



What is Green Infrastructure?

Green Infrastructure is made up of natural and semi-natural areas that together function as a strategically planned network and deliver multiple nature-based services. These networks of green elements provide economic benefits, local services, improve quality of life, support a green economy, contribute to protecting biodiversity and safeguard ecosystem services, such as water purification, air quality, space for recreation and climate 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. Within EU transport policy,

substantial benefits can be achieved by including Green Infrastructure in Environmental Impact Assessments and Strategic Environmental Assessments for transport projects or programmes, thereby integrating climate change and biodiversity into the assessments.

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 (NCF) of the European Investment Bank (EIB).

Links between Transport & Green Infrastructure

Green Infrastructure 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.

Transport is responsible for around a quarter of EU greenhouse gas emissions, making it the second biggest greenhouse gas emitting sector after energy. Transport also has significant impacts on biodiversity through ecosystem destruction and fragmentation, thereby negatively impacting ecosystem services.

Avoiding or mitigating the fragmentation impacts of transport infrastructure on nature is a well-established Green Infrastructure strategy in the transport sector. Fragmentation of nature networks may be minimised by choosing specific design solutions, e.g., tunnels, or viaducts which minimise land-take or by allowing watercourses, including natural banks, to continue under the structure. A large expertise in the transport sector exists on the implementation of green bridges and eco-tunnels to mitigate the barrier effects for wildlife. Developing Green Infrastructure adjacent to infrastructure has the potential to deliver many ecosystem services. Road and railway verges and canal banks form important wildlife corridors and play a key part in the tourism appeal of the landscape for many

recreational activities. They can be an important food source for wild pollinators. Moreover, vegetation reduces noise levels by hampering or modifying the propagation of sound.

Green Infrastructure solutions can also sustainably mitigate carbon emissions, using the potential of new or restored peat lands and forests for carbon uptake and storage. Furthermore, transport infrastructure is vulnerable to extreme weather events and natural disasters, such as floods, landslides and avalanches, which cost lives and are the cause of billions of EUR of damage each year in the EU. Green Infrastructure solutions that boost disaster resilience of infrastructure form an integral part of EU policy on disaster risk management.

Costs & benefits of Green Infrastructure in relation to Transport

The benefits of green transport corridors go beyond just biodiversity; they create benefits for regional economies, employment, tourism and recreation, public health, water management and sustainability of energy and transport systems (climate change mitigation and adaptation). Green Infrastructure can often provide more benefits at lesser cost than single-purpose grey infrastructure.

In the transport sector, integration of transport and Green Infrastructure may enhance scenic value and connectivity resulting in increased benefits from leisure and tourism. Combining Green Infrastructure with permeable pavements may further reduce storm management costs and environmental pollution. Environmental benefits are derived from: the long-term conservation of nature and biodiversity; reducing the carbon footprint of the transport sector; maintaining ecological coherence in the landscape; and from avoiding traffic accidents caused by wildlife. Green

walls or green embankments along infrastructure function as noise barriers, reduce air pollution through particulate filtering, mitigate water run-off as well as reduce storm-water flows as part of a sustainable drainage systems. Elements of Green Infrastructure that can be integrated into road construction include vegetated drainage in combination with porous materials, permeable pavers, into streets or parking lots. These measures increase on-site neighbourhood storm water capacity.



Good practices in Transport & Green Infrastructure

Permeable pavement linked to Green Infrastructure is cheaper than traditional pavement (USA)

Storm water run-off from roads and highways pollutes and erodes water bodies, imposing health, financial, and environmental costs on local communities. These costs can be avoided or significantly reduced by ensuring that roadways retain storm water onsite. Permeable pavement combined with other Green Infrastructure is an effective measure to avoid storm water run-off. It can be up to 25% cheaper than traditional pavement when all construction and drainage costs are included. The California Storm water Management Association estimates a one-hectare permeable pavement surface to incur EUR 23,500 in total construction costs, and EUR 9,400 in annual maintenance costs. Permeable paving surfaces are expected to last for up to 25 years if properly maintained.

Mitigation: Alpine Carpathian Corridor (Austria, Slovakia)

The project aimed to construct and preserve a coherent 120 km ecological corridor from the Alps to the Carpathians in response to the increasing fragmentation caused by agriculture intensification, the rapid expansion of built-up areas and expanding transport infrastructure. The main objectives are to safeguard these habitats and enable the migration and genetic exchange between wild animal populations. From 2009-2012, several measures were implemented within the framework of this cross-border and cross-sectorial project, such as improving the traffic network by building 'green bridges' over highways at key points / bottlenecks as well as the creation of suitable habitat patches or stepping stones within the corridor. Public awareness campaigns and environmental education for schools within the region are also part of the project. The project costs amount to EUR 4.8 million, whilst the project delivers several additional benefits, such as recreation and ecotourism.

Storm water management through green road verges (USA)

The Edmonston, Maryland Green Street project (USA, 2010) transformed the main residential street into a national model for roadway storm water management. Prior to the project, the town experienced years of devastating flooding due to poor storm water management practices, and polluted run-off from the road fouled the neighbouring



Anacostia River. The created green infrastructure consists of rain gardens with native plants (62% of the street's area) and bike paths with permeable pavement (28% of the street's area). These measures will capture nearly 90 % of all rainstorms in a typical year. Green Infrastructure is an especially effective method for retaining storm water that also generates a wide range of economic and social benefits beyond improved water quality. The project's total costs were EUR 1.2 million. The project delivers multiple benefits: in addition to the management of storm water management, a large tree canopy filters airborne pollutants and provides shade to decrease the urban heat island effect.

Reconnection in an existing road network: Holstein Habitat Corridors (Northern Germany)

The Hamburg metropolitan region is surrounded by a dense traffic network of trans-European importance. Together with an intensification of land use, this has led to a fragmentation of habitats. Many species already became extinct, as natural biological exchange processes are reduced to a minimum. A project funded by the Federal agency for nature conservation aims at the reconnection of fragmented habitats to secure and re-establish biodiversity. In a first project (2010 - 2013), fauna passages crossing one of the federal motorways were connected with close by and highly diverse nature protection areas including Natura 2000 sites by installing the nationwide first "ecological hinterland connections" of fauna passages. In a second project (2013 - 2017), the project group builds-up ecological corridors between several fauna passages crossing other motorways. The aim of the project is to reduce regional conflicts between infrastructure and habitat network, make a key area on the land bridge to Scandinavia permeable for wildlife again, and enable adaption and migration processes of species and habitats in times of climate change.



Green bridges and eco-tunnels



Permeable pavement

Challenges and opportunities

A Green Infrastructure strategy to achieve a safe and ecologically sustainable transport infrastructure requires diverse measures and planning procedures. The implementation of such a strategy requires:

- Knowledge dissemination and awareness raising among planners and decision-makers on the importance of Green Infrastructure benefits for transport.
- Ensuring an integrated planning and decision-making process at the national, sectorial, regional and local levels (in order to plan and design projects).

- Ensuring the provision of necessary financial resources and prioritising expenditure on practical actions, such as removal of barriers to restore ecological continuity (in order to implement Green Infrastructure).
- Including Green Infrastructure in Environmental Impact Assessments and Strategic Environmental Assessments for transport projects or programmes, thereby integrating climate change and biodiversity into the assessments.

References

- COST 341 Habitat Fragmentation due to Transportation Infrastructure. WILDLIFE AND TRAFFIC A European Handbook for Identifying Conflicts and Designing Solutions European Commission, DG Environment (2013). Building a Green Infrastructure for Europe. Green Infrastructure Implementation and Efficiency (20120) IEEP <http://www.ieep.org.uk/work-areas/agriculture-and-land-management/2012/03/green-infrastructure-implementation-and-efficiency> http://ec.europa.eu/environment/integration/green_semester/index_en.htm http://www.iene.info/wp-content/uploads/COST341_Handbook.pdf <http://www.lebensraumkorridore.de/> Naumann, Sandra, McKenna Davis, Timo Kaphengst, Mav Pieterse and Matt Rayment (2011): Design, implementation and cost elements of Green Infrastructure projects. Final report to the European Commission, DG Environment, Contract no. 070307/2010/577182/ETU/F.1, Ecologic institute and GHK Consulting. The Natural Resources Defense Council, NRDC, After the Storm: How Green Infrastructure Can Effectively Manage Stormwater Runoff from Roads and Highways, New York www.nrdc.org.

Contract details: EC DG ENV, ENV.B.2/SER/2014/0012 "Supporting the implementation of the European Green Infrastructure Strategy"

Presented by: Trinomics, Alterra, Arcadis, Regional Environment Centre, Risk & Policy Analysis, Stella Consulting.

Disclaimer: The information and views set out in the factsheet are those of the author(s) and do not necessarily reflect the official opinion of the European Commission (EC). The EC does not guarantee the accuracy of the data included in this factsheet. Neither the EC nor any person acting on the EC's behalf be held responsible for the use, which may be made of the information contained therein.