focus

NATURE

LIFE building up Europe's green infrastructure

Addressing connectivity and enhancing ecosystem functions

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Habitat loss, degradation and fragmentation have been by far the biggest drivers of terrestrial biodiversity loss at EU level over the past 50 years. This is a result of the massive expansion of urban zones and transport infrastructures, which have been cutting up Europe's landscape. In addition, traditional land-use practices have been replaced by more intensive, mechanised and industrial-scale activities, especially in the agricultural and forestry sectors. This has weakened ecosystems, their functions and the biodiversity they support.

It is essential to ensure that ecosystem functions are maintained in order to sustain crucial ecosystem services. As the Natura 2000 network of protected sites reaches completion, it is becoming increasingly important to ensure that the Natura 2000 network of sites is spatially and functional coherent. This represents a great conservation and policy challenge and a cornerstone of efforts to prevent the loss of biodiversity. However, further benefits can also be reaped from the development of and investment in 'green infrastructure' in the 83% of the EU territory falling outside the Natura 2000 network. Such an approach would call for the restoration of ecosystems, insofar as possible, to strengthen their resilience and sustain the key services they provide, while also achieving conservation objectives and enabling Member States to adapt to climate change. The Commission is promoting and supporting exchanges of best practice as a basis for an EU strategy on green infrastructure to be developed after 2010.

Building a green infrastructure is one of Europe's main contributions to reversing the trend of biodiversity loss and to linking and strengthening diverse ecosystems in urban and rural areas.

The added value of green infrastructure, arises from its multifunctional use: it often ensures efficient and sustainable land use by integrating interacting functions or activities on the same piece of land. The spatial character of green infrastructure addresses both the issue of connectivity and the provision of ecosystem services (e.g. natural coastal protection through marshes/flood plain restoration; such climate change mitigation and adaptation measures are often more effective and cheaper than building dikes).

Improving the functional and spatial connectivity of ecosystems – by tackling fragmentation, improving resilience and enhancing mitigation and adaptation to climate change – will strengthen Europe's green infrastructure and, as a result, increase the value of the goods and services that its ecosystems provide. In the long term, such efforts will help safeguard and improve the habitats and conservation status of endangered species, and thus protect the EU's rich biodiversity.

LIFE Nature and, to a certain extent, LIFE Environment, have already made a contribution to developing Europe's green infrastructure, mainly on a local or regional level. The challenge now is to assess the substantial knowledge acquired through LIFE-funded projects and to finalise the concept of the green infrastructure strategy. This strategy will aim to find ways to reduce landscape fragmentation, improve ecosystem resilience, including the protection of its biodiversity, adapt to climate change and integrate spatial planning.

The good practices and innovative solutions introduced by LIFE projects – as highlighted in this brochure – are demonstrating how such a green infrastructure can be best supported and built up in the future.

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Why support Europe's green infrastructure?

The concept of green infrastructure emphasises the value of functionally and spatially connected, healthy ecosystems and the importance of ensuring that they keep providing their goods and services. Green infrastructure has a vital role to play in the conservation of the EU's biodiversity and in tackling fragmentation[1]. The concept highlights the importance of adopting a joined-up approach to integrated spatial planning and a flexible approach to climate change adaptation.

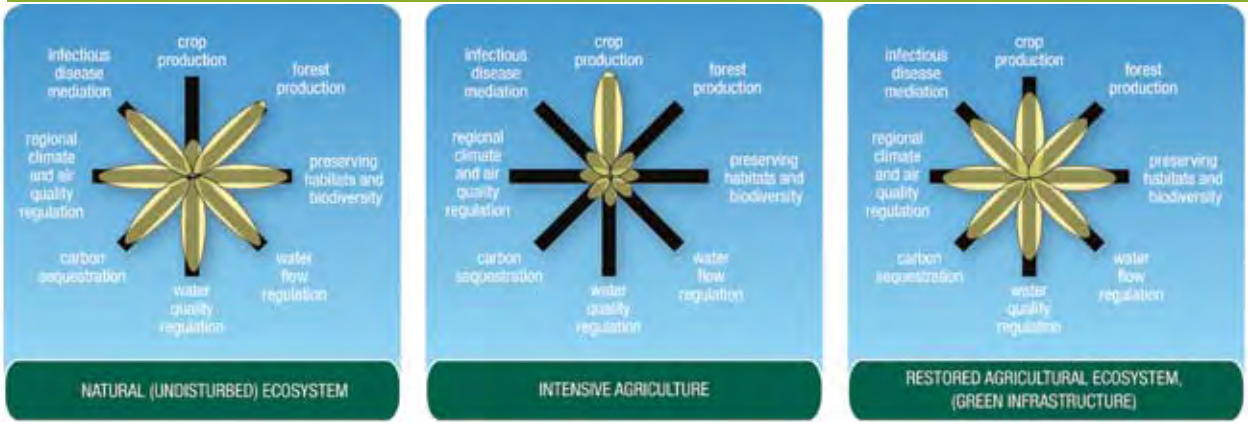
Europe's landscape is threatened by land cover change, fragmentation, and land-use intensification as a result of the unremitting pressure of human development. In the EU, land cover is changing dramatically, with around 1 500 ha of mainly agricultural land lost everyday as a result of urbanisation and construction. According to the European Environment Agency, around 8 000 km² were concreted over during the 1990s. Urban sprawl and the construction of transport routes and energy infrastructures has split up valuable landscapes, affected the habitats and species found in these landscapes, and weakened the spatial coherence of natural areas. In addition, other more wide-spread land-uses, such as agriculture and forestry, have intensified, using more energy, fertilisers and water. This shift from extensive agriculture and forest systems to very intensive ones, has resulted in the reduction of species richness and undermined the capacity of ecosystems to sustain food production, maintain freshwater and forest resources, and regulate climate or air quality.

Ecosystems – the combination and dynamic relations of all organisms in their environment – provide a wide range of goods and services upon which economies and communities depend. Goods include food, water and fuel, and services comprise water supply and storage, soil formation, carbon sequestration, nutrient cycling, pollination and recreational areas. The delivery of these goods and services is often closely linked with the state of biodiversity in these ecosystems. A single ecosystem, such as a wetland, provides a multitude of goods and services that too often are not taken in account in economic decisions. By draining the wetland and transforming it into agricultural land or by intensifying grassland production, several services are lost (see figure). These changes may lead to an unstable and unsustainable state of the environment, which could have serious economic and social consequences.

Core natural areas – those that are important for key species and habitats – are now protected by the Natura 2000 network, which covers more than 17% of Europe's land area. However,

1 Europe's landscape has been transformed by urban sprawl, a increasingly dense network of transport and energy infrastructure, and unsustainable forestry and agriculture, either leading to intensive crop production or abandonment of biodiversity-rich extensive farmland

Comparison of ecosystems provision on different land uses (adapted from Foyle et al., 2005)

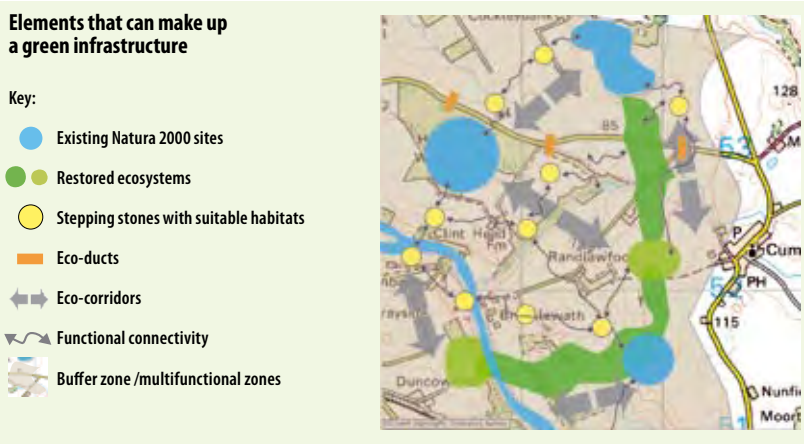


this alone will not be enough to halt the loss of biodiversity in Europe. Species have difficulty in dispersing and moving to fulfil their needs (e.g. access to specific habitats during migration, sufficient areas for food and breeding, etc.). In addition, ecosystem functions are disrupted as they become isolated, even in areas such as Natura 2000 sites, since these too often become 'pockets' or 'islands' if they are not connected to the surrounding landscape. The Natura 2000 network might not establish its coherence as intensively used landscape is expanding too quickly, thus preventing dispersal (and genetic exchange) of species and regular ecosystem functions, such as the flow of nutrients and water. This results in less permeable and diverse landscapes with direct negative consequences on biodiversity and ecosystem goods and services.

Healthy ecosystems also play a central role in the fight against climate change. They can cope and recover better in the face of change and disturbance and become more resilient. They protect us better against the negative effects of a changing climate and offer a whole range of ready-made natural solutions for mitigating, and adapting to, climate change.

In the face of all these threats – and with the aim to build on opportunities – the European Commission started working towards a framework for a green infrastructure across Europe, which will not only help to reconnect already fragmented natural areas, but also to maintain healthy ecosystems across a broader landscape and contribute to sustainable development.

Elements that can make up a green infrastructure



Green infrastructure consists of spatially or functionally connected areas which maintain ecological coherence as an essential condition for healthy ecosystems. Its purpose is not only to reconnect species populations but also to strengthen the functionality of ecosystems for delivering goods and services to mitigate and adapt to climate change effects, and enhance the quality of life (e.g. health, tourism, green business opportunities and conserving historic and cultural heritage).

This integration of nature conservation on a broader scale into land-use practices and measures intends to reduce barrier effects and strengthen ecosystems outside and inside protected areas. The multifunctional and multi-scale approach of green infrastructure ensures efficient and sustainable use of land by integrating interacting functions or activities occurring on the same area. Green infrastructure can, therefore, provide a multitude of ecosystem services under different land-use regimes (illustrated in figure, page 3). Natural ecosystems, such as a river and its floodplain in a Natura 2000 site (diagram, above), are able to support many ecosystem services at high levels, but not food production. The intensively managed cropland (centre), however, can produce food in abundance, but at the cost of diminishing other ecosystem services. However, an extensive cropland (right), which can be part of a green infrastructure, and is explicitly managed (or restored) to maintain other ecosystem services, may be able to support a broader portfolio of ecosystem services. As such, green infrastructure is best supported by a multi-faceted and flexible approach to land management that recognises the connections between habitats, species and ecosystems, and a strategic planning approach, when making the choice between decisions driven by different (economic, social and environmental) drivers.

GREEN INFRASTRUCTURE KEY OBJECTIVES

Europe's green infrastructure should serve the following purposes:

- Combating biodiversity loss by increasing connectivity between existing

Photo: LIFE00 NAT/D/007058

Photo: Markus Reisenberger

A key green infrastructure goal is to increase connectivity between existing nature areas and to increase their ecological coherence mitigating fragmentation effect of roads by wildlife strips along roads and 'ecoducts' in Germany

natural areas and increasing their ecological coherence (elements such as hedgerows, wildlife strips in fields, small watercourses, 'ecoducts', green urban areas and habitat patches could help in this respect);

- Strengthening the functionality of ecosystems for delivering goods and services, as well as mitigating and adapting to climate change effects;
- Increasing the resilience of ecosystems by improving their functional and spatial connectivity;
- Promoting integrated spatial planning by identifying multi-functional zones or by incorporating habitat restoration measures and other connectivity elements into various land-use plans and policies;
- Contributing to developing a greener and sustainable economy by investing in ecosystem services instead of purely technical solutions, and mitigating adverse effects of transport and energy infrastructure.

These objectives are addressed in the following sections of this brochure, which outlines the contribution of the LIFE programme and explains how certain LIFE project actions have been effective in strengthening green infrastructure. While very few LIFE projects have primarily focused on green infrastructure, they have implemented key elements of the concept.

HOW TO BUILD A GREEN INFRASTRUCTURE

Investing in green infrastructure often entails boosting connectivity between important biodiversity areas by constructing green bridges, tunnels and fish passes, as well as restoring rivers and wetlands. Other actions include restoring and maintaining hedgerows, tree lines, ponds and other suitable habitats in high nature farmland, where land uses that support healthy bio-diverse ecosystems are favoured over activities that are incompatible with these objectives. Wetlands, forests, heathlands, lakes and floodplains, mountains, coastal and marine areas, and green urban areas all have their role to play in building up a green infrastructure. However, this requires that those ecosystems are healthy and can deliver sufficient functional or spatial links to enable targeted species to thrive by providing foraging areas, breeding or resting sites and assisting in their migration/dispersal.

One of the most effective ways to build up green infrastructure is through spatial planning. Policies that adopt a spatial planning approach can improve spatial interactions over a large geographical area – i.e. at a local and regional level. Spatial planning entails bringing together different sectors in order to decide on land-use priorities in an integrated and co-operative way. Integrated spatial planning can, for instance, guide future infrastructure developments away from sensitive sites, and help minimise the risk of further habitat loss and fragmentation.

In order to engage all stakeholders in the process, the concept of green infrastructure must be clearly communicated and widely understood. The interests of land users and conservation groups are not incompatible: healthy ecosystems provide valuable services and investing in a green infrastructure makes economic sense. Maintaining ecosystems' capacity to deliver goods and services is economically far more cost-effective than having to replace these lost functions by investing in heavy and expensive man-made infrastructures. For example, the provision of ground water retention and purification and flood control by natural ecosystems is less expensive than building dykes, dams or water treatment plants. In addition, maintaining healthy ecosystems is a cost-effective way of mitigating and adapting to climate change.

Promoting integrated spatial planning by identifying multi-functional zones, such as Mediterranean coastal areas

Photo: LIFE00 NAT/E/007303

Photo: LIFE00 NAT/E/007355

Building a 'green infrastructure' for Europe

The need for healthy ecosystems is now widely recognised, not just to halt the loss of biodiversity, but also to benefit from the many valuable services they provide. An essential condition for healthy ecosystems is the maintenance of ecological coherence. However, habitats throughout Europe are becoming increasingly fragmented. Many initiatives are already playing a role in tackling this issue but, given the scale of the challenge, the European Commission now wants to initiate a coordinated approach to build an ecologically coherent green infrastructure for Europe.

A key aspect of this coordinated approach is the Natura 2000 network[1], now almost fully established on land. Encompassing more than 25 000 sites (covering more than 17% of the EU territory), it forms an integral part of current EU biodiversity policy. As the emphasis shifts from site designation to management, an ongoing challenge will be to ensure that this network operates in an ecologically coherent and co-ordinated way, and that it provides the necessary genetic exchange between populations to ensure their long-term survival.

The Habitats and Birds Directives – which form the legal basis of the Natura 2000 network – include various connectivity conservation measures for safeguarding Europe's biodiversity, both within protected areas and in the wider environment. Article 10 of the Habitats Directive (see page 23) suggests that conservation of landscape features is particularly important as a means of supporting the coherence of the Natura 2000 network. Similarly, Article 3 of the Birds Directive indicates that habitat conservation and restoration measures should be taken inside and outside protected areas.

The EU Biodiversity Action Plan (COM 2006/216) places a high priority on enhancing the coherence and connectivity of protected areas, incorporating both Natura and non-Natura sites. In particular, it recognises that as well as 'structural tools' (such as flyways, stepping stones and ecological corridors), enhancing

1 http://natura2000.eea.europa.eu

Photo: LIFE02 NAT/LV/008496

Integrating Natura 2000 sites within the broader landscape provides valuable environmental goods and services

the connectivity and resilience of the Natura 2000 network requires actions that support biodiversity in the wider environment.

The plan also includes a set of specific actions related to supporting biodiversity adaptation to climate change. The aim of these actions is to substantially reduce adverse climate change impacts on biodiversity. One of the listed actions specifically addresses the coherence, connectivity and resilience of the Natura 2000 network.

Despite the successful establishment of Natura 2000 sites on land (the same approach is now being taken for marine areas), much of Europe's landscape is highly fragmented and under intensive land use or heavily urbanised. Already it is clear that there are many connectivity problems with Natura 2000 sites and that dialogue is needed to discuss how to better integrate these into other areas of high nature value and into intensively used areas throughout Europe. Moreover, this integration of Natura 2000 sites in the wider landscape could provide valuable environmental goods and services, such as the storing of carbon (e.g. wetlands, bogs and forests) and thus reducing the amount of greenhouse gases in the atmosphere, while at the same time militating against extreme weather events, such as floods and droughts. Many studies have shown that nature conservation is one of the most cost-effective and sustainable ways of adapting to climate change.

WHAT HAS BEEN DONE?

The Commission is already promoting and supporting exchanges of best practice as a basis for an EU strategy on green infrastructure. The White Paper on Adaptation to Climate Change (more on pages 39-43), and the Economics of Ecosystems and Biodiversity (TEEB) process (see page 32-33) both call for the development of a green infrastructure in Europe. The latter study shows how the loss of biodiversity and ecosystem services is having a negative economic impact both locally and globally.

Against this background, the Commission organised an expert workshop on green infrastructure in March 2009. The workshop's main aim was to help promote further thinking on how a green infrastructure could be shaped and built. A key finding was that the term 'green infrastructure' should not be interpreted in a narrow sense, but in a way that illustrates that European habitats, species and landscapes must be part of a broader system that is interlinked and functional and which delivers valuable services and goods.

In early 2010, the Commission published a Communication (COM 2010/4) on combating biodiversity loss beyond 2010. Acknowledging the need for the development of and investment in green infrastructure, the Communication pledges action to promote and support exchanges of best practices as a basis for an EU strategy on green infrastructure, to be developed after 2010. This has been endorsed by the Council of the European Union (Environment) on March 2010[2].

The LIFE+ programme has a key role to play in generating substantial learning (best practices) and innovation. It can also promote success stories in the reduction of fragmentation of species and habitats in Europe. Moreover, LIFE+ Nature and Biodiversity projects in particular, but also LIFE+ Environment projects, can provide useful examples for assisting the construction of green infrastructure.

2 http://register.consilium.europa.eu/pdf/en/10/st07/st07536.en10.pdf (16 of March 2010)

Photo: LIFE03 NAT/E/000050

LIFE and **green infrastructure**

Through direct actions that enhance the connectivity of habitats and through implementing a series of measures that result in more resilient ecosystems and integrated land management, the LIFE programme has demonstrated a range of effective approaches to building green infrastructure in Europe.

Spatial connectivity is vital for the long-term survival of many European species. For this reason, many LIFE projects have aimed to connect the habitats of threatened species to strengthen populations through genetic exchange. Some LIFE actions have extended beyond the Natura 2000 network of protected sites to include stopover areas (for migrating birds for example) and corridors linking habitats.

Tackling fragmentation is one of the key pillars of a green infrastructure strategy, and LIFE projects have implemented a range of measures that have **enhanced the connectivity** of species and habitats.

The species most targeted by LIFE projects aiming to enhance population connectivity, are those that present higher mobility or have seasonal migrations. The most targeted species group were mammals – such as the brown bear (see page 15-16) and the mink – and migratory fish species, especially anadromous fish that live mostly in the ocean and breed in fresh water (e.g. the Atlantic salmon that is highly dependent on clean, free-flowing rivers without blockages). Several invertebrate species, such as butterflies (*Euphrydrias aurinia* – see page 45 – and *Osmoderma eremita*) were targeted by project actions in order to restore their habitat's continuity (e.g. grasslands and old growth forest with dead wood).

Amphibian species populations, such as the fire-bellied toad (*Bombina bombina*) and great-crested newt (*Triturus cristatus*) benefited from restoration actions, sometimes involving the construction of a network of viable ponds. In the case of migratory bird species the projects targeted both stopover sites and wintering sites in order to secure and restore the birds' habitats along its migratory flyway (see page 34-36).

The wide-ranging actions undertaken by LIFE projects included:

- Removal of obstacles in rivers for fish;
- Regeneration and construction of ponds for amphibians and some invertebrates (dragonflies);
- Establishment of eco-bridges or tunnels in order to mitigate the negative effects of 'grey infrastructure' (i.e. rail and road) to nature;
- Restoration of habitats as stepping stones (coastal meadows, wetlands) on the flyways of migratory birds.

LIFE projects have also restored several habitats included in Annex I of the Habitats Directive. Several projects reconnected former core prime habitats areas with newly restored ones or established continuity between habitats. Examples include the restoration of:

Photo: LIFE00 NAT/SLO/007226

Several LIFE projects have focused on controlling the fragmentation of landscapes by promoting better use of urban green areas

- River continuum and the reconnection of rivers with their floodplains;
- Continuous grasslands and coastal meadows;
- Networks of bogs and mires;
- Old growth and boreal forests.

By restoring habitats – for example, converting spruce forests to grasslands or bogs – several LIFE projects have made landscapes more permeable for species dispersion and water flow by reconnecting different ecosystems. At the same time, project actions also increased landscape diversity by restoring habitats such as wetlands and forests. Several projects resorted and managed several habitats at the same time, from dunes to forests and grasslands. By restoring such a range of habitats, projects improved the landscape complexity and diversity and, in turn, the services and goods provided.

LIFE projects have also **strengthened the resilience** of ecosystems by restoring the range of functions that they provide. Resilient ecosystems, which have a rich biodiversity, are more likely to withstand disturbance and sudden shocks such as fires, droughts, floods and alien species invasions. Resilient areas are also better able to regulate climate, a critical ecosystem function.

For riparian areas, ecosystem services include flood management and transportation, and as LIFE projects carried out on the Danube and its tributaries have shown, actions that take into account the multi-functionality of the target area are best suited to improving Europe's green infrastructure. Some initiatives have even demonstrated the financial benefit of safeguarding ecosystem services, especially as a means of preventing flood damage (see page 31).

Physical space, however, is vitally important for resilience. LIFE projects have demonstrated that restoring more areas to their original condition can increase the effective functioning of ecosystems. For example, restored wetlands can store rainwater and prevent flooding farther down river, as well as reducing the run-off of nutrients from the soil.

Recent projects have also focused on climate change, which will have the greatest impact on those areas most dependent on ecosystem services. Building up green infrastructure is essential for mitigating and adapting to climate change. For example, restoring blanket bogs in Wales has improved their ability to absorb greenhouse gases and thus mitigate climate change. Several projects also focused on restoring floodplains and coastal habitats and, as a result, those areas are now better able to cope with climate change impacts.

Integrating spatial planning is another area where LIFE can play an important role. Several LIFE projects have already promoted partnerships among several stakeholders in support of biodiversity. One good example of such a partnership in action is the project to protect the endangered marsh fritillary butterfly (*Euphydryas aurinia* - **LIFE03 NAT/UK/000042**). By encouraging co-operation among interested parties, it succeeded in re-routing a major road and thereby increasing the area of favourable habitat for the target species (See page 46). Other projects have focused on controlling the fragmentation of landscapes by promoting better use of urban land (for example, **LIFE02 ENV/E/000200**).

LIFE projects, however, have not focused specifically on building and establishing an EU green infrastructure. But the actions highlighted in this brochure point the way forward for building a future EU green infrastructure policy. LIFE actions demonstrate useful approaches and the lessons learned can help shape a future common EU approach. In this respect, the LIFE+ programme has an important role to play in providing further examples and publicising innovative practice.

By restoring areas to their original condition, LIFE projects have boosted ecosystems' functions – such as cross pollination and extensive farming on grasslands habitats

Photo: LIFE03 NAT/SLO/000077

ENHANCING CONNECTIVITY FOR SPECIES

Photo: H. Drews

LIFE actions towards **ecological connectivity**

Ensuring ecosystem connectivity – by building up green infrastructure – is a high priority of EU biodiversity policy. If ecosystems become too small or isolated, they may be unable to deliver valuable services and maintain biodiversity. The LIFE programme has demonstrated a range of actions to enhance landscape connectivity that are vital to improving the conservation status of species.

Landscape fragmentation and land-use change – due to increased urbanisation and agricultural intensification, for example – can adversely affect the functioning of ecosystems. The Habitats and Birds Directives, which form the legal basis of the Natura 2000 network, include various connectivity conservation measures for reducing pressures on biodiversity, both within sites and in the wider landscape.

Article 10 of the Habitats Directive, for example, says that Member State land-use planning, development policies and proposals for improving the ecological coherence of the Natura 2000 network should encourage the management of features of the landscape that are of major importance for wild fauna and flora. Such features are those which, by virtue of their linear and continuous structure (e.g. river banks and traditional systems for marking field boundaries) or their function as stepping stones (e.g. ponds or small woods), are "essential for the migration, dispersal and genetic exchange of wild species".

To ensure connectivity between important biodiversity areas, it is necessary to invest in the construction of ecological corridors (e.g. flyways, with green bridges, and fish passages), to restore rivers and wetlands (including the removal of obsolete 'grey' infrastructure that act as barriers to natural flow)

Habitat restoration promoted by LIFE is vital to enhancing species connectivity – digging new ponds for amphibians

Photo: LIFE04 NAT/DE/000028

and to create suitable habitats in farmed landscapes. LIFE can play an important role in supporting the implementation of such measures to increase connectivity in Europe, through conservation actions implemented mainly at local or regional level.

One such LIFE co-funded initiative took place in Scotland (**LIFE04 NAT/GB/000250**) (see box), where the removal of certain artificial river barriers, and the construction of a number of fish passages, has allowed a Habitats Directive listed species, the Atlantic salmon (*Salmo salar*), access to spawning grounds in parts of the river systems that had been inaccessible for many years. Another LIFE project (**LIFE04 NAT/DE/000028**) aimed to conserve vulnerable populations of the Annex II-listed amphibian, the fire-bellied toad (*Bombina bombina*) at 27 project sites in the Baltics (see box page 12) by developing a network of ponds for the toads, with hibernation sites close by to reduce fragmentation.

LIFE projects actions have also focused on habitat improvements and the removal of threats at key breeding, staging and wintering sites along the European flyways of important migratory bird species. The overall aim is to halt or slow down the decline in population sizes at targeted sites, increase survival during the wintering period and increase the time that especially vulnerable species spend in safe and adequately managed conservation sites.

LIFE TACKLING FRAGMENTATION

Preserving species diversity, so vital to the health and resilience of ecosystems, is linked directly to the degree of connectivity between the areas where these species live and the size of their habitats. Species often become locally extinct and only through connections between viable habitat areas can they survive in the long term. In Portugal for example, the extremely endangered Iberian lynx (*Lynx pardinus*) – once widely distributed – is now all but extinct in the wild. However, habitat improvements co-funded by LIFE, including the building of dispersal corridors, are paving the

LIFE CLEARS THE WAY FOR ATLANTIC SALMON MIGRATION

The Atlantic salmon population – considered a vital indicator species for healthy functioning river systems – has declined in many European countries as a result of several factors, including deteriorating water quality and barriers to migration. In Scotland, where river water quality is generally good, salmon had disappeared from sections of the river systems, due to migration problems. One of the key project actions of the successful LIFE project, CASS (**LIFE04 NAT/GB/000250**), was to remove obstacles to allow salmon access to spawning grounds in parts of eight river systems in Scotland, which had been inaccessible for many years. The project team removed 25 obstacles to migration, resulting in 187 km of extra salmon habitat. Monitoring of results showed that salmon are returning to these rivers, one of which, the Coy, has not seen salmon for over 250 years. More than 70 000 m2 of juvenile spawning habitat has been improved and two of the rivers were restocked over the lifetime of the project. The work has also had a direct positive influence on populations of another Annex II-listed species – the freshwater pearl mussel (*Margaritifera magaritifera*).

The construction of a migratory passage for Atlantic salmon was also the focus of a Swedish project to restore the habitat of the river Moälven (**LIFE05 NAT/S/000109**). A major achievement was the completion of a new fish-ladder and tunnel constructed beside an artificial waterfall, making it possible for the salmon and other fish species to reach the Utterån tributary.

Removing river obstacles by building a fish passage

Photo: LIFE04 NAT/GB/000250

NETWORKING TO AID FIRE-BELLIED TOADS

A German-led LIFE project (**LIFE04 NAT/DE/000028**) aimed to improve the conservation status of highly endangered populations of the fire-bellied toad (*Bombina bombina*) at 27 project sites in the Baltic regions of Denmark, Sweden, Latvia and Germany. A key aspect of the project was the international networking among conservation groups to encourage joint actions such as new pond construction. The project focused in particular on developing a network of ponds, with hibernation sites close by (e.g. strategically placed stone piles) so that the toads do not need to cross 'danger zone' agricultural fields. Genetic analysis was also carried out to increase knowledge of the different populations and their genetic variations and relationships. This information is now being used to improve the species' long-term survival chances.

Photo: LIFE04 NAT/DE/000028

A network of ponds for the firebellied toad

way for future reintroductions, repopulation or expansion of populations from neighbouring Spain.

By adopting a 'metapopulation' approach – a conservation strategy that focuses on a set of partially isolated populations of the same species between which individuals can freely migrate – a number of LIFE projects have directly or indirectly helped to enhance connectivity of species. This section provides a number of examples of LIFE projects that have implemented actions to enhance functional connectivity for populations of species, such as the brown bear (*Arctos ursus*).

Similarly, the micro-reserve model for plants (see box) provides an efficient means of safeguarding fragmented populations of rare and endemic plant species. The model – first introduced with LIFE support in Valencia – allows target species to be closely monitored and conservation actions to be tailored to their needs across a whole territory.

Habitat fragmentation has worsened as a result of agricultural intensification and 'grey' infrastructure development – for example, roads cutting through natural areas, increased urbanisation, energy generation and transport (electrical overhead cables are a major problem for migrating birds). The subsequent loss of connectivity is in many areas one of the greatest threats to species, alongside climate change. Read more about LIFE actions to improve connectivity for species on the following pages.

MICRO-RESERVES TO RE-CONNECT PLANT POPULATIONS

Europe's first plant micro-reserves – fostering a small-scale and flexible approach to plant conservation – were set up in 1994, with the support of the LIFE programme in Valencia. This region has a remarkable diversity of plant species: twelve of its 355 endemic plant species are included in Annexes II and IV of the Habitats Directive; and 150 species are considered rare or threatened. Much of this flora appears in micro-populations fragmented throughout the whole region.

The aim of a two-phase LIFE initiative (**LIFE93 NAT/E/011100** and **LIFE95 NAT/E/00856**) was to re-connect these highly fragmented populations via a network of more than 100 small botanical reserves (up to 20 ha in size) that would be representative of the main endemic plant communities found in Valencia. In total, 158 micro reserves, with an area of 285 ha were established, 77 of which are included in the Natura 2000 network.

The micro-reserve network has continued to expand and today consists of more than 247 plots, with a total surface area of 1 684 ha, making it the densest network of protected sites for plant conservation in the world.

Photo: LIFE04 NAT/GR/000104

The micro-reserve concept has been adopted in five EU countries – protecting **Cephalanthera cucullata** *in Crete*

Photo: Aixa Sopeña

Since the launch of the LIFE programme in 1992, a significant number of LIFE projects have focused on the conservation of the endangered brown bear (*Arctos ursus*) populations in certain parts of Europe – mainly the Apennines, the Alps, Cantabria, Dinara/ Pindos and the Balkans. Many of these LIFE projects have undertaken actions that have directly or indirectly helped to enhance functional connectivity for this large carnivore: restoring crucial habitats and food sources; increasing genetic flow between tiny and fragmented populations (by constructing 'green bridges', restoring habitat, etc.) and reintroducing bears to areas where they had become extinct.

Combating loss of connectivity for brown bear in Europe

The main threats to the bear come directly or indirectly from human activity. Direct threats include poaching, particularly by people looking to protect crops, livestock and human settlements. Indirect threats come principally from the degradation and fragmentation of important habitats. Bears can also be killed by traps and poison set for other predators. An increasing number of fatalities are also casued by grey infrastructure – for example, the recently constructed Egnatia highway that crosses the bear habitat in the Pindos mountains of northern Greece. It is anticipated that new road infrastructure will cause similar problems to the Rhodope bear populations in Greece and Bulgaria. Isolated populations can suffer low genetic diversity, which also increases risks to survival.

LIFE projects have aimed to raise stakeholder (especially farmers, livestock producers and hunters) awareness about the brown bear. Bears are often feared, disliked and attacked because of the damage they cause to livestock, beehives and crops.

Measures to restore important bear habitats, tackling fragmentation in order to improve survival chances, have taken different approaches. These include the restoration of areas of forests, the planting of wild fruit trees and the artificial supply of forage – all techniques used to improve food supply for the bear. More general habitat protection measures include preventing or reducing tourist access to sensitive areas, such as wintering sites.

Securing migration routes or ecological corridors between zones of suitable habitat is another key measure for increasing connectivity between scattered populations of bears. For example, in the eastern Alps, just a few kilometres from the point where Austria borders Italy and Slovenia, the Schütt-Dobratsch Natura 2000 area is of central importance as a migration route for the brown bear. There was clear evidence that in the last few decades the bears had been wandering into the Austrian Alps from Italy and Slovenia via this region. However, the completion of a section of the A2 motorway in

LIFE projects have helped to secure migration routes or ecological corridors with suitable habitats for bears.

Photo: FOP

Photo: LIFE00 NAT/A/007055

Green bridges over or under infrastructure (mainly roads) are crucial for bear dispersal

1984, cutting through the southern part of the area, made it much more difficult for the bears to cross into Austria. The ensuing reduced genetic exchange jeopardised the further development of the Alpine brown bear population, estimated by the IUCN in 2009 at between 35 and 40 individuals.

The main objective of the Schütt-Dobratsch LIFE project (**LIFE02 NAT/A/008519**) was to construct a motorway overpass, a 'green bridge' for bears and other fauna. Based on earlier observations in the area and from the experience of a similar project in Croatia, the project team was confident that once it was completed, the bears would quickly start using the overpass.

A concrete bridge was successfully constructed over the motorway and planted with vegetation and trees to make it appear as natural as possible. The project was completed at the beginning of 2005 and shortly afterwards a bear was observed crossing over the bridge from the Italian/ Slovenia side into the Austrian Alps.

Another LIFE project (**LIFE07 NAT/E/000735**) is currently seeking to establish an eco-corridor for a small population of brown bears in the Cantabrian mountains of northern Spain. The population's viability is under threat from diverse factors, in particular habitat degradation and fragmentation, poaching and poisoning, low social acceptance and low genetic variability. Bear numbers were recently estimated at about 105-130 individuals. These are distributed between two main sites that so far appear distinct, at least from a genetic perspective, despite the fact that bears sporadically use a 50 km-wide 'corridor' between them. This 'Leitariegos corridor' presents opportunities for improving bear habitat. However, the bear's ability to use it is hindered by obstacles such as roads, railways and a ski resort.

The overall objective is to reduce specific risks and negative impacts. Among

The viability of the brown bear population in some areas of Europe is threatened by habitat degradation and fragmentation – Cantabrian mountains, northern Spain

Photo: Aixa Sopeña

several conservation actions, the project is aiming to facilitate the natural movement of bears between the two sites by restoring habitat connectivity and reducing threats such as illegal snares and poisoning in the inter-population corridor.

TRANS-BOUNDARY CO-OPERATION

Two Italian projects have captured bears in Slovenia and released them into sites in the Italian Alps to restore numbers and help improve genetic diversity (**LIFE96 NAT/IT/003152** and **LIFE00 NAT/IT/007131**). However, such cross-border reintroductions are not without controversy, as was illustrated by the intense media debate concerning the death of 'Bruno', the brown bear shot by hunters in Bavaria in 2006.

Bruno (real name: JJ1) was born to a mother brought to Italy from Slovenia by the 2000 LIFE project. He was the first wild bear in Germany since 1835. However, he was classified as a 'risk' due to problems associated with his habit of foraging for food too close to humans (e.g. raids on stables and housing areas). Despite considerable efforts, the usual trapping methods were unsuccessful. This case highlighted a need for improved co-operation between neighbouring countries: while there had been co-ordination, via the LIFE projects, between Austria, Italy and Slovenia, this was not the case with Germany.

The issue of trans-border connectivity was also tackled by a Greek LIFE project (**LIFE99 NAT/GR/006498**), which followed on from two earlier LIFE projects targeting the conservation of brown bear and its habitats (see below). The third-phase of the project targeted Gramos (part of the Pindos range) bear populations in Greece and Albania and the Rhodope bear population in Greece and Bulgaria. The project carried out a study on connectivity in the border areas and organised seminars and training sessions with Balkan NGOs and other stakeholders in the regions. This has helped to foster significant exchange of experience and knowledge of the species between the countries concerned.

Photo: Aixa Sopeña

Obstacles to bear dispersal on for example, roads can be a threat to population viability – Greece

Several LIFE projects have also increased understanding of the bears and their movements at a national level through the use of radio tracking. Using this information, a project in Slovenia (**LIFE02 NAT/SLO/008585**), for example, has developed an action plan for habitat improvement of zones that were identified as important for bears. These include 'winter dens' zones; feeding places; areas of particularly rich natural interest; and migratory eco-corridors. The plan includes guidance on how railways and roads should be planned and constructed to aid connectivity.

NON-NATURAL DEATHS

Finally, road accidents are a major threat to bears, as well as to other large carnivores such as the highly endangered Iberian lynx (see pages 16-17).

Following awareness raising through the projects, **LIFE93 NAT/GR/010800** and **LIFE96 NAT/GR/003222**, on the impending Egnatia highway construction which cuts through bear habitat, the European Commission requested the Greek government to take mitigation measures. This safeguarded the bears along the first stretch of the highway. However, bears are being killed in the recently opened sections, which lack appropriate fencing and throughways for the bears. Another Greek project (**LIFE07 NAT/GR/000291**), currently in progress, is seeking to improve the conservation status of brown bear in terms of habitat condition and population trends. It is ensuring that core bear habitat within the project area is not fragmented and that human-related mortality rates, such as road kills and poisining are reduced.

Photo: Callisto

Tackling fragmentation to aid the 'critically endangered' Iberian lynx

Since 1992, LIFE Nature projects in Spain and more recently in Portugal, have been targeting the Iberian lynx (*Lynx pardinus*), the world's most endangered wild cat species. Many of these projects have undertaken conservation actions that have directly or indirectly addressed fragmentation issues for the lynx: restoring crucial habitats and food sources; developing dispersal corridors to improve links between surviving populations and increase genetic diversity; and reintroducing animals bred in captivity into the wild.

The Iberian lynx was once common all across Spain and Portugal. However, over recent centuries, and particularly in the past few decades of the 20th Century, its overall population and distribution decreased dramatically. In 2009, it was estimated that only around 250 lynxes remain (with an additional 74 in captivity) in the south-western corner of the Iberian Peninsula.

This medium-sized feline (8–14 kg) is found in areas characterised by Mediterranean woodland and scrubland. It favours a mosaic of dense scrub for shelter and open pasture for hunting its principal prey, the rabbit. The main causes of the dramatic decline in lynx numbers and distribution include: habitat change (e.g. due to intensive farming and forestry); habitat loss; the wiping out of its main food source (rabbit populations) through disease and hunt-

The main causes of the dramatic decline of the Iberian lynx are habitat change, loss of habitat and food source

Photo: LIFE02 NAT/E/008609

Photo: LIFE02 NAT/E/008609

Surviving lynx populations are clustered in small groups that have limited opportunities to mix genetically – the main population is in Sierra Morena (pictured)

ing; new roads and other urban infrastructure, resulting in road accidents (lynx mortality rate due to traffic accidents is high); and poaching.

Surviving populations in Andalusia, Spain, are clustered in small groups that have limited opportunities to mix genetically. Currently, the species has only two known breeding populations – in Sierra Morena and Doñana. Moreover, the Sierra Morena population is split into two sub-populations that are not connected.

Two LIFE projects by the Andalusian Regional Authority have been central to the protection and enhancement of current lynx populations. The first project (**LIFE02 NAT/E/008609**) succeeded in halting the decline in Doñana and stabilising numbers of individuals and breeding territories in Sierra Morena. The follow-up project (**LIFE06 NAT/E/000209**) is seeking to secure the existing populations, increase the number of individuals and create new territories and connectivity between isolated sub-populations.

RESTORING CRUCIAL HABITATS

Key management actions for both projects were agreed with stakeholders (mainly farmers and hunters). The cooperation of private landowners was essential, as 75% of current lynx territories are located on private lands (mainly game hunting estates). One major action was the increase of the population of rabbits (i.e. the lynx's main food source) in important habitat areas. This encouraged lynx populations to expand naturally into those areas linking the two Sierra Morena sub-populations. Rabbit restoration was mainly achieved through artificial, protected breeding areas for new populations. Restrictions on land-use and hunting practices (e.g. snares and rabbit hunting) that could directly or indirectly affect the lynx were also introduced. Temporary feeding actions were carried out when prey was scarce.

On the other side of the border, LIFE co-funded management actions in Portugal, similar to those mentioned in Spain, have identified areas with good rabbit densities that could serve as natural corridors for this species. An ongoing project (**LIFE06 NAT/P/000191**) is aiming to establish a natural corridor for the recovery or reintroduction of the species in the medium to long term.

GREENING GREY INFRASTRUCTURE

The lynx mortality rate due to traffic accidents is high. Therefore, LIFE projects have taken steps to try to mitigate the impacts of new roads and other urban obstructions by installing fences, green bridges or tunnels to reduce fatalities. They have also repaired or covered dangerous wells to prevent accidents.

IMPROVING LINKS BETWEEN POPULATIONS

The ongoing (**LIFE06 NAT/E/000209**) Spanish project is also seeking to enhance genetic variability of current populations by bringing lynxes from Sierra Morena to Doñana. In addition, the project began to reintroduce captive-bred animals into territories where the lynx was previously found. For example, in early 2010, three male and female pairs were released in Guadalmellato, near Cordoba in southern Spain, where the species had disappeared. The eventual long-term aim is that these efforts will lead to new lynx territories in the Cordoba region covering a range of 18 000 ha. This experience will also help to design reintroductions in other parts of Spain and Portugal in the future.

Finally, GPS tracking devices fitted to individual animals has enabled project researchers to monitor their movements, providing some surprising insights into the lynxes' habits. For example, the lynx can quickly cover distances of up to 200 km (travelling 50 km in just one day) – as illustrated by the unexpected dash into Portugal of one of the males moved by the Spanish LIFE team from Sierra Morena to Doñana. The incident highlighted the importance of providing enough habitat areas to encourage species' connectivity in a future green infrastructure.

GPS tracking devices fitted to a lynx to monitor its movements

Photo: LIFE06 NAT/E/000209

Migratory bird species require a functional and secure network of sites along their flyways[1] in order to successfully reach their breeding and winter staging places. Several European migratory bird species are threatened by the degradation of breeding grounds and the loss of staging and wintering sites.

LIFE improving **functional flyways for birds**

Migratory birds face different threats as they cross country borders due to differences in conservation policy. The implementation of the Birds Directive, which introduced Special Protection Areas (SPAs) as part of the Natura 2000 network at EU level, is an important tool for the protection of the migratory species along their flyways.

1 "The concept of flyway is essentially an operational concept linked to waterfowl whose populations one wishes to manage over their entire migration space." Convention on the Conservation of Migratory Species of Wild Animals, United Nations Environment Programme.

The conservation of migratory birds is enhanced by the restoration of stopover and winter sites with healthy ecosystems as part of a coherent network in a future EU green infrastructure. However, there are several species that have winter or breeding sites outside the EU. These species are covered by the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA).

Several LIFE projects have developed habitat restoration actions that target bird species migration routes. A Finnish project (**LIFE05 NAT/FIN/000105**), which targeted the lesser white-fronted goose (*Anser erythropus*), is an example of a project that focused on all the flyway and breeding sites in several countries. Other projects have focused on particular sites along the species route (see table).

In general, LIFE project conservation actions focus on the restoration of breeding sites which are normally considered a

Anser erythropus

LIFE restoring stopover and winter sites with healthy ecosystems

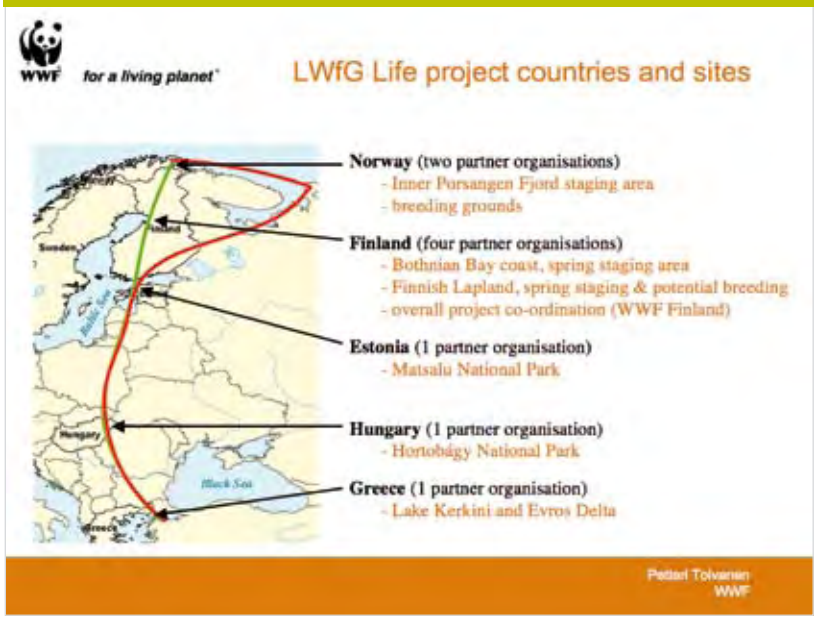
Photo: Petteri Tolvanen - WWF

priority for conservation. However, some projects focus only on wintering or flyway sites – e.g. the red-breasted goose (*Branta ruficollis*) Romanian project (**LIFE04 NAT/RO/000220**) and the Finnish project (**LIFE03 NAT/FIN/000039**) 'Management of wetlands along the Gulf of Finland migratory flyway'.

SECURING THE EUROPEAN FLYWAY OF THE LESSER WHITE-FRONTED GOOSE

The lesser white-fronted goose breeds in the tundra zone (low-arctic and forest) from northern Fennoscandia to eastern Siberia. Currently there are 20-30 breeding pairs in the European flyway. Its nesting habitat is typically open tundra, and it feeds in the breeding season on sedge marshes or mires around lakes.

The location of LIFE project actions along the European flyway route of the lesser white-fronted goose



During migration, the species stops over at coastal meadows (Finland and Estonia) and natural steppes (Hungary). It also uses agricultural land due to changes in its natural staging habitats. A key staging site for the autumn migration of the Fennoscandian population is the northern part of the Kanin Peninsula (north-western arctic Russia). Here, the population divides into two parts for the winter: more than half of the Fennoscandian geese follow the European migration route from Kanin via the Baltic States to Hungary, and then further south to the wintering sites in northern Greece and westernmost Turkey (e.g. the Evros Delta area).

The Finnish LIFE project focussed on the conservation of this population that takes the European migration route. The ultimate objective of the project was to stop the decline of the Fennoscandian population, which has been mostly brought about by hunting and poaching. The lesser white-fronted goose closely resembles the white-fronted goose (*Anser albifrons*), which is an important game species in most countries in its range.

Targeted Species by LIFE	Projects	Countries with LIFE projects actions	Migration route
Anser erythropus	**LIFE05 NAT/FIN/000105** Conservation of Anser erythropus on European migration route **LIFE97 NAT/FIN/004098** Conservation of the Lesser White-fronted Goose in Finland **LIFE2002 NAT/ST/FIN/000024** Conservation of Anser erythropus on the European migration route	Finland, Estonia, Hungary, Greece and in partnership on Norway	European route: Norway, Finland, Estonia, Hungary Greece
Acrocephalus paludicola	**LIFE05 NAT/PL/000101** Conserving Acrocephalus paludicola in Poland and Germany **LIFE02 NAT/E/008616** Conservation of the aquatic warbler in the ZEPA 'La Nava-Campos' **LIFE04 NAT/FR/000086** Conservation of the Aquatic Warbler in Brittany	Spain, France, Germany and Poland	Senegal (wintering) – Germany, Poland and Bielorussia (breeding) France, Spain (stopover)
Branta ruficollis	**LIFE04 NAT/RO/000220** Improving wintering conditions for Branta ruficollis at Techirghiol	Romania (wintering)	Siberia (breeding) – Romania and Bulgaria (wintering)
Several species	**LIFE03 NAT/FIN/000039** Management of wetlands along the Gulf of Finland migratory flyway	Finland	n.a

Photo: Petteri Tolvanen - WWF

Restored habitat for Anser erythropus (after and before) at a stopover site in Estonia

A satellite tracking study revealed a previously unknown 'loop migration' route from the Fennoscandian breeding grounds to moulting sites of non-breeding birds in Siberia and back to the wintering sites in Greece via Kazakhstan, southern Russia and Ukraine. Several major staging sites were also discovered.

As a result of the habitat management actions, the lesser white-fronted goose started to use sites restored and managed by the project in the Hortobágy National Park, Hungary, and in the Matsalu National Park, Estonia. By the end of the project, at Hortobágy the goose only used the sites within the national park that had been restored.

New National Action Plans for the lesser white-fronted goose were prepared by the project and adopted by the national authorities in Norway, Finland and Estonia. In Norway, conservation actions proposed in the national plan had already begun during the project: hunting of all geese is now banned in the autumn staging area in the Inner Porsangen Fjord area; and control of the red fox (*Vulpes vulpes*) population in the core breeding area started in 2007.

The LIFE project also played a key role in drawing up an International Species Action Plan for the conservation of the western Palearctic population of the lesser white-fronted goose, which was adopted by AEWA in 2008. According to the project beneficiary, WWF Finland, it is too early to assess the conservation impact of the public awareness campaigns, but in Estonia and Hungary, co-operation with hunters' associations has been good, both at national and regional levels. In Greece, however, co-operation proved to be very difficult to achieve and was fruitful only at the local level. A male lesser white-fronted goose colour-ringed by the project in Norway in 2006, and later shot dead inside the hunting free zone of a strictly protected area in Greece, shows that much more needs to be done to protect the lesser white-fronted goose from hunting, especially in Greece.

RESTORING FLYWAY HABITATS FOR THE MIGRANT AQUATIC WARBLER

The aquatic warbler (*Acrocephalus paludicola*) is by far Europe's rarest warbler. It breeds in central and eastern Europe (Poland, Hungary, Germany, the Baltic States, Ukraine and Belarus) and has an estimated population of 15,000 pairs.

This small passerine bird is found in wetlands with sedge and similarly structured marshy habitats. Drainage of such wetlands and destruction of the habitat has meant that the species has declined by 40% in the last 10 years. It became extinct in western Europe in the 20th Century and has declined dramatically in central Europe. As a result, the aquatic warbler is the only globally threatened passerine

Photo: LIFE05 NAT/PL/000101

bird found in mainland Europe. At the European level, the bird is classified by IUCN as endangered and is included in Annex I of the Birds Directive.

For many years, its wintering grounds were unknown, but recently it was discovered that the bird's European population spends its winters in Djoudj National Bird Sanctuary in Senegal –between 5,000 and 10,000 birds visit this single site. Aquatic warblers have been recorded in 13 European countries on their migration path. Birds from Poland and eastern Germany migrate in a westerly direction along the Baltic coast in Poland and eastern Germany, then along the North Sea coast of western Germany, the Netherlands, Belgium and sometimes England, before heading south along the French and Iberian Atlantic coast.

Furthermore, the main stopover and feeding areas during the post-breeding migration are in north-western France, along the Channel coast and further down the Iberian Peninsula. These regions are characterised by a string of coastal marshes and wetlands that are currently suffering from inadequate management, degradation of hydrological conditions, natural filling-up, water pollution and man-made changes. These factors have led to a decline in their ecological value as feeding and resting habitats for the aquatic warbler during its migration.

Photo: LIFE04 NAT/F/000086

Work to restore ecological functions essential for the aquatic warbler

LIFE has co-funded three projects that focus on the stopover sites of the species along its migration route. Projects in Spain, 'Conservation of the aquatic warbler in the ZEPA, La Nava-Campos' (**LIFE02 NAT/E/008616**), and France, 'Conservation of the aquatic warbler in Brittany' (**LIFE04 NAT/FR/000086**), targeted resting and feeding areas, while the project 'Conserving *Acrocephalus paludicola*' (**LIFE05 NAT/PL/000101**) in Poland and Germany targeted breeding sites.

Specifically, the Spanish and French projects aim to maintain or rehabilitate the ecological functions essential for the aquatic warbler. Actions aimed to: improve knowledge of the migratory stopover sites and the role of their habitats for the species (using radio tracking and other techniques); restore and manage the wetlands habitats (by clearing and maintaining ditches); implement management plans for the most important stopover sites; and share results with interested parties.

The main Polish and German project actions involve raising awareness among local authorities, local communities and key stakeholders of the need for conservation of the warbler, in particular its specific habitat requirements. The project also improved the warbler habitat in Pomerania and Biebrza and enlarged its habitat. Finally, it will identify replicable financial and legal mechanisms for ensuring the long-term sustainable management of the warbler in Germany and Poland.

The project will create 1 500 ha of potential habitat in Pomerania and Biebrza and implement restoration actions on another 1 500 ha with the aim of increasing the population of aquatic warbler by 15%. Measures to be implemented include hydrological management, removal of shrubs and overgrowth from wet meadows and mires, initiation of extensive grazing and appropriate mowing of aquatic warbler habitats.

Together these LIFE projects actions along the migration route of the aquatic warbler will help to ensure the conservation of the species. Moreover, the projects have established a platform for knowledge-sharing and co-ordinated conservation efforts throughout the flyways. Nevertheless, full conservation of the entire route entails protecting wintering sites outside of the EU (e.g. Senegal) by enforcing the international agreements under AEWA.

LIFE actions along a bird migration route – aiding conservation in an integrated way

Photo: LIFE04 NAT/F/000086

ENHANCING HABITATS' CONNECTIVITY

Photo: LIFE03 NAT/E/000067

Improving the coherence of the Natura 2000 network

Increasing links between habitats is a cornerstone of a coherent approach to green infrastructure. The need for ecological connectivity is enshrined in Article 10 of the Habitats Directive. In order to achieve this connectivity, experts recognise the importance of increasing the permeability of landscapes in order to form buffers around protected areas, allow species movement to the wider landscape and provide additional habitats for wildlife. The LIFE programme has an important role to play in this process.

The fragmentation of habitats is acknowledged as one of the main causes of habitat degradation and biodiversity loss in the EU and elsewhere. Fragmentation may also lead to changes in the abundance, diversity and composition of species in a particular habitat or ecosystem, resulting in disruption of the ecosystem functions and health, with knock-on effects on the provision of ecosystem goods and services.

Article 10 of the Habitats Directive (see box on page 23) recognises that the long-term survival of many species and habitats depends not only on habitat quality but on the ecological coherence of the Natura 2000 network. Achieving interconnectivity and coherence in Europe's landscape involves the application of flyways, buffer zones, corridors and stepping stones connecting species populations and habitats.

Necessary functional connectivity between Natura 2000 sites and their surroundings must be maintained – e.g., rivers, floodplains and agriculture areas

Photo: LIFE02 NAT/F/008482

In order for these protected sites to form an ecologically coherent network, functional connections between the sites and their surroundings must be maintained. Therefore management measures may need to go beyond the designated sites' boundaries and apply to the wider environment.

Promoting the implementation of Article 10 of the Habitats Directive and Article 3 of the Birds Directive forms an integral part of EU biodiversity policy.

INCREASING LANDSCAPE PERMEABILITY

There are several aspects to the process of forming an ecologically coherent

ARTICLE 10 OF THE HABITATS DIRECTIVE STATES

"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 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."

For further information see the August 2007 publication by the Institute for European Environmental Policy: Guidance on the maintenance of landscape connectivity: http://ec.europa.eu/environment/nature/ecosystems/docs/adaptation_fragmentation_guidelines.pdf

network. One key element is the development of buffer zones around existing core sites, where compatible land uses can be maintained or reintroduced. The actions required to buffer core areas against destructive external factors also serve to render the surrounding landscape more permeable to species movement and provide additional habitats for wildlife outside protected areas. In the long run, the aim is that protected areas, such as Natura 2000 sites, are better integrated into the European landscape.

As the primary user of land in Europe, agriculture has a crucial role to play in increasing landscape permeability. The EU's rural development regulation could be used to introduce carefully designed agri-sylvi environmental schemes and wildlife-friendly farming practices around core nature areas.

However, as past experience has shown, careful thought must go into the precise design of any such schemes and sufficient resources dedicated to their implementation in order to ensure that they influence land-management practices on a sufficiently large-scale within these buffer zones. LIFE projects have and can be used to design such initiatives, as the LIFE Burren project in Ireland demonstrates (see page 41).

The creation and management of buffer zones may also require the integration of other land-use practices (e.g. infrastructure, forestry and water management) with the needs of farming and nature conservation. Instruments such as the Water Framework Directive (WFD) in co-ordination with the Habitats and Birds Directive will widen the scope for integrated planning. Moreover, an integrated approach will also help deliver a range of additional environmental and social benefits (e.g. fishing opportunities and lower nitrogen flows in the case of the WFD).

THE ROLE OF LIFE

The LIFE programme has supported a significant number of projects that have taken actions to enhance the connectivity of habitats. The main LIFE project actions to connect habitats can be summarised as follows:

- Increasing the size and productivity of source populations through habitat improvements and habitat expansion (e.g. for the capercaillie and fire-bellied toad);
- Reconnecting and consolidating fragmented habitats (e.g. for the large blue butterfly – see box *Reconnecting grasslands* - and the Iberian lynx);
- Creating and/or restoring habitat patches as stepping stones for dispersal (e.g. for the bittern and great crested newt);
- Creating and/or restoring linear habitat corridors to allow for dispersal, migration and genetic flow between populations (e.g. for the brown bear);
- Removing dispersal and migration barriers (e.g. for fish); and
- Protecting and enhancing migration staging posts (e.g. along the Gulf of Finland flyway).

The increased scope of LIFE+ offers further possibilities for Member States to develop projects that aim to increase landscape permeability and maintain and restore the connectivity of habitats.

LIFE is helping to improve landscape permeability and diversity – e.g. opening up gaps in Finnish forest

Photo: LIFE03 NAT/FIN/000034

Connecting protected areas of the sea – Marine Protected Areas (MPAs), Important Bird Areas and Natura 2000 marine sites – is one of the most challenging aspects of nature conservation. A number of LIFE Nature projects have risen to this challenge and have provided a blueprint for maintaining the biodiversity of Europe's seas.

Marine network corridors and conservation areas

Seas and oceans are our greatest source of biodiversity. European marine waters cover 3 million km^2 – equal to the total landmass of Europe. However, the marine environment faces many threats. The Marine Strategy Framework Directive (MSFD) was adopted by the European Commission in June 2008. Its objective is to secure a common basis for the protection and management of Europe's seas in order to ensure the "good environmental status" of marine areas by 2020.

The MSFD takes an ecosystem-based approach to the sustainable development of Europe's seas and oceans and to the effective protection of the marine environment. This policy tool builds on the achievements of existing policy tools such as the Birds Directive and Habitats Directive as they relate to the marine environment. In November 2008 the EU adopted a Communication on Maritime Spatial Planning[1] as a key instrument of the Integrated Maritime Policy (IMP). The IMP aims to help public authorities and stakeholders to co-ordinate their actions and optimises the use of marine space to benefit economic development and the marine environment. Enhancing the coherence of a network of marine protection areas is an important component of any ecosystem-based approach. LIFE projects have taken significant steps towards reaching this goal.

LIFE has been crucial in efforts towards a coherent network of marine protection areas

Photo: LIFE00 NAT/E/007303

PROTECTING SPAIN'S 'ECO-CORRIDOR' FOR LARGE MARINE ANIMALS

Turtles and cetaceans are good indicators of the health of the marine environment. These large marine animals are directly affected by environmental pressures such as overfishing, pollution and maritime traffic. Within the framework of the Habitats Directive, the LIFE project 'Conservation of cetaceans and sea turtles in Murcia and Andalusia' (**LIFE02 NAT/E/008610**) aimed to develop management models for these important species and for areas important to their conservation in consultation with relevant stakeholders and interest groups (e.g. the fishing and tourism industries). The LIFE project proposal was shaped by the results of a three-year research project which proposed a series of marine Natura 2000 sites and MPAs in the Alboran Sea off the coast of Spain. This area is vitally important, not only as a feeding and breeding area for 12 species of cetaceans, but also as a migration corridor between the Mediterranean and the Atlantic Ocean for the loggerhead turtle (*Caretta caretta*). The marine migration corridors for sea turtles and cetaceans delimited by the project are an important step towards defining a future 'blue' infrastructure for the marine environment and support the concept of an EU Maritime Spatial planning policy.

The LIFE project, which ran from 2002-2006, aimed to contribute to Spain's implementation of international marine biodiversity conservation strategies. It focused, in particular, on the Alboran Sea and adjacent waters as one of Europe's most valuable marine sites, which will, in future form part of the Natura 2000 network.

The LIFE project convened a scientific committee to develop conservation plans for the loggerhead turtle and the bottlenose dolphin, which would be effectively at this wider scale while also enabling concrete actions on site. As well as this 'vertical axis', the plan also operated on a 'horizontal axis', where issues other than nature conservation were addressed (e.g. tourism, fisheries, defence).

1 http://ec.europa.eu/maritimeaffairs/spatial_planning_en.html.

Photo: João Salgado

LIFE teams have worked closely with stakeholders (such as fishermen) in defining management plans for Natura 2000 marine sites

The conservation and management of resources in the open sea presents major challenges, however. For this reason, the project tried out a wide range of surveying and monitoring tools, including satellite tracking, to obtain baseline data. From July 2002 to March 2006, four research ships spent more than 6 800 hours collecting observation data, taking about 40 000 images of cetacean's fins for photo-identification and tracking, and sampling (crossbow dart tissue biopsy and tagging) nearly 2 000 dolphins.

From the data collected, the project produced conservation plans for the targeted species and proposed management plans for Natura 2000 marine sites in the area, in co-operation with local stakeholders.

In April 2005, the project won approval for the relocation of the Cabo de Gata Traffic separation scheme, a sea-traffic plan originally proposed by the Spanish merchant navy but which would have introduced major sea-going traffic right through the bottlenose dolphin (Tursiops truncatus) special area of conservation (SAC). This relocation was an important step for the bottlenose dolphin conservation plan. Several meetings established common ground among researchers, conservationists, maritime authorities and fishermen.

LINKING MARINE IBAS

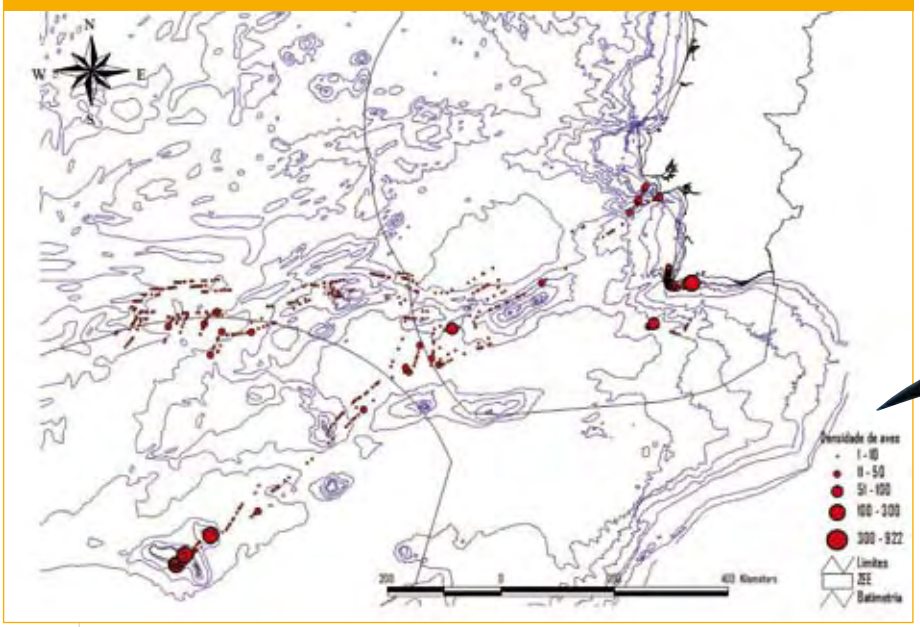
Important Bird Areas (IBAs) are sites that are essential for the long-term viability of bird populations, particularly those of threatened species. One important use of BirdLife International's IBA inventories is to analyse whether the current Special Protected Areas (SPA) in the Natura 2000 network are adequate or not.

Whereas the terrestrial breeding colonies of marine birds are generally well protected, the definition of marine SPAs at sea has represented a gap in the overall Natura 2000 network. Levels of quantitative data on bird populations and their distribution often decrease with distance from shore.

Two closely linked LIFE projects, one covering Portuguese territorial waters (**LIFE04 NAT/P/000213**) and the other covering Spanish waters (**LIFE04 NAT/ES/000049**), set out to prepare detailed inventories, using objective methodological criteria, to determine marine IBAs for seabird species listed in Annex I of the Birds Directive.

LIFE support was vital for testing the most effective means of collating the necessary information. This involved co-ordinating a wide range of different data sources – e.g.

Seabird surveys were used in the definition of marine IBAs



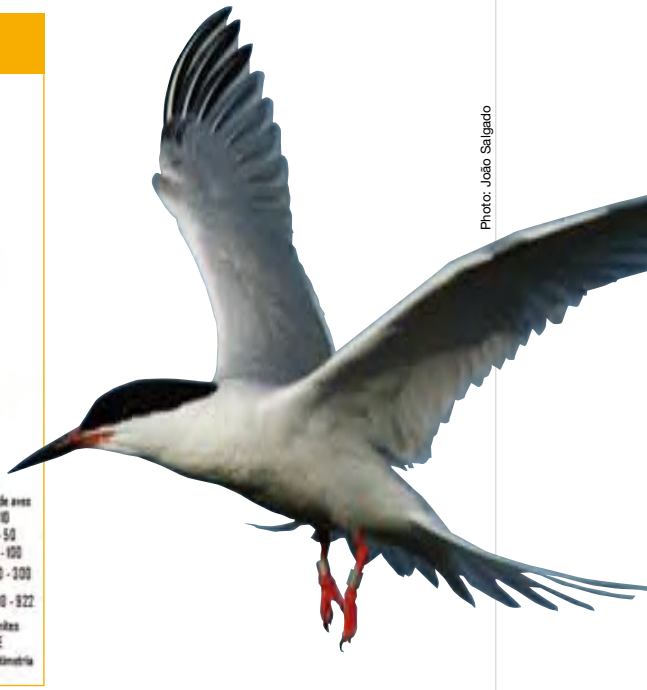


Photo: João Salgado

Photo: LIFE02 NAT/E/008610

*Defining a 'blue' infrastructure for the marine environment will aid the conservation of the bottlenose dolphin (*Tursiops truncatus*)*

bibliographic and satellite sources on sea parameters; long-term sea seabird population trends; field censuses using strip-transects on boats - from a variety of different stakeholders.

The Spanish and Portuguese LIFE projects worked together to hone the methodology, which was then further refined following consultations with national and international partners.

The methodology identifies three types of marine IBA:

1. **Seaward extensions of breeding colonies.** A significant number of birds associated with breeding colonies gather in the surrounding waters, either when they are in transit to or from feeding areas or when they are using the area for feeding, resting, courtship displays or preening.
2. **Coastal or pelagic seabird congregations.** Seabirds tend to congregate in large numbers in certain areas, mainly because of the abundance of food, although other factors could also be important (shelter, water temperature and/or salinity, etc.). These areas may be located either close to the coast or in the open sea. The density of populations will depend upon the species and the characteristics of the area. In some cases IBAs will be identified as those used by a large number of birds on a regular basis, while in other cases they will be areas frequented by certain key species of high conservation importance.
3. **Migration bottlenecks.** Finally, there are areas which, due to their geography, act as true bottlenecks, constraining the movements of entire bird populations (or a large proportion of them) during migration. The Straits of Gibraltar are a clear example of this type of Marine IBA.

This methodology has been used to help identify 42 marine IBAs in Spanish waters (which together provide habitats for 27 different sea bird species) and 17 marine IBAs in Portuguese waters (mainland, Azores and Madeira). Additional areas of importance to sea bird conservation were identified in international waters, highlighting the need for wider international co-operation.

LIFE projects are extending coastal breeding colony Natura 2000 sites (such as for Madeiran Storm-petrel Oceanodroma castro*) to offshore areas*

Photo: João Salgado

The importance of the work of the two LIFE projects in terms of integrated spatial planning is highlighted by the fact that the Spanish government decided to use the interim results during its decision-making process on the location of off-shore wind farms. The approach developed with the support of LIFE has now been adopted by members of BirdLife International as part of a global standard. Moreover, these IBA proposals are important planning tools for extending the current Natura 2000 network into marine areas. As a result, the Portuguese and Spanish projects have made a major contribution to improving the coherence of the Natura 2000 network, extending coastal breeding colonies sites and establishing maritime integrated spatial planning and blue infrastructure that takes in to account economic activities (transport, fisheries) in areas of migration bottlenecks (Gibraltar, Berlengas Islands) and bird feeding areas (Concepción Bank in Canaries Islands).

MARINE PROTECTED AREAS IN LATVIA

Another LIFE Nature project focused on Baltic Marine Protected Areas (**LIFE05 NAT/LV/000100**). The project's inventories and threat assessments resulted in the proposal of several new marine Natura 2000 sites and the redefinition of existing ones. In Estonia, the project gathered new data and information on marine habitats and species (e.g. new breeding sites of seabirds). In Latvia, where previously there were no marine Natura 2000 areas, seven new marine protected areas were proposed. In Lithuania, the project proposed the redefinition of the limits of the existing marine sites in order to include the migration route of shad (*Alosa fallax*), an endangered fish species, and wintering and feeding areas for seabirds. Moreover, the project drew up six Natura 2000 sites management plans, two in each country. This transboundary project has made a significant contribution towards blue infrastructure and integrated maritime spatial planning in the Baltic.

Photo: LIFE00 NAT/UK/007075

A significant number of LIFE Nature projects have focused on the restoration of Europe's bogs. As well as restoring important services provided by these ecosystems, such as water retention and CO_2 intake, LIFE co-funding has also helped to increase the bogs' resilience.

Reconnecting bogs in Europe

Since 2002, a total of seven LIFE Nature projects dedicated to bogs and wetland habitats have taken place in Belgium (two for species, four for peat restoration and one on a military site in the Ardennes). While these projects have been carried out by a range of beneficiaries, they have had certain common goals:

- To stop threats to existing sites;
- To restore these sites and extend their borders; and
- To increase connectivity by restoring new sites.

When all seven LIFE projects are completed, more than 4 000 ha will have been restored and 1 500 ha will be classified as nature reserves.

Four of the seven Belgian projects have taken a highly integrated approach to restoration of bog habitats, with major benefits for species. The LIFE Croix Scaille project (**LIFE05 NAT/B/000087**), which ran from January 2006 to the end of 2009, targeted the Croix Scaille plateau in southern Belgium (containing the following habitats: bog woodland; Nardus grasslands and Tilio-Acerion; and alluvial forests). Extensive conifer plantation has caused the destruction and fragmentation of these semi-natural habitats. In particular, the bogs are threatened by spontaneous reforestation and invasion by purple moorgrass (*Molinia caerula*).

The project focused on the removal of 160 ha of exotic conifer plantations from three Natura 2000 sites. The overall objective was to improve the quality of the two river valleys of the Croix Scaille plateau by restoring open landscapes and enhancing connectivity between fragmented habitats.

Thanks to the extensive work of the beneficiary, Réserves Naturelles-RNOB, and its project partners, an area of 170 ha was cleared of conifers (60 ha from the peat zones on the plateau and 110 ha along the river valleys leading from the plateau). The project team also restored some 85 ha of river valley habitats (low marsh, alluvial meadows, etc.) and 44 ha of peat bogs by blocking drains and digging hundreds of ponds.

LIFE restored open landscapes and enhanced connectivity between fragmented bog habitats in Belgium

Photo: LIFE05 NAT/B/000089

Photo: LIFE00 NAT/UK/007078

Core restored bog areas can act as sources (donors) of species and habitats for surrounding areas

To maintain and develop the achievements of the Croix Scaille project, a long-term management plan has been prepared. The plan proposes four kinds of actions, depending on the particular site and habitat:

- Maintenance by mowing;
- Maintenance by grazing;
- Maintenance by coppicing; and
- Total non-intervention (re-wilding).

REHABILITATION OF HEATH AND MIRES

The 'high fens' of eastern Wallonia are a region of great ecological value with outstanding flora and fauna that preserve boreo-montane and oceanic elements. As a result of drainage, widespread spruce plantation and the abandonment of traditional extensive agricultural, this area of heaths, fens and bogs has been reduced from some 20 000 ha at the end of the 18th century to just 5 000 ha today, much of which is in a degraded state.

The aim of the LIFE project, 'Rehabilitation of heath and mires on the Hautes-Fagnes plateau' (**LIFE06/NAT/B/000091**), which runs from January 2007 until December 2011, is to restore some 1 800 ha of endangered peaty and wet habitats on a 9 724 ha working zone in six Natura 2000 sites. Targeted habitat types include peat moss (*Sphagnum*) and birch woods, raised bogs, damaged or inactive bogs, wet heathlands, transition mires, wet open acid peat with white beak-sedge (*Rhynchospora alba*), old acidophilous oak woodlands on sandy plains, as well as dry heathlands, mat-grass swards, mountain hay meadows, rivular alder woods, and tall-herb communities of humid meadows or watercourse fringes.

In addition to clearing trees from 400 ha, purchasing 100 ha of forest for habitat restoration and negotiating with forest owners to turn 630 ha of plantation forests over to nature conservation, the project seeks to guarantee the sustainable conservation of the open landscapes and related habitats through the introduction of extensive grazing via agreements with farmers.

An important feature of the two LIFE Nature projects outlined above, and the other Belgian projects targeting wet habitats, is that they have focused on existing core natural areas (e.g. mires and heathlands) and areas with a good conservation status. These areas can act as sources (donors) of species and habitats for surrounding areas, which have the potential for recovery, and connect with other core areas. This increases connectivity, improves landscape permeability and creates many new possibilities for the exchange of individuals and genes, even over short distances.

ENHANCING CONNECTIVITY AND RESILIENCE ACROSS EUROPE

LIFE support for restoration of bogs, fens and mires is not limited to Belgium, however. In the UK, for example, the projects 'Restoring active blanket bog of European importance in North Scotland' (**LIFE00 NAT/UK/007075**) and 'Restoration of Scottish raised bogs' (**LIFE00 NAT/UK/007078**) are also noteworthy. The former, in addition to enlarging an area of restored blanket

Photo: LIFE06 NAT/UK/000134

LIFE improved bogs' ecosystem functions, such as gasses intake (CO_2) and retention (methane) – monitoring gas release, Wales (UK)

bog – benefiting more than 16 600 ha of peatland through the removal of commercial forestry and blocking of drains – devised the Peatlands of Caithness & Sutherland Management Strategy 2005-2015, a long-term land use strategy for the sustainable management of the SAC/SPA in co-operation with the principal stakeholders (landowners, conservation NGOs, the forestry authorities and the statutory conservation agency). A Peatlands Partnership is continuing to promote sustainable economic development and an appropriate balance between woodlands and peatlands. The second Scottish LIFE project again used a partnership approach to restore 1 256 ha of active raised bog across 11 sites to a favourable condition, as well as increasing an area of raised bog by 315 ha through the clearance of trees, shrubs and heather.

In Germany, the 'Rosenheim Master Basin Bogs' project (**LIFE05 NAT/D/000053**) took steps not only to restore 444 ha of raised bogs, but also, crucially, to improve the hydrological situation of adjacent fen-meadow habitats through closure of drainage ditches. By maintaining the natural dynamics of rivers and streams in the project area, it is hoped that the long-term hydrology of the bogs and fens will be improved.

Such restoration of bogs, fens and mires projects improved the conservation status of the targeted habitats. As a result, the projects were able to reconnect bog habitats in a spatial coherent way and increase the permeability of the landscape, not only to species movements, but also to water flow and dynamics between the restored bogs. This was done mainly by eliminating overgrowth and commercial forests that broke up the bogs landscape, and by regulating and raising the water levels of the bogs (by blocking the drainage). Moreover, the projects improved some bogs' ecosystem functions, such as ground water retention and gas intake (CO_2) and retention (methane), as well its aesthetic value. All of these projects have helped to enhance the conservation status of the bog habitats and species, improve intake of gas as a mitigation measure against climate change, and increase resilience to climate change of these important habitats.

Restoration actions, such as spruce elimination, improves the conservation status of bogs and thus their resilience to climate change

Photo: LIFE00 NAT/UK/007075

Two neighbouring Spanish LIFE projects have demonstrated how joined-up management approaches to Natura 2000 sites can connect vital core nature conservation areas and support the conservation status of endangered European species.

Co-ordinating Natura 2000 site connectivity in Spain

Of all EU countries, Spain's Natura 2000 network contains the largest area of SPAs (more than 105 000 km²) and SCIs (more than 130 000 km²) that are protected by the Birds and Habitats Directives. Moreover, the Spanish sites tend to be larger than those in the other Member States as they include core nature areas and buffer zones.

Such a diverse collection of sites presents both opportunities and challenges: these areas are under pressure from tourism, infrastructure and urban development, and intensive farming, resulting in fragmented habitats and isolated species populations. Spanish conservation bodies recognise the limitations of isolated investments in wildlife support and acknowledge the benefits to be gained from more joined-up approaches to coherent management of the country's habitats and species.

CONNECTING SPANISH NATURA 2000 SITES

LIFE projects have played a role in demonstrating the synergies that can be gained from co-ordinating nature conservation actions across Spain's Natura 2000 sites. These innovative approaches have been operational since 1999, when an early connectivity initiative was launched consisting of two parallel LIFE projects (**LIFE99 NAT/E/006352** and **LIFE99 NAT/E/006371**) in the Sierra de Ancares mountains.

Located in north western Spain, the Sierra de Ancares contains several important forest areas that support endangered species, including the brown bear (*Ursus arctos*), capercaillie (*Tetrao urogallus*) and the black woodpecker (*Dryocopus martius*). These species are dependent on woodland habitats that straddle the administrative boundaries of two regional governments (Junta de Castilla y León and Xunta de Galicia), each of which has neighbouring areas notified within the Natura 2000 network. LIFE projects were established to improve coherence between these adjacent sites.

Brown bears provided a joint focus for both LIFE projects, since the Sierra de Ancares are considered to be an appropriate staging post for expanding the range of this rare species further southwards. In order to help facilitate such species dispersal, LIFE interventions were required to address conservation concerns that were common on either side of the regional border. Shared threats included bear hunting, uncontrolled tourism, and habitat fragmentation fuelled by deliberate forest fires.

COHERENT MANAGEMENT SYSTEMS

In order to address these common concerns, a co-ordinated approach was proposed. Initial work involved setting up a co-ordination committee made up of representatives from the Ancares pSCI in León and the pSCI of Galicia. Also comprising environmental authorities from the Castilla y León and Xunta de Galicia regional governments, the committee provided a platform for discussing and agreeing a more coherent management system for the total brown bear habitat.

Achievement of multi-purpose land use objectives was seen as essential by the committee members, who were keen to harmonise wildlife interests with the economic needs of local populations. Indeed, financial prosperity was noted as being an important long term factor to prevent further habitat loss through land use abandonment.

Plans for multi-functional zones were drawn up by the co-ordination committee, within the framework of separate national park proposals for each Natura 2000 site. Consultations between the committee members during this process helped to ensure that the resulting pSCI management plans contained similar and mutually-supportive conservation actions.

A combination of habitat restoration and species recovery measures were designed to reduce risks to the brown bears and reinforce the ecological integrity of the Sierra de Ancares. Forest trails were closed in critical or sensitive areas and tests were also carried out to assess the benefits of low impact forestry practices. In addition, a wildlife monitoring programme was established to track bear behaviour, tackle illegal trapping and identify different biological or landscape corridors that were being used by bears (as well as birds and other species) to move between the neighbouring Natura 2000 sites.

CORRIDOR CONSERVATION MEASURES

Following mapping of the wildlife corridors, work began on strengthening these essential ecological highways in order to redress problems associated with fragmentation. Co-ordinated afforestation actions were carried out in both project locations to strengthen the corridors and provide a patchwork of continuous, accessible, natural forest habitat. This LIFE-funded corridor conservation activity helped to improve the functional relationship between core ecological elements in the Natura 2000 sites, such as migration passages and feeding zones for brown bears.

Connecting key habitats in this way led to improvements in around 400 ha of priority forest types, such as oak woods with *Quercus robur* and *Quercus pyrenaica* (9230), *Castanea sativa* woods (9260) and, to a lesser extent, forests of *Ilex aquifolium* (9380). Brown bears and other indigenous fauna, favour these woodland habitats and the LIFE projects' co-ordinated restoration works paved the way for ongoing joined-up management of the Natura 2000 sites, which has helped improve prospects for the bears' survival and dispersal. Local wildlife can now become more dispersed, thanks to a partnership approach that allows a more strategic and inclusive approach to of habitat support activity.

RESULTS AND LESSONS

The LIFE projects were a catalyst for applying the green infrastructure concept to the Sierra de Ancares' overall ecological structure. Collaboration between the beneficiaries created cost-effective results from awareness-raising work with key stakeholders. Foresters, residents, hunters and tourists were all targeted by the co-ordination committee members to increase local knowledge of the advantages of the Natura 2000 conservation work. Such an inclusive approach generated direct employment and improved opportunities for sustainable tourism.

These actions helped to secure support among local community groups for Natura 2000 interventions, and the consistent messages sent out by both beneficiaries contributed greatly to the effectiveness of the communication campaign.

STRATEGIC SHIFTS

One of main lessons that can be learned from this initiative is the potential that the co-ordination committee approach offers for joined-up conservation work in Natura 2000 sites. Options have been identified for focusing on other priority species, particularly the capercaillie, which remains at risk in the area. Further forest habitat restoration has also been proposed.

Success factors behind establishing coherence in ecological structures and co-ordinated management in Natura 2000 sites, such as the above Spanish example, can be credited to good working relationships between partner organisations and their individual representatives. Wider co-operation along the lines of this type of approach will help promote a shift in mainstream conservation management and planning methodologies towards more strategic joined-up efforts at EU, national and local levels.

Consequently, LIFE will continue to play its important role in facilitating the evolution of good practice to improve the coherence of the Natura 2000 network.

Ancares mountains, Spain – management plans are shared between two Natura 2000 sites

LIFE RESTORING ECOSYSTEM FUNCTIONS

Photo: LIFE97 NAT/D/004216

LIFE restoring **multi-functional ecosystems**

The environment provides a range of services, from climate regulation and valuable resources to the enjoyment of nature and beautiful landscapes. Collectively, these are known as ecosystem services and they are crucial for our well-being and social and economic development. In recent decades, however, the natural 'capital' of ecosystems has been increasingly undermined by human activities.

LIFE Nature projects have aimed to improve the conservation status of species and habitats as set out in the Birds and Habitats Directive and in support of the Natura 2000 network. By implementing effective restoration actions, LIFE projects have also, indirectly, restored ecosystem functions and, as a result, boosted the goods and services they provide. This, in turn, increases the value of the restored ecosystems and the biodiversity assets therein. The delivery of ecosystem services and goods depends most of the time on maintaining biodiversity at a good conservation status, necessary for nutrient cycling, water regulation and pollination for example (see figure 1). Therefore, by improving the conservation status of species and habitats through restoration actions, LIFE has also frequently been boosting the services and goods provided by ecosystems in the project areas.

Delivering ecosystem services and goods depends on maintaining biodiversity at a good conservation status - as a result, water levels are improved, for example

Photo: LIFE02 NAT/HU/008638

In addition, several LIFE projects have implemented a combination of different measures to restore such ecosystems as bogs, wetlands, rivers, grasslands and marine areas. These actions can reinstate 'healthy' multi-functional zones and secure the provision of several services, including the retention of flood water, the prevention of soil erosion, the facilitation of CO_2 uptake, the protection of genetic stock, and the prevention of forest fires. These restored and healthier ecosystems deliver a broader range of services that they did prior to the project actions, when they were managed primarily to deliver one single service (e.g. commercial spruce forests or intensive agriculture) that almost certainly reduced their ability to provide others.

Through the LIFE programme, the management and restoration of a diverse range of ecosystems plays an impor-

Creating a coherent ecosystem functional area, such as for forests and mires in Finland (pictured), where several LIFE projects have been implemented over the same area

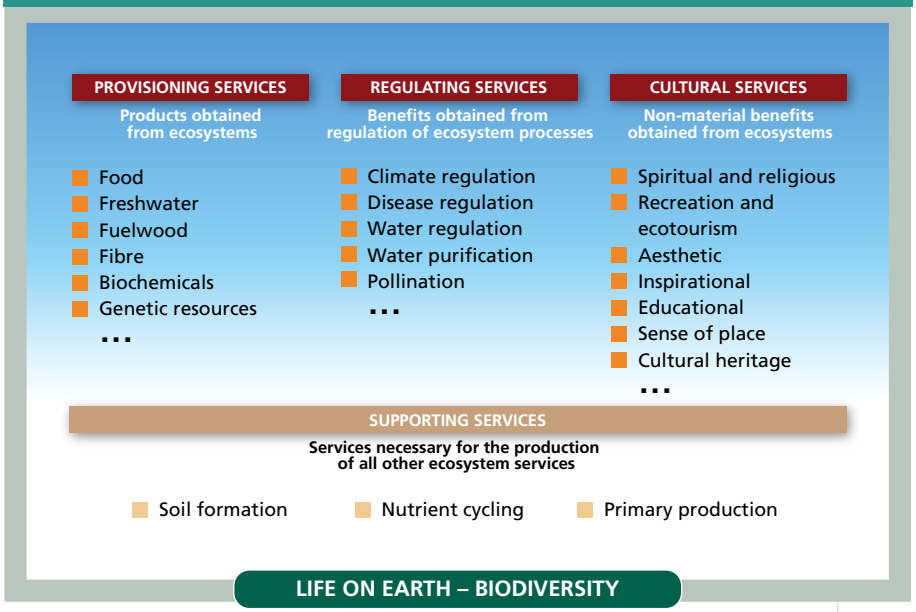
tant role in strengthening various ecosystems across the EU, which will be part of a green infrastructure, as well as mitigating and adapting to climate change effects, and enhancing the quality of life (health, tourism, conserving historic and cultural heritage).

The following pages focus on examples of project actions that restored certain functions of multi-functional ecosystems – for example, floodplains of the Danube, forests and mires in Finland, and high-nature-value farmland in Ireland. Although the projects have almost all implemented localised actions, the demonstration of integrated management and the combination of several projects implemented in the same area has laid the foundation for coherent ecosystem functional areas that are of high socio-economic value.

Moreover, projects have shown how certain measures can be financially beneficial. For example, the economic value of the restored services is often greater than the financial resources spent of the restoration actions. Restoring a floodplain for habitats and species (increasing the floodplain water retention) often represents a cost saving when taking into account damages due to flooding. For example, while lower Danube flood-risk mitigation has cost around €180 million, this is significantly lower than the €400 m worth of damages caused by flooding in 2005 alone.

The economic value of ecosystems was highlighted in a global study, launched by the European Commission in response to a proposal by the G8+5 environment ministers at Potsdam, Germany in 2007. The Economics of Ecosystems and Biodiversity study (TEEB) was an independent study hosted by the United Nations Environment Programme with financial support from Germany, the UK, Norway, the Netherlands and Sweden. The interim report in May 2008 showed how the loss of biodiversity and ecosystem services is having a negative economic impact both locally and globally. The study estimated that such losses add up to around €50 billion per year. Therefore, by restoring ecosystems and promoting green infrastructure, LIFE projects make a strong economic contribution. For example, restoring a costal wetland, is far more cost-effective than having to replace lost services that were provided by the ecosystems (e.g. buffers against storms or flood protection) with much more costly man-made technological solutions, such as protection walls.

Figure 1 – **Ecosystems services categories restored by LIFE projects (adapted from Millennium Ecosystems Assessment Report - 2005)**



River continuum for European mink habitats in Spain

Photo: GAVRN

Populations of the European mink (*Mustela lutreola*) have declined significantly in recent decades as a result of habitat degradation and fragmentation – in addition to the invasion of American mink (*Mustela vison*). One LIFE project, the GERVE project, has addressed this problem by improving the connectivity of existing mink areas and creating new ones.

The European mink was once found along riverbanks, streams and in wetlands all across Europe. Today, this small mammal occupies less than 10% of the area it once covered and has disappeared from more than 20 countries. It is now mostly found in southern France and northern Spain and fewer than 2000 adult individuals survive in the wild.

Riverine habitat degradation and river continuum disruption – both of river dynamics and riverside forest gallery habitats – are significant threats to the European mink, isolating and reducing the genetic viability of sub-populations.

The GERVE LIFE project, 'Ecosystemic Management of Rivers with European Mink' (**LIFE05 NAT/E/000073**), aimed to restore and secure European mink habitats in the Natura 2000 network sites of Aragón and Arga Rivers. The overall objective was to ensure a viable population of European mink in the area and to provide the species with possibilities for expansion by improving connectivity between riparian habitats, and by increasing scientific knowledge about the local European mink populations, its dispersion and habitats requirements.

Actions carried out during the habitat restoration works led to the creation of new biotopes and improved the connectivity between existing ones. Channels were excavated to link water courses and pond areas were dug to encourage prey for the European mink, such as small mammals, frogs, molluscs, crustaceans, fish and insects. Additional conservation works included alterations to oxbows and dykes and the removal of embankments. These actions helped to facilitate beneficial fluvial dynamics and enhanced the river's natural floodplain habitats. As a result of the project actions, the capacity of riverine habitats for carbon storage and water retention has been strenghtened. The restoration of the river dynamics also helps to prevent erosion. Thus, by implementing conservation actions targeting species, the project also boosted the ecosystem functions for society.

Final results from the GERVE project showed habitat enrichments on 24 ha of gullies, 30 ha of meanders, nearly 6 ha of wetlands and around 1.7 ha of breeding areas for the target species. Re-vegetation work was carried out on a number of river breakwaters and a total of about 13 ha of riparian gallery forest habitats was restored. Willows were planted to provide European mink with shelter and to facilitate its movements along the river banks. The quality of another 70 ha of riverside woodland habitat was also improved and more favourable habitat cover was created following the sealing of a 1 250 m^3 dumping ground.

By restoring the river habitats through re-vegetation and the reconnection of the river gallery habitats, river regulation functions – such as runoff, drainage, discharge, retention and storage – were improved. Project actions also helped to reduce erosion/siltation of the riverbed. Thus the overall health of the rivers Arga and Arágon was improved, and they are now more resilient to future disturbances and better able to cope with change and support biodiversity.

Restoring river habitats for the European mink also improved the river regulation functions

Photo: Aixa Sopeña

The Danube, which is the longest river in the EU, has been the focus of several LIFE projects targeting the river's habitats and species. By restoring river dynamics and reconnecting floodplains, the projects have considerably improved the ecology of the river and its ecosystem functions, while at the same time maintaining the navigability of the river. In this way, they have supported the green infrastructure associated with the river by allowing areas to be used for many purposes and by restoring areas containing valuable ecosystems.

Floodplain and habitat restoration on the Danube

Photo: LIFE02 NAT/A/008518

Originating in the Black Forest in Germany and flowing eastwards for a distance of 2 850 km into the Black Sea, the Danube is characterised by fluctuating (seasonal) fast-flowing waters and regular flooding. Its basin is home to high population densities and supports important economic activities as well as priority species and habitats at EU level. It is also an important transport route, classified as a "Transport Corridor VII" under the EU's Trans-European Transport Network. In order to conserve its vast natural value and the goods and services provided by the Danube, synergies must be found between conservational and commercial interests. Ecosystems face many competing pressures and collaborations among different interest groups are necessary to make proper use of their services while safeguarding habitats.

For example, in order to regulate the flow and facilitate navigation of the Danube, its banks were heavily modified. Restricting the movement of water between the main river channel and the adjacent floodplains has benefitted navigation and the economy. It has also had a negative impact on habitats and species and on the ecosystem services provided by the river and its floodplain, such as provision of fish and maintaining the groundwater table in the floodplain. The Danube river interventions also disrupted its natural flow and its functionality was severally damaged as a natural corridor that crosses half of Europe. Migratory fish, such as the sturgeon and the Huchen (or Danube salmon) and birds were affected by this disruption and the river ecological functions, such as water retention, hydromorphology and sedimentation-erosion dynamics, were also damaged.

LIFE ACTIONS

Since 1992, more than 30 LIFE projects have restored the natural river and floodplain dynamics of the Danube and its tributaries, with the objective of improving the conservation status of its species and habitats. A common action of these projects was to reconnect the floodplain to the main river by removing stone barriers and recreating the gentle mud and shingle shelves that allow the river to flood naturally. An Austrian project in 2002 (**LIFE02 NAT/A/008518**) set out to remove all artificial elements strengthening the bank along a 2.8 km pilot section on the left bank of the Danube, near the town of Hainburg, so that erosion and accretion processes could again lead to the formation of natural river bank structures. In this way, the project helped to recreate breeding habitats for fish and birds, such as kingfishers and sand martins, and provided the optimum conditions for plants to flourish, thus slowing down erosion. Such measures also slowed down the river current and decreased the likelihood of problems further downstream.

Around 24,000 m³ of stone blocks were targeted for removal. As the river has flowed through the restored area, it has eroded the steep bank to form a gently shelving shallow shore with localised cliffs where the bank has collapsed. The main course of the Danube along this stretch is now running between shingle and mud banks.

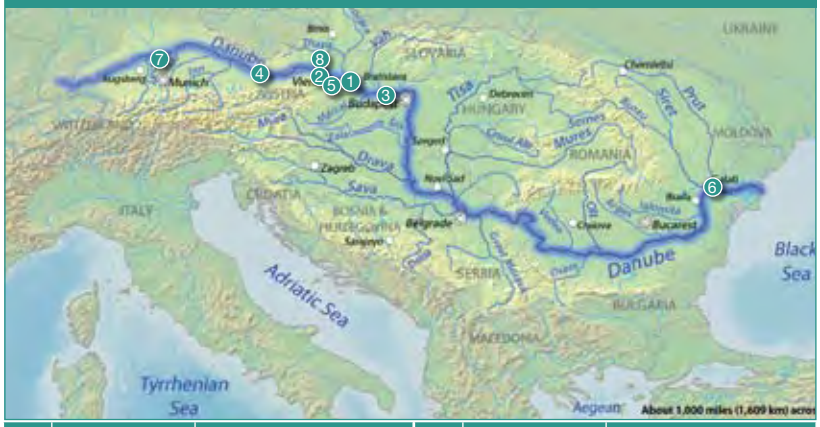
Photo: LIFE02 NAT/A/008518

More than 30 LIFE projects have restored the natural river and floodplain dynamics over several hundred kilometres of the Danube

An earlier project (**LIFE98 NAT/A/005422**) carried out in the Donau-Auen National Park focused on reconnecting cut-off side river arms to the main river. Covering an area of more than 10,000 ha, the national park contains one of the biggest and best preserved lowland riparian forest areas in Central Europe. However, the 30 km stretch of the Danube that passes through the National Park is also used intensively by shipping, especially river barges. The riparian forest was degrading as a result of its isolation from the river. By reconnecting the river arms the conservation status of the floodplain forest habitats significantly improved along with the river dynamics. The reconnection of the side river arms to the main river flow reactivated the various succession stages of the floodplain ecosystem. This action created new habitats (gravel banks) and improved water dynamics on the flooded plain, thus stabilising groundwater levels that were previously decreasing – providing a direct benefit for the neighbourhood city of Vienna.

Another key focus of the 2002 (**LIFE02 NAT/A/008518**) project was to introduce effective ecological management, compatible with the requirements of navigation and the existing flood protection scheme. This had to take account of the needs of the barges for a navigable channel, which is as stable and safe as possible, as well as providing the park

Some LIFE projects locations along the Danube river



	ACRONYM	PROJECT NUMBER		ACRONYM	PROJECT NUMBER
1	Donau - Auen	LIFE02 NAT/AT/008518	5	Donau - Ybbs	LIFE04 NAT/AT/000006
2	WACHAU	LIFE03 NAT/AT/000009	6	Luncaprut	LIFE05 NAT/RO/000155
3	DANUBE FORESTS	LIFE03 NAT/SK/000097	7	Swabian Danube valley	LIFE06 NAT/D/000006
4	Donauwaelder	LIFE04 NAT/AT/000003	8	Mostviertel - Wachau	LIFE07 NAT/AT/000010

with an adequate water supply for the lowland riparian forest. In fact, the project also contributed to flood protection in the cities of Hainburg and Bratislava by maintaining the groundwater table level as a result of reconnecting the river with the floodplains.

The project demonstrated a holistic approach to river engineering, adapted to the specific requirements of this part of the Danube. The removal of riprap on 3 km of the river and the elimination of forestry roads that blocked the floodplain river side arms led to a marked improvement in river dynamics and the ecological situation of the floodplains within the project area. River restoration experts from many countries now visit the project, which serves as a model for similar restoration initiatives along the Danube and elsewhere in Europe.

THE WACHAU GORGE

The Danube winds through the 33 km Wachau gorge between Krems and Melk. Pannonic and Alpine influences have supported a range of rare and endemic species in this area and a LIFE project (**LIFE03 NAT/A/000009**) was set up to protect these as well as to restore the river's natural dynamics. Although the main river is free flowing, a dramatic loss of structural diversity had occurred in recent decades. Similar to the Hainburg stretch, the gravel banks had been removed and lateral channels had disappeared as a result of increasing sedimentation in cut-off stretches of the river during periodic floods.

The project recreated the gravel banks and islets using around 400,000 m³ of gravel that is dredged annually from the shipping channels. Together with the reactivated lateral river channels, the gravel structures serve as spawning ground for the fish fauna and as resting and breeding sites for aquatic birds. Thus, green infrastructure is bolstered by better conditions for fishing and more opportunities for tourism.

The project demonstrated the benefits of establishing a local platform consisting of the river authorities, the regional fishing association, all the area's municipalities and its two abbeys. By restoring the riverine habitats the project also met the needs of all users of the river by increasing the value of the ecosystems and the services they provide.

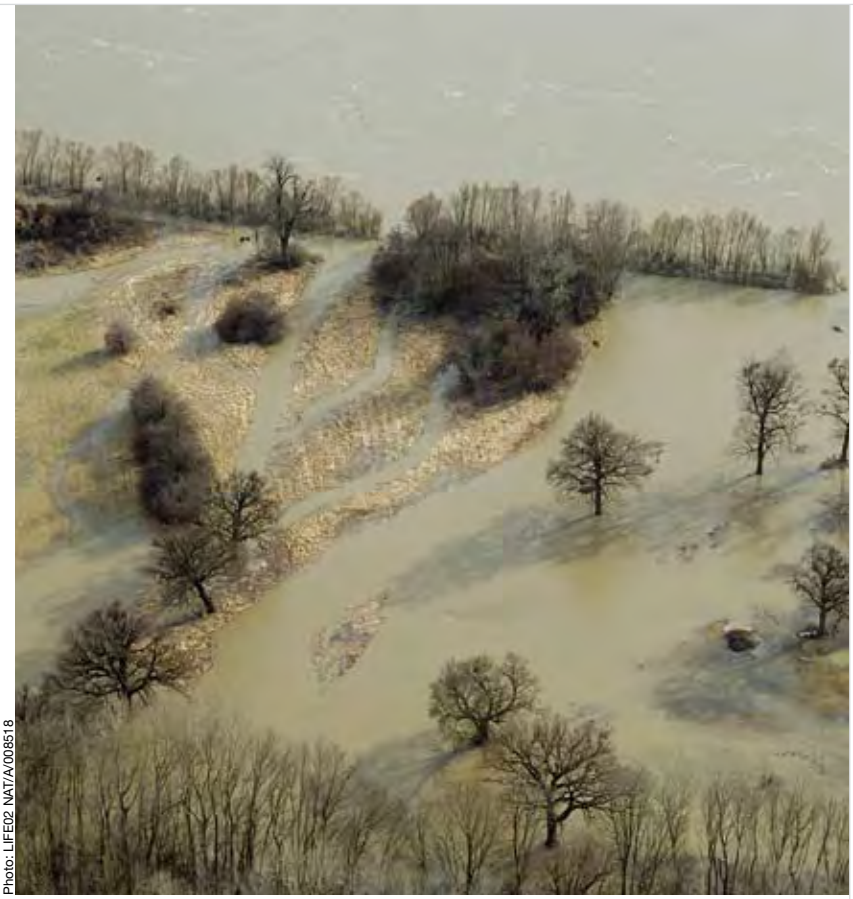


Photo: LIFE02 NAT/A/008518

LIFE actions have also contributed towards the flood protection of several cities along the Danube

OTHER TARGETED SECTIONS

Restoration of river banks is essential for the conservation of certain fish species. An ongoing Danube project (**LIFE07 NAT/A/000010**) is targeting rheophile fish species, which migrate to the tributaries to reproduce at sites where gravel banks still exist. The project is aiming to construct new side arms and backwaters and create a new mouth to the river Pielach, to facilitate this spawning process. The rivers within the project area are habitats for some 40 autochthonous fish species, including 13 species listed in Annex II of the Birds and Habitats Directive. As well as carrying out restoration work at three sites on the river Ybbs, the project **(LIFE04 NAT/AT/000006)** is also building a migration channel at the Melk power station, in co-operation with the power company.

Restoring breeding and foraging sites of the Birds Directive Annex I-listed species was also the focus of a German project (**LIFE06 NAT/D/000006**). The project area encompassed parts of three SPAs ('Schwäbisches Donaumoos', 'Donauauen', 'Wiesenbrüterlebensraum Schwäbisches Donauried') and parts of six pSCIs, and also, contains important stopover areas for migrating birds. Habitat improvements carried out along the Swabian Danube valley are consistent with other measures taken along the river.

LIFE projects have increased the ecological value of the river, and its neighbouring habitats and floodplains, by restoring sections to their natural conditions and demonstrating how future management of the river can proceed. In total, LIFE projects have restored several hundred kilometres of floodplain and river banks along the Danube.They have also helped shaped policies that are favourable to maximising the ecosystem services provided by the river. The recycling of gravel at Wachau is one such action that has the potential to become an established policy of the river authority.

Reconnecting multi-functional areas in Fennoscandia

Steady delivery of an ecosystem's goods and services is highly dependent on the favourable conservation status of its habitats and on its integration at a broader scale intro a multifunctional landscape. In Finland, LIFE project restoration actions have been integrated at a broader level in the cross-border 'corridor' zone between Finland, Russia and Norway, on a stretch of more than 1 300 km.

To be effective, corridors or ecological networks must establish functional relations between nature conservation core areas, such as Natura 2000 sites and protected areas. But at the same time, these 'corridors' have to maintain healthy, multifunctional ecosystems across entire landscapes. In the EU, several approaches have been taken and definitions adopted for these multifunctional areas that connect core natural areas. LIFE has contributed to the restoration of core natural areas (Natura 2000 sites) and helped 'build' multifunctional areas, such as the European Green Belt.

EUROPEAN GREEN BELT AND LIFE

The European Green Belt is a network of protected areas that contributes to nature conservation along the former 'iron curtain'. The Green Belt connects nature conservation areas (Natura 2000 network, national parks) and trans-boundary protected areas, as well as non-protected areas along or across borders It also supports regional development initiatives based on nature conservation. The objective is to better harmonise human activities with nature conservation and to boost socio-economic opportunities and the sustainable development of local communities.

In Fennoscandia, the Finnish-Russian and the Norwegian-Russian borders did not originally fall under the definition of

LIFE projects locations along the Fennoscandian Green Belt

	ACRONYM	PROJECT NUMBER
1	Wild forest reindeer	LIFE98 NAT/FIN/005325
2	Pohjois - Karjala	LIFE00 NAT/FIN/007062
3	Karelian Mires	LIFE03 NAT/FIN/000036
4	Gulf of Finland	LIFE03 NAT/FIN/000039
5	GreenBelt	LIFE04 NAT/FI/000078

Source: Adapted from Metsähallitus

the 'Iron Curtain'. The Russian border now serves as an external border of the EU, and a basis for co-operation at a local level – especially among protected area management authorities – for nature conservation.

LIFE has been supporting several projects focusing on nature conservation areas along the Green Belt, especially the Fennoscandia stretch, along the border with Finland, Russia and Norway (see map).

RESTORING FORESTS AND MIRES

The projects mainly focused on the restoration of boreal forest and mires habitats, covering extensive areas along the Green Belt. In the case of the boreal forests habitat, the restoration actions involved the promotion of its variability by increasing deadwood and creating openings mainly by using fire as a management tool. In most of the cases, the low diversity commercial forests were restored to a more natural and diverse forest habitat. By restoring these habitats the ecosystem services provided were improved. Moreover, forest services and goods (e.g. tourism and commercial berries) were improved. By blocking dykes and restoring the water level, the aapa mires habitat conservation status was improved and its ability to retain water and absorb green house gasses increased. On a broader scale the combined restoration actions helped reconnect habitats as stepping stones for species such as the flying squirrel and enhanced the coherence of the landscape mosaic along the Green Belt. Moreover, the projects also improved the ecosystem's services and its resilience on a broader and multifunctional scale.

The project 'Natural Forests and mires in the Green Belt of Koillismaa and Kainuu' (**LIFE04 NAT/FI/00078**) aimed to conserve forests and mires in 13 Natura 2000 sites in eastern Finland. These sites form part of the Fennoscandian stretch of the European Green Belt – including an extensive network of forests, mires and fells in Finland, Russia and Norway. In fact, the project aimed to complement the work already started by a number of other Finnish LIFE Nature projects on boreal forests and aapa mires.

Photo: LIFE04 NAT/FI/000078

Restored aapa mires – project actions increased water levels and improved hydrodynamics, retention and water quality

The project restored 578 ha of boreal forests (mainly former commercial forests): 85 ha were restored by controlled burning and 492.6 ha by increasing decaying wood and the variability of the forests (e.g. creating small opening to boost the growth of deciduous trees in forests dominated by conifers). Notably, fire-dependent insects invaded the burned areas very rapidly and several rare and threatened species were found. Moreover, the project restored 390 ha of aapa mires and bog woodlands by filling and blocking ditches and by clearing excess trees. The project actions increased water levels and improved the hydrodynamics, retention and water quality of the mires.

The close proximity of the restored sites to the Russian border is particularly important as they can provide a vital stepping stone, allowing species and habitats that are still abundant in Russia to re-colonise areas in Finland. Habitat restoration seminars were organised as part of the LIFE project for the staff of the Russian protected areas. These seminars covered alternative habitat restoration and management methods, and provided an opportunity to examine the results of ongoing restoration projects. As a result, flying squirrel populations will be surveyed in Russia's Paanajärvi National Park, and burnt forest habitats

The proximity of core natural areas to Russia provides a vital stepping stone, allowing species and habitats to re-colonise areas in Finland

Photo: LIFE04 NAT/FI/000078

will be mapped in the Kalevala National Park in Russian Karelia to facilitate plans to recreate similar habitats in Finland.

A LIFE project (**LIFE00 NAT/FIN/007062**) carried out in the Karelian forests drew up forest management guidelines for flying squirrel and white-backed woodpecker in parts of the Green Belt that were not part of Natura 2000 sites. These areas serve as feeding grounds and ecological corridors between the nesting areas. The project beneficiary, the Forest Centre, contacted forest owners to gain permission to include guidelines on how to manage white-backed woodpecker habitats as part of the forest management plans for privately owned forests. If permission wasn't gained, the Forest Centre retained key habitat information for use when the land owner begins managing the forest (he or she is obliged to inform the Forest Centre in advance).

The project restoration work concentrated on prime forest habitats. By the end of the project, a new white-backed woodpecker couple were observed in the restored area, a promising result given that there are only around 50 nesting couples in all of Finland. The restored areas form a network of 'stepping stones' to Russian populations of flying squirrel and white-backed woodpecker. Another project (**LIFE03 NAT/FIN/000036**) was set up to complement the work of this earlier project (**LIFE00 NAT/FIN/007062**). Located in the same region, this project focused on a further nine Natura 2000 network sites, which cover a total of around 13 000 ha. The project succeeded in protecting 76 ha in Paiholan metsä (with project funding), acquiring 105 ha of land for conservation and protecting 65 ha of Natura 2000 sites (with other funding). Nature conservation areas (under Finnish legislation) were established on 97.5% of the project areas, and 373.5 ha of forest was restored by controlled burning. The use of fire increased the quantity of decaying wood and the variability of the forests by creating small openings that facilitate the development of mixed forests and also mimic storm effects. Restored forests will develop into natural boreal forests within a few decades. Around 480 ha of mires were also restored. Blocking and filling of around 125 km of ditches helped to increase the water level of these restored mires.

Photo: LIFE03 NAT/FIN/000034

*White-backed woodpecker (*Dendrocopos leucotos*)*

Meanwhile, the project, 'Management of wetlands along the Gulf of Finland' (**LIFE03 NAT/FIN/000039**), carried out work on migratory flyway along the Baltic coast, in the Green Belt area along the flyway of the Northern Coastal Gulf of Finland. Here, waterfowl and waders winter before migrating in the spring to their breeding grounds. The project's 12 areas along the flyway are internationally valuable wetlands and home to 35 species listed in Annex I of the Birds Directive. Management plans were drafted and approved for all project areas (covering 3 353 ha in total).

A range of restoration activities took place: some 87 ha of land was cleared of trees and bushes, while reed beds were removed from approximately 185 ha of coastal meadows by crushing, mowing and grinding. A total of 176 ha of new pastures were created and grazing was begun during the project. The long-term management of the pastures is secured through agri-environmental support agreements made with local farmers. The water vegetation was removed and dredged and the mosaic structure of wetlands was increased in around 163 ha. The project redirected and divided ditches and created canals to improve the water quality and levels on 76 ha of wetlands.

INTEGRATION OF MULTI-FUNCTIONAL AREAS BY LIFE

All Finnish projects that implemented actions along the Green Belt have made a crucial contribution to the conservation of species (e.g. flying squirrel, white-backed woodpecker, and beetles dependent on burned or dead wood), and played an important role in restoring habitats, such as aapa mires, wetlands, coastal meadows, old growth forests and boreal forests. Moreover, the conservation actions of these projects indirectly resulted in a range of beneficial outcomes, such as:

- Increased cross-border co-operation between Russia and Finland;
- Implemented habitat restoration guidelines that can be used along the Green Belt;
- The establishment of common management plans throughout the Natura 2000 network and their integration to the Green Belt initiative; and
- Integration of the restoration project actions at a landscape level.

LIFE actions – using fire as a management tool to restore boreal forests

Photo: LIFE04 NAT/FI/000078

Intensification of in European agriculture has adversely affected the conservation status of many species and habitats. A range of LIFE projects are demonstrating methods to help farmers develop green infrastructure in the EU countryside.

LIFE's role in **strengthening farm-based ecosystems**

As Europe's largest land user, the farming and forestry sector is an important partner in EU efforts to strengthen green infrastructure. Key challenges for the various stakeholders concerned focus on addressing the quality, quantity and coherence of ecosystem features across landscapes. This involves balancing food production with biodiversity conservation and requires coordinated approaches to achieve win-win results for Europe's citizens and wildlife.

LIFE continues to be at the forefront of such work, through pioneering initiatives with farmers that are helping to improve the conservation status of species and habitats, tackle habitat fragmentation, develop mutually beneficial multifunctional zones for economic and environmental interests, facilitate landscape permeability to help species and habitats dynamics, and increase spatial connectivity between high-nature-value (HNV) farm areas.

HNV HUSBANDRY

HNV farmland is typically characterised by low-intensity land use, the presence of semi-natural vegetation, and diverse, mosaic like landscapes. Many varied examples of HNV farmland can be found in Europe, and the high levels of biodiversity that these rural areas support remains dependent on specific localised farming systems.

A good example is the Burren limestone landscape, which is located on the western edge of Europe along Ireland's Atlantic coastline. Here a LIFE Nature project (**LIFE04 NAT/IE/000125**) has been working with local livestock farmers to promote coherence practices within the Burren's unique ecological environment by countering effects of habitat

Pioneering initiatives with farmers in the Burren, Ireland – where new agri-environment models are benefiting multifunctional areas both for economic and environmental interests

Photo: LIFE04 NAT/IE/000125

Photo: LIFE04 ENV/E/000184

LIFE helping to restore high nature value (HNV) farm land in a spatially coherent way

deterioration and fragmentation. Covering 47 000 ha, the project takes in five Natura 2000 priority habitats containing limestone pavements, turloughs, petrifying springs, *Cladium* fens and orchid-rich grasslands.

Traditional grazing systems, previously practised by the Burren's network of small scale private farmers, had successfully supported a rich mix of rare plant and insect life in the area. However, modernised husbandry methods led to less winter grazing which began to disrupt the Burren's ecological balance and increase habitat (mainly grasslands) fragmentation. LIFE support was used to help harmonise the eco-equilibrium by developing a new agri-environment model, which provides incentives for farmers to implement sustainable agriculture measures within a coordinated species conservation framework.

Now mainstreamed in Ireland's Common Agricultural Policy support packages, the LIFE project's area-based technique provides a controlled approach to strengthening the coherence of the Burren's green infrastructure through a connected series of HNV farm management plans. LIFE also introduced useful agri-innovations, including new feed concentrates that compensate for the lower nutrient levels in winter grass and allows livestock to graze the Burren all year round.

Restoration of traditional grazing practices has achieved good ecological results. This success owed much to the co-operation established with another LIFE project (**LIFE99 NAT/UK/006094**), which implemented similar habitat enhancement measures in UK limestone environments. This type of knowledge transfer remains an important tool for helping improve operational efficiencies for other farmer-led green infrastructure initiatives, such as those involved in strengthening eco-corridors (e.g. bush edges and traditional dry-stone walls) or improving spatial connectivity of species and habitats.

CONNECTING KESTREL COLONIES

Portuguese populations of the lesser kestrel (*Falco naumanni*) plummeted during the latter half of the last century. This decline can be largely attributed to a breakdown in habitat functionality, following loss of nesting areas and foraging sites. New irrigated crop production systems caused a shift away from extensive farm cultivation patterns, which had in the past provided a mosaic of cereal fields, fallow land and pastures, much favoured by the lesser kestrel.

LIFE support (**LIFE02 NAT/P/008481**) was used to help fill these gaps that had emerged in the kestrels' habitat over a large expanse of southern Portugal. A network of spatially targeted actions was designed to connect and improve farm-based forage sites for the globally-threatened species. Activities on the ground were then managed within a strategic plan that piloted new agri-environment actions to reintroduce crop rotations, increase the proportion of fallow fields, restrict grazing pressures, avoid ploughing or sowing near riparian zones, maintain natural vegetation, and restrict plantation of permanent crops, like olive groves or forestry.

Project outcomes prove the biodiversity benefits that can be achieved from improving spatial connectivity and functionality within a habitat. Portuguese authorities acknowledged this achievement and the project's legacy is now being sustained via Rural Development Programme co-financing for agri-environment activity in the target SPAs.

MULTIFUNCTIONAL LAND USE

Elsewhere in Iberian SPAs, another LIFE project (**LIFE04 ENV/ES/000269**) has been working with agriculturalists to introduce environmentally friendly farming practices methods around some of Spain's priority wetland areas. Staff from the LIFE project carried out research to identify crop production systems that were compatible with wetland conservation priorities in the Ramsar designated Doñana national park. The overall aim was to identify mutually favourable options for farmers and wildlife, through establishing an effective multifunctional land-use regime.

Soil quality featured strongly in this LIFE project, which demonstrated the cost effectiveness of low-impact erosion control techniques, such as minimum tillage, direct sowing, and use

Photo: LIFE00 NAT/FIN/007062

LIFE projects demonstrating low-impact actions (such as extensive grazing) are cost-effective in controlling erosion and for other ecosystem services

of sown or naturally occurring ground cover. Results from the research were published and a LIFE-funded training programme helped improve awareness among local farmers about how they can help to maintain multifunctional and diverse habitats around wetland areas.

PROMOTING LANDSCAPE PERMEABILITY

An essential function of wetlands and other ecosystems is their use by species to disperse and migrate. In farm habitats this 'landscape permeability' can be facilitated by introducing or restoring wildlife-friendly features, and many LIFE projects implement related habitat improvements on farmland. A good example can be found in Sweden (**LIFE00NAT/S/007117**), where LIFE has made a significant contribution to nature conservation in the agricultural landscape around Öland.

Here, the LIFE project operated in parallel with Swedish agri-environment assistance to restore nearly 4 500 ha of wetlands and coastal meadows comprising priority habitats such as Boreal Baltic coastal meadows, calcareous grasslands, and Nordic alvar. Species can now easily disperse within these restored habitats thanks to local farmers' participation in LIFE interventions – the conservation status of birds such as Ruff (*Philomachus pugnax*), golden plover (*Pluvialis apricaria*), dunlin (*Calidris alpina schinzii*) and black tern (*Chlidonias niger*) was also improved.

COMBINING MULTIFUNCTIONAL HNV

Positive outcomes from each of these LIFE projects underlines the crucial role that EU farmers have in species and habitats conservation. LIFE has also highlighted the reliance of farm-dependent species and habitats on ecosystems that are structurally and functionally healthy. Europe's agricultural areas provide the structural basis and location for a future EU green infrastructure, while farmers hold the potential to allow these HNV areas to function effectively. The LIFE programme will continue to reflect this reality by showing how actions can be combined to address multifunctional areas and help farmers build better green infrastructure in the EU countryside.

Europe's agricultural areas provide the structural basis and location for a future EU green infrastructure

Photo: LIFE02 NAT/P/008481

ADAPTATION TO CLIMATE CHANGE

Photo: LIFE03 NAT/S/000073

Maintaining and restoring ecosystems as a tool for adapting to climate change

Maintaining and restoring healthy, functioning ecosystems is central to the EU's strategy for adaptation to climate change. Ecosystems not only provide a range of different goods and services to society, but also play a crucial role in climate regulation and in protecting against climate impacts. The conservation and restoration of such ecosystems has been the focus of several LIFE projects, which have provided valuable insights for future action in this area.

Climate change is now a reality: rising global average temperatures are changing weather patterns, raising sea levels and increasing the frequency and intensity of extreme weather events such as storms, floods, droughts and heat waves.

Certain regions and sectors will be affected more than others. The European Environment Agency's report on the 'Impacts of Europe's changing climate (2008)' identifies southern Europe, the Mediterranean Basin, outermost regions and the Arctic region as the most vulnerable areas in Europe. Mountain areas, in particular the Alps, islands, coastal and urban areas, and densely populated floodplains also face particular problems.

In terms of sectors, the potential impact of climate change is predicted to be highest in sectors that rely on ecosystem services, water availability and climatic conditions. Some of the most vulnerable sectors therefore include agriculture and forestry, fisheries and aquaculture, energy and tourism.

LIFE actions are helping to maintain and restore healthy, efficient and climate change-resilient ecosystems

Photo: João Da Silva

RECOGNISING THE ROLE OF GREEN INFRASTRUCTURE

In April 2009 the European Commission published a White Paper, which outlined the framework for adaptation measures and policies to reduce the EU's vulnerability to the impacts of climate change. The White Paper warned that climate change will increasingly drive ecosystem and biodiversity loss, affecting individual

species and "significantly impacting ecosystems and their related services, on which society depends".

At the same time, it also highlighted the important role ecosystems play in both climate regulation and in climate change adaptation. An impact assessment that accompanies the White Paper suggests that "working with nature's capacity to absorb or control impacts in urban and rural areas can be a more efficient way of adapting than simply focusing on physical infrastructure." The report suggests that resilient ecosystems, as part of the EU's green infrastructure, could play a crucial role in adaptation by, for example, improving the soil's carbon and water storage capacity, and conserving water in natural systems to alleviate the effect of droughts and to prevent floods, soil erosion and desertification.

THE ROLE OF LIFE

A priority objective of the EU's climate change adaptation strategy is, therefore, to maintain and restore healthy, effectively functioning and climate change-resilient ecosystems. The LIFE programme has been supporting efforts to achieve this objective, with LIFE projects contributing in a number of different ways to the maintenance and restoration of ecosystems with an important role in climate change adaptation.

WETLANDS AND WATER REGULATION

Wetlands play a key role in regulating water supply, especially during periods of droughts or heavy rainfall. These ecosystems store vast quantities of water, which is then slowly released into neighbouring watercourses. The loss or damage of these ecosystems can therefore result in less reliable water supplies, increased droughts, or a greater likelihood of flooding.

A number of LIFE projects have implemented actions aimed at maintaining or restoring wetland habitats and species. In most of these projects, actions focus on restoring water levels, dynamics (hydromorphology) and quality. The LIFE project, 'Restoring active blanket bog in the Berwyn and Migneint SACs in Wales' (**LIFE06 NAT/UK/000134**), for example, is working to restore 5,039 ha of blanket bog in the Berwyn and South Clwyd Mountains special area of conservation (SAC) and 440 ha in the Migneint Arenig Dduallt SAC. Initial results from this project shows that blocking moorland drains significantly raises soil water tables. The project is also monitoring potential benefits for climate change mitigation, as a result of improved absorption of greenhouse gases.

CONSERVING AND RESTORING FLOODPLAINS

Floodplains provide an essential buffer for flood waters and represent another key piece of green infrastructure in protecting against the impacts of climate change. The LIFE project 'Restoration of Latvian floodplains for EU priority species and habitats' (**LIFE04 NAT/LV/000198**) undertook a nationwide programme to restore and reconnect 16 priority floodplain habitats, covering over 14 085 ha.

The project beneficiary – the Latvian Fund for Nature, in partnership with 22 other organisations and the 19 municipalities – drew up management plans for 15 sites and undertook urgent restoration works on some 2 400 ha of meadows. With over 90% of the project area privately owned, the active involvement of local landowners was a key aspect of the project. A total of 226 landowners agreed to sign contracts for the restoration of 4 112 ha of habitats, and to apply for funding under agri-environmental schemes to ensure continuity of habitat management activities after the LIFE project ended.

An earlier LIFE project in Belgium (**LIFE98 NAT/B/005171**) demonstrated the financial and environmental benefits of natural floodplains over the construction of dams in preventing flooding. LIFE funding enabled Natuurpunt, a Flemish NGO, to acquire land along the banks of the Dijle, in Leuven, and to remove obstacles to flooding, such as poplars and maize crops.

Before the implementation of the project actions, flooding would regularly affect areas of Leuven, including the famous University campus. However, since the completion of the project, the city has not experienced flooding for several years. The dual conservation and flood management benefits of the project means that it has been a win-win situation. It has also proven to be a cheaper alternative to constructing a large dam near the city, even taking account of the cost of buying the land.

Restoring bogs (Wales, United Kingdom) – by raising water levels and improving hydromorphology is helping to mitigate climate change

Photo: LIFE02 NAT/IRL/008490

Photo: Jon Eldridge

Restored natural river and floodplain dynamics – prevents flooding and helps to alleviate the impact of extreme climatic events

CONSERVATION AGRICULTURE

Soil erosion and desertification pose a serious threat to habitats and food production in many parts of Europe and these processes are expected to intensify in the future as a result of the impact of climate change.

The Seville's young farmers association, Asociación de Jóvenes Agricultores de Sevilla, managed a pioneering LIFE project (**LIFE00 ENV/E/000547**) that aimed to develop a model for more sustainable soil management. The project actions focused on the Doñana National Park, one of Spain's main natural heritage reserves. Here, an increased coverage of arboreal crops and more intensive production had lead to an increase in sedimentation, fertiliser runoff and pesticide pollution, particularly in the Guadiamar river basin, which feeds much of the park's wetland areas.

This pioneering LIFE project focused on identifying what types of vegetation cover provided the best protection against erosion for different soil characteristics. Thirty-three demonstration farms were selected for the project's trials, which covered close to 320 ha of agricultural land. A variety of different species of vegetation were tested on different slopes and soil types. The data obtained during three agricultural cycles was recorded in a georeferenced database, enabling inclusion of data in a geographic information system (GIS) developed by the project.

Results from the trials were impressive, with erosion being reduced on the majority of test sites. Farmers were particularly pleased with actions taken on difficult sloping areas; considerable improvements in the overall soil structures were noted. The associated improvements in water quality from diminished agrichemical run-offs were further increased by the soils' enhanced retention capacity provided by the new vegetation cover. This also had a positive effect on local landscape quality and biodiversity, with analysis confirming higher species diversity among insects, earthworms and soil microorganisms. At a broader scale, the change in land cover increased the coherence and resilience of the agrarian landscape, improving its resilience to climate change.

Preventing soil erosion with vegetation in an agriculture area

Photo: LIFE00 ENV/E/000547

FLOOD DEFENCE AND COASTAL HABITATS

Managed realignment is a process whereby sea walls are breached or neglected to allow land to become intertidal. It is now the preferred means of flood defence in many coastal areas, as well as offering a way of replacing lost intertidal habitats. Restored coastal tidal habitats also serve as a buffer against extreme events, such as storms and rising sea level. Moreover, managed realignment is less expensive than constructing sea walls and other heavy and costly to maintain infrastructure. Finally, it is an important tool in adapting to climate change and associated sea level rise.

By restoring tidal ecosystems, LIFE actions provide an important natural buffer to sea-level rises

Photo: LIFE04 NAT/NL/000202

The LIFE project, 'Tiengemeten, restoration of freshwater tidal area in the Haringvliet estuary, the Netherlands' (**LIFE04 NAT/NL/000202**), transformed 700 ha of farmland into a tidal ecosystem. The project formed part of the wider Deltanatuur initiative to restore and create thousands of hectares of intertidal habitats in the estuary by restoring a more natural tidal regime. The project is also expected to lead to the increase of rare and endangered species in the site.

Salt marshes are another important coastal habitats that provide an important natural buffer to sea-level rises, as well as storm surges, hurricanes and other extreme weather events. The LIFE project, 'Environmental restoration and conservation of the habitat of the Saltpan of the SCI Comacchio Marshes' (**LIFE00 NAT/IT/007215**) focused on the restoration of 600 ha of salt marshes in the Po Delta Regional Park (Italy). The project was successful in re-establishing water circulation in order to protect the typical habitats and species of the coastal lagoon. The Po Delta Park authority is now continuing the management of the restored salt marsh, ensuring its future conservation.

FORESTS ON THE FRONTLINE

Forest ecosystems are highly significant in terms of landscape, erosion control, water regulation, preservation of biodiversity, and as a source of fuel and building material. Moreover, forests play an important role in climate regulation and in absorbing CO_2 from the atmosphere. However, forests, and particularly Mediterranean forests, are especially vulnerable to the negative impacts of climate change, particularly the expected increased incidence of forest fires and droughts, which will lead to more pests and vulnerability to biotic and abiotic factors.

The LIFE+ BOSCOS project (**LIFE07 ENV/E/000824**) aims to contribute to the development of sustainable forestry management to mitigate the negative impacts of climate change on Mediterranean forest in Menorca. Local sustainable forest management plans at estate level will be agreed and implemented, including measures to decrease vulnerability of forest stands in the context of global warming. These will particularly target forest owners, forest managers and other forest professionals to build capacities.

LIFE AND SPECIES ADAPTATION: A SURVIVAL ROUTE FOR THE ARCTIC FOX

In addition to restoring and conserving habitats that create green infrastructure, helping to protect against the impacts of climate change, LIFE projects have also identified a role for green infrastructure in helping species to adapt to climate change impacts.

A recent LIFE Nature project in northern Sweden and Finland (**LIFE03/NAT/S/073**), for example, has improved understanding of how Arctic species have responded to habitat loss due to climate change and suggested a novel approach to assisting climate change adaptation by the endangered Arctic fox (*Alopex lagopus*).

Using fossil DNA to examine genetic variation in the Arctic fox through a period of habitat expansion and contraction, the project beneficiary found that the Arctic fox in midlatitude Europe became extinct at the end of the Pleistocene period and did not track the habitat when it shifted north. Instead, a high genetic similarity between the populations in Scandinavia and Siberia suggests an eastern origin for the Scandinavian population at the end of the last period of glaciation.

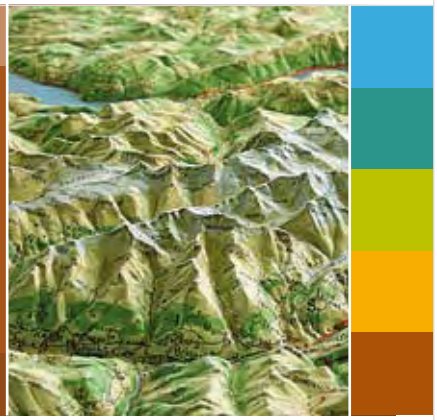
These results suggest that Arctic Fox populations are unable to track decreases in habitat availability and that Arctic species may be particularly vulnerable to increases in global temperatures. This highlights the importance of refugia for the long-term survival of Arctic species, such as the Arctic fox. In response to these findings, a key outcome of the project was the proposal of constructing multifunctional corridors that will allow the Scandinavian Arctic fox populations to reconnect with Siberian populations.

Photo: Keith Morehouse

CONCLUSIONS

To date, the benefits of LIFE projects for climate change adaptation have gone largely unnoticed, as these projects primary focus on the restoration and conservation of habitats and species. Because of this, information on the benefits for climate change adaptation is not routinely collected, which makes it difficult to comprehensively quantify the impacts, or assess the economic value of these project actions. However, useful approaches and methodologies have been developed and with climate change now a priority objective within the LIFE+ programme, there is an opportunity to close this information gap in the coming years.

INTEGRATED SPATIAL PLANNING



LIFE promoting **integrated spatial planning**

Successfully establishing a green infrastructure requires an integrated approach to spatial planning. The LIFE programme has shown how this can be achieved through several innovative projects.

Integrated spatial planning has an important role to play in improving landscape coherence and connectivity between core natural areas (protected areas, Natura 2000 sites, high-nature-value farmland, etc.), helping to restore ecosystem functions and enabling adaptation to climate change. An integrated approach to spatial planning can, also outside protected areas, increase landscape permeability and help establish multifunctional zones in order to create an ecologically and functionally coherent network that effectively safeguards Europe's biodiversity and its associated ecosystems goods and services. Therefore, integrated spatial planning could be an effective tool for building a green infrastructure.

Moreover, integrated spatial planning of green infrastructure as part of a broader development policy, which aims to mobilise the potentials of European regions and cities for sustainable economic growth, will contribute to the EU's territorial cohesion agenda under the Lisbon Treaty.

HOW INTEGRATED SPATIAL PLANNING WORKS

In order to achieve these goals, it is necessary to bring together different policy sectors in an integrated and co-operative way, so that land-use priorities can be determined in a sustainable and intelligent manner at a strategic level, over a large enough geographical area (e.g. at municipal, regional or higher level). In practical terms, this means considering the ecological impact of such necessities as housing, energy and transport at all stages of the planning process, rather than housing authorities make planning decisions that are subsequently subject to ecological impact assessments.

Authorities and stakeholders at local or regional level should be engaged at the earliest possible stage in planning the framework of a future EU green infrastructure, particularly as they have a crucial role to play in its implementation. For the sake of coherence, these local and regional spatial planning strategies then need to be supported by an overall policy framework that sets clear objectives, targets, timetables and funds for implementation.

THE ROLE OF LIFE

LIFE and LIFE+ can play an important role in establishing new ways of integrating spatial planning to enable the development of green infrastructure. A number of LIFE projects have already promoted a partnership approach among different agencies that enables planning decisions to be made in line with the overall aim of supporting biodiversity and the specific habitat and species conservation and restoration aims of the individual project. As a result, a major trunk road was re-routed to enable an increase in favourable habitat for the endangered marsh fritillary butterfly (*Euphydryas aurinia* - **LIFE03 NAT/UK/000042**); a demonstration model that integrates environmental considerations in sustainable land-use planning was developed (**LIFE99 ENV/UK/000177**); a more rational use of urban and peri-urban land has helped to contain the fragmentation of natural landscapes (**LIFE02 ENV/E/000200**); and a range of innovative tools for biodiversity action planning at municipal-level were developed (**LIFE03 ENV/UK/000614**). As a result, LIFE has been improving ecosystems and boosting biodiversity in urban areas (with actions such as green roofs, biodiversity-rich parks, urban wetlands etc.), and is able to link these areas with peri-urban, rural landscapes and Natura 2000 sites, in order to develop a more coherent structure between urban areas and core natural areas.

The 'Mid Cornwall Moors' LIFE project (LIFE03 NAT/UK/000042) stands as a shining example of how integrated spatial planning can have a beneficial impact on habitat and species conservation. By working closely with the UK Highways Agency, it was possible to re-route a major road and secure an internationally significant metapopulation of the marsh fritillary butterfly (*Euphydras aurinia*).

Cornwall's butterflies benefit from highway partnership

In line with the overall European trend, the UK population of the marsh fritillary butterfly has fallen significantly with the decline of traditional livestock grazing. The mid-Cornwall moors remain a stronghold of the species, and two sites 10 km apart, the Breney Common and the Goss and Tregoss Moors, have been designated a Special Area of Conservation.

To sustain a viable population of the species requires a minimum of 70 ha of suitable breeding habitat over a wide area. English Nature set up the "Mid Cornwall Moors" LIFE project in order increase the size, connectivity and quality of suitable breeding habitats for the marsh fritillary butterfly population across the Breney Common and Goss and Tregoss Moors Natura 2000 sites and at seven satellite sites. These nine sites cover 1 048 ha in total.

THE ROAD TO SUCCESS

Partnership with statutory bodies, in particular the Highways Agency, played a key role in ensuring the success of the project and shows the importance of integrated spatial planning in nature conservation. The agency, which is responsible for operating, maintaining and improving the strategic road network in England, was persuaded to re-route the A30, a major trunk road in Cornwall, which previously passed through the middle of the SAC. This allowed the LIFE project to connect previously isolated heathland butterfly communities.

FAVOURABLE RESULTS

Implementation of the project has led to an increase in the amount of breeding habitat in favourable condition for the marsh fritillaries, from 15 ha to some 130 ha. As a direct result of the project, the SAC boundary may also be extended. Connectivity between sites has improved markedly through the removal of exotic trees and clearance of willow and gorse scrub. After the initial clearance work, livestock grazing was reinstated on the project sites, using cattle (leased to land users on a long-term basis) and local ponies.

Monitoring by the LIFE project should improve understanding of species ecology and metapopulation dynamics and help inform the future management of the project sites. The project also provides a strong demonstration value, applicable Europe-wide, for the marsh fritillary butterfly and other species that require a similar landscape-scale approach.

Perhaps the greatest demonstration benefit though, comes from the involvement of the Highways Agency. Although Mid Cornwall Moors was the first LIFE project it had been involved with, this involvement did not come out of the blue. Rather, it was in accordance with the aims of its own Highways Agency Biodiversity Action Plan (HABAP), part of a long-term strategy for the conservation of habitats and species on the motorway and trunk road verges of England. The key objectives of HABAP are to:

- Provide habitat and species action plans which are relevant and appropriate to the network and to the work of the agency;
- Set practical and realistic actions and targets to maximise the agency's contribution to biodiversity; and
- Raise awareness and understanding of the importance of the agency's biodiversity work.

The HABAP and the Mid Cornwall Moors LIFE project illustrate that when road authorities and other infrastructure bodies integrate nature conservation considerations into their planning, the 'road' to success for LIFE green infrastructure projects becomes a great deal clearer.

Euphydras aurinia

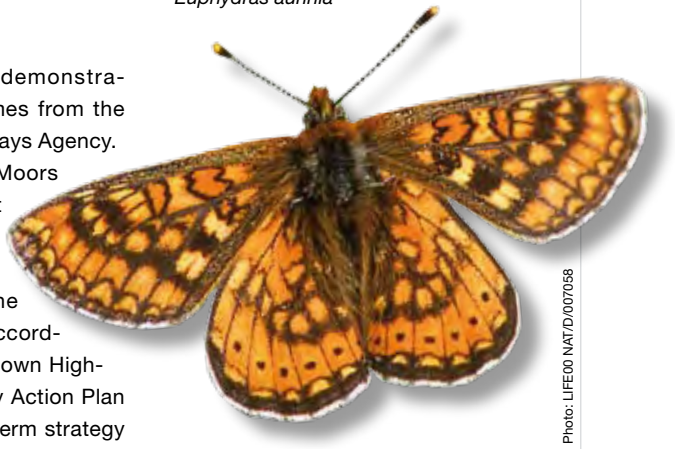


Photo: LIFE00 NAT/D/007058

INTEGRATED SPATIAL PLANNING

Building **green infrastructure into urban planning**

In order to enhance the potential multi-functional areas, there must be greater communication at the planning stages between the various policy sectors and decision-makers. The LIFE programme has been an important "pump primer" for the concept of green infrastructure at local and regional levels.

With the support of LIFE, Cheshire County Council in the Northwest of England developed ECOnet (**LIFE99 ENV/UK/000177**), one of the earliest projects dedicated to connectivity at a municipal level in UK and Italy. When the project was implemented, eco-networks were not a priority for the UK, which often resulted in firefighting against development in order to link islands of biodiversity. Cheshire County Council had earlier been a partner in the Pond LIFE project (**LIFE94 ENV/UK/000651**), so was aware of the opportunity of using LIFE funding to integrate ecology into land-use planning.

LIFE has helped to promote a more rational and environmentally sustainable use of urban and peri-urban land

The council and its project partners from the Emilia-Romagna and Abruzzo regions in Italy used the latest information technology (e.g. aerial photography, Geographical Information Systems - GIS) to analyse their landscapes. This information was used to identify concentrations of habitats of high value for wildlife, potential areas for the creation of new habitats and corridors for the movement of species.

LIFE ECOnet successfully carried out its five main tasks: technical development of GIS and the application of landscape ecology principles; assessment of land-use policy and instruments; demonstration of integrated land management; participation of stakeholders; and dissemination.

One of the biggest challenges to the successful implementation of the project was the logistics of running several programmes simultaneously across two countries and three regions. Nevertheless, it provided a unique opportunity to see what other countries were doing. While in the UK, the objective was to connect butterflies and small mammals, in Italy the target was mainly large carnivores.

Despite the achievements of ECOnet, the project was only successful in demonstrating a model. One of the main problems for the practical implementation of the model was the lack of funding. However, thanks to the expectation created by the project, additional funds were secured from the Forestry Commission North West to do some small-scale practical demonstrations (planting trees in buffer zones around existing ancient woodlands).

Since 2003, the project team has explored further funding, including a feasibility study backed by the North West Development Agency. Indeed, creating a network in Cheshire has been very useful for bringing additional funds in for habitat restoration (e.g. for meres and mosses).

The authority has also used the model developed by the LIFE project for land-use planning to influence quarry restoration. For instance, a sand quarry owned by Tarmac Ltd was originally going to be returned to agricultural use, but the company later agreed to restore about half the area to its original condition as heathland and acid grassland.

FUNCTIONAL ECOLOGICAL FRAMEWORKS FOR THE FUTURE

In addition to inspiring actions on the ground, the ECOnet methodology has fed into planning structures, including local plans for waste, district nature conservation strategies, the Cheshire 2016 Structure Plan, and at a wider level the 'Regional Spatial Strategy for the North West of England' (which states that local authorities "should develop functional ecological frameworks that will address habitat fragmentation and species isolation, identifying and targeting opportunities for habitat expansion and re-connection").

The council is currently drafting such a functional ecological framework, which will feed into its Local Development Framework (LDF), a document that will guide urban planning decisions through to 2026. It is expected that the LDF will enable the needs of economic development, homes for people and ecological networks to be balanced.

The LDF will also emphasise the importance of linking Cheshire's network with those of neighbouring regions, particularly as Cheshire is "an important area for recreation for the cities of Liverpool and Manchester". The Mersey Forest – a network of woodlands and green spaces in Cheshire and Merseyside supported by funding from the North West Development Agency – is taking the lead in the task of joining up green infrastructure across the wider region. There is also a green infrastructure guideline for north-west England, one of a number of tools for creating dialogue.

PILOT PROJECTS DEMONSTRATE THEIR VALUE

These projects demonstrate the role of LIFE as a pump primer. The demonstration value of the programme can also be seen in the impact of other projects with an urban planning dimension.

Another UK-led project with an Italian partner, the 'Sustainable Urban Planning Networks for Green Spaces' project (**LIFE03 ENV/UK/000614**), drew on some of the lessons of LIFE ECOnet to develop and test innovative tools for biodiversity action planning that allow municipalities to undertake urban planning more effectively, thereby supporting the policy objectives of the 6th Environment Action Programme (6th EAP).

The goals of the project, which was led by the Borough of Sutton, in partnership with four other London boroughs, an NGO and the City of Rome, were to produce and implement a series of local biodiversity action plans in urban settings around London and Rome, and to demonstrate innovative approaches to developing and testing transferable stakeholder engagement tools for urban green space management.

The beneficiary and UK partners each implemented at least four habitat or species management projects and the Italian authority three projects. These projects were divided into five categories:

1. Volunteer/stakeholder management of urban green-space designated within the local development plan as a wildlife site.
2. Individual species projects involving landowners, householders and individual (e.g., birdhouse schemes for back gardens).
3. General habitat enhancement schemes involving green corridors or public open space (e.g. removal of invasive species).
4. Access and interpretation projects (such as pram/wheelchair access improvements).
5. School or sports club projects to enhance the biodiversity of school playing fields or sports grounds.

Many of the projects proved to be highly innovative, engaging with a wide range of stakeholders, including such disadvantaged groups as refugees and young offenders, and successfully integrating biodiversity objectives with other urban planning priorities. Four new biodiversity action plans were also produced and two more revitalised. The local communities are continuing with some of the action plans and projects after-LIFE.

The Gallecs project (**LIFE02 ENV/E/000200**), which took place on the fringes of the Barcelona metropolitan area, helped contain the fragmentation of natural landscapes and habitats by promoting a more rational and environmentally sustainable use of urban and peri-urban land. This pilot project has demonstrated that it is possible to achieve environmentally, socially and economically sustainable development in transition zones that face increasing pressures from urban expansion.

The project actions – such as restoration of several environmentally degraded areas, including a former motor cross circuit, and maintenance of hedgerow in agricultural fields, so they function as natural corridors in Gallecs – have impacted positively on urban areas. For example, they have influenced the microclimate by reducing the 'heat-island effect' of the city, and have improved air quality. In addition, the recreation of the wetland, "Humedal de Can Benito", has helped to regulate heavy torrents of water and reduce flooding, which is common in the region after spells of intense precipitation. The installation of water-efficient irrigation systems in rural areas also reduced the pressure on the groundwater supplies.

Similar to ECOnet, lessons from the Gallecs project are being integrated into urban-planning decisions affecting the region today, as the implemented green infrastructure actions proved to be beneficial to the cities' environment.

LIFE has helped to support the integration of biodiversity conservation with other urban planning priorities

Photo: LIFE02 ENV/F/000289

Photo: Frédéric Larrey & Thomas Roger

LIFE supporting **an EU green infrastructure**

The development of a green infrastructure strategy for Europe, currently under discussion at EU level, is emerging as a priority for future biodiversity policy. Among other programmes, LIFE has already contributed to the implementation of green infrastructure elements, mainly at a local or regional level. The challenge now is to assess the knowledge and experience acquired through LIFE funded projects and to finalise the concept of the green infrastructure strategy. This strategy will aim to find ways to reduce landscape fragmentation, improve ecosystem resilience, including the protection of its biodiversity, adapt to climate change and promote integrated spatial planning.

The EU Biodiversity Action Plan[1], published in 2006, already places a high priority on enhancing the coherence and connectivity of the Natura 2000 Network (as stipulated in Art. 10 of the Habitats Directive[2]), and on conserving and restoring biodiversity in the wider EU countryside. The new Communication on a vision and target for biodiversity after 2010[3] marks the start of a process, which will *inter alia* lead towards the development of an EU strategy on green infrastructure. This green infrastructure strategy aims to build on what has already been achieved. It aims to provide a framework for further development that enables different policy sectors, stakeholders and levels of government to use those approaches that are best suited to their local circumstances and local land uses.

LIFE has been a key instrument for the funding of green infrastructure initiatives, even before a coherent strategy on green infrastructure has been developed. In this respect, DG Environment is actively promoting the exchange of best practices on the implementation of green infrastructure initiatives across different parts of the EU and is investigating ways to increase support for green infrastructure development through existing EU policies and funding mechanisms. Future policy and

1 COM(2006)216 final, on http://ec.europa.eu/environment/nature/biodiversity/comm2006/index_en.htm.
2 Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora

3 COM(2010)4: Options for an EU vision and target for biodiversity beyond 2010; agreed by Environment Council Conclusions of 15/03/10, confirmed by European Council Conclusions of 25-26/03/10. More information on http://ec.europa.eu/environment/nature/biodiversity/policy/index_en.htm.

Photo: Krainer

LIFE actions have played a major part in helping to reconnect and consolidate fragmented habitats – such as bear habitats (bear passage over an Austrian motorway)

funding initiatives will also be based on the experiences of LIFE projects. The case studies presented in this brochure have collected considerable experience in building up various elements of green infrastructure, even if their primary objectives were habitat restoration, protection of species or integrated planning – all of those targets will be part of a comprehensive, co-ordinated and effective strategy on green infrastructure for Europe. The development of such a strategy can only be successful if interest groups, stakeholders, national and regional authorities, and international organisations are adequately consulted and have their interests represented in the final policy. Further to analysing what has been implemented on the ground by LIFE projects, this 'bottom-up' process will include a session on green infrastructure during Green Week 2010[4].

LIFE ENHANCING CONNECTIVITY FOR SPECIES AND HABITATS – TACKLING FRAGMENTATION

LIFE has clearly demonstrated how various actions on the ground to enhance habitat connectivity have also helped to improve the conservation status of endangered species, such as the brown bear, the Iberian lynx or the fire belly toad. LIFE also targeted migratory birds that face different threats as they cross country borders. These birds require a functional and secure network of sites along their migration routes. One project that targeted the lesser white-fronted goose focused on all flyway and breeding sites for the species in several countries.

Similar successes have been clearly demonstrated by LIFE actions to enhance the connectivity of habitats in Natura 2000 sites. These include restoration works to reconnect and consolidate fragmented habitats; creating and/or restoring habitat patches as stepping stones for dispersal; and creating and/or restoring linear habitat corridors to allow for dispersal, migration and gene-flow between populations. LIFE offers further possibilities to develop projects that aim to increase landscape permeability and maintain/restore the connectivity of habitats.

A number of LIFE Nature projects have provided a blueprint for maintaining the biodiversity of Europe's seas. For example, a Spanish project demonstrated that on-site concrete actions, which targetted the loggerhead turtle and the bottlenose dolphin, could also function effectively on a wider scale. Moreover, thanks to this project's actions, it was possible to define coherent marine Natura 2000 sites and re-adjust the Gibraltar transportation route in order to protect marine areas. Two closely linked LIFE projects, one covering Portuguese and the other Spanish territorial waters, have determined coherent marine protected sites for endangered seabird species, ensuring the protection of coastal breeding colonies and of feeding areas, as well as developing applied maritime integrated spatial planning that takes into account economic activities (transport, fisheries) on bird migration routes.

LIFE RESTORING ECOSYSTEM FUNCTIONS (IMPROVING RESILIENCE)

As well as demonstrating effective restoration actions, LIFE actions are also helping to restore ecosystem functions and, as a result, are boosting the value of these ecosystems. Projects have implemented a combination of different measures to restore such habitats as bogs, wetland, rivers, grasslands and marine areas. By restoring them, the project actions enabled ecosystems to provide their range of goods and services. These includes the retention of flood water, the prevention of soil erosion, the facilitation of CO_2 intake, the protection of genetic stocks and the prevention of forest fires. Such strengthened ecosystems are more resilient to stress factors such as climate change. These actions usually involve the restoration of several different habitats types in multiple ecosystems. In a broader context projects recover 'healthy' multi-functional areas, which allow a better use of limited land and resources, and enable ecosystems to provide a range of goods and services. A significant number of LIFE Nature projects have focused on the restoration and reconnection of Europe's bogs in Belgium, Ireland, Finland and the UK. LIFE co-funding has helped to increase the bogs' resilience to droughts or to the invasion of alien species, while also restoring important services provided by these ecosystems, such as water retention and purification, carbon storage, and delivering benefits for biodiversity, such as providing habitats for rare or endangered bog species.

LIFE SUPPORTING CLIMATE CHANGE MITIGATION AND ADAPTATION

By maintaining and restoring healthy, effectively functioning and climate change-resilient ecosystems, LIFE projects have also been contributing to the maintenance and restoration of ecosystems with an important role in climate change mitigation and adaptation. Protecting and restoring ecosystems allows for the conservation and enhancement of carbon stocks and the reduction of emissions caused by ecosystem degradation and loss (mitigation). Such activities also provide cost-effective protection against some of the threats that result from climate change – for example, coastal ecosystems such as salt marsh and barrier

4 http://ec.europa.eu/environment/greenweek/

beaches provide natural shoreline protection from storms and flooding. Such benefits for climate change adaptation and mitigation resulting from LIFE projects have almost gone unnoticed, as these projects primary focus on the restoration and conservation of habitats and species. However, useful approaches and methodologies have been developed and, with climate change now a priority objective within the LIFE+ programme, there is an opportunity to close this information gap in the coming years.

LIFE PROMOTING STRATEGIC, INTEGRATED SPATIAL PLANNING

LIFE can play an important role in establishing new ways of strategically integrating spatial planning. It is important to engage all sectors in the integrated planning approach, as a necessary and effective tool for the development of green infrastructure. A number of LIFE nature and environment projects have already promoted a partnership approach among different agencies that enables planning decisions to be made in line with the overall aim of supporting biodiversity, and the specific habitat and species conservation and restoration aims of the individual project. Integrated spatial planning can guide infrastructure away from sensitive areas, and identify areas for reconnecting habitats and restoring ecosystems. In the UK, for example, a major trunk road was re-routed to enable an increase in favourable habitat for the critically endangered marsh fritillary butterfly. While in Spain, a more considered use of urban and peri-urban land has helped to contain the fragmentation of natural landscapes.

LIFE has been crucial in the restoration of ecosystem functions, such as coastal wetlands, and promoting Integrated Coastal Zone Management (ICZM)

Photo: LIFE06 ENV/UK/000401

LIFE AHEAD

LIFE-Nature has played an important role in highlighting the efficacy of connectivity measures – mainly on a local or regional level – and in improving the conservation status of habitats and species of Community interest[5]. The conservation status of these habitats and species is dependent on the contribution of the Natura 2000 network and their situation outside protected areas in the wider countryside. All LIFE projects that aim to improve the coherence of the Natura 2000 network, acting inside and outside Natura 2000 areas, have therefore implemented a main element of green infrastructure in Europe. With a few notable exceptions, such projects were not strategically planned to establish links between restored or protected sites on a large scale, or target all the populations across the entire distribution range of locally restricted, endemic species.

However, there are now new opportunities under the LIFE Biodiversity and LIFE Environment Policy and Governance components for funding projects actions outside the Natura 2000 network that help to build green infrastructure by:

- Giving back space to ecosystems, in order that they deliver their valuable services.
- Promoting integrated spatial planning and delivering intelligent, multi-purpose uses for biodiversity and ecosystems benefits in the same area.
- Better integrating high-nature-value farmland and biodiversity-rich forests into the surrounding countryside by (re-)establishing functional or spatial linkages which maintain landscape diversity and guarantee the permeability between forest areas and open land.
- Developing urban green infrastructure and its linkages to the peri-urban and rural countryside. As these green areas are often rather small or isolated, linking them is crucial to maximise their functions and services – thus integrating them into a green infrastructure network which allows the different elements to work together, to interact and to be connected where necessary.
- Expanding the 'blue' component of green infrastructure: maintaining and restoring river morphology, better linking marine and coastal areas and reconnecting water bodies to their floodplains and marshes.
- 'Greening' existing energy and transport infrastructure and strengthening the functionality of the spatially linked ecosystems.
- Developing climate change adaptation and mitigation aspects as part of green infrastructure.

LOOKING FORWARD: ECONOMIC AND FINANCIAL ISSUES

International efforts to put an accurate value on ecosystem goods and services is well underway. The work carried out under the TEEB process[6] is crucial for assessing the economic consequences of ecosystems failing to deliver their services, and to show the benefits ecosystems deliver to society. These findings should encourage the faster construction of green infrastructure.

Finally, in order to facilitate a future EU-wide green infrastructure, further funding sources will need to be identified. Green infrastructure initiatives could, for example, be supported by Common Agricultural Policy funding, as well as the European Fund for Regional Development and Cohesion funding. Further financing opportunities are offered by research funding programmes and under EIB (European Investment Bank) schemes. Building green infrastructure could also lead to new partnerships, for example with private banks and other finance operators. LIFE will act as complementary funding source to such funding instruments.

For more information, see the Commission's green infrastructure webpage: http://ec.europa.eu/environment/nature/ecosystems/index_en.htm.

5 LIFE improving the conservation status of species and habitats LIFE Focus, European Commission 2010 http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/art17.pdf

*6 **T**he **E**conomics of **E**cosystems & **B**iodiversity http://ec.europa.eu/environment/nature/biodiversity/economics/*

Projects focusing on **Green Infrastructure**

The table below provides examples of LIFE projects mentioned on this publication focusing on Green Infrastructure. For more information on individual projects, visit the online database at: http://ec.europa.eu/environment/life/project/projects/index.cfm

Country	Project Reference	Title
Improving species and habitats connectivity		
Austria	LIFE02 NAT/A/008519	Conservation and management of the brown bear in Austria
Belgium	LIFE06 NAT/B/000091	Rehabilitation of heaths and mires on the Hautes-Fagnes Plateau
Belgium	LIFE05 NAT/B/000087	Actions for the valleys and turf moors of Croix Scaille (Belgium)
Belgium	LIFE07 NAT/B/000039	Reconstituting a habitat network for threatened butterflies (Euphydryas aurinia, Lycaena helle, Lycaena dispar) in the Walloon region (Belgium)
Finland	LIFE03 NAT/FIN/000039	Management of wetlands along the Gulf of Finland migratory flyway
Finland	LIFE05 NAT/FIN/000105	Conservation of *Anser erythropus* on European migration route
Finland	LIFE06 NAT/FIN/000128	Promotion of public awareness and protection of aapa mires in Lapland master basin bogs
France	LIFE04 NAT/FR/000086	Conservation of the Aquatic Warbler in Brittany
Germany	LIFE05 NAT/D/000053	Rosenheimer master basin bogs
Germany	LIFE08 NAT/D/000010	Improvement of the connection between the river and the floodplain within the pSCI “Lippe floodplain
Germany	LIFE08 NAT/D/000005	Management and Connectivity of Amphibians in the Cultural Landscape of Lower Saxony
Greece	LIFE99 NAT/GR/006498	Implementation of Management Plans in Gramos and Rodopi Areas, Greece
Ireland	LIFE04 NAT/IE/000121	Restoring raised bogs in Ireland
Latvia	LIFE05 NAT/LV/000100	Marine protected areas in the Eastern Baltic Sea
Poland	LIFE05 NAT/PL/000101	Conserving *Acrocephalus paludicola* in Poland and Germany
Poland	LIFE04 NAT/PL/000208	Conservation of baltic raised bogs in Pomerania, Poland
Portugal	LIFE06 NAT/P/000191	Recovery of Iberian Lynx habitat in Moura/Barrancos Site
Portugal	LIFE04NAT/P/000213	Important bird areas for seabirds in Portugal
Slovenia	LIFE02 NAT/SLO/008585	Conservation of large carnivores in Slovenia - Phase I (Ursus arctos)
Spain	LIFE02 NAT/E/008609	Population recovery of Iberian Lynx in Andalusia
Spain	LIFE02 NAT/E/008616	Conservation of the aquatic warbler in the ZEPA ‘La Nava-Campos’
Spain	LIFE02 NAT/E/008610	Conservation of cetaceans and turtles in Andalusia and Murcia
Spain	LIFE04 NAT/ES/000049	Important Bird Areas for Seabirds
Spain	LIFE99 NAT/E/006352	Ancares project : co-ordinate management of two adjoining communitarian sites of interest
Spain	LIFE99 NAT/E/006371	Ancares Project : co-ordinate management of two adjoining sites of community interest
Spain	LIFE07 NAT/E/000735	Corridors for Cantabrian Brown Bear Conservation
United Kingdom	LIFE00 NAT/UK/007075	Restoring active blanket bog of European importance in North Scotland
United Kingdom	LIFE00 NAT/UK/007078	Restoration of Scottish raised bogs

Country	Project Reference	Title
Restoring ecosystem functions		
Austria	LIFE02 NAT/A/008518	Restoration of Danube river banks
Austria	LIFE03 NAT/A/000009	WACHAU
Austria	LIFE04 NAT/AT/000006	Donau- Ybbs Linkage
Austria	LIFE07 NAT/A/000010	L -Living space in the rivers of Mostviertel- Wachau
Austria	LIFE07 NAT/A/000012	Living space in the estuary stretch of the river Traisen
Austria	LIFE99 NAT/A/006055	Combine of the flood plain-forests of the Upper Drau-river valley (Kärnten)
Denmark	LIFE07 NAT/DK/000100	Re-establishing a natural water flow level in the river system "Mølleåen"
Finland	LIFE00 NAT/FIN/007062	Herb-Rich Forests, Forests of Dencrocopos leucotus and Western Taigas in North Karelia
Finland	LIFE04 NAT/FI/000078	Natural Forests and mires in the "Green Belt" of Koillismaa and Kainuu
Germany	LIFE06 NAT/D/000006	Swabian Danube valley
Germany	LIFE08 NAT/D/000013	Improvement and Long-Term Safeguarding of the Natura 2000 Site "Dessau-Wörlitz Elbe Floodplain"
Ireland	LIFE04 NAT/IE/000125	Farming for conservation in the Burren
Portugal	LIFE02 NAT/P/008481	Re-establishment of the Lesser Kestrel (Falco naumanni) in Portugal
Slovakia	LIFE03 NAT/SK/000097	Conservation and management of Danube floodplain forests
Spain	LIFE05 NAT/E/000073	Ecosystemic management of rivers with European mink
Spain	LIFE04 ENV/ES/000269	Integrated management of agriculture in the surroundings of community importance wetlands (sustainable wetlands)
Sweden	LIFE00 NAT/S/007117	Coastal Meadows and Wetlands in the Agricultural Landscape of Öland
Adaptation to Climate change		
Belgium	LIFE07 NAT/B/000043	Dry calcareous and rupicolous grasslands of lower and middle valleys of the Meuse basin
Netherlands	LIFE04 NAT/NL/000202	Tiengemeten, restoration of freshwater tidal area in the Haringvliet estuary, the Netherlands
United Kingdom	LIFE06 NAT/UK/000134	Restoring active blanket bog in the Berwyn and Migneint SACs in Wales
United Kingdom	LIFE07 NAT/UK/000938	Tackling Climate Change-Related Threats to an Important Coastal SPA in Eastern England
United Kingdom	LIFE03 ENV/UK/000611	Responding to the risks from climate change - developing sustainable strategies for management of natural hazards in coastal areas taking account of the impacts of climate change
Integrated spatial planning		
France	LIFE98 ENV/F/000294	Landscape and management of natural suburban areas
Spain	LIFE02 ENV/E/000200	Demonstration project on land use and environmental management of the physical planning in Gallecs as a biological and stable connector in the fringe space of Barcelona metropolitan area
Spain	LIFE00 ENV/E/000415	GREEN BELT. A proposal for sustainable territorial planning
United Kingdom	LIFE03 NAT/UK/000042	Restoration of the mid Cornwall Moors for the Euphydryas aurinia
United Kingdom	LIFE99 ENV/UK/000177	A demonstration model which integrates environmental considerations in sustainable land use planning and management through the use of ecological networks
United Kingdom	LIFE03 ENV/UK/000614	Sustainable Urban Planning Networks for green spaces

Available LIFE Nature publications

LIFE Focus Nature brochures

LIFE improving the conservation status of species and habitats: Habitats Directive Article 17 report (2010 - 84 pp. - ISBN 978-92-79-13572-9)

LIFE and Europe's reptiles and amphibians: Conservation in practice (2009 – 60 pp. - ISBN 978-92-79-12567-6)

LIFE and Europe's grasslands: Restoring a forgotten habitat (2008 - 54 pp. – ISBN 978-92-79-10159-5)

LIFE and endangered plants: Conserving Europe's threatened flora (2007 – 52 pp. – ISBN 978-92-79-08815-5)

LIFE and Europe's wetlands: Restoring a vital ecosystem (2007 - 68 pp. – ISBN 978-92-79-07617-6)

LIFE and Europe's rivers: Protecting and improving our water resources (2007 – 52 pp. ISBN 978-92-79-05543-0 – ISSN 1725-5619)

LIFE and the marine environment (2006 – 54 pp. ISBN 92-79-03447-2 – ISSN 1725-5619)

LIFE and European forests (2006 – 68 pp. ISBN 92-79-02255-5 – ISSN 1725-5619)

LIFE-Nature Projects 2006 compilation (2006 – 67 pp. – ISBN 92-79-02788-3)

Integrated management of Natura 2000 sites (2005 – 48 pp. – ISBN 92-79-00388-7)

LIFE, Natura 2000 and the military (2005 – 86 pp. – ISBN 92-894-9213-9 – ISSN 1725-5619)

LIFE for birds: 25 years of the Birds Directive: the contribution of LIFE-Nature projects (2004 - 48 pp. – ISBN 92-894-7452-1 – ISSN 1725-5619)

LIFE-Nature: communicating with stakeholders and the general public – Best practice examples for Natura 2000 (2004 – 72 pp. – ISBN 92-894-7898-5 – ISSN 1725-5619)

LIFE for Natura 2000 - 10 years implementing the regulation (2003 - 108 pp. – ISBN 92-894-4337-5)

LIFE and agri-environment supporting Natura 2000: Experience from the LIFE programme (2003 – 72 pp. – ISBN 92-894-6023-7 – ISSN 1725-5619)

Other publications

Nature & Biodiversity Projects 2008 compilation (2009, 87pp. – ISBN 978-92-79-13426-5)

Best LIFE Nature Projects 2007-2008 (2009 - 48 pp. – ISBN 978-92-79-13746-4)

Nature & Biodiversity Projects 2007 compilation (2009, 67 pp. – ISBN 978-92-79-12257-6)

Learning from LIFE: Nature conservation best practices (2008 - 68 pp. – ISBN 978-92-79-11635-3)

A number of LIFE publications are available on the LIFE website: ***http://ec.europa.eu/environment/life/publications/lifepublications/index.htm***

A number of printed copies of certain LIFE publications are available and can be ordered free-of-charge at: ***http://ec.europa.eu/environment/life/publications/order.htm***

The programme

LIFE+ "**L**'**I**nstrument **F**inancier pour l'**E**nvironnement" / The financial instrument for the environment

Period covered (LIFE+) 2007-2013.

EU funding available approximately EUR 2,143 million

Type of intervention at least 78% of the budget is for co-financing actions in favour of the environment (LIFE+ projects) in the Member States of the European Union and in certain non-EU countries.

LIFE+ projects

> **LIFE Nature projects** improve the conservation status of endangered species and natural habitats. They support the implementation of the Birds and Habitats Directives and the Natura 2000 network.

> **LIFE+ Biodiversity projects** improve biodiversity in the EU. They contribute to the implementation of the objectives of the Commission Communication, "*Halting the loss of Biodiversity by 2010 – and beyond*" (COM (2006) 216 final).

> **LIFE+ Environment Policy and Governance projects** contribute to the development and demonstration of innovative policy approaches, technologies, methods and instruments in support of European environmental policy and legislation.

> **LIFE+ Information and Communication projects** are communication and awareness raising campaigns related to the implementation, updating and development of European environmental policy and legislation, including the prevention of forest fires and training for forest fire agents.

Further information on LIFE and LIFE+ is available at http://ec.europa.eu/life.

How to apply for LIFE+ funding The European Commission organises annual calls for proposals. Full details are available at http://ec.europa.eu/environment/life/funding/lifeplus.htm

Contact

European Commission – Directorate-General for the Environment
LIFE Unit – BU-9 02/1 – B-1049 Brussels – Internet: http://ec.europa.eu/life

LIFE Focus / LIFE building up Europe's green infrastructure: Addressing connectivity and enhancing ecosystem functions

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