



Green Infrastructure and Ecological Connectivity

EEAC Biodiversity WG Briefing Paper

1. Context

1.1 Ecosystems are continuously being degraded due to a variety of pressures resulting from population growth, overexploitation of resources, climate change, invasive species and many other factors which are impacting on natural habitats and causing biodiversity to decline¹. The world's poor are most at risk from the continuing loss of biodiversity, as they are the ones that are most reliant on local ecosystem services that are being degraded.

1.2 A recent study on the social and economic costs of policy inaction highlights the importance of biodiversity to our current and future wellbeing². Human well-being is dependent upon "ecosystem services" provided by nature for free, such as water and air purification, fisheries, timber and nutrient cycling. These are predominantly public goods with no markets and no prices, so their loss often is not detected by our current economic incentive system and can thus continue unabated. According to the initial findings of the Economics of Ecosystems and Biodiversity (TEEB) study, the costs of the loss of biodiversity, under a business as usual scenario would amount to 7% of global GDP by 2050.

1.3 A previous EEAC statement³ on biodiversity and adaptation to climate change drew attention to the importance of extending conservation planning across whole landscapes, halting net loss of habitat, enhancing ecological connectivity to reduce fragmentation and recreating ecosystems on a large scale (consistent with Article 10 of the Habitats Directive).

¹ SCBD (Secretariat of the Convention on Biological Diversity) (2006): Global Biodiversity Outlook 2. Montreal: Secretariat of the Convention on Biological Diversity.

² Braat L. & P. ten Brink, (eds.), with J. Bakkes, K. Bolt, I. Braeuer, B. ten Brink, A. Chiabai, H. Ding, H. Gerdes, M. Jeuken, M. Kettunen, U. Kirchholtes, C. Klok, A. Markandya, P. Nunes, M. Van Oorschot, N. Peralta-Bezerra, M. Rayment, C. Travisi, M. Walpole, 2008. *The Cost of Policy Inaction, The case of not meeting the 2010 biodiversity target*. Wageningen, Alterra, Alterra-rapport 1718. 314 blz.; 85 figs.; 45 tables; 140 refs.

³ EEAC (2005) – Biodiversity Conservation and Adaptation to the Impacts of Climate Change

1.4 There is no widely accepted standard definition of green infrastructure. For the purpose of this paper, we have taken green infrastructure to include actions to build connectivity in the national and European nature protection networks as well as actions to incorporate multi-functional green spaces in urban environment.. Across the EU many initiatives have been launched at local, regional, national and trans-national levels to develop “green infrastructure” initiatives⁴. Approaches to green infrastructure are quite broad and diverse and may be understood both as a nature based approaches and a more structural element which supports with green elements. There are example definitions from England, The Netherlands and elsewhere (see below). While ‘grey infrastructure’ (roads, rails etc.) is physical and concrete, ‘green infrastructure’ is based on theoretical planning approaches that maintain ecological functions at the landscape scale in combination with multi-functional land uses⁵.

1.5 EU nature conservation policy has been very successful in designating approximately 20% of EU territory, about 25,000 sites, as areas where the protection of nature is given the highest priority through the implementation of the Habitats and the Birds Directives. Most crucially, the provisions of the Habitats Directive to protect sites throughout the countryside, effectively manage and protect sites, and specifically encourage connectivity between sites and monitor status and trends, are only starting to be implemented⁶. Adaptation to climate change is concerned with reducing the vulnerability of human and natural systems. In biodiversity conservation, this should be complemented with activities to reduce pressures arising from, for example, habitat fragmentation, ensuring habitat connectivity and strengthening coherence/resilience by establishing ecological networks⁷.

1.6 The EEAC draft statement on *Sustainable Infrastructure for Europe* makes the case that green infrastructure and ecological connectivity are essential for the protection and enhancement of ecosystem goods and services but also critical infrastructure for Europe as are our transport and energy networks and as vital to the pursuit of sustainable development.

1.7 This paper has been prepared by the EEAC Working Group on Biodiversity and is aimed at providing further elaboration on the crucial role of green infrastructure to support the EEAC statement.

⁴ See Proceedings from the Workshop “Towards a green infrastructure for Europe”, 25-26 March 2009, Brussels (www.green-infrastructure-europe.org)

⁵ Bennet, C. 2009 in: Proceedings from the Workshop “Towards a green infrastructure for Europe”, 25-26 March 2009, Brussels (www.green-infrastructure-europe.org), page 15

⁶ European Environmental Bureau (2008). *Building Green Infrastructure for Europe*

⁷ EEAC Advisory Councils (2005): Biodiversity Conservation and Adaptation to the Impacts of Climate Change. Statement (www.eeac-net.org)

2. The benefits of green infrastructure

2.1 Green infrastructure provides us with a wide range of benefits. It provides space for nature and the natural systems that deliver vital ecological services underpinning our quality of life⁸. Green infrastructure enhances the land's permeability for migrating species and re-connect habitats which had been separated by intensive land use, transport routes and urban sprawl.

2.2 Not only are these green infrastructure benefits relevant today, but the benefits for future climate change adaptation is increasingly being recognised. For example, floodplains alleviate flooding by storing water after heavy rainfall and releasing it back slowly into streams and rivers. Woodlands and extensively managed pastures act as carbon sinks, helping to offset the impacts of increasing carbon emissions.

2.3 While other conservation approaches typically are undertaken in isolation from - or even in opposition to - development; green infrastructure is considered "smart" conservation, addressing the ecological and social impacts of urban expansion and the accelerated consumption and fragmentation of semi-natural habitats in a strategic manner. This represents a paradigm shift away from conservation activities that are reactive, site-specific, narrowly focused, or not well integrated with other efforts⁹.

2.4 Establishment of green infrastructure reverses habitat fragmentation and increases biodiversity, thereby restoring functioning ecosystems. This is not only necessary if we are to halt the loss of biodiversity across Europe, but it will also contribute to achieving a wider range of goals, including adaptation to climate change and the maintenance of ecosystem services such as clean water, productive soils and attractive recreational areas.

3. National Policy Perspectives

3.1 In a lot of European countries, for example Czech Republic, Denmark, Germany¹⁰, Netherlands, and Slovakia, the establishment of ecological networks is foreseen in national legislation, usually the same legislation which transposes the Birds and Habitats Directives. There is a wide variation in the type of work being undertaken in developing green infrastructure and it is happening at different scales:

⁸ Clabby, C. (2009) *Green Infrastructure: Critical Infrastructure for a Smart Economy*. Comhar SDC commentary <http://www.comharsdc.ie/files/Commentary%2040%20Green%20infrastructure.pdf>.

⁹ Green Infrastructure - A briefing note with contributions from Phil Baarda (SNH), Russell Elliott (CCW), Richard Ferris (JNCC), Jim Latham (CCW), and Ed Mountford (JNCC)

¹⁰ Von Haaren. C. & Reich M. (2004) *The German way to greenways and habitat networks*. Institute for Landscape Planning and Nature Conservation, University of Hannover.

at a larger sub-regional or even regional scales, or for some species and ecosystems it is necessary to build corridors at a local scale. Some examples of national policy initiatives are set out below:

The United Kingdom

Natural England defines green infrastructure as ‘a strategically planned and delivered network comprising the widest range of high quality green spaces and other environmental features. Designed and managed as a multi-functional resource capable of delivering those ecological services and quality of life benefits required by the community it serves and needed to underpin sustainability. Its design and management should also protect and enhance the character and distinctiveness of an area with regard to habitats and landscape types. Green infrastructure includes established infrastructure and new sites and should thread through and surround the built environment and connect the urban areas to its wider rural hinterland. Consequently it needs to be delivered at all spatial scales- regional, sub-regional, local and neighbourhood levels, accommodating both accessible natural green spaces within local communities and also much larger sites in the urban fringe or wider countryside.’

Types of green infrastructure include parks and gardens, amenity green spaces, natural and semi-natural urban green spaces, green corridors, allotments, community gardens, city farms, cemeteries and church gardens, and farmland.

The *Green Infrastructure North West* initiative¹¹ has resulted in the production of guidance for planners in producing Green Infrastructure Plans, and supports GI policy in the NW Regional Spatial Strategy. Finding a joined-up and cross-regional approach to planning – namely the North-West’s future GI - is seen as crucial in the context of climate change, development pressure and a rapidly changing business and agricultural landscape.

Scotland's new National Planning Framework (NPF2) is a spatial representation of Scotland's planning aspirations and is currently awaiting Scottish ministerial approval¹². This includes the aspiration to create a Central Scotland Green Network. This goes beyond the North-West GI project definition, having several additional outcomes – i.e. biodiversity and environment, stronger communities, health improvement, and enterprise development. For example, see the Glasgow and Clyde Valley Green Network¹³.

¹¹ <http://www.greeninfrastructurenw.org.uk/>.

¹² <http://www.scotland.gov.uk/Publications/2008/12/12093953/0>

¹³ <http://www.gcvgreennetwork.gov.uk/>

In Wales, the issue of scale is important and the Countryside Council for Wales (CCW) programme focuses on ecological connectivity and responding to climate change and identifies three broad levels of action:

1. Individual sites – management of individual sites and improving condition of adjacent landscape and expanding and restoring habitats to develop effective buffers.
2. Clusters of sites – treating groups of protected sites as units, encouraging habitat linkages and complementary management objectives.
3. Large scale linkages or natural connections – large scale connections across the landscape that buffer sites and give species opportunities to move in response to climate change.

The Netherlands National Ecological Network¹⁴

The National Ecological Network (NEN) consists of core areas, nature development areas, and ecological corridors. The sustainability is supported by a buffer policy directed at eliminating or minimizing external influences on the National Ecological Network.’ The three component areas are:

- Core areas are large nature areas or a number of smaller areas linked together whose value is of national and international significance. The core areas can include areas with other designated functions than nature, like agriculture, forestry or water catchment areas. Through management contracts with the farmers and other land managers fulfilling management objectives are strived at.
- Nature development areas are those designed to increase (and reinforce) the existing core areas, but they can also grow so large that they develop into new core areas.
- Ecological corridors are areas or structures that enable the expansion, migration and exchange of plant and animal species between various core areas. These connections may take the form of interconnections or stepping-stones of varying sizes.

The Nature Policy Plan introduced the concept of the National Ecological Network (NEN) in 1990. The goal is to realize an interconnected network of good quality nature reserves and conservation areas by 2018. The NEN has survived many government shifts, but there have been alterations to the way the NEN is realised. The most fundamental change is the shift towards less public acquisition of land, coupled with greater scope for wildlife and landscape management by private landowners and farmers. So far, however,

¹⁴ Nature Policy Plan of the Netherlands. Ministry of Agriculture, Nature Management and Fisheries, 1990. p.42-49 The National Ecological Network (NEN) is called Ecologische Hoofdstructuur (EHS) in Dutch.

management by private landowners has had very limited success and the growth in the area of land under on-farm conservation schemes is tailing off. Between 1990 and 2006, the area of nature reserves has increased, and the environmental conditions and spatial coherence have improved. However, during the past five years this beneficial development has either slowed or has stopped entirely. This means that without supplementary measures, most of the established aims concerning wildlife habitats will not be achieved in a timely fashion. It is unlikely that the National Ecological Network will be completed in the year 2018 as planned.

Germany: Ecological Networks

The German Nature Conservation Act, as amended in 2002, calls for the establishment for an ecological network (Biotopverbund) on at least 10 % of the German territory. The German federal states are requested to implement this network following a trans-boundary approach. A system of common criteria for identifying components of ecological networks was agreed on by experts from the Federal Nature Conservation Agency and the federal state authorities in 2004. Applying these criteria core areas and corridors of national and international relevance are currently being identified. A comprehensive national ecological network plan is expected to be finalized by early 2010. The federal states are in charge of the implementation of ecological networks. The national government can only support the states by providing technical and scientific support and by funding of selective model projects.

Ireland – Green City Guidelines

Green City Guidelines¹⁵ provide advice for planners and developers on how to integrate biodiversity into new developments, specifically medium to high-density housing developments in urban areas. The guidelines provide practical examples of how semi-natural habitats such as woodlands, grasslands, treelines, hedgerows and watercourses can be successfully maintained, enhanced and created within new developments through appropriate planning and management.

4. Ecosystem Fragmentation and Infrastructure Provision

4.1 Habitat fragmentation and loss of connectivity, especially caused by developments in transport infrastructure, urbanisation, energy generation and agricultural intensification, pose one of the most significant threats to ecosystem survival. The further development of new transport and energy infrastructures may

¹⁵UCD Urban Institute Ireland, Dun Laoghaire Rathdown County Council & Fingal County Council (2008) - *Green City Guidelines – Advice for the protection and enhancement of biodiversity in medium to high density urban developments*

have negative impacts on shrinking natural habitats, especially on the European wide network of protected sites (Natura 2000), the favourable conservation status of habitats and species and the target to halt the loss of biodiversity by 2010. These conflicts result from limited space and the fact that land consumption for transport and energy infrastructures lead to less space for other uses and to habitat fragmentation.

4.2 Conflicts must be addressed at an early stage in the planning process through strategic environmental assessments (SEA). However, experience shows that assessments which are based on a weighing of interests usually result in a priority for economic interests, whereas non-commercial interests have a more difficult stand. In order to take account of article 6 of the Treaty, which demands that environmental protection requirements must be integrated into the definition and implementation of the Community policies and activities, environmental values must legally be made to carry more weight in these assessments.

4.3 On the other hand, besides analysing conflicts by strategic assessment of other infrastructure planning, measures should also be taken to improve biodiversity corridors through the creation of features that enhance ecological coherence and connectivity (as outlined in Article 10 of the Habitats Directive and Article 3 of the Birds Directive). Guidelines have been published on how to address adaptation and fragmentation which should be used in infrastructure development¹⁶. While the EU has the means to essentially influence the EU-wide planning of energy and transport networks, this is not sufficiently the case for green networks. This imbalance must be addressed. A variety of initiatives¹⁷ exists already in order to further develop European ecological networks, which will have to be developed further and need to be coordinated among each other.

4.4 On the financial side, the development of transport infrastructure funded by the EU Structural and Cohesion Funds has contributed to nature loss and fragmentation. Therefore, it will be crucial that full impact assessments including proper consideration of alternatives are carried out for all projects funded by the EU and European Investment Bank.

¹⁶ Kettunen, M., Terry, A., Tucker, G. & Jones A. 2007. Guidance on the maintenance of landscape features of major importance for wild flora and fauna - Guidance on the implementation of Article 3 of the Birds Directive (79/409/EEC) and Article 10 of the Habitats Directive (92/43/EEC). Institute for European Environmental Policy (IEEP), Brussels, 114 pp. & Annexes.

¹⁷ See outcomes from the Workshop "Towards a green infrastructure for Europe", 25-26 March 2009, Brussels, Background Document (<http://green-infrastructure-europe.org/download/Green%20Infrastructure%20workshop%20background%20document%20Final.pdf>)

5. Developing a European Vision for Green Infrastructure

5.1 Development of green infrastructure will need a long-term approach just as for other infrastructure development and it will need political support. The complexity of the issue is a challenge as many actions will be habitat and species dependent and there is a need to consider the cost effectiveness and efficiency of measures.

5.2 Given the range of initiatives that can come under green infrastructure, it is useful to differentiate between those that are focused on incorporating multifunctional green spaces into urban environments and those which relate to national and European nature protection networks as the actions recommended would be different for each.

5.3 The European Environmental Bureau (EEB) has made the case¹⁸ that building green infrastructure does not require the EU to develop new legislation, but rather invest in the better implementation of existing Directives, such as Habitats, Birds and Water Framework Directives.

5.4 Variation in methodology for identifying and implementing ecological networks or developing green infrastructure projects across member states makes comparisons difficult. Given that there is no common approach to development of green infrastructure, the European Commission and Member States should identify examples of best practice and lessons learnt to inform a common European vision. This common European vision and guidance should take account of the differentiated responsibilities and competencies (regions within states, members states, European Union/ EEA, etc).

5.4 Strategic guidance at European level for developing green infrastructure needs to be considerably strengthened. The interim EU Biodiversity Action Plan assessment states that the experience of the application of SEA to structural funds for the protection of biodiversity suggests the need for guidance on how to do this. Spatial planning will be a key variable to the development of green infrastructure and this is presently developed at member state levels.

5.5 Potential tools for use at a European level could be supporting financial instruments and strategic guidance for member states and for the cooperation between member states. Having regard to the very strong case arising from the health and welfare effects of living close by natural assets, then there might also be a case for some funding of green infrastructure investments through the relevant health authorities and through life insurance premiums.

¹⁸ European Environmental Bureau (2008). *Building Green Infrastructure for Europe*

A European Vision for Green Infrastructure will need to address:

- *The baseline situation.* To inform thinking on green infrastructure and identify the most important actions we need to know the baseline situation. Member states will need to identify current assets, functional requirements and benefits of current green infrastructure.
- *Means of development.* There is a need to build on existing networks (PEEN and PEBLDS - Pan-European Biological and Landscape Diversity Strategy, European Green Belt initiative) and policies such as the Water framework Directive (WFD) and Integrated Coastal Zone Management (ICZM), and there is a need for co-ordination and participation. In addition member states should be invited to incorporate biodiversity “offsets” for all contracts involving new infrastructure so that developers invest in appropriate green corridors and stepping stones for the effective migration of species as habitats shrink due to climate change.
- *Policy options:* Measures at EU level should include guidance and standards for member states; sector specific instruments (regulations, guidance); impact assessments; and financial instruments. Regular monitoring of land use effects of sectoral policy.
- *Funding:* Potential sources include the European Financial Instrument for the Environment (Life+); Structural and Cohesion Funds though inclusion as a priority in strategic and operational plans; the European Agricultural Funds for Rural Development (EAFRD) for actions in a forestry, agricultural and rural development context.
- *Strengthened EU competence in spatial planning:* While many EU policies directly and indirectly affect land use, the EU has no instrument and no competence, to strike a balance between the different and sometimes conflicting uses. Green Infrastructures, as first established by the Water Framework Directive and the Habitat- and Birds Directives, need to be further developed and should be an essential pillar of a renewed European Spatial Development perspective¹⁹. Strategic Environmental Assessments at all levels, including proper mechanisms for public participation then might help to anticipate trade-offs, to look for less conflict-intensive alternative options and to organise an informed public debate, which helps to better integrate the different infrastructures.

¹⁹ The need to develop a strategy to steer the development of the European territory has emerged as an important issue on the EU policy agenda. However after the development of the European Spatial Development Perspective (ESDP) endorsed by Ministers in Nordwijk in June 1997 and finalised in Potsdan in 1999 the initiative has had no real follow-up. See: http://ec.europa.eu/regional_policy/sources/docoffic/official/space_en.htm