



What is Green Infrastructure?

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.” 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 adaptation.

The European Green Infrastructure Strategy

The Green Infrastructure Strategy proposed by the European Commission, promotes the development of Green Infrastructure across the EU delivering economic, social and ecological benefits and contributing to sustainable growth. It guides the implementation of Green Infrastructure at EU, regional, national and local levels. A main feature of the Green Infrastructure Strategy is its integration into relevant policies through: ecosystem-based adaptation into climate change policies; nature-based solutions into research and innovation policies; natural water retention measures into water policies; and through its focus on delivering multiple ecosystem services and their underlying factor - a rich biodiversity - into nature policies. The Natura

2000 network in particular plays a major role in protecting many of the core areas with healthy ecosystems.

As Green Infrastructure can make a significant contribution to many sectors and EU policy objectives, Green Infrastructure is being integrated into many funding streams including Structural Funds (the European Regional Development Fund (ERDF); European Social Fund (ESF)), the Cohesion Fund (CF), the European Maritime and Fisheries Fund (EMFF), the European Agricultural Fund for Rural Development (EAFRD), LIFE+ and Horizon 2020 project funds and the Natural Capital Financing Facility (NCCF) of the European Investment Bank (EIB).

Links between Water & Green Infrastructure

Water is an essential component for human health and well-being, as well as for the maintenance of ecosystems and habitats. Green Infrastructure is an important instrument for achieving and maintaining healthy water ecosystems and offers multiple benefits to the water sector by: providing a regulation of water flows, water retention for further use later on, water purification and water provisioning, species protection, biodiversity enhancement, climate change mitigation and adaptation and disaster reduction by the prevention and mitigation of floods. To integrate Green Infrastructure aspects into water and river basin management has the potential to significantly contribute to the improvement or preservation of water of good quality and quantity. Such integration also has a

large potential to reduce the impacts of floods and droughts and to mitigate hydro-morphological pressures.

Examples of water-related functions of Green Infrastructure include Natural Water Retention Measures (NWRM), which are multi-functional measures that aim to safeguard water resources using natural means and processes. The main focus of NWRM is to enhance, as well as preserve the water retention capacity of aquifers, soils and ecosystems with a view to improve their status. NWRM provide multiple benefits, including the reduction of the risks of floods and droughts, improved water quality, groundwater recharge and habitat improvement. They can be applied in several

types of areas such as in rivers and wetlands (through flood plain reconnection and restoration, wetland restoration), urban areas (improving infiltration through sustainable urban drainage systems, green roofs), agricultural land (green cover, buffer zones) as well as forestry and semi-natural areas (meadows, riparian, woodland). Another example of water-related Green Infrastructure is Integrated Constructed Wetlands (ICW), artificial wetland systems that assist in waste water treatment. Although artificial wetlands systems require more space than traditional waste water management, they offer multiple benefits which go well beyond their water purification capacities (e.g., carbon-sequestration and preserving biodiversity).

Costs & benefits of Green Infrastructure in relation to Water

Water related Green Infrastructure measures have the potential to bring cost savings primarily through the avoidance of measures to deliver similar services, such as relieving pressure on wastewater treatment plants or securing adequate water supply. Green Infrastructure thus has the potential to deliver cost-efficient solutions for implementing several of the EU's key water directives, including the Water Framework Directive, Drinking Water Directive, Waste Water Directive and Ground Water Directive, EU Floods Directive.

It also brings many opportunities for job creation and innovation. Developing Green Infrastructure in the water sector requires high-skilled jobs such as engineers, architects and planners but also calls for numerous opportunities for "green collar" employees in terms of construction and maintenance. Furthermore, the multi-functional water aspects of Green Infrastructure provide many additional benefits spilling over to a range of sectors as it can contribute

to reduced temperatures in urban areas, energy efficiency in buildings, climate change mitigation (through, e.g., reduced energy demand), etc.

Examples of the economic benefits from water related Green Infrastructure projects have shown that large savings could be achieved in a number of sectors. The flood protection functions of Green Infrastructure have a large potential for significantly reducing the increasing cost for flood damage (amounting to billions of EUR across Europe annually) and lowering flood risk management costs. By reducing flood risks and providing water-efficiency practices, Green Infrastructure also contributes to increased property values. Additionally, estimations have shown that the economic value of wetlands can be as high as commercial values of other land uses. For example, in the Crooked River Watershed (Portland, USA), the World Resources Institute estimates the Portland Water District would save an expected USD 12 million - and possibly as much as USD 110 million - over the next 20 years by investing in Green Infrastructure alternatives to grey infrastructure (i.e., a membrane filtration plant). Moreover, a case study in McKenzie Watershed (Oregon, USA) estimated the value of riparian buffers to be between USD 2,548 - 6,588/ha annually, estimated based on a range of benefits delivered via associated ecosystem services, from water supply and quality to recreation.



Good practices in Water & Green Infrastructure

Optimal use of Green Infrastructure elements for ecosystem service delivery from freshwater ecosystems (France)

This example presents innovative measures to ensure an enhanced and continued ecosystem service delivery from freshwater ecosystems, through restoration zones (adaptation of infrastructure, restoration of wetlands and natural connectivity of rivers) and sustainable land use (purchase of wetlands to ensure sustainable management). The initiative follows the adoption of two new legal provisions of the Grenelle II law; Article 132: a programme for the restoration of the ecological continuity of water bodies and Article 133: conditions for the purchase and sustainable management of wetlands by public authorities.

The initiative has a positive cost-benefit ratio in terms of the water purification ecosystem function of wetlands. Under Grenelle II Article 132 activities, one-off costs are EUR 18 million with an additional EUR 16 million recurring costs per year. For Grenelle II Article 133 activities, one-off costs for the purchase of wetlands vary between EUR 3,000 and 7,000 per hectare. The benefits of the project are primarily related to improved water quality, which are estimated to amount

to between EUR 2,500 and 3,000 per hectare per year which primarily relates to avoided treatment costs.

Flood protection regulations through wetland (UK)

Flooding is becoming increasingly problematic in the UK, as well as across Europe. This project aimed to estimate the value of selected ecosystem goods and services generated by wetlands, freshwaters and floodplains in the UK.

In terms of flood protection Green Infrastructure can provide economic benefits from mitigating impacts of flooding and heavy rain fall. In the UK, the annual cost of flood damages is about GBP 1.4 billion, with a further GBP 1 billion spent on flood risk management. The project showed that the value of an additional ha of wetland in the UK, due to flood protection properties, is GBP 407 ha/year for inland wetlands and GBP 2,498 ha/year for coastal wetlands. The default estimates of annual benefits are GBP 303 ha/year for inland wetlands and GBP 1,856/ha for coastal wetlands.

Vienna water charter (Austria)

The drinking water supply for the city of Vienna is mainly obtained from mountain springs originating in the Lower Austrian-Styrian high alpine zones. Vienna established water protection areas in 1965 (and extended in 1988), and preservation areas were established around the supply sources to ensure the sustainable use of the water resource. The City of Vienna now administers a total area of approximately 32 000 ha of forest, mountain pastures and meadows, enabling the city administration to coordinate the use of rural, tourism, hunting and fishing activities with the requirements of spring protection.

The benefits of the city's efforts are improved water quality and safe guarded water supply for Vienna. Additional benefits are linked to preserving biodiversity.



wetlands



green roof

Challenges and opportunities

There is growing recognition on the positive role Green Infrastructure can play in the water sector and the vast opportunities for Green Infrastructure investments to deliver cost efficient services are beginning to be embraced. However, to boost further uptake of Green Infrastructure in the water sector there is a need for:

- A stronger evidence base on Green Infrastructure integration into the water sector and the related benefits.
- Prioritising green over grey solutions.
- Stronger focus on integrated spatial planning taking the wide range of ecosystem

services related to water supply, water treatment and flood management into account.

- Need for awareness raising among water and waste water treatment companies about Green Infrastructure-based alternatives to traditional grey infrastructure investments.
- Need for improved access to financing for Green Infrastructure in the water sector.
- Upscaling from local/regional pilots to large scale use of green solutions for the water sector.
- Increased use of NWRM.

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