Report on Socio-Economic Benefits of Wetland Restoration in Central and Eastern Europe

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Abbreviations:

BROZ	Bratislavské Regionálne Ochranárske Združenie (Regional Association for Nature Conservation and Sustainable Development)
CBD	Convention on Biological Diversity
CC	Creative Commons
CEE	Central and Eastern Europe
CEEweb	Central and Eastern European Web for Biodiversity
CICES	Common International Classification of Ecosystem Services
EC	European Commission
EEA	European Environmental Agency
EIA	Environmental Impact Assessment
ES	Ecosystem Services
ETC/BD	European Topic Centre on Biodiversity
EU	European Union
EUR	Euro
FAO	Food and Agriculture Organisation of the United Nations
GEF	Global Environmental Facility
GI	Green Infrastructure
IAS	Invasive Alien Species
IGES	Institute of Global Environment and Society
IUCN	International Union for the Conservation of Nature
LIFE Fund	L'Instrument Financier pour l'Environnement
MAES	Mapping and Assessment of Ecosystems and their Services
NGO	Non-Governmental Organisation
PPP	Purchase Power Parity
RBD	River Basin District
TEEB	The Economics of Ecosystems and Biodiversity
UNEP	United Nations Environment Programme
US	United States of America
US EPA	US Environmental Protection Agency
WCMC	World Conservation Monitoring Centre
WWF	World Wildlife Fund

Introduction and rationale

Wetlands – intermediate, or, as ecologists call it - *ecotone* - habitats between land and water have traditionally been seen as an unfriendly landscape. A seemingly terrestrial habitat, yet hiding treacherously deep water and mud within, uninvitingly hidden in a layer of mist. Not suitable for most human use such as agriculture or developing infrastructure, they have come to be seen as wasteland. This lack of understanding of the role wetlands play in ecosystem and societal health has resulted in the loss of 64% of the Planet's wetlands since 1900 and as much as 87% since 1700 (Davidson 2014).

Converted to other land uses, fragmented, drained, polluted with excess nutrients, chemicals and affected by climate change, wetlands and their biodiversity dependent are under threat. As noted by the World Wildlife Fund's (WWF) Living Planet Index (2014), freshwater vertebrate animal populations have decreased by 76% between 1970 and 2010. Worldwide, amphibians are the most threatened animal class with 30.2% of the species being endangered according to the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species (Baillie et al 2004). In Europe, 37% of European freshwater fish (Freyhof and Brooks 2011) and 31% of European non-marine molluscs are threatened according to the European Species Red List (Cuttelod et al 2011). However, species loss due to habitat loss is not the whole worrisome story of wetlands. The loss of wetland biodiversity is further accompanied by the loss of valuable ecosystem services. According to the Millennium Ecosystem Assessment (2005), wetland ecosystem services deliver benefits to the human society worth over €12 trillion every year. Together with the loss of wetlands, we are losing access to fresh drinking water, coastal and flood protection, carbon storage and wetland livelihoods (Ramsar 2015c).

Recognising the importance of protecting Europe's remaining wetlands and of restoring those that have been degraded, CEEweb for Biodiversity decided to focus its ecosystem restoration projects on wetland habitats. Within the frames of "Building Blue-Green Infrastructure in Central-Eastern Europe: from Pilot Projects to Regional Action" project funded by Michael Otto Foundation for Environmental Protection CEEweb for Biodiversity restored three wetland ecosystems in Slovakia, Estonia and Romania. The present report not only details the results of those projects but further analyses the ecosystem services of Central and Eastern European wetlands. With this research, we intend to raise awareness regarding the benefits of healthy wetland ecosystems and influence decision makers to devote attention and funding to wetland restoration and management. We specifically focus on ecosystem services of wetlands and the restoration and improvement of ecosystem service

flow through wetland restoration, as we believe that emphasizing the socio-economic benefits of nature conservation has the potential to bring multi-sectorial stakeholders on board of wetland conservation. CEEweb for Biodiversity has been active in capacity building and stakeholder involvement among both conservation and non-conservationist stakeholders in Europe for the past 20 years and we have noticed the need to stress the ecosystem service approach to environmental protection. With this report, we would like to draw the attention towards the ecosystem services of one of the most valuable yet much degraded habitat type – European wetlands.

Literature Review

What are wetlands?

Wetlands are ecotone habitats, stretched between terrestrial and aquatic habitats, seasonally or permanently saturated with water (Ramsar 2015a). Hydric soil and anaerobic conditions result in specific vegetation which distinguishes wetlands from other aquatic and terrestrial ecosystems.

Present report will follow the Ramsar Convention's (1987) understanding of wetlands – as a habitat type including rivers and lakes (up to 2 meters deep), marshes, swamps, peatlands, wet grasslands, tidal flats, deltas, mangroves, coral reefs, near-shore marine areas as well as man-made habitats such as rice paddies, reservoirs, salt pans and fish ponds. Wetlands are distinguished by their permanently high water table level which reaches almost to the wetland surface. The hydric soil supports hydrophytes, or aquatic plants.

Definition

> The Ramsar Convention (1987, Article 1.1) defines wetlands as "(...) areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres." "[Wetlands] may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six metres at low tide lying within the wetlands" (Ramsar Convention 1987, Article 2.1).

Wetland typology

Paul Keddy (2010, pp 2) emphasizes that a wetland is "an ecosystem that arises when inundation by water produces soils dominated by anaerobic processes, which, in turn, forces the biota, particularly rooted plants, to adapt to flooding." Wetlands vary depending on the intensity and timing of flooding, salinity, nutrients available in the soil, disturbances,

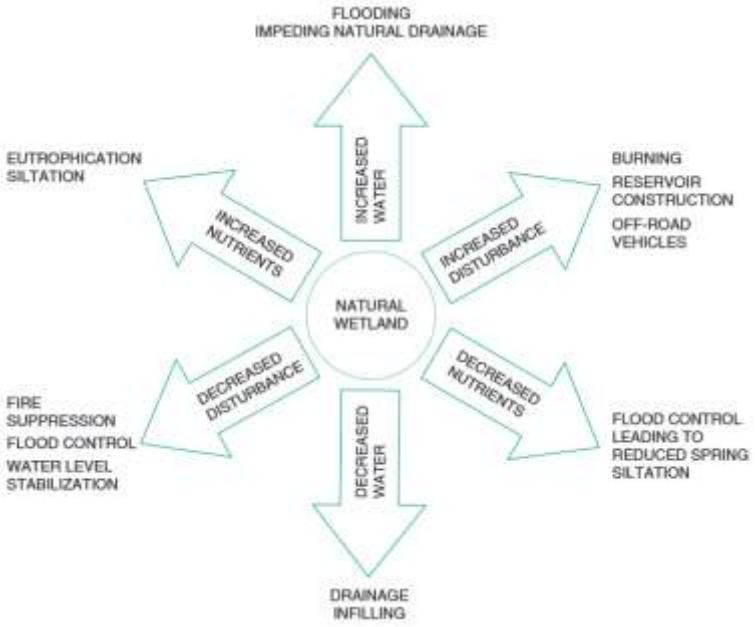


Figure 1 Flooding, disturbance and nutrients as the three main factors behind wetland variability

competition and the presence of herbivorous animals. Thus, the main factors influencing the formation of a particular type of wetland are the hydrological regime, land topography, vegetation and anthropogenic impact. Figure 1 is an illustration of the resulting principle that "three key factors (flooding, disturbance, and nutrients) control much of the variation in wetland communities (Keddy 2010, pp 31)".

There are numerous types of wetlands; for instance, WWF (2015) counted 42; however, classifications vary between countries, depending on specific typology and its determinants. Figures 2 and 3 portray the main determinants of wetland character and type with examples.

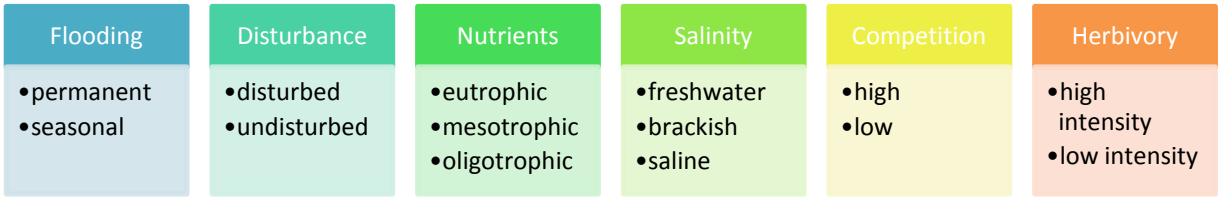


Figure 2 Wetland characterising variables I

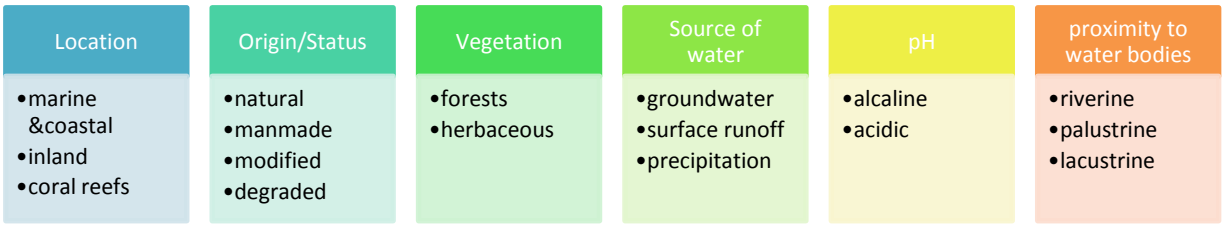


Figure 3 Wetland characterising variables II

Selected types of wetlands are briefly characterised in Figures 4 and 5.

Swamp

- Forested wetland
- Occurs on river banks or around lakes
- Swamp forests or shrub swamps
- Mangroves or freshwater forest swamps
- E.g.: Pripyat Swamps, Ukraine and Belarus

Marsh

- Herbaceous wetland
- Occurs on stream and lake edges, forms transitional habitats
- Overgrown by reeds, rushes, grasses and shrubs
- E.g.: Cepkeliai Marsh, Lithuania

Bog

- Also called peatland or peat mire
- Occurs on acidic soils poor in nutrients
- Overgrown by *Sphagnum* moss, ericaceous shrubs and peat-forming plants
- E.g.: Viru Bog, Lahemaa National Park, Estonia,

Riverine floodplain

- Area surrounding a river which is persiodically flooded by it
- Overgrown by water loving trees and bushes and reedy vegetation
- Rich in nutrients from the flooding and organic matter
- E.g. the floodplain of River Tisza in Hungary

Oxbow lake

- A cut off meander of a river, separated either by natural fluvial processes or by channelisation of the river
- Overgrown by riparian vegetation
- E.g. oxbow lakes along the Danube in Slovakia (e.g. the polit project site of the Michael Otto Project

Figure 4 Selected wetland typology

Saline lake

- Inland lake containing salty or brackish water
- Form when inflowing water cannot escape the lake, it evaporates and leaves higher salt concentrations behind
- Depending on salinity, overgrown by typical lacustrian vegetation or hardly anything (e.g. Dead Sea)
- E.g. lakes on the Baltic Sea shore, separated from the sea by a sandy spit, Aral Sea, Dead Sea

Sodic lake

- Strongly alkaline lake, with pH between 9 and 12 (can also be saline)
- Sodic lakes host a n exceptional diversity of microbial organisms
- Overgrown by alkaphile vegetation, adjusted to alkalinity and unable to live in neutral pH
- E.g. Sodic lakes in Hortogaby National Park, Hungary

Alpine meadow

- Wet meadow ocurring at high altitudes
- Develop where sufficiently thick soil has formed on the bedrock whcich block water outflow
- Overgrown by mire vegetation adapted to the difficult weather conditions
- E.g. alpine meadows in the Tatra mountains, Poland and Slovakia

Freshwater spring

- A place where underground water from an aquifer surfaces
- The water either seeps gently from underground or comes more intensively through a crack in the rocks
- A spring can lead to the formation of a stream or a lake
- E.g. Sachsenbrunnen in Germany

Fen

- Peat-forming wetland
- Occurs on nutriend rich, alkaline or pH-neutral soils
- Overgrown by sedges, grasses and brown mosses
- E.g: Avaste Fen, Estonia

Mangrove

- *Rhizophoraceae* forest ecosystem
- Salt-filtering halophytes, adapted to salinity, anaerobic and waterlogged conditions
- Growing in saline coastal water
- In the tropical and sub-tropical climate, two thirds of tropical coastline are lined with mangrove forests (WWF 2015)
- E.g.: Shinas, Mahout Island and Qurm Park, Oman, Sea of Oman, nothern Persian Gulf, Iran

Coral reef

- Peat-forming wetland
- Occurs on nutrient rich, alkaline or pH-neutral soils
- Overgrown by sedges, grasses and brown mosses
- E.g.: Darwin Mounds, off the northwest coast of Scotland, Røst and Sula Reefs, Norway

Figure 5 Selected wetland types II

Wetlands are among the most biologically diverse habitats on Earth (CBD 2015, Russi et al 2013, WWF 2015).

Where are wetlands found?

The many varying definitions and typologies of wetlands result in different worldwide wetland maps produced by different institutions. A notable example of a wetland is Pantanal – the largest tropical wetland in the world, situated in Brazil, Bolivia and Paraguay. The following maps (Figures 7 and 8) illustrate the distribution of wetlands in the world according to UNEP (Figure 7) and the US Department of Agriculture (Figure 8).

Figure 6 Pantanal tropical wetland

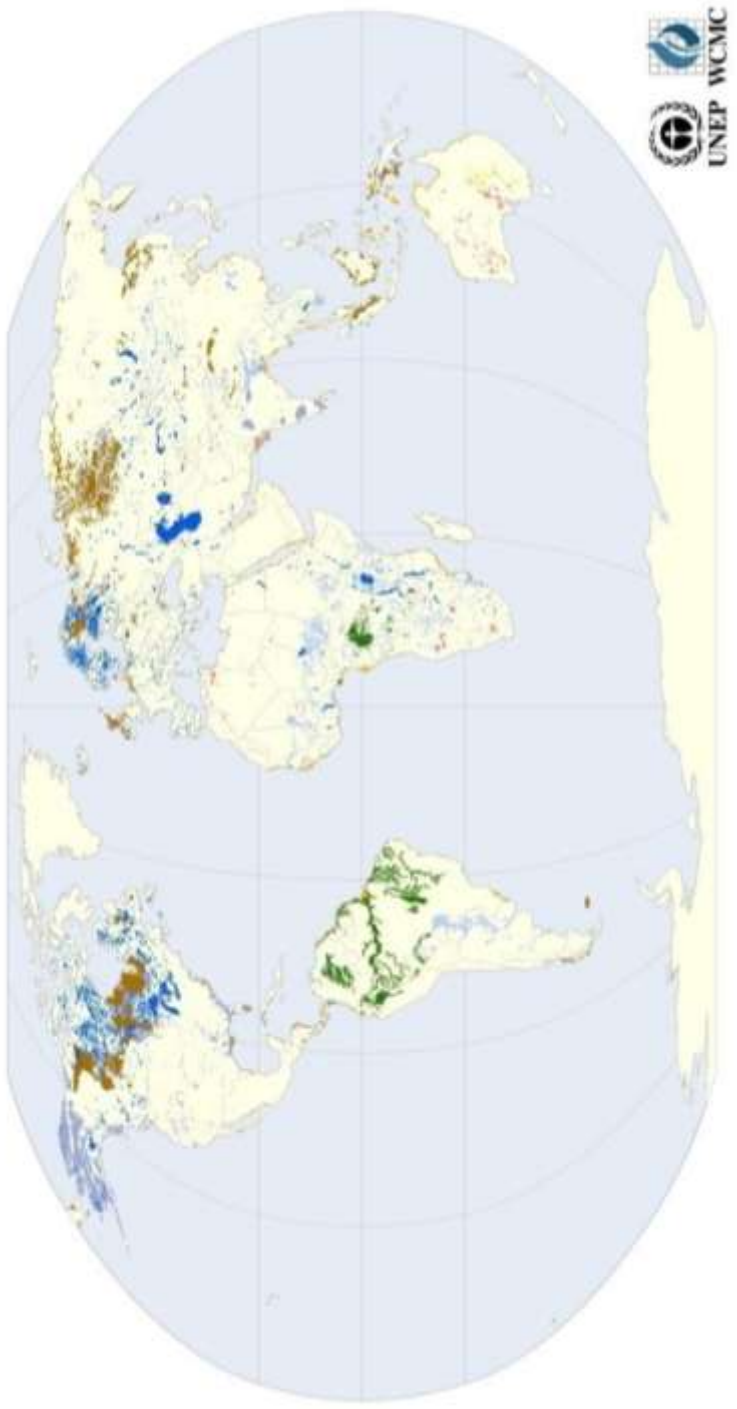


Figure 7 Worldwide distribution of wetlands I

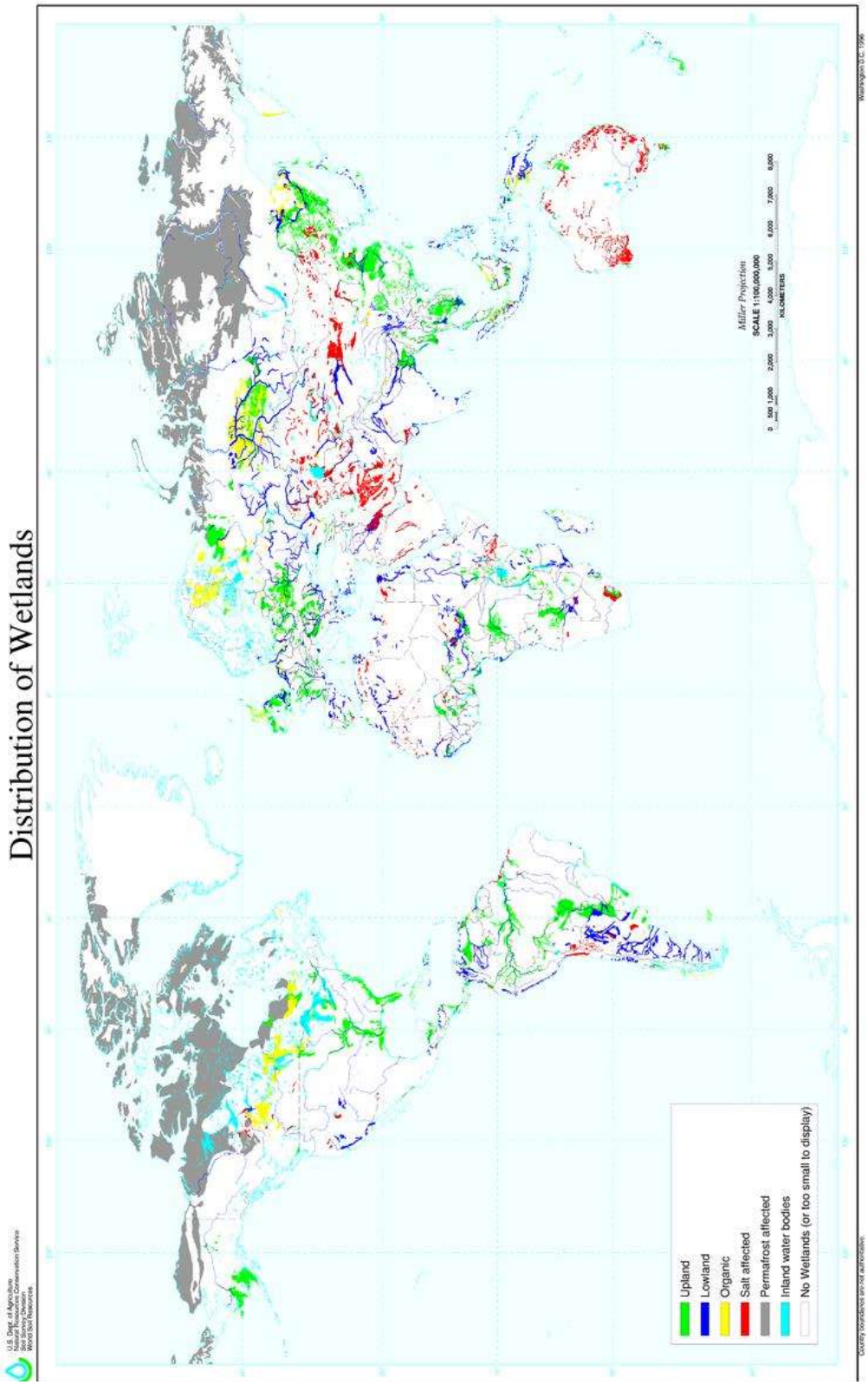


Figure 8 Worldwide distribution of wetlands II

Wetlands in the European Union

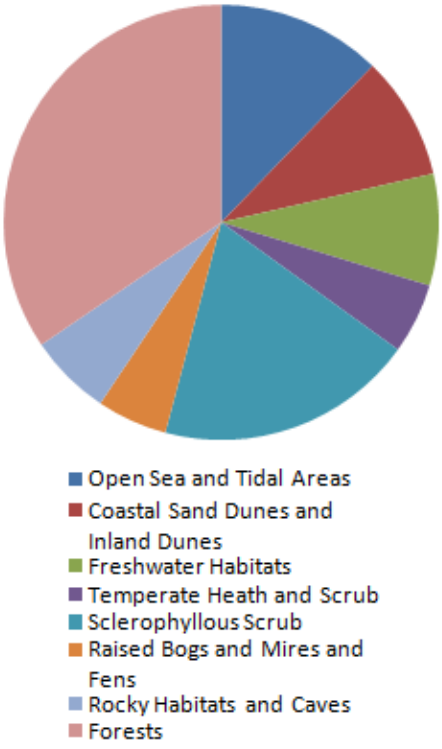


Figure 9 Number of ecosystems listed on Annex I of the Habitats Directive by habitat type (Source: Council Directive 92/43/EEC)

In the EU, wetlands constitute about 2% of the territory (ETC/BD, 2011). However, due to the varying definitions and classifications, it is very difficult to estimate the exact amount of wetlands that exist, have existed or have been lost.

Within the habitat classification used in Annex 1 of the Habitats Directive (92/43/EEC), out of 229 habitat types, at least 80, or almost 30% can be defined as wetlands according to the Ramsar Convention's definition (Figure 9).

According to Figure 10, as of 2000, the highest concentration of wetlands in Europe can be found in Scandinavia, Ireland, Hungary, Central and Northern United Kingdom, the Baltic Republics, the Danish and Dutch coasts and Romania's Black Sea coast (the Danube Delta).

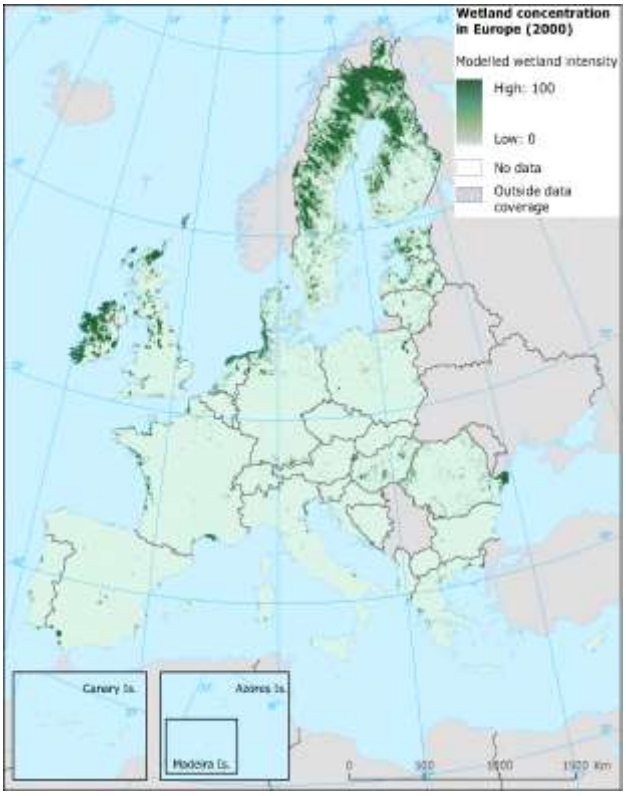


Figure 10 Wetland concentration in Europe. Source: EEA, 2006

Situation of wetlands

Globally, wetlands occupy between 5.3 and 12.8 million square kilometres (Zedler Kercher & 2005). Globally, between 50 (Kercher & Zedler 2005) and 87% (Davidson 2014) of wetlands have already been lost. Equally, the Millennium Ecosystem Assessment concluded that wetlands, more than any other ecosystem type on Earth, have been heavily degraded through human activities. As Figure 11 illustrates, Europe's wetlands have lost the highest proportion of their surface as compared to other continents. Moreover, three

quarters of the world's coral reefs are under threat and 10% have been irreversibly damaged (Burke et al 2011). We have lost almost 40% of live hard coral within the past 30 years alone (Russi et al 2013).

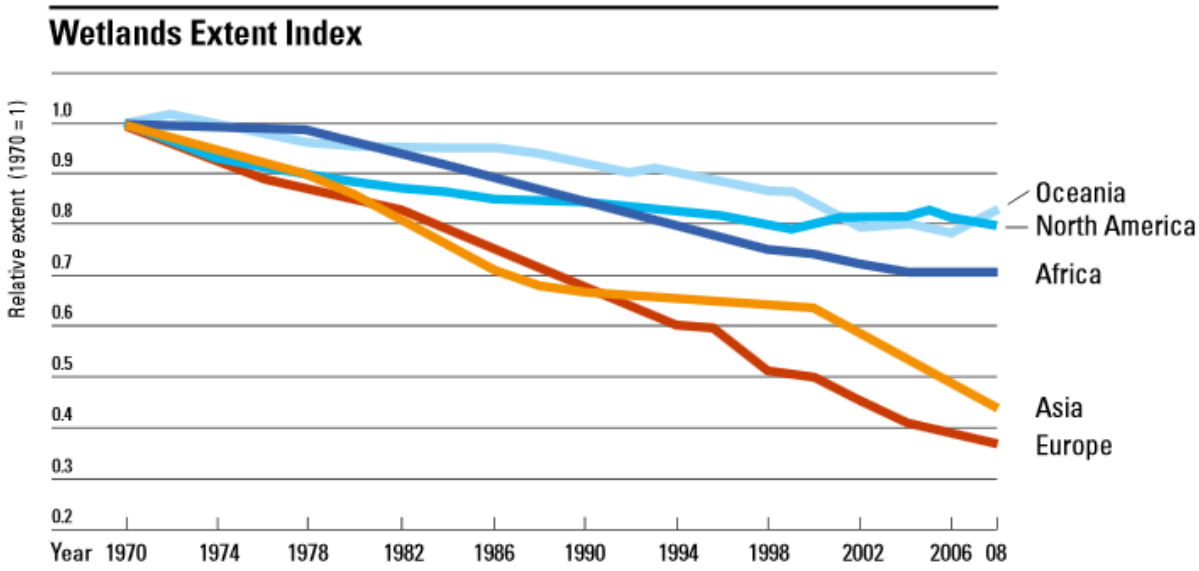


Figure 11 Wetland Extent Index (Leadley et al. 2014)

Humans have been degrading wetlands through drainage and conversion to other land uses (such as intensive agriculture and construction), water regulation works on rivers and damming with the use of impervious materials such as concrete. This approach has resulted in the loss of natural floodplains and has led to more intense flooding (while more serious droughts some months later) and human infrastructure losses and then, in turn, further channelization works. Loss of floodplains is usually accompanied with the loss of floodplain biota, natural vegetation and increased soil erosion. Moreover, wetlands are threatened by pollution, agricultural nutrient runoff, over-grazing, the abandonment of traditional agricultural management methods, invasive alien species and climate change.

Ramsar Convention

Figure 12 Ramsar site information panel

Awareness regarding wetland degradation, their importance and ever worsening condition led to the establishment of the *Ramsar Convention on Wetlands of International Importance, especially as Waterfowl Habitat*, 45 years ago. The Convention was signed in 1971 in the

Figure 13 Ramsar logo

Iranian city of Ramsar by 168 nations to date. The main aim of the convention is to list wetlands of international importance by designating them as Ramsar sites (e.g. such as in Figure 12), to foster international cooperation and to preserve wetlands by promoting sustainable exploitation. Ramsar is the only convention that focuses on just one ecosystem. Altogether, 2100 Ramsar sites occupy the area of 208 million hectares. As can be noticed in Figure 14, in Central and Eastern Europe, Ramsar sites are frequent in Hungary, Austria, Slovakia and the Baltic States, but much underrepresented in Poland, Romania, Czech Republic, Bulgaria and Greece.

Ecological restoration in EU policies

Being able to realize hands on wetland restoration projects in the field relies on there being a sound policy framework which earmarks funding and other resources to restoration of ecosystems. This section will go through relevant policies and describe their contribution towards restoration.

1. EU Biodiversity Strategy 2020

> **Target 2:**
>
> **By 2020, ecosystems and their services are maintained and enhanced by establishing green infrastructure and restoring at least 15 % of degraded ecosystems.**

The EU 2020 Biodiversity Strategy lays the ground work for understanding biodiversity, species and ecosystems and their services as natural capital, which is necessary for the survival of human civilization on Earth and constitutes natural capital which provides insurance for future generations inhabiting the Planet. The Biodiversity Strategy is not binding for Member States. However, it provides and important incentive and motivation as well as outlining a general direction of the EU's biodiversity related activities. Under Target 2, the Strategy commits EU members to restore at least 15% of degraded ecosystems by 2020. The target also mentions Green Infrastructure as a tool to preserve and improve natural habitats. This can be achieved by focusing on three identified Actions: Mapping and Assessment of Ecosystems and their Services (further discussed below), ecosystem restoration and implementation of Green Infrastructure and biodiversity proofing of EU funds as well as setting up biodiversity offsetting (both will be discussed separately here).

- **Action 5**: Map and assess the state and economic value of ecosystems and their services in the entire EU territory; promote the recognition of their economic worth into accounting and reporting systems across Europe
- **Action 6**: Restore ecosystems, maintain their services and promote the use of green infrastructure
- **Action 7**: Assess the impact of EU funds on biodiversity and investigate the opportunity of a compensation or offsetting scheme to ensure that there is no net loss of biodiversity and ecosystem services

2. Mapping and Assessment of Ecosystems and their Services

Sound environmental policy decisions, including conducting ecological restoration, require a baseline, which can be provided by the MAES exercise. Under Target 2 of the EU Biodiversity Strategy, Member States are required to map and assess the state of their ecosystems, the associated ecosystem services, their monetary value to the economy and incorporate this knowledge into the national and EU accounting and reporting systems (Action 5). Understanding the state of habitats and their associated services to humans is crucial for being able to measure progress towards and achieve all of the biodiversity targets the EU has laid in front of its members. In order to standardize the approach towards mapping and assessment across all European countries, the EU has commissioned an analytical framework together with indicators which constitute available guidance to the Member States. All countries have undertaken some work towards achieving this goal; efforts have also been made at the EU level by the Join Research Centre, The European Environmental Agency, EU Topic Centre on Biological Diversity, Directorate General for Research and Innovation as well as Eurostat.

3. Restoration Prioritization Framework

Under Action 6a of the Biodiversity Strategy, Member States are asked to compile Restoration Prioritization Frameworks, documents, which are to guide them though their restoration efforts and help them identify areas of restoration interest and priority. The European Union has commissioned a number of studies to guide MSs through this process. While few states have already created their RPFs, the majority is still working on producing the documents.

4. Biodiversity Proofing

Biodiversity proofing of EU funds (Action 7a under the Biodiversity Strategy) has been proposed as a tool to ensure that all funds distributed by the European Union do not contradict each other but rather work towards a common goal of reaching a

prosperous EU society and healthy ecosystems. Thus, all non-environment related funds and grants should include environmental and biodiversity criteria in order to guarantee that they do not have a negative impact on biodiversity. While sustainability criteria are already present in Cohesion and Structural Funds, biodiversity remains insufficiently incorporated into the funding system.

5. No Net Loss Initiative

   Although controversial in the environmentalist circles, the No Net Loss (Action 7b under the Biodiversity Strategy) could be an important tool to promote ecosystem restoration, as it calls for compensatory measures. According to the No Net Loss Initiative, all ecosystems lost would have to be recreated elsewhere. While this could potentially lead to too much degradation of existing habitats, it acknowledges the importance of ecosystem restoration as a possible tool to recover much of the lost nature in Europe – one of the most heavily transformed environments on Earth. The No Net Loss Initiative rests on the principle that any loss in ecosystems should be balanced by equivalent, if not larger, gain. While Natura 2000 allows for development which is of overriding public interest and priority and mandate appropriate compensation, no such rule functions outside of Natura 2000 designated areas. Thus, NNLI proposes that biodiversity offsetting be mandatory on the entire territory of the EU.

6. Green Infrastructure Strategy

   Green Infrastructure in closely connected to ecosystem restoration; the two terms figure together in Target 2 of the Biodiversity Strategy. The Green Infrastructure Strategy is supported by the MAES initiative, the No Net Loss Initiative, Biodiversity Proofing and the Restoration Prioritization Frameworks. It aims to lay out funding for GI, set up a Natural Capital Financing Facility, which can support bankable Green Infrastructure and ecosystem service oriented projects through attractive loans, support EU-wide GI projects and initiatives, create a TEN-G trans-European Green Infrastructure Network, promote GI as contributing to all policies and beneficial for all sectors and raise awareness regarding GI and its application.

7. Natura 2000 – Birds and Habitats Directives

   Natura 2000 lies at the core of EU's Green Infrastructure network. While Natura 2000 is not a spatially coherent network, together with the urban and sustainable use elements of GI, it provides a system of nature conservation across all EU member

countries. Natura 2000 encompasses many wetland areas, many of which should be restored to their previous states in order to realize their full environmental and socio-economic potential.

8. Common Agricultural Policy

   The Common Agricultural Policy financially supports implementation of Green Infrastructure through its Pillar 2 payments. Green Infrastructure elements in agriculture include hedgerows, groups of trees left in fields (so called stepping-stones) as well as applying certain practices such as adjusting the timing and technique of mowing to bird hatching periods, foregoing the use of artificial fertilizers, pesticides and herbicides, low tillage, intercropping, sustainable water use and many others. Traditional low-scale agriculture is included in the definition of Green Infrastructure as it is home to many species of fauna and flora, especially farmland birds. Some agricultural fields also constitute wetlands, especially wet meadows used for livestock grazing.

9. Water Framework Directive

   The Water Framework Directive aims to protect EU's surface and ground water bodies. While dealing with pollution, urban waste water and agricultural runoff and the resulting eutrophication of waters, the WFD also places importance on the preservation of water ecosystems. Aquatic biodiversity, important habitats and species and the protection of clean water for drinking and bathing have led to the formulation of Good Ecological and Chemical Status for lakes and rivers as well as Good Quantitative Status for underground aquifers. By obliging Member States to strive towards Good Ecological Status of water bodies and apply River Basin Management, the Water Framework Directive indirectly embraces ecological restoration and opposes grey engineering solutions towards flood protection.

State of wetlands in the EU

As shown in figure 11, in the last Natura 2000 (Art. 17) reporting period wetlands had 51% of the habitats assessed as being in unfavourable - bad condition, which constitutes the highest proportion among all habitat types (State of Nature Report, EEA 2015). Moreover, 44% of habitats were not only unfavourable, but also declining. Only 13% of habitats were in favourable conservation status. Species assessments under the Habitats Directive have resulted in 22% of the non-bird species being classified as Favourable, 21% Unfavourable-bad, as much as 46% Unfavourable-inadequate and 28% of all assessed species are Unfavourable and declining (Figure 15). As for bird species whose reports were mandated by the Birds Directive, over half (54%) of wetland-associated bird species are in Favourable Conservation condition, while 17% have been reported to be near threatened or depleted and 15% as threatened. As much as 14% of the species' statuses and 18% of the trends are unknown. Unfortunately, as much as 31% of all species short-term trends are declining and 24% are stable or fluctuating, where the latter could be potentially risky (Figure 16). Regarding the specific pressures on European wetlands, experts point to intensive agriculture, hydrological systems modification and pollution as the most serious threats (Figure 17). Further on the list were natural processes, forestry activities, urbanisation, climate change, invasive alien species and transportation.

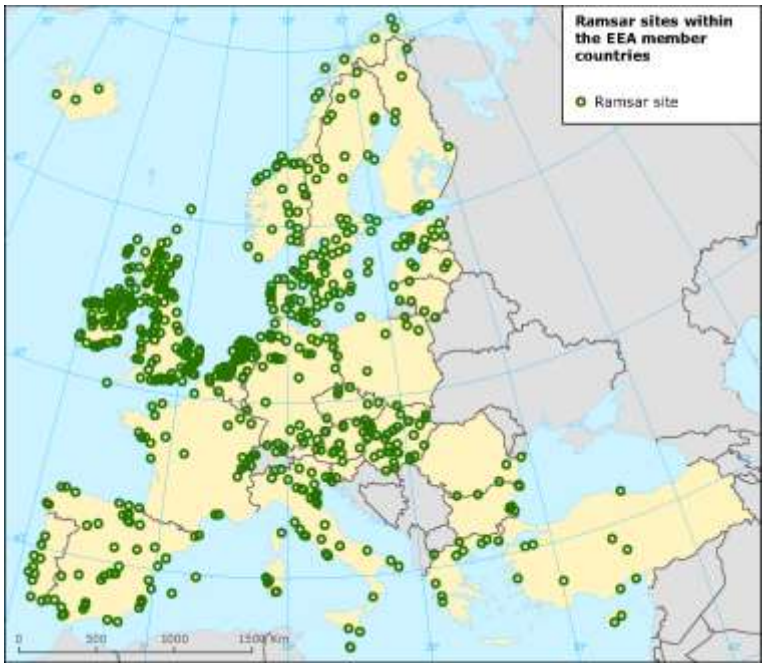


Figure 14 Ramsar sites in EEA member countries

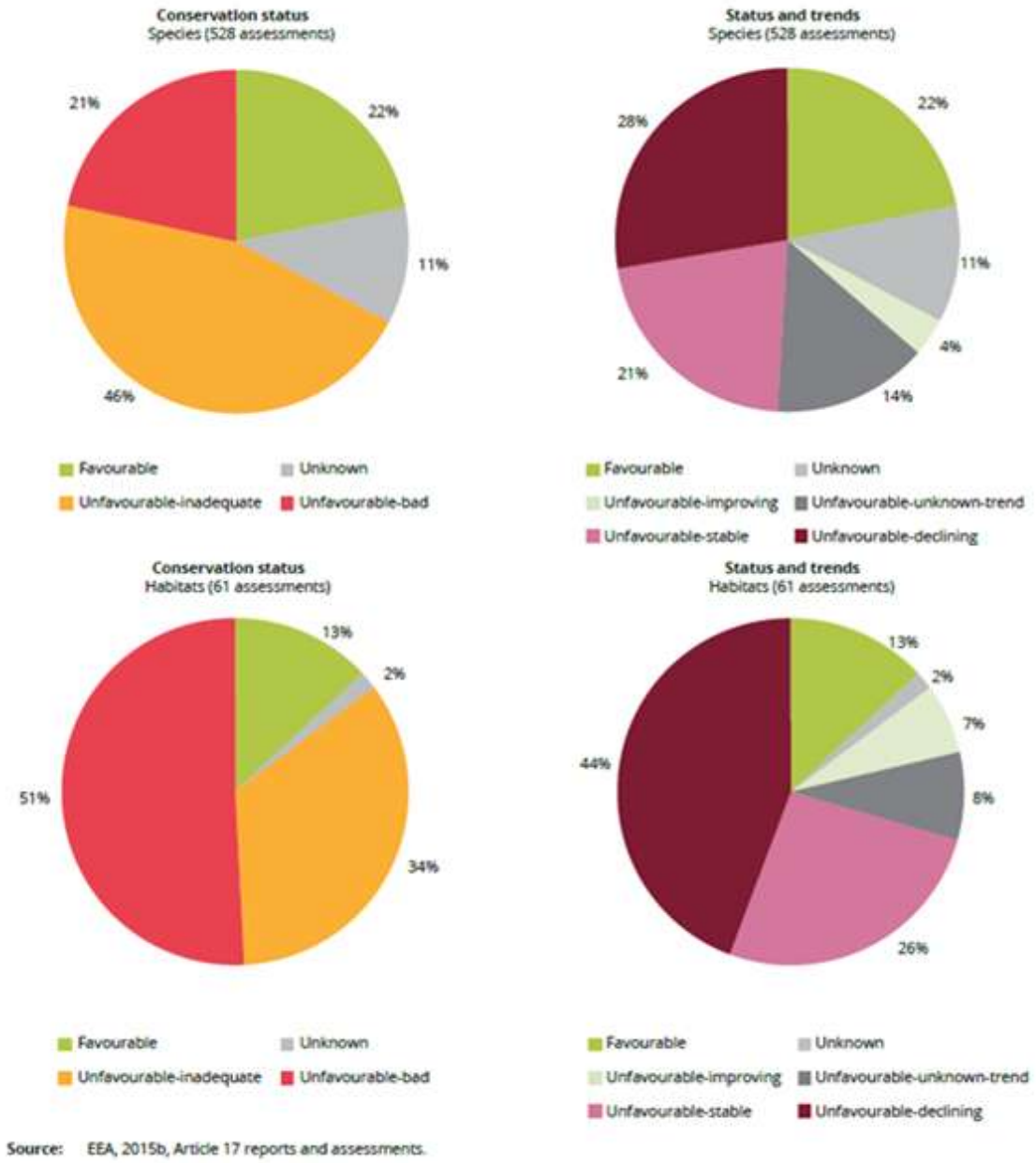


Figure 16 Conservation status and trends of non-bird species and habitats (Habitats Directive) associated with wetland ecosystems

Figure 16 Population status and short-term trends of bird species associated with wetland ecosystem

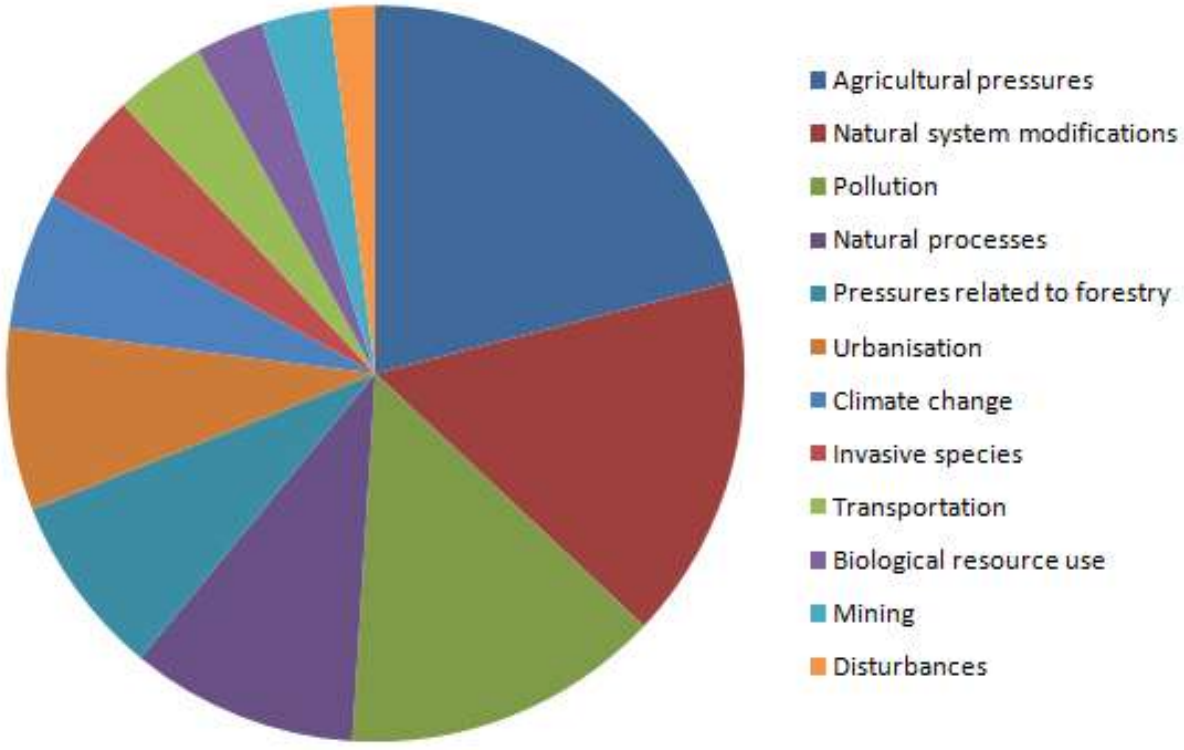


Figure 17 Pressures on EU wetland habitats (van Gossum et al 2015)

Ecosystem services: an introduction

Ecosystem services (ES) can be simply described as the benefits humans reap from nature. Because these benefits/services can vary a lot in nature, it is helpful to think of ecosystem services in terms of their typology. As portrayed in Figure 18, ecosystem services can be classified into Provisioning Services, Regulating Services and Cultural Services. Provisioning services include certain goods which nature provides such as

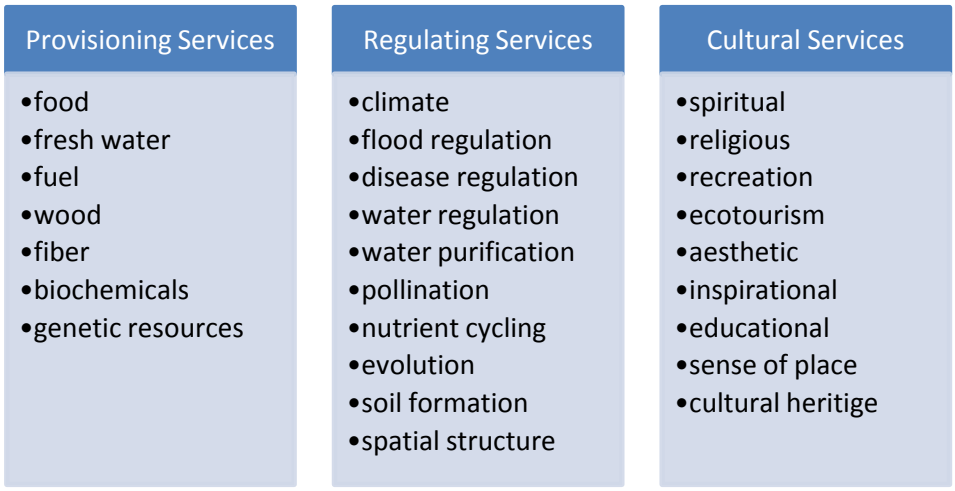


Figure 18 Typology of ecosystem services (adapted from CICES)

food, fodder, fresh water, timber, fuel, fibres, genetic resources or biochemicals. Regulating services are those which help to maintain the environment as a safe habitat for humans: climate regulation, flood mitigation, disease control and water cycle maintenance, water purification, pollination, nutrient cycling, soil formation, evolution and spatial structure. Last but not least, cultural services include the effect that nature has on our religions and spirituality. They include recreation, ecotourism, aesthetic, inspirational and educational value, the sense of place and cultural heritage. Figure 18 portrays the above described ES typology; another useful classification is provided by the Common International Classification of Ecosystem Services (CICES). CICES is a typology which was developed by the European Environmental Agency's work on environmental accounting in order to propose a standardised classification of ES which could be used internationally for the purpose of ecosystem accounting (EEA 2015).

Wetland Ecosystem Services

Ecosystem services provided by a given wetland depend to a large extent on its type and associated factors such as location and the level of degradation. The following sections will describe ecosystem services one by one with an emphasis on their potential to provide benefits and be translated into monetary value.

Flood control

Floodplains surrounding major rivers, such as the Danube floodplain originally, constitute natural reservoirs which can absorb water in case of flooding. Wetlands can be compared to sponges which absorb water from heavy precipitation, prevent flooding and later safeguard the area against droughts (Ramsar 2015a). Rather than channelizing excess water and intensifying the impact downstream, floodplains slow the water down and spread it over a large area, acting as "natural shock absorbers" (Ramsar 2015f) and buffering extreme weather events. Wetlands which are situated at upper river and stream courses are especially useful in preventing flooding due to heavy rainfall or spring snowmelt. As river floods and other unusual weather events arising from the changing climate are expected to intensify and become more frequent, wetlands can provide us with Ecosystem Based Adaptation. However, this capacity has been significantly reduced due to water regulation works that decreased the area of floodplains throughout Europe.

The best example of investing into wetlands as a flooding solution is the Estuary of River Scheldt located between Belgium (Flanders) and the Netherlands. Two catastrophic flooding events occurred there in 1953 and 1976, the former resulting in 1800 casualties (Claessens nd). As a response, the governments of Belgium and the Netherlands invested EUR 500 million in restoring the estuary and adjacent wetlands and constructing a system of small dykes. As much as EUR 100 000 was invested per hectare. In return, until 2100, the benefits from flood alleviation, water purification and soil loss control have been valued at 740 million euro. An additional 150 million are expected by 2100 in ecological and cultural services (tourism, recreation, protection of habitats etc.).

Coastal protection

Around 200 million people inhabit low-lying coastal areas prone to extreme weather events, flooding, tsunamis and hurricanes (WWF 2015). Coastal wetlands, especially mangrove forests, salt marshes and coral reefs stabilise shorelines against storms and constitute important coastal protection. They can reduce the height and speed of strong waves and tides. Plant roots consolidate the shorelines, prevent erosion by waves and wind and act as a defence line for climate change induced extreme weather patterns (Ramsar 2015a). Unfortunately, many shorelines have been subject to large-scale infrastructure development due to their aesthetic value and have thus lost their capacity to act as a shore protection. It is estimated that coral reefs alone benefit 500 million inhabitants of tropical coastal regions by safeguarding their shoreline, providing employment in the tourism sector and food (Wilkinson 2008).

Figure 19 portrays the situation in Sri Lanka after a tsunami hit the Indian Ocean in 2004. Two neighbouring resorts were equally hit by the tsunami waves, yet the one that was sheltered by an undamaged foredune habitat was only reached by a 5 cm high wave and remained intact. The resort that was built directly on the beach and where the dune habitat was removed, was wiped out by a 7m high wave which killed 27 people.

Figure 19 Left: Yala National Park, Sri Lanka, right: Yala Safari Resort, Sri Lanka after the 2004 Tsunami

Groundwater recharge

As wetlands are saturated with water, they help to replenish underground water reservoirs depleted by unsustainable human use. As much as 95% of the world's drinking water and 65% of Europe's public water comes from underground aquifers (Ramsar 2015g). According to the Institute of Global Environment and Society (IGES 2015), 2 billion people in Asia and 380 million in Europe (Eurostat 2015) depend on aquifers for everyday water supply. As Figure 20 illustrates, many of Central and Eastern European groundwater bodies are depleted, especially in the Czech Republic (up to 50% of water bodies in poor quantitative status), Poland, Hungary and Bulgaria (up to 30% of water bodies in poor quantitative status). Wetlands can be seen as an important tool in working towards recharging the depleted underground water supplies, especially in areas where the substrate is pervious (e.g. limestone). In areas where the water table levels are changeable, wetland presence is also immensely helpful to underground water recharge (Ramsar 2015g). Additionally, wetlands regulate and cushion water table fluctuations on the surrounding land (e.g. in karst landscapes).

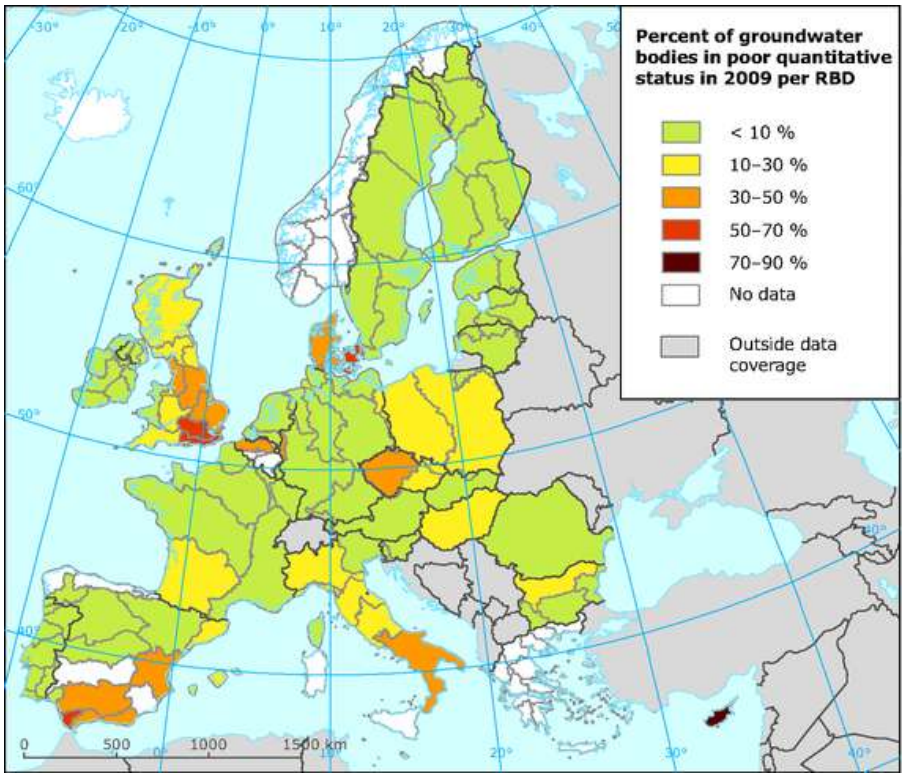


Figure 19 Percentage of groundwater bodies in poor quantitative status in 2009 per River Basin District (European Environmental Agency, 2009)

Water purification

Wetlands naturally take up nutrients from their surroundings (Figure 21). Biofilters lock up toxins, pesticides, chemicals, metals and other pollution in sediments, peat, plants and animal bodies. Plant filters absorb harmful chemicals through their roots, stems and leaves, while aquatic fauna such as molluscs and oysters filter chemicals and sediments mechanically in their search for food.

But, while wetlands function as great stores of harmful chemicals, they each have their limits depending on wetland type, size and bio-geo-chemical characteristics. Excessive nutrient input results in wetland eutrophication. Although in water, nitrogen transforms into environmentally neutral nitrogen gas (WWF 2015), excessive input of nitrogen has been shown to increase N_2O emissions from wetlands into the atmosphere which has considerable greenhouse and ozone-depleting potential.

Mimicking the natural design of wetlands, environmental engineers have designed many types of constructed wetlands with the purpose of waste, effluent, storm and agricultural runoff filtration.

Both frogs (thanks to their toxin-absorbing skin) and molluscs (thanks to their feeding habits) are useful bioindicators of wetland ecosystem health and saturation with pollutants.

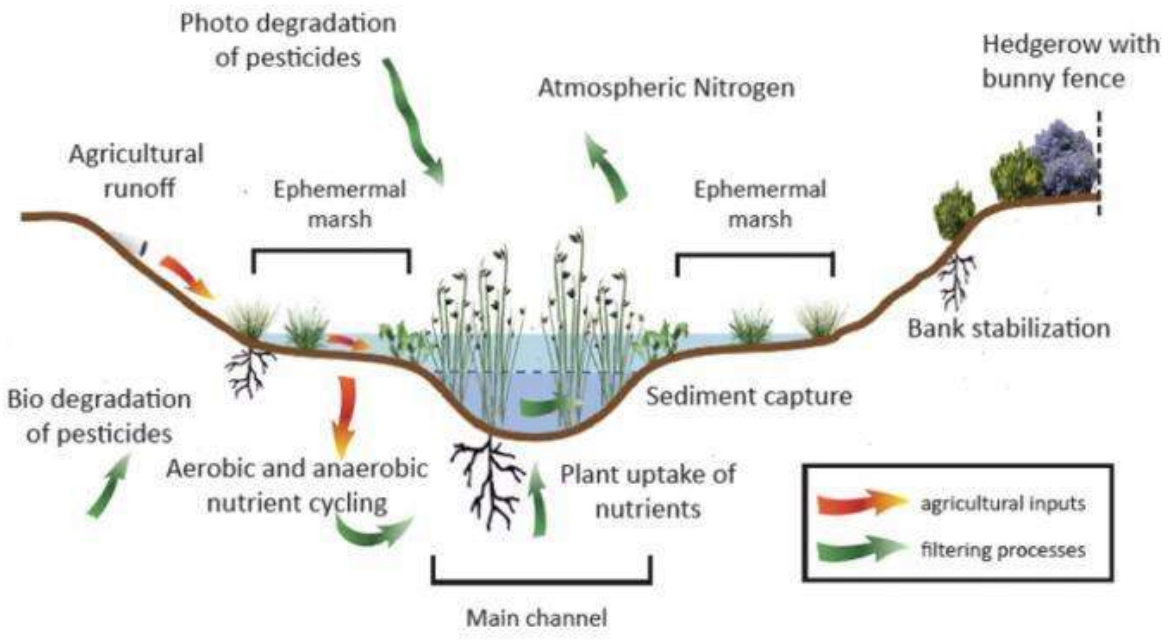


Figure 21 Physical, chemical and biological processes in wetlands which help to filter pollutants

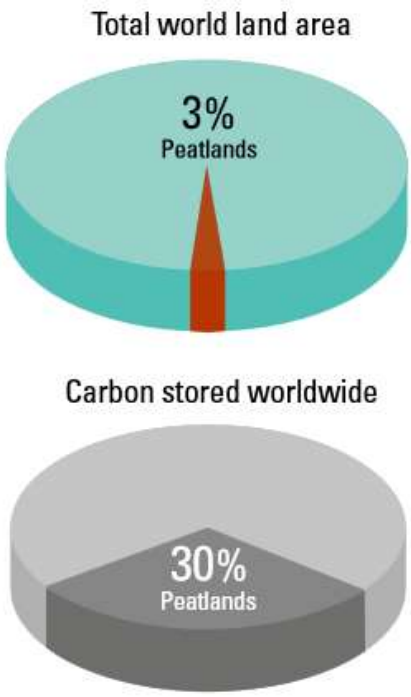


Figure 22 Illustration of the magnitude of carbon stored by wetlands

Carbon sequestration

Wetlands can mitigate climate change by acting as a carbon sink. Due to anaerobic conditions, dead plant matter turns into peat and stores its carbon within the wetland. Their water absorption capacity further helps to mitigate factual climate change. It is estimated that wetlands store between 300 and 700 billion tons of carbon globally (Bridgham, 2006, Wetlands International 2015, Chmura et al 2003). When comparing the area occupied by wetlands (Figure 19) we can see that the carbon storage service of wetlands is of a much higher magnitude than the surface they occupy. Peatlands and forested wetlands account for over 25% of the soil carbon pool (Newcome *et al* 2005). Carbon storage potential of a

wetland depends on a number of factors including wetland type, size, vegetation cover, past use etc.

On the other hand, when wetlands are drained or burnt, carbon from peat decomposes into carbon dioxide and is released into the atmosphere, thus turning wetlands from a carbon sink into a carbon source. As reported by Ramsar (2015a), peatland fires, peat extraction and drainage contribute 10% of annual global CO_2 emissions from fossil fuels (as peat is considered a fossil fuel). N_2O emitted by wetlands, is a 300 times more powerful greenhouse gas than CO_2 and it also contributes to ozone depletion. Similarly, methane emitted from wetlands acts as a powerful greenhouse gas (Laanbroek 2009).

Food and materials

Wetlands are a source of fresh- and saltwater fish, agricultural crops (mostly rice and sago palm which is used to produce sago flour), salt (see Figure 23), vegetable oil for cooking and soap production, cranberries, animal fodder, timber, fuel wood and peat, fibres (e.g. reeds and grasses for weaving and basket making, thatch for covering roofs, for paper and textile making), dyes, tannins (used to treat leather) and traditional medication (e.g. extracted from Mangrove tree bark fruit and leaves WWF 2015). On average, every person consumes 19 kg of fish per year (US EPA 2015) and most of commercial fish farms rely on coastal wetlands for some of the fish life cycle (FAO 2015). Thus, wetlands satisfy almost 60% of the world's fish consumption (WWF 2015). Rice, on the other hand, constitutes the main food for almost 3 billion people worldwide (40% of the human population) and adds up to one fifth of human food intake (FAO 2015). Aquaculture and fishing provides jobs for almost 62 million people worldwide, 660 million together with their dependants (FAO 2015). Sustainable reef management in the Pacific and Indian Oceans can yield 3-5 tons of seafood every year on each square kilometre of the coral reef (Bell et al 2009). In Europe, agricultural wetlands produce meat and other animal products.

Figure 23 Atanasovsko Lake - the wetland site of salt production

Wildlife habitat

Duration of flooding is the main factor rendering a wetland a suitable habitat for some species and unsuitable for others. Factors of secondary importance include water chemistry, pH, salinity and amount of nutrients.

Plants found in wetlands can grow either completely underwater (**submerged** vegetation), **float** on water surface, stretch between the submerged roots and **emergent** stems, leaves and flowers or constitute shrubs and trees that grow on the surrounding land.

Fish largely depend on wetlands for spawning (e.g. in estuaries) and feeding (e.g. in coral reefs). Amphibians, (the most threatened taxon worldwide) and especially frogs need both terrestrial and aquatic habitats and are therefore highly dependent on wetlands. European wetlands are further home to reptiles such as turtles (European Pond Turtle *Emys orbicularis*), snakes and lizards.

Wetlands are especially important for waterfowl and migratory birds: cranes, herons, pelicans, ducks, geese, storks, eagles, rails, terns, gulls, bitterns, warblers and many more (Erwin et al 1999). Mammals inhabiting European wetlands include moose, bison, beaver, otters, wolves, water voles and many more. Insects, molluscs and other invertebrates inhabit wetlands soils, waters and the atmosphere above them.

Currently, we are aware of 100 000 freshwater species which dwell in wetlands, with new species being discovered each day (Millenium Ecosystem Assessment 2005). In the Amazon River basin alone, the last decade brought news of over 250 new species of freshwater fish alone (WWF 2010). Wetlands have a high level of species endemicity, notable sites being Lake Baikal in Russia (see Figure 24) or the Rift Valley Lakes in East Africa.

Figure 24 Baikal Seal Phoca sibirica. Two thirds of the 2500 plant and animal species found at Lake Baikal are endemic to the area. photo: Per Harald Olsen CC

Freshwater wetlands cover only 3% of the surface of the Earth, yet they support 30% of all known fish species (WWF 2015). According to WWF (2015), wetlands contain as much as

40% of all known species and 12% of all animal species. Figure 25 portrays examples of species diversity dependent on wetland type.

Figure 25 Species diversity according to wetland type

Recreation

Wetlands constitute a great destination for bird watching, fishing, hunting, survival skill training (Figure 26) and sports such as canoeing, rafting, snorkeling, swimming and sailing. Coral reefs are one of the top attractions of the natural world. In Belize, income from coral reef tourism reaches up to 200 million US dollars per year (Russi et al 2013). The Great Barrier Reef in Australia yield benefits of over 1 billion US dollars each year in tourism revenue (WWF 2015).

Figure 26 Survival skills training at a wetland site

Cultural value

Finally, wetlands are also important from the anthropological point of view – for their cultural, religious, historical and archaeological value. The Coburg Peninsula in Australia which was the first place to have been designated a Ramsar site is home to indigenous people who continue their ceremonies and traditional hunting-gathering lifestyle there to this day (WWF 2015). In the Western civilisation, wetlands give inspiration to artists, photographers, travelers and writers. Certain European wetlands, such as Lake Fertő (Hungary), Hortobágy landscape (Hungary) or the Danube Delta (Romania and Ukraine) have been designated as UNESCO World Heritage sites.

All the above mentioned benefits can be seen to translate into societal health and well-being as well as job creation and economic development. The following chapter will provide

examples of socio-economic benefits of wetlands as well as attempts at their monetary valuation.

Understanding the value of ecosystem services

Ecosystem services support human well-being, health, livelihoods and even survival (de Groot et al 2012). While biodiversity declines worldwide, it is of crucial importance to draw the attention of the public and decision makers to the loss of ecosystem services and the life-supporting machine which is being lost alongside with biological diversity. Current trends in consumption and advancing climate change create further bleak prospects for the flow of ecosystem services from nature to people.

When compared to other ecosystem types, the value of wetland ecosystem services has been estimated to equate to US$14 trillion annually (Costanza et al 1997). As Figure 27 shows, coral reefs, coastal wetlands, coastal systems and inland wetlands are the most productive biomes on Earth, regarding the services they provide.

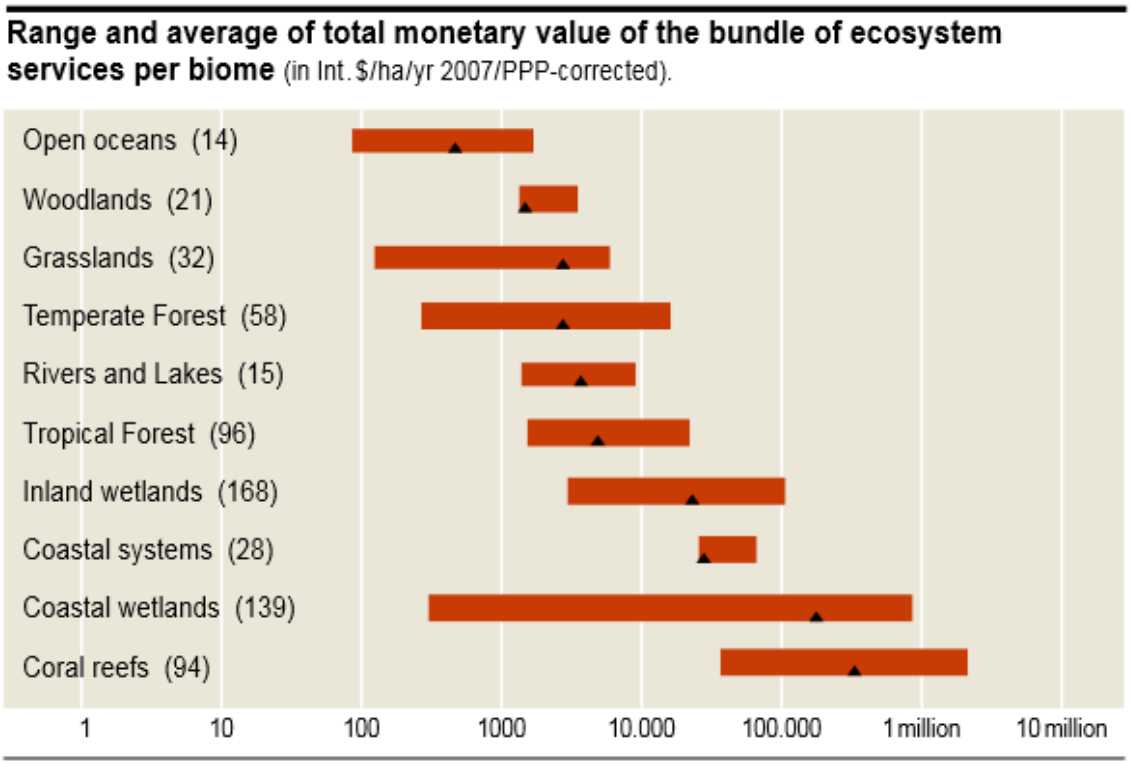


Figure 27 Range and average of total monetary value of the bundle of ecosystem services per biome (de Groot et al 2012)

Understanding the intrinsic value of ecosystems and biodiversity is important, yet monetary valuation of the many ecological, social, cultural and economic benefits nature constitutes a powerful tool for communicating the need to preserve nature to decision makers and the wider public.

Nevertheless, ecosystem services should not be seen as tradable, inexhaustible or free (Groot *et al.* 2012). Overexploiting ecosystem services compromises the livelihoods of those dependent on those ecosystems and indebts us to poor and future generations. Oftentimes, it is the lack of acknowledgement of ecosystem services which leads people to transform wetlands into other less valuable and less profitable land uses (e.g. intensive agriculture).

Wetland restoration: Practice and Policy

As much of the world's wetlands have been lost or degraded, wetland restoration is now a popular method to revive the habitats, its species and associated ecosystem services. However, it remains a question for scientists, whether it is possible to restore ecosystem services, whether it takes longer than mere habitat restoration?

Wetlands are complex systems difficult to replicate. Furthermore, success of wetland restoration has to be determined based on the particular goal that has led to the restoration works being carried out. Zedler (1997) emphasized that ecological connectivity plays an important role in wetland restoration. As larger systems usually support higher biodiversity and are more resilient, restoration of patches adjacent to larger undisturbed habitats has larger chances of success. However, it needs to be noted that small wetlands can constitute valuable sinks of threatened populations (Raymond et al 1998).

The European Union has recognised the importance of habitat restoration and included a 15% restoration target in the 2020 Biodiversity Strategy. Under the Strategy, EU Member States are committed to restore 15% of degraded ecosystems by 2020 as well as setting up a Restoration Prioritisation Framework, which is also a target under the Convention on Biological Diversity. While the baseline for what can be considered a degraded ecosystem remains to be identified by Member States individually and most Member States are lagging behind on both baseline identification and actual restoration, the 2020 Biodiversity Strategy remains an important commitment and lobby tool for environmentalists.

Blue-green infrastructure

Related to the concept of ecological restoration is blue-green infrastructure. The same target 2 of the 2020 Biodiversity Strategy which encourages Member States to restore 15% of their degraded ecosystems mentions that Green Infrastructure is a tool to do so. Rather than being a new concept, Green Infrastructure can be understood as a new useful conservation language which helps to emphasise ecosystem services and the different sectorial benefits of nature and nature restoration which appeal to various stakeholders. Thus, by implementing

blue-green infrastructure, environmentalists can create win-win solutions for the environment, the society and the economy.

Blue-green infrastructure is a network of protected and non-protected, natural and artificial areas and urban spaces which protect biodiversity and deliver multiple environmental and socio-economic benefits to both nature and society. GI encompasses both protected areas such as Natura 2000, national and landscape parks and nature reserves, natural non-protected areas, sustainable use zones, areas of traditional small-scale agriculture, ecological corridors, riparian zones, green roofs and walls, rain gardens and other urban GI elements, city parks and green bridges over motorways. GI elements function at different scales, from local (e.g. a roof garden) through regional and national up to transnational (e.g. international migratory fauna corridors). Perhaps the most important feature of GI elements is their multifunctionality. Rather than being focused on delivering just one benefit (e.g. in such a way as a traditional concrete roof delivers shelter), GI delivers many various benefits at the same time (e.g. a green roof offers a biodiversity habitat, pollination, heat island effect reduction, heating/cooling cost reduction, water absorption and reducing stress on the city's drainage system, recreation, aesthetic value, societal health benefits, work places and many more). Thus, Green Infrastructure is closely related to the notion of ecosystem services which it delivers. GI functions across different sectors such as agriculture, business, local community, water management, nature conservation, ecological restoration, climate change adaptation, energy and policy making. For all those sectors GI offers high long-term benefits which can be reaped if we are prepared to make an upfront investment and not discount the health of future ecosystems, generations and future ourselves.

Methodology

The aim of present report was to showcase the results of wetland restoration projects in the Central and Eastern European Region, review which ecosystem services improved in the course of ecological restoration and based on the acquired information, formulate policy recommendations. In addition to surveying the three pilot projects (completed by BROZ Regional Association for Nature Conservation and Sustainable Development in Slovakia, Estonian Fund for Nature in Estonia and Milvus Group in Romania) conducted under the Building Blue-Green Infrastructure Project funded by Michael Otto Foundation for Environmental Protection, we selected thirteen projects from the Region to be surveyed. The case selection criteria included:

- Location: Central and Eastern Europe
- Actor: primarily cases of projects conducted by CEEweb members
- Restoration component of a wetland habitat (according to the broad Ramsar definition)
- Available sufficient data and information to compile the report

Factsheets on each of the sixteen projects were combined using internet data sources, project websites, reports and other documentation. In addition to including information on ecological restoration, we included information on provisioning, regulating and cultural ecosystem services. We based our ecosystem services classification on CICES and adapted it for our use by adding the category of socio-economic benefits which included creation of employment opportunities and economic growth. For a brief explanation of the CICES methodology, please refer to the Literature Review section.

We then asked project leaders (and team members) of selected wetland restoration projects to fill in questionnaires regarding wetland ecosystem services and how they improved (or decreased) in the course of ecological restoration. An example of a blank questionnaire can be viewed in the Annex to the present report. In addition, we carried out extensive open-ended interviews with project leaders giving them the chance to answer both specific ecosystem service related questions and report any additional thoughts they may have regarding wetland restoration and their project. Questions asked during the interviews included:

General information:

- What did you restore, where and when?
- Who funded your project?

Ecosystem services:

- Do you have any quantifiable data on how any of the ecosystem services improved?
- Can you support the above given information with any studies/sources, what did you base your estimate on?

Please share with us examples of Ecosystem Services and socio-economic benefits of conservation, e.g.:

- How many people worked on your restoration project, how many workplaces were created?
- Aesthetically, how do you feel the project site has changed?

Challenges and opportunities

- What were the main challenges in implementing your project?
- What would have made the implementation of your project easier?
- What were the enabling factors in your work?

Policy recommendations

- What policy recommendations can you formulate based on the experience gained during the implementation of the project?
- What could be improved in terms of the restoration framework, political conditions etc.?

Moreover, all project leaders were given the chance to review the project factsheets and correct potential inaccuracies.

Finally, based on the collected factsheets and the literature review, we compiled policy recommendations for decision makers to help them make sound decisions in socio-environmental matters.

Results

Figure 28 Map of projects selected to be surveyed

Selected projects

- Building Blue-Green infrastructure: Slovak pilot
- Building BlueGreen infrastructure: Estonian pilot
- Building BlueGreen infrastructure: Romanian pilot
- BALTCOAST Rehabilitation of the Baltic coastal lagoon habitat complex
- Conservation and restoration of endangered water-dependent habitats in central Sudety Mountains
- Conservation of Baltic raised bogs
- Development of a Pilot Ecological Network through Nature Frame areas in South Lithuania
- Lower Prut Floodplain ecological restoration of the Lower Prut Floodplain
- Management of the Lubana Wetland Complex, Latvia
- LIMNOTOP susstainable landfill rehabilitation
- Protection of Emys orbicularis and amphibians in the North European lowlands
- Restoration of Babina Polder in the Danube Delta
- Restoration of Comana Wetlands
- Restoration of the Hortobagy Sodic Lakes and its marsh habitat
- Restoration of Vacaresti Delta wetlands
- The Salt of Life

Building Blue-Green infrastructure in Central- Eastern Europe: from pilot projects to regional action

Location: Southwestern Slovakia, near Gabcikovo Dam

Figure 29 Building Blue-green infrastructure in Slovakia

Site description: Danube's river branches which are part of the river's inland delta have almost entirely dried out in Kralova Luka. Gabcikovo Dam and road construction cut off the branches from the main flow of the Danube, while some areas were drained in order to make room for commercial forestry. Some river branches were blocked by falling leaves and timber residue. Modified water regime has driven hydrophilic vegetation to local extinction. The habitat for fish fry was lost, as was the habitat for the majority of amphibians, reptiles and snails. Invasive alien species such as box elder *Negundo aceroides (Acer negundo)* have colonized the site weakened by water regime change. The present day habitat consists of riparian forests and degraded marshes. Despite some degradation, the Danube floodplains are a protected landscape area, a wetland of international importance (under the Ramsar Convention) and a Natura 2000 site.

Activities: Restoration activities on the site included the removal of invasive alien species (mainly box elder) which have overgrown former river branches and separate them from the main river course. Other barriers which separate the river branches from the main course such as forestry residue and unused forest roads are also currently being removed. Several parts of the branches behind the artificial barriers where most sedimentation took place in the recent years are being deepened and small isolated wetlands and river branches are being reconnected to the river system. Larger cut off river branches are being connected to the river in order to ensure constant water supply. Restoration activities are taking place along 6300 meters of the river which will positively impact the water regime on 220 ha. Habitat conditions for numerous bird, amphibian, fish, mammal, beetle and plant species will improve as a result of the implemented activities.

Actors: BROZ Regional Association for Nature Conservation and Sustainable Development

Timeframe: January 2015 - December 2015

Budget and financing sources: Michael Otto Foundation for Environmental Protection (EUR 15 000), LIFE Fund (EUR 1500)

Ecosystem Service Improvement:

Provisioning: fish for local fishermen

Regulating: regulation of local climate (temperature decrease and increased humidity) resulting in more bearable temperatures for humans and higher crop yields

Cultural: tourism, recreation, aesthetic value

Socioeconomic benefits: monetary returns from better crops and better societal health

More information: http://www.broz.sk/BlueGreen/en

Building BlueGreen infrastructure in Central- Eastern Europe: from pilot projects to regional action

Figure 30 Building blue-green infrastructure in Estonia

Location: Kavaru Wetland, South-Western Estonia

Site description: Kavaru is a Baltic coastal meadow and an important site for wading birds and amphibians. In the Soviet era the meadow was drained, natural ditches flowing through it have been straightened and deepened. As a result, the flooding periods have decreased. Accumulation of sediments in the area of the former delta and absence of conservation management between 1990 and 2008 have led to the excessive growth of reed beds. The size of the ecologically valuable ecosystem has decreased despite being a priority habitat at the EU level. The site is now a degraded meadow overgrown by reed beds, nevertheless being home to the following breeding bird species: Baltic dunlin (*Calidris alpina schinzii)*, redshank (*Tringa tetanus)*, lapwing (*Vanellus vanellus)*, oystercatcher (*Haematopus ostralegus)*, ringed plover (*Charadrius hiaticula)*, skylark (*Alauda arvensis)*, meadow pipit (*Anthus pratensis)*, yellow wagtail (*Motacilla flava)* and plants: marsh angelica (*Angelica palustris)*, a dandelion species (*Taraxacum suecicum)* and orchid species (*Dactylorhiza baltica),* military orchid *Orchis militaris)*.

Activities: The aim of the project is the restoration of the typical rural landscape by restoring the meadow's natural hydrological regime and reintroducing cattle grazing to manage the site for biodiversity. In total, 50 hectares of the Baltic coastal meadow was restored, biomass (reeds) and nutrient levels will be lowered and the breeding success of coastal waders was improved thanks to an increase in suitable breeding habitat.

Actors: Estonian Fund for Nature

Timeframe: January 2015 - December 2015

Budget and financing sources: Michael Otto Foundation for Environmental Protection (EUR 15 000), LIFE Fund (EUR 1500)

Ecosystem Service Improvement:

Provisioning: fresh drinking water, feed for cattle, beef, reed pellets, improved biodiversity

Regulating: improved water cycle and water retention, flood protection

Cultural: touristic value

Socioeconomic benefits: tourism, jobs in animal husbandry (shepherding)

More information: http://elfond.ee/en/news/1700-kavaru

Building BlueGreen infrastructure in Central- Eastern Europe: from pilot projects to regional action

Figure 31 Building blue-green infrastructure in Romania

Location: Central Romania (Transsylvania) along an oxbow of the Târnava Mică (Kis-Küküllő) River, South of Cluj-Napoca

Site description: Originally the meadows around the Târnava Mică River were devoted to agricultural use. Later on, a gravel quarry was created and continued to operate until summer 2015. Prior to the ecological restoration undertaken by Milvus Group Romania, the site was a brownfield with small water ponds.

Activities: Milvus Group carried out small-scale restoration activities on the oxbow of Târnava Mică. The slopes of the pond were adjusted to the needs of amphibian species, except for places where the steep banks constituted a nesting place of sand martin (*Riparia riparia)* and European bee-eater (*Merops apiaster)*.

Actors: Milvus Group Romania

Timeframe: January 2015 - December 2015

Budget and financing sources: Michael Otto Foundation for Environmental Protection (EUR 7 500), Milvus's own sources (EUR 750) and tree planting activities

Ecosystem Service Improvement:

Provisioning: improved biodiversity, amphibian and bird habitat, reduction of pests by frogs, genetic resources, increased crop yields of farmers cultivating the surrounding land (in Makfalva/Trei Sate municipality: Hármasfalu/Ghindari), reed and poplar as a raw material/fuel/timber
Regulating: better water retention and cycling, soil formation, water filtration (much fertilizers are applied by Transilvanian farmers and thus humid areas are important for filtering agricultural runoff; e.g. above the project site there is a blueberry and strawberry farm which uses much chemical input which is then filtered by the reeds in the restored wetland), drought reduction (in spring Küküllő River floods the area which raises the ground-water level in the agricultural areas around the site and reduces summer drought),

Cultural: increased tourist and aesthetic value, recreational value for local people (bathing site for children), educational site for schoolchildren to learn about animal and plant species,

Socioeconomic benefits: revenue from tourism, 3 internal jobs, 5 external subcontracted positions

More information: http://milvus.ro/en/in-february-milvus-group-have-been-started-the-project-building-bluegreen-infrastructure-in-central-eastern-europe-from-pilot-projects-to-regional-action/7214

Baltcoast - Rehabilitation of the Baltic coastal lagoon habitat complex

Figure 32 Baltcoast project

Location: A range of 34 Baltic coastal lagoon habitat complexes located in Denmark, Germany, Sweden, Lithuania and Estonia

Site description: Baltic lagoons are well-developed complex ecosystems and thus a priority habitat under the Habitats Directive. They are composed of various ecosystems such as: dunes, cliffs, stone beaches, salt meadows and grasslands. Baltic lagoons are the breeding site of the ruff (*Philomachus pugnax)* and dunlin (*Calidris alpina schinzii)*. The project also targeted the avocet (*Recurvirostra avosetta)*, European green toad (*Bufo viridis)*, natterjack toad (*Bufo calamita)* and creeping marshwort (*Apium repens)*. Hydrological changes, natural succession and eutrophication as a result of agricultural runoff have largely damaged Baltic coastal lagoons.

Activities: The project's management activities were focused on a reference restoration site in Sweden. Management included blocking of drainage trenches and removal of eutrophic mud and dense reed vegetation in order to improve the habitat for wading birds and amphibians. Dry habitats such as dunes were managed through clearing of natural succession, and removal of invasive alien species (e.g. *Rosa rugosa*). Grazing by hardy sheep and cattle was introduced in order to control natural succession in the future. Through extensive cooperation between managers from Sweden, Germany, Denmark, Estonia and Latvia the above described model was propagated and adopted across the Baltic States in order to prevent the extinction of the ruff (*Philomachus pugnax)*.

Actors: Denmark: Saltholm Ejerlaug, Velje Amt, Amphi Consult, Danish counties: South Jutland, Fyn, West Zealand, Storstrøm. Germany: Stiftung Naturschutz Schleswig-Holstein, Landesamt für Natur und Umwelt Schleswig-Holstein, Naturschutzbund Deutschland e. V., University of Hamburg. Lithuania: Lithuanian Fund for Nature. Estonia: Ministry of the Environment, Kihnu Strait Marine Park Foundation, NPO Põhjakonn, Kallapa Farm, Tauno Tähe. Sweden: Vellinge Municipality, County Administration Board of Gotlandand Kalmar, Nature Artbevarande och Foto i Ale AB, Ornithological Society of Scania, SKOF.

Timeframe: 2005-2012

Budget and financing sources: EUR 5 685 005, out of which EUR 3 403 203 from the LIFE Fund.

Ecosystem Service Improvement:

Provisioning: habitat for the ruff, feed for livestock, animal husbandry products (100 cattle were purchased for the project), preservation of 30% of German genetic reserves of of Apium graveolens, improved conservation status of many endangered plant species, recolonisation of sites by dunlin

Regulating: coastal defense, shoreline stabilization, flooding control (restoration of 67 hectares of coastal habitat within the project), protection of soil on coastal meadows

Cultural: tourist and aesthetic value, diversification of landscape, ornithological observations, educational value, creation of 2 full time jobs at the lead NGO and 91 jobs with

the partner organizations, subcontracting of 187 people/companies with a turnover of about 2.2 million euro (services included digging, mowing, translation, biological monitoring etc.)

Socioeconomic benefits: increased revenue from tourism and animal grazing

More information: http://www.life-baltcoast.eu/

Conservation and restoration of endangered water-dependent habitats in central Sudety Mountains

Location: Sudety Mountains, South-Western Poland

Figure 33 Restoration of montane bogs in Poland

Site description: Despite the fact that water retention in the mountains is important for flood protection in the entire country, montane bogs have been especially strongly transformed by anthropogenic activities. The project area is an old mountain range (maximum altitude of 1015 meters); the majority of sites are quaking and raised bogs, wet meadows and swampy forests located between 500 and 1000 meters above sea level. Past efforts to make those sites more productive for agriculture and forestry have led to drastic changes in plant composition and hydrology. Most of the sites are designated Natura 2000 sites.

Activities: Phase I of the project consisted in restoring small water bodies and micro-retention. Experimental fen restoration and the publication of a montane wetland protection manual accompanied the project. Phase II of the project aimed to improve the hydrological and light conditions at the sites. In order to stop drainage and runoff, micro-obstacles were put in place, using locally sources logs and rocks. The logs were also meant to stabilize peat-forming vegetation. Secondly, natural succession (especially spruce) was removed to increase light at the sites. Rendering meadows fit for mowing, restoring small water bodies for endangered amphibian species, reintroduction of beavers and battling invasive species also took place. Monitoring of vegetation and hydrology was conducted.

Actors: Phase I: Naturalists Club Poland, Stołowe Mountains National Park, Forest Districts of Świdnica, Wałbrzych, Lądek and Bystrzyca, Phase II: Naturalists Club Poland, Forest Districts of Jugów, Kamienna Góra, Świdnica and Wałbrzych

Timeframe: 2008-2009 (Phase I), continued 2009-2012 (Phase II)

Budget and financing sources: European Fund for Regional Development, Polish National Fund for Environmental Protection and Water Management

Budget and financing sources: EUR 319 525: European Fund for Regional Development, co-financing: Polish National Fund for Environmental Protection and Water Management (85%) and Center for Coordination of Environmental Projects (15%)

Ecosystem Service Improvement:

Provisioning: habitat for endangered amphibians and wetland vegetation

Regulating: flood protection for the entire country (increased water retention), water management and decreased runoff, nutrient cycling

Cultural: tourism, existence value (safeguarding the most degraded habitat type across Europe)

Socioeconomic benefits: decreased frequency of floods and associated costs downstream

More information: http://www.mokradla-sudety.kp.org.pl/

Conservation of Baltic raised bogs

Location: Pomerania, Poland

Site description: 80 Baltic raised bogs occur in northmost Poland, 30 of which are located in the Pomeranian county. They are fed solely by rainfall, are low in nutrients and high in acidity. Rare at the European scale, they are home to numerous endangered species. Long-term gradual degradation of the bogs has led to bog soil decomposition, overgrowing by conifers and birches, evaporation of water and the disappearance of *Sphagnum* moss, sundew, cloudberry and other typical bog vegetation.

Figure 34 Conservation of Baltic raised bogs

Activities: The project's aims were the restoration and conservation of the bogs by preventing them from drying out (by blocking draining ditches with sluices and dams or filling them), removing natural succession (birch, pine and spruce trees), decreasing evapotranspiration, experimental removal of dry peat earth and transplantation of *Sphagnum* moss, putting in place a water table monitoring system, raising awareness among the local population, organizing study visits, publishing a bog conservation manual and filling knowledge gaps regarding the hydrology and ecology of bogs in order to create effective management plans. As a result of the project, 7 nature reserves were created and 15 sites were added to the Natura 2000 Network.

Actors: Phase I: Naturalists Club Poland, Pomeranian and West Pomeranian County, Kliniska and Szczecinek Forest Districts and Phase II: Naturalists Club Poland, Regional Directorates for Environmental Protection in Gdańsk and Szczecin

Timeframe: 2003-2008 (LIFE Project), continued 2007-2011 (Operational Programme "Infrastructure and the Environment")

Budget and financing sources: Phase I (EUR 970570,25): LIFE Fund (EUR 681,080), GEF Global Environmental Facility (EUR 41353), The EcoFund Foundation (Ekofundusz, EUR 148872,98) and Phase II (EUR 259187): Polish Operational Program "Infrastructure and Environment" (EUR 220175) and EcoFund Foundation (Ekofundusz, EUR 32692).

Ecosystem Service Improvement:

Provisioning: conservation of species, genetic diversity and a rare European habitat, peat

Regulating: improvement in water quality, decreased surface runoff, flood protection, soil formation

Cultural: education and research, creation of protected areas, publication of manual

Socioeconomic benefits: revenue from tourism

More information: http://www.kp.org.pl/plbaltbogs/a_index.html

Development of a Pilot Ecological Network through Nature Frame areas in South Lithuania

Location: Southern Lithuania

Figure 35 Development of a pilot ecological network in Lithuania

Site description: Southern Lithuania has suffered due to extensive abandonment of small-scale farms. Natural succession has threatened to take over the habitat of many important amphibian and reptile species (such as European pond turtle (*Emys orbicularis),* fire-bellied toad *(Bombina bombina),* great crested newt *(Triturus cristatus), toad (Bufo calamita), toad (Bufo viridis),* common spadefoot *(Pelobates fuscus),* European tree frog *(Hyla arborea),* frog *(Rana arvalis),* frog *(Rana lessonae) and* lizard *(Lacerta agilis)*). The area is covered by three Natura 2000 sites.

Activities: The project aimed to ensure the favourable conservation status and viability of the populations of its target species by restoring and creating new suitable nesting sites. Degraded ponds were renovated and new ponds were dug as well as improving terrestrial habitats. The populations of European pond turtle (*Emys orbicularis)* and European tree frog (*Hyla arborea)* were saved from local extinction and their populations were reinforced, alongside with toad (*Bufo viridis)* and toad (*Bufo calamita)*. A pilot ecological network in Southern Lithuania was developed. The project also made efforts to raise awareness and create a positive attitude towards nature conservation among the local population. It contributed to knowledge creation and experience exchange among experts on ecological networks.

Actors: Lithuanian Fund for Nature, Amphi Consult, Lithuanian Environment Ministry, Pan Parks, Dzūkija National Park, Meteliai and the Veisiejai Regional Parks, Lithuanian ZOO

Timeframe: 2010-2014

Budget and financing sources: EUR 766,260: EUR 381,510 LIFE+ Nature (50%), the Ministry of Environment of the Republic of Lithuania (25%), other partners and donors (25%)

Ecosystem Service Improvement:

Provisioning: strengthened population of endangered (Annex II and IV) species, improved habitats, safeguarding genetic resources

Regulating: water management, aquifer recharge and decreased surface runoff, improved local microclimate, nutrient cycling

Cultural: aesthetic value and species preservation (existence value)

Socioeconomic benefits: costs avoided from better local climate and health

More information: http://www.glis.lt/ekotinklas/index.php/en

Lower Prut Floodplain – Ecological restoration of the Lower Prut Floodplain Natural Park

Location: Lower Prut Floodplain Natural Park, South-Eastern Romania

Figure 36 Ecological restoration of the Lower Prut Floodplain

Site description: The project site is located at the entrance of the Danube Delta Biosphere Reserve. The Lower Prut Floodplain Natural Park is an important resting place for the migratory bird species, as it is lying on their flyway route. The project site is a nesting site for over a hundred bird species, of which over 50 species are protected under the EU Birds Directive and the Bern Convention. The park is recognized both at national and international levels as an important ecological site. Rural settlements are present in the area of the natural park for which fishing and agriculture are the main economic activities.

Activities: The aim of the project was to improve the conservation status of the aquatic bird species, which are listed in the EU Birds Directive. The project objectives were to address the degradation of hydrological structures and re-establish the ecological balance of lakes, including improvement of the water level and its maintenance. Project activities included creating a scientific inventory, monitoring, drafting of a management plan, the designation of four Special Protected Areas as well as awareness raising activities. Ecological restoration works included the creation of dams to maintain the optimal water level in Vlascuta Lake, restoration of two canals for water supply and evacuation in the Prut River, cleaning and re-profiling of the two channels connecting Pochina Lake and Prut River, construction of dykes, rehabilitation of two dykes which separate the Mata Lake.

Actors: Galati County Council, Ministry of Environment and the Sustainable Development, University of Bucharest, Romanian Ornithological Society, Galati Forest Department, Galati Regional Environmental Protection Agency

Timeframe: 2005 - 2010

Budget and financing sources: EUR 800 000 (50% financed by LIFE Fund)

Ecosystem Service Improvement:

Provisioning: food, fibre, freshwater

Regulating: water retention, water level regulation, water purification, primary production, nutrient cycling, water cycling, soil formation

Cultural: education, recreation and aesthetic experiences

Socioeconomic benefits: ecotourism, improvement of fishing and agriculture conditions

More information: http://www.luncaprut.ro/eng/lunca_prut/lunca_prut.htm

Management of the Lubana Wetland Complex, Latvia

Location: Central Latvia

Site description: The Lubana Wetland Complex covers almost 50 000 hectares in central inland Latvia and has the highest diversity of habitats in Latvia. The site contains the country's largest shallow water lake, numerous fishponds, fens and wet grasslands. 186 bird and 23 mammal species were recorded on the site.

Figure 37 Management of the Lubana Wetland, Latvia

Activities: The main aim of the project was to develop a holistic participatory management plan for the wetland. The plan included three activity types: habitat management (removing natural succession, erection of dams, deepening the sites of fish wintering, building islands, restoring sluices and controlling the water level), strengthening the management capacity, stakeholder involvement, governance and raising public awareness.

Actors: Madona Regional Council, Aiviekste State Department of Land Reclamation Systems, Latvia Teici Nature Reserve, Latvia Rezekne Regional Council, Local Municipalities: Osupe, Indrani, Lazdukalns, Berzpils, Gaigalava, Nagli, Barkava, Rugaji.

Timeframe: 2003-2007

Budget and financing sources: EUR 1 346 208, out of which EUR 969 270 from LIFE Nature and EUR 376 938 from the Environmental Protection Fund for Latvia and the Fish Fund

Ecosystem Service Improvement:

Provisioning: preservation of rare Latvian bird, fish and mammal species and landscape heterogeneity

Regulating: improved water cycling and retention, soil fertility enhancement

Cultural: aesthetic value, tourism, recreation

Socioeconomic benefits: greater public participation in Lubana wetland management and local involvement and approval for conservation activities, holistic and participatory planning

More information:
http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=file&fil=LIFE03_NAT_LV_000083_LAYMAN.pdfhttp://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=2476#BENEF

Limnotop - The sustainable rehabilitation of the landfill site

Figure 38 Sustainable rehabilitation of a landfill, Slovenia

Location: Dobrava, Ormoz Municipality, Slovenia

Site description: The project site was a landfill for disposal of regular municipal waste. It is located in the agricultural lowlands of Pannonia in Eastern Slovenia. The project site is part of the Municipality of Ormoz – a town of 20 000 inhabitants.

Activities: The objective of the project was to implement an eco-remediation of the four hectares of landfill in Dobrava. The aim of the project was to showcase a successful implementation of green technologies in the remediation of waste landfill. The activities implemented under the project included removal of old waste and contaminated soil, implementation of groundwater discharge, implementation of leachate isolation, collection and drainage, planting a layer of dense woodland to ensure evapotranspiration, implementation of arrangements for degassing and drainage of runoff, construction of a wetland for leachate treatment in order to provide water protection and avoid the risk of both surface and ground water contamination and implementation of an irrigation system for reusing purified leachates.

Actors: Municipality of Ormoz, Communal Company of Ormoz, LIMNOS, Company for applied Ecology, Institute for physical biology, University of Ljubljana

Timeframe: 2006 - 2010

Budget and financing sources: EUR 594,721, of which EUR 267,624 were contributed by the LIFE Fund

Ecosystem Service Improvement:

Provisioning: creation of a habitat for fauna and flora, wood biomass (for renewable energy)

Regulating: landfill gas regulation, waste treatment and assimilation, water purification, nutrient cycling, soil formation

Cultural: education, enhancement of landscape aesthetic value

Socioeconomic benefits: avoiding costs associated with artificial sewage treatment and landfill remediation, savings through the protection of drinking water sources and pollutant removal

More information: http://nwrm.eu/case-study/limnotop-eco-remediation-near-ormoz-slovenia

Protection of European pond turtle and amphibians in the North European lowlands

Figure 39 Protection of European pond turtle in Northern Europe

Location: 7 sites in Lithuania, 9 sites in Poland, and 6 sites in Germany

Site description: The European pond turtle (*Emys orbicularis)* inhabits pond complexes in the North-European lowlands. In Lithuania, most individuals occur in the Southern part of the country. The sites consist of a mosaic of forests, agricultural lands, lakes, wetlands, swamps and alkaline fens. In Poland, the sites are mainly forests with water bodies, wetlands, lakes, bogs, and marshes. In Germany, the sites are dominated by agricultural lands and moors, peatlands, rivers and river beds.

Activities: The objective of the project was to ensure the conservation of the European pond turtle (*Emys orbicularis)*, the European fire-bellied toad (*Bombina bombina)*, and the great crested newt (*Triturus cristatus)*. The following activities were envisaged under the project to preserve the turtle populations: pond digging and restoration, implementation of sustainable grazing regime and removal of unwanted vegetation to ensure areas for nesting, rearing of turtles to support small populations through introduction.

Actors: Lithuania: Lithuanian Fund for Nature, Zuvintas Biosphere Reserve, Veisieai Regional Park, Meteliai Regional Park. Poland: North Podlasian Society for Bird Protection, Bialowieza National Park, Naturalists Club. Germany: Arbeitsgemeinschaft Natur und Artenschutz, Landschaftsförderverein Oberes Rhinluch and Georg August University of Göttingen.

Timeframe: 2005 - 2009

Budget and financing sources: EUR 2 400 000, of which 49.5% were provided by the LIFE Fund and 50.5% by partner funding from Lithuania, Poland and Germany.

Ecosystem Service Improvement:

Provisioning: site-specific biodiversity (80% of restored sites are now inhabited by species), genetic resources, livestock and fodder

Regulating: nutrient cycling, regulation of species composition, water retention and cycling, evolution, spatial structure, primary production, climate change mitigation

Cultural: educational, cultural heritage, tourism, aesthetic landscape value

Socioeconomic benefits: generation of work places in ecotourism and shepherding, local companies were hired for the project (e.g. 10 workers were involved in bush cutting in Lithuania alone)

More information: http://www.glis.lt/life/?pid=33&lang=en

Restoration of Babina Polder in the Danube Delta

Location: Danube Delta, Romania

Figure 40 Restoration of Babina Polder, Danube Delta, Romania

Site description: Babina polder extends over 2100 hectares in South-Eastern Romania. In the 20th century, Babina polder was dyked to be a rice paddy, but abandoned before being fully built. As a result of such intervention, the natural processes and the ecological balance were altered, which led to the deterioration and loss of area-specific habitats.

Activities: The aim of the project was to connect the abandoned agricultural polders and fishponds to the natural flooding regime of the Danube by breaching the dams. The objective of the project was to ensure ecological restoration of the area by recovering the hydrological, biogeochemical and ecological functions characteristic to wetlands. Such restoration enabled redevelopment of the ecosystem and its functions and, as a consequence, site-specific habitats and their biodiversity recovered. The following activities were implemented under the project: creation of breaches in the banks, creation of wetlands and reconnection of Babina polder to the Danube flooding regime.

Actors: The Danube Delta Biosphere Reserve Authority, Danube Delta National Institute for Research and Development

Timeframe: 1994-2005

Budget and financing sources: EUR 2 407 000 million from the Global Environmental Fund

Ecosystem Service Improvement:

Provisioning: food, fresh water, fibre, fish, genetic resources (restoration of site-specific biodiversity)

Regulating: water regulation, water purification, flood risk management, biofiltering the Black Sea, fixating toxic substances, nutrient retention, water cycling and primary production

Cultural: aesthetic experiences, recreation, spiritual enrichment as a result of interesting aquatic landscapes created, revenue from tourism

Socioeconomic benefits: the reconnected polder enables reed harvesting, grazing, fishing and ecotourism and the associated monetary benefits

More information: http://wiki.reformrivers.eu/index.php/Babina

http://recette.nwrm.eu/case-study/babina-restoration-project-romania

Restoration of Comana Wetlands

Location: Romania, Giurgiu County

Figure 41 Restoration of Comana Wetlands, Romania

Site description: Comana is the third most important wetland area in Romania comprising wetlands, forests, lakes and agricultural lands. Reedbeds, oak and hornbeam forests and lakes create great conditions for waterfowl. Comana wetland is a Ramsar and a Natura 2000 site as well as being located along an important bird migratory corridor. Past water drainage activities have led to negative changes of the plant community and the local ecosystem. As a result, three quarters of the area were no longer flooded and banks were overgrown by rushes and reeds.

Activities: Within the frames of the project ecological restoration of the wetland habitat was carried out on 1180 hectares, together with the reinforcement of species populations. Project activities reconnected the river to the floodplain, raised the water level and increased the flooded area and the surface of channels and ponds. A dam featuring a sluice and a fish pass was constructed on the Neajlov River in order to regulate the water regime. Additionally, a monitoring system for Natura 2000 areas and protected areas was set up, education and tourist infrastructure (educational and visitor centers, ornithological observatories and information panels) was erected and awareness raising activities were conducted.

Actors: Giurgiu Council, Comana Nature Park

Timeframe: 2009-2011

Budget and financing sources: EUR 1 800 000 million: 65% from the Romanian Sectorial Operational Programme "Environment" (Priority Axis 4 "Implementation of Adequate Management Systems for Nature Protection") and 35% from the state budget.

Ecosystem Service Improvement:

Provisioning: fish (size of poplations increased by 50%), birds (populations doubled in size, the number of species rose from 152 to 212), general wildlife habitat (surface permanently covered with water increased from 80 to 400ha), biomass (its use by the locals is regulated by the park's administration)

Regulating: water management and flood control, aquifer replenishment, carbon sequestration, soil (increase in the quality of local grasslands and increased farmer livelihoods)

Cultural: ecotourism, recreation, increased aesthetic value, education and research value (4 observatories built)

Socioeconomic benefits: 20 temporary construction jobs and creation of 15 permanent jobs, local jobs in tourism (the area hosts 10 000 visitors and 500 educational excursions per year, number of tourists increased by 50% between 2013 and 2015), development of local businesses (2 grocery stores, 1 adventure park, 1 restaurant, and a number of small producers of traditional products)

More information: http://nwrm.eu/case-study/restoration-comana-wetlands-romania

Restoration of the Hortobagy Sodic Lakes and its marsh habitat

Location: Carpathian Basin, Hungary

Figure 42 Restoration of Hortobagy Sodic Lakes, Hungary

Site Description: Hortobágy Sodic Lakes (with higher Na_2CO_3 concentrations) are located in the Pannonic steppic grasslands habitat and have been designated as Natura 2000 sites. Due to the past use of the lakes as a waste dump and sewage pond of Balmazújváros, the lakes have been badly damaged. Built using obsolete technologies, they did immeasurable harm to surface and underground waters. Due to limited information and expertise, given the complex and vulnerable nature of the microecosystem, no restoration programme for these sodic lakes had been implemented.

Activities: Restoration of sodic lake habitats and neighbouring steppic grasslands in the Hortobágy area at the Nagy-szik and Magdolna-puszta sites included eliminating unfavourable and detrimental processes affecting the lakes e.g. inappropriate drainage systems, shrinking of seasonal water bodies, sewage run-off, decline in traditional grazing by domestic animals and lack of environmental education. In order to fight those, two separate plans were devised: i) entire elimination of the waste dump and restoration of loess grassland in its former location and ii) naturalization of burrow pits and their utilization as wetlands. Around 42.9 hectares of land was purchased to help restore hydrological regimes and improve the conservation status of lake bed features and natural shorelines. Measures were applied to retain rain water, while urban and industrial water pollution was eliminated through canal system reconstruction, clearing waste deposits, removal of invasive plant species, reintroduction of traditional grazing systems along with public participation and awareness raising activities. Project outcomes estimated an increase bird biodiversity in the area by around 30%.

Timeframe: January 2009 – December 2013

Actors: Hortobágy Environmental Association, Foundation for the Nagy-szik of Balmazújváros, Tiszatáj Public Foundation for Environmental Protection and Nature Conservation, Hortobágy National Park Directorate

Budget: EUR 1 557 507 of which Life Fund contribution was EUR 1 168 130 and the rest was provided by the Hungarian Ministry of Agriculture and Hortobágy Environmental Association

Ecosystem services improvement:

Provisioning: food, crops, improvement of bird aquatic habitat for 250 species, livestock products

Regulating: nutrient cycling, water cycling, freshwater storage, climate regulation, flood prevention, purification of air and water, more predictable conditions for grazing and agriculture

Cultural: increased intensity of ecotourism due to better bird watching conditions (an increase from 1000 to 3000 visitors per year), conservation of natural landscape and cultural

heritage of the grazed steppe ('puszta'), promotion of scientific research, environmental education, improved aesthetic value and landscape composition

Socioeconomic benefits: revenue from and job creation in ecotourism, revenue from grazing, improved health of the local population as a result of a better microclimate, growing prices of real estate in the region, 5 workplaces in the project and 40 subcontracted positions

More information: http://www.hortobagyte.hu/

http://www.hortobagyte.hu/downloads/HEA_final_report.pdf

Restoration of Vacaresti Delta wetlands

Location: Bucharest, Romania

Site Description: The Vacaresti Delta is an abandoned construction pit located in South-Eastern Bucharest. As an unexpectedly rich natural ecosystem has developed there in recent years, the area was designated as a Ramsar and Natura 2000 site.

Figure 43 Restoration of Vacaresti Delta, Romania

The area is 190 hectares large, stretching on a former marsh and features miniature lakes and wetland vegetation. Vacaresti is now a breeding ground for over 90 species of birds and home to eagles, marsh harriers, little owls, pheasants, goldfinches, purple herons, spoonbills, kingfishers, terns, swans, wild ducks (e.g. ferruginous duck), bitterns and mammals such as otters, foxes, martens, European pond turtles, pike, grass snakes, numerous lizard, frog, dragonfly and butterfly species. Problems in the area include vegetation burning, illegal timber harvesting, wild dogs, illegal fishing and poaching and fly-tipping.

Activities: Save the Delta initiated a project in the year 2012, along with several specialists involving biologists, ecologists and geologists from various international organisations. The NGO cleaned up the area and night observatory in a neighbouring block. In 2012 National Geographic Romania published an article on the Delta which led to nationwide attention and media exposure. Together with Salvati Delta NGO, National Geographic started a lobbying campaign with the local and national authorities in order to establish the Delta as a Nature Reserve. A first step was the favourable decree of the Romanian Academy of Science in 2012 which stated that Vacaresti Delta should be given a Nature Reserve status. In 2014, the General Council of Bucharest voted favorably for the creation of a Nature Reserve but their vote was overruled by the court. The Council voted positively again in 2015, this time with no legal opposition. Thus, the matter has been brought to the Ministry of Environment who can now declare the site a Nature Reserve with an Emergency Ordinance. Salvati Delta NGO would like to build more tourist and educational infrastructure in the area modeled on the London Wetland Centre.

Actors: National Geographic, Romanian Academy of Science, Salvati Delta NGO, Bucharest Municipality (The General Municipal Council)

Timeframe: 2012-present

Ecosystem Services Improvements:

Provisioning: Food, crops, improvement of aquatic bird habitat; the area holds a new species for Romanian fauna: *Tetramesa variae*. 11 bird species present in the area are listed in Romania's red list of endangered species.

Regulating: Carbon sequestration, purification of water and air, decreasing surface runoffs, flood prevention, improvement of soil quality, aquaculture, climate regulation (the temperature in Vacaresti is 1-2 degrees cooler which helps the city's inhabitants to survive heat waves in the summer).

Cultural: Ecotourism (20-25 guided tours are on offer, tourist numbers are expected to increase from 2000 in 2015 to 10 000 in 2016 and 100 000 in 4-5 years in case the area is declared a natural park), recreation, city rebranding

Socio-economic benefits: creation of jobs in ecotourism and education, cost-efficient clean air mechanism (Bucharest is amongst the most polluted European capitals with 23.21 m^2 of green spaces per capita, which is below the EU legal requirement of 26m^2) expansion of available intra-urban public space for recreation, potential for growth in local tourism and recreation related businesses, increase in property value and demand for properties overlooking the wetland, urban regeneration in a not-so-attractive city district. Vacaresti Delta is vital for Bucharest, which has very few green spaces. There are also projects to use Vacaresti for water harvesting as the aquifers below Bucharest are seriously depleted.

More information: http://www.ceeweb.org/wp-content/uploads/2015/05/12-Dan-Barbulescu.pdf

The Salt of Life

Location: Bulgaria, Atanasovsko Lake

Site description: Atanasovsko Lake is a Natura 2000 site and the richest bird site in Bulgaria hosting 14 species of globally endangered bird species. The Lake is 4.3 km in width and 9 km in length and divided into two parts: a firth and a coastal lagoon by a road. In addition to being an important biodiversity area, Atanasovsko Lake constitutes Bulgaria's largest field of curative mud and the country's largest salt production site with extraction reaching 50 thousand tons annually. The 100-year long tradition of salt production resulted in the production of dykes, barriers and pools of varying salinity which helped to create breeding and feeding grounds for numerous bird species. The salt production methods employed in the region are traditional and environmentally friendly.

Figure 44 The Salt of Life Project, Bulgaria

Activities: Conservation activities include restoring dykes and barriers in order to restore the wetland habitat and the breeding and roosting sites associated with it, repairing bypass dyke and channel in order to decrease pollution, protecting the lagoon from floods and creating specific roosting sites for priority birds for conservation (11km of channel was cleaned and is now suitable for bird feeding). The project will monitor hydrological, hydrochemical and biodiversity (plants and birds) indicators in order to determine whether the project was

successful. Furthermore, education and awareness-raising activities within the frames of the project include the creation of a website, organization of a Salt of Life Festival, establishment of the Atanasovsko Lake Public Council in order to strengthen local participation and support and promotion and communication of the project.
Actors: Bulgarian Biodiversity Foundation, Bulgarian Society for Protection of Birds, Black Sea Salinas Ltd.

Timeframe: 2012-2018

Budget and financing sources: EUR 2 million, 75% of which come from the LIFE+ Fund

Ecosystem Service Improvement:

Provisioning: salt (which has the potential to be marketed as a local eco-product and sold at higher prices), habitat for wildlife (roosting and feeding grounds for birds), biodiversity preservation

Regulating: climate control and flood management, protection from extreme rainfall, health benefits, nutrient cycling

Cultural: preservation of aesthetic values of the habitat and its wildlife, recreation (in the summer 2000-3000 people visit the salt bath – a byproduct of the salt extraction - daily), education, local heritage (around 2000-3000 people visited the Salt Festival organised in the last two years)

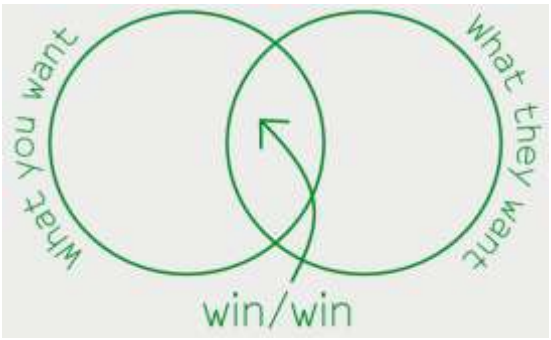
Socioeconomic benefits: jobs in salt mining, jobs in ecotourism, increased long term income of the partner salt mining company

More information: http://www.saltoflife.biodiversity.bg/en/

Discussion

As observed through the research process for present report, information regarding ecosystem services, their quantification and monetary valuation is usually difficult to access, much more so than the scientific parameters of wetlands and wetland restoration works. While the European Union has a system of collecting data to assess the conservation status of species and habitats, the state of ecosystem services remains unknown, in spite of the Mapping and Assessment of Ecosystems and their Services (MAES) initiative which was launched by the European Commission. While this initiative is an excellent idea, much more scientific work and data collection is needed to create a reliable knowledge base on the state of ecosystem services in Europe. Additionally, extra effort is required to convince scholars and, importantly, Member States of the importance of carrying out the MAES exercise in a timely and serious manner.

While decision-makers are waiting to be persuaded of the importance of ecosystem services, environmentalists themselves have to understand and support the concept first. Unfortunately, conservation project managers still tend to focus on a narrow view of biodiversity and environment as separated from the society and economy. Many conservationists when approached with questions regarding the socio-economic benefits of their projects state that conservation activities which they are implementing do not yield any such benefits. Whether this is scepticism, lack of understanding or awareness, or lack of will to engage with non-conservationist audiences, such attitude among conservationists is counterproductive. Lack of acknowledgement of the socio-economic benefits of conservation among the proponents of conservation means that those benefits are very unlikely to be understood and acknowledged by agents whose first and foremost task is not nature conservation, but rather socioeconomic development. Ecosystem services can be seen as a very useful tool in convincing non-environmentalist stakeholders of the need to engage in nature conservation.



The idea behind Green Infrastructure is precisely creating intersectorial dialogue by highlighting the win-win solutions which entail benefits from all perspectives. The language of ecosystem services has the potential of uniting all stakeholders around biodiversity issues which matter from the point of view of the society and the economy. The first ever efforts in nature conservation were sparked by concerns over

human health due to advancing air pollution. This fundamental concern for people and their environment still remains the main reason for worldwide conservation efforts. Oftentimes opponents of environmental protection argue that environmentalists place higher value on endangered species than humanity and problems related to world poverty. This report aims to precisely fight such a view and spread the word that environmental conservation is about people and protecting our only home. A home which is safe for us to live in thanks to the air it provides for us, the people-friendly climate it maintains, the food it gives us and numerous other ecosystem services which we take for granted every day. Unfortunately the time has come when ecosystems and the benefits they offer us are in danger of being destroyed and we must spread the word of the role they play in building human prosperity. Back at the beginning of sustainability science, economists made a division between natural and man-made capital. The first step in the right direction was strong sustainability - the idea that not only overall capital, but natural capital should not diminish. It is only now that we begin to see that the divisions between natural and man-made, nature and humans are a mere illusion and one that pushes us in the wrong direction. It is nature that is the source of all life, of all our riches and prosperity, of all money and products. And unlike man-made capital, only nature can ensure that life on Earth continues to flourish. In the face of global environmental changes such as climate change, ozone depletion, atmospheric pollution, eutrophication, ocean acidification, global epidemics, pests and biodiversity loss, the natural environment is our only life insurance thanks to its resilience and adaptability.

While some ecosystem services, such as provisioning services or certain cultural services are easier to put a price tag on and thus more widely acknowledged, it is the supporting and regulating services which truly underpin life on Earth. Thus, working to promote those services, be it through monetary valuation or awareness raising should be our priority for the coming years.

Based on the interviewed project coordinators, two themes require discussion: challenges encountered while trying to implement the project and policy recommendations.

Challenges to wetland restoration

Most implementers reported some difficulties in cooperating with the local authorities, getting them on board or even reaching them with the message of nature conservation and ecosystem services. As in case of the Hortobágy Sodic Lake Restoration, local inhabitants perceived the project as harmful, as it would prevent their cattle from grazing and increase the number of mosquitoes in the area.

Related to the issue of local dwellers is a similar problem with local authorities. Most interviewees reported that it would be beneficial to their project if the civil society could cooperate better with the local authorities and administration. In some cases, such as the Tarnava Mica project, a conflict arose between the nature conservation NGO and the water management authorities who had a different view regarding what water management and flood protection works should be done. As reported by the Montane Bogs project coordinator, Polish administration is often unwilling to help NGOs take any action and prefers to perpetuate the status quo. As the legal regulations are subject to interpretation, any controller can either praise or criticise a project according to his personal standpoint and beliefs.

All of the project leaders, however, tried to overcome such issues and organised meetings, consultations and awareness raising activities which helped to create an understanding and some support for the project. Different arguments seem to work in different countries, which is a challenge encountered by international projects. As reported by the coordinator of the Baltcoast project, there was a tendency among stakeholders to hold the belief that passive conservation would be the best for the sites rather than any action. Oftentimes, restoration needs to be heavily justified in order to convince the national, regional, local and sectorial authorities. Even when authorities are familiar with the term of ecosystem services, they do not understand why those services are not visible in monetary terms, as reported by the Vacaresti Delta project coordinator.

Unfortunately, the dispute between environmental protection and local development remains a challenge. As reported by the coordinator of the Atanasovsko Lake Restoration project, urbanization around the city of Burgas is currently the biggest challenge for nature conservation in the area. As the city is planning to develop by situating buildings directly at the lake shore, this vulnerable habitat may be threatened once more.

Many interviewees mentioned inadequate laws and policies, both national and European as constituting obstacles to successful implementation of wetland restoration projects. In case of Romania wetland restoration poses a problem as in light of the national legislation, wetlands cannot be created. Thus, if an organization wishes to reclaim a former gravel mine, it can either create a fishing pond or fill the area back with soil, as creating a wetland is legally impossible. The Comana Wetland Restoration project leader reported that oftentimes wetland restoration in Romania is not in fact in accordance with the Climate Change Adaptation Strategy which should be one of the main arguments for wetland restoration. In

Lithuania and Poland, Forestry Regulations were reported as hindering wetland restoration efforts.

Bureaucracy was another problem mentioned in case of the Baltic Raised Bogs project. According to Polish law, any small damming requires many permits and procedures which hampers nature conservation efforts yet this problem did not receive any attention from the national authorities.

Generally low law enforcement was reported as a challenge in Bulgaria, where regional environmental agency directors change often and projects are thus hard to complete according to their original arrangement.

Similarly to incorrect national legislation, very often the agricultural subsidies are the subject of criticism. The Hortobágy Sodic Lakes are not eligible for agricultural subsidies, even though they require grazing to be maintained. Under the Common Agricultural Policy, both sodic lakes and their direct catchments should receive financial support in order to prevent local farmers from draining them. Germany and Denmark (in comparison to Sweden) also have issues with CAP agricultural subsidies, as in case of grasslands whose conservation status improves. When a grassland reaches favourable conservation status it is no longer eligible for funding which is counterproductive as most grasslands require active conservation which is connected with maintenance costs. In case of the Atanasovsko Lake project, the site is not eligible for subsidies because Burgas is not considered a rural area and salt is not considered a food product. Compensating salt producers for income forgone should be possible as an exception in the frame of Natura 2000 compensations as it is done in France. However, such changes in Bulgaria would require strong political lobby.

Additional financial challenges included lack of co-financing for Life projects and some countries such as Romania withdrawing co-financing which was there in the past and rendering it impossible for local NGOs to collect such money themselves.

Conclusions and Recommendations

Based on literature review and surveyed projects, the following recommendations can be proposed for advancing the inclusion of ecosystem services into socioeconomic policy at the local, regional, national and European levels.

Recommendation 1: It is vital to follow up on the MAES initiative and include its results into national accounting systems by 2020, as required by the EU Biodiversity Strategy 2020.

Rationale: The economy can no longer treat environmental costs as externalities. A healthy environment provides ecosystem services which can be monetized; however, a loss of ecosystems incurs measurable financial costs to the society and the economy.

Recommendation 2: During the review of the Multiannual Financial Framework in 2017 and the discussion of the framework for 2020-2027, it is necessary to earmark more funding for the protection and restoration of ecosystem services, Natura 2000 and ecological connectivity within national budgets as well as the EU budget.

Rationale: Green infrastructure requires an upfront investment in order to provide higher returns in the future. Wetland restoration should be seen as a financial investment into the future health of our society, our planet and our economy and as such should receive more funding, both nationally and at the EU level.

Recommendation 3: Only thorough implementation of EU and national legislation, including Natura 2000 and the Water Framework Directive will enable wetlands to persist and function in order to keep providing the society with invaluable ecosystem services.

Rationale: Extensive EU legislation has been created in order to protect our natural capital. Only proper implementation can ensure the survival of species and habitats or community importance.

Recommendation 4: It is vital to take wetland ecosystem services into account in decision-making.

Rationale: Ecosystem services provide measurable socio-economic benefits which, when overlooked, can be lost thus lowering human living standard. Wetland ecosystems have been proven to be amongst the most socio-economically valuable habitats.

Recommendation 5: It is important to raise awareness among the society, local and regional authorities and national decision-makers regarding the role wetlands play in sustaining a healthy human environment, society and economy.

Rationale: Only by knowing and understanding the role that ecosystems, and especially wetland ecosystems play in our health and wellbeing, can we treat and preserve them in accordance with the value they constitute.

Recommendation 6: We need to find a healthy balance between human and wildlife use of wetlands.

Rationale: No ecosystem should be managed solely for the purpose of its socio-economic benefits. Nature has intrinsic value and the needs of wild fauna and flora should be granted next to human needs. Moreover, future option value of ecosystems can be an insurance in case of new pests, diseases or unprecedented environmental conditions.

Recommendation 7: Restoration of degraded wetlands is an important tool in restoring the wildlife habitat as well as reinstating the flow of their ecosystem services.

Rationale: Most of wetlands worldwide have been lost. Ecosystem restoration is often the only available tool for reviving wetland habitats for both nature and people's needs.

Recommendation 8: We must ensure that sufficient financial sources are made available for wetland restoration and management.

Rationale: It is not possible to reinstate the flow of wetland ecosystem services without a financial investment in ecosystem management or restoration. Green infrastructure projects often include a high initial cost and their benefits are only visible in the long run. Thus, considerable financial investment is needed to ensure healthy ecosystems are in place for the use of future generations.

Recommendation 9: Evaluating future impact of both conservation activities and other development works enables us to make sound decisions regarding future land use.

Rationale: Sound decisions require research and attempted forecasting of the results of our activities. Only by careful consideration of all factors and aspects and Environmental Impact Assessment, can be pick the most environmentally and socially profitable scenario.

Recommendation 10: Thorough land use planning can ensure proper management of habitats valuable for biodiversity as well as social purposes.

Rationale: Based on Environmental Impact Assessment, it is crucial to conduct detailed land use plans and ensure their cross-sectorial implementation. We can only maximise environmental and socio-economic benefits by following a carefully designed action plan.

Recommendation 11: It is important to work together with the local community when planning for wetland conservation and genuinely involve them in decision-making.

Rationale: Only decisions accepted by local stakeholders have the chance to be successfully implemented. Local stakeholders must have a say in how and for what their ecosystems are managed. Hopefully, having been exposed to awareness raising and information campaigns regarding the importance of nature to societal health and the value of ecosystem services, they will make the right decisions regarding conserving their local nature.

Recommendation 12: Local and indigenous knowledge can often provide better fitting and tailored solutions than textbook solutions from outsiders.

Rationale: Nobody knows the local environment better than indigenous people. Thus, their knowledge and experience should be gratefully acknowledged, made use of and combined with the scientific information provided to the decision makers by the academic community.

Recommendation 13: Exchange of experience as well as specific wetland management practices can improve wetland management Europe-wide.

Rationale: Habitat managers across Europe can benefit greatly from experience and knowledge exchange with colleagues from other countries. Events such as CEEweb Academy, organised in the frames of present project, can save much effort and costs related to finding out the best habitat management techniques.

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Picture Sources

Cover page: Barva Regina (CEEweb)

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Annex

Ecosystem Service Questionnaire

Please fill this out to the best of your knowledge. Rather than ticking the services that you hope were improved, please tick the ones where you have had some sort of confirmation or proof that there was an increase.

This questionnaire should not take you more than 15 minutes.

Thank You very much for your time!

Your name	
Your organisation	
Project name	

1. In the course of the restoration project, which ecosystem services were improved?

ES class	Ecosystem Service	↑ INCREASED	= DID NOT CHANGE	↓ DECREASED	? I DON'T KNOW	X NOT APPLICABLE
Cultural	Aesthetic value	☐↑	☐=	☐↓	☐?	☐X
Cultural	Value for recreation/ sport	☐↑	☐=	☐↓	☐?	☐X
Cultural	Value for tourism	☐↑	☐=	☐↓	☐?	☐X
Cultural	Spiritual value	☐↑	☐=	☐↓	☐?	☐X
Cultural	Value for research	☐↑	☐=	☐↓	☐?	☐X
Provisioning	Genetic material from all present species	☐↑	☐=	☐↓	☐?	☐X
Provisioning	Crop provisioning	☐↑ Please specify:	☐=	☐↓	☐?	☐X
Provisioning	Timber provisioning	☐↑	☐=	☐↓	☐?	☐X
Provisioning	Fish / game provisioning	☐↑	☐=	☐↓	☐?	☐X
Provisioning	Fiber provisioning	☐↑ Please specify:	☐=	☐↓	☐?	☐X
Provisioning	Fuel (e.g.	☐↑ Please	☐=	☐↓	☐?	☐X

	peat) provisioning	specify:				
Provisioning	Provisioning of chemicals/ medicines	☐↑ Please specify:	☐=	☐↓	☐?	☐X
Provisioning	Provisioning of groundwater (aquifer recharge)	☐↑	☐=	☐↓	☐?	☐X
Regulating	Soil quality	☐↑	☐=	☐↓	☐?	☐X
Regulating	Flood frequency (local and beyond local)	☐↑	☐=	☐↓	☐?	☐X
Regulating	Quality of freshwater in the area	☐↑	☐=	☐↓	☐?	☐X
Regulating	Coastal protection	☐↑	☐=	☐↓	☐?	☐X
Regulating	Climate regulation	☐↑	☐=	☐↓	☐?	☐X
Regulating	Carbon sequestration	☐↑	☐=	☐↓	☐?	☐X
Regulating	Nutrient cycling	☐↑ Please specify:	☐=	☐↓	☐?	☐X
Regulating	Disease control	☐↑ Please specify:	☐=	☐↓ Please specify:	☐?	☐X
Regulating	Habitat maintenance	☐↑	☐=	☐↓	☐?	☐X
Regulating	Pest control	☐↑ Please specify:	☐=	☐↓ Please specify:	☐?	☐X
Regulating	Pressure from mosquitos	☐↑	☐=	☐↓	☐?	☐X
Regulating	Pollination	☐↑	☐=	☐↓	☐?	☐X
Socioeconomic benefit	Local GDP	☐↑	☐=	☐↓	☐?	☐X
Socioeconomic benefit	Estate prices in the area	☐↑	☐=	☐↓	☐?	☐X
Socioeconomic benefit	Number of temporary jobs	☐↑	☐=	☐↓	☐?	☐X
Please specify: ☐in conservation ☐in education ☐in research ☐other:.....						
Socioeconomic benefit	Number of permanent jobs	☐↑	☐=	☐↓	☐?	☐X

Please specify: ☐in conservation ☐in tourism ☐in agriculture ☐in education ☐in research ☐other:.....						
Socioeconomic benefit	Health of the local population	☐↑	☐=	☐↓	☐?	☐X

2. Are you satifsied with the outcomes of the project?Why/ Why not?