European Commission

BIODIVERSITY MAINSTREAMING IN AND BY ECONOMIC SECTORS

'If nature is destroyed, human life would cease to exist'

Neighbourhood and Enlargement Negotiations

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INTRODUCTION

The European Green Deal invites all sectors to go beyond the mantra of '*doing no harm*', and think in terms of how a sector can enhance biodiversity, both in terms of conservation as well as the sustainable use of ecosystem services. This document focuses on investments in non-biodiversity sectors that can generate biodiversity co-benefits, or use biodiversity as part of a solution. Basic biodiversity concepts will be explained and new approaches are introduced to enhance biodiversity by effectively making use of biodiversity-related goods and services in a variety of sectors. This document is supported by a series of case studies.

SOME CONCEPTS

Biodiversity = biological diversity = genetic diversity within each species, diversity among species, and diversity in ecosystems. It is the formalised and quantifiable term for 'nature'.

Ecosystem[1] = a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit; provider of ***ecosystem services***.

Biodiversity maintains stocks of ***natural capitaland*** flows of ecosystem goods and services of benefit to human society.

THE ROLE OF BIODIVERSITY[2]

We rely on nature to provide us with food, water, shelter and basic materials; regulate our climate and disease; maintain nutrient cycles and oxygen production; and provide us with opportunities for recreation and recuperation, enhancing our health and well-being. We also use the planet as a sink for our waste products.

Nature is therefore an asset, just as produced capital (roads, buildings and factories) and human capital (health, knowledge and skills) are assets. Over half of the world's GDP is generated by industries that depend on nature and its services. Like education and health, however, nature is more than an economic good as for many it also has intrinsic value.

Diversity in nature works as insurance. Just as diversity within a portfolio of financial assets reduces risk and uncertainty, diversity within a portfolio of natural assets increases nature's resilience to shocks. Biodiversity is presently declining at a rate around 1,000 times higher than the historical rate. Such declines are fuelling extreme risk and uncertainty for society.

Nature provides goods and services for the benefit of people, referred to as natural capital (stocks) and ecosystem services (flows). The functioning of ecosystems and their provision of goods and services usually depends on common species which fall outside regulations for nature protection or environmental impact assessments (for example, erosion control in hilly landscapes with vegetation composed of "ordinary" plant species; soil fertility maintained by multiple common worm and insect species). Consequently, impacts of human activities on such ecosystem services may not be recognised in impact assessments and risk going "undetected". Moreover, many ecosystem services are also performed by manmade landscapes: think of groundwater infiltration


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[1] As defined by the *Convention on Biological Diversity*

[2] Inspired by Dasgupta, P. (2021), *The Economics of Biodiversity: The Dasgupta Review.* Abridged Version. (London: HM Treasury).

and storage in virtually all landscapes; noise, dust, heat and pollution reduction by city parks; water purification by freshwater bodies; and much more.

Protected areas play an essential role in conserving and restoring biodiversity, but only 14% of global land surface has a recognised protected status, while only one-fifth of these are well managed. Conserving nature is less costly than restoring it. Protected areas maintain an essential stock of biodiversity and the potential for restoration of degraded areas. In Europe, the birds and habitats directives and the Natura 2000 network provide the framework for protection. Moreover, the EU's biodiversity strategy for 2030 sets out the long-term plan to protect nature and reverse the degradation of ecosystems; it also aims at raising the level of ambition and commitment worldwide.

Restoration of nature is increasingly important in improving the health and resilience of our planet. The economic sectors that have long been responsible for degradation can also play a role in undoing the damage and restoring the natural cycles of life (e.g. an agro-ecological approach to food production instead of monoculture, or joint planning for green and grey infrastructure instead of only seeking to mitigate damage). Increasingly, we need to replace our focus on avoiding, mitigating or compensating negative impacts (i.e. 'do no harm' through the mitigation hierarchy), and actively seek to take stock of the many opportunities for biodiversity enhancement ('*do good*')[3].

Climate change and biodiversity are two sides of the same coin since protection and sustainable management of ecosystems contributes to carbon uptake, adaptive capacity and disaster risk reduction potential; and inversely, climate change globally affects biodiversity, with yet unknown consequences. Furthermore, actions on low-carbon, resource-efficient, circular, resilient and environmentally sustainable development in line with the European Green Deal can all contribute to biodiversity by tackling drivers of biodiversity loss.

Biodiversity is closely linked to physical and mental health and the well-being of people, both in a positive and a negative manner. The right to health is well established as a fundamental right of every human being. Biodiversity is at the heart of the intricate web of life on earth and the processes essential to its survival. The increasingly complex global health challenges that we face, including poverty, malnutrition, infectious diseases and the growing burden of noncommunicable diseases, are more intimately tied than ever to the complex interactions between ecosystems, people and socioeconomic processes[4].


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THE BUSINESS CASE FOR BIODIVERSITY

Between 1992 and 2014, produced capital per person doubled, and human capital per person increased by about 13% globally. Over the same period, the stock of natural capital per person declined by nearly 40%. In other words, human prosperity has grown immensely at a devastating cost to nature. Today, we would require 1.6 planet earths to maintain the world's current living *standards*[2]..

Transitioning to nature-friendly production practices could generate up to $10.1 trillion in annual business opportunities and create 395 million jobs by 2030. Biologically diverse ecosystems can provide up to 37% of carbon emissions reduction needed to meet the goals of the Paris Agreement and provide substantial and cost-effective resilience and adaptation benefits against the physical impacts of *climate change*[5].

[3] See: UNEP 2021: *Ecosystem Restoration for People, Nature and Climate*
[4] See: UNEP, CBD, WHO (2015). *Connecting global priorities: biodiversity and human health: a state of knowledge review.* 344 pages, with a summary of 67 messages.
[5] IFC 2022: Biodiversity Finance Reference Guide - Building on the Green Bond Principles and Green Loan Principles (*Draft for Comments*)

KEY DRIVERS OF BIODIVERSITY LOSS[6]

- **Land use change** from agriculture, unsustainable forestry, urbanization, industrial developments, and energy and transport networks leads to habitat loss, fragmentation, and degradation, and is the biggest cause of biodiversity loss.
- **Over-exploitation and destructive harvesting practices** are a critical threat, particularly to marine ecosystems, unsustainable water use for agriculture, cities, energy, and industries puts further pressure on the health of freshwater and terrestrial ecosystems.
- **Pollution** from nutrients (nitrogen and phosphorous) and from industrial, mining, and agricultural activities, untreated urban and rural waste, and plastic pollution are a threat to all ecosystems.
- **Climate change** is already having an adverse impact on biodiversity. More frequent extreme weather events and changing patterns of rainfall and drought will have further impacts.
- **Invasive species** continue to be a major threat to all types of species and ecosystems.

APPROACHES TO MAINSTREAM BIODIVERSITY


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The following approaches show considerable overlap and may go under different names. Different sectors are working in this field so **terminology for similar approaches may differ**, or the interpretation of concepts may differ among audiences.

Yet, the common denominator is to **stop working against nature, but to start working with nature** for the benefit of people, the economy and nature itself. To reach a true transition, countries have to move from a re-active assessment of the potential impacts of actions to **early pro-active identification of opportunities to integrate green objectives into all actions**, from planning, to design, to implementation.

GREEN INFRASTRUCTURE

Green infrastructure is a strategically planned network of natural and semi-natural areas designed and managed to deliver a range of ecosystem services such as water purification, air quality, space for recreation, climate mitigation and adaptation[7]. It includes **networks of green (land) and blue (water) spaces** which provide **ecological connectivity** by interconnecting natural or semi-natural areas in seriously disturbed and urban landscapes. Such ecological corridors may consist of natural areas but also areas with human activities, provided the area within the corridor is explicitly managed for ecological connectivity.

Protected areas are the backbone of green infrastructure but other natural and semi-natural areas are indispensable to connect green and blue spaces into a functioning network. They might be stepping stones, like a group of trees for birds or a hedgerow linking fields and forests or more substantial, man-made corridors, such as fish ladders on rivers or eco-bridges over motorways. Activities aimed at **biodiversity restoration and enhancement** are most effective when fitting in a larger network of natural and semi-natural areas.

See case (2) Urban, (4) Transport and (8) Energy. Further reading: EU ENV; USAID, 2017; IUCN 2020

[6] IPBES 2019: *Global Assessment Report on Biodiversity and Ecosystem Services*
[7] *EU Environment:* EU Strategy for Green Infrastructure

NATURE-BASED SOLUTIONS

The term Nature-based Solutions (NbS) is often used in relation to climate adaptation and mitigation activities, to deliver climate resilience or store carbon (also referred to as ecosystem-based climate adaptation and mitigation).

NbS can **replace, complement or protect** traditional grey infrastructure by natural processes:

- restoring a coral reef replaces traditional breakwater constructions for coastal protection (see insurance case);
- restoring vegetation in an upstream watershed complements dam operation by regulating water supply and reducing inflow of sediments;
- planting/restoring mangroves protects a coastal area against erosion, saltwater intrusion and sea level rise (see transformational change case from Indonesia).

Grey infrastructure is fixed and can be either insufficient (e.g. against rising sea levels) or too expensive (e.g. oversized). NbS are more flexible and resilient in the light of an unpredictable future and usually have co-benefits for communities, the economy and biodiversity. Hybrid engineering is a combination of nature-based and traditional approaches (*'green where possible, grey where necessary'*). Examples are plentiful.

See cases on (1) River Management, (5) Forestry and (7) Soil Remediation. Further reading: IDB, 2020; EEA, 2021; UNEP 2019; EWN, 2019


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PAYMENT FOR ECOSYSTEM SERVICES

Payment for ecosystem services (PES) is a market-based instrument used to finance nature conservation. PES occurs when the beneficiaries of an ecosystem service make payments to the providers of that service. Ecosystem services initially provided for free are thus turned into a financial incentive for their conservation, targeted at local owners or managers of natural resources. The idea is that the **financial incentive is sufficient in order to not over-exploit or convert the ecosystem.**

These programmes are typically based on ecosystem services for (i) carbon sequestration for climate mitigation, (ii) biodiversity protection, (iii) watershed protection for water supply, or (iv) landscape beauty for tourism. Some PES programs involve contracts between consumers of ecosystem services and the suppliers of these services (e.g. water companies paying upstream land owners). However, the majority of the PES programs are funded by governments and involve intermediaries, such as non-government organisations. It often requires a long process of negotiation, where the role of intermediaries and participation of stakeholders is key to its success.

See case (3) on Coastal Protection. Further reading: CIFOR 2014; Wikipedia; EU Science for Environment Policy

CARBON CREDITS FOR BIODIVERSITY[8]

Carbon credits can be used as a PES scheme. A carbon credit is a reduction in greenhouse gas emissions to compensate for emissions made somewhere else. Credits are traceable, tradable and finite: When they are purchased, they are retired forever. This revenue can fund activities that protect or restore ecosystems, often supporting local communities with alternative livelihood opportunities that keep ecosystems functional. Nature can provide at least 30 percent of the mitigation action needed to limit global warming. Protecting natural ecosystems is one of the most effective ways to stabilize global climate change. Yet, natural climate solutions receive less than 3 percent of all global climate funding.

Carbon projects must meet various standards, including but not limited to:

- **Additionality:** that emissions cuts would not have occurred without the carbon project investment.
- **Permanence:** that emissions reductions or removals represented by a carbon credit endure for the long term.
- **Leakage:** that deforestation is not simply displaced from a specific forested area to somewhere else.
- **Benefit-sharing:** that the beneficiary communities of carbon projects are equitably compensated.

All forest carbon credits traded internationally will need to meet requirements agreed under the U.N., including:

- **Baseline:** a national baseline against which deforestation, degradation, conservation and restoration are measured to ensure that emissions are being reduced or removed
- **Monitoring:** a forest monitoring system so that changes against that baseline can be accurately measured, to ensure additionality
- **Strategy:** a national strategy to ensure permanence and avoid leakage
- **Safeguards:** adherence to and reporting on a series of social safeguards to ensure respect for indigenous rights and the participation of local stakeholders, and environmental safeguards to mitigate the risk of forest loss.

INSTRUMENTS FOR BIODIVERSITY MAINSTREAMING


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LANDSCAPE APPROACHES

There is an increasing acceptance that sectorial approaches to land management are no longer sufficient to meet (often) conflicting global challenges (such as poverty alleviation, biodiversity conservation, and food production). Integrated Landscape Approaches provide a framework for **balancing competing demands and integrating policies for multiple land uses within a given area.**

By definition, **a landscape is multifunctional**: it provides various ecosystem services linked to different groups of stakeholders, possibly with opposing interests. This creates cross-sectoral linkages and different perceptions of success in a landscape approach.

In consultation with actors and stakeholders in a particular area, a commonly agreed long term goal and short term objectives are defined. **Different alternative pathways may exist** to reach the objectives, so it is important not to mix up the goal and the means to reach that goal.

Complicated as it may be, the **principle of sustainability has to be jointly defined** in some way or another. One can think of the direction of change the

[8] IPBES 2019: *Global Assessment Report on Biodiversity and Ecosystem Services*

process will create (defining which direction is good and which is wrong) or the setting of limits of acceptable change (including direction and a threshold, thus more complicated). The Sustainable Development Goals can provide inspiration for the definition of sustainability indicators.

There is no standard recipe as social and biophysical dynamics and the sheer number of potential variables to manage are too diverse. Each situation merits its own tailored approach; yet generic guidance is available. A principle from resilience theory applies: **one has to learn one's way towards a sustainable future!**

Community-based Natural Resource Management is closely related to a landscape approach. It involves those concerned with resource use and management, notably local government and communities, and it is based on the notion that the livelihood of rural people depends on their natural surroundings.


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See case (6) Rural (pastoral) development; further reading: The Little Sustainable Landscapes Book; Sayer at el 2014

STRATEGIC ENVIRONMENTAL ASSESSMENTS (SEA)

Sector planning deals with the definition of how to implement national development priorities for a sector. It may define a countries' energy mix, transport modalities, pattern of urban development, water allocation priorities, etc. An SEA can identify the mechanisms (drivers of change) in the sector which may create negative biodiversity effects and highlight opportunities for net biodiversity benefits at the earliest possible moment when development options are still open.

Spatial planning deals with competing demands for limited space and resources and aims at optimising their use. Conducting an early SEA, integrated in or parallel to the planning process, can inform spatial planning on regional development opportunities and constraints based on a (participatory) inventory of biodiversity and ecosystem services and their status (e.g. under- or overexploited). River basin management planning can be considered a special form of spatial planning.

An SEA creates transparency on (i) sustainability, (ii) winners and losers, and (iii) the transfer of problems to other areas or towards the future. It facilitates thinking in terms of **alternative pathways of development**, creating the possibility to compare alternatives with similar objectives.


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An SEA can provide the **legally embedded process tool to apply a landscape approach**. Both processes share the principles of transparent decision-making, based on scientifically valid information, with the involvement of relevant stakeholders.

See Transport Case (4); Further reading: SEA in EU development cooperation; IAIA FasTips


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GREEN FINANCE FOR BIODIVERSITY/NATURE

While government is responsible for spatial and sector policy planning, the private sector plays an important and complementary role in project implementation. In parallel, random development of the private sector has harmed and may continue harming biodiversity if negative impacts are not anticipated, measured, reduced and offset. **The full potential of the private sector needs to be used for a green transition.** To create private sector leverage in a green transition, availability of certified 'green finance' and mainstreaming biodiversity into the investment decision process are needed.

The *EU Taxonomy* is a classification system, establishing a list of environmentally sustainable economic activities by sector. **It is based on a 'net environmental benefit' approach, so going beyond the 'do not harm'**. The EU taxonomy defines which economic activities can be considered environmentally sustainable within European borders. It provides a framework and common language, and thus creates security for investors and protects from greenwashing. The *EU Taxonomy Compass* provides a matrix that displays the economic activities per environmental objective, including which economic activities for a given sector are considered taxonomy-relevant and view the technical screening criteria applicable to them. So far, this has only been elaborated for climate adaptation and mitigation - biodiversity is expected to follow.

Financial actors have been exploring how to bridge biodiversity and finance for several years, mainly through the **format of innovative financial vehicles for nature finance**. Business cases, good practice, including investment and transparency/reporting and a variety of approaches (nature-based solutions, landscape approach, blue finance, payment for ecosystem services, offsetting schemes through biodiversity or water credits, corporate funds, forest certification, impact investing, debt for nature swaps etc), are emerging. To contribute to the expansion of the asset class with major capacity to leverage high amounts of funding, the IFC has drafted a *Biodiversity Finance Reference Guide* for sustainable bonds which has been recently posted for consultation.

The different players of the financial ecosystem, including credit-rating agencies, public and commercial banks, insurance companies, research organisations and NGOs, standards providers, mobilise funding and teams to contribute and propose solutions. Acknowledging the challenge of integrating nature into financial decisions and scaling up biodiversity finance from pilot funds to mainstream finance, a forward-looking group of financial centres promoting sustainability proposes *guidance and capacity-building* on the subject. Ecosystems and ecosystem services are also a key result area for the **Green Climate Fund** under adaptation objectives, and biodiversity is featured in a significant number of approved projects.

At upstream level in financial markets, the international Central Banks and Regulators network for greening the financial system consider there is *"sufficient evidence to suggest that climate change and the extent and severity of threats to sustainable development posed by biodiversity loss could be systemic".* They have proposed an *Agenda for action on biodiversity loss, financial risk and system stability*.

See cases on (1) Coastal Protection and (3) Flood management

AN ENABLING ENVIRONMENT FOR BIODIVERSITY MAINSTREAMING[9]

Mainstream biodiversity into **policy, legislation, and regulations:**

- Integrate biodiversity into policy commitments for multiple linked objectives (e.g. national development planning, climate and disaster risk reduction commitments, infrastructure plans).
- Translate policy commitments into laws and regulations that govern implementation on the ground.
- Seek opportunities to use existing coordination mechanisms between different ministries (e.g. environment, finance, planning) to ensure that the potential of biodiversity is realized and goals are aligned.
- Integrate biodiversity into infrastructure planning and procurement processes so downstream actors obtain the necessary expertise to win contracts and deliver policy-compliant projects.

Skills, methodologies, tools, and capacity:

- Develop new technical skillsets and capacities for delivering biodiversity gains where they differ from traditional projects.
- Support education opportunities through integrating biodiversity into professional development and academic curricula (e.g. engineering) to equip future project developers and engineers with relevant skills.
- Prioritise the development of the business case as a means to create demand for the development of commercial products supportive of biodiversity finance.

Financial Institutions:

- Deploy financial instruments to de-risk biodiversity-positive projects (e.g. risk underwriting, provision of guarantees, and technical assistance).
- Provide support to local financial institutions while they build a track record and common understanding of biodiversity positive finance.

See all cases; Further reading: OECD 2018; CBD 2020

[9] Adapted from IADB 2019: *Nature-Based Solutions: Increasing Private Sector Uptake for Climate-Resilience Infrastructure in Latin America and the Caribbean*

SOME SUGGESTIONS ON THE MAINSTREAMING OF BIODIVERSITY IN ECONOMIC SECTORS

TRANSPORT[10]

All major infrastructure projects follow similar stages. Within this process, there are limited and specific opportunities to most effectively implement ecologically sensitive planning and design:

- **Strategic planning.** Focus on options that avoid or improve ecological outcomes based on strategic environmental assessment (SEA). Examples of key questions include: can the impact on important wildlife migration routes be avoided? Can the project enhance wildlife connectivity by restoring connections? Can areas without roads be avoided? Do alternative modes of transport provide better solutions (water or rail transport)?
- **Physical planning.** Focus on linear infrastructure designs that minimise, mitigate or offset impacts based on detailed ecological analysis. Examples of key questions include: where should fauna crossings be located? Can the design be modified to minimise impact on important habitats?
- **Construction.** Ensure that ecologically sensitive designs are easily translated to construction. Examples of key questions include: has the design of wildlife crossing structures met the required standards for the target species? Has the detailed drainage design considered the impact on adjacent important habitat?
- **Operation.** Ongoing ecological management, maintenance of mitigation measures, review and adaptive management. Examples of key questions include: is there a plan for monitoring and maintenance in place to ensure crossing structures remain effective over time? Are areas of important habitat adjacent to the road project being managed to ensure that they are not degraded by indirect impacts of the operation of the road? Is there coordination between authorities?

Developing Green Infrastructure adjacent to (grey) infrastructure has the potential to deliver many ecosystem services. Road and railway verges and canal banks form important wildlife corridors and play a key part in the quality of the landscape. Vegetation can provide a habitat for wild pollinators while reducing noise levels, compensate carbon emissions, and serving as protective buffer against floods, landslides and avalanches.

See Transport case (4). Further reading: IENE 2020, WII 2016

URBAN DEVELOPMENT[11]

Opportunities and risks: cities concentrate people, power, wealth, and productivity; they are drivers of economic prosperity and hubs for human development, innovation and creativity. However, rapid expansion of urban populations, pressure on land and lack of adequate infrastructure leads to congestion, environmental degradation and unhealthy living conditions.

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[10] Adapted from: Roberts & Sjölund. Incorporating Biodiversity Issues Into Road Design: The Road Agency Perspective. In: Ree, Smith & Grilo (2015). Handbook of Road Ecology. John Wiley & Sons, Ltd

[11] Adapted from QuickTips: *Green Cities: Integrating Environment and Climate Ambitions in Urban Development*

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Priorities for action include:

- To harness the transformative potential of cities, urban development needs to move away from sector-based policies towards a broad urban vision and an **integrated planning approach**.
- **Take surrounding areas into account**; cities depend on supply of food, energy, and water from outside, while outside communities may depend on city suppliers.
- **Give space to nature.** Conservation or restoration of ecosystems in and around cities can reduce cities' vulnerabilities to shocks and adapt to climate change in a cost-effective manner and enhance local biodiversity; apply the principle of 'green where possible, grey where needed'.
- **Create green and blue areas and corridors** to accommodate floods, store water, treat wastewater, preserve biodiversity, combat heat stress, filter air, capture carbon, provide recreational space and wind breaks, etc. Promote the use of local species and avoid invasive species.
- **Avoid** urban development in **vulnerable areas** such as natural ecosystems or flood-prone riverine, coastal and subsiding areas.
- **Combat urban sprawl:** create compact (build up, not out) polycentric settlements with optimal connections, reducing traffic and mobility needs and avoiding unnecessary loss of productive land or natural ecosystems.
- **Quantify the benefits of biodiversity** such as health gains, jobs created, avoided climate adaptation costs, carbon capture, insurance savings and increased property value, to make the business case for biodiversity.

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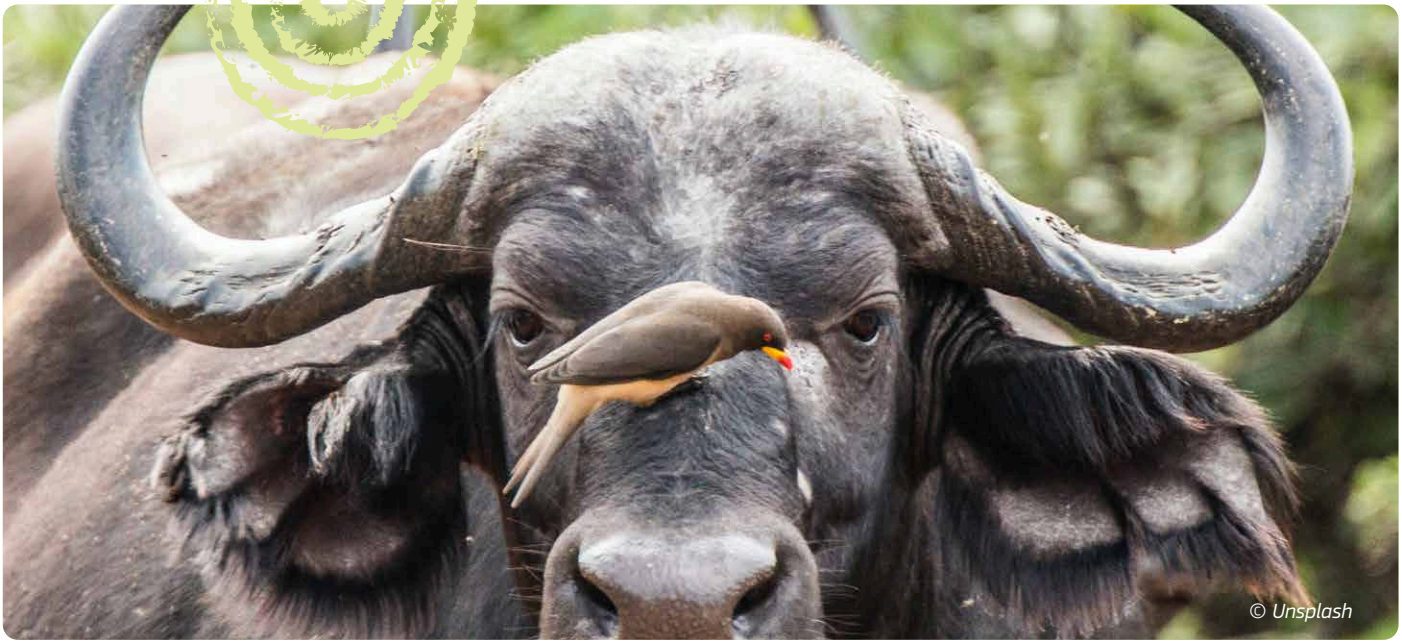
See urban case (2); further reading: GreenCities.EU; GreenClimateCities 2019; TNC 2016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AGRICULTURE AND RURAL DEVELOPMENT


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Experience shows it is possible for **agricultural and pastoral systems within multi-functional landscapes** to provide food, feed, fuel and fibre as well as habitat and corridor functions for biodiversity, climate resilience and enhanced ecosystem services.

Agro-ecological, climate-smart and agro-forestry approaches provide pathways, supported by both high- and low-tech innovations. Such approaches can also contribute to climate mitigation, adaptation and disaster risk reduction. At farm level, they can include minimizing soil disturbance and tillage, nutrient cycling, natural pest management, water conservation, mulching, the use of (green) manures, crop rotation, use of local/traditional/native species, cover and companion cropping, the reduction of synthetic pesticide and mineral fertilizer use, lower livestock densities, managed and free-range grazing, crop diversification, nutrient balancing, recovery and reuse, and the inclusion of landscape elements such as hedgerows and flower strips which also attract pollinators.

Yet, more systematically enhancing the positive and reducing the negative impacts of agriculture on biodiversity, requires a **larger landscape perspective**. This allows land use management to provide optimal connectivity between areas of natural habitat and to manage agricultural land within the mosaic to provide habitat and corridor functions for wildlife, from hedges, woodland patches and clearings in forests, to waterways, ponds or other biodiversity-friendly features of the production environment. Furthermore, adoption of principles of circular economy on agriculture and value-chain further contributes to the overall sustainability of agriculture.

Priorities for action include:

- protecting remaining natural habitat,
- agricultural and pastoral land management aimed at biodiversity enhancement, GHG emission reduction, and climate resilience, and
- restoration of abandoned or degraded agricultural land, either to natural habitat or to sustainable food production.

See ClimaEast case (6); further reading: FAO 2020; WWF 2021; EU Farm to Fork Strategy

ENERGY

Forget about new lignite, coal, and oil exploitations!

Many excellent and detailed guidelines exist on the minimisation of biodiversity impacts by marine (on birds and marine mammals) and terrestrial wind parks (on birds and bats), power lines (on birds and bats), solar farms (on habitat loss) and hydropower (multiple impacts in entire river basin and coastal areas)[12]. However, more is needed to ensure net biodiversity benefits.

Energy sector investments usually involve huge amounts. Environmental Impact Assessment (EIA) studies for such projects virtually always indicate an obligation to compensate the loss of biodiversity and loss of livelihoods. This provides **opportunities to invest in biodiversity conservation and sustainable use beyond the minimally required**, for the benefit of long term biodiversity conservation and the sustainable exploitation of ecosystem services by local communities. Additional costs can be minimised when pro-actively planning for such measures. Awareness is fundamental!

Ideally, energy development projects (and all other developments for that matter) are embedded in a larger strategic planning framework. Priorities for action include:

- **Energy sector planning** focussing on the optimal energy mix for a specific region, including off-grid and mini-grid solutions (avoiding transmission lines) which minimise the environmental and climate footprint of energy production.
- **Spatial planning** indicating development opportunities (suitability for wind, solar, hydro- and other sources of renewable power) and no-go areas for certain activities (e.g. leaving parts of a river basin untouched by dams to maintain fundamental ecological processes; avoiding migration corridors of large birds or mammals).
- **River basin management planning** taking into account all human interventions and water uses, and the flow dynamics needed for a functional river system (i.e. ecological flow requirements), including the identification of river branches suitable for hydropower development and those which should be left free flowing.
- **Use of strategic environmental assessment**, integrated in or parallel to planning processes, to inform such planning processes at an early stage on, amongst many other things, opportunities for biodiversity enhancement.

See case on solar power parks (8).

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WATER

Water is an extremely broad sector ranging from river basin and water quantity management, water supply and sanitation, to disaster risk reduction and even combating against desertification. The **water sector is intricately linked to nature**. Nature is both a consumer and provider of water, including many water-related ecosystem services (e.g. water supply to people, agriculture and industry; water quantity and quality regulation; transporter of sediments, nutrients, pollutants; provider of renewable energy; substrate for economic activities such as shipping, fisheries, aquaculture and tourism; it provides connectivity for aquatic species; etc.). Therefore, **green and blue infrastructure, nature-based solutions and PES schemes abound in the water sector.**

[12] Too many to mention so please contact Greening Facility for info: INTPA-GREENING-FACILITY@ec.europa.eu


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Priorities for action/generic recommendations[13] include:

- **Carry out basin-scale ecosystem conservation and restoration investments**, based on water quantity and quality requirements for healthy freshwater and coastal ecosystems, including groundwater-dependent wetlands or lagoons.
- Establish watershed protection schemes, such as payment-for-ecosystem-services, to **link downstream and upstream communities**, and protect vital headwaters and recharge areas, from unsustainable practices in land-use value chains.
- **Harness nature-based-solutions** for improved resilience, including natural water retention measures (floodplains, wetlands and mangroves) to minimise flood and drought risks, and 'soft' investments such as early warning systems and improved spatial planning, hampering construction in floodplains and fostering 'sponge cities'.
- **Water quality** is best maintained by functional and healthy wetlands and freshwater bodies; artificial/constructed wetlands can assist in the pre-treatment of waste water.
- **Dismantle obsolete infrastructures** to recover free-flowing rivers; restore water, nutrients and sediment flows to deltas, estuaries, coasts and beaches; and recover biodiversity migration corridors, which many species depend upon.
- Encourage EU partner countries to **adopt and apply the** *UNECE Water Convention*, especially to prevent, control and reduce the pollution of waters, to ensure sound and rational water management, conservation of water resources and environmental protection, and the conservation and, where necessary, restoration of ecosystems.
- Encourage **cross-country collaboration** platforms and joint initiatives and apply *water diplomacy* to leverage the environment and promote climate resilience.


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See cases on solar power parks (8), Urban (2), Transport (4)

[13] Adapted from QuickTips on *Integrating the Environment and Climate Change in Water Resources Management*

WASTE[14]

Human and ecosystem health can be adversely affected by all forms of waste, from its generation to its disposal, both directly (e.g. the consumption of plastic by marine wildlife) and indirectly (e.g. landfill sites releasing pollutants into the soil, water and air). Good waste management does more than just clean up the environment – it can also provide diverse benefits for communities that engage in waste management activities.

These include harnessing new sources of energy, improving well-being and tourism potential by creating a more pleasing landscape, enhancing the services local ecosystems provide (such as food and clean water), and creating income sources through, for example, compost-making, recycling, energy generation and sanitation.

Good waste management has three main components:

1. **Avoid:** apply circular economy principles to minimise the production of waste (and zero waste).
2. **Collection and sorting:** collecting different waste at source (glass, plastic, organic, etc.). Developing waste collection and sorting schemes creates jobs.
3. **Processing** is the act of reusing, recycling and generating energy and other useful products from waste. For example composters, waste-to-energy plants, use for biodegradable waste, recycling facilities.
4. **Embedding** local processes within waste management strategies to ensure sustainability.

This involves educating, training and awareness raising among local communities, small-scale businesses and entrepreneurs to develop and run local waste management initiatives that create livelihoods. Markets and infrastructure are needed for products such as compost, energy and recycled material.

Further reading: See case on Waste (7); MEA Chapter 10

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[14] Adapted from *Why Manage Waste?*

La Brague Natural Park © Credit

CASE STUDY – WATER MANAGEMENT SECTOR

THE BRAGUE DEMONSTRATION SITE IN SOUTHERN FRANCE

CASE HIGHLIGHTS

Nature-based solutions (NbS) for flood risk mitigation in the Brague catchment are economically more beneficial than traditional grey engineering solutions. This is largely caused by the co-benefits associated with NbS.

Flash floods cannot entirely be avoided by upstream measures in this type of river basin so downstream spatial planning measures are needed in support of nature-based solution to create sufficient room for the river. This requires involvement of a broad group of stakeholders.

ISSUE ADDRESSED

The Brague basin measures 61 km², and combines rural headwaters, a forested central part and urban lowlands on the French Riviera. On 3rd October 2015, severe rainfalls triggered dramatic flash floods, statistically representing a 1 in 100 years magnitude. Twenty people died, about € 550-650 million in losses were observed, as well as cascading complications on transportation, communication and energy networks. Flooding was seriously worsened by tree trunks blocking bridges and culverts.

Climate change affects the seasonal variability of droughts and precipitation, challenging (fresh) water management across Europe. The flood event has therefore been used for an in-depth study of torrential flood hazards and risks, the effects on ecosystems, and the effectiveness of nature-based flood solutions as compared to traditional engineering approaches.

APPROACH FOLLOWED

The impacts of classic "grey" solutions for flood mitigation strategies were assessed against NbS. The grey solution included huge retention dams, concrete channels and measures to avoid bridges becoming obstructed with trees and debris. NbS combine retention measures that give room to the river by creating small natural water retention areas in the upper catchment and widening the river corridor in the lowlands, enhanced by floodplain works including bed and bridge widening, maintaining of a forest corridor, wetlands restoration, and debris management. They are integrated in a so-called "giving-room-to-the-river" strategy.

An analysis of flood risk showed that forest wildfires significantly aggravate floods. However, although wildfire hazards are high to very high in this region, wildfires are seriously limited by the existing efficient firefighter organization. Only during extremely dry and hot summers may they be overwhelmed and large scale fires may occur, aggravating run-off and erosion during a few years until nature has restored itself.

Sky News: Flash Floods On French Riviera: Up To 17 Dead

Sunday, 4 October 2015

BENEFITS OBTAINED

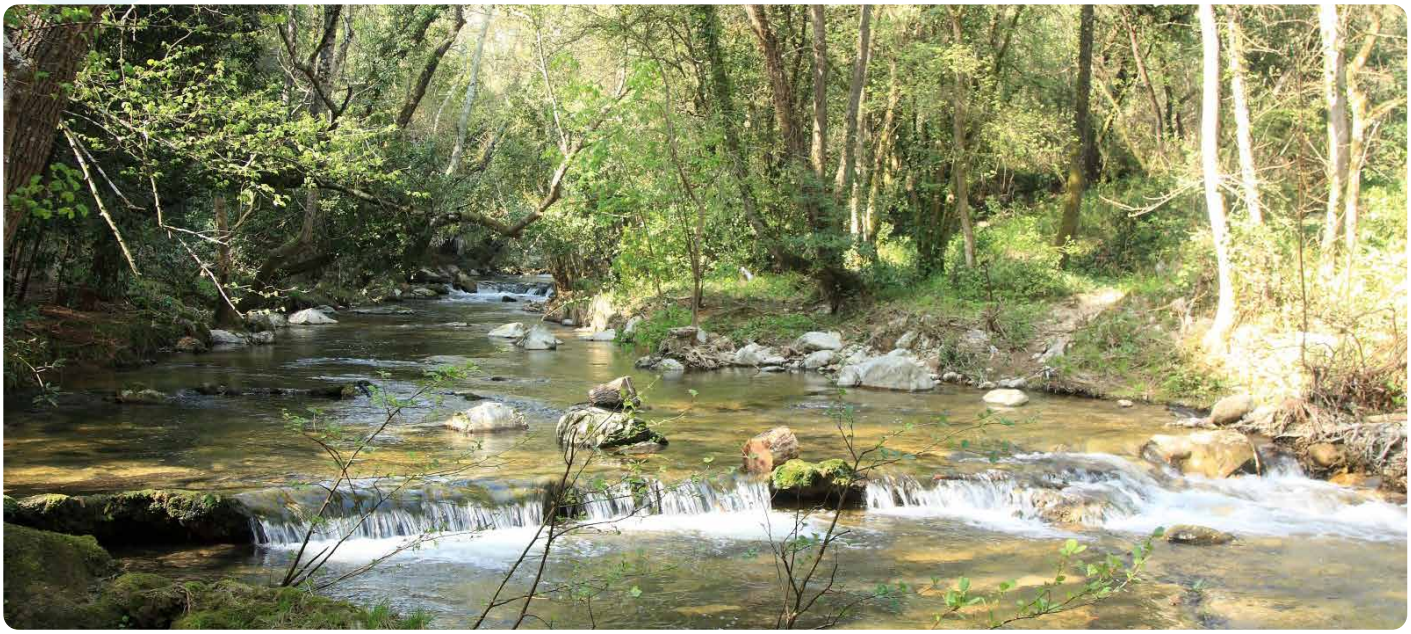
The role of large wood in flood hazard is a particular source of concern. An importantg message is that clogging of bridges by tree trunks cannot be dealt with by annual forest management (removing dead and tilting trees). Such management has been caried out for 20 years and nonetheless more than 3000 trees were found downstream during the 2015 flood, mostly living, healthy trees. The flood event simply was too extreme. The relevant and cheaper solution over the long term is to implement large wood-trapping facilities upstream of bottleneck sections (bridges, dams) and to leave the streams in the upstream section untouched. This is cheaper, more efficient and more sustainable, and better for nature.

Flood modelling demonstrates that the traditional engineering techniques such as retention basins and channelization of water courses are not capable of coping with extreme events such as the October 2015 flood. The broader message is that in rivers hit by large-scale Mediterranean thunderstorms, even a high level of ambition on retention measures in the upper and mid-catchment is insufficient to prevent flooding of downstream floodplains. Therefore, a sufficiently large corridor must be maintained so that such rivers can convey water.

Protecting built up areas may become extremely expensive or even impossible. Building such vulnerable assets should be avoided. Large corridors are most resilient, sustainable and provide numerous co-benefits, but require a long-term land-use strategy which has to be accepted by all local stakeholders.

In the Brague case, NbS solutions were found to have lower costs of implementation than grey solutions for the same level of risk reduction. However, the economic benefits arising from the reduced flood damage are not sufficient to fully cover the investment, maintenance and opportunity costs. It is the co-benefits of NbS that makes the measures economically interesting.

Nature-based solutions for water-related risks can thus not automatically be assumed to be economically efficient. There is a need for an economic evaluation to identify the most suitable strategy in a context of limited public funding. The largest share of the value of NbS comes from their co-benefits, which has implications for the funding of NbS and the need to maximise co-benefits in their design. Apart from reducing peak flows and flood risks, co-benefits in the Brague catchment included climate change adaptation; reduction of drought risk; improving resilience of infrastructure and local populations; better protection of coastal ecosystems.



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ELSEWHERE: DRAVA LIFE (2015-2014) – INTEGRATED MANAGEMENT OF RIVERS IN CROATIA

The Drava is one of the last semi-natural rivers in Central Europe. Hydropower development has left only a small free-flowing section, mostly in Croatia, with a length of 310 km, including 4 Natura 2000 sites. Key natural features of the riverine ecosystem are restored to showcase this innovative approach of river management. The restoration encompasses the opening of new side-arms, removal of embankments and groins, as well as the preservation of retention areas and natural steep river banks. This will benefit endangered habitats and species within Natura 2000 sites. Furthermore, the restoration is favourable for flood control by lowering high water levels locally, and diverting water away from settlements, bridges, roads and dikes. Climate resilience of floodplains will be enhanced by increased infiltration of river water and higher groundwater levels. Recreational opportunities for local inhabitants will increase. Extensive awareness raising activities will be organized in cooperation with local citizens and schools.

ADDITIONAL INFORMATION

Case:
NAIAD Case Studies: Brague Demonstration site (France)

EEA:
NbS in Europe for climate change adaptation and disaster risk reduction

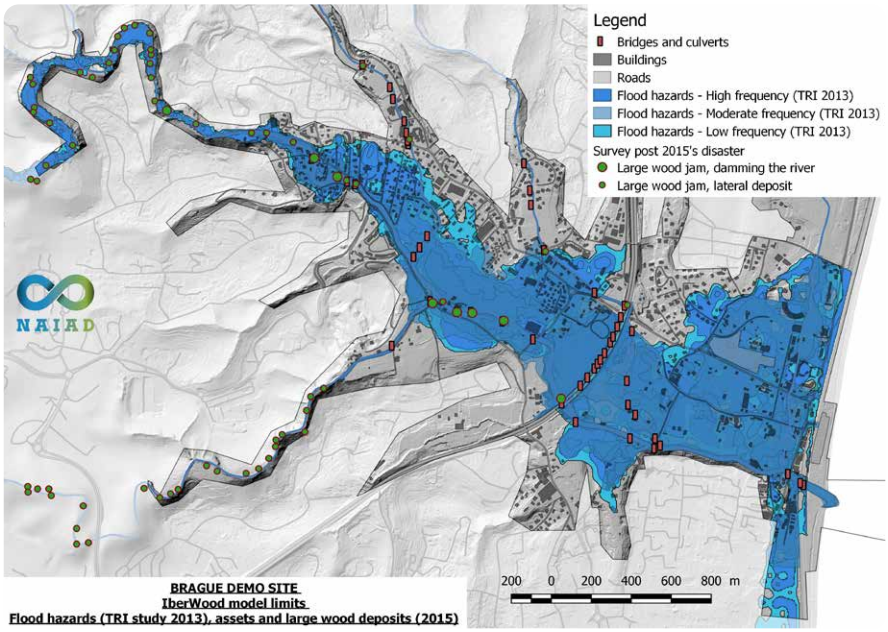
UNEP:
Ecosystem based adaptation. Selected cases from Africa

EWN:
Engineering With Nature® An Atlas
(118 examples from around the globe)

BEST PRACTICE LESSONS

It is essential to build and choose solutions on strong physical evidence, accepted and understood by traditional (technical) flood risk managers, but also to consider other environmental and social features and to make them accepted and implemented by stakeholders, preferably through a participatory approach.
Forests (including riparian forests) have recognized positive effects on hydraulics, ecological habitats preservation, etc. However, they remain vulnerable to wildfires which may induce increased flood risks. Good fire prevention and control institutions are thus part of the nature-based solution.

For rivers basins in the Mediterranean hit by thunderstorms, even high ambition on retention measures in the upper and mid-catchment can be insufficient to prevent flooding. Therefore a sufficiently large corridor (floodplains) must be maintained to convey flows. Such corridors can be natural but also allow for flood resilient activities (e.g. grazing or annual crops), but buildings should be avoided.



Brague Demo Site © NAIAD

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CASE STUDY – URBAN SECTOR

THE GREEN INFRASTRUCTURE IN VITORIA-GASTEIZ (SPAIN)

CASE HIGHLIGHTS

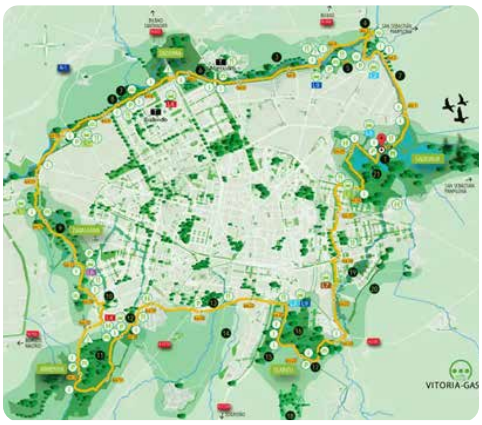
The Green Belt of Vitoria-Gasteiz is the result of an ambitious project to restore and recover the peripheral areas around the city with both biodiversity and recreational benefits. The belt now has one official Ramsar wetland site and two Natura 2000 sites, winning international recognition for their high environmental value. Green infrastructure within the city contributes to climate adaptation (reducing heat stress and improving flood management), mitigation (carbon sequestration), and a clean and healthy living environment.

ISSUE ADDRESSED

Vitoria-Gasteiz is a city of more than 200,000 inhabitants facing climate change challenges, most prominently due to an increase in temperature and subsequent heatwaves, and an increase in extreme rainfall events resulting in higher flood risk. Furthermore, in the early nineties, biodiversity in the landscapes surrounding the city was degraded, with few isolated green spaces remaining. The quality of life for inhabitants could definitely be better.

APPROACH FOLLOWED

In 1993, the city started with the initiative to create a Green Belt around the city. Now, after 18 years, a surface area of 727 ha (with an ultimate plan for 993 ha) with 79 km of foot and bike paths (see map) exists. The Green Belt comprises 6 consolidated parks; work is ongoing on the strengthening of ecological corridors between the parks. Being aware of the necessity to also transform the inner city into a space that reconnects with nature and has to become more resilient, the City Council proposed a new line of action based on the application of the green urban infrastructure. For this, the 2012 Green Urban Infrastructure Strategy has been developed, aimed at improving connectivity and functionality of the different urban and peri-urban green spaces. The strategy is anchored to other municipal plans such as the Biodiversity Conservation Strategy and the Plan to combat and adapt to climate change. Interventions in different parts of the city included connecting urban parks by ecological corridors (e.g. by tree-lined streams and streets); the transformation of vacant plots into new green spaces; the increase of biomass and number of trees and shrubs in parks and gardens; the enhancement of existing green areas to improve the conservation of native species; improvement of water management; the promotion of ecological agriculture in free and peri-urban spaces; the promotion of green building facades. Fifty neighbourhood projects worked on greening of the immediate living environment with the aim of improving the ecological and environmental functionality of existing green spaces and vacant plots, as well as reducing the costs incurred in their management and maintenance.



Green belt and green infrastructure

An emblematic intervention is the renovation of the Gasteiz Avenue with eco-design techniques and the creation of a green facade in the Congress Palace Europa. The renovation included a restored river corridor, plantation of trees along the channel and creation of car-free streets.

BENEFITS OBTAINED

The Green Belt offers a wealth of natural features such as woods, rivers, wetlands, meadows, fields, groves and hedgerows. It is easily accessible on foot or by bicycle through a series of recently completed urban pathways, and offers a multitude of opportunities for walking, leisure and the pure enjoyment of being in contact with nature. It is also fast becoming the ideal location for educational activities and initiatives, designed to increase the public's awareness of environmental issues.

Interventions have resulted in improved water management and reduced flood risk, reduction of air pollution, improvement of temperature regulation and a reduction of the heat-island effect. The vertical garden on the Congress Palace Europa is done with native species and has contributed to thermal and acoustic insulation of the building and the enhancement of the aesthetic quality. Public use of green spaces increases with the increase in recreational opportunities.

The project costs between 2012 and 2020 amounted to about € 12.5 million. The strategy does not identify a specific final date; new projects and interventions will be designed and implemented as long as the Council will allocate budget.

BEST PRACTICE LESSONS

Such success doesn't come overnight but is the result of a clear vision, adaptive capacity and stakeholder involvement. An overall strategy with clear goals provided an overarching framework, guiding the design and implementation of many different interventions over a longer period of time. Planned interventions have multiple objectives and produce co-benefits for biodiversity, climate change adaptation and mitigation and quality of life for city inhabitants.

The involvement of citizens and local private sector stakeholders is considered a success factor, as they have helped to create a consensus on the needs as well as the benefits of the implementation of the Green Urban Infrastructure Strategy. Interventions were tested in one neighbourhood and adapted where needed, before being implemented in other neighbourhoods.

ADDITIONAL INFORMATION

Cases information: Victoria-Gasteiz: Green Capital and Climate-Adapt case information

Urban greening: Green Cities Quick Tips with further info sources; European Green Capital Award

ELSEWHERE: BLUE-GREEN CORRIDORS IN BELGRADE, SERBIA

Belgrade, the capital of Serbia with 2,000,000 inhabitants faces serious erosion problems and torrential floods caused by loss of forest surface, urbanization and inadequate agricultural practices. Belgrade authorities have defined a new holistic strategy backed by research and models in ecological engineering and landscape planning. It recommends changes in land use (agricultural) practices, reforestation, and the restoration of 'blue-green' corridors, making use of residuals of open streams and fragments of forest vegetation. In an experimental watershed forest, the surface increased by 18%, river discharge decreased by about 50% and erosive material by about 40%. Ten km of sealed walking and cycling paths, 1.7 km of unsealed forest paths, six open gyms and seven rest areas will strengthen the potential for sports and recreation. The final goal is the creation of a network of 'blue-green' corridors in the city, providing both effective erosion and stream control and environmental and social services.

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CASE STUDY – TOURISM AND INSURANCE SECTORS

THE COASTAL ZONE MANAGEMENT TRUST IN QUINTANA ROO, MEXICO

CASE HIGHLIGHTS

A series of hurricanes hitting a stretch of the Mesoamerican coral reef and beaches triggered the world's first coral reef insurance policy, based on its protective service. It will pay out to repair and restore the reef in the event of a major storm.

The combination of an insurance policy for the coral reef and a well-organized post-storm response capacity proved a highly successful approach to help the reef recover, thus protecting both nature, people and business.

Similar coastal protection benefits are known from sandy coasts (e.g. dunes) and coastal wetlands (e.g. mangroves) so opportunities to apply this mechanism exist around the world.

ISSUE ADDRESSED

In 2005, Mexico's Caribbean coast was struck by two hurricanes, causing US$8 billion in damages and closing hotels and other businesses in Cancún. But some hotels and beaches in Puerto Morelos were protected by a stretch of coral reefs and suffered less damage. A healthy coral reef can reduce up to 97 percent of a wave's energy before it hits the shore. But coral reefs can themselves be damaged by severe storms which then greatly reduces the protection they offer for coastal communities. Local authorities often lack the financial resources to repair the damages by such fierce weather events.

APPROACH FOLLOWED

To confront this threat in the Mexican state of Quintana Roo, various stakeholders—state government, hotel owners, The Nature Conservancy (TNC) and The National Parks Commission (CONANP)—have come together to pilot an innovative conservation strategy to build post storm response capacity: the Reef Brigades, representing a qualified team of community members (tour guides, diving instructors, park rangers, fishermen, researchers) trained and equipped to repair the reef after a storm. When broken corals roll around and get buried in the sand, they soon die. But pieces can be saved if they are fastened back onto the reef.

The same year, Quintana Roo government established the Coastal Zone Management Trust, in collaboration with the tourism industry, The Nature Conservancy (TNC), civil society organisations, the local science community, and the international insurance industry. It is designed to collect and manage funds for reef maintenance.

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The trust purchased the first ever coral reef and beach insurance policy to ensure these vital ecosystems have funding for repairs after extreme storms hit. Hotel and tourism operators with beach front properties pay a concession to the government. Twenty-five percent of this concession is put in a Trust Fund which is allocated for on-going coral reef maintenance and the purchase of the annual insurance. In 2020, the coverage extended across six municipalities and approximately 160 kilometres of coastline, including the towns of Cancún, Playa del Carmen, Cozumel and Puerto Morelos.

The insurance is a one-year parametric policy, an insurance in which the policy is triggered not by financial losses, but when a specified set of conditions are met. Parametric insurance has three elements: (i) a parameter (wind speed in this case) and the threshold that would trigger the insurance, (ii) a geographic area (polygon) where the measurement of the parameter (wind speed) must meet the threshold to trigger a payout, (iii) the amount of payout to the policy holder.

The parametric insurance in Quintana Roo is triggered if wind speed within the polygon is greater than 100 knots. The payout increases according to the maximum sustained wind speed since stronger winds result in greater damage and expenses.

BENEFITS OBTAINED

On October 7, 2020, Hurricane Delta entered the polygon defined in the insurance policy and registered windspeeds of over 100 knots. The insurance policy was triggered and paid close to $800,000 to the Trust Fund, allowing swift damage assessment, debris removal and initial repairs to be carried out by the Brigades, followed by a longer periods of restoration to restore the reef's value as a coastal barrier. The funds have substantially expanded the post-storm response and repair efforts on the reef. The pay-out is the first time ever that funding from an insurance policy is available to help reef recover.

Even though coastal protection is the direct benefit obtained from coral reefs, obvious co-benefits in this case are the tourism, recreation and fisheries industries and the conservation of biodiversity. This post storm response capacity, with its innovative funding system, helps protect the region's US$10 billion tourism industry, encourage the conservation of a valuable natural asset and create a new market for the insurance industry—a model which could be applied to other regions and ecosystems.

ELSEWHERE: THE UPPER TANA-NAIROBI WATER FUND IN KENYA

The Tana River supplies 95 percent of the water for 9 million residents in the watershed, including the capital of Nairobi. It also feeds agricultural areas and half of the country's hydropower output. Upstream land clearance, erosion and sedimentation can choke water treatment and distribution facilities causing service disruptions. The Water Fund is founded on the principle that upstream prevention of water problems is cheaper than it is to address them further downstream. Public and private donors and major water consumers downstream contribute to the Fund to support upstream water and soil conservation measures, resulting in improved water quality and supply. Highlights include 73,000 hectares of land in the watershed under sustainable management, including 36,000 hectares of public forests; 3.6 million trees planted; 8,500 coffee farms certified by the Rainforest Alliance; special subsidies for conservation inputs given to women and the elderly. The actions of the water fund will result in up to USD $3 million in increased agricultural yields for smallholders and agricultural producers.

© Simo Räsänen, Wikimedia

ADDITIONAL INFORMATION

TNC:
Insuring Nature to Ensure a Resilient Future

Quintana Roo/TNC:
A Post-Storm Response and Reef Insurance Primer

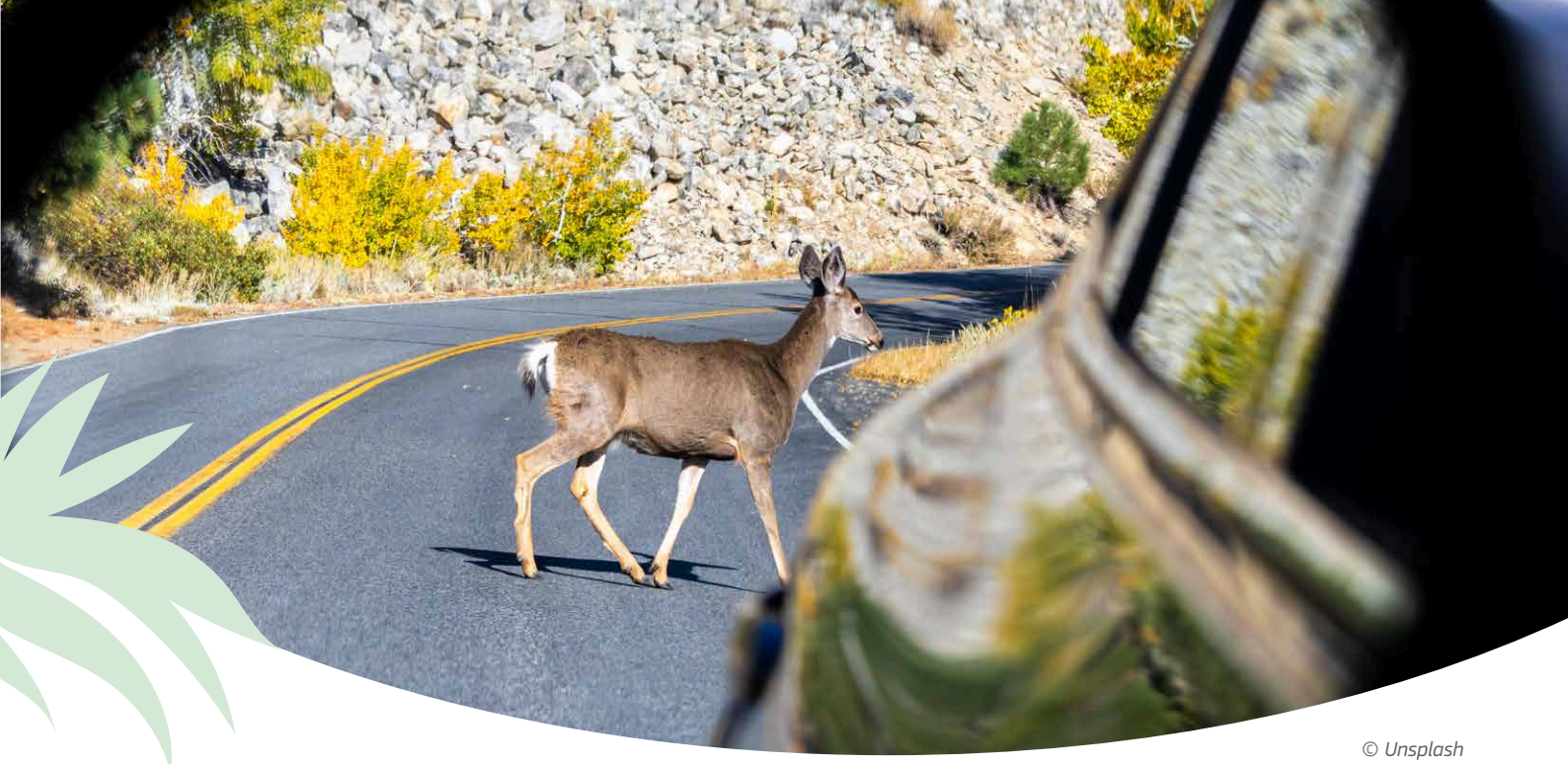
IADB:
Increasing Infrastructure Resilience with Nature Based Solutions

EEA:
Nature-based solutions in Europe: Policy, knowledge and practice for climate change adaptation and disaster risk reduction

BEST PRACTICE LESSONS

The economic cost of not repairing the damage to the coral reef would be much higher to the local economy than paying for the restoration of the reef. Transferring the cost of restoration to the market via an insurance policy reduces the burden for local authorities. The insurance policy is a cost-effective financial investment to guarantee the availability of funding to implement a post-storm response.

TNC is now working to replicate the model developed in Quintana Roo for other reefs and investigate whether other ecosystems such as coastal wetlands could benefit from a similar approach. To date, TNC has engaged with the United Nations Development Program, international organizations and the insurance community. Prospective projects are currently being explored in the Caribbean, Asia, Australia and the United States.



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CASE STUDY – TRANSPORT SECTOR

LARGE MAMMALS IN THE ALPINE-CARPATHIAN-DINARIC REGION

CASE HIGHLIGHTS

Biodiversity enhancement in transport development is possible when green (and blue) and grey infrastructure are planned in a coordinated effort. It is necessary to cross boundaries between sectors!

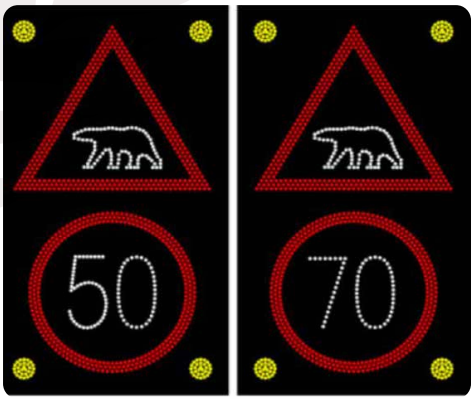
Availability of ecological information is of fundamental importance to identify optimal sites and measures for biodiversity enhancement. It takes time but technology is readily available.

ISSUE ADDRESSED

Infrastructure development introduces barriers to wildlife, currently recognized as one of the main threats for endangered species and a critical obstacle to species recovery. Transport networks divide natural habitats into small isolated patches threatening the survival of entire populations. “Habitat patches” are areas with favourable conditions for the species; these are separated by “barriers” which seriously hinder individuals from passing. Green infrastructure corridors can enhance ecological connectivity between habitat patches.

Species in the region most vulnerable to the impact of motorways and railways are large carnivores (brown bear, wolf, lynx) as well as large herbivores (species of deer, chamois, wild boar). Two projects looked at ways to enhance biodiversity in (planning for) transport and linear infrastructure (TLI) which affect the movement of animals between the Alps and two other mountain regions:

- The Alpine-Carpathian Corridor: This animal migration route is threatened by an increasing demand for built up land between Vienna, Bratislava and Budapest in the Danube and Morava valleys. Austrian and Slovak project partners from nature conservation, spatial planning and transport work together with diverse stakeholders to create a coherent 120 km ecological corridor from the Alps to the Carpathians, by mitigating the fragmentation effects of motorways.
- The LIFE DINALP BEAR project focusses on scientifically valid information of brown bear populations in Northern Dinaric Mountains and south-eastern Alps (Croatia, Slovenia, Austria, Italy) and experiments with measures to address high traffic-related mortality of bears, associated with the increasing fragmentation of its habitat by growing traffic infrastructure.



Dynamic traffic signalization uses sensors to detect when animals are present near roads. As they are only activated when animals are present, drivers are more aware of them than with classical signalization.

APPROACH FOLLOWED

The exchange between populations of mammals such as brown bear, red deer and lynx along traditional migration routes between Alps, Carpathian and Dinaric mountains is increasingly blocked by traffic routes and areas of intensive land use. Re-colonization of the Eastern Alps through natural expansion of bears from existing populations is one of the priorities of bear conservation in Europe. Improving habitat connectivity is critical for establishing a viable bear population in the Alps.

Under the Alps-Carpathians Corridor a system of 'Green Bridges' has been constructed including suitable habitats to reconnect existing stepping stones which are needed as resting and feeding places for migrating animals. The first was constructed in Austria across the A4 Vienna-Budapest motorway. A similar wildlife overpass is introduced in Slovakia across the highway from Bratislava to Brno.

In Croatia, planning for wildlife crossing structures began over ten years ago when possible habitat fragmentation due to a planned motorway became a great concern. Several crossing structure projects have been put into practice, and guidelines on planning and suitability of different structures for animal crossing have been developed. Several highways now have animal crossings (tunnels, viaducts, bridges and green bridges). Some of these have been intensively studied. Animal tracks have been counted on crossings, with between 4 and 37 crossings per day per crossing structure by large mammals. Radio-tracked bear, wolf and lynx showed strong positive selection for tunnels and viaducts. Further measures included electric fencing of problematic motorway sections with frequent collisions, and dynamic traffic signs to alert and slow down drivers coupled to sensors capable to detect large animals approaching the road.

The Green bridge on D2 motorway (Slovakia) to restore animal migration in the Alpine-Carpathian corridor. https://www.youtube.com/watch?v=VMPS86qJMxI

BENEFITS OBTAINED

The Alps-Carpathian Corridor's project structure has created a forum for the managers of these regions to share ideas and develop solutions that can be applied within the entire region, instead of only per protected area. To ensure long-term continuity, key stakeholders are party to a Memorandum of Understanding. In addition, the relevant spatial development plans at regional and federal level will factor in the results and recommendations from this project. Public awareness campaigns and environmental education for schools within the region are part of the project.

Provision of correct information for planning and impact assessment is a priority. The understanding of habitat suitability and spatial connectivity of landscape for brown bears has been obtained by the observation of radio-collared bears. Based on the information, a bear habitat suitability model was developed aimed at identified potential corridors; this information is used in EIA for new projects but also for mitigating the impacts of existing infrastructure. All of this is translated into a *handbook for spatial planning*, as a measure to prevent further fragmentation and to assess current barriers aimed at finding the best areas for corrective measures.

The measures already taken showed traffic collisions with large carnivores and other mammals to be reduced by 50%; radio-tracked bear movements showed clear avoidance effect of the 'treated' road sections.

ELSEWHERE: PENCH TIGER RESERVE, INDIA

As part of the India's National Highway Development Project, it was proposed to upgrade National Highway 44 from a 2-lane to a 4-lane highway. Approval was granted with the condition of provisioning of animal crossing structures to reduce animal-vehicle collisions/mortality and also to ensure habitat continuity in the landscape. Based on extensive research on animal movements and habitat use along the highway in Pench Tiger Reserve, Maharashtra, a 16 km section of the highway was identified for planning wildlife crossings to secure connectivity of habitats. Four minor bridges and five animal underpasses were constructed with spans ranging from 50 m to 750 m. They are the first of their kind in India, and perhaps the largest in the world. Camera trapping efforts showed the effectiveness of all nine crossing structures, with regular crossings recorded of 19 species of large mammals (including 89 tiger crossings!). Between the first and second year, a 195% increase was recorded, showing adaptation of animals to the crossings. The case shows that road upgrading can be used for this benefit of biodiversity and undo earlier damage.

ADDITIONAL INFORMATION

Innovative Alps-Carpathians Corridor re-establishes a major migration route for wild animals, Green Infrastructure for the Benefit of Both People and Nature

Green Infrastructure and the Transport sector

Guidelines how to minimize the impact of transport infrastructure development on nature in the Carpathian countries

A Global Strategy for Ecologically Sustainable Transport and other Linear Infrastructure

Quick tips on Infrastructure and Green mobility

Tiger using NH44 underpass © WII Dehradun

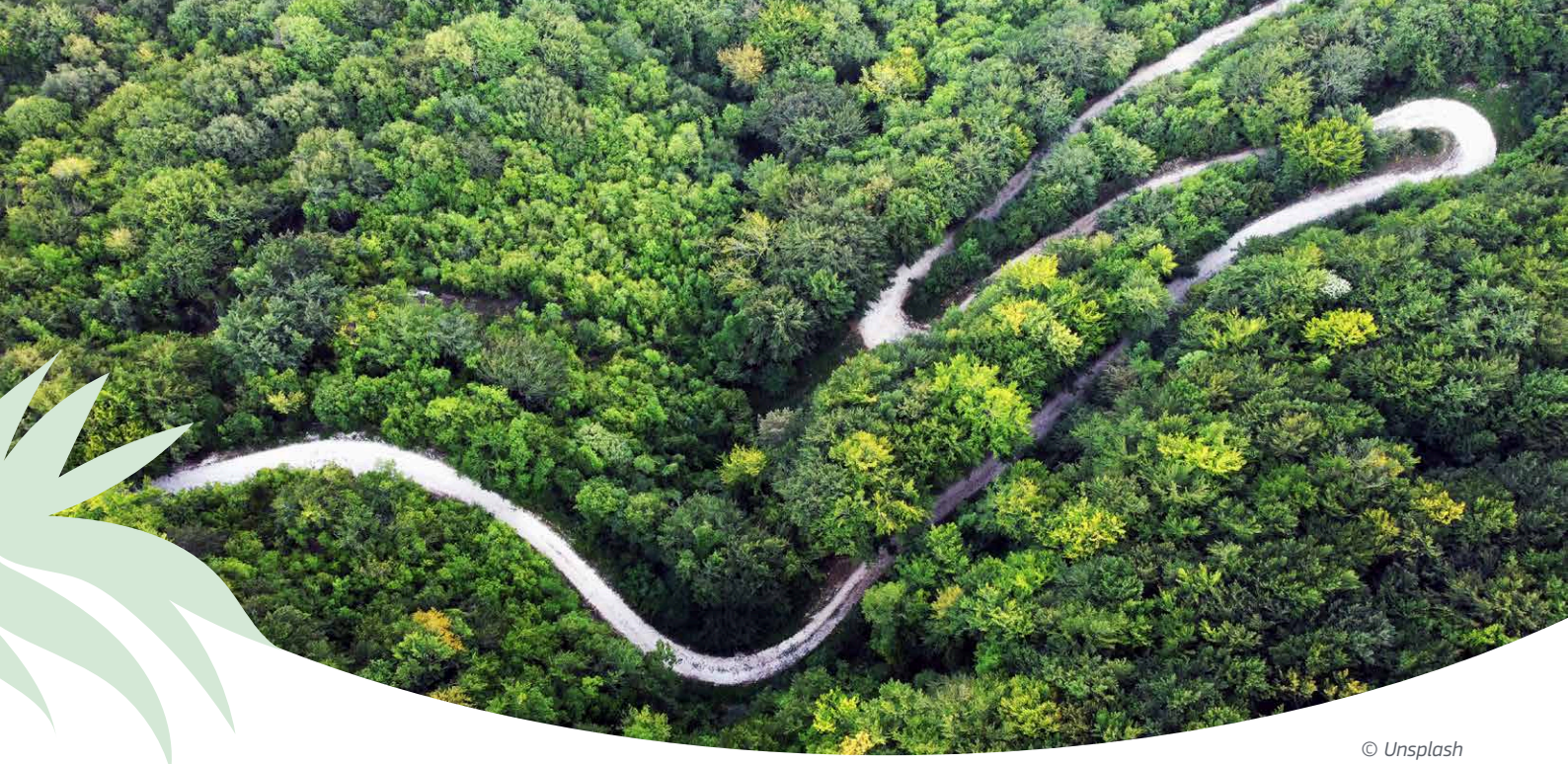
BEST PRACTICE LESSONS

Strategic focus: practice points towards the need to have biodiversity conservation as an objective in national transport master planning and where possible making a link to existing spatial planning frameworks.

Interdisciplinarity: Combined green and grey Infrastructure requires interdisciplinary and interagency cooperation. There is a need to share experiences as there still is little practical experience.

Data on animal movement and use of habitats has proven to be fundamental to identify the best location for ecological connectivity measures and to provide evidence of their concrete use.

Stakeholder involvement at all stages of project development is essential to make use of available knowledge and to avoid conflict.



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CASE STUDY – FORESTRY SECTOR

VERENIKE – ENHANCING BIODIVERSITY AND FOREST RESISTANCE AGAINST FOREST FIRES

CASE HIGHLIGHTS

Instead of planting monocultures in post-fire restoration of forest ecosystems, the VERENIKE project showed that post-fire reforestation may be implemented with a large number of different species, in order to increase resistance against forest fires and enhance biodiversity of burnt forest ecosystems.

ISSUE ADDRESSED

Each summer forest-fire is becoming a more prominent issue all over Europe, particularly in the Mediterranean. While globally some 90 percent of fires are caused by humans, climate change, characterised by drier weather and longer fire seasons[15], leads to more fires becoming "wildfires". The Western Balkans and NEAR East and South regions are becoming more and more vulnerable to such wildfires.

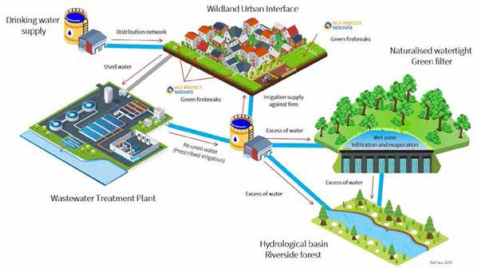
In addition to substantial economic and social impact on the communities exposed to wildfires, wildfires have an unquantified ecological impact, including the degradation of forests, soil erosion and loss of fertility, a decline in biodiversity and the emission of greenhouse gases.[16]

There are disparities and differences among countries in managing forest fires. However, in most cases the post-fire management of burned areas has been given much less attention than fire suppression and prevention; usual practice of active restoration is limited to planting only a few species that can be easily produced on a large scale, resulting in a 'restored' ecosystem characterised by low biodiversity.

APPROACH FOLLOWED

The VERENIKE project recognized that conditions of a wildfire are favourable to regeneration. The project focuses on developing a new methodology involving the germination and cultivation of a wide range of forest species in mini-plugs[17] for post-fire restoration of forest ecosystems. This was the first time in Greece that seedlings of a great variety of species have been used to reforest burnt areas.

[15] https://www.fao.org/3/cb6627en/cb6627en.pdf
[16] https://hdr.undp.org/system/files/documents//riskproofingthewesternbalkanspdf.pdf
[17] A plug plant is a seedling that was sprouted and grown in a small cell. Plug plants are often grown together in a large tray with many cells. Plug plants grow easier than starting plants from seed.



Detailed scheme of the hydraulic system and its components. Source: The GUARDIAN project Journal N° 1. https://www.uia-initiative.eu/sites/default/files/2020-06/Riba%20Roja_GUADRIAN_Journal%201.pdf

ADDITIONAL INFORMATION

EC, 2018, FOREST FIRES - Sparking fire smart policies in the EU

FAO, 2006, Fire management Voluntary guidelines: Principles and strategic actions

The first step was the collection and handling (cleaning and storing) of more than 65 kg of seeds from 26 targeted Mediterranean species (shrubs and trees), including the development of cultivation manuals for seedlings in mini-plugs. A prototype system was constructed, with the capacity to produce numerous high-quality seedlings for a variety of the targeted species throughout the year (more concretely, between 20 000 and 75 000 seedlings per cultivation period during the project duration). In the field, the project reforested three pilot areas using seedlings from the 26 targeted Mediterranean species (18 different species at each site). The survival and growth characteristics of the transplanted seedlings were monitored for two years to assess the success of the developed methodology, and the ability of the species to overcome transplantation shock and adverse field conditions.

BENEFITS OBTAINED

The project demonstrated that a large number of different species may be used to regenerate burnt areas. Nevertheless, the characteristics of the regenerated sites and the species that are aimed to be planted are crucial and determine the success of the regeneration effort. The project also provided guidelines as to which species are more suitable for each site, as well as germinability protocols for 22 Mediterranean forest species.

BEST PRACTICE LESSONS

In order to enhance biodiversity and increase the forest ecosystem resilience, as many different forest species as possible should be used, bearing in mind they are native to the ecosystem.

On a strategic level, a holistic approach should be promoted, by developing integrated solutions which take into account the objectives of forestry, urban and rural development, agricultural, climate and energy policies to ensure that wildfires are managed in such a way that the safety of people and housing, economic growth and ecosystem services are maintained or increased.

ELSEWHERE: BUILDING FIRE RESILIENCE USING RECYCLED WATER, SPAIN

In contrast to the VERENIKE example which deals with post-fire management, this project focuses on reducing fire risks while providing a safe natural environment for citizens.

Fires in wildland-urban-interface areas are exceeding fire-fighters' capacities to respond simultaneously to wildfire suppression, community evacuation and structure protection. Recycled water is used to increase the resilience of forested area around a town of 15,000 against forest fires. Projects to design, build and maintain green firebreaks, reusing water from the urban wastewater treatment plants, can prevent the advance of fire in the urban-forest interface area. It consists of building hydraulic infrastructure, including a water treatment station for the elimination of microcontaminants. The reclaimed wastewater is also used to improve the water quality of an existing wetland. Green firebreaks consist of low flammability strips of vegetation of strategically planted fire-resistant trees, designed in a way to form transitional 'green belts' around the urban area. Groundwater recharge is an additional benefit.

Source: Climate ADAPT, Case study

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CASE STUDY – RURAL DEVELOPMENT SECTOR

CLIMA EAST – SUSTAINABLE MANAGEMENT OF PASTURES AND FORESTS IN NEAR EAST COUNTRIES

CASE HIGHLIGHTS

The Clima EAST project showed that intact ecosystems can have a strong and cost-effective, positive effect, both on climate change mitigation and adaptation. An ecosystem-based approach combining rural development, sustainable land management, and sustainable livelihoods can establish community-centred solutions to climate change. Although the project was focussed on climate issues, the benefits for biodiversity were more than evident - over 66,000 hectares of key ecosystems and at least 57 key species of flora and fauna have either reduced climate-related threats and/or improved their biodiversity status.

ISSUE ADDRESSED

Unsustainable land management in the past and the impacts of climate change through increased droughts and erratic weather resulted in land degradation in six NEAR East Countries. The primary reason of degraded pastures in Azerbaijan, Armenia, Georgia and Moldova is overgrazing, which results in losses of organic soil carbon through wind and water erosion and soil impoverishment. As a consequence, ecosystems and their services for farming communities are negatively impacted. In Belarus and Ukraine, peatlands are degraded due to large-scale drainage projects implemented in the past for agricultural needs, but with only temporary viability.

APPROACH FOLLOWED

The CLIMA East project supports the development of ecosystem-based approaches to climate change as well as regional co-operation between the NEAR East countries. It focuses on pasture and forest restoration and sustainable pastoral management in 4 countries and peatlands conservation and improved peatlands management in 2 countries. Primarily it has a strong climate adaptation and mitigation component (avoiding GHG emission by replacing fossil fuel with biomass, and through the restoration of peatlands, forests, and pastureland) with co-benefits to biodiversity.

Through the project, rotational grazing, new roads, water supply systems, etc. have been introduced in order to minimize the pressure on pastoral ecosystems and therefore improve their productivity and biodiversity. In Armenia, a mixed line of climate-resilient trees is established, creating a new forest belt which mitigates heavy winds.


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"Now, I understand what a sustainable solution truly means. This is a win-win for the nature, the people, and the economy."

Oleksandr Pyvovar,
Head of Kukshyn village council (Ukraine)

Source: Clima East – Shifting ground,
https://www.adaptation-undp.org/shifting-ground

BENEFITS OBTAINED

Overall, over 66,000 hectares of key ecosystems and at least 57 key species of flora and fauna have either reduced climate-related threats and/or improved their biodiversity status.

- **Belarus:** Construction and maintenance of water-regulating facilities and access points to provide active regulation of water levels and access for machinery that, in return, will help to sustain the natural condition of the peatland and conserve endangered species of plants and animals; an increased number of birds can be found in the restored peatlands;
- **Azerbaijan, Armenia:** Established rotational grazing systems for 16 farms of approximately 3000 hectares in total. Restored more than 3000 hectares of summer pastures – reducing pressures on pasture ecosystem, allowing them to regenerate and therefore allowing the pastoral practices to persist.
- **Armenia:** Established 34.2 hectares of new forest belts, including 18.2 hectares of community forest; rehabilitated 25.8 hectares of degraded natural forest to protect the settlement from heavy wind; improved road conditions that allow cattle and sheep to move between summer and winter pastures, ensuring that winter pastures aren't overgrazed and limiting soil erosion during livestock transit;
- **Georgia:** Installation of water supply systems and watering points in order to lower pressure from sheep movement routes, and to reduce pressures on pastoral ecosystem and a protected area;

ELSEWHERE: SHEEP-GRAZING TO MAINTAIN AN OPEN LANDSCAPE, POLAND

Contrary to the previous example and the CLIMA East project, the typical open landscapes within the Popradzki Landscape Park in Poland were threatened by overgrowth and shrub encroachment due to land and sheep farm abandonment and under grazing. In order to preserve montane meadows and pastures it was crucial to bring back an indigenous sheep species and sheep farming practice into the region. Through a good cooperation with local farmers, the sheep farm has expanded the scale of production to enhance its income based on the production and sale of cheese, mutton, wool and other "grazing services".

ELSEWHERE: LOCAL SUSTAINABLE DEVELOPMENT SOLUTIONS FOR PEOPLE, NATURE, AND RESILIENT COMMUNITIES, MOROCCO

Amsing Association was formed by members of Douar Elmoudaa village in order to contribute to the development of the village and to protect the natural resources critical to local livelihoods in a context of infrastructural isolation and a harsh climate. The farming communities in Douar Elmoudaa village are particularly vulnerable to the impacts of unpredictable rainfall patterns and variations in temperature due to climate change. Amsing Association has successfully reintroduced a traditional land management practice called 'azzayn' which bans herders from grazing their livestock on protected lands. By outlawing grazing in certain degraded areas of land through the enforcement of the azzayn system, the community has protected and sustained native shrubs and grasses, allowing them to passively regenerate in areas from which they had disappeared. As a result, Douar Elmoudaa is now home to varieties of native flora that have completely disappeared in other areas of the valley. This passive revegetation, alongside the planting of native tree species on ten hectares of land surrounding the village, benefits biological diversity and has as well lessened the effects of erosion in the local area and reduced the risks of flash-flooding.

Source: UNDP, Equator Initiative, Amsing Association, Morroco, Case study

ADDITIONAL INFORMATION

Handbook for developing and implementing Pro-Biodiversity Business Projects, 2009

Agriculture Sector and Biodiversity Conservation Best Practice Benchmarking

Practical guide on biodiversity for SME s in the agri-food sector, 2022

Business@Biodiversity

List of potential AGRICULTURAL PRACTICES that ECO-SCHEMES could support

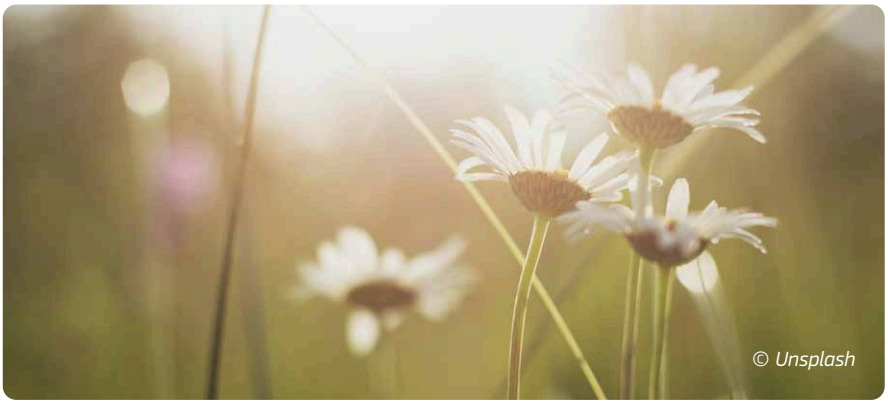
Agri-environment schemes: impacts on the agricultural environment , 2017

- **Moldova:** The productivity of pastures due to restoration activities more than doubled, from 2tonnes of hay per hectare in 2014 to 4.6 tonnes in 2016.
- **Ukraine:** Converting degraded private arable peatlands to semi-natural conditions with high value for local people and biodiversity conservation; cleaning of 12km of the existing main irrigation canal, repairing 4 sluices and 12 tube crossings at irrigation system. As a result, the risk of devastating fires decreased and plants and animals have returned to the area.

BEST PRACTICE LESSONS

Ecosystem-based approaches in managing pastural, forest and peatlands (but also in other agricultural activities) focus on enhancement of services these ecosystems provide to the communities. Healthy ecosystems are more resilient to climate change and can help farming communities to cope with it.

Local farming communities play a central role in the process of ecosystem-based land management. Since a shift in regular practice is needed, awareness raising among the local communities on the benefits of this approach is crucial.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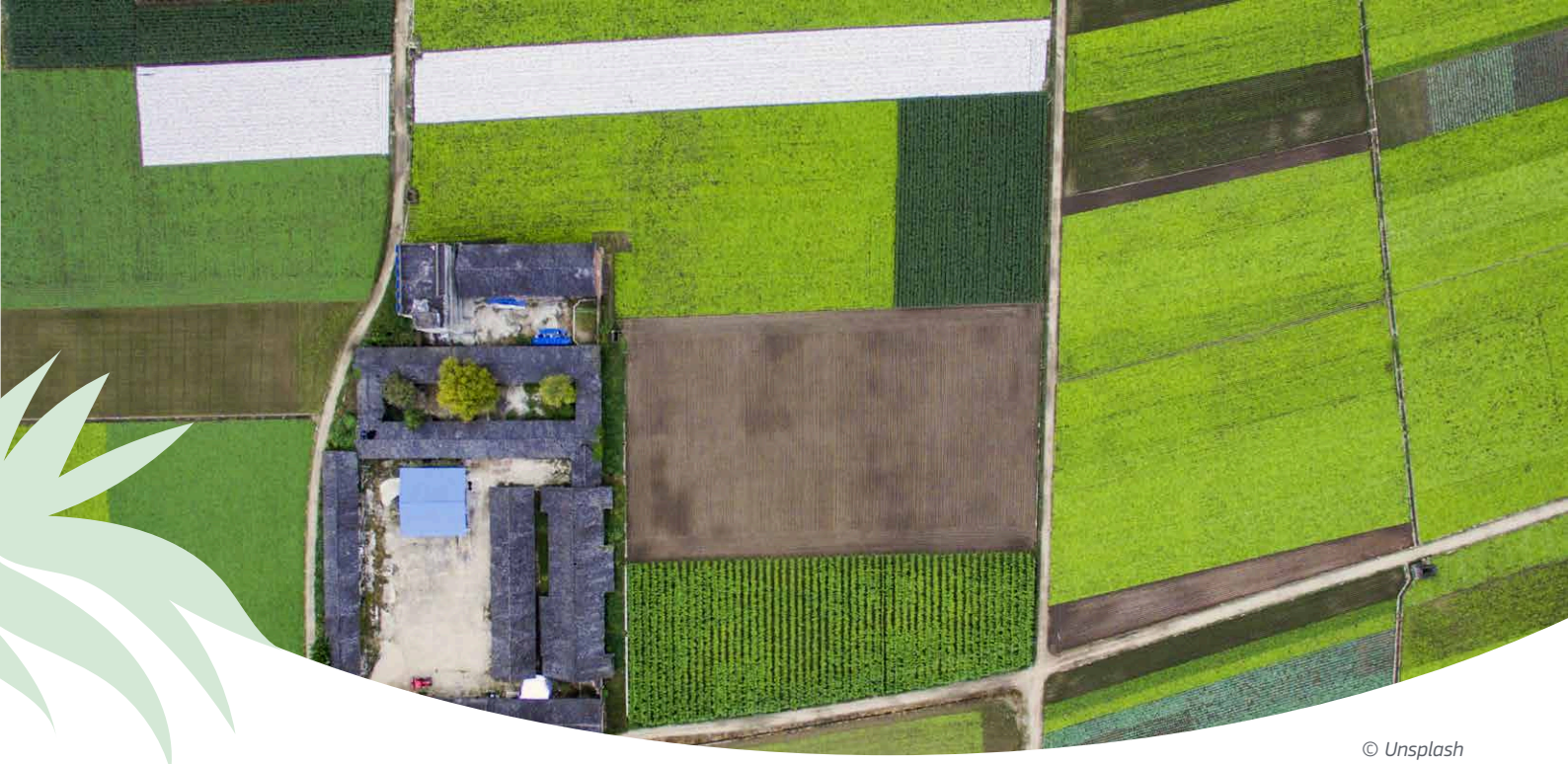

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CASE STUDY - WASTE SECTOR

PHYTO-REMEDIATION OF CONTAMINATED AGRICULTURAL SOIL (ECOREMED PROJECT)

CASE HIGHLIGHTS

Phytoremediation, i.e. the use of green plants and associated microorganisms to clean up contaminated soils, preserves soil resources and improves ecosystem services of the soil by a combination of low input soil management techniques (such as soil ripping to reduce soil compaction and compost fertilization) and permanent soil covering by vegetation. It is cost-effective compared to other chemical and physical techniques, whose costs can be 20-50 times higher.

ISSUE ADDRESSED

Soil pollution is an increasing concern for the environment, for water systems and for public health, due to the risk of pollutant accumulation in the food chain.

The project developed an operative protocol for phytoremediation of contaminated agricultural soils and demonstrated its effectiveness on six different pilot sites with different types and levels of contamination:

- physically degraded sites;
- sites contaminated by bioavailable[18], immobile[19] Potentially Toxic Elements (PTEs), in this case copper;
- sites contaminated by PTEs (chromium and zinc) and/or organic contaminants (e.g. oil pollution);
- sites contaminated by mobile/bioavailable PTEs (lead and cadmium).

APPROACH FOLLOWED

Depending on the land characteristics and type and level of contamination, different remediation techniques were conducted on the sites, which revealed that:

- in case a site is contaminated by bioavailable PTEs, remediation is necessary since the contaminants are absorbed by crops. Phytoremediation could be used to secure an area and fix contaminants, reducing the risk it may reach people. However, to secure dismissed sites permanently, it is necessary to isolate the pollution sources from other environmental compartments and phytoremediation need to be assisted with other remediation techniques (for example to avoid substances to reach groundwater).

[18] Bioavailability, in environmental and soil sciences, represents the amount of an element or compound that is accessible to an organism for uptake or adsorption across its cellular membrane.

[19] Mobility in soil is the potential of a substance, if released to the environment, to move under natural forces to the groundwater or to a distance from the site of release.


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- in case pollution is caused by non-bioavailable PTEs (e.g. chromium) and/or organic compounds (e.g. hydrocarbons, DDT) phytoremediation is used to temporarily secure the area, providing time for bioremediation by bacteria and fungi to degrade organic pollutants. In these cases, harvestable biomass from the site will be not contaminated and can be used without limitation.
- in case of physically degraded land, phytoremediation can be used to restore the environment together with waste disposal and removal. A combination of phytoremediation and agronomic techniques to restore soil fertility is most appropriate.
- if biomass produced on the site is contaminated, contaminants can be removed by pyrolysis[20] while producing so-called biochar. Biochar is somewhat similar to charcoal and can be used for energy production.

BENEFITS OBTAINED

Direct environmental benefits to sites where the protocol was applied:

- Soils polluted with different contaminants were cleaned up and given back to agricultural use;
- Phyto-remediation plants and trees reduced contaminant movements toward groundwater by 30 % and achieved 65 % efficacy in removing organic pollutants;
- Increase in organic soil matter (carbon storage) was different at each site, but reached up to 2 t/ha (in 30 cm soil layer), contributing to improving soil quality but also to climate change mitigation;
- Trees and underlying grasslands also helped in absorbing nitrates, thus protecting groundwater from pollution;
- Phyto-remediation strategies allow to concentrate contaminants - avoiding their mobility - in biomass, which can be used to produce renewable energy, additionally saving up to 10 t/ha of CO_2 emissions.

[20] Pyrolysis process is the decomposition of materials at high temperatures without oxygen. Best known example is production of charcoal.

ELSEWHERE: GREENING OF WASTE PROCESSING FACILITY, FRANCE

Nantes Métropole has been committed to sustainable development for 15 years, a commitment marked by the award of the European Green Capital title in 2013. Nantes has stepped up and taken a new direction by effectively involving the local area and all its stakeholders in the ecological transition, to reduce greenhouse gas emissions, preserve the environment and its citizens' quality of life.

Arc-en-Ciel in Nantes, north-western France, is home to a waste recovery plant operated on behalf of the Nantes metropolitan authority. Located close to a Natura 2000 protected area. An on-site assessment by an ecologist was used to draw up an action plan to improve the site's environmental performance and create and implement an ecological management plan. In 2016, the waste recovery plant was the first such unit to be certified Biodiversity Commitment by ECOCERT Environment. Some actions put in place included establishment of a large parcel of natural grassland grazed by Ouessant sheep. The presence of sheep, apart from cutting grass naturally, brings with it positive benefits in terms of the arrival of insects and birds formerly discouraged by grass-cutting machinery. Moreover, a compost-enriched zone is established to fertilize the soil in preparation for future tree planting, as well as a picnic area with tables and benches made from recycled waste.

Source: www.veolia.com

ADDITIONAL INFORMATION

Assisted phytoremediation for restoring soil fertility in contaminated and degraded land

ECOREMED, LAYMAN REPORT

Moreover, the socioeconomic advantages of phytoremediation with respect to other high-technology strategies were clear. The protocol proved to be very cost effective compared to the main alternative solutions: € 100,000 /ha compared to € 2-5 million /ha for 'dig and dump' and € 1-2 million/ha for 'capping with cement platforms'.

BEST PRACTICE LESSONS

It is vital to determine the sources of contamination, the land uses and the population at risk in order to develop the remediation techniques. Attention must be paid to how the land and its ecosystem services are used by the surrounding population. Since contaminated land usually is a very sensitive topic in local communities, timely and meaningful public communication is necessary for building a climate of confidence and credibility about the innovative approaches for agricultural soil remediation.

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CASE STUDY – ENERGY SECTOR

SOLAR PARKS IN GERMANY

CASE HIGHLIGHTS

Solar (or Photo-Voltaic = PV) Power parks are suitable for promoting biodiversity! By planning solar parks on degraded areas and areas of low biodiversity value, there are opportunities to enhance biodiversity within the boundaries of solar parks but also in surrounding areas. Moreover, these areas are suitable also for agricultural activities, such as beekeeping, grazing, cultivation of crops by nurseries, etc.

ISSUE ADDRESSED

The usual impacts of solar parks on biodiversity are related to habitat loss through land clearance, habitat alteration due to changes in microclimatic condition, habitat fragmentation and disruption of wildlife migration by fences, bird collision with solar panels (mistakenly seen as water bodies) and power lines, etc. These impacts are usually considered in an environmental impact assessment procedure in which mitigation measures and adequate monitoring are prescribed accordingly.

However, in addition to standard mitigation measures, there are also opportunities in developing solar parks to enrich biodiversity and preserve, restore or establish new ecosystem services at the site if biodiversity concerns are considered early in the process - starting from site selection and avoidance of high-value biodiversity sites, taking into account local environmental conditions and land use, continuing with nature conservation/enhancement measures during construction and operation.

APPROACH FOLLOWED

In a number of cases in Germany, the development of solar parks was coupled with biodiversity enhancement measures. Although these measures resulted from strategic environmental assessment at planning stage and environmental impact assessment at design stage, they did go beyond the standards mitigation measures, such as minimisation of the sealed area, requirements for a chain-link fence that allows small wild animals to pass, etc.

The solar plant in Salmdorf near Munich was planned on an area with a history of gravel pits, landfills, and agriculture. During construction of the solar plant, a species-rich meadow was developed, which is mown twice a year. This already led to a significant improvement in the environmental quality of what used to be a field with few animal or plant species. In addition, numerous other measures were implemented to enable an additional improvement in environmental quality. For example, a wide belt of grassland bordered by hedges and trees was created to surround the solar plant and two ponds were dug on the site serving as stepping-stone biotope for the threatened green toad.

At the **Fürth-Atzenhof** solar plant, the grassland is maintained and conserved by a shepherd, who grazes sheep on the site twice a year. Grazing is a natural means of avoiding regrowth of shrubs and trees (which are obviously incompatible with solar panels) and leads to a larger variety of herbal plant species. The 1 hectare solar plant was built in 2003 on the southern slope of the former municipal landfill site. Investigations in 2009 revealed an astonishing diversity of plant species. A total of 254 types of ferns and flowering plants and 30 types of moss were found, 23 species being included on red lists at regional, national or international levels.

Solar parks can also help conserve the **regional genetic diversity of plant** by using native seeds and plants that are suitable for the site and that have been obtained from within a defined source region. Depending on the project objectives, it may be desirable to leave an area unsown. If it is left to form its own ground cover, species will establish themselves over the years. This type of ground cover can be encouraged by sowing hay flowers or by spreading suitable grass cuttings containing seeds.

ADDITIONAL INFORMATION

Solar parks – profits for biodiversity

EC, Wind & solar energy and nature conservation, 2014

Opportunities to enhance pollinator biodiversity in solar parks, 2021

Solar parks – Opportunities for Biodiversity, 2010

IUCN, Mitigating biodiversity impacts associated with solar and wind energy development

BENEFITS OBTAINED

The most significant benefits for biodiversity can be obtained by planning the solar parks on degraded land and brownfield sites. Further benefits include regional genetic plant diversity and productive benefits such as grazing and beekeeping. Surrounding agricultural land benefits from the enhanced biodiversity, for example by enriching species for pollination and pest control.

BEST PRACTICE LESSONS

Strategic planning – Plan the location of solar parks in the areas that are unproblematic from the aspect of nature conservation, such as degraded land and brownfield sites with opportunities for enhancing biodiversity. Involving environmental experts and applying SEA can help in identifying appropriate sites. Take into consideration local environmental conditions and land use in the surrounding area. In case of agriculture activities in surrounding area, connect with local people to seek for opportunities to enhance biodiversity on solar parks but also in the wider area.

Designing and operation – Envisage appropriate design, seating of the solar panels and use of the remaining area. Integrate nature conservation and enhancement measures and extensive maintenance measures into design. Use native species for seeding. Regularly and properly maintain the area.

ELSEWHERE: CREATION OF GREEN CORRIDORS FOR BIODIVERSITY UNDER HIGH-VOLTAGE LINES, BELGIUM AND FRANCE

Nantes The aim of the project was to create green corridors under overhead electrical lines in wooded areas in Belgium and France. The idea was to replace conventional vegetation management ("U" shaped corridor) by the alternative one ("V" shaped corridor).

Various innovative actions took place in order to enhance biodiversity and to raise people awareness concerning natural habitats and species linked to this linear context. The actions included planting and restoration of forest edges, fruit trees of wild and local species, restoration of natural habitats protected by the EU Habitats Directive (bogs, moors, chalky grasslands and lean meadows), digging of ponds, establishment of a pasture or mowing, combating invasive plant species, and harvesting seeds, sowing and mowing of flower meadows. The project showed that with proper management, the land under powerlines can enable and support greater biodiversity.

Source: LIFE Elia, http://www.life-elia.eu/en/The-project