-2014*

- The multi-functionality of GI is a benefit but it also makes planning and implementation of GI at the same time very difficult. The prerequisites for the different services provided by the GI, the multiple scales required for the functioning of different services, make it all very complicated and context dependent. In this respect integrating a GI framework into Environmental Impact Assessments might be a way forward, as this would guarantee that the potential of GI in landscape planning is considered.

Extent GI is integrated in standards and the potential
In climate change adaptation the notion that green adaptation provides sustainable solutions with multiple benefits is well established. In this context the term ecosystem based adaptation is the more familiar term for applying green infrastructure as a climate adaptation measure. Many guidelines and good examples exist on how GI can be applied in this sector. Most standards involve methodological guidelines and procedures on how to incorporate GI in decision making.

Way forward

- A framework with guidelines on how to assess the potential of GI-solutions and how to implement GI to reduce vulnerability for climate hazards would be a welcome product.
- A database of good practice is always helpful as it informs local planners on the solutions that were effective elsewhere and which they might adjust to their specific situation.
- Integrating a GI framework into Environmental Impact Assessments (EIA) and Strategic Environmental Assessments (SEA) might be a way forward, as this would guarantee that the potential of GI in landscape planning is considered.

Major findings on standards for performance elements

- Performance standards for climate adaptation are being developed, for instance by the ACC-CG group. However, the focus is on transport infrastructure, energy infrastructure and the building sector and not on GI.
- An exception is the CCB standards that identify land management projects that deliver net positive benefits for climate change mitigation, for local communities and for biodiversity. Successful CCB Verification enables the addition of a 'CCB label'.

Major findings on standards for procedures

- The UNEP uses the term ecosystem-based adaptation instead of GI. The goals for these two terms are similar. The benefits of ecosystem-based adaptation as a sustainable adaptation approach are highlighted. In addition to protection from climate change impacts, also the many other benefits to communities are highlighted, for example through the maintenance and enhancement of ecosystem services crucial for livelihoods and human well-being, such as clean water and food.
- There is need for a stronger focus on integrated spatial planning and methods to stimulate cross-sectoral regional cooperation.

Major findings on standards for methodology

Many examples of tools, guidelines and best practices already exist on how to apply GI, or nature-based solutions, in adapting to climate change. For example the EEA[164] recently published a practical methodology for screening ecosystem services in areas where GI may contribute to reducing current (or future) weather- and climate-related natural hazards.

[164] *http://www.eea.europa.eu/publications/exploring-nature-based-solutions-2014*

4.4.8 GI standards and rural abandonment

GI can offer solutions for both the prevention of farmland abandonment and for minimizing the negative impacts when farmland is already abandoned. There are no specific GI standards in the context of rural abandonment. An indirect way to stimulate GI in rural abandonment areas is for instance via the Common Agricultural Policy (CAP) funding scheme or European Structural Funds.

Table 16: Examples of standards related to rural abandonment with indication on whether GI (GI) is thoroughly included (green: GI well covered; orange: GI moderate to basically; red: GI hardly or not covered)

Type	Standard	Key aspects	
Performance	Common Agricultural practice (CAP)[165]	The CAP is an indirect instrument to stimulate Green Infrastructure in rural abandonment areas. Green Infrastructure is already well integrated in agricultural policies for instance in Pillar 1 funding and Pillar 2 European Agricultural Fund for Rural Development (EAFRD) funding. Collective Ecological Focus Areas give the opportunity to move from individual farms to implementing GI on a regional level in collective ecological focus areas.	
Procedure	European Structural Funds[166]	European Structural Funds form an opportunity to invest in rural abandonment areas. Green infrastructure is not specifically mentioned in these funds.	
	Integrating green infrastructure into EIA and SEI[167]	An EC guidance document on how to integrate climate change and biodiversity as a standard procedure in 'Environmental Impact Assessment' (EIA) and 'Strategic Environmental Assessment' (SEA). Although the guidance focuses on the terms biodiversity and climate change, the recommendations are also valuable for GI. When an environmental impact assessment is made for landscape planning in rural abandonment, the integration of GI in EIA would also stimulate the implementation of GI in rural abandonment areas.	
Methodology	High nature value farming indicator[168]	Rural abandonment can be prevented by linking Green Infrastructure to opportunities offered by HNV farming. The HNV Impact Indicator aims to assess changes in the extent and condition of HNV farming and forestry in relation to a baseline established at the start of the programming period. There is no single indicator or data source appropriate for this purpose. In the approach proposed, the Impact Indicator therefore consists of a basket of indicators put in place at the national and/or regional level.	
	Rewilding Europe examples[169]	Rewilding Europe aims to bring the variety of wildlife back to Europe's abandoned lands. Rewilding creates new opportunities for abandoned land, creating new economic models based on wild nature. There are several ongoing pilot projects in Europe.	

[165] http://ec.europa.eu/agriculture/cap-post-2013/
[166] http://ec.europa.eu/regional_policy/en/funding/
[167] http://ec.europa.eu/environment/eia/pdf/EIA%20Guidance.pdf./
[168] http://ec.europa.eu/agriculture/rurdev/eval/hnv/guidance_en.pdf
[169] http://www.rewildingeurope.com

Interview highlights

No interview was taken because it can be argued rural abandonment does not really qualify for consideration as a sector. The opposite, intensified agriculture, is indeed a sector but falls outside of the scope here.

Extent GI is integrated in standards and the potential

There are no specific GI standards in the context of rural abandonment. An indirect way to stimulate GI in rural abandonment areas is for instance through the Common Agricultural Policy (CAP) funding scheme, high nature value farming (HNV-farming) or European Structural Funds. GI is already well integrated in CAP and HNV-farming but GI is not specifically mentioned in the European Structural Funds.

Way forward

- The implementation of GI in the context of land abandonment would gain from standardized procedures to integrate GI into Environmental Impact Assessments (EIA) and Strategic Environmental Assessments (SEA), as this would guarantee that the potential of GI in landscape planning is considered.
- A challenge is the development of assessment methods to identify the most suitable areas for prevention of rural abandonment as well as for use of opportunities created by rural abandonment.

Major findings on standards for performance elements

- There are no specific GI standards in the context of rural abandonment. An indirect way to stimulate GI in rural abandonment areas is for instance through the Common Agricultural Policy (CAP) funding scheme. GI standards are already well integrated in CAP.

Major findings on standards for procedures

- The European Structural Funds form a potential to invest in GI in rural abandonment areas.

Major findings on standards for methodology

- HNV-farming and the Rewilding Europe initiative offer best practices for how to avoid land abandonment or create new opportunities for already abandoned land.
- A challenge is the development of assessment methods to identify the most suitable areas for prevention of abandonment as well as for use of opportunities created by rural abandonment.

4.4.9 GI standards and the energy sector

Terrestrial energy infrastructure consists of energy production facilities (hydropower, windfarms, gas and coal based power plants, nuclear power plants) as well as the energy transmission infrastructure (oil and gas pipelines, electricity grid). As a consequence, possibilities for developing GI are quite diverse and rather specific for each type of energy infrastructure. The energy sector is under full development and is characterized by increasing investments in renewable energy as well as in electricity transmission infrastructure in the EU. But also existing energy infrastructure is being revitalized. The energy sector might benefit from investments in GI for various reasons, ranging from reducing risks (operational, reputational) to grasping opportunities (cost reduction, reputational), depending on the type of investments. Due to the variety of energy infrastructure, generic GI standards for the energy sector are not available, but there are a number of specific standards available.

Table 17: Examples of standards for the energy sector with indication on whether GI (GI) is thoroughly included (green: GI well covered; orange: GI moderate to basically; red: GI hardly or not covered)

Type	Standard	Key aspects	
Performance	Hydropower Sustainability Assessment Protocol[170]	The Hydropower Sustainability Assessment Protocol provides useful guidance for promoting ecological design. This protocol covers technical, environmental, social, economic and integrative sustainability. The protocol covers all stages of a hydropower project, covering 20 performance topics which are each scored based on six criteria. Biodiversity and invasive species is one of the topics covered. All criteria have basic and best practice requirements. This has potential to cover GI and ecosystem services as a best practice requirement.	
Procedure	European Renewable Energy Source Directive[171]	This directive establishes an overall policy for the production and promotion of energy from renewable sources in the EU. It requires the EU to fulfil at least 20% of its total energy needs with renewables by 2020, to be achieved through the attainment of individual national targets. Within the directive there is a bonus system for the use of degraded land. Further, there is acknowledgement of the impact of the production of biofuels and bioliquids on biodiversity. However, no further reference is made to consider how to link energy production or transportation to ecosystem services and GI.	
	European Grid Declaration on Electricity Development and Nature Conservation[172]	In 2011 Europe's largest transmission system operators (TSOs) and environmental NGOs signed the European Grid Declaration on Electricity Development and Nature Conservation. This Declaration sets out principles and commitments for ensuring there is no conflict between grid development and nature protection. It recognizes that the European environmental legislation provides a good basis for environmentally sensitive grid planning and delivery. It calls for full and proactive implementation of procedures such as strategic environmental assessment of grid plans. Its focus is	

[170] http://www.hydrosustainability.org/
[171] https://ec.europa.eu/energy/en/topics/renewable-energy/renewable-energy-directive
[172] http://renewables-grid.eu/documents/eu-grid-declaration.html

		on avoiding negative impacts, not touching upon GI or the benefits ecosystem services may provide.	
	SEA/EIA	The process ensures a detailed assessment of adverse and beneficial environmental effects for a range of alternative solutions, either at the planning stage (SEA) or the project stage (EIA). While the focus is on the assessment of impacts, an important part of these assessments is dedicated to mitigation measures. Although this provides an excellent opportunity to promote GI, the multi-functionality of it or its societal benefits are often poorly described.	
	Wind energy developments and Natura 2000[173]	This document provides guidance on how best to ensure that wind energy developments are compatible with the provisions of the Habitats and Birds Directives. It is designed for use by competent authorities and developers, as well as consultants, site managers and other practitioners who are involved in the planning, design, implementation or approval. Focus of the document is on avoiding negative impacts on biodiversity, but the document also contains examples of wind farms having delivered overall net benefits for biodiversity, this especially in areas with degraded ecosystems.	
Methodology	Life Elia[174]	Life Elia, in collaboration with the French TSO RTE, several environmental NGO's (Solon, Carah), and the Walloon government, is implementing an EU-funded Life+ project to restore and/or create habitats in Natura2000 sites under existing overhead lines. The overall objective of the project is to restore 130km of corridors under overhead lines in Belgium and France. It aims at fostering innovation in the management of forest corridors. Furthermore, the project wants to prove that active management for biodiversity can reduce the costs of securing and maintaining corridors, thereby making use of the positive benefits of GI. Guidance documents are under preparation.	
	Connecting energy, protecting nature[175]	With the report "Connecting energy, protecting nature", BirdLife Europe and European Environmental Bureau present their ideas on how to protect nature when planning and investing in a low carbon society. It focusses on protecting habitats and vulnerable species, but also provides guidance on how to protect and enhance natural resources, ecosystem services and the natural environment. Unfortunately it does not refer to GI as an opportunity to invest in and to the multiple societal benefits GI may provide.	
	AECOM for National Grid[176]	AECOM has developed a tool for National Grid which: (i) quantifies natural capital (NC) assets; (ii) identifies the ecosystem services (ES) provided by these assets; (iii) assesses how these ES change under different management scenarios; (iv) estimates the monetary value of these ES; (v) develops a business case for investing in NC assets.	

Interview highlights

The interview with Simon Devoghele (LIFE Elia) confirmed some of the findings of the other sectors and provided a number of useful additional insights:

- There is a general lack of standards related to the maintenance of infrastructure. For the design and building phase of high voltage electricity transmission infrastructure there are a number of instruments including safeguards related to protected areas (e.g. SEA, EIA, Natura 2000 guidance). However, once the route is decided, there is no further guidance anymore.

[173] http://ec.europa.eu/environment/nature/natura2000/management/docs/Wind_farms.pdf
[174] http://www.life-elia.eu/
[175] http://renewables-grid.eu/fileadmin/user_upload/Files_RGI/Reports/272-1861-13-14_Energy_infrastructure_report_w_low_res_final__1_.pdf
[176] http://ec.europa.eu/environment/biodiversity/business/assets/pdf/workstream2/aecom-for-national-grid_en.pdf

- Standardisation of maintenance approaches which are beneficial for Green Infrastructure is more than welcome. Certainly when considering the transnational character of electricity transmission grids in the EU.
- The following key elements of a good standard for GI are mentioned: 1) a good standard should not only focus on protected species and habitats, but should deal with common biodiversity too, 2) a good standard for GI related to electricity transmission should allow continuous maintenance by TSOs (TSO = Transmission System Operator); as a consequence a balance needs to be found between practical maintenance possibilities and the required conditions for habitats and species, 3) a good standard needs to be developed in cooperation with TSOs; they must be on board.
- The LIFE ELIA team is preparing the publication of a guidebook (foreseen early 2017). This guidebook will include best practices on vegetation management under high voltage lines, and will cover all ecosystem types in Continental and Atlantic biogeographic areas (another one will focus on Boreal, Alpine and Mediterranean ecosystems). Key issues include 'How can we promote biodiversity under linear infrastructure and increase public acceptance?', 'Which (technical) actions can be taken and how can they be implemented?', 'How can stakeholders be involved?'. It will also include cost issues (at least with reference to the Cost Benefit Assessment that was conducted under the LIFE ELIA project).

Extent GI is integrated in standards and the potential

In the field of nature protection and restoration there are a number of standards for specific subsectors of the energy sector, such as for hydropower, windfarms and electricity grid infrastructure, but not all of them refer to GI as an opportunity to reduce risks and enhance societal benefits. It has been demonstrated, not at least by the Life Elia project (see Table 17), that smart development of GI as part of new project development substantially increases societal acceptance. For existing electricity transmission systems it significantly reduces the maintenance cost. Hence there is room for improvement.

Way forward

The energy sector would also benefit from GI standards. The sector needs to be made aware that GI has multiple benefits: it increases societal acceptance of new infrastructure which is key to acquire the license to operate, in some cases it reduces operational costs and it always contributes to a green reputation amongst the stakeholders. Guidance material including best practices and figures on costs and benefits should be prepared and made available.

Major findings on standards for performance elements

- Very little performance standards on GI in the energy sector have been found. Only for the hydropower sector has a sustainability performance standard been traced. Unfortunately it doesn't contain specific requirements on GI. However a suitable best practice approach on GI related to hydropower are afforestation measures in the watershed basin which reduce erosion and the associated siltation in the lake.
- No Net Loss of biodiversity is a requirement for all wind energy projects in France.

Major findings on standards for procedures

- The Renewables Grid Initiative (RGI) promotes the integration of 100% renewably-generated electricity into the European grid. TSOs and NGOs join forces in RGI to support the build-up of a sufficient grid infrastructure in Europe

for both decentralized and large-scale renewable energy sources. This grid development should be efficient, sustainable, timely, environmentally friendly, and socially acceptable to all stakeholders.

- SEA provides a perfect instrument to cover GI when comparing alternative routings or locations for new energy infrastructure, while EIA serves as an excellent tool to fine-tune the most suitable options at a more detailed level. However, the concept of GI in SEA and EIA is mostly limited to its biodiversity and landscape functions, while the full potential of its wide range of positive societal benefits (ecosystem services) very often is only covered to a minor extent. As a consequence the opportunities provided by GI e.g. in terms of human health benefits, are not fully exploited. Initiatives promoting the uptake of the ecosystem services concept in environmental impact assessment, including the development of guidance on this issue, would be very beneficial to enhance the uptake of GI in plans and projects at all levels (including transboundary).

Major findings on standards for methodology

- Most identified GI standards for the energy sector are focusing on methods and best practices. A most recommendable approach is the Life Elia approach.
- Projects that link GI to existing 'grey' infrastructure - such as Gaz de France's creation of ecological networks linked to its gas pipeline infrastructure[177] - can provide tangible early benefits and overcome scepticism amongst decision-makers. In the case of Shell[178] GI has been utilized strategically to ensure protection of coastal gas pipelines against erosion, through natural reclamation processes, habitat restoration or development of oyster reefs.

[177] http://www.gdfsuez.com/en/commitments/climate-environmental/protecting-biodiversity/
[178] www.nature.org/about-us/the-case-for-green-infrastructure.pdf

4.4.10 General findings on integration of GI in standards

Here, we re-evaluate Table 7. At the start of this work we made best judgements to what extent GI is included in standards for the different sectors. We based the scores in Table 7 on our best judgment given our own expertise, and a quick screen of available literature. Now, we are in position to make new evaluation based on a more extensive review and information that was collected through the interviews. In Table 18, the upper table shows the results of our initial assessment. The lower table shows the results of our new evaluation based on the insights we gained through doing the study.

Table 18: Update of Table 7 based on the interviews

Original (Table 7)			
Sector	**Performance**	**Procedure**	**Methodology**
Finances			
Building			
Water			
Transport			
Public health			
Industry			
Climate			
Rural Abandonment			
Energy			

Revised Scores			
Sector	**Performance**	**Procedure**	**Methodology**
Finances			
Building			
Water			
Transport			
Public health			
Industry			
Climate adaptation			
Rural Abandonment			
Energy			

[Note: For each of the nine sectors it is indicated to what extent GI is included in standards on performance, procedure and methodology (green: fairly well covered; orange: rather basic; red: little or lacking). The upper table is the original table, while the lower table shows the scores based on review and interview.]

The results in Table 18 provide at a glance to what extent GI is included in sectorial standards. Also, the table shows several interesting and relevant findings for improving the way GI is included in technical standards:

- For performance standards, none of the sectors scored well. In most instances, if anything was included in performance evaluations, it was biodiversity and ecosystem services. Therefore, there is much room for having GI included in performance standards.
- For procedure standards, GI is covered for the building and water sector, indicating the approaches taken by these sectors may provide inspiration when including GI in procedure standards for other sectors.
- For standards on methodology, results are more positive. For the building, water, industry, climate adaptation and energy sectors, each have guidance or

handbooks on how to make use of GI. For the transport sector, it should therefore be relatively straightforward to also put more emphasis on GI in guidance and handbooks. With respect to the finance sector it seems reasonable that they focus mainly on performance and procedure standards, and leave it to the sectors they finance for developing standards on methodologies.

- We are all concerned about public health. There is increasing evidence on the benefits green living environments provide to our health and productivity. However, as it appears from our work, there certainly is a gap for the public health sector when it comes to covering GI in standards.

4.5 General recommendations

4.5.1 Integrated spatial planning

Several sectors (such as climate adaptation, water, land abandonment and infrastructure) have indicated that the implementation of GI would benefit from integrated spatial planning early in the planning process. Also, it has been increasingly recognized that it is necessary to work at the landscape level to ensure that sectors can capture the benefits of GI and to maintain biodiversity and ecosystem services. A landscape approach can contribute to bringing together sectoral economic development plans and national action plans on biodiversity conservation, water management and climate change. Note, for example, the emergence of Integrated Water Resource Management (IWRM).

The International Federation of Landscape Architects (IFLA)[179] recommends that GI must become an integral part of policy and decision making. They gave the following recommendations to achieve this:

- GI needs to be integrated into Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA);
- Monitoring of GI delivery from EU funded infrastructure projects;
- Funding for GI-related research and training;
- Developing an expert service providing guidance and support on GI for public and community bodies;
- Promoting EU GI strategy, advice and guidance through professional communication channels.

An EC guidance document is available on how to integrate climate change and biodiversity as a standard procedure in 'Environmental Impact Assessment' (EIA) and 'Strategic Environmental Assessment' (SEA)[180] (EC, 2013a and 2013b). Although the guidance focuses on the terms biodiversity and climate change, the recommendations are also valuable for GI. EIAs are legally required and provide an opportunity to systematically integrate GI into a wide range of public and private projects. The report observes however that biodiversity (and GI) and climate change are, so far, not being systematically integrated into EIA/SEA. The main reason for this is that climate change and biodiversity are not yet explicitly included in the formal requirements of EIA procedures. In addition, they are multi-faceted issues that do not lend themselves to simple or quick analyses. In this context, we highlight the Guidance Manual 'Integrating Ecosystem Services in Strategic Environmental Assessment: A guide for

[179] http://iflaeurope.eu/wp-content/uploads/sites/2/2014/03/EU-GI-IFLA-Europe-ECTP-v8-200114.pdf.
[180] http://ec.europa.eu/environment/eia/pdf/SEA%20Guidance.pdf

practitioners'[181]. The aim of this guidance is to better integrate ecosystem assessment, scenario development and economic valuation of ecosystem services into development planning at various scales (national, sub-national and local).

As indicated by IFLA, platforms providing guidance and information on GI are needed. In this context we link to Task 3 of this contract in which an evaluation was made on how to improve the digital disclosure of GI information through EC and sector-based platforms.

4.5.2 Green procurement

European and the Member States' public authorities are major consumers. By using their purchasing power to choose environmentally friendly goods, services and works, they can make an important contribution to sustainable consumption and production – what is called Green Public Procurement[182], or GPP. All of the nine sectors that have been evaluated will have activities or business ongoing with public authorities. Therefore, the way GI is included in GPP will have a major impact on how GI will be considered in activities and businesses. GPP therefore will be key to ensure GI procurement. What may be needed is to develop and establish a GI Public Procurement (GIPP) to include in public tenders the use of GI as innovative solutions presenting a real alternative to standard grey infrastructure.

Although GPP is a voluntary instrument, it has a key role to play in the Europe's efforts to become a more resource-efficient economy. It can help stimulate a critical mass of demand for more sustainable goods and services which otherwise would be difficult to get onto the market. GPP is therefore a strong stimulus for eco-innovation. To be a success, GPP needs clear and verifiable environmental criteria for products and services. A number of European countries already have national criteria, and the challenge now, as GPP becomes more widespread, is to ensure that the criteria are compatible between Member States. A level playing field will boost the single market, ensuring that what is good for the EU is also good for the environment.

The EU GPP criteria are developed to facilitate the inclusion of green requirements in public tender documents. These criteria have been developed for a variety of different product groups[183]. There is a well-defined process for setting criteria including the possibility for stakeholder participation[184]. It is also agreed for the possibility of revising the existing GPP criteria. Therefore, with developments in the field of GI, it is possible to have criteria designed to be favourably contribute to the deployment of GI.

4.5.3 Finding the appropriate standard

For users of standards, the ability to understand which set of standards is required for specific applications and to easily find and get access to those standards could be rather challenging. There is no obvious, simple and non-time consuming way of understanding which standards are most suitable to meet needs. Therefore, users require assistance in finding the 'needle in the haystack' standard that matches their needs. A way forward therefore would be to investigate ways to facilitate the search and access to standards. There could be a role here for sectorial organisations to facilitate for their members the search for appropriate standards and to provide

[181] http://www.proecoserv.org/images/docs/sea/2014Guideline%20ES%20into%20SEA-unep-proecoserv.pdf
[182] http://ec.europa.eu/environment/gpp/index_en.htm
[183] http://susproc.jrc.ec.europa.eu/product_bureau/projects.html
[184] http://ec.europa.eu/environment/gpp/gpp_criteria_process.htm

guidance on what can be achieved with which standard. This is indeed undertaken in practice by several of the references included in this report where the overview of standards is given on methodologies, tools and the like. In addition, it may be considered to also work on this with the standards-making bodies. For example, this could lead to exploring possibilities for a collaborative interactive database with a hierarchical tree facilitating location of standards and gaining insight into what can be done with shortlisted standards.

4.5.4 Harmonization across infrastructure sectors

Each of the infrastructure sectors (e.g. buildings, transport, energy, water) have their own standards on performance, procedure and methodology. In the past, each of these sectors was mainly operating in isolation from the other sectors. However, over recent years, integrated approaches have become more common. Therefore, it may be seen as an opportunity that the sectors we reviewed have large potential for improving on the way GI is included in standards. Indeed, rather than each sector working on improving the way GI is included there is potential for collaborative action and harmonization across sectors on including GI into standards on performance, procedure and methodology.

5 Task 5 - Assessing costs and benefits of establishing a TEN-G

Chapter summary

Task 5 included all exploratory work related to the potential introduction of a Trans-European Network for Green Infrastructure (TEN-G) in order to determine whether a TEN-G approach is a feasible and sensible way of improving the uptake of GI across Europe.

The rationale for possibly setting up a TEN-G stems from the objective of the EU's GI related policy ambitions to have an EU network of green infrastructure in optimal condition to deliver essential ecosystem services throughout Europe. To promote sustainability, recovery and maximum effectiveness, there should be an interlocking, coherent and co-ordinated approach across the different spatial scales (local, regional, national, EU) to the mapping and assessment of the ecosystem condition and to the identification of priorities for GI intervention/investment.

At the level of the EU, a TEN G would involve the promotion of strategic investments in the EU network of Green Infrastructure motivated by:

1. the need to protect, restore and enhance the overall quality of the network and to maintain certain minimum quality levels to ensure the continued delivery of ecosystem services;
2. the need to protect, restore and enhance the delivery of priority ecosystem services in identified geographic locations at a scale which transcends administrative boundaries, taking into account in particular trans-boundary impacts; and
3. social and/or cultural considerations that transcend administrative boundaries (e.g. the Green Belt initiative following the line of the "iron curtain" or the pilgrimage route to Santiago de Compostella).

To this end, TEN-G exploratory work that has been carried out under the service contract. Chapter 5.1 first summarises what we can learn from existing trans-European infrastructure networks (energy and transport) in terms of the possible design options of a TEN-G. As a second step (as presented in Chapter 5.2), the team developed a baseline estimating the current EU funding levels for GI under the existing GI policy and funding structures in order to compare and contrast the expected costs and benefits of a TEN-G to a situation without it.

The **key outputs** for the **GI baseline scenario** can be summarised as follows:

- **During the 2014 – 2020 programming period, we estimate that green infrastructure will likely receive EU finance amounting approximately to €6,397 million by public EU funds** through various funding mechanisms, namely: LIFE+; the European Regional Development Fund (ERDF), the European Social Fund (ESF) and the Cohesion Fund[185]; the European Agricultural Fund for Rural Development (EAFRD); and the European Fisheries Fund (EFF)[186]. This is an average of **approximately €915 million** per year.
- Based on the current distribution of this amount spread across the different types of GI components, a **TEN-G could focus on promoting projects that enhance natural and artificial connectivity, as this is an underfunded area under the current set-up and could also contribute to reducing fragmentation**.

Building on this baseline, the team implemented a **first-phase assessment of costs and benefits of a potential TEN-G versus continuing the current GI policy and funding structures**. Whilst the assessment process is high level and subject to a number of uncertainties, the **findings indicate** that **a TEN-G has the potential to provide greater benefits per € invested than the current GI policy implementation and funding allocation** (as described under the baseline scenario). Considering only the top five ranked components in the assessment, the benefit-cost ratio (BCR) for TEN-G is more than double the BCR under the current funding allocation. If the goal is to maximise the BCR (as opposed to focusing on particular environmental or social priorities), then the top five priority components that could make up a TEN-G network are: Natura 2000 sites, Extensive agricultural landscapes, Regional and National parks, Multi-functional sustainable managed agricultural landscapes, and Wilderness zones. The ranking of priority components changes when the aim is to maximise the level of environmental or social benefits delivered.

[185] These three funds present their project beneficiaries together, without specifying which amounts come from CF, ERDF and ESF.
[186] For the period 2014-2020, the EFF is replaced by so-called European Marine and Fisheries Fund (EMFF)

Other findings of the assessment include:

- Overall, the results indicate that directing money towards components already known for their high environmental value (e.g. Natura 2000 sites) can result in benefits. However, if the **list of components funded** is extended to consider the top components in terms of maximising the BCR, contributing to social priorities and contributing to environmental priorities, the results show that a wider variety of components should be prioritised under a TEN-G.
- **Operating at an EU scale** rather than at Member State level enables the network to focus on those components that will provide the most benefits to Europe for the money invested, since the area of land available for implementation of such components is far greater than that available to one Member State. Therefore, at a theoretical level, the overall benefits of setting up a TEN-G would outweigh the costs, since the network could focus on implementing those components that provided the greatest benefits. At a practical level, considerations other than space would need to be taken into account to ensure that the TEN-G was comprehensive and inclusive, and shared benefits across the EU-28. However, such a network could still be far more cost beneficial than the current allocation of funding across the various GI components. Factors to take into account in the development of TEN-G would include the existing spread of GI components across the EU (to avoid imbalances between Member States), the condition of existing components, and the location of settlements and their current access to GI components (which affects the value of some of the benefits provided).

Introduction

This introduction provides a summarised overview of the key GI features rendering it suitable for potentially capturing European added value under a common trans-European network structure. The introduction also highlights the current implementation and knowledge status as regards the concept of a network of GI. The introduction concludes with capturing the rationale for investigating the possible costs and benefits of establishing a TEN-G as compared to retaining the current status quo.

Key GI features suitable for capturing European added value

The **cross-sectoral and cross-scale applications of GI solutions** make it an interesting tool to apply across various sectors on local, regional, national as well as European levels. A coordinated approach for prioritising Green Infrastructure investment could potentially be beneficial for all stakeholders involved.

Given the wide definition of GI, measures can range from green roofs, to wildlife overpasses, to urban farming as well as biodiversity-rich business parks. The large variety of cross-sectoral applications of GI on the one hand is an immense advantage to offer solutions to various societal and environmental challenges. On the other hand, the broad coverage also represents a certain challenge as it is difficult for decision-makers to grasp the comprehensiveness and complexities of the topics and possible applications involved. Figure 11 overleaf provides a non-exhaustive visual illustration of different types of GI measures that can be applied as solutions for various sectoral challenges.

Figure 11 Illustration of different types of GI measures applied in Europe

[Source: Trinomics]

As mentioned before, GI is a spatial concept providing services at different scales. Application of GI measures can therefore range from local, to regional, to national and EU levels. Table 19 depicts the wide range of GI measures/components grouped by their different types of functions and their applicability on the different scales. This GI component categorisation is used throughout the Task 5 analysis as the basic units for attaching cost and benefit measures.

Table 19 GI components by type and scale[187]				
Descriptor	**Scale**			**Actions**
	Local	**Regional/national**	**EU**	
Core areas – inside protected areas	Local nature reserves, water protection areas, landscape protection areas, Natura 2000 sites	Regional and National parks and wilderness zones (including Natura 2000 sites)	Ecological networks with cross-border areas, including Natura 2000 network	Management of sites to maintain or enhance their conservation status
Core areas – outside protected areas	Natural and semi-natural ecosystems, such as pastures, woodland, forest, ponds, bogs, rivers and floodplains, coastal wetlands, lagoons, beaches, marine habitats	Extensive agricultural and forest landscapes, large marsh and bog areas, rivers and floodplains, shorelines/coastal zones	Freshwater systems, major river basins, mountain ranges, regional sea basins	Management of land to maintain it in its current condition
Restoration zones	Restored areas which were before fragmented or degraded natural areas, brownfield land or disused quarries, transitional ecosystems due to land abandonment or regeneration processes	Restored ecosystem types	Restored landscape systems covering a substantial part of agricultural/forestry areas, and industrialised sites, including cross-border areas	Actions associated with restoration and then ongoing management of the land once it has been restored
Sustainable use zones	High nature value farmland and multi-use forests (such as watershed forests), protection forests (against avalanches, mudslides, stonefalls, forest fires), natural buffers such as protection shorelines with barrier beaches and salt marshes	Extensive agricultural landscapes, sustainable forest management on regional and national levels, functional riparian systems	Transboundary landscape features on river basin or mountain range level, sustainable coastal and marine management zones related to the respective sea basin	Actions associated with moving to sustainable use and then ongoing management of the land once it is being used sustainably
Green urban and peri-urban areas	Street trees and avenues, city forests/woodlands, high-quality green public spaces and business park/premises, green roofs and vertical gardens, allotments and orchards, storm ponds and sustainable urban drainage systems, city reserves including Natura 2000	Greenways, green belts, metropolitan park systems	Metropolitan areas with substantial share of high quality, green areas in Europe, including coherent approaches in cross-border urban zones	Actions associated with implementing green urban and peri-urban areas and then ongoing management of the land once in place
Natural connectivity features	Hedgerows, stone walls, small woodlands, ponds, wildlife strips, riparian river vegetation, transitional ecosystems between cropland, grassland and forests	Multi-functional, sustainably managed agricultural landscapes, riparian systems	Supra-regional corridors, substantial share of structure-rich agricultural, forestry or natural landscapes	Actions associated with implementing natural connectivity features and then ongoing management of the land once in place
Artificial connectivity features	Eco-ducts, green bridges, animal tunnels (e.g. for amphibians), fish passes, road verges, ecological powerline corridor management	De-fragmented landscapes, improved areas along transport and energy networks, migration corridors, river continuum	European-wide or transnational defragmentation actions	Actions associated with implementing artificial connectivity features and then ongoing management of the land once in place

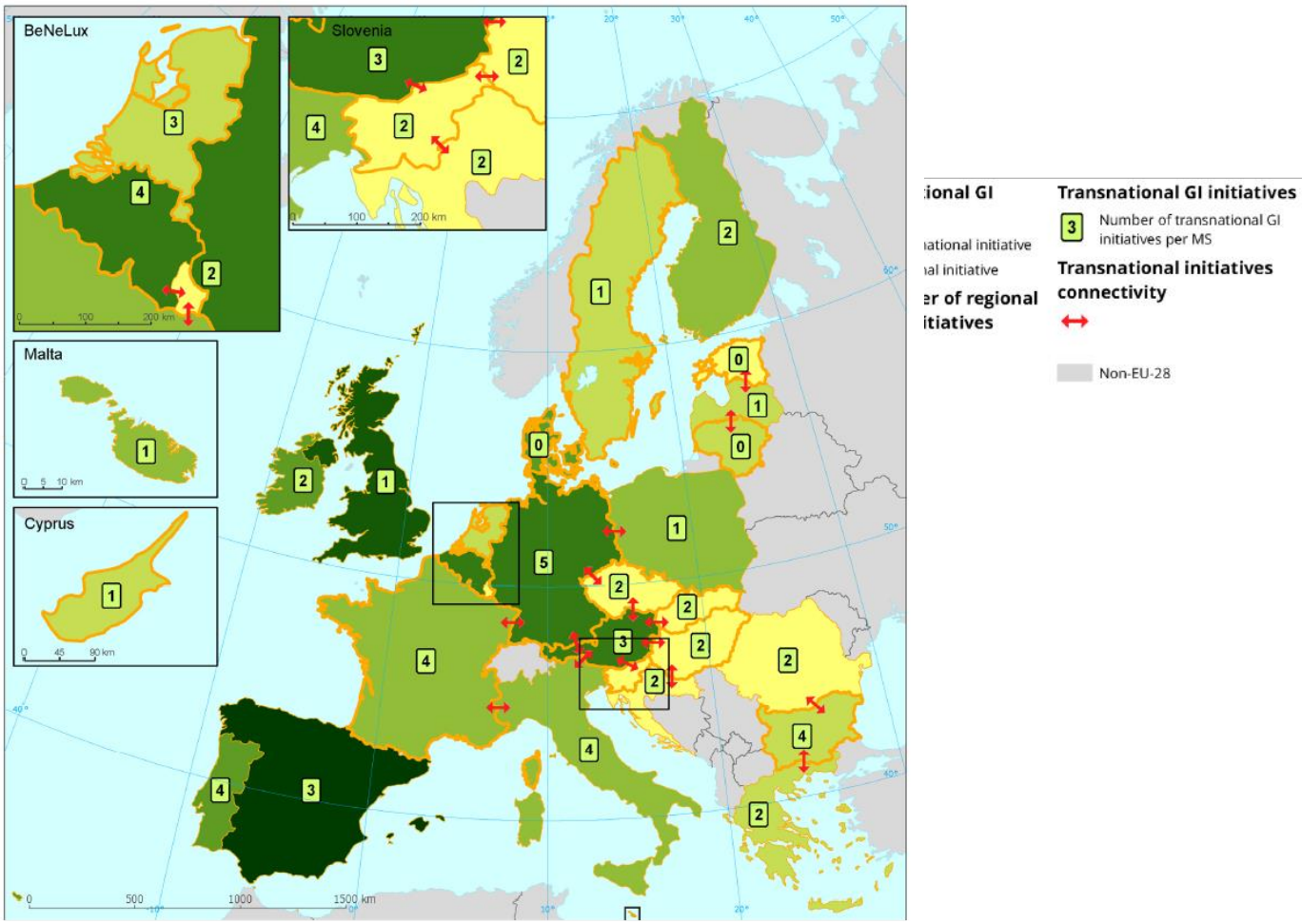
[187] Source: http://ec.europa.eu/environment/nature/ecosystems/docs/Table%203%20Gi.pdf

GI implementation progress by Member States

The following map provides an overview of reported GI initiatives across different scale levels for the EU-28 Member States. The map depicts different levels of GI initiatives per EU-28 Member State. Orange country outlines are representing the realisation of GI initiatives on national level. Projects limited to regional or local scale are visualised by shades of green colour for country territories ranging from 0 to 6 initiatives per Member State. At the highest spatial level transboundary initiatives connecting multiple countries are described by arrow symbols at the common borders.

As can be seen from the map (Figure 12), cooperation and coordination not only across regional borders, but also on a national as well as cross-border level is already being initiated for some GI initiatives when such cooperation is seen as mutually beneficial – even without a coordinated TEN-G in place. Further, it should be noted that the total number of GI initiatives reported in this map is not exhaustive and the types of GI measures implemented also range across a wider spectrum.

Figure 12 Reported GI initiatives across EU-28 by 2015



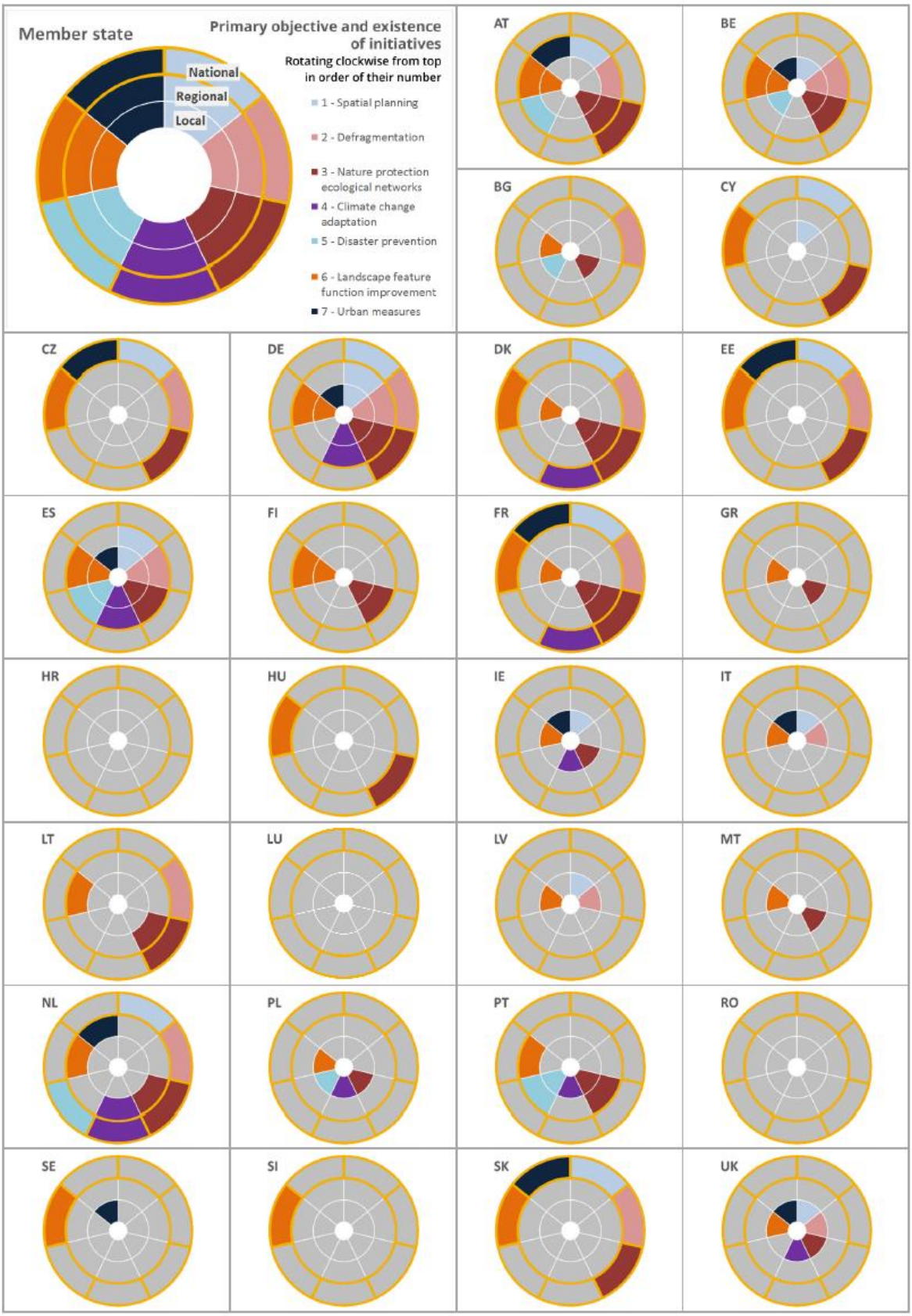
[Sources: EEA/ETC-ULS, 2015 for the Green Infrastructure Implementation and Restoration Working Group, European Commission, 2015]

Figure 13 overleaf depicts a cross-check of reported existing GI initiatives versus each Member State's primary GI objectives.[188] As can be seen from the visualisation, no general trend patterns can be concluded. While some Member States have solely worked on national level implementation to date, others have so far only implemented local measures. Similarly, there is a wide spread across the different types of GI components that are being implemented; though it seems that to date GI measures implemented for the objectives of 'nature protection and ecological networks', 'defragmentation', as well as 'landscape feature function improvement' are prioritised in many MS. However, this prioritisation can also possibly be explained by the selection of GI measures that has been included here, which are likely those easily recognisable as 'GI', i.e. those that help defragment and build ecological networks.

This brief review of the current GI implementation status by Member States sheds a light on those areas that may more likely be covered by national / local initiatives and ambition versus those areas that may be better off if coordinated on a European scale via a structured approach under a potential TEN-G.

[188] It should be noted that the GI initiatives presented in this figure are most likely not a complete overview for every MS. These are the ones that have been reported as GI by the national representatives to the EU Working Group on Green Infrastructure and Restoration. More 'hidden' projects, such as those funded under the European Cohesion Fund or the European Fisheries Fund, which may only have a GI component as part of their overall project, have likely not been captured here.

Figure 13 Cross-check of reported existing GI initiatives versus primary GI objectives, EU-28



[Sources: EEA/ETC-ULS, 2015 for the Green Infrastructure Implementation and Restoration Working Group, European Commission, 2015]

The rationale for developing a TEN-G

The spatial arrangement of green and grey elements in Europe has been shaped predominantly by geology, climate, nature and centuries of human intervention. It is only relatively recently that we have started to explore the opportunities for looking strategically at the green elements in the landscape and seeing these individual elements as a part of a network as opposed to a random patchwork. As defined in the European Commission's Communication, Green Infrastructure is "a strategically planned **network** of natural and semi-natural areas--- designed and managed to deliver a wide range of ecosystem services" that can maximize the benefits from ecosystems services to society.

The overall objective of the EU's GI related policy ambitions therefore is to have an EU network of green infrastructure in optimal condition to deliver essential ecosystem services throughout Europe. However, in practice priorities will need to be identified. To promote sustainability, recovery and maximum effectiveness, there should be an interlocking, coherent and co-ordinated approach across the different spatial scales (local, regional, national, EU) to the mapping and assessment of the ecosystem condition and to the identification of priorities for GI intervention/investment.

At the level of the EU, a TEN-G would involve the promotion of strategic investments in the EU network of Green Infrastructure motivated by:

1. the need to protect, restore and enhance the overall quality of the network and to maintain certain minimum quality levels to ensure the continued delivery of ecosystem services;
2. the need to protect, restore and enhance the delivery of priority ecosystem services in identified geographic locations at a scale which transcends administrative boundaries, taking into account in particular trans-boundary impacts; and
3. social and/or cultural considerations that transcend administrative boundaries (e.g. the Green Belt initiative following the line of the "iron curtain" or the pilgrimage route to Santiago de Compostela).

To this end, the remainder of Chapter 5 captures the analysis and results from the TEN-G exploratory work that has been carried out under the service contract. Chapter 5.1 first summarises what we can learn from existing trans-European infrastructure networks (energy and transport) in terms of the possible design options of a TEN-G. Chapter 5.2 builds on the initial broad review provided in this introduction and builds the baseline scenario reflecting the current status quo in terms of policy and corresponding GI funding levels. Chapter 5.3 delivers the cost-benefit assessment evaluating whether a TEN-G can deliver a higher benefit-cost ratio than the current situation. Chapter 5.4 concludes on the policy implications of Task 5 findings.

5.1 Learning from the Trans-European Networks (TENs)

The Trans-European Networks (TENs) in the areas of transport (TEN-T), energy (TEN-E) and telecommunications (eTEN) exist in EU policy since 1993. TENs aim to link European regions, to support the functioning of the internal market and to connect Europe with other parts of the world.[189] The main EU instruments to carry out this policy are the *Union Guidelines* which set out objectives and priorities and outline measures for establishing and developing networks; and an EU *infrastructure fund* (the Connecting Europe Facility) to support projects of common interest.

Title XVI, Articles 170 – 172 of the Treaty on the Functioning of the European Union (TFEU) provides the current legal basis for establishing the TENs.

Treaty on the Functioning of the European Union, Title XVI: Trans-European Networks

Article 170

1. To help achieve the objectives referred to in Articles 26 [establishing and ensuring the functioning of the internal market] and 174 [strengthening the Union's economic, social and territorial cohesion] and to enable citizens of the Union, economic operators and regional and local communities to derive full benefit from the setting-up of an area without internal frontiers, the Union shall contribute to the establishment and development of trans-European networks in the areas of transport, telecommunications and energy infrastructures.

2. Within the framework of a system of open and competitive markets, action by the Union shall aim at promoting the interconnection and interoperability of national networks as well as access to such networks. It shall take account in particular of the need to link island, landlocked and peripheral regions with the central regions of the Union.

Article 171

1. In order to achieve the objectives referred to in Article 170, the Union:

- shall establish a series of guidelines covering the objectives, priorities and broad lines of measures envisaged in the sphere of trans-European networks; these guidelines shall identify projects of common interest,

- shall implement any measures that may prove necessary to ensure the interoperability of the networks, in particular in the field of technical standardisation,

- may support projects of common interest supported by Member States, which are identified in the framework of the guidelines referred to in the first indent, particularly through feasibility studies, loan guarantees or interest-rate subsidies; the Union may also contribute, through the Cohesion Fund set up pursuant to Article 177, to the financing of specific projects in Member States in the area of transport infrastructure.

The Union's activities shall take into account the potential economic viability of the projects.

2. Member States shall, in liaison with the Commission, coordinate among themselves the policies pursued at national level which may have a significant impact on the achievement of the objectives referred to in Article 170. The Commission may, in close cooperation with the Member State, take any useful initiative to promote such coordination.

3. The Union may decide to cooperate with third countries to promote projects of mutual interest and to ensure the interoperability of networks.

Article 172

The guidelines and other measures referred to in Article 171(1) shall be adopted by the European Parliament and the Council, acting in accordance with the ordinary legislative procedure and after consulting the Economic and Social Committee and the Committee of the Regions.

Guidelines and projects of common interest which relate to the territory of a Member State shall require the approval of the Member State concerned.

[189] http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/legal-basis_en.htm

The TENs were set up by the 12 Member States at the time. In 1996, the first "Community guidelines" for setting up a TEN-T were adopted and, subsequently, modified in 1999.[190] A substantial review of TEN-T launched in 2009 and led to the adoption of a new legislative framework that came into force in 2014.[191]

Of particular importance for green infrastructure is TEN-T. Compared to other regions of the world, the European landscape is densely populated and its active land use is high. Grey infrastructure (roads, railways, bridges and energy networks) has expanded significantly and, as a consequence, the size and amount of core nature areas has diminished, leaving remaining reserves fragmented across the continent. This fragmentation has a negative impact on ecosystems and biodiversity hindering wildlife from migrating between different habitats. To achieve the ambitious EU target of halting the loss of biodiversity in the EU by 2020, it is crucial to connect the core nature areas. Green infrastructure can play a key role in this regard.

The existing Trans-European Networks may provide, to some extent, a model for the establishment of TEN-G in terms of governance and financing mechanisms, although the objectives of TEN-G would be broader than those specified in the TFEU for the TENs.

The following sections provide an overview of TEN-T and TEN-E and the 'lessons learnt' from their establishment which could potentially be applicable to TEN-G. Since the Trans-European Telecommunications Network (eTEN) is largely based on the same principles as the other two TENs, but less connected to TEN-G in direct physical terms, it was not examined in detail in this study.

5.1.1 Learning from the Trans-European Network for Transport (TEN-T)

TEN-T stands for the Trans-European network for Transport (TEN-T) and consists of a transport infrastructure policy that includes projects on road, rail, maritime, inland waterways, air, logistics, co-modality and innovation. Understanding the construction of TEN-T can help us in framing a possible TEN-G.

Objectives and regulation of TEN-T

The main objectives of TEN-T are to close the gaps in the transport networks between European Member States, to remove bottlenecks that hamper the smooth functioning of the internal market, and to overcome technical barriers (e.g. incompatible standards for railway traffic).

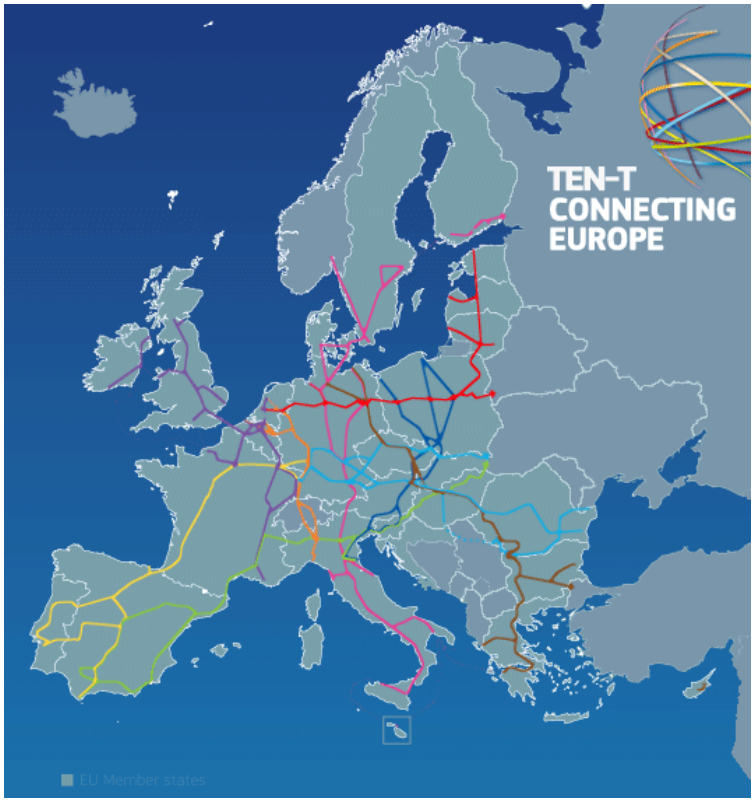
TEN-T was first adopted in 1996. The guidelines for the network's development were then reviewed in 2009 (with an analysis of strengths and weaknesses) for the period 2014-2020. TEN-T policy is currently laid down in Regulation (EU) No 1315/2013.[192]

[190] http://ec.europa.eu/transport/themes/infrastructure/ten-t-policy/index_en.htm
[191] http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/legal-basis_en.htm
[192] Regulation (EU) No 1315/2013 of the European Parliament and of the Council of 11 December 2013 on Union guidelines for the development of the trans-European transport network and repealing Decision No 661/2010/EU.

Revisions to the guidelines
The Green Paper "Towards a better integrated trans-European transport network at the service of the common transport policy" published in February 2009 prompted the TEN-T policy review process. With a view to the EU's Financial Framework for 2014–2020, the European Commission launched a policy review in 2009. The review process led to the new legislation on TEN-T, adopted in December 2013. The main novel aspects that the revision of 2009 brought were: governance at EU level, a strong legal form, a genuine network approach and a powerful instrument for TEN-T funding. The revised TEN-T approach includes a new north-south orientation for the corridors recognising that the south of the EU is mostly affected by the financial crisis of 2007. It also gives priority to transport by sea, for being more environmentally friendly and reliable.

As foreseen by the 2013 Guidelines, so-called 'core network corridors' (see Figure 14) were introduced to facilitate the coordinated implementation of the core network. Nine core network corridors are identified in the annex to the Regulation establishing the Connecting Europe Facility (CEF), which includes a list of projects pre-identified for possible EU funding during the period 2014 - 2020, based on their added value for TEN-T development and their maturity status.[193] The ultimate objective of such corridors is to complete seamless connections in order to deliver efficient, future-oriented and high-quality transport services for citizens and economic operators. The corridors also aim at integrating rail freight corridors, promoting clean fuel, advancing telematics, integrating urban areas, and enhancing safety. This 'core' transport network is to be supported by a 'comprehensive network' of routes feeding into the core networks at regional and national level.

Figure 14 European TEN-T core network corridors



[Source: European Commission (2016) http://ec.europa.eu/transport/themes/infrastructure/index_en.htm]

[193] http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/corridors/index_en.htm

The instruments used in the development of TEN-T – in particular, guidelines adopted at EU level (through the ordinary legislative procedure) setting out the priorities and broad lines of measures for developing TEN-T and a framework for identifying projects of common interest – may provide a model for a future legislative framework on TEN-G.

Budget and eligibility for TEN-T funding

The Trans-European Networks are partly funded by the EU - through the Connecting Europe Facility (CEF) adopted in 2013, the Cohesion Fund and the European Regional Development Fund (ERDF) – and partly by the Member States.[194] A similar financing model could potentially be applied to TEN-G.

The budget allocated to TEN-T for the period 2007-2013 was approximately €8 billion. For 2014-2020, the TEN-T component of the CEF amounts to €26.25 billion (of which €11.305 billion will be available only for projects in Member States eligible for the Cohesion Fund).[195] The Commission and the Member States estimated that the development of the TEN-T network during the period 2014–2020 would require about €500 billion of investments.[196]

CEF financing takes the form of grants awarded by the Commission, as well as contributions to innovative financial instruments such as project bonds issued by the European Investment Bank (EIB).[197] The CEF also includes project support actions, to help strengthen the Member States' and project promoters' ability to prepare project pipelines.[198] The CEF is intended to act as a catalyst for further private and public investment by giving infrastructure projects credibility and lowering their risk profiles.[199]

As EU funding has been fragmented between the TEN-T Programme (succeeded by the CEF), the Cohesion Fund and the ERDF, the 2011 White Paper 'Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system' recognised the need for "better coordination of the Cohesion and Structural funds with the transport policy objectives".[200]

TEN-T funding is open to MSs or, with the agreement of the MSs, international organisations, joint undertakings, or public/private undertakings or bodies. Two legal acts guide the allocation of EU financial support and provide information regarding the types of projects funded and amounts: 1) the TEN Guidelines[201] and 2) the CEF Regulation.[202]

[194] http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/project-funding/index_en.htm
[195] http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/project-funding/cef_en.htm
[196] European Commission (2015) Action Plan. Making the best use of new financial schemes for European transport infrastructure projects. Available at http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/doc/2015_06_03_cbs_action_plan_final.pdf
[197] http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/project-funding/financial-instruments_en.htm
[198] European Parliamentary Research Service (2015) Connecting Europe Facility. Briefing PE 565.903.
[199] http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/project-funding/financial-instruments_en.htm
[200] European Commission (2011) White Paper: Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system, COM(2011) 144 final.
[201] Regulation (EU) No 1315/2013 of the European Parliament and of the Council of 11 December 2013 on Union guidelines for the development of the trans-European transport network and repealing Decision No 661/2010/EU.
[202] Regulation (EU) No 1316/2013 of the European Parliament and of the Council of 11 December 2013 establishing the Connecting Europe Facility.

Eligible projects are projects of common interest and transport-related projects involving a cross-border section or a part of such a section whenever a written agreement exists between the MSs (and third countries) concerned. Priority projects were defined in the 2010 TEN-T Guidelines as projects meeting the following criteria:

(a) intend to eliminate a bottleneck or complete a missing link on a major route; cross-border projects, cross natural barriers or have a cross-border section;
(b) are on such a scale that long-term planning at European level contributes significant added value;
(c) present, overall, potential socio-economic net benefits and other socio-economic advantage
(d) significantly improve the mobility of goods and persons between MSs
(e) contribute to the territorial cohesion of the Union by integrating the networks of the new MSs and improving connections with the peripheral and island regions;
(f) improve safety and reduce environmental damage caused by transport, by promoting a modal shift towards railways, intermodal transport, inland waterways and maritime transport;
(g) demonstrate commitment to carrying out studies and evaluation procedures in time to complete the work in accordance with a date agreed.[203]

The 2013 Guidelines define projects of common interest as those which: contribute to at least two of the four categories of objectives of the trans-European transport network (i.e. cohesion, efficiency, sustainability, and increasing benefits for the network's users); comply with the Regulation's provisions concerning the development of the 'comprehensive network' and, if applicable, the 'core network'; are economically viable; and demonstrate European added value.[204]

Governance

The Commission's Directorate-General for Mobility and Transport (DG MOVE) defines TEN-T policy. The TEN-T Executive Agency[205] turns this policy into action by managing the individual TEN-T projects on behalf of the EC and by monitoring all open TEN-T projects (in the periods 2000-2006 and 2007-2013 funding schemes).

The transport Ministries of the European Member States remain fully involved in TEN-T projects because of their strategic importance at the national level. Construction in fact is often in the hands of national implementing bodies.

The EC nominated a so-called European Coordinator to support the development of each of the nine core network corridors and for two horizontal priorities: 1) the European Rail Traffic Management System (ERTMS) and 2) Motorways of the Sea. Coordinators act in the name of and on behalf of the EC and therefore cannot consist of individuals whose territory is directly affected by a corridor. The criteria for the selection is instead based on their knowledge of transport, financing and European institutions. Their mandate includes an array of tasks:[206]

- Drawing up the relevant corridor plan or the work plan for horizontal priority;
- Supporting and monitoring implementation of the work plan, highlighting difficulties, providing solutions;

[203] Decision No 661/2010/EU of the European Parliament and of the Council of 7 July 2010 on Union guidelines for the development of the trans-European transport network, Article 23.
[204] Regulation (EU) No 1315/2013, Article 7.
[205] Executive Agency established in October 2006 in order to realise the technical and financial implementation of the TEN-T programme. It ceased its activities on 31 December 2013 and was superseded by the Innovation and Networks Executive Agency (INEA).
[206] http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/european-coordinators/index_en.htm

- Regularly consulting the corridor forum;
- Making recommendations regarding transport development along corridors and access to financing/funding sources;
- Annual reporting of progress to the European Parliament, the European Council, the EC and the MSs.

In June 2015, the finalised work plans of the 11 European Coordinators for the TEN-T were approved, establishing the basis for action until 2030.[207]

Implementation experiences and lessons learnt
One of the most remarkable achievements of the experience with TEN-T is the smooth connection between Eastern and Western Europe in the aftermath of the 2004 enlargement.[208] Another success relates to its mode of governance – with an Executive Agency that turns policy into action - which has resulted in fewer delays and more influence over the projects.

It should be noted that despite TEN-T governance at the EU level, responsibility for completing the large numbers of projects rests almost entirely with the Member States, whose investment decisions are essentially driven by national objectives.

Providing adequate funding for TEN-T has been a key challenge since the programme's beginning. The European financial envelope dedicated to TEN-T in 2007-2013 did not have enough resources to cover the required spending on TEN-T (it amounted to €8,013 million, while the estimated needs were €250 billion. Funding available under the CEF for the 2014-2020 is considerably higher (€26 billion) but additional sources will still be necessary. Innovative financial instruments such as the EIB Loan Guarantee Instrument and the Risk Capital Facility represent additional promising ways of supporting TEN-T projects. The lion's share of investment (73%) between 2007 and 2013 had to come from national budgets or private financing.[209]

The bulk of the investment in transport infrastructure has been provided traditionally by the public sector, however in the aftermath of the financial crisis, government budgets cannot finance the transport infrastructure needs by 2020. At the same time, the volume of private participation in financing infrastructure projects in the EU remains relatively modest. The main sources of funding will continue to be national sources representing over 70% of TEN-T investment requirement, followed by EU grants and EIB standard loans.[210] In the case of cost overruns, the burden is borne by the Member States.[211] The TEN-T programme requires commitment by the project promoters for EU financial aid and by the MSs concerned to make a financial contribution to the project, mobilising private funds if necessary. The TEN-T funding covers only a small part of the total funding of the project and is generally given in the form of a grant. These considerations would also be relevant when developing funding instruments for TEN-G.

[207] http://ec.europa.eu/transport/themes/infrastructure/index_en.htm
[208] http://ec.europa.eu/transport/themes/infrastructure/ten-t-policy/index_en.htm
[209] Expert Group (2010) Final report of the expert group 2 – Integration of Transport Policy into TEN-T Planning, 19 April 2010
[210] Bodewig, K. and Secchi, C. (2014) Attracting investments towards transport infrastructure: potential lines of action. Brussels: DG MOVE, European Commission.
[211] European Commission (2011) Mid-term evaluation of the TEN-T Programme (2007-2013)

5.1.2 Learning from the Trans-European Network for Energy (TEN-E)

High-quality infrastructure is essential for the economic growth of European Member States and the EU as a whole. Reasonable prices for electricity, gas and oil in a unified European energy market depend on the existence of energy transmission grids covering the individual states and connecting them. Transformation to a sustainable economy with a large proportion of energy drawn from renewable sources will require major changes in the transmission grid infrastructure. Upgrading the existing infrastructure and building new infrastructure thus represents a major challenge for the coming decades and the EC is actively striving to promote it. TEN-E, which stands for the Trans-European Networks for Energy would serve this purpose.

Objectives and regulation of TEN-E

The objective of TEN-E is to help build and finance important energy infrastructure in order to connect EU countries currently isolated from European energy markets, strengthen existing cross-border interconnections, and help integrate renewable energy. Concretely, its aim is to:

- **Ensure effective operation of the internal energy market** through the interconnection, interoperability and development of trans-European networks for transporting electricity and gas;
- **Ensure security and diversification of supply** for instance by interoperability with the energy networks of third countries;
- **Strengthen territorial cohesion** through reducing the isolation of the less-favoured, island, landlocked or remote regions;
- **Promote sustainable development** by improving the links between renewable energy production installations and through more efficient technologies.

TEN-E is regulated by Regulation (EU) No 347/2013 of the European Parliament and of the Council of 17 April 2013 on guidelines for trans-European energy infrastructure repealing Decision No 1364/2006/EC and amending Regulations (EC) No 713/2009, (EC) No 714/2009 and (EC) No 715/2009. The Regulation's aim is to facilitate the timely development and interoperability of trans-European energy networks (TEN-E). In particular, the Regulation:

- addresses the identification of projects of common interest necessary to implement priority corridors and areas;
- facilitates the timely implementation of projects of common interest by streamlining, coordinating more closely, and accelerating permit granting processes and by enhancing public participation;
- provides rules and guidance for the cross-border allocation of costs and risk-related incentives for projects of common interest;
- determines the conditions for eligibility of projects of common interest for Union financial assistance.[212]

Budget and eligibility for TEN-E funding

The total TEN-E budget was 155 million euro in the period 2007-2013.[213] Funding sources are multiple, including the TEN-E budget line (around EUR 20 million per year, mainly intended for financing feasibility studies), the European Fund for Energy, Climate change and Infrastructure loans, the Structural and Cohesion Funds, the

[212] Regulation EU No 347/2013, Article 1 (2).
[213] http://www.crpm.org/pub/agenda/1856_jdh_-_connecting_europe__ten-e.pdf

European Neighbourhood and Partnership Instrument (ENPI), the Neighbourhood Investment Facility (NIF), the EU Research Programmes, and the European Investment Bank (EIB) loans.

In the programming period 2014-2020, the Trans-European Networks in the field of energy (TEN-E) are financed through the Connecting Europe Facility (CEF). The amount earmarked for trans-European energy infrastructure in the CEF is approximately €5.4 billion over the 2014-2020 Multiannual Financial Framework.[214]

Governance
The main instruments governing the implementation of TEN-E are Regulation 347/2013, which lays down guidelines for trans-European energy infrastructure, and Regulation 680/2007/EC (as amended by Regulation 347/2013) which sets out general rules for the financing of Trans-European Networks.

Following close consultations with Member States and stakeholders, the Commission identified 12 strategic trans-European energy infrastructure priority corridors (for electricity, gas and oil) and thematic areas whose implementation by 2020 was deemed essential for the achievement of the Union's energy and climate policy objectives. The TEN-E Regulation 347/2013 lays down rules for the timely development and interoperability of these priority corridors and areas. In particular, it sets out guidelines for streamlining the permitting processes for major energy infrastructure projects that contribute to European energy networks. Such projects, referred to as 'Projects of Common Interest' (PCIs), are selected by twelve regional groups established under the Regulation, composed of representatives from the Member States, the Transmission Systems Operators (TSO), the Commission, the Agency for the Cooperation of Energy Regulators and the European Network of Transmission Systems Operators (ENTSO). Project promoters wishing projects to be included on the "Union List" of PCIs apply to the regional groups, which adopt a regional list of proposed PCIs. Each individual proposal for a project of common interest requires the approval of the Member States to whose territory the project relates. Based on the Regional Lists, the Commission adopts a Union List of PCIs through a delegated act. For a project to be included in the list, it has to: have significant benefits for at least two EU Member States; contribute to market integration and further competition; enhance security of supply; and reduce CO_2 emissions. The Union list of PCIs is updated every 2 years.

The TEN-E guidelines state that PCIs should be implemented as quickly as possible and closely monitored and evaluated, while keeping the administrative burden for project promoters to a minimum. It also foresees that the Commission may designate European coordinators for projects facing particular difficulties.

As in the case of TEN-T, the financing and governance instruments of TEN-E could potentially provide a model for the development of TEN-G.

Implementation experiences, successes and hindrances
An ex-post evaluation of the TEN-E funding programme for 2000-2006[215] concluded that TEN-E had made a positive contribution towards the integration of gas and electricity markets, facilitating cross-border collaboration and encouraging greater public and private investment. However, the evaluation also highlighted a number of barriers to the programme's impact, including budget limitations and the fact that

[214] European Parliamentary Research Service (2015) Connecting Europe Facility. Briefing PE 565.903.
[215] Rademaekers, K. et al. (2009) Ex-Post Evaluation of the Trans-European Energy Networks (TEN-E) Funding Programme 2000-2006. Final report, DG TREN Framework Contract TREN/A2/143-2007, Rotterdam: ECOFYS and ECORYS.

priority actions were not suitably identified in advance. Calls for proposals attracted few applications, and sometimes of poor quality, so the allocated TEN-E budget often remained under-spent. These concerns were addressed in the current CEF, whose budget is substantially greater than that of TEN-E, and includes the identification of PCIs that outline priority areas for EU action and funding.[216]

The Impact Assessment accompanying the 2013 TEN-E Regulation[217] also highlighted a number of factors hindering the development of TEN-E under the previous legislative instruments. In particular, it concluded that lengthy and ineffective permit granting procedures, along with public opposition to the projects, were amongst the major reasons impeding the timely implementation of energy infrastructure projects. Long delays were caused, inter alia, by the complex and fragmented permit-granting process, the lack of binding time limits for the procedures in many MS, and opposition by landowners, citizens living in the vicinity of potential installations and stakeholder organisations. Other obstacles mentioned in the Impact Assessment include the lack of appropriate regulatory incentives and long-term signals to meet EU priorities, lack of coordination for cross-border investment approval processes, and the lack of innovative financial instruments at EU level which would support projects in a different manner than only by reducing the initial capital expenditure for investors. Since energy infrastructure projects are different in nature from the building blocks of a potential TEN-G, it is difficult to assess to what extent similar obstacles would impede the development of TEN-G. Nevertheless, issues such as budget limitations, the need for adequate incentives at EU level, and the need to set an effective framework for identifying and implementing priority projects appear, in principle, relevant in the context of TEN-G.

5.1.3 Conclusions regarding the future design of TEN-G

The overall lessons to be drawn from the set-up and implementation of TEN-T and TEN-E with respect to a possible architecture of a TEN-G framework can be summarised as follows:

- A future **legislative framework** for TEN-G could potentially have recourse to similar instruments as those used in the development of the existing TENs, i.e. guidelines adopted at EU level setting out the priorities and broad lines of measures for developing the network and a framework (including specific criteria) for identifying priority projects (or 'projects of common interest'), as well as a **dedicated EU fund** to support such projects.
- The architecture of TEN-G could potentially be based on **similar concepts**, such as 'core network corridors' supported by a broader network of features (akin to the 'comprehensive network' in TEN-T) feeding into the core network at regional/national levels.
- Elements of the current TENs' **governance structure** could also be mirrored in TEN-G, for example, the process for including projects of common interest on the 'Union List', the appointment of European coordinators, the delegation of responsibility for managing/overseeing the PCIs to an executive agency.
- TEN-G could be based on a similar **financing model** as the existing TENs, with funding provided partly by the EU (through a mix of grants and innovative financial instruments), partly by the Member States and private investors. The experience with TEN-T and TEN-E has highlighted the need to **use EU funding as**

[216] European Parliamentary Research Service (2015) Connecting Europe Facility. Briefing PE 565.903.
[217] Impact Assessment accompanying the Proposal for a Regulation of the European Parliament and of the Council on guidelines for trans-European energy infrastructure, SEC(2011) 1233 final.

a catalyst for other investment sources and to employ innovative financial instruments.

- In terms of **challenges** highlighted by the implementation of TEN-T and TEN-E, the need to secure adequate funding for the network and to set an effective framework for implementing priority projects (avoiding delays, facilitating the permitting process, avoiding conflicts among stakeholders, etc.) should also be borne in mind when designing TEN-G.

5.2 Developing the current TEN-G baseline

The **baseline scenario** (otherwise known as the *no-action scenario* or *business as usual*) of green infrastructure (GI) implementation in the EU is – for the purpose of this task - defined as the current scope of and expenditure on GI projects by the EU, assuming that policies continue as they are, and that a TEN-G network is not going to be implemented. Therefore, the baseline scenario assumes no *new* GI activities are taking place other than those already included in current policies, programmes and planning.

5.2.1 The methodology to estimate and assess the baseline

Our approach to estimate such a baseline has been twofold:

1) Defining the scope of GI;
2) Quantifying EU funding given to projects that fall under that definition.

We have defined the scope of GI in line with the building blocks of GI (the various elements or services of GI on the different scales – from local, to regional/national, to European scale - grouped by their function) as elaborated by the EC.[218] These are: core green areas within[219] and outside protected areas[220], restoration zones[221], sustainable use green zones[222], green urban and peri-urban areas[223], natural connectivity features[224], artificial connectivity features[225]. Everything that falls under those elements has been considered GI.

Subsequently, we have analysed different EU funding mechanisms for potential eligible projects per component type. GI projects have been sought for under LIFE+, the European Regional Development Fund (ERDF), the European Social Fund (ESF), the European Agricultural Guarantee fund (EAGF), the European Agricultural Fund for

[218] http://ec.europa.eu/environment/nature/ecosystems/docs/Table%203%20Gi.pdf.
[219] GI in protected areas include Nature reserves; Water protection areas; Landscape protection areas; Natura 2000 sites; Regional / National parks; Regional / National wilderness zones; Ecological networks
[220] GI outside protected areas includes Pastures; Woodland; Forests; Ponds; Bogs; Rivers; Floodplains; Coastal wetlands; Lagoons; Beaches; Marine habitats; Freshwater systems; River basins; Sea basins;
[221] Restored areas of previously fragmented or degraded natural areas; Brownfield land / disused quarries; Transitional ecosystems; Restored ecosystems; Restored landscape systems covering agricultural/forestry areas and industrialised sites
[222] High nature value farmland; Multi-use forests (e.g. watershed forests); Protection forests e.g. against avalanches, mudslides, stone fall, forest fires; Protection shorelines (e.g. with barrier beaches and salt marshes); Extensive agriculture landscapes; Sustainable forest management on regional/national level; Functional riparian systems; Transboundary landscape features on river basin or mountain range level; Sustainable coastal and marine management zones
[223] Street trees; City forests / woodlands; High-quality green public spaces; Business parks/premises; Green roofs; Vertical gardens; Allotments and orchards; Storm ponds; Sustainable urban drainage systems; City reserves; Greenways; Green belts; Metropolitan park systems
[224] Hedgerows; Stone walls; Small woodlands; Ponds; Wildlife strips; Riparian river vegetation; Transitional ecosystems between cropland, grassland and forests; Multi-functional, sustainably managed agricultural landscapes; Riparian systems; Supra-regional corridors; Structure-rich agricultural, forestry or natural landscapes
[225] Eco-ducts; Green bridges; Animal tunnels; Fish passes; Road verges; De-fragmented landscapes; Improved areas along energy and transport networks; Migration corridors; River continuum.

Rural Development (EAFRD), the European Marine and Fisheries Fund (EMFF), and the Cohesion Fund. For each of these funds[226], we have accessed databases of project funding beneficiaries and have screened all projects therein, in order to identify all those projects that we can consider to be GI projects. Overall, we have looked into every theme under which GI investments could be going on from environment, to climate, to urban development, to rural development, to water, etc. For a detailed overview of the filters applied for each fund, see Annex 17 "Method_LIFE_ERDF_CF_ESF_EAFRD_EFF". We have only included GI projects concerning *implementation* and have excluded awareness-raising and research aimed projects, as these do not directly expand green infrastructure as such.

For the purpose of the analysis, we have grouped projects according to their objective so as to grasp which aspects of GI are currently (not) covered by EU funding. The categories in which we have grouped projects read as follows (inspired by the GI building blocks of the EU): core green (protected) areas, restoration zones, sustainable use zones, green urban and peri-urban areas, natural connectivity features, artificial connectivity features.

For every GI project identified, we have searched for the EU-funded amount. These amounts have then been recorded in an Excel database for the year they have been reported. It should be noted that the baseline therefore does not take into account potential delays in implementation or fund allocation.

The sum of all EU funds allocated to GI projects across all considered funding mechanisms forms the baseline for the 2007-2013 programming period, which we have then extrapolated to the current 2014 – 2020 programming period.

The remaining sub-sections of chapter 5.2 provide a more detailed information on the 2007-2013 data available on GI funding levels, an analysis of the differences between the two funding periods, and a presentation of the GI baseline that was consequently developed for the purpose of assessing the costs and benefits of establishing a TEN-G.

5.2.2 Analysis of funds allocated to GI in the period 2007-2013 (analysis of the Excel file)

The analysis presented here is based on the baseline excel file included as Annex 16.

Amounts and origin of GI funding

The result of the analysis of the Excel file entries show that for the period 2007-2013 green infrastructure received EU finance amounting to **€6,579 million** through various funding mechanisms, namely: LIFE+; the European Regional Development Fund (ERDF), the European Social Fund (ESF) and the Cohesion Fund[227]; the European Agricultural Fund for Rural Development (EAFRD); and the European Fisheries Fund (EFF)[228]. This is an average of almost **€940 million** per year.

Although in monetary terms the fund contributing most to GI by far appears to be the agriculture fund EAFRD, only around **1%** of its total budget (€420.7 billion) was allocated to GI between 2007 and 2013. That accounted for **€5,631 million** (**85%** of the total EU-funded GI). Proportionally speaking in fact, LIFE funds are the most important contributor to GI. Funding from LIFE amounts to almost **€774 million** for

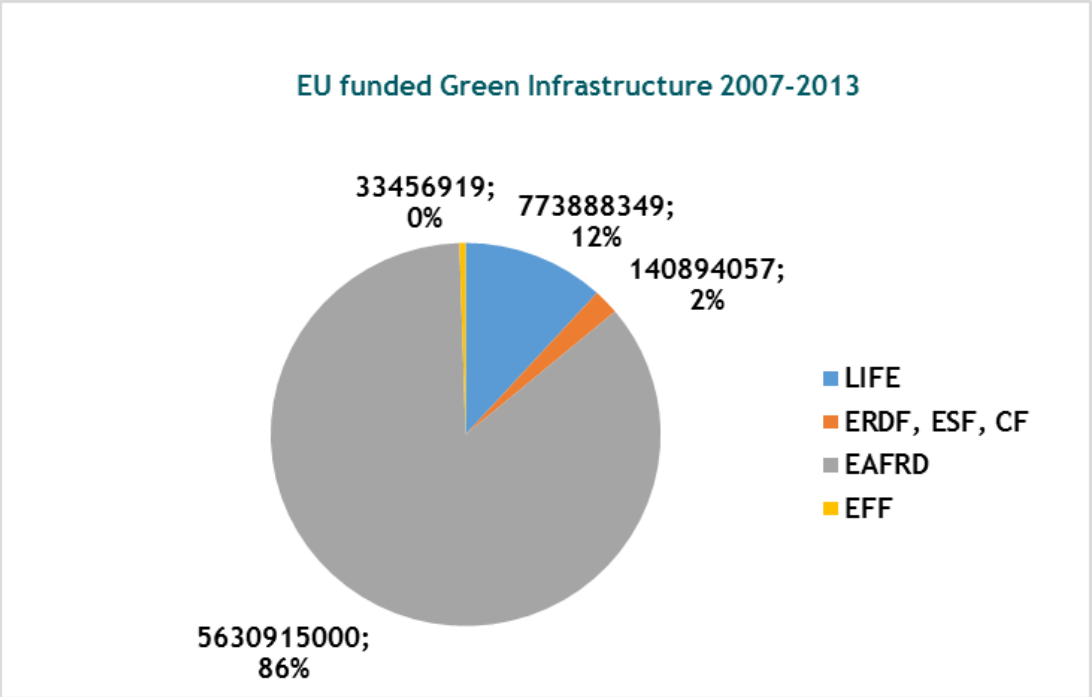
[226] Except for the agricultural funds for which project-level information for the period under consideration is not available

[227] These three funds present their project beneficiaries together, without specifying which amounts come from CF, ERDF and ESF.

[228] For the period 2014-2020, the EFF is replaced by so-called European Marine and Fisheries Fund (EMFF)

the period 2007-2013 (more than **20%** of the total EU-funded GI) which means that more than **36%** of the total LIFE budget is allocated to activities that can be considered GI. Less than **1%** of the total EFF budget has been invested in activities that can be considered GI implementation, accounting for **€33 million** in the period 2007-2013 (less than **1%** of the total EU-funded GI). A very small percentage (0.04%) of all the ERDF, CF and ESF budgets have also funded GI in the EU (amounting to **€140 million** for the period 2007-2013; **2%** of the total EU-funded GI).

Figure 15 Contribution of EU funds to GI in total € values (2007-2013)

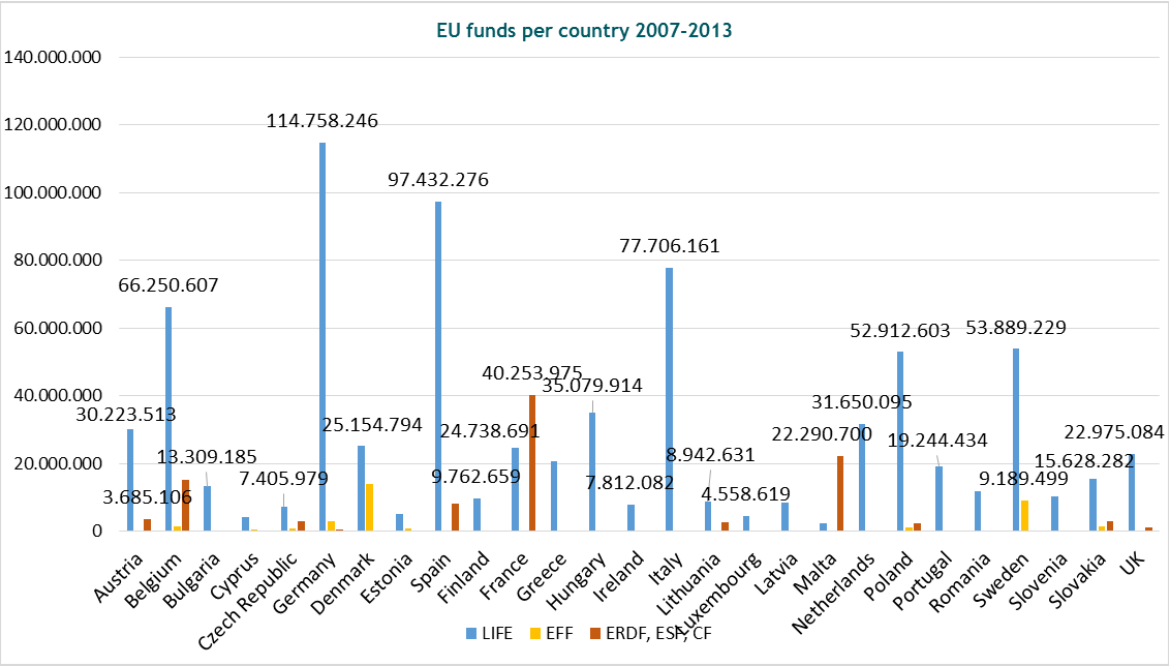


[Source: Own analysis based on gathered data]

The countries making most use of LIFE funds are Germany, Spain, Italy and Belgium, in that order (see Figure 16). This indicates that although Germany is not the top beneficiary of total LIFE funds (the LIFE evaluation available shows that Italy and then Spain are the main beneficiaries of the total LIFE funds and Germany the third[229]), it places a greater focus on GI than does, for instance, Italy.

229 http://ec.europa.eu/environment/life/publications/lifepublications/evaluation/documents/LIFEplus_mte_annexes.pdf

Figure 16 EU funds per country (in €) (2007-2013)

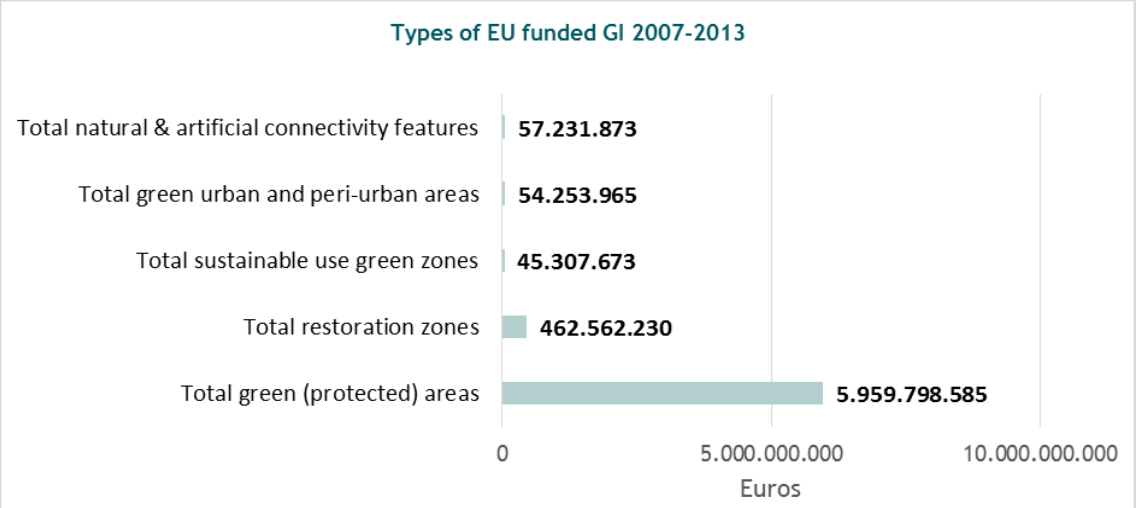


[Source: Own analysis based on gathered data]

The aspects of GI currently funded and the gaps in such funding

Between 2007 and 2013 funding has primarily been allocated to finance the conservation of green areas (**€5,960 million**; **90%** of all GI funding) and restoration of green areas (**€462 million; 7%** of all GI funding) (see Figure 17). By contrast, GI funding for sustainable use of zones, green urban and peri-urban areas and natural and artificial connectivity features was in this period relatively very scarce (less than **1%** of all GI funding each). These building blocks of GI can be considered underfunded in the baseline situation.

Figure 17 Types of EU-funded GI (in €) (2007-2013)



[Source: Own analysis based on gathered data]

LIFE captures a variety of elements across all realms of GI, especially funding biodiversity conservation and restoration, but also a few sustainable use, urban and connectivity-related projects. The projects falling under sustainable use of zones regarded mainly sustainable management of water habitats and green areas. Investments in urban and peri-urban areas involve green roofs, city parks, urban forestation and the like. Connectivity projects under LIFE are wild. There is no indication of financing having been provided to projects dealing with other connectivity-related GI such as eco-ducts, green bridges, areas along energy and transport networks. GI implementation is not the ultimate aim of the projects. Instead, the implementation of GI is the result or the means though which projects that aim at, for example, biodiversity conservation/restoration, greening of urban areas and increased liveability are realised.

For the rest of the funds, a very small part of what it is funded corresponds to GI. The ERDF covers projects across various elements of GI, from conservation and restoration to connectivity and urban interventions. It is also the fund in which GI cross-boundary projects –involving various countries- are funded. The EAFRD on the other hand only finances aspects of GI that concern conserving, expanding or restoring green (rural) areas. The EFF is an interesting case for the stark differences found between countries in the number and the type of projects with a GI component that are implemented. For instance, while GI projects related to the marine environment were not found in Austria or Portugal, plenty of these projects were found for Denmark. Spain, which benefits massively from these funds, has just implemented a handful of projects that can considered GI. Overall, the focus of the EFF is primarily on funding marine ecosystems restoration and (re-)stablishing fish passes and artificial riffs.

The above sheds light on the extent to which current funding covers the different elements of GI. Current funding for conservation and restoration is significantly greater than for other categories. Certain GI elements have not received any funding. With regard to sustainable land use, for instance, sustainable agriculture or crop rotation are currently not covered by EU funding. Investments in greening urban and peri-urban areas fail to address greenways and green belts. Connectivity mostly funds fish passes and animal corridors while there is no indication of funding allocated to projects dealing with other connectivity-related GI such as eco-ducts, green bridges, areas along energy and transport networks.

5.2.3 Differences between the programming periods 2007-2013 and 2014-2020

This section highlights the differences between the two programming periods to be taken into account when extrapolating the GI funding baseline from the past to the current programming period.

LIFE

As outlined by the LIFE programme website, the programming period 2007-2013 had a budget of €2,143 million. The programme consisted of three components: 1) LIFE+ Nature and Biodiversity, 2) LIFE+ Environment Policy and Governance, and 3) LIFE+ Information and Communication. **Up to 50% of the budget at least was dedicated to the *LIFE+ Nature & Biodiversity*** component. This focused on co-financing best practice or demonstration projects that contribute to the implementation of the *Birds and Habitats Directives* and the *Natura 2000 network*, and innovative or demonstration projects contributing to the implementation of the objectives of the Commission's Communication on "*Halting the loss of biodiversity by 2010 – and beyond*". ***LIFE+ Environment Policy & Governance*** focused on co-financing innovative or pilot projects contributing to the implementation of European environmental policy and the development of innovative policy ideas, technologies, methods and instruments. It also helped monitor pressures on the environment (including the long-term monitoring of forests and environmental interactions). ***LIFE+ Information & Communication*** co-financed communication and awareness-raising campaigns on environmental, nature protection or biodiversity conservation issues, as well as projects related to forest fire prevention (awareness raising, special training).

For the LIFE 2014-2020 programming period, the Commission will allocate **€3,456.7 million.**[230] One innovative aspect of it is that it will include one sub-programme for environment and another one for climate which will get **€2,592.5 million, €864.2 million** budget respectively.[231] The 'Environment' strand covers three priority areas: environment and resource efficiency *(*implementation of environment policy and exclude market replication-oriented innovation); nature and biodiversity (biodiversity challenges, Natura 2000); and environmental governance and information (knowledge sharing, dissemination of best practices, better compliance, awareness raising campaigns). The 'Climate Action' strand covers climate change mitigation (reduction of greenhouse gas emissions*)*; climate change adaptation (increasing resilience to climate change); and climate governance and information (increasing awareness, communication, cooperation and dissemination on climate mitigation and adaptation).

ERDF

The ERDF supports programmes that intend to strengthen economic, social and territorial cohesion in the European Union by correcting imbalances between regions. For the period 2007-2013 the fund amounted **€200.7 billion**.[232] Funding priorities included research, innovation, environmental protection, risk prevention, and infrastructure investment especially in the least developed regions.[233] For 2014-2020 the available budget is **€187.4 billion**.[234] Priority areas are again research and development, and innovation; and expand to also include topics such as improving access to and quality of information and communication technologies; climate change and the transition towards a low-carbon economy; business support to SMEs;

[230] http://ec.europa.eu/environment/life/about/documents/life2014-2020.pdf
[231] http://ec.europa.eu/environment/life/about/documents/life2014-2020.pdf
[232] http://epthinktank.eu/2014/05/07/structural-and-cohesion-funds-in-the-member-states-an-overview/erdf_esf_cf2007-2013/
[233] http://ec.€opa.eu/regional_policy/en/information/legislation/regulations/2007-2013/#erdfregulation
[234] https://cohesiondata.ec.€opa.eu/

telecommunication, energy, and transport infrastructures; enhancing institutional capacity and effective public administration; health, education, and social infrastructures; and sustainable urban development.[235]

ESF

The **European Social Fund** (ESF) contributes to economic, social and territorial cohesion by investing in people. It increases the employment opportunities of European citizens, promotes better education, and improves the situation of the most vulnerable people at risk of poverty. Its focus for 2007-2013 was on four key areas: increasing adaptability of workers and enterprises, enhancing access to employment and participation in the labour market, combating discrimination and facilitating access to the labour market for disadvantaged people, and promoting partnership for reform in the fields of employment and inclusion.[236] Its budget was **€76.8 billion**.[237] For the period 2014-2020 the available budget amounts to approximately **€86.4 billion**. The four thematic objectives read: promoting employment and supporting labour mobility; promoting social inclusion and combating poverty; investing in education, skills and lifelong learning; and enhancing institutional capacity and an efficient public administration.[238] The innovation is that ESF should in this new programme also contribute to objectives such as the transition towards a low carbon society, and a climate-resilient and resource efficient economy; enhancing the use of information and communication technologies; strengthening research, technological development and innovation; and enhancing the competitiveness of small and medium-sized enterprises (SMEs).

CF

The **Cohesion Fund** contributes to interventions in the field of the environment and trans-European transport networks (TEN-T).[239] In the period 2007-2013, it amounted **€70.1 billion**.[240] For 2014-2020, the fund will have a budget of **€63.2 billion.**[241]

EAGF, EAFRD

Common Agricultural Policy (CAP) is financed by two funds: the European Agricultural Guarantee Fund (EAGF) and the European Agricultural Fund for Rural Development (EAFRD). The CAP budget for 2007-2013 was €**420.7 billion**.[242] In 2014-2020 the CAP budget is established at around **€418.4 billion**, **€317.2 billion** as EAGF to finance direct payments to farmers and measures to regulate agricultural markets such as intervention and export refunds; and **€101.2 billion as** EAFRD, to finance the rural development programmes of the Member States. Compared to the period 2007-2013, for the period 2014-2020 funds for EAGF decreased 17.5% and those for EAFRD increased up to 9%. The decrease of spending on activities related to the natural resources is estimated at 11.3% (€47.5 billion).[243]

[235] http://ec.€opa.eu/maritimeaffairs/policy/sea_basins/atlantic_ocean/atlanticforum/funds_en.pdf
[236] http://ec.€opa.eu/regional_policy/en/information/legislation/regulations/2007-2013/#erdfregulation
[237] http://epthinktank.eu/2014/05/07/structural-and-cohesion-funds-in-the-member-states-an-overview/erdf_esf_cf2007-2013/
[238] http://ec.€opa.eu/regional_policy/en/information/legislation/regulations/2007-2013/#erdfregulation
[239] http://ec.€opa.eu/regional_policy/en/information/legislation/regulations/2007-2013/#erdfregulation
[240] http://epthinktank.eu/2014/05/07/structural-and-cohesion-funds-in-the-member-states-an-overview/erdf_esf_cf2007-2013/
[241] https://cohesiondata.ec.€opa.eu/
[242] Stępień, S., & Mironescu, A. (2013). Budget of the EU for 2014-2020. Results of the Negotiations in the Light of the Polish Agriculture Interests. *Romanian Economic Business Review*, *8*(4.1), 167-178.
[243] Stępień, S., & Mironescu, A. (2013). Budget Of The Eu For 2014-2020. Results Of The Negotiations In The Light Of The Polish Agriculture Interests. *Romanian Economic Business Review*, *8*(4.1), 167-178.

EFF, EMFF

The European Fisheries fund (EFF) had a budget of **€4.3 billion** for 2007-2013. It targeted all sectors[244] of the industry focusing on five priority areas (axes)[245] that read:

- adjustment of the fleet (e.g. to support scrapping of fishing vessels);
- aquaculture, processing and marketing, and inland fishing (e.g. to support the shift to more environmentally friendly production methods);
- measures of common interest (e.g. to improve product traceability or labelling);
- sustainable development of fisheries areas (e.g. to support diversification of the local economy);
- technical assistance to finance the administration of the fund.

For the period 2014-2020, the EFF has been replaced by the so-called European Maritime and Fisheries Fund (EMFF). With a budget of around **€5.749 billion**[246] the EMFF aims to fund: the promotion of sustainable and competitive fisheries and aquaculture; fostering the development and implementation of the Union's Integrated Maritime Policy; the promotion of balanced and inclusive territorial development of fisheries areas (including aquaculture and inland fishing); the contribution to the implementation of the Common Fisheries Policy. The EMFF is structured around 4 pillars, namely:

- Smart Green Fisheries- aid to promote selective gears, discard measures, foster innovation, economic viability of the sector;
- Smart Green Aquaculture- aid to develop aquaculture production;
- Sustainable and Inclusive Territorial Development- aid to promote growth, skills and job diversification to other sectors of the maritime economy;
- Integrated Maritime Policy- aid to enhance marine knowledge, maritime spatial planning, integrated coastal zone management, adaptation to climate change.

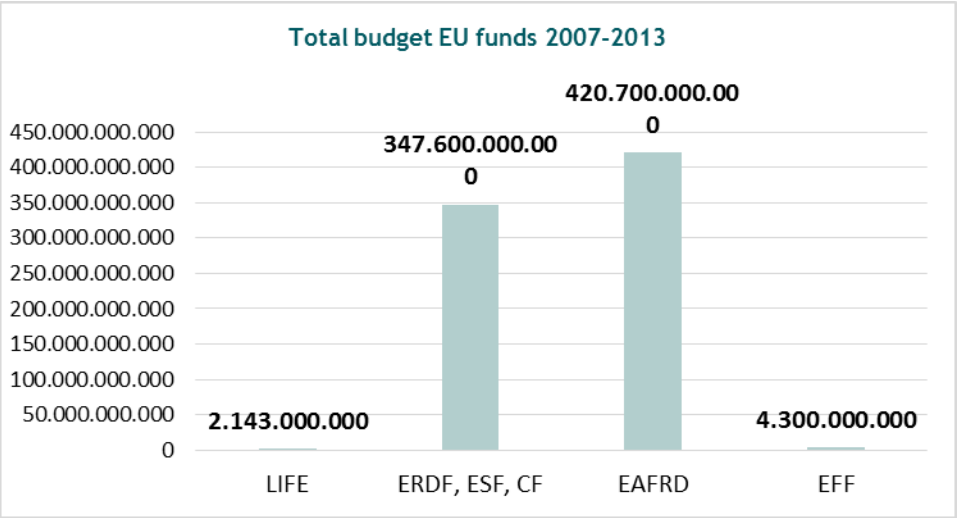
It has been argued that the main difference between the EFF and the EMFF is the inclusion of the Integrated Maritime Policy (IMP).[247] This IMP includes a number of cross cutting measures including maritime surveillance, data sharing, Marine Spatial Planning (MSP) and Integrated Coastal Zone Management (ICZM).

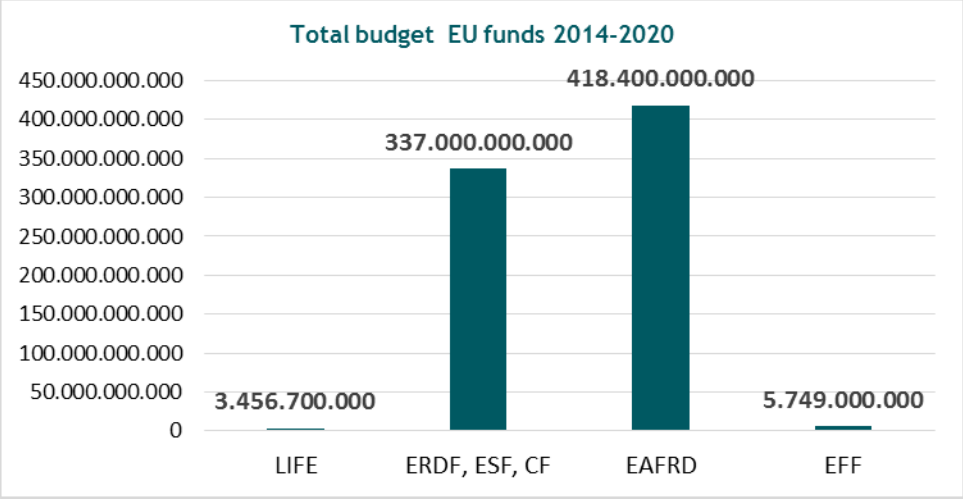
Total available budgets for the two programming periods

Figure 18 shows the total available budgets of the analysed EU funds for the 2007-2013 and the 2014-2020 periods respectively, to place the GI baseline into perspective in relation to the overall available budgets per fund.

[244] sea and inland fishing, aquaculture (the farming of fish, shellfish and aquatic plants), and processing and marketing of fisheries products.
[245] http://€-lex.€opa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32007R0498&from=EN
[246] http://ec.€opa.eu/fisheries/documentation/publications/pcp_en.pdf
[247] https://www.gov.uk/government/consultations/€opean-marine-and-fisheries-fund-emff

Figure 18 Total budget of EU funds (2007-2013 and 2014-2020)





5.2.4 The Baseline - Extrapolation of the results for 2007-2013 into the new programming period 2014-2020

In order to calculate the baseline, we have parted from the analysis for the period 2007-2013 above (for which accurate project-level information exists), made assumptions based on the differences described in section 5.2.3 and have accordingly calculated the baseline of GI funding for the current programming period 2014-2020.

Assumptions for the extrapolation

LIFE

While the priorities within its 'environment' strand do not seem to change much for the new period, the new focus in climate topics is promising for GI solutions targeted at enhancing ecosystem services that contribute to climate change mitigation or adaptation (and which were rather lacking in the period 2007-2013).

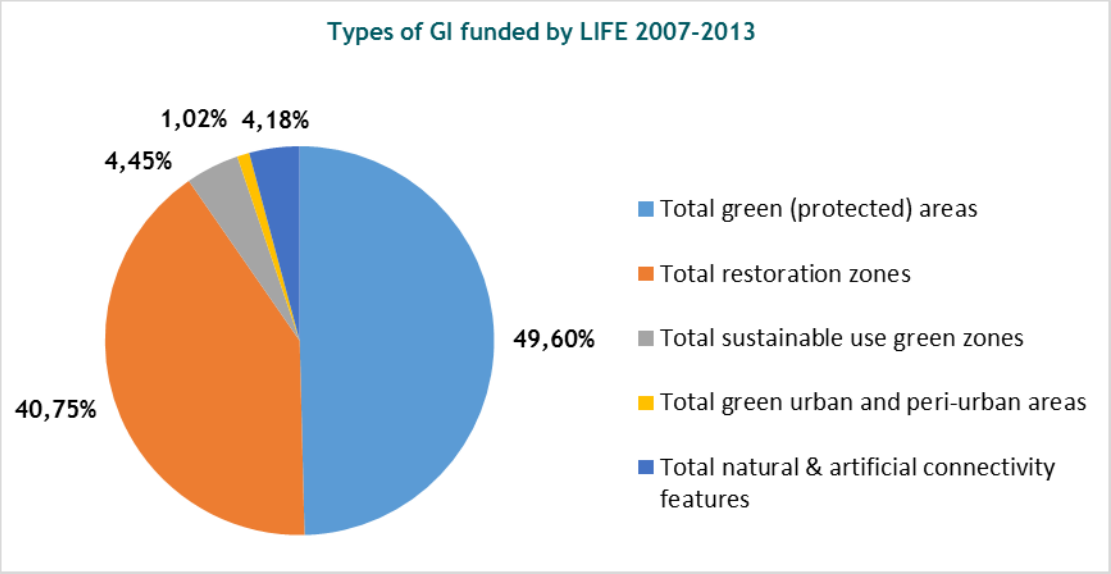
Throughout 2014-2020, an additional **€1313.7** million will be allocated in comparison to 2007-2013; in other words, the LIFE funding line has been expanded by **60%** for 2014-2020. Our assumption is that the focus of the sub-programme accrued to

environment remains comparable to the previous period (as it again consists of 3 lines of focus, the third being more concerned with communication – and hence less relevant for our assessment of GI *implementation*). Similarly, the sub-programme on climate is divided in three lines of which the first two (on adaptation and mitigation) are relevant for GI implementation and the third is not (as it regards governance and information).

Assumption: It cannot be deducted from the programme's priorities whether more funds will be allocated to GI than in the programme before. Thus, the assumption we are making is that 36%[248] of total LIFE funds will be allocated to GI activities for the period 2014-2020. Yet, due to the new climate investment line within LIFE, the categories or aspects of GI funded are likely to change, in favour of GI investments particularly aiming at climate adaptation and mitigation. If we are to make assumptions of what this could mean for the categories we have classified projects into, we could argue that projects on climate adaptation and mitigation majorly would fit under the categories 'Total sustainable use green zones' and 'Total green urban and peri-urban areas'. Thus, the baseline we propose assumes that 36% of the total funds that will be allocated to climate (€864.2M) belong to GI investments made in these two categories.

Figures 19 and 20 show the types of GI funded by LIFE and their relative weighting in the two programming periods.

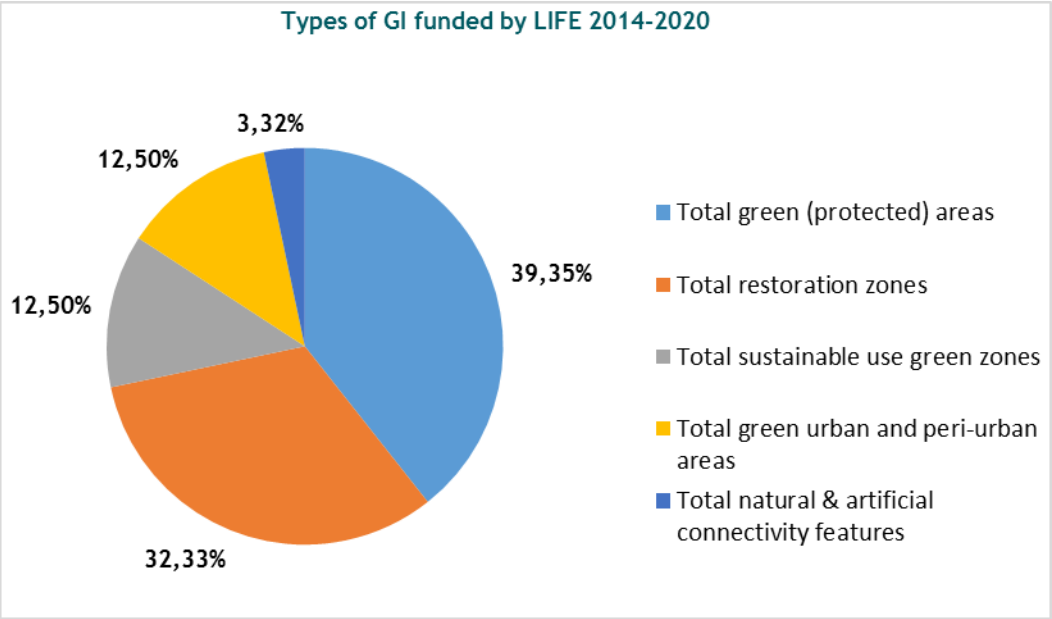
Figure 19 Types of GI funded by LIFE 2007-2013



[Source: Own analysis based on gathered data]

[248] This is the percentage of the total LIFE budget allocated into GI in the period 2007-2013.

Figure 20 Types of GI funded by LIFE 2014-2020



[Source: Own analysis based on gathered data]

ERDF, ESF, CF

The ERDF, CF and ESF compose the so called European Regional Policy. For the programme period 2007-2013, the paid ERDF, CF and ESF amounted respectively to a total of 121,901,735,976; 38,320,126,486 and 48,698,321,829[249]. The challenge is to extract from this amount what was allocated to financing green infrastructure.

Unlike the programming period 2007-2013, the new priority areas of the ERDF do not explicitly mention environmental protection. Yet the new programme includes new priorities where GI could play a role, namely climate change and sustainable urban development.

Assumption: In the absence of further evidence, we will assume that the same percentage of ERDF funds gets allocated to GI as in 2007-2013. The ESF's priorities, similar to the previous period, do not include hints of potential for GI investment, yet the new programming period does mention that ESF investments should contribute to a low carbon economy. In the absence of further specifications, we will assume the ESF % accrued to GI remains the same. We will also assume nothing has changed for the CF.

EAGF, EAFRD

The new program seems to set greater focus on competition and less on rural development. This might be detrimental for interventions related to GI. The expected decrease of spending on activities related to the natural resources (11.3%)[250] will be taken into account.

[249] http://ec.europa.eu/regional_policy/sources/docgener/evaluation/data/financial_execution_by_period_fund_country.xls
[250] Stępień, S., & Mironescu, A. (2013). Budget Of The Eu For 2014-2020. Results Of The Negotiations In The Light Of The Polish Agriculture Interests. *Romanian Economic Business Review*, *8*(4.1), 167-178.

EMFF

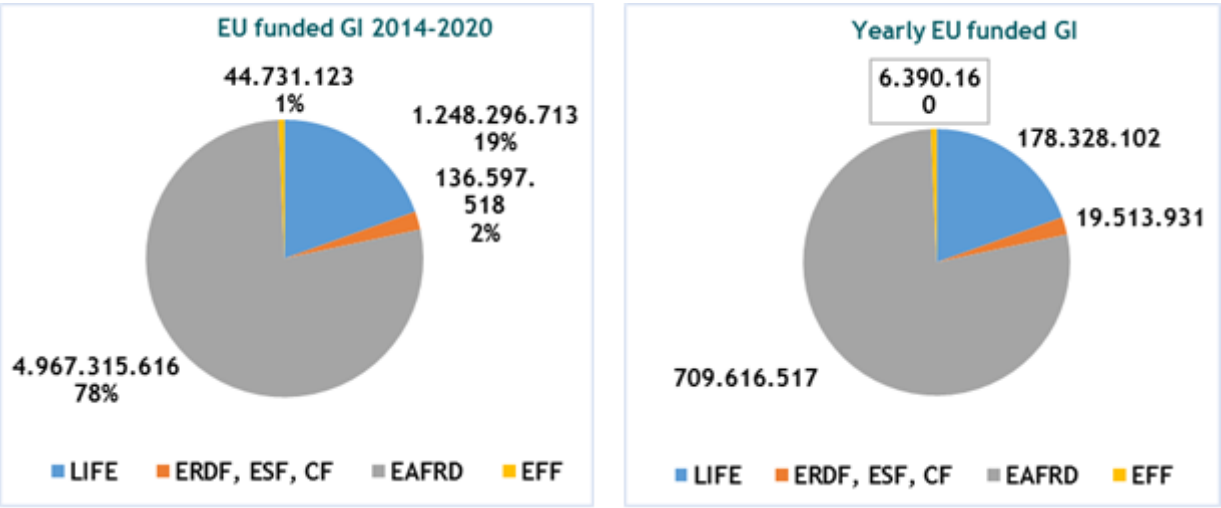
It is not straightforward to assess whether the EMFF will involve more GI measures than its predecessor, the EFF, so our assumption is that the percentage thereof allocated to GI will remain the same.

Amounts and origin of GI funding in the baseline situation

The extrapolation to the new programming period shows that **between 2014 and 2020, green infrastructure would receive EU finance amounting approximately to €6,397 million by public EU funds** through various funding mechanisms, namely: the European Agricultural Fund for Rural Development (EAFRD); LIFE+; the European Regional Development Fund (ERDF), the European Social Fund (ESF) and the Cohesion Fund[251]; and the European Fisheries Fund (EFF)[252]. This is an average of **approximately €915 million** per year.

Although in monetary terms the fund contributing most to GI by far appears to be the agriculture fund EAFRD, less than 1% of its total budget (**€418 billion**) was allocated into GI between 2014 and 2020. That accounted for **€4,967 million** (**77%** of the total EU funded GI). In fact, proportionally speaking, LIFE is the biggest contributor to GI implementation. For 2014-2020, funding from LIFE would amount to **€1,248 million** (**19%** of the total EU-funded GI), which means that **36%** of the total LIFE budget is allocated to activities that can be considered GI. Less than **1%** of the total EFF budget has been invested in activities that can be considered GI implementation, accounting for **44 million** (less than **1%** of the total EU funded GI). A very small percentage (**0.04%**) of all the ERDF, CF and ESF budgets have also funded GI in the EU, amounting to **€136 million** (**2%** of the total EU funded GI).

Figure 21 Contribution of EU funds to GI (in €)



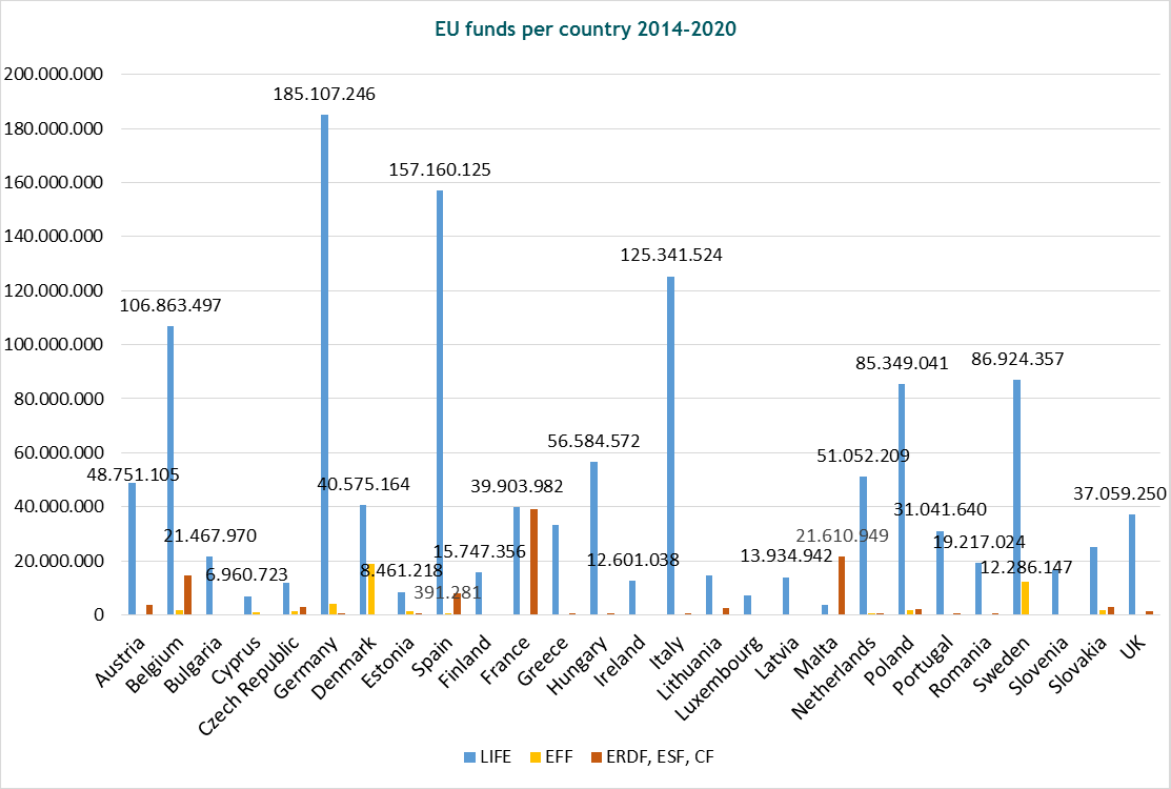
[Source: own elaboration based on gathered data]

[251] These three funds present their project beneficiaries together, without specifying which amounts come from CF, ERDF and ESF.

[252] For the period 2014-2020, the EFF is replaced by so-called European Marine and Fisheries Fund (EMFF)

Figure 22 captures the distribution of GI funding across countries.

Figure 22 EU funds per country (2014-2020)[253]



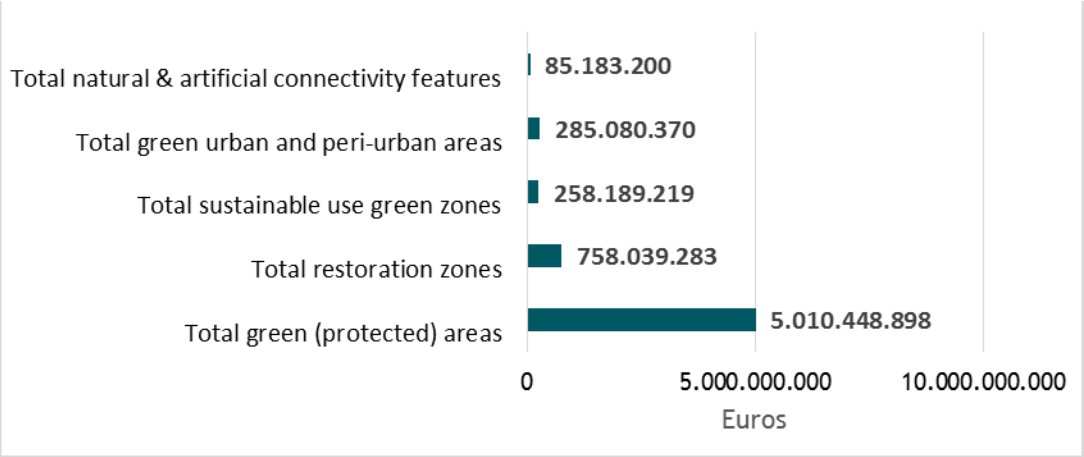
[Source: own elaboration based on gathered data]

Types of GI funded under the baseline situation and identified gaps

Current funding is primarily allocated to finance the conservation of green areas (**5,010 million** of all GI funding; **78%** of all GI funding) and restoration of green areas (**78 million** of all GI funding; **12%**) (see Figures 23 and 24). By contrast, connectivity issues, sustainable use green zones and green urban and peri-urban areas are underfunded in the baseline situation, as these building blocks receive only approximately **1%, 4% and 4%** of all EU funds allocated to GI projects respectively. Investments in greening urban and peri-urban areas are mostly spent on green roofs, city parks, urban forestation and the like. Connectivity mostly funds fish passes and animal corridors while there is no indication of financing having been provided to projects dealing with other connectivity-related GI such as eco-ducts, green bridges, areas along energy and transport networks. Against this backdrop, TEN-G could focus on promoting projects that enhance natural and artificial connectivity, as this is an underfunded area and could also contribute to reducing fragmentation.

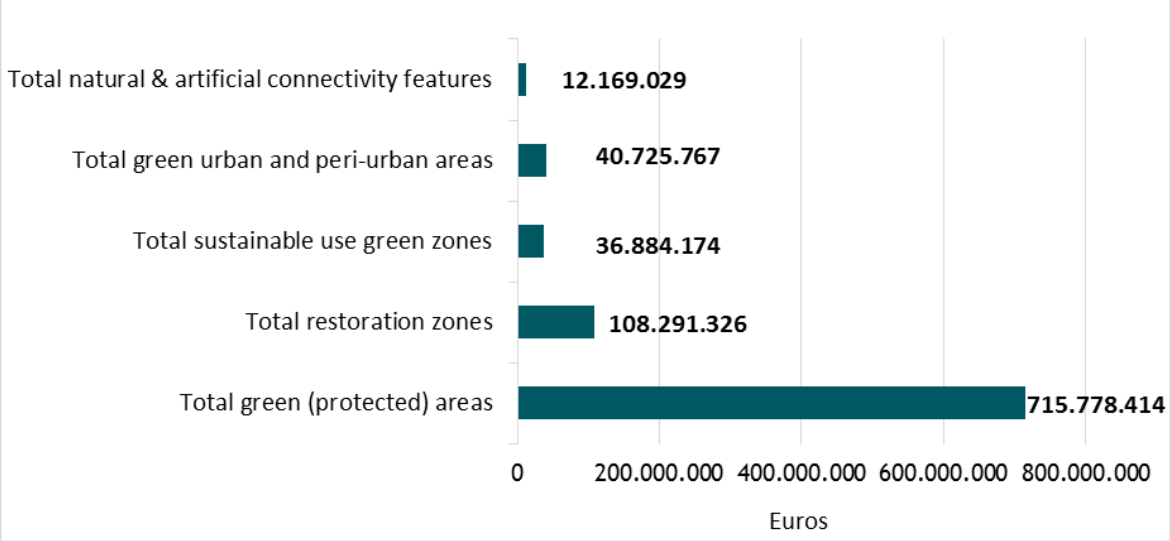
[253] EAFRD has not been included in the graph due to lack of information at the project - and therefore country – level. To estimate the amount of EAFRD funds allocated to GI, we have used aggregate figures from the Commission's annual financial reports, from which we extracted amounts from the categories we presumed to be related to GI activities.

Figure 23 Funding per type of GI component (2014-2020)



[Source: own elaboration based on gathered data]

Figure 24 Annual funding levels per type of GI component



[Source: own elaboration based on gathered data]

LIFE captures a variety of elements across all realms of GI, especially financing biodiversity conservation and restoration, but also a few sustainable use, urban and connectivity-related projects. The projects falling under sustainable use of zones regarded mainly sustainable management of water habitats and green areas. Investments in urban and peri-urban areas involve green roofs, city parks, urban forestation and the like. Projects under the last two categories are often aimed at climate adaptation and mitigation. Connectivity projects under LIFE are wildlife / ecological corridors. GI implementation is not the aim of the projects. Instead, the implementation of GI is the result or the means though which projects that aim at biodiversity conservation/restoration, greening of urban areas and increased liveability are realised.

For the rest of the funds, a very small part of what is funded corresponds to GI. The ERDF covers projects across various elements of GI, from conservation and restoration to connectivity and urban interventions. It is also the fund in which GI cross-boundary projects – involving various countries - are funded. The EAFRD on the other hand only finances aspects of GI that concern expanding (e.g. afforestation) or restoring green

areas. The EFF is an interesting case for the stark differences found between countries in the number and the type of projects with a GI component that are implemented. For instance, while GI projects related to the marine environment were not found in Austria or Portugal, plenty of these projects were found for Denmark. Spain, which benefits massively from these funds, has just implemented a handful of projects that can be considered GI. Overall, the focus of the EFF is primarily on funding marine ecosystems restoration and (re-)stablishing fish passes and artificial riffs.

5.2.5 Challenges and limitations of the baseline

Projects and their titles do not mention 'green infrastructure' despite being/including GI. GI is very seldom explicitly mentioned and therefore identifying these projects has been a time-consuming exercise. Out of the 500+ GI projects identified, only three explicitly mention the term "green infrastructure".

Identification of projects somewhat subjective. Stemming from the above, one limitation of the method for the assessment of the baseline is the fact that the identification of GI projects has been subjective to a certain extent. Whether something has been considered GI or not has been the result of expert judgement. When in doubt from the title of the project as to whether a project in question was GI or not, we have resorted to the project's website or internet-based research for clarification.

Some GI projects are hybrid projects which include non GI features. Certain projects identified are not 100% GI, but a combination of green and grey infrastructure, or include non-GI implementation related activities such as information campaigns, making of inventories or other side activities. Consequently, the baseline might have been somewhat overestimated. Yet, we are confident the assessment has been done as accurately and rigorously as possible.

Different level of detail for different funds. Another shortcoming is the fact that the EARDF and EAGF funds have not been considered at project level, but a rougher estimate has been made based on annual financial reports from which we have extracted amounts from the categories we presumed GI activities fit, applying a percentage to it[254]. This might have led to an overestimation of the baseline. In fact, any choices about whether to include a measure within CAP or not, and whether to apply one percentage or other to it, leads to considerable differences in the results.

Information not available. Related to the above, in cases such as the EFF, information is not available. Despite the transparency initiative of the EU requiring Member States to publish the list of beneficiary projects and amounts assigned to those, various countries have that information simply not available e.g. Latvia, Slovenia, France and the UK. We contacted authorities and local representatives such information, with no success.

Information only available in national language. Next to that, we encountered that the EFF website and information of beneficiary projects therein is in the national language of each country. Another hurdle is that each Member State who reports this information, does that in a different way. In a similar vein, not all beneficiaries' lists

[254] From 2013 onwards the reform of the CAP requires Member States to make information public, about project funding beneficiaries.

provided a description of the project[255] and therefore some GI projects might have gone unnoticed in our assessment.

GI projects are multi-purpose and therefore hard to categorise. Although we have classified GI projects as conservation projects, restoration projects, and so on[256], most of these are hybrid. Currently the baseline suggest 90% of the projects are conservation projects. It is likely that some of these projects could have belong to other categories too. Especially in many LIFE projects, we found that conservation and restoration go generally hand-in-hand. Our decision to place such projects under one or the other category has been determined by reading the projects' description and objectives and assessing where most stress is placed on. Also, a project to restore e.g. salt marshes could be classified either under the 'restoration' category or under 'sustainable use zones' categorise to which salt marshes belong. In that case, we have chosen for placing such under 'restoration'. In a similar vein, connectivity projects might in some cases be result of restoration activities and so on. Therefore, despite we believe in the accuracy and rigorousness of the baseline presented, the categorisation of where funds get allocated is partly illustrative.

Potential delays in funding / implementation not taken into account. All funding has been reported for the year and/or period it has been reported for. Possible delays have not been taken into account.

The baseline has been calculated as an extrapolation. The baseline has been calculated extrapolating the results for the programming period 2007-2013 into the current programming period 2014-2020. Obviously, there is no project level information for this new programming period. The extrapolation has been done by having a look at the main characteristics and funding priorities of each programming period and reflecting on whether consequent changes in funds allocated to GI are foreseeable. For most of the funds, there is no way to know how much (more or less) GI will be funded and therefore high uncertainty exists regarding what will happen in practice. It has been considered a 'safe' option to assume in most of the cases that the percentages accrued to GI will remain the same.

5.3 Assessment of the costs and benefits of establishing a TEN-G

It should be noted that the narrative provided in this section of the Final Report is supported with the developed excel calculation sheets and a technical methodological report as annexes 18 and 19 respectively.

5.3.1 Purpose and scope

Purpose

The cost-benefit assessment focused on comparing the potential additional European added value a TEN-G could theoretically deliver compared to the baseline scenario. This involved comparing the benefits of the various GI components against their costs to identify which offered the best 'value for money' if delivered on a European network scale, and hence to prioritise where funding might be allocated under a TEN-G.

[255] E.g. the information in the EFF beneficiaries' lists in Ireland and Portugal is limited to the name of the beneficiary and the funding given, that is there is no mentioning of the projects' name or description.
[256] The decision to make each project belong to one category or another is based on the primary purpose of the project.

Scope
The assessment of the economic, social and environmental benefits of a TEN-G has been undertaken at a high level due to the nature of this first-phase exploratory nature of the work, as well as the timescale and budget available for the analysis. The components were assessed generically without being fixed to any particular location. As a result, it was not possible to adjust the benefits or costs to relate to specific factors that would be relevant were an assessment made of the implementation of GI in a particular location. Of particular importance is the likely under-estimation of benefits associated with GI located in urban areas as no population weighting can be applied. Average (mean) values were used wherever possible to reflect variation across the EU. Again, this reflects the high level of the assessment and the need to keep the analysis at a level that is applicable to the EU as a whole, rather than using information that may be specific to one or more Member States. Wherever possible, for example, cost data have been used that reflect averages across a number of Member States and benefits were taken on a per hectare value from sources that reflect European or even global average values. Such data were not available for all types of green infrastructure, however, so some specific values were used to fill data gaps. The uncertainty introduced by this, and other steps within the assessment is discussed in detail below.

GI components assessed
The assessment of TEN-G involved identifying the costs and benefits associated with different GI components. The GI components covered by the assessment are set out in Table 19 in the introductory section of Chapter 5.

GI Baseline as basis for comparison
Existing funds that have been allocated to each of the GI components have been estimated using the projects that have been funded under LIFE+, the European Regional Development Fund (ERDF), the European Social Fund (ESF), the European Agricultural Guarantee Fund (EAGF), the European Agricultural Fund for Rural Development (EAFRD), the European Marine and Fisheries Fund (EMFF) and the Cohesion Fund. This information was then used in combination with identified data on the costs of each GI component (in € per ha) to estimate the area of each component delivered, and hence the ecosystem service benefits under the existing situation (the current baseline).

The assessment then looked at whether a TEN-G would provide greater benefits than those estimated under the baseline. Section 5.3.2 provides further details on the approach to the assessment of costs and benefits, whilst Section 5.3.3 provides the results including a comparison of the baseline situation to that envisaged under a TEN-G.

5.3.2 Methodological approach in a nutshell

The assessment involved comparing the benefits of the GI components against their costs to identify which offered the best 'value for money'. This section outlines the various aspects of the approach. A detailed technical description of the various assessment steps is included in Annex 18.

Identification of the benefits of the GI components

To determine the benefits of the components, tasks included:

- Identifying the increase in ecosystem services predicted to result from implementation of the GI components; and

- Identifying monetary values for those services.

The benefits of the GI components were assessed using an ecosystem services framework. This framework looked at the benefits that GI can provide to people through provision of goods and services (provisioning services), through regulation and control of environmental resources and risks (regulating services), and through social benefits such as cultural, recreational and aesthetic services (cultural services). Each GI component was assessed to identify the ecosystem services it would support. This assessment was based on a review of the literature as well as the expert judgement of our team.

Monetary values for each of the ecosystem services were taken from the TEEB (The Economics of Ecosystems and Biodiversity) database. These monetary values do not cover all of the ecosystem services, so not all of the benefits can be valued in monetary terms. Those values that were identified have been evaluated during the TEEB project, so are considered amongst the best available values to use. However, there is uncertainty associated with assigning monetary values to ecosystem services. Therefore, uncertainty ratings were assigned to each of the ecosystem services considered relevant to each GI component. These uncertainty ratings were used in the sensitivity analysis to enable the reliability of the results to be tested.

Identification of the costs of the GI components

The estimated costs of the GI components were based on costs of implementation from previous projects. The reliability of the cost estimates, therefore, depends on the number of cost estimates that could be used and the variability across those cost estimates. Whilst many cost estimates were identified from internet research, these were in a range of units and so could not necessarily be used for the assessment (which required data in € per ha for consistency and comparability). To take account of the resultant uncertainty in the data, each GI component was assigned an uncertainty rating to reflect availability and variability, with this used in the sensitivity analysis to assess the reliability of the findings.

Prioritisation of the components based on benefits and costs

The estimated monetary costs and benefits of the GI components were used to prioritise where funding might be allocated. Those GI components with the highest benefit-cost ratio (benefits divided by costs) were ranked highest so more funding was allocated to those components that delivered a higher level of benefits for very € spent. It is important to note that the same benefit value was used whichever GI component delivered a particular ecosystem service. This was a necessary simplification given the scale of the assessment (EU wide) and the lack of location data (the funding baseline indicated which components were being implemented, but not where these components were implemented). This meant that it was not possible to determine whether a component was being delivered in an urban area, and so might benefit a greater population, thus resulting in a higher benefit per ha value. A more local level assessment with geographical/spatial data would be required to highlight how delivery of an ecosystem service might differ dependent on where a component was implemented. Such an assessment would be able to take factors such as population density into account.

Prioritisation of the components based on qualitative benefits

The benefit-cost ratios estimated only included those ecosystem services that could be valued in monetary terms. The GI components were also ranked in terms of the qualitative (non-monetary) benefits that they could provide. This assessment was linked to the number of ecosystem services that would be enhanced or increased from

implementation of the components. Those GI components that would result in enhancement of more of the ecosystem services were, therefore, ranked higher under the qualitative assessment.

Prioritisation of the components according to social and environmental criteria

As well as ranking on all ecosystem service benefits, the GI components were ranked according to how they perform when the emphasis is placed on social or 'green' outcomes. The purpose of this approach is to explore if and how this might result in a different set of GI components and, hence, potentially an alternative focus for future investments.

The Juncker Commission priorities were used as the basis for assessing the priorities for social criteria. Each of Juncker Commission priorities is linked to the qualitative benefits that would be delivered by each of the components in terms of the extent to which ecosystem services would be enhanced. In this way, those components that would deliver the highest level of social priorities can be determined. This assumes that the Juncker Commission objectives provide a good representation of the social benefits. Some priorities, such as jobs, growth and investment, and internal market are strongly linked to provisioning services. Energy Union and climate is more associated with provisioning services such as 'biomass-based energy sources' but also to regulating services such as 'gaseous/air flows'. The priority objective on justice and fundamental rights is linked with cultural services such as spiritual, symbolic and other interactions with biota, ecosystems and land/seascapes. Some priority objectives have limited links with the environment. This includes the digital single market and migration (of people). Thus, account is taken of the likely relevance of the Juncker priorities to social issues that have a possible bearing on the environment.

Environmental criteria were identified from the environmental pressures considered by the International Union for Conservation of Nature (IUCN) in their European Red List[257] and the EEA's[258] priorities for mitigating the impacts of weather and climate change related hazards. These give the following areas as being of priority:

- Pressure on Red Book Species (IUCN):
  - pollution;
  - modification of natural systems;
  - biological resource use;
  - development;
  - invasive and problematic species and genes;
  - human intrusion and disturbance;
  - climate change and severe weather; and
  - energy production/mining.
- EEA (2015):
  - protection against landslides and avalanches;
  - protection against flooding;
  - protection against storm surges; and

[257] IUCN published factsheets for each member state in 2013. Environmental pressures have been identified from these factsheets. Further information is available at: http://ec.europa.eu/environment/nature/conservation/species/redlist and http://www.iucnredlist.org/europe

[258] EEA (2015): Exploring nature-based solutions, the role of green infrastructure in mitigating the impacts of weather and climate change related hazards

- global climate regulation.

The use of these existing priorities ensures that the assessment is relevant to other initiatives and policy areas.

The ecosystem services that were thought to benefit each of the above social and environmental priorities were identified. The assessment then highlighted the GI components that would provide the most relevant services (i.e. benefits) to help meet these priorities.

Assessing different levels of ambition for green infrastructure delivery

Different levels of ambition in terms of green infrastructure delivery were taken into account through varying the funding intensity, with double the baseline funding and ten times (x10) the baseline funding both considered (these are referred to as the medium and high funding intensity scenarios).

The marginal benefits of an extra unit of funding were seen as unlikely to remain constant if funding was continually allocated to a particular component. This issue was dealt with through applying assumptions whereby the provision of benefits from a particular component was decreased once delivery of the component surpassed a threshold area. Different assumptions were used for each group of components. For example, for protected areas, once the lower area threshold was reached, each additional ha of the component was assumed to provide only 50% of the benefits. It is acknowledged that the threshold areas and associated percentages are uncertain. However, without such an approach, an increase in the funding available would simply result in more funding being allocated to those components which had already received funding. This would not represent good value for money since there would be a point where the component area and habitat condition would not improve any further, however much more funding was provided for it.

Uncertainties

As well as uncertainties within the values assigned to the monetary costs and benefits, the ranking of the assessment highlighted other uncertainties that could affect the order in which the GI components were ranked. These uncertainties include:

- Whether a GI component is assigned an ecosystem service benefit (or not): the process of assigning services drew on information from existing studies as well as expert judgement, with a general presumption that a benefit would occur unless it is clear that this is unlikely to be the case, e.g. wilderness zones are unlikely to provide direct benefits[259] to cultivated crops;
- Whether a social or environmental priority is assumed to benefit from the provision of a particular ecosystem service (or not). The ranking of the components according to the social and environmental priorities took account of the fact that some ecosystem services are likely to contribute towards the priorities more than others. However, the assessment of these services was subjective (different individuals may feel that different services will contribute more to the priorities), thus changing the services seen as beneficial for the different priorities could result in a different ranking of the GI components; and

[259] Direct benefits are those that can be linked directly to the GI component, thus, wilderness zones would not result in cultivated crops being grown hence there is no direct benefit. There may be indirect benefits, e.g. due to populations of pollinators or native species that can help reduce pest populations on nearby farmland but these are not included as they would double count with benefits due to pollination or pest control.

- The decline in benefits per unit that was assumed to result where additional funding was allocated to areas already in good/favourable condition. Assumptions were developed for the various component groups (e.g. assumptions for protected areas were based on the status levels used in condition reports (unfavourable recovering, favourable, etc.)), since there is currently a lack of data on the extent to which the ecosystem services are currently in favourable condition. Thus the likely condition of ecosystem services and, hence the extent of benefits that could be delivered by enhancing these services is based instead on the condition of habitats. Different assumptions could result in a different allocation of funding.

5.3.3 Results

This section summarises the results of the cost-benefit assessment.

Overall results

Whilst the assessment process is high level and subject to a number of uncertainties, the findings indicate that:
a TEN-G could provide more benefits than the current allocation of funding to GI components.

Considering only the top five ranked components in the assessment, the benefit-cost ratio (BCR) for TEN-G is **more than double** the BCR under the current funding allocation.

Table 20 presents the top five and top ten ranked components that could make up a TEN-G network, assuming the intention is to maximise the BCR (as opposed to focusing on particular environmental or social priorities). It includes an indication of the uncertainty associated with the costs and benefits of these components, as well as the overall uncertainty for the BCRs. Whilst several of the components identified have high levels of uncertainty associated with the benefits they provide, many of the components included are designated sites, and thus would be expected to lead to significant benefits. This suggests that the approach followed is working, and is not providing anomalous results.

Table 20: Top-ranked components when aim is to maximise the benefit-cost ratio					
Top 5 ranked components			**Top 10 ranked components**		
Component	**Uncertainty**		**Component**	**Uncertainty**	
	Costs	**Benefits**		**Costs**	**Benefits**
Natura 2000 sites	Moderate	Very high	Natura 2000 sites	Moderate	Very high
Extensive agricultural landscapes	High	High	Extensive agricultural landscapes	High	High
Regional and National parks	Moderate	High	Regional and National parks	Moderate	High
Multi-functional sustainable managed agricultural landscapes	High	High	Multi-functional sustainable managed agricultural landscapes	High	High
Wilderness zones	High	Very high	Wilderness zones	High	Very high
			High nature value farmland	Moderate	High
			Metropolitan park systems	High	Moderate-low
			City reserves	High	Moderate-low
			Ecological networks with cross-border areas	High	High
			Storm ponds and sustainable urban drainage systems	High	Very-high
Overall BCR	**High**	**Very high**	**Overall BCR**	**High**	**Very high**

Where the medium and high funding intensity scenarios are considered, the BCR still remains above the baseline BCR. This suggests that even allowing for decreasing marginal benefits where more than a threshold area of a particular component is funded, a TEN-G could still result in more benefits per unit of cost invested than the current (assumed) funding allocation.

Table 21 highlights the top five and top ten components to fund should green infrastructure be focused on contributing towards social priorities. Again, the components which are featuring are those which are generally already recognised for their environmental value. Whilst urban GI components may provide particular ecosystem services within a specific location (and thus be extremely valuable to the surrounding population), they do not tend to provide as many different services as the components listed in Table 21, thus they do not rank in the top ten within this assessment. Had a more detailed, local level assessment been undertaken involving location data, urban GI components may have been ranked more highly than they are here due to the large populations likely to benefit from the services provided by features such as green roofs, allotments and orchards, etc.

Table 21: Top-ranked components when aim is to maximise the level of social benefits delivered	
Top 5 ranked components	**Top 10 ranked components**
Substantial share of structure-rich agricultural, forestry or natural landscapes	Substantial share of structure-rich agricultural, forestry or natural landscapes
Multi-functional sustainably managed agricultural landscapes	Multi-functional sustainably managed agricultural landscapes
Ecological networks with cross-border areas	Ecological networks with cross-border areas
Regional and National Parks	Regional and National Parks
High nature value farmland	High nature value farmland
	Restored landscape systems covering a substantial part of agricultural/forestry areas
	Supra-regional corridors
	Natura 2000 sites
	Sustainable coastal and marine management zones related to the respective sea basin
	Restored areas which were before fragmented or degraded natural areas
Notes: Components have been ranked on the basis of all benefits provided, rather than just those which for which monetary values have been identified	

Table 22 presents the top ranked components assuming components are prioritised towards environmental goals. As would be expected, environmental priorities are best met through focusing on GI components that relate to protected areas and sustainable use zones.

Table 22: Top-ranked components when aim is to maximise the level of environmental benefits delivered	
Top 5 ranked components	**Top 10 ranked components**
Wilderness zones	Wilderness zones
Local nature reserve	Local nature reserve
Natura 2000 sites (=3)	Natura 2000 sites (=3)
Regional and National Parks (=3)	Regional and National Parks (=3)
Ecological networks with cross-border areas	Ecological networks with cross-border areas
	Multi-use forests (such as watershed forests)
	Protection forests (against avalanches, mudslides, stonefalls, forest fires) (=7)
	Sustainable forest management (=7)
	Natural buffers such as protection shorelines with barrier beaches and salt marshes
	Mountain range level (sustainable use zones)
Notes: Components have been ranked on the basis of all benefits provided, rather than just those which for which monetary values have been identified	

Sensitivity analysis

Sensitivity analysis was used to indicate how the rank order of the components might change should the unit costs and benefits associated with each component alter. Unit costs were changed according to the level of uncertainty allocated to a particular cost or benefit, with uncertainty ranging from low, where values were increased or decreased by 10%, to very high, where values were increased or decreased by 75%.

Three sensitivity tests were carried out:

1. Costs and benefits both increased by the percentage indicated by their uncertainty;
2. Costs and benefits both decreased by the percentage indicated by their uncertainty; and
3. Costs increased and benefits decreased by the percentage indicated by their uncertainty.

Even under the worst case scenario, where costs were increased and benefits decreased, sensitivity testing suggested little change in the rank order of the components. This is explained by the fact that the top ranking components (e.g. Natura 2000 sites) have such high benefit cost ratios that considerable changes are required in costs and benefits before other components take their place in the ranking. However, if components lower down the ranking list are considered, then the sensitivity testing does result in significant changes. For example, the component 'local nature reserve' moves up nine places when costs are increased and benefits decreased (sensitivity test 3).

Whilst these sensitivity tests appear to indicate that the results are relatively robust, it should be acknowledged that benefit values have not been identified for all the ecosystem services. The sensitivity tests are only able to analyse the impacts on the results of changing the identified costs and benefits. Where a component provides several services for which no benefits value has been identified, that component might actually be lower down the ranking that it would be, were all services monetised. However, this point is countered by the fact that the assessments focusing on the social and environmental priorities are based on the qualitative benefits, so all benefits provided are taken into account. Given that the outcomes from these assessments are relatively similar to those from the 'maximise BCR' assessment, it is assumed that there are few (if any) key services that are missing a monetary value and would significantly impact the overall results.

5.3.4 Conclusions and discussion

This section provides a broader reflection of what can be learned from the cost-benefit assessment findings.

Overall direction of the outcomes

Taking account of the uncertainties associated with the costs and benefits, the allocation of services to components and the extent to which benefits received per unit might change with the area funded, a TEN-G network has the potential to provide greater benefits per € invested than the current GI policy implementation and funding allocation (as described under the baseline scenario). However, consideration should be given to the location of existing GI components, as well as their condition, when determining where and how to invest in an EU wide GI network.

Clearly, directing money towards components already known for their high environmental value (e.g. Natura 2000 sites) can result in benefits. However, if a wider applicability is used for a TEN-G network based on the components that were **ranked in the top ten** at least twice in this assessment (based on benefit-cost ratio, level of qualitative benefits, based on social priorities or based on environmental priorities) alongside those that could generate sufficient benefits to attract private funding would include[260]:

- Natura 2000 sites
- Regional and National parks
- Multi-functional sustainably managed agricultural landscapes
- Wilderness zones
- High nature value farmland
- Ecological networks with cross-border areas
- Local nature reserve
- Sustainable forest management
- Multi-use forests (such as watershed forests)
- Water protection areas
- Restored landscape systems covering a substantial part of agricultural/forestry areas;
- Allotments and orchards
- Storm ponds and sustainable urban drainage
- City reserves
- Metropolitan park systems
- Wildlife strips

The above list of potential priority components for a TEN-G incorporates a range of different types of components, thus would be suitable for implementation in a variety of areas across the EU. However, it should be acknowledged that the level of benefit resulting from each component may vary dependent on factors such as the size of the local population (in particular, in densely populated urban areas). In terms of funding and targeting GI initiatives as part of a TEN-G, the location of any existing GI components is also likely to affect the benefits that could result from newer components.

In addition, once a threshold area of a particular component is reached, further investment in that particular component may result in fewer benefits per € of input. This needs to be borne in mind when considering how best to share costs and magnify the benefits of GI at the EU level. Failure to take this into account could lead to certain areas benefiting at the expense of others (for example, if additional investment continues to be made in a component once it has reached good status).

Challenges relating to the quality and quantity of available data

The key challenge for this assessment is the quality and quantity of available data on costs and benefits. Where monetary values are available in the desired format (€ per ha), they have been applied. However, there are many services for which benefit

[260] The following components reached the Top10 list due to their suitability for private funding: Water protection areas; Restored landscape systems covering a substantial part of agricultural/forestry areas; Allotments and orchards; Storm ponds and sustainable urban drainage; City reserves; Metropolitan park systems; Wildlife strips.

The following components could also be included in the Top10 list if only focusing on one of the prioritisations: Extensive agricultural landscapes; Functional riparian systems; Transboundary landscape features on river basin; Substantial share of structure-rich agricultural, forestry or natural landscapes; Supra-regional corridors; Sustainable coastal and marine management zones related to the respective sea basin; Restored areas which were before fragmented or degraded natural areas; Protection forests (against avalanches, mudslides, stonefalls, forest fires); Natural buffers such as protection shorelines with barrier beaches and salt marshes; Mountain range level (sustainable use zones).

figures have not been determined (perhaps because data are available, but they are in a different format and cannot be converted). This obviously affects the ranking of the components providing these non-monetised services when identifying those components providing the greatest benefits to costs. Similarities between the components ranked in the top ten for the 'maximise BCR' assessment (based on costs and benefits) and the environmental and social priorities assessments (based on qualitative benefits) suggest that the results are relatively robust, but having a full set of benefits and costs for all components would make the assessment fairer.

The allocation of services to the various components is another key issue which requires consideration. This has been carried out based on available evidence and expert judgement. However, the TEN-G is being assessed at the EU level, not the individual member state or even ecosystem level. A different level of service may be provided by the same component dependent on where it is implemented (e.g. if it is close to a large urban based population, or in a sparsely populated rural area). A more detailed local level analysis is required to tease out such effects and their impacts for the analysis.

Data and knowledge gaps

There are several areas where data and knowledge gaps need to be addressed to enhance any future assessment. These include:

- The availability of cost values in the necessary format. Whilst many studies have considered the costs of implementing GI measures, these costs are presented in a range of units. For example, costs were identified for € per structure or linear metre. These costs could not be used within this assessment since the monetary values needed to be in €/ha to enable all GI components to be treated equally;
- The availability of benefit values for each ecosystem service. Where values were not available, the services were assessed qualitatively. However, this did mean that they were omitted from the 'maximise BCR' assessment. Whilst the results of this assessment are not unexpected in terms of the components coming out at the top, it should be borne in mind that the assessment is not based on a full set of data due to availability issues;
- The ecosystem service benefits provided by each component in terms of which services a component is expected to provide, and which it might provide dependent on certain conditions being fulfilled (e.g. bio-geographical location, access by a large population);
- There is a need for a better understanding of how the benefits provided by the various components may change as more and more funding is allocated to a particular component. As the condition of a component improves, it is assumed that the marginal benefits per unit of investment decline. However, there is little evidence on the point at which this might occur; and
- The variability in terms of provision of benefits according to where a component is sited. Components in urban areas might attract higher benefits values for some services (e.g. cultural services) than those in more sparsely populated rural areas. This assessment has been undertaken at the EU level, and has not been able to use locational data. However, further work may need to consider what components are in existence already, and where within the EU these are located.

5.4 Policy implications

A TEN-G provides the opportunity to consider, plan and prioritise green infrastructure at the EU level rather than just at the individual Member State level. Operating at such a scale enables the network to focus on those components that will provide the most benefits for the money invested, since the area of land available for implementation of such components is far greater than that available to one Member State. Therefore, at a theoretical level, as indicated by this assessment, the overall benefits of setting up a TEN-G would outweigh the costs, since the network could focus on implementing those components that provide the greatest environmental, societal and economic benefits.

At a practical level, considerations other than space would need to be taken into account to ensure that the TEN-G was comprehensive and inclusive, and shared benefits across the EU28. However, given the benefit-cost ratios identified in this study, such a network could still be far more cost beneficial than the current allocation of funding across the various GI components. Careful selection of components to provide a range of services according to the requirements of both the local area (e.g. for certain cultural services) and the wider EU (e.g. for regulating services) would ensure that any investment resulted in considerable benefits. Factors to take into account in the development of TEN-G would include the existing spread of GI components across the EU (to avoid imbalances between Member States), the condition of existing components, and the location of settlements and their current access to GI components (this affects the value of some of the benefits provided e.g. cultural services).

Furthermore, the location of components in combination with the types of benefits they are expected to provide is likely to affect the level of private investment the components may attract. Components that provide services that are marketable (e.g. crops, livestock) are likely to attract private investment, whereas those which provide universal but non-exclusive services (e.g. regulating type services related to air quality, climate regulation) may be more reliant on public investment. These issues all require consideration when designing the network to ensure that greatest benefits possible can be achieved for the money invested.

All these aspects of how to maximise benefits across GI components will need to be considered – in combination with the lessons that can be drawn from reviewing the design options and set-up of existing trans-European networks. Together, the analysis carried out in Task 5 delivered valuable insights and estimates as part of DG Environment's exploratory work on the potential implementation of a TEN-G. Results should be able to contribute to answering the question of whether or not it is 'worth it' to build a TEN-G, as compared to continuing the current policy framework.

Conclusions

This service contract sought to support the implementation of the EU Green Infrastructure Strategy through a range of actions, including:

- the development and dissemination of GI information (through fact sheets and workshops) targeting Member States with little GI information available, sectors with further GI uptake potential, and topic areas offering interesting linkages to other policy areas;
- capacity-building and 'train the trainers' activities, including the design and implementation of two workshop modules (on GI and wetland restoration and on better linking GI with existing operational programmes) and producing material for a Massive Open Online Course (MOOC) on GI;
- evaluating the current visibility and content of GI information on a number of digital platforms and proposing means of improving the capacity of such platforms to deliver GI information;
- assessing how technical standards in a range of relevant sectors could help increase the deployment of GI and formulating recommendations to this effect;
- assessing the costs and benefits of implementing a Trans-European GI network (TEN-G).

Below, we outline the key conclusions emerging from each task.

Task 1

The development of 20 factsheets under this task generated additional information regarding the status of implementation, good practice examples, and the level of awareness related to GI for the selected countries, sectors and topics. However, the process of developing the factsheets also highlighted some challenges regarding the availability and accessibility of GI information for specific countries, sectors and/or topics. The delivered factsheets will serve as a GI promotional tool across countries, sectors and various stakeholder groups beyond the timeframe of this project.

The sectoral workshops were appreciated by participants and demonstrated the usefulness of such events. All three workshops have shown that there is an urgent need to further raise awareness and build capacity on the linkages between GI and other sectors. While some steps have been taken, further efforts are needed to present good examples and provide training on how to integrate GI in other policy areas, in particular by developing decision-support tools for those stakeholders that are faced with taking decisions on infrastructure solutions (e.g. grey versus green options). Another major barrier to the deployment of GI that became evident during the workshops is the insufficient understanding amongst stakeholders of the way natural ecosystems function, which often results in an underused potential for GI development. Better use of integrated spatial planning processes, improved capacity of decision-makers and better institutional cooperation are important elements to address this challenge.

Task 2

As part of Task 2, we have reviewed existing GI-related training programmes across the EU-28. The aim of this quick-scan was to identify a short-list of activities which are particularly relevant to enhancing capacities for GI. This scanning exercise indicated

that there is a need for greater availability of tailored GI information sessions that can teach decision-makers the practical application of 'green options' as an alternative to traditional grey infrastructure solutions. To this end, materials for two 'train the trainers' workshops were developed and test-run as a parallel session linked to an existing event.

In addition to these targeted training sessions, it was agreed with the client that a broader GI course available for a wider public throughout Europe could help those interested in the topic gain the necessary knowledge to then teach or inform others. To this end, we developed the lecture scripts with content for a freely accessible MOOC that could eventually be provided by a university, NGO or other European institution via commonly known platforms, such as COURSERA or edX.

Task 3

Task 3 evaluated the current visibility of GI information on a range of digital platforms and considered means of improving the content and accessibility of digital information on GI.

For platforms hosted by the European Commission, the evaluation shows that GI information is relatively dispersed across the different platforms and not presented in a coherent manner. The reviewed platforms contain a large amount of information that is highly relevant to GI, but not defined and labelled as such. With respect to the available policy information, GI is only visible on a limited number of EC-related websites and platforms. Significant progress can, therefore, be made by having the concept, its relevance for the sector and a link to the GI section on BISE integrated across the websites of relevant policy sectors. Among the stakeholder platforms evaluated, only those of CEEweb, FACE and WBCSD contain clear and inspiring information on GI. On several other platforms, GI is mentioned, but very little information could be retrieved. Certain platforms containing related information (e.g. biodiversity, ecosystem services, nature-based solutions) make a link to GI in some documents; however, the platforms do not include sections dedicated to GI specifically. Altogether, the visibility of GI on relevant IT platforms and websites can be considered poor. Improving it can make a significant contribution to distributing GI information to the public and various end-users.

Eight platforms were explored in more depth, focusing on the end-users and their expectations, the type of GI information available and lacking, whether there is potential to connect across platforms, and how to improve the visibility of GI. A more detailed analysis was conducted and concrete recommendations formulated for three major platforms: BISE, NWRM and Climate-ADAPT.

With respect to BISE, although not labelled as such, most information of the BISE platform is highly relevant from a GI perspective. However, the GI relevant sections need to be made more visible, e.g. by labelling GI-related sub-sections as such. The coherence and user-friendliness of the available information can also be improved. Further interlinkages between the various GI-related sections could be provided, in order to create a more holistic picture and increase the usefulness of BISE for its end-users. The GI information available should be extended to encompass policy aspects and provide greater depth with regard to the different GI options and measures mentioned. The GI library hosted by BISE has the potential to be further developed into a rich source of GI information, but needs to be made more visible and accessible.

All information on the NWRM (Natural Water Retention Measures) website is highly relevant to GI since NWRM are an example of GI solutions. However, the website could be improved by better integrating the GI concept and making the connections between NWRM and GI explicit. Further linkages should be made to other GI platforms and sources of information.

GI is among the most widely applicable, economically viable and effective tools to support climate change adaptation. The Climate-ADAPT platform contains a few references to GI, but not sufficient to reflect its significance. The few GI references are scattered across the platform, making the GI-relevant information on the platform difficult to locate by its potential users. The website contains highly relevant knowledge which could provide useful information and guidance on sectors, measures, and processes relevant for GI, and in particular GI measures supporting climate adaptation. However, the GI relevance of this information needs to be made more explicit. It would also be important to increase the interlinkages across the platform in order to provide a more complete overview of GI and to help users locate the information. It would be beneficial to create a separate section on GI and adaptation which could present all these aspects in a coherent and visible way. These improvements would be necessary to establish links with other platforms, such as BISE.

In the short-term, BISE should be developed into a GI information hub, while considering that it should not become the only access point for GI knowledge. Therefore, it is important to decide which GI information should be made available through BISE, and which through other platforms (such as NWRM or Climate-ADAPT). It should be ensured that GI information presented through other platforms is also linked to BISE, such that it can also be reached by end-users accessing through BISE.

In the mid-term, it would be desirable for GI information to be made available through the different websites or platforms linked to specific policy sectors or stakeholder groups. It will be important to consider end-users' needs when deciding where to disclose which GI information. Another challenge is to connect the different sources available on the various platforms. Rather than having to search for GI information on separate platforms, it may be beneficial to make GI information available through a single search or from a single page with convenient links to platforms where other information is available. To improve user access to GI information, a search function in combination with a single repository where all GI related information is centralized would be the most effective solution. However, the feasibility of this option is low, as it is very unlikely that all platforms involved would be willing to share all information in an agreed manner. A longer-term recommendation to address this issue is to make use of the potential of machine to machine communication, for example through the use of "Structured Data Markup" or Web APIs.

Task 4

Task 4 examined the extent to which GI is currently covered in the technical standards of nine sectors (finances, buildings, water, transport, public health, industry, climate, rural abandonment and energy) and assessed the need for (further) harmonising, adapting or developing GI-related standards. A series of sector-specific fact sheet and cross-sectoral recommendations were developed.

The key findings for each of the nine sectors are:

- **Financial sector**: Whilst direct lending for biodiversity projects by financial institutions accounts for a limited proportion of financial markets, retail and

investment banks as well as institutional lenders are increasingly applying sustainable investment criteria to their loans that incorporate impacts and dependencies on biodiversity and ecosystem services. However, the focus is mainly on conservation and restoration of biodiversity values affected by project developments, rather than actively promoting the deployment of GI as part of project developments. Even the substantial benefits of GI in the field of climate change adaptation (such as flood risk reduction) are largely undervalued by financial and insurance companies. As a consequence, there is substantial room for improvement, starting with increased efforts in awareness raising, in particular about the long-term financial benefits of GI. Other opportunities are the uptake of GI in performance standards applied by the sector.

- **Building sector**: There is a plethora of sustainability standards in the buildings sector across Europe with varying levels of requirement. Few are known to be legally required but they can often be mandated at country, region, city or local level. Building sustainability standards focus primarily on materials and energy performance. Where biodiversity requirements exist, they are often not mandatory, carry little weight and do not promote high levels of biodiversity. Where GI is integrated into buildings, it is often limited to green roofs, with little focus on other elements of the building or surrounding area. Developments that have taken place in the context of green roofs may provide inspiration for broader inclusion of GI in the building process.
- **Water sector**: In the water sector, procedural standards for sustainable water management in Europe are available through the Water Framework Directive. In the private sector there is a growing awareness of proactive investment in sustainable water management in the catchment in which companies operate. Although GI is not always explicitly mentioned, the application of GI fits well in the ecosystem and catchment-based approaches. As a way forward for the implementation of GI, it is important to incorporate 'green', 'grey', and hybrid solutions in the initial assessments of options in such a way that actors can compare and make the best choice for their situation. At the moment, criteria are often established for evaluating the performance of 'grey' options, but not of GI or for comparing across 'grey' and 'green' options. This poses a barrier to the wider implementation of green options.
- **Transport sector**: There is a substantial amount of guidance and good practice on how to address fragmentation and barrier effects of transport infrastructure by means of, e.g., overpasses or fauna tunnels, which in some cases are supported by GI measures. Also at a landscape level, GI offering improved habitat connectivity is often applied as part of wildlife and landscape management, and increasingly incorporated into regional spatial planning. However, guidance on how to reconcile transport networks with ecological networks at a regional scale is very scarce. The same goes for guidance on how to optimize the ecosystem services provided by GI to mitigate the impacts of transport infrastructure on biodiversity.
- **Public health sector**: With the exception of accessibility standards that recommend the availability of GI for citizens, the standards, guidelines and protocols of the public health sector are outside the scope of GI. However, there is a growing body of literature linking GI to human health and wellbeing, but the underlying mechanisms are poorly understood and the knowledge tends to remain in the green sector, not penetrating the health sector. Exceptions include some SMEs and bottom-up local initiatives bridging the gap between the green sector and the health sector. There is a large potential for GI standards for the health sector, but before standardization can take place, the evidence base needs to be

improved, and the results must be dissipated within the health sector rather than only in the green sector.

- **Industry sector**: The industry sector is very familiar with sustainability standards. Although biodiversity, as part of sustainability, has long been a rather neglected issue, the recent increase in specific biodiversity guidance for industry reflects a growing interest in the field of 'business and biodiversity'. However, when zooming in on the topic of GI within this growing amount of biodiversity standards, it is clear that there is room for improvement. Particular issues which deserve more attention are the costs and benefits of GI in an industrial context, as well as guidance on how to implement GI.
- **Climate sector**: Many examples of tools, guidelines and best practices already exist on the application of GI, or nature-based solutions, in the context of climate change adaptation. Performance standards, which are common practice in, e.g., the building world, are not a useful way forward in the climate adaptation sector. The reason for this is that the local situation is generally too specific. The multi-functionality of GI is a benefit, but at the same time makes planning and implementation of GI very difficult. Integrating a GI framework into Environmental Impact Assessments might be a way forward, as this would guarantee that the potential of GI in landscape planning is considered.
- **Rural abandonment**: GI can offer solutions for both the prevention of farmland abandonment and for minimizing negative impacts on already-abandoned farmland. There are no specific GI standards in the context of rural abandonment. An indirect way to stimulate GI in rural abandonment areas is through the Common Agricultural Policy (CAP) funding scheme or European Structural Funds.
- **Energy sector**: Possibilities for developing GI in this sector are quite diverse and rather specific for each type of energy infrastructure. The energy sector is under full development and is characterized by increasing investments in renewable energy, as well as in electricity transmission infrastructure in the EU. At the same time, existing energy infrastructure is being revitalized. The energy sector might benefit from investments in GI for various reasons, ranging from reducing risks (operational, reputational) to grasping opportunities (cost reduction, reputational), depending on the type of investments. Due to the variety of energy infrastructure, generic GI standards for the energy sector are not available, but a number of specific standards exist.

The study also formulated cross-sectoral recommendations in relation to four aspects:

- **Integrated spatial planning**: Several sectors (such as climate adaptation, water, land abandonment and infrastructure) have indicated that the implementation of GI would benefit from integrated spatial planning early in the planning process. Moreover, it has been increasingly recognized that it is necessary to work at the landscape level to ensure that sectors can capture the benefits of GI and to maintain biodiversity and ecosystem services. A landscape approach can contribute to bringing together sectoral economic development plans and national action plans on biodiversity conservation, water management and climate change.
- **Green procurement**: Public authorities are major consumers. By using their purchasing power to choose environmentally friendly goods, services and works, they can make an important contribution to sustainable consumption and production. Therefore, the way GI is included in Green Public Procurement (GPP) will have a major impact on how GI will be considered in activities and businesses. GPP will therefore be key to ensuring GI procurement. It may be necessary to develop and establish a GI Public Procurement (GIPP) to include in

public tenders the use of GI as innovative solutions presenting a real alternative to traditional grey infrastructure.

- **Finding the appropriate standard**: There is no obvious way of understanding which standards are most suitable to meet specific needs. Therefore, users require assistance in finding the 'needle in the haystack' standard that matches their needs. A way forward would be to explore ways of facilitating the search for and access to appropriate standards. Sectorial organisations could play a role in this respect, by assisting their members in the search for appropriate standards and providing guidance on what can be achieved with which standard. Standards-making bodies could also be involved. Possibilities could be explored for a collaborative interactive database with a hierarchical tree which facilitates the search for appropriate standards and provides insight into what can be achieved with shortlisted standards.
- **Harmonization across infrastructure sectors**: Each of the infrastructure sectors (e.g. buildings, transport, energy, water) have their own standards regarding performance, procedure and methodology. In the past, each of these sectors mainly operated in isolation from the other sectors, but integrated approaches have become more common in recent years. This may be seen as an opportunity for improving the way GI is included in standards. Indeed, there is potential for collaborative action and harmonization across sectors as regards the inclusion of GI in standards.

Task 5

This task included all the exploratory work carried out with regards to the potential introduction of a TEN-G.

The review and analysis included the consideration of lessons learnt from existing trans-European networks in terms of informing the design options and set-up of a TEN-G in terms of governance structures, eligibility criteria, etc. The research showed that while some of the experiences and feedback could certainly be considered for the various design options, a more detailed analysis tailored to the much broader GI objectives (as compared to rather focused energy and transport objectives) will need to be carried out.

The baseline building exercise has shown the data limitations and access to information when working with GI. While the baseline has to be seen with these limitations in mind, it still offers a first consolidated picture of what the current EU-level spending looks like for GI.

Similarly, while restricted by certain limitations, the first-phase cost-benefit assessment of the potential environmental, social and economic advantages of introducing a TEN-G versus continuing the status quo has generated food for further thought and discussion on the matter. In the next follow-up steps it will be important to start looking in more detail into the possible design options including potential locations where components could be implemented, realistic ambition levels in terms of funding for TEN-G, and chosen priority components for a TEN-G that could be taken forward by DG Environment.

Annexes