

ReCo

Transnational atlas on national level along the CE EGB and for six ReCo pilot regions

(D.1.2.3)

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Broader Habitat Type Historical Landcover Landcover Change Ecosystem Services Morphological Spatial Pattern Analysis (MSPA) Euclidean Distance Potential of Restoration based on BHT Historical Target Habitat Reclassified MSPA Restoration Suitability

Introduction

Central European landscapes have undergone significant transformations over the centuries, driven by agricultural intensification and expansion, urbanization and industrial activities, but also abandonment of traditional forms of agricultural management. These changes have resulted in habitat fragmentation, loss of biodiversity, and degradation of ecosystem services. Recognizing the urgency of these challenges and the need to take actions in crucial areas to reconnect and revitalize natural habitats and thus strengthen the ecological network, this Working Paper was developed.

This Atlas presents the collection of maps resulting from Deliverable *D.1.2.1 Transnational and regional GIS surveys* - and *D.1.2.2 Transnational and regional proposals for targeted restoration actions along EGB CE*. The Atlas is divided in 5 parts, one containing the map collection of each Pilot Region where joint pilot restoration actions are being developed. Each sections includes the overview of the region, habitat maps, main ecosystem services maps, target ecosystems for restoration, historical landcover maps, connectivity analysis of the target habitats. The Atlas also includes all the derived analysis for identifying suitable areas for future restoration measures to restore ecological integrity, enhance biodiversity, and promote sustainable land use practices.

The maps for each region were developed following the conversations with Project partners regarding the restoration goals for the regions. The dialog gave the guidelines for the selection of habitats to be the focus of the analysis. The aim of the resulting collection of maps is for it to offer a basis for future planning and stakeholder alignment for restoration along the CE EGB.





Broader Habitat Type

- A Marine habitats
- A2 Littoral sediment
- B1/2 Coastal dunes and shingle
- C1 Inland surface waters standing
- C2 Inland surface waters watercourses
- C3 Lithoral zone of inland waterbodies
- D Mires, bogs and fens
- E1 Dry grasslands
- E2a Mesic grasslands, intensively managed
- E2b Mesic grasslands, medium intensive
- E3 Seasonally wet and wet grasslands
- E5 Woodland fringes and clearings, tall forb stands
- F3/4 Temperate and mediterranean-montane scrubs and heathland
- F9 Riverine and fen scrubs
- FA Hedgerows
- FB Shrub plantations
- G1 Broadleaved deciduous woodland
- G1.D Fruit and nut tree orchards
- G3 Coniferous woodland
- G5 Lines of trees, small anthropogenic woodlands, recently felled woodland, early-stage woodland and coppice
- H Inland unvegetated or sparsely vegetated habitats
- I1a Arable land and market gardens intensive
- I1b Arable land and market gardens low intensity
- 12 Cultivated areas of gardens and parks
- J3 Extractive industrial sites
- J4 Transport networks and other constructed hard-surfaced areas
- J6 Waste deposits
- Ja Constructed, industrial and other artificial habitats with significant green spaces
- Jb Constructed, industrial and other artificial habitats high imperviousness



Pilot Region 1: Fichtelgebirge and Smrčiny Mountains





PR1: Fichtelgebirge And Smrčiny Mountains

Erlenbächlein Area, Rehauer Forest in the Fichtelgebirge Mountains and Smrčiny Mountains. The pilot action for this region is located in the catchment area of the Lužní Brook, which forms the state border between the Czech Republic and Bavaria, and Erlenbächlein, which drains into the Höllbach (Pekelský potok), also a border stream. The entirety of the catchment area is evenly divided between Bavaria and the Czech Republic. This locale represents a typical Green Belt area, once situated beyond the Iron Curtain.

The Erlenbächlein area in the Rehauer Forest embodies a unique mosaic of diverse biotopes, encompassing flat moors, spring moors, meadows, and sedge or rush-rich wet meadows. Nevertheless, these pristine biotopes face fragmentation due to drained, degraded, and afforested areas, significantly compromising the ecological integrity and connectivity of the region. The pilot action efforts are committed to restoring this fragmented landscape into a connected and resilient ecosystem through targeted actions.

The Smrčiny Mountains hold their main value in the preservation of watercourses and their catchment areas. A concentration of biodiversity, particularly notable for hosting rare species such as the freshwater pearl mussel Margaritifera margaritifera, the brook lamprey Lampetra planeri, the bullhead Cottus gobio, and the common minnow Phoxinus phoxinus, defines the area. Various measures are underway to restore and preserve the natural form of the catchment. The catchment areas of Lužní potok and Bystřina are pivotal sites for the pearl mussel action plan, involving the release and nurturing of juveniles into adulthood.

Efforts are being made to restore natural channels of small tributaries and vernal pools, although these initiatives are still in progress. Given the extensive size of the entire area, continued restoration of small tributaries and the maintenance of facilities are imperative to provide a conducive environment for the juvenile stages of pearl mussels.

The maps for this region focus on water habitats and grasslands. Connectivity between patches is analysed and potential of restoration between the target ecosystems is assessed. The analyses posses as a base for the identification of areas with potential of restoration and high connectivity impact, following the necessity of the pilot actions to work on the restoration of small tributaries as a measurement for ensuring the continuous supply of sufficient water to the juvenile pearl mussel nursery.











Historical Landcover

The historical land cover of PR1 showed a more or less equal share of arable land and forest, with regional differences: while more fertile and flat areas were occupied predominantly by arable land, central, more mountainous parts were occupied by forest. Grassland habitats in the form of meadows and pastures could be found in the river valleys, settlements were scattered throughout the pilot region. The habitats targeted for restoration, i.e. wetlands, wet grassland, peatbogs and literal zones of water bodies were more common than nowadays.

Regarding changes between historical land cover and present broader habitat types, analyses showed that more than half of the region did not change - this concerned mainly semi(natural) habitats. If changes indeed did occur, they were mostly captured as changes to (semi)natural habitats, and the major processes were overgrowing by woody vegetation. However, also quite extensively the processes showed loss of targeted habitats, both of water affected habitats and meadows.



















Morphological Spatial Pattern Analysis (MSPA)

Inland surface waters - standing Inland surface waters - watercourses Lithoral zone of inland waterbodies Mires, bogs and fens Seasonally wet and wet grasslands Mesic grasslands, medium intensive Germany / Czech Republic



Connectivity Analysis - MSPA Core Loop Islet Bridge Perforation Branch Edge Broder-Opening 5 10 15 km 1:300.000 15 km

Sources: Esri, DigitalGlobe, GeoEye, GTB, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Defer



Euclidean Distance

Inland surface waters - standing Inland surface waters - watercourses Lithoral zone of inland waterbodies Mires, bogs and fens Seasonally wet and wet grasslands Mesic grasslands, medium intensive

Germany / Czech Republic



Euclidean Distance (m)







Potential of restoration based on BHT

Inland surface waters - standing Inland surface waters - watercourses Lithoral zone of inland waterbodies Mires, bogs and fens Seasonally wet and wet grasslands Mesic grasslands, medium intensive Germany / Czech Republic





Sources: Esri, DigitalGlobe, GeoEye, GTB, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community





Historical Target Habitat

Inland surface waters - standing Inland surface waters - watercourses Lithoral zone of inland waterbodies Mires, bogs and fens Seasonally wet and wet grasslands Mesic grasslands, medium intensive Germany / Czech Republic



Farget habitat in historical data		
Target Habitats		
10	0	15 km
1:300.000		
urces: Arcanum, Esri, DigitalGlobe, GeoEye, GTB, ubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, I, IGP, swisstopo, and the GIS User Community		
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Co-funded by the European Union

ReCo



CZ



Restoration Suitability Index

Inland surface waters - standing Inland surface waters - watercourses Lithoral zone of inland waterbodies Mires, bogs and fens Seasonally wet and wet grasslands Mesic grasslands, medium intensive Germany? Czech Republic



Sources: Arcanum, Esri, DigitalGlobe, GeoEye, GTB, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community







Pilot Region 3: Škocjanski zatok Nature Reserve





PR 3 Škocjanski zatok Nature Reserve

The Škocjanski zatok Nature Reserve stands as a distinctive ecosystem in Slovenia, distinguished by its proximity to the sea, Mediterranean climate, sub-Mediterranean vegetation, and anthropogenic origin. Boasting a diverse array of habitats, including Page 47 freshwater wetlands, ponds, reedbeds, shallows, salt marshes, mudflats, islets, and deepwater areas, this reserve serves as a haven for a rich variety of fauna and flora, some of which are rare and endangered. Notably, 41% of all Slovenian amphibian species, 41% of reptile species, over 66% of bird species observed in Slovenia, and 36% of Slovenia's mammals find refuge in this area.

A noteworthy accomplishment in meeting conservation objectives is the establishment of a freshwater marsh, coupled with extensive efforts to restore and regenerate the habitat in the brackish lagoon, conducted between 2006 and 2007. This success exemplifies best practices in natural habitat creation, marked by collaboration between botanical, ecological, and hydrological experts alongside technical specialists. The restoration and creation of various habitats, rare and endangered at both Slovenian and European levels, have fostered conditions conducive to the proliferation of bird species, especially those of national and international importance. The introduction of mudflats and marginal habitats in the brackish water lagoon has provided new nesting sites for significant Natura 2000 species, including the Sterna hirundo (common tern), Sternula albifrons (little tern), Himantopus himantopus (black-winged stilt), Tringa totanus (common redshank), and Charadrius alexandrinus (kentish plover).

Coastal wetlands, including the Škocjanski zatok Nature Reserve, represent ecosystems subject to bi-directional flooding occurring twice daily in most regions. A crucial physiological aspect of these ecosystems lies in their periodic and predictable flooding, significantly shaping successional development, species composition, stability, and productivity. Recognized for years, coastal wetlands' importance for diverse flora and fauna stems from the intricate interplay between marine and terrestrial habitats. Dominated by halophytes, these areas serve as vital feeding, resting, and nesting sites for numerous bird species.

Research indicates that climate change-induced sea-level rise will profoundly impact coastal wetlands, with projections suggesting a faster increase in the 21st century. This phenomenon poses a substantial threat globally, particularly in low-lying sedimentary coastal regions where more frequent flooding or vertical habitat retreat is anticipated. The Mediterranean and Baltic Sea regions, in particular, may witness the complete disappearance of coastal wetlands by 2080 due to relative sea-level rise. This poses a formidable challenge for developing cost-effective biodiversity conservation plans, considering the considerable expense involved in restoring or reconstructing lost habitats.

The maps presented for this region consider the habitats that are present in the reserve that serve as habitat for several species. A connectivity analysis is presented, and suitability for restoration in the extended area. Although, the core region is particularly characterized by its built up and intensively managed surroundings. Therefore, the target habitats serve particularly as a stepping stone of different habitats in the bigger scale.











PR 3 Škocjanski zatok Nature Reserve

Historical Landcover

Historical landscape of the extended area of PR3 was mainly used for wine growing with scattered forests and meadows, in the higher parts also by pastures. The region around the core area was largely part of the sea and salt marshes.

The pilot region experienced massive anthropogenic changes with the spread of the town of Koper and other settlements. This concerned not only marine and coastal habitats but also agricultural land. About twenty percent of water affected habitats were dried out and about five percent of anthropogenic habitats were changed to (semi)natural habitats, either grasslands or forests.






















Pilot Region 3 - Škocjanski zatok:

Potential of restoration based on BHT

Litoral seddiments Inland surface waters Lithoral zone of inland waterbodies Coastal dunes and shingle Mires, bogs and fens, Saline coastal lagoons Slovenia













Pilot Region 3 - Škocjanski zatok:

Restoration Suitability Index

Litoral seddiments Inland surface waters Lithoral zone of inland waterbodies Coastal dunes and shingle Mires, bogs and fens, Saline coastal lagoons Slovenia



Unsuitable Very Low Suitability Low Suitability Moderate Suitability High Suitability Very High Suitability Core areas <u>1 2 3 km</u> <u>1:50.000</u>



Pilot Region 4: Gorenjska region





PR 4 Gorenjska region

The target geographical area of the Joint Pilot Action of the region is situated in the Western Karavanke Mountains, specifically encompassing the Karavanke region within the municipal boundaries of Jesenice. In Jesenice, the mountain daffodil is found in the Karavanke segment of the municipality, initially appearing in the lower part of the Karavanke foothills at an altitude of approximately 700 m.a.s.l. The daffodil habitats include meadows and pastures in the broader vicinity of Plavški Rovt, Planina pod Golico, Prihodi, and Javorniški Rovt. They also extend to overgrown hay meadows above Hrušica, reaching up to the summit ridges of the Karavanke Mountains, notably on Golica (1,835 m.a.s.l.). In the eastern part, the daffodil's distribution is confined to the Javorniški Rovt area, encompassing Jezerec and Mavra. In the western part, its range extends into the municipality of Kranjska Gora, covering the areas of Raven and Dovška Rožca.

The municipality of Jesenice, nestled in the Karavanke region, is home to expansive and widely recognized daffodil habitats, notably on the slopes of the Golica Mountains and the meticulously cultivated meadows encircling the villages of Plavški Rovt, Planina pod Golico, Prihodi, and Javorniški Rovt. Local narratives from older generations vividly describe the Golica Mountains' slopes adorned in white with daffodil flowers, making it the largest and most frequented daffodil site in Slovenia. Despite the recognition of daffodil habitats in other regions of the country, Golica and its surrounding villages remain unparalleled in both size and popularity among tourists. In nurturing these natural environments for daffodils, proper agricultural management of the meadows is indispensable. However, the evolving landscape in these hill regions, adapting to modern agricultural trends and techniques, exerts pressures on daffodil sites. Challenges include:

- overgrowth of farmland,
- shift in agricultural use towards extensive farming, negatively impacting daffodil growth (such as the abandonment of mowing meadows solely for grazing),
- transition to intensive farming with adverse effects (including early spring grazing, premature mowing, ensiling, and baling instead of traditional drying on the ground).

The Joint Pilot Action area comprises a mosaic of diverse ecosystems, including forests, cultivated grasslands, and mountain pastures. Conservation efforts primarily target the steeper, extensively cultivated meadows, often encircled by forests. Preserving these meadows is vital for safeguarding the specific flora and fauna intricately connected to the mosaic structure of the habitats in the area. This interconnection creates unique environments and essential connections crucial for the area's flora and fauna, such as meadows serving as grazing areas for game, the distinctive species structure of grasslandforest edges featuring light-loving fruiting tree species, and extensive hay meadows providing a habitat for grassland butterflies. Establishing an ecologically coherent landscape with diverse grassland and woodland habitats, showcasing rich biodiversity, will enhance the region's resilience to potential climate change pressures.











Broader Habitat Types



Broader habitat type EUNIS

C1	F3/4	Н
C2	FB	l1a
D	G1	l1b
E2a	G1.D	Jb
E7	G3	

5	10	15 km	
	1:300.000		





PR 4 Gorenjska region

Historical Landcover

In the PR4, in the past as well as now, the mountainous landscape was dominantly forested. The mountain peaks were either bare or covered by meadows or pastures, sometimes with scattered trees. Wet grasslands could be found in the valleys around rivers, together with patches of arable land and settlements.

When comparing historical land cover with current situation, analyses showed that more than half of the pilot region remained unchanged, especially due to forested mountains. However, about one third of the (semi)natural habitats interchanged - mostly by overgrowing bare surfaces and meadows and pastures by woody vegetation. As such, many target habitats were forever lost. This is true especially in cases where meadows and pastures were turned into forest. In some cases, these habitats were overgrown only by scrubs and heath or by scattered trees, making the potential restoration of meadows more feasible









Regulation Functions



Ecosystem Services - Regulation







Habitat Functions



Ecosystem Services - Habitat







Production Functions



Ecosystem Services - Production







Information Functions



Ecosystem Services - Information







Carrier Functions



Ecosystem Services - Carrier









Euclidean Distance



Euclidean Distance (m)







Potential of restoration based on BHT

















HR

2 km

Pilot Region 5: Ińsko Lakeland





PR 5 Ińsko Lakeland

The Ińsko Lakeland, encompassing the core area, spans a total of 880 km² in Northwestern Poland, while the extended Pilot Region extends over an area of 40,200 km². The region is characterized by its primary land use in agriculture and forestry, boasting a rich system of watercourses, water bodies, and wetlands. With a developing road and railway network, the area is relatively sparsely urbanized, emphasizing a focus on wildlife and nature-oriented tourism. Notable protected areas within the Ińsko Lakeland include the Ińsko Landscape Park, designated as Natura 2000 site with the code PLB320008 Ińsko Refugium, and PLH320067 Ińsko Lakeland.

The goal of the Joint Pilot Action in the region is to increase both the size and range of the European bison Bos bonasus population that has been reintroduced in Northwest Poland. To achieve this overarching goal, two key objectives have been identified. Firstly, efforts will be directed towards enhancing migration routes for European bison herds, ensuring a conducive environment for their movement. Secondly, there is a focus on minimizing conflicts between humans and European bison, promoting coexistence and harmonious interactions in the region. Through these concerted efforts, the aim is to foster a sustainable and thriving European bison population in Northwest Poland.

Restoration Approaches include the enhancement of the management of European bison herds reintroduced in NW Poland. This involves identifying migration barriers and formulating recommendations for transport infrastructure investments. Additionally, efforts are directed towards optimizing the population's spatial structure by maintaining low densities (<3 individuals/1,000 ha) through the increase in the number of herds. The implementation of constant population monitoring is crucial, ensuring a swift response to potential human-bison conflicts

The maps presented for this region present the analysis of forest and open land habitats both suitable habitats for the bison populations. The layers obtained will later be used as the base for the analysis that will combine GPS data of collared individuals. The aim of the data overlay is to understand the routes of bison and possible relations with the different habitats, the analysis will provide guidelines for conservation efforts and understanding of the behaviour of the herds in terms of their movement and possible relation with the landscape.











Pilot Region 5 - Ińsko Lakeland:

Broader Habitat Types








Historical Landcover

The dominant land cover in the PR 5 in the past was represented by arable land, which covered more than the half of the core area of the pilot region. The proportion of grasslands and forests was similar. The landscape was also characterized by occurrence of natural water bodies, wet grasslands, peatbogs and wetlands.

The changes that were captured in this pilot region were mostly conversion to (semi)natural habitats, predominantly forests but also to meadows. Unchanged land covered about half of the region and the unchanged anthropogenic and (semi)natural habitats were represented equally.



















Poland DE

Pilot Region 5 - Ińsko Lakeland:

Euclidean Distance

Forest and Woody features



Euclidean Distance (m)



Sources: GuidosToolbox, Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community













PL



Euclidean Distance



Euclidean Distance (m)

Sources: GuidosToolbox, Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community











Pilot Region 6: National Parks Thayatal & Podyjí





PR6 National Parks Thayatal & Podyjí

The Thayatal National Park, situated at the border of northern Lower Austria and the Czech Republic, along with its neighboring Podyjí National Park, represents some of the most biodiverse areas within Central Europe's protected regions. This steep valley, adorned with natural forests, owes its remarkable biodiversity to a combination of diverse geology, river morphology, and its location at the intersection of two climate zones. Amidst the fragmented landscapes of Waldviertel, Weinviertel, and South Moravia, this relatively small expanse of 7,660 hectares (Thayatal NP 1,360 hectares, Podyjí NP 6,300 hectares) holds significant value for wildlife in Central Europe.

Despite its size, the area serves as a crucial stepping stone for migrating wildlife, including the European Wildcat, Lynx, Wolf, and other species requiring interconnected movement corridors for migration and dispersion. Podyjí National Park, part of the Inter- National Park along with Austria's Thayatal National Park, is one of the Czech Republic's four national parks. It safeguards near-natural forests along the deep Dyje River valley, with a biome considered unique in Central Europe. Encompassing elevations from 534 to 214 meters, the park features diverse habitats, including forest, grassland, arable land, shrubland, rocky areas, and inland wetlands. The Dyje River, flowing for 40 kilometers through the park, carves a deeply forested valley within the Českomoravská vrchovina uplands, reaching a depth of 220 meters. The park's land use is dedicated to nature conservation, research, forestry, and agriculture, offering park trails leading to historic sites such as Nový Hrádek castle ruins, Hardegg Castle, and Vranov nad Dyjí Chateau.

The European wildcat, once extinct in Austria, experienced a remarkable rediscovery in Thayatal National Park in 2007, subsequently becoming a flagship species for the park. Its presence serves as an indicator of a healthy ecosystem with functional trophic levels. The sensitivity of Felis silvestris to disturbance further highlights its role in signifying undisturbed ecosystems. Characterized by its high mobility, the European wildcat occupies territories ranging from 500 to 1,000 hectares. Landscape connectivity is pivotal in habitat selection and sustaining the species. While Thayatal National Park is primarily covered by undissected forests, the common landscape area encompassing Lower Austria's Eastern Quarter, Waldviertel, Weinviertel, and the counties of South Bohemia, Vysocina, and South Moravia faces increasing fragmentation due to construction, roads, and intensive use. This fragmentation disrupts wildlife migration corridors, isolating crucial protected areas and near-natural landscapes like those in the Waldviertel, South Bohemia, Thayatal, and Podyjí National Parks.

The maps presented for this region focus on the Forest habitats and analyse the connecting elements between patches as the main corridors of the European Wildcat.

















Historical Landcover

Austria / Czech Republic





Sources: Arcanum, Esri, NÖ Landesbibliothek

(i)

8.8



Historical Landcover

More than half of PR6 was in the past used for agricultural purposes, both in the form of arable land and viticulture. Forests covered around twenty five percent of the region. They occupied the steep slopes of the Thaya river and their surroundings (nowadays they form both national parks). Meadows and pastures were scattered throughout the region, although their higher concentrations could be found in the eastern part of the PR where they created sort of a transition between forests and agricultural land.

Regarding the land cover changes, more than sixty percent of the PR did not change. This concerned mainly localities with agricultural land but also forests. About one third of the region experienced spread of (semi)natural habitats, mainly grasslands and woodland fringes on arable land. On the other hand, many grassland habitats were at the same time overgrown by woody vegetation. Yet, at the same time, some woody elements were lost, contributing to lower connectivity of this habitat outside large forest complexes.























SK

HU

8 km
