Briefing
November 2017

European Parliament

# Nature-based solutions
## Concept, opportunities and challenges

**SUMMARY**

Nature-based solutions are actions inspired by, supported by or copied from nature that aim to help societies address a variety of environmental, social and economic challenges in sustainable ways. Most nature-based solutions do not have a single objective, but aim to bring multiple co-benefits. The concept emerged in the 2000s to promote nature as a source of solutions to challenges associated with climate change. It has been supported and broadened by the International Union for the Conservation of Nature and later by the European Commission.

In European Union (EU) policy, nature-based solutions are primarily addressed through the Horizon 2020 framework programme for research and innovation, which allocated approximately €185 million to the topic between 2014 and 2020. Other EU funds, estimated at €915 million per year, are also allocated to support green infrastructure projects. Other relevant policy initiatives include the 7th environment action programme, the biodiversity strategy, and the communication on green infrastructure.

Nature-based solutions can provide a number of opportunities, including: delivering multiple benefits; reducing and/or avoiding costs; contributing to job creation and the green economy; and positioning the EU as a world leader in the area. However, nature-based solutions can also pose a number of challenges, including: tackling knowledge gaps; managing trade-offs; implementing successful actions; dealing with natural elements; and financing projects.

The European Parliament has expressed support for nature-based solutions and urged Member States and the European Commission to establish a coherent network of blue-green infrastructure in rural and urban areas across the EU.

Vienna skyline from the city's green outskirts.

**In this briefing:**



EPRS | European Parliamentary Research Service
Author: Didier Bourguignon
**Members' Research Service**
PE 608.796

EN

**Glossary**

**Blue-green infrastructure:** strategically planned natural and semi-natural areas with environmental features designed and managed to deliver a wide range of ecosystem services. May be situated in marine areas (where it is called 'blue infrastructure'), or on land, both in rural and urban settings (where it is called 'green infrastructure'). For practical purposes, the concept is often similar to 'nature-based solutions', albeit with a narrower focus.

**Ecosystem:** a dynamic complex of plant, animal and micro-organism communities and their non-living environment, interacting as a functional unit.

**Ecosystem services:** the direct and indirect contributions of ecosystems to human wellbeing. Examples include provisioning services (providing food, wood, water, medicine); regulating services (regulating climate and air quality, storing carbon, protecting against extreme weather events, preventing soil erosion, treating waste water, pollinating); cultural services (recreation and tourism); and habitat services (providing species with habitat).

**Nature-based solutions:** actions inspired by, supported by, or copied from nature that aim to help societies address a variety of environmental, social and economic challenges in sustainable ways.

## Background

**Biodiversity** – the variety of life on earth – is generally recognised to have an intrinsic value and to underpin our economy and wellbeing by providing us with food, materials, medicines, clean air and water. However, the conservation status of 77 % of EU habitat types and 60 % of species of European conservation interest is unfavourable, according to the 2015 State of the environment report by the European Environment Agency. Among key threats to biodiversity, the Agency underlines habitat fragmentation, degradation and destruction; over-exploitation of natural resources; invasive alien species; pollution; and climate change. A 2015 Eurobarometer survey indicates that 9 out of 10 Europeans think biodiversity loss is a serious global issue.

**Climate change** is a source of significant risks for our societies. In 2017, the World Economic Forum listed 'extreme weather events', 'natural disasters', and 'failure of climate change mitigation and adaptation' among the top global risks. Experts expect climate change to have particular impact in urban areas. Risks include the effects of extreme weather events (such as heat waves, droughts, and floods), changes in patterns of infectious diseases, and impacts on freshwater supplies and food yields.

The European Union is made up of predominantly **urban communities**. In 2014, 72.5 % of inhabitants lived in cities, towns and suburbs, a share expected to rise above 80 % by 2050. This trend presents challenges in terms of economic, environmental and social sustainability. Urbanisation and associated pressures, such as the densification of built-up areas, soil sealing, and the loss or degradation of natural areas pose further challenges to ecosystems and human wellbeing in cities.

## Concept

The concept of 'nature-based solutions' emerged in the 2000s to promote nature as a source of solutions to challenges associated with climate change. The concept has been supported and broadened by the International Union for the Conservation of Nature (IUCN) and later by the European Commission.

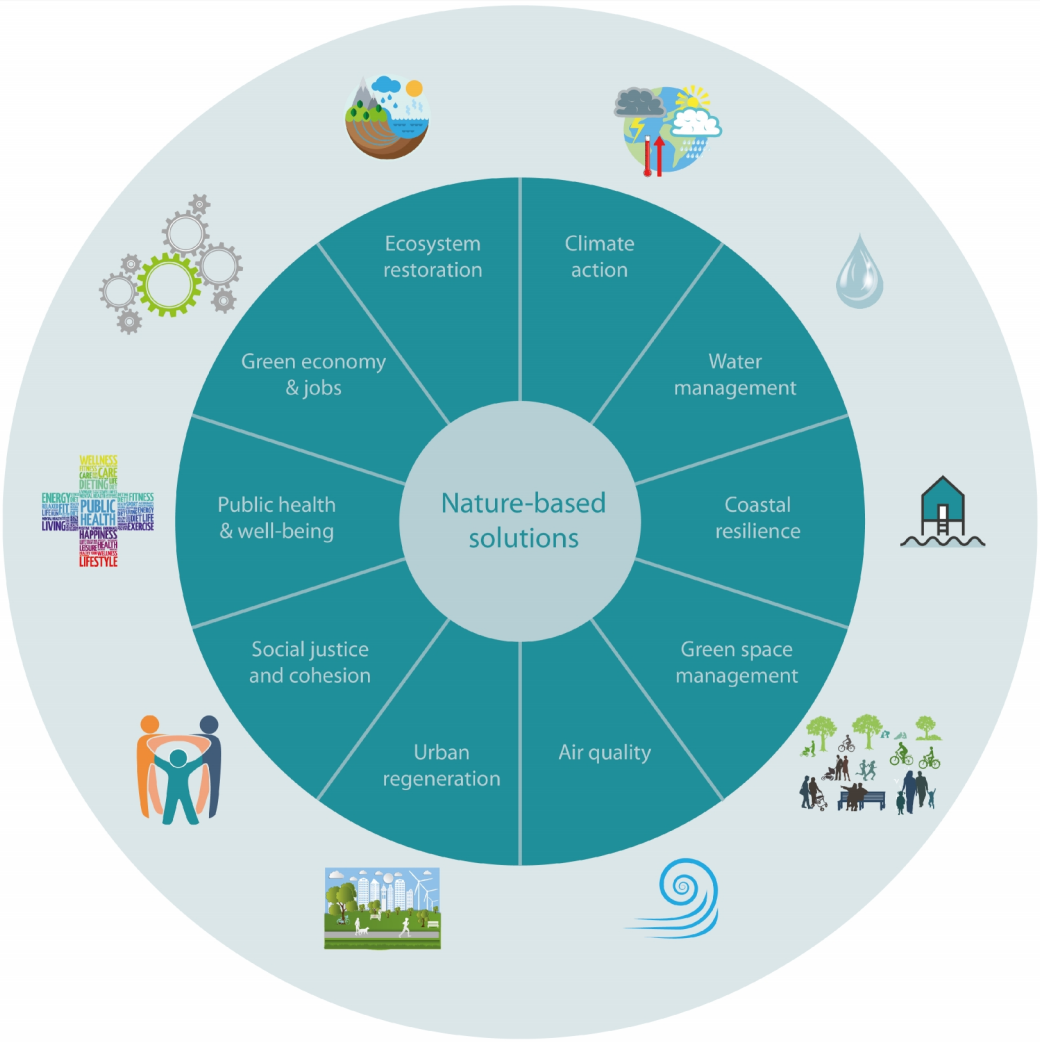
A 2015 **European Commission** report defines nature-based solutions as actions that 'aim to help societies address a variety of environmental, social and economic challenges in

sustainable ways. They are actions which are inspired by, supported by, or copied from nature', for instance to store carbon and regulate water flow. Nature-based solutions are 'ideally' resource-efficient, resilient to change and adapted to local conditions. They may involve using and enhancing existing natural solutions to challenges, or exploring more innovative solutions, for example mimicking how nature copes with environmental extremes. However, they 'exclude methods that artificially alter nature, such as genetically modified organisms'.

The idea, which the IUCN defined in 2012 from a slightly different perspective, can be seen as an **umbrella concept** covering several approaches promoting the protection, sustainable management and restoration of ecosystems as a way to address societal challenges, while providing human wellbeing and biodiversity benefits. Related approaches and problem-solving techniques include 'ecosystem services', 'ecosystem approach', 'ecosystem-based adaptation and mitigation', 'blue-green infrastructure' and 'ecological engineering'. In most cases, these approaches and techniques are complementary and have considerable overlap.[1]

The 2015 European Commission report mentioned above identifies four main **goals** which nature-based solutions can address: 1) enhancing sustainable urbanisation; 2) restoring degraded ecosystems; 3) developing climate change adaptation and mitigation;

**Figure 1 – Selected functions of nature-based solutions**

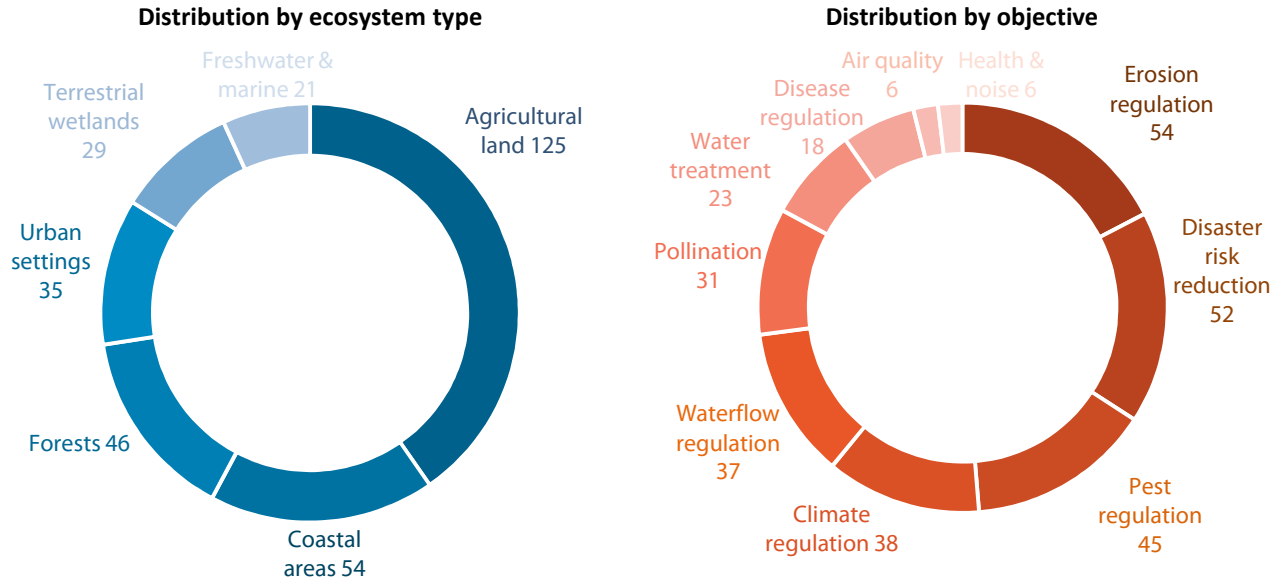



Source: Adapted from C. M. Raymond et al., An Impact Evaluation Framework to Support Planning and Evaluation of Nature-based Solutions Projects, EKLIPSE, 2017.

4) improving risk management and resilience. Other perspectives exist, such as the more function-based framework developed in the EKLIPSE project (see figure 1).

The 2015 European Commission report contains a preliminary list of **possible interventions** that could be applied in nature-based solutions. Looking at the distribution of possible interventions by ecosystem type and objective provides another point of view of the concept, as shown in figure 2.

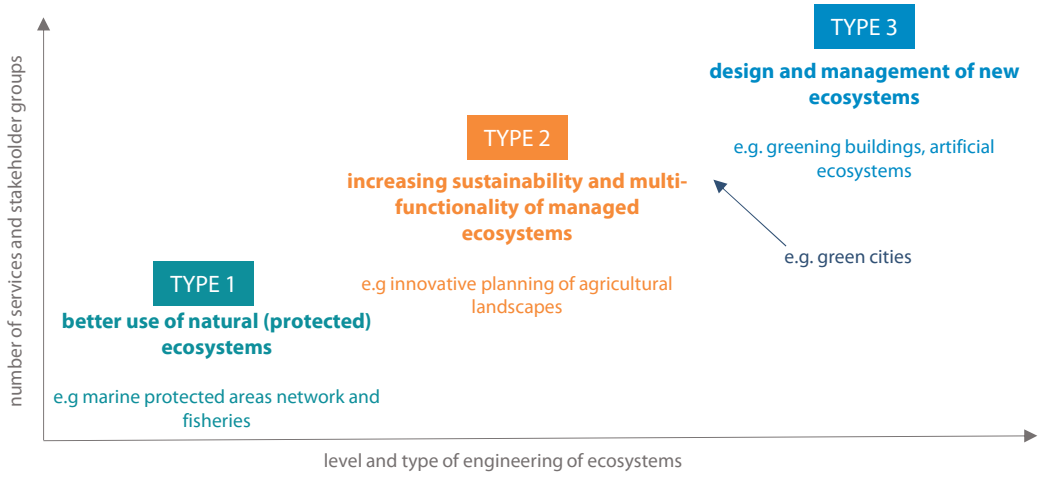
**Figure 2 – Possible interventions in nature-based solutions**




Source: European Commission, Towards an EU Research and Innovation policy agenda for Nature-Based Solutions & Re-Naturing Cities, 2015.

Finally, yet another perspective on the concept is provided when distinguishing **three broad types** of nature-based solutions based on the level of engineering of biodiversity and ecosystems, and the number of services and stakeholder groups involved, as shown in figure 3.

**Figure 3 – Three broad types of nature-based solutions**




Source: adapted from H. Eggermont at al., Nature-based Solutions: New Influence for Environmental Management and Research in Europe, GAIA, 2015.

**Examples of nature-based solutions** include conserving and increasing tree cover, in particular forests; renaturing water bodies; creating areas for temporary flooding along rivers; restoring wetlands, drylands and coastal ecosystems; increasing connections between green spaces; building green walls and roofs in cities; and converting

brownfields to green areas in urban regeneration projects. Most solutions do not have a single objective, but numerous **co-benefits**. For instance, increasing tree cover can deliver benefits in terms of carbon storage, water management, erosion regulation, air quality, temperature control, biodiversity and recreation, while restoring wetlands can positively impact carbon storage and flood management. **Implemented nature-based solutions** include the 'cloudburst' management plan in Copenhagen, the management of green spaces in Vienna, the 'Room for the river' programme in the Netherlands, or the Parco Nord and the Promenade plantée contributing to urban regeneration in Milan and Paris.[2]

## European Union policy

The concept of nature-based solutions appeared in EU policy in 2013, when it was included in the Horizon 2020 framework programme for research and innovation. It remains primarily addressed through the European Union's **research policy** (see text box below). However, other concepts, actions and policy initiatives are also relevant.

**European Union funding for nature-based solutions**

The European Union funds research activities related to nature-based solutions through **Horizon 2020**, its **framework programme for research and innovation**, which has nearly €80 billion of funding available for the period 2014-2020.[3] From 2014 until 2020, approximately €185 million has been allocated to nature-based solutions. As part of societal challenge 5: 'Climate Action, Environment, Resource Efficiency and Raw Materials', the programme funded an expert group on 'nature-based solutions and renaturing cities', citizen's engagement in EU research policy-making on the topic, three calls on nature-based solutions for territorial resilience[4] and two calls on cultural heritage for sustainable growth.[5] As part of the cross-cutting activities, the programme funded three calls on sustainable cities through nature-based solutions.[6] Until 2020, the programme is expected to fund three new calls on nature-based solutions as part of societal challenge 5.[7] In addition, the European Commission funds, together with Member States, the BiodivERsA research network on biodiversity and ecosystem services under the ERANET scheme.

A fraction of **EU funds** is allocated to support **green infrastructure** projects. According to estimates carried out in 2016 for the European Commission, green infrastructure is expected to receive about €6.4 billion from EU funds[8] over the period 2014-2020 (or approximately €915 million per year), with 77 % (or €5 billion) of funding coming from the European Agricultural Fund for Rural Development.[9] Green infrastructure funding is primarily allocated to support nature conservation (78 %) and restoration (12 %), while connectivity issues, sustainable green areas, and green areas in and around cities receive respectively 1 %, 4 %, and 4 % of funding.

Other support includes the European Investment Bank's **Natural Capital Financing Facility** (NCFF), an instrument intended to finance, among other things, green infrastructure and payments for ecosystem services. The NCFF was launched in 2014 with a pilot phase from 2015 to 2019 and a total budget of €100-125 million.

The **7th environment action programme** (EAP), adopted jointly by the European Parliament and the Council in 2013, highlights the benefits of ecosystem restoration and green infrastructure through 'natural solutions', and the role of cities as pioneers of 'innovative solutions to environmental challenges'. The European Commission confirmed its commitment to green infrastructure and nature-based solutions in the 2017 action plan for nature, people and the economy.

As regards **biodiversity**, the 2011 biodiversity strategy sets a headline target ('halting the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as feasible, while stepping up the EU contribution to averting

global biodiversity loss') and six mutually supportive targets, each translated into a series of actions. It mentions 'nature-based innovation' as a source of new skills, jobs and business opportunities. Target 2 of the strategy ('by 2020, ecosystems and their services are maintained and enhanced by establishing green infrastructure and restoring at least 15 % of degraded ecosystems') is of particular relevance for nature-based solutions. However, in the strategy's mid-term review in 2015 the Commission found that progress towards the target had been insufficient.

A 2013 European Commission communication on **green infrastructure** highlights the multiple contributions it can make to EU policies and sets out a strategy to promote green infrastructure at European level: integrating the concept into key policy areas, with EU funding to be made available through a variety of mechanisms; creating and improving the knowledge base; fostering investments; and considering the development of a trans-European network of green infrastructure (TEN-G). A 2016 report for the European Commission concludes that developing a TEN-G could provide greater benefits per euro invested than the current allocation of funds and suggests looking at the design of such a network in more detail, including possible locations. The European Commission is expected to publish a report on green infrastructure policy by the end of 2017.

## Opportunities and challenges

### Opportunities

Unlike conventional solutions, which tend to aim for a single objective, nature-based solutions can deliver **multiple benefits**. In turn, these benefits can ultimately increase societal resilience, in particular against the backdrop of climate change. For instance, the restoration of coastal ecosystems can make local communities more resilient to sea level rise and storms, the restoration of wetlands can contribute to increased carbon storage and flood protection, and the restoration of forest ecosystems can contribute to higher carbon storage and reduced risks of landslides and avalanches. In urban settings, nature-based solutions can contribute to the regeneration of previously neglected areas, but also help regulate water flow, prevent floods and reduce heat stress. Nature-based solutions in urban areas can also have positive impacts on perceived health and wellbeing.

Nature-based solutions can contribute to **reducing and/or avoiding costs**. For instance, research published in 2011 indicates that green roofs reduce heating and cooling demand in Mediterranean buildings. Nature-based solutions could contribute to avoiding costs from fluvial and coastal flooding, which a 2014 report for the European Commission estimates respectively at €5.5 billion and €1.9 billion annually (and forecasts respectively at €97.9 billion and between €17.4 and €25.4 billion annually by 2080, if no action is taken). A 2010 report by the United Nations Environment Programme indicates that ecosystem restoration can provide cost-benefit ratios ranging between 3 and 75 depending on the ecosystem restored and its economic context, 'thus providing in many cases some of the most profitable public investments'.

Nature-based solutions can contribute to **job creation** and the **green economy**. They may provide opportunities for mainstreaming environmental aspects across EU policy areas and in business sectors not traditionally dealing with the environment. Nature-based solutions may create a new narrative associating biodiversity and ecosystem services on the one hand, and innovation for jobs and growth on the other, which could contribute to initiating transitions towards sustainability.

Building on knowledge of and practice in nature-based solutions, the European Union could become an inspiration and a **world leader**, both in research and innovation on nature-based solutions and in the global market for these solutions.

**Challenges**

There are **knowledge gaps** regarding the long-term effectiveness of nature-based solutions for climate change mitigation and adaptation, as well as regarding their impacts on the natural and social environment. Research published in 2016 indicates that there is incomplete evidence on a series of aspects, including the effectiveness of nature-based solutions (for instance as regards positive effects on human health and well-being or the comparative merits of various approaches in the long-term), the relationship between nature-based solutions and society, the design of nature-based solutions and their implementation.

In a number of instances, nature-based solutions can give rise to difficult **trade-offs**. A 2017 report mentions examples, which include the following: some projects, such as greening urban space or creating floodplains, may compete for land with other needs; maintenance of urban green areas, especially in hotter climates, requires irrigation, contributing to higher water demand; trees in urban areas make a modest contribution to lower the emissions of $CO_2$ and some pollutants, but can also produce allergens and other air pollutants; overall health benefits of urban green spaces may be offset by health risks, such as allergies and infectious diseases; and the increased availability of urban green spaces may induce unwanted effects, such as gentrification.

A number of challenges relate to the **implementation** of successful nature-based solutions, particularly in urban areas. Research published in 2015 highlights the need for coordinated approaches at city scale and for careful implementation, for instance when selecting species to be used in green walls and roofs. Research published in 2016 underlines a few barriers to nature-based solutions: the fear of unknowns among urban residents and policy-makers; the long-term planning, implementation and maintenance processes associated with nature-based solutions; the non-alignment of nature-based solution projects and the traditional structure of city departments; and the tendency of cities to focus development on increasing built-up areas, even when populations decline.

Challenges may also exist, associated with the **natural element** in nature-based solutions. On the one hand, decisions about acceptable levels of human intervention may be required in some cases, for instance in relation with geoengineering. On the other hand, nature-based solutions need to build on strong biodiversity and ecosystems, and cannot be a substitute for them.

Finally, **financing** of nature-based solutions can be a challenge. Research published in 2017 points out that in many cases, cities lack funds, primarily as a result of the structure of municipal revenues and spending, leaving little room for autonomous investments. A 2012 report by the Organisation for Economic Co-operation and Development (OECD) highlights the role private investments can play to fill **funding** gaps provided certain pre-conditions are met.

## European Parliament's view

In its resolution of 2 February 2016 on the mid-term review of the EU biodiversity strategy, Parliament highlighted the economic and environmental contribution of nature-based solutions to address challenges such as climate change, scarcity of raw materials, pollution and antimicrobial resistance. It also encouraged Member States to establish a

coherent network of blue-green infrastructure in rural and urban areas and urged the Commission to come forward with a specific proposal for the development of a trans-European network for green infrastructure (TEN-G) by 2017.

## Main references

Cohen-Shacham, E. et al. (eds.), Nature-based Solutions to address global societal challenges, IUCN, 2016.

European Commission, Towards an EU Research and Innovation policy agenda for Nature-Based Solutions & Re-Naturing Cities, 2015.

Raymond, C. M. et al., An Impact Evaluation Framework to Support Planning and Evaluation of Nature-based Solutions Projects, EKLIPSE, 2017.

## Endnotes

1 For a comparison of the definitions of 'nature-based solutions' by the European Commission and the IUCN and for an overview of related concepts, see E. Cohen-Shacham et al. (eds.), Nature-based Solutions to address global societal challenges, IUCN, 2016 and C. Nesshöver et al., The science, policy and practice of nature-based solutions: and interdisciplinary perspective, Science of Total Environment, 2016.

2 For more examples, see E. Cohen-Shacham et al. (eds.), Nature-based Solutions to address global societal challenges, IUCN, 2016.

3 The 7th framework-programme for research (2007-2013) also funded research projects on the wider topic, although not under the 'nature-based solutions' label. Relevant projects (GREEN SURGE, OPERAs, OpenNESS, TURAS, RAMSES, ARTS and BRIDGE) together received over €40 million EU funds.

4 Large-scale demonstrators on nature-based solutions for hydro-meteorological risk reduction (€29 million), operationalising insurance value of ecosystems (€5 million) and multi-stakeholder dialogue platform to promote innovation with nature to address societal challenges (€3 million).

5 Cultural heritage as a driver for sustainable growth (€14 million) and innovative financing, business and governance models for adaptive re-use of cultural heritage (€5 million).

6 Demonstrating innovative nature-based solutions in cities (€40 million), new governance, business, financing models and economic impact assessment tools for sustainable cities with nature-based solutions (€15 million) and sustainable urbanisation (€5 million).

7 Strengthening international cooperation on sustainable urbanisation: nature-based solutions for restoration and rehabilitation of urban ecosystems (€20 million), visionary and integrated solutions to improve wellbeing and health in cities (€43 million) and mainstreaming natural capital in policies and in business decision making (€5 million).

8 From the following funding mechanisms: LIFE; the European Regional Development Fund (ERDF), the European Social Fund (ESF) and the Cohesion Fund; the European Agricultural Fund for Rural Development (EAFRD); and the European Marine and Fisheries Fund (EMFF).

9 This amount represents about 1 % of the EAFRD's total budget for the period 2014-2020 (€418 billion).

## Disclaimer and Copyright



eprs@ep.europa.eu
http://www.eprs.ep.parl.union.eu (intranet)
http://www.europarl.europa.eu/thinktank (internet)
http://epthinktank.eu (blog)