



Project of local ecological network

Case Study: Border triangle Austria, Slovenia, Italy

Mapping report identifying the GBI elements, barriers, connectivity measures in the pilot area Trilateral transboundary pilot site (Austria-Italy-Slovenia)

Activity 2.3 Case Studies 2nd step: To design a GBI network for connectivity across administrative boundaries or transnational cross-border areas in pilot sites

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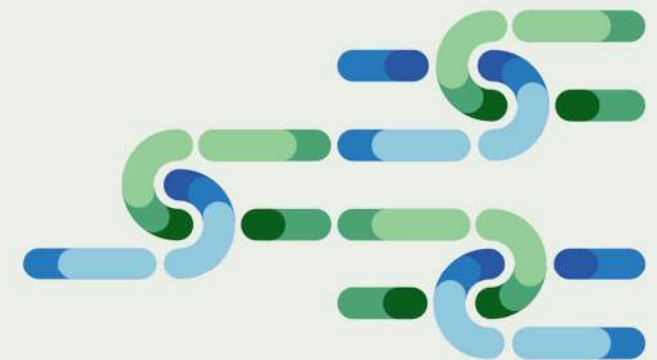


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GLOSSARY

“Connectivity” (structural and functional)

“Connectivity comprises two components, structural and functional connectivity. It expresses how landscapes are configured, allowing species to move. Structural connectivity, equal to habitat continuity, is measured by analysing landscape structure, independent of any attributes of organisms. [...]. Functional connectivity is the response of the organism to the landscape elements other than its habitats (i.e. the non-habitat matrix). This definition is often used in the context of landscape ecology. A high degree of connectivity is generally linked to low fragmentation.” (EUROPEAN COMMISSION - Technical information on Green Infrastructure (GI), 6.5.2013, Glossary)
(Definition of connectivity see also Deliverable 1.1.1, chapter 8)

GBI – Green and Blue infrastructure

Green infrastructure (GI) is a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services. It incorporates green spaces (or blue if aquatic ecosystems are concerned) and other physical features in terrestrial (including coastal) and marine areas. On land, GI is present in rural and urban settings.” (EUROPEAN COMMISSION - Green Infrastructure (GI) — Enhancing Europe’s Natural Capital, 6.5.2013)

RCWG – Regional connectivity working group – a group of stakeholders out of different sectors and levels, to be established in the project to discuss and validate specific corridors and connectivity measures

CB-RCWG – Cross border regional connectivity working group - Regional connectivity working group for trilateral pilot area – a group of stakeholders out of different sectors and levels of the three Countries Austria, Italy and Slovenia, to be established in the project to discuss and validate specific corridors and connectivity measures

SACA - Strategic Alpine Connectivity Areas

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EXECUTIVE SUMMARY

The priority corridor selected in this pilot study is the direct connection between the bilateral UNESCO Biosphere Reserve Julian Alps in Slovenia and Italy and the Natura Park Dobratsch in Austria. The corridor connects the Upper Sava Valley at Podkoren and the Dobratsch Mountain west of the City of Villach. The aim is also to find possible suitable areas for ecological important connection.

The approach is a mixture of data analyses and stakeholder consultation. The first aim was to compile existing protected area data and connectivity data of the three countries of the pilot area to come up with a harmonized approach. The approach is quite different; therefore harmonization of the data was part of the analysis. The network pieces collected were compared with the alpine wide model and important corridor and GBI elements verified with stakeholders in a national and in an international workshop setting. Additionally, stakeholder interviews and observer workshops were held to address priority corridors and potential threats. Field visits to selected barriers and bottlenecks were done.

The selected corridor in the wider pilot region contains basically huge forest areas, especially Illyric broad leaf forest on the mountain slopes. Additionally rocky areas and areas with traditional small scale agricultural uses and pastures occur mainly in the valley floors. There are also gaps and bottlenecks for connectivity. Wetlands also occur within the selected corridor and function as connecting elements because they are rarely used.

Target species are bigger mammals, the definition “everything bigger than a hare” is taken over from the Austrian approach of lebensraum.at. Species like bear and lynx are not specifically addressed but occur in the border region. Especially lynx is highly sensitive on high quality forest and avoids human infrastructure. However, there are some existing barriers to be addressed, and some threats regarding infrastructure development to solve for the future. Especially the protected areas situation within the corridor shows gaps on the Austrian side. For establishing the corridor and securing it for the future, those gaps and bottlenecks should be addressed, and a legal base should be developed in form of a memorandum of understanding. The importance of the corridor should be addressed in a wider stakeholder setting. Options for future collaborations of the neighbouring parks will be highlighted in the planning document.

REPORT

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1 Introduction

1.1 About the area

The pilot area in the border triangle between Austria, Slovenia and Italy comprises the recently recognized bilateral UNESCO Biosphere Reserve Julian Alps (in Slovenia around the Triglav National Park) and the Julian Pre-Alps (Italy). To the north, on the Austrian side, the Dobratsch Nature Park connects with the Karawanken in the east and the Carnic Alps in the west. Separated by the Gail valley, which connects to the Italian side via the Slizza/Gailitz river, the Dobratsch with its steep southern slopes offers habitats that are also found on the other side of the border.

While the mountain areas are mainly used extensively, the valley areas such as the river Gail valley (A) and the (peri-)urban area of Villach (A), the canal valley (I) around Tarvisio or the Sava valley (Si) are used intensively and are under constant development pressure (economic and land use changes). The Dobratsch Nature Park (A) is an important link in the ecological corridor system that connects the Balkans and the Karawanken with the Hohe Tauern / Central Eastern Alps. The pilot area is part of the Alpine biogeographical region and is characterized by Illyrian elements typical of the Southern Alps.

The area still offers vast natural spaces with varying degrees of protection, with the Triglav National Park and the Prealpi Giulie Natura Park representing an important core area that should be connected. They already cooperate as a bilateral UNESCO biosphere reserve, which is recently approved by the UNESCO. The biosphere reserve consists of a quite strict protected core zone (without human use), a buffer zone (where traditional use in terms of habitat maintenance takes place) and a transition zone (where sustainable uses should be achieved in the communities of the reserve). The biosphere reserve is a model region for sustainable regional development and therefore also means also a promising base for careful handling of upcoming projects in the communities. There are also several Natura 2000 areas in both countries, acting as SACA 1 smaller than 300 m².

In Austria, the Dobratsch Nature Park was established based on the Schütt-Dobratsch Natura 2000 site, a natural area created by a huge rockfall in the 14th century. In addition, wetlands, limestone meadows alpine pastures and vast beech and fir forests on the mountain slopes of the Karawanks complement a rich natural and semi-natural heritage.

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Additional core areas are some smaller Natura 2000 sites (like western Karawanks and Kokra) that should not be isolated from similar habitats in neighbouring countries. The steep forest slopes of the Karawanks are basically dedicated as protective forests according to forest function plan of the county, which means the economic function is less important. However, they are not protected in the sense of being a protected area, and economic use of the forest is possible.

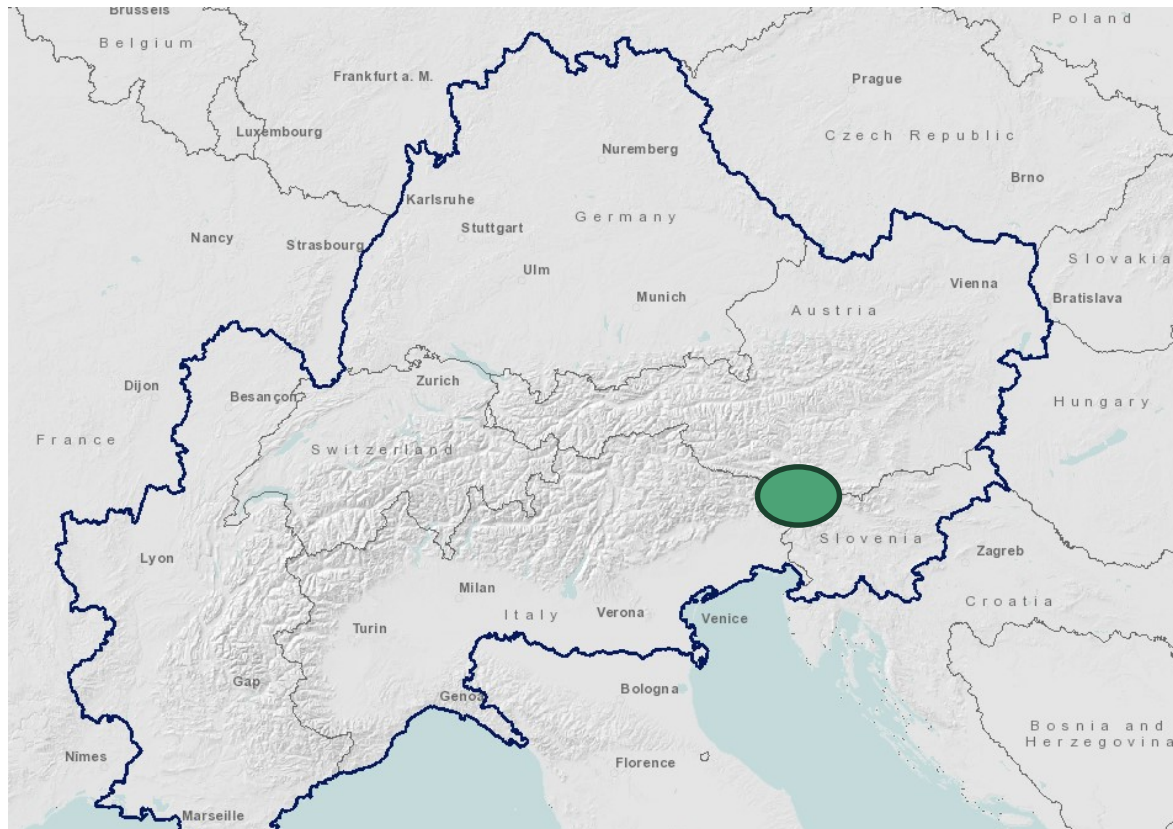


Figure 1: Pilot area in the context of the Alpine Region

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1.2 Objectives for the pilot area

The cross-border situation of the protected areas, the geographic vicinity and similar habitat and species in the region gave the idea for securing the existing GBI for the future. Especially the three conservation areas of Nature Park Dobratsch in Austria, and the transboundary UNESCO Biosphere Reserve Giulian Alps with the core zones Triglav National Park (Slovenia) and Nature Park Prealpi Giulie (Italy) shall be connected based on the corridor.

Using the macroregional model as a base for connecting structural corridors, following objectives will be achieved in this project.

- The main objective of the case study is to create a harmonized transboundary GBI network to connect loose ends and different corridor approaches of the three countries to support efforts to improve transboundary coordination of nature conservation.
- The targeted connectivity is based on structural corridors, but also considers functional aspects like suitable corridors for wildlife like lynx and bear and ungulates. Those prefer moving in forested areas. Therefore, forested areas within the biosphere reserve and also in Austria across the border should basically remain also in future. Additionally, the actual landscape pattern is a result of traditional small scale agricultural use and alpine livestock keeping. Connecting elements like hedges, groups of trees, fruit trees and shrubs within the landscape are part of it and should be basically preserved and secured also in future.
- A second objective is to establish administrative and technical contacts for the exchange and coordinated spatial development of the area. Sufficient areas should remain available for a metapopulation of species inhabiting the corridor to move through the landscape over several generations.

The highest pressure on the pilot area basically exists on the valley floors, where anthropogenic land uses are concentrated. Especially transportation infrastructure is present, acting as a barrier to migratory species or leading to roadkill. Ecological connectivity between the three neighbouring countries should not only be linked to the most cost-effective route (distance), but rather be determined by topography (e.g. along valleys such as the Channel Valley).

Common species and their typical habitats should remain connected around the border triangle. Typical habitats of the Southern Alps should be preserved and occur on all three sides of the border. Corridors for typical species of the Julian Alps are addressed in the border communities, and in particular rare mammals such as the brown bear and lynx, which still occur in the bilateral biosphere reserve, should be able to cross over into Austria. International core and connectivity areas should be considered in regional and local planning processes in order to maintain and secure connectivity in the future. The study therefore also supports the collaboration of the three parks.

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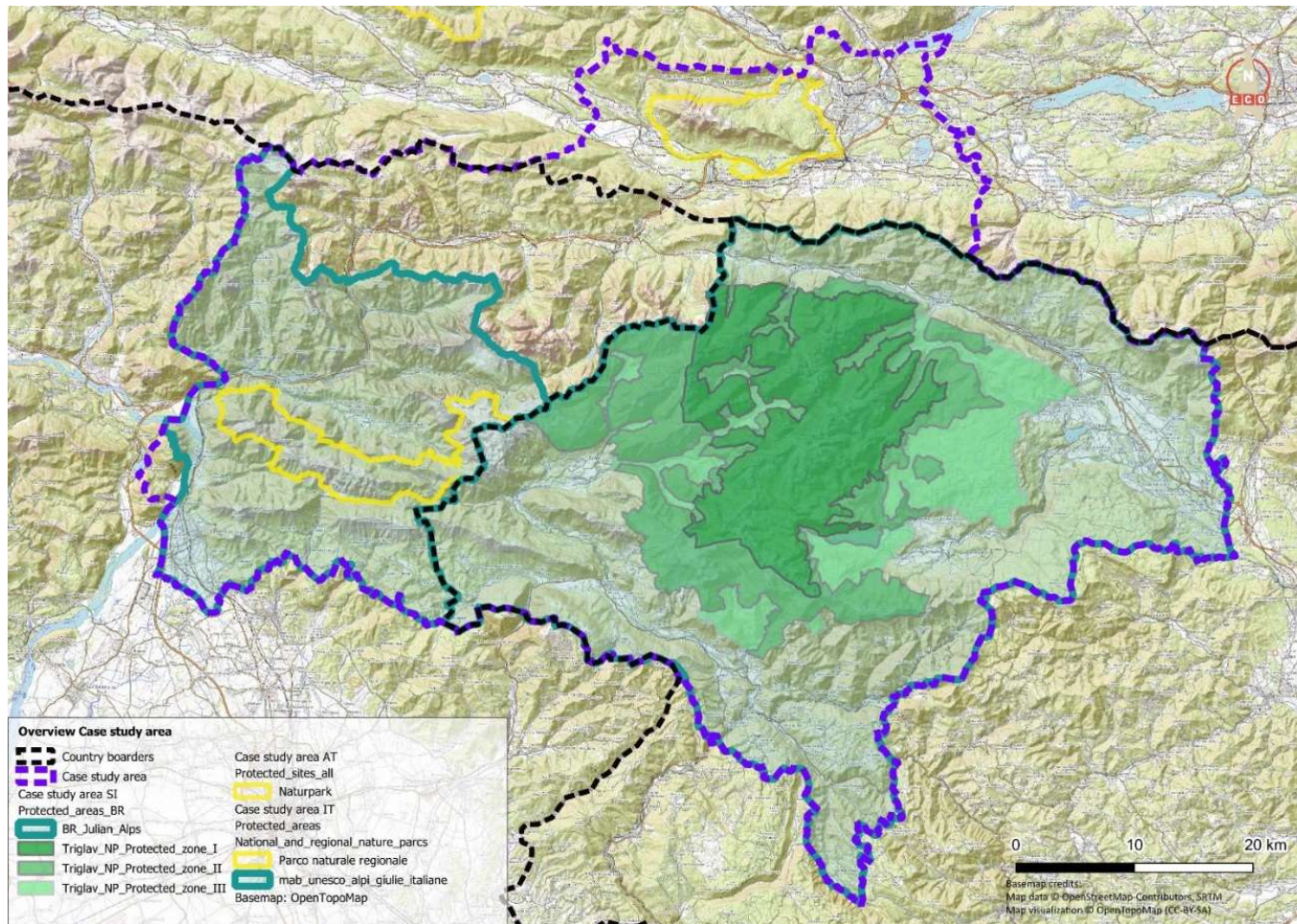


Figure 2: Overview of the case study area: The Nature Park Dobratsch (Austria) is situated a bit north of Triglav National Park (Slovenia), Nature Park Prealpi Giulie (Italy) and Biosphere Reserve Giulian Alps. The study aim is to achieve a better connection. Source: E.C.O. Institute for Ecology Mapping report identifying the GBI elements, barriers, connectivity measures in the pilot area Trilateral transboundary pilot site (Austria-Italy-Slovenia).

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In terms of the Alpine Wide Structural Connectivity the study area is key to connect better the species of the southern Alps to the species of higher elevations in the Central alps. A functional corridor in that area is vital to improve the north south connection from Slovenia and Italy to the Austrian National Parks like NP Hohe Tauern, NP Kalkalpen, NP Gesäuse in future.

2 Pilot region

The Pilot region is situated in the border triangle of Italy, Slovenia and Austria. The idea is to allow typical species occurring in the Bilateral Biosphere Reserve “Julian Alp” to move northwards, to connect the Austrian Natura Park to the Biosphere reserve and to close a nature conservation gap in Austria.

In Austria, the region is located in the federal state of Carinthia, more precisely in the administrative districts of Villach Stadt and Villach Land. On the municipal level, the municipality of Arnoldstein, the municipality of Bad Bleiberg as well as parts of the municipalities of Nötsch im Gailtal and Treffen am Ossiacher See are part of the examination area. The pilot region (PR) is located on the Italian side in the region Friuli Venezia Giulia more precisely in the province of Udine. The whole region covers an area of 4,969.23 km² and the capital of the region is the city of Udine. The region has a population of 518,442 (01/01/2022 - Istat) and a population density of 104.33 inhabitants/km². The pilot area is located in the province of Udine, more precisely in the municipalities Tarvisio, Malborghetto Valbruna, Pontebba, Moggio Udinese, Dogna, Chiusaforte, Venzone, Resiutta, Resia, Bordano, Gemona del Friuli, Artegna, Montenars, Lusevera, Taipana are located in the pilot region. The rest of the pilot region is located on Slovenian territory in the region Zahodna, more specific in the provinces Celje and Brežice, in the municipalities Kobarid, Bovec, Kranjska Gora, Jesenice, Žirovnica, Bled, Bohinj, Tolmin, Radovljica.



Figure 3: Impression of habitats in the pilot area

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The rather huge pilot side has a size of 355.584 ha. The land use in the study area is mainly covered by the classes 7 (Broad leaf and mixed forest) on the mountain slopes, 8 (sparsely vegetated areas) on the mountain ridges, 6 (coniferous forest and land occupied by agriculture with significant areas of natural vegetation) in the upper Sava valley and the Gail valley slopes and 5 (pastures and agroforestry).

Due to the huge size of the area, the focus of the study lays on the linkage between national corridors at the borders to avoid loose ends. Additionally, the protection status across the border should be harmonized. Within the transboundary Biosphere Reserve, the connectivity to the neighbouring protected areas is already quite good. Protected areas connect to protected areas or to similar land use types like forest. Looking at the border in detail, there is no major gap or barrier. Connectivity is basically given on the mountain ridges, also to the Austrian side. However, at the border to Austria, strict protection areas across the border are missing or can be found only small scale. Due to the land ownership (a high number of private landowners), the probability of establishing new forest protected areas to close the gap is not really feasible and the probability of successful designation is low. However, the forest habitat quality is still good, and with the Austrian forest law, the general protection of the forest (structural connectivity) is legally given. Forest must remain forest according to the Austrian forest law. Additionally, the steep slopes are designated as protective forest in the forest development plan, a big scale forestry is not the common practice.

The macroregional model (see also Deliverable D.2.1.1) shows potential linkages out of the core areas to the north to Austria, in the southern part in Slovenia (handled by lead partner UIRS) and in the western part of the pilot area in Italy. One corridor is situated west of Hermagor (A) and east of Pontebba (Italy). The area is mainly forested and situated outside the pilot area around Nature Park Dobratsch.

Therefore, the focus of the pilot study is on the modelled linkage corridor between west of the city of Kranjska Gora in the Sava valley (SI) and west of the city of Villach (Austria), which connects the Nature Park Dobratsch with the Biosphere Reserve in the south. The selected potential linkage directly runs through the Natura Park Dobratsch and can act as potential linkage between the Natura Park and the UNESCO bilateral biosphere reserve Julian Alps.

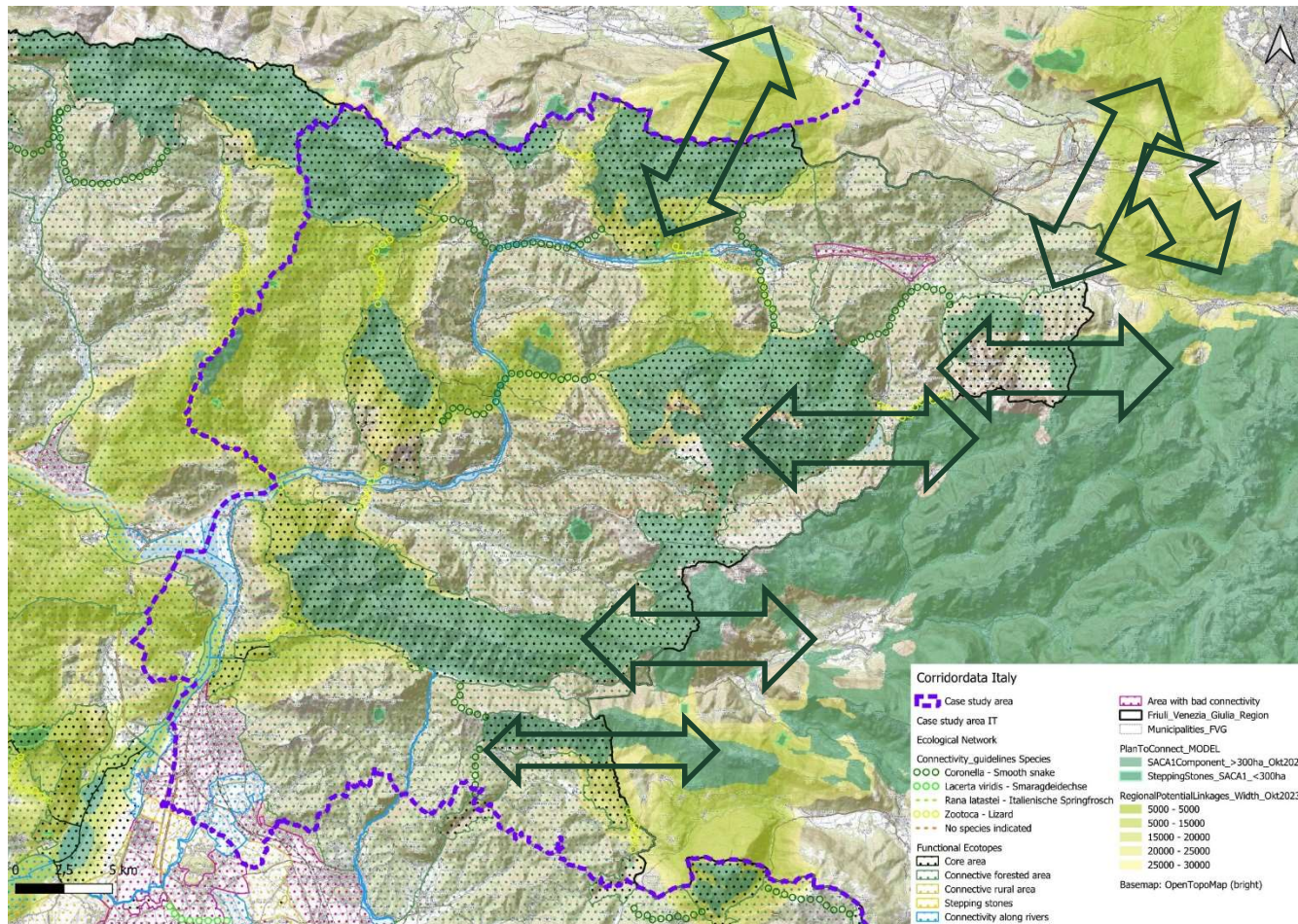


Figure 4: Corridor System in Italy overlaid with regional potential linkages of the macroregional model

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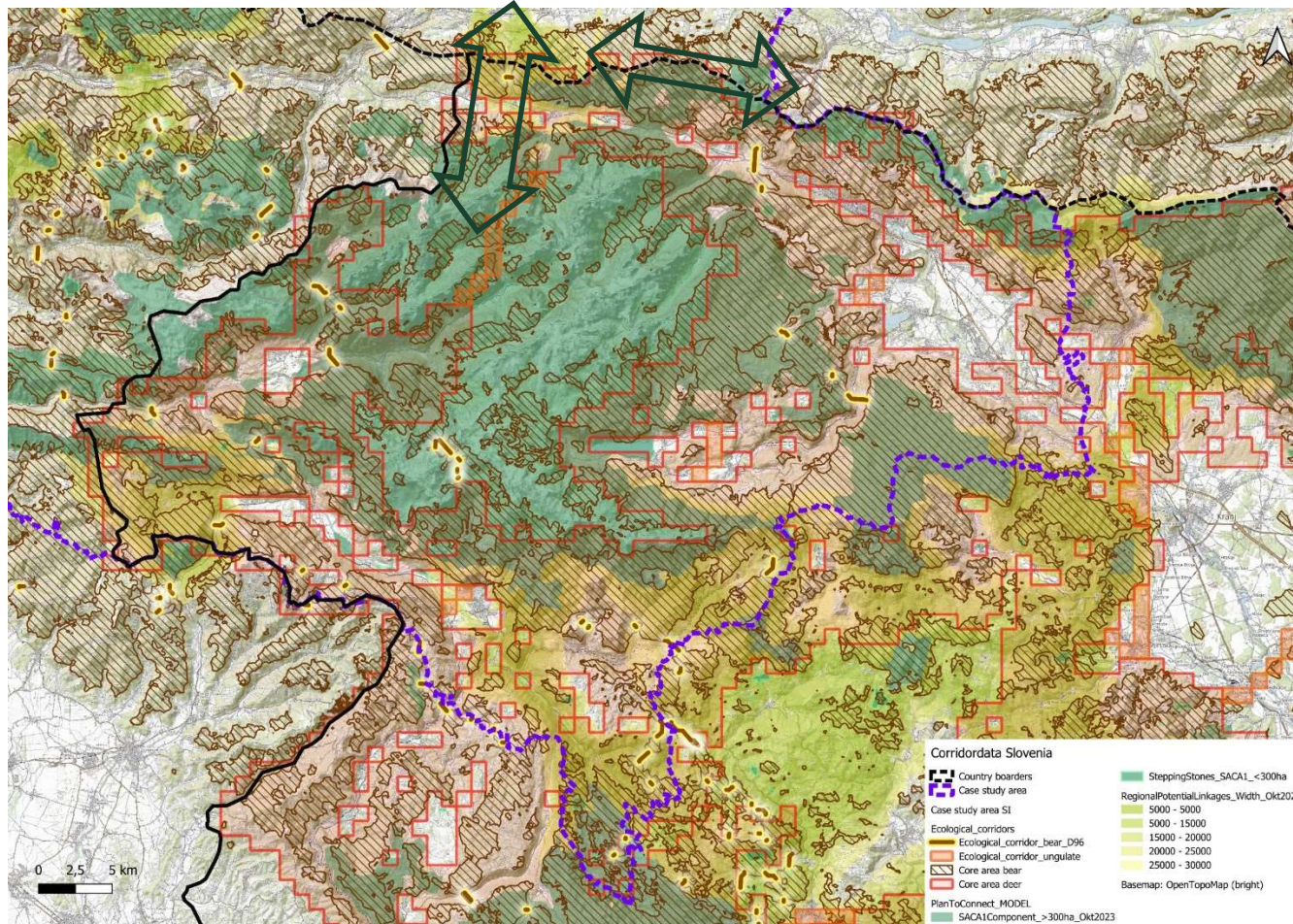


Figure 5: Corridor system in Slovenia overlaid with regional potential linkage of the macroregional corridor

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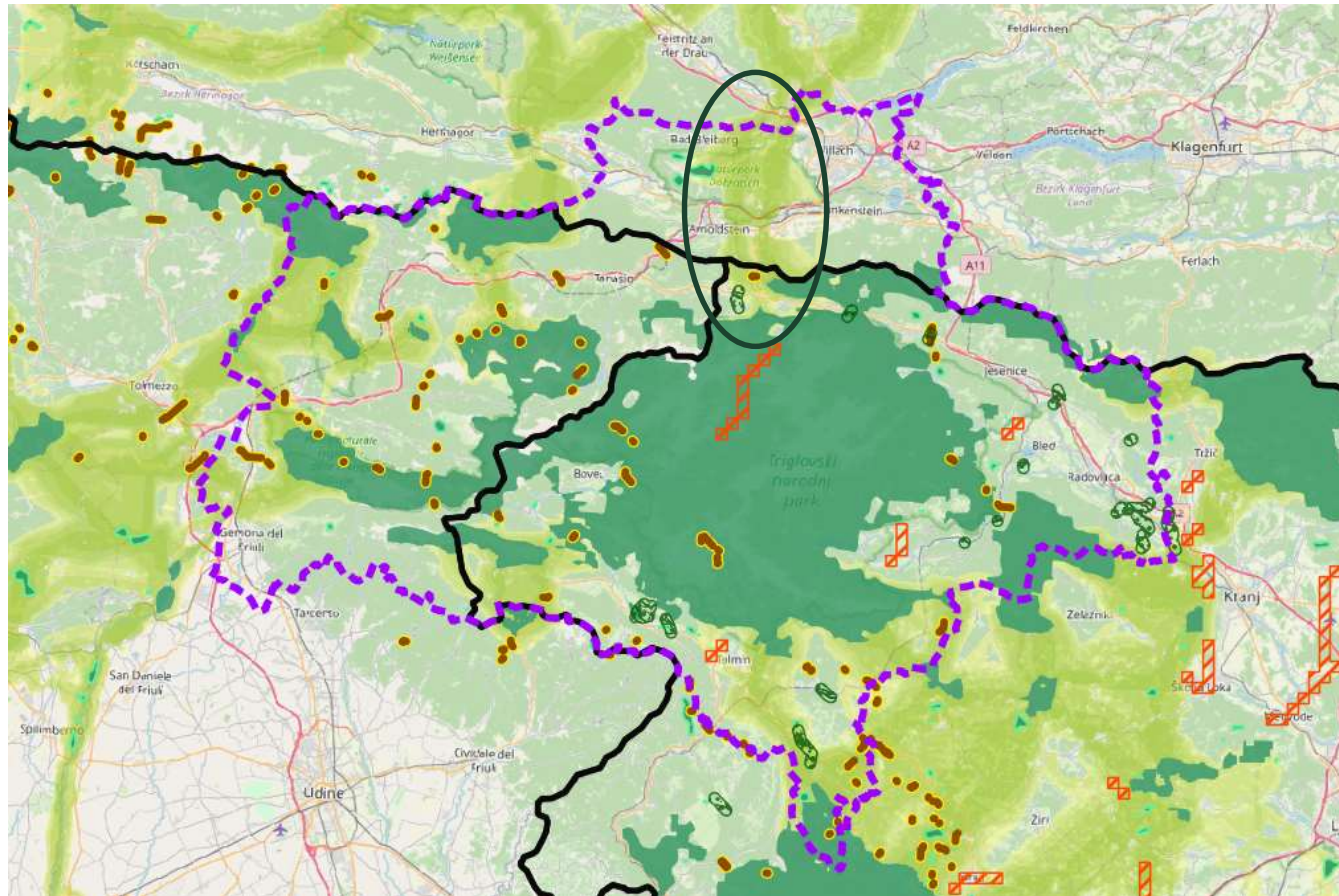


Figure 6: Selected corridor in the study area and existing corridor elements in Italy and Slovenia

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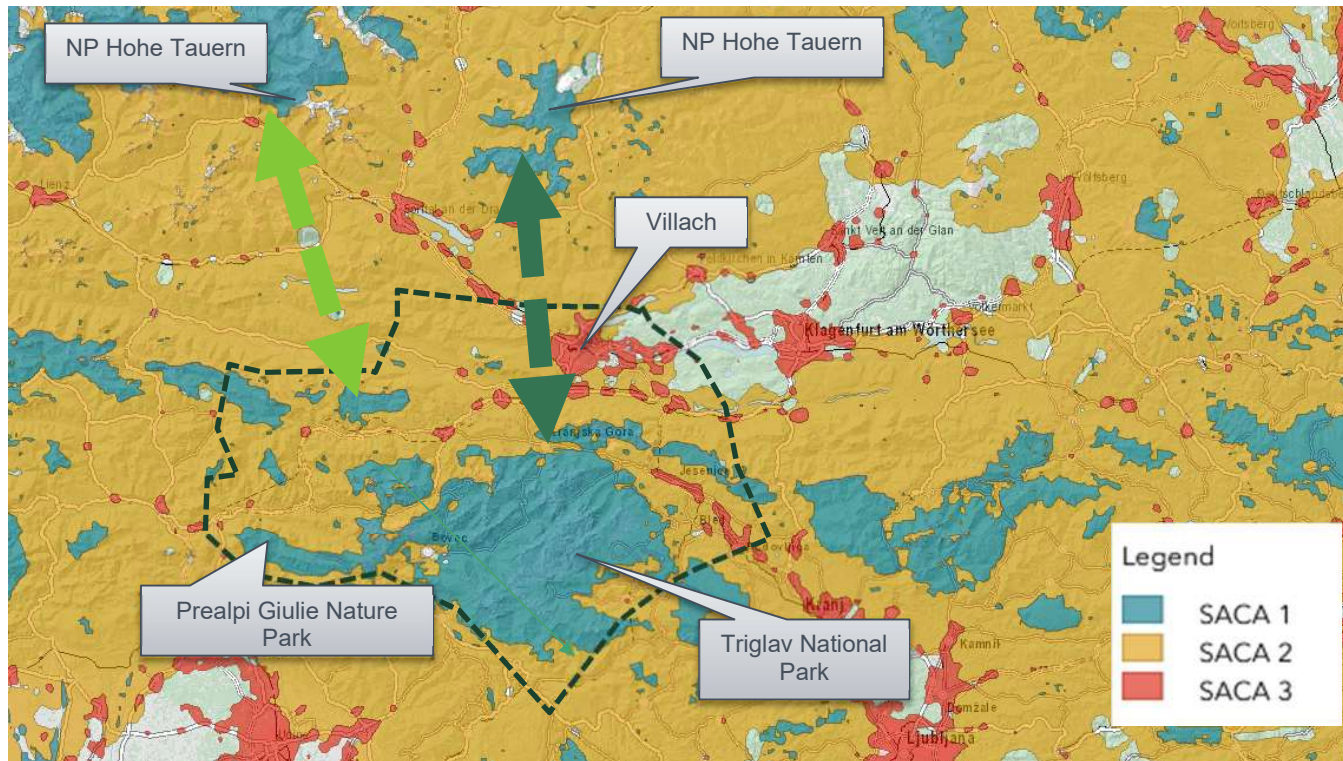


Figure 7: Overview – Location of pilot area and SACA areas with schematic pilot area boundaries

The pilot area encompasses the huge SACA 1 area of Triglav National Park and the neighbouring Prealpi Giulie Nature Park which shall be connected further north to SACA 1 area of Nock Mountains and National Park Hohe Tauern. There are mainly SACA 2 areas in between, but also SACA 3 areas around the cities of Tarvisio (I), Villach (Austria) and Jesenice and Lesce (Slovenia) in the Sava valley.

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The major stakeholders to work with in our pilot region area are the respective protected area administrations (who are in the project as observers) as well as the communities and their spatial planning experts and regional development agencies. Additionally, nature conservation experts on the Austrian site of the border are relevant, as well as wildlife and forest experts. They should cope with the idea of connecting to the Bilateral UNESCO Biosphere Reserve Julian Alps in terms of strengthening the ecological connectivity across the border. A workshop to introduce the importance of the corridor was held in June 2024 in Villach. The communities of the Carinthian nature park Dobratsch were informed about the necessity of keeping the corridors open and consider this in their spatial planning activities also in future. Due to the fact, that all communities will have to revise their community development plans within the next years, the time is right to incorporate relevant connectivity targets into the plans.

However, due to the mainly private landscape pattern in the area, the establishment of strictly protected potential core zones across the corridors are difficult to achieve and depend on a broad majority and consensus in the communities. Huge effort for lobbying, respective funds and a strong commitment of the administration for Governance will be needed to achieve the legal establishment of the proposed corridor on the ground.

3 Methodical approach in the pilot area

3.1 Methodical approach

The Alpine Wide Structural Connectivity Model gives a base for the connectivity approach in the pilot area. The model connects the SACCA areas within the Alpine region. Three different systems and approaches need to be harmonized, and the current project can be seen as a first step. Therefore, the comparison of the modelled corridors with the three existing national corridor systems was a first step (see also deliverable 2.1.2). Due to the cross-border situation and the huge study area, detailed spatial analyses were made for the selected corridor only. Activities in this pilot study focus more on the interaction with stakeholders than on spatial analyses.

3.2 Data used

A compilation of national data on connectivity was done. Data on protected areas, wildlife corridors and functional species corridors were collected from different stakeholders and administrative institutions or scientific projects in all three countries. The national corridors were overlaid with the Alpine Wide Structural Connectivity Model to identify the coverage, the potential gaps and barriers. The scope of the trilateral pilot study is on higher scale and does not cover all potential corridors. However, the selected corridor, which provides the linkage from Austria to Slovenia within the Nature Park region was analysed more in detail.

Table 1: Overview of available data in the three pilot area countries

Layer	Austria	Italy	Slovenia
Boundary	State border communities	State border	State border

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Layer	Austria	Italy	Slovenia
Protected areas	Nature Park (Core and outline) Natura 2000 areas	Nature Park Natura 2000 areas UNESCO Biosphere reserve (core, transition and development zone)	National Park UNESCO Biosphere reserve (core, transition and development zone)
Ecological network/Wildlife corridors	Wildlife Corridors (Lebensraum.at) – everything bigger than a hare	Modelled bear corridors and core areas	Ecological corridors bear and ungulates Core areas for this species
Important step stone areas	Biotope map of Carinthia	Natural values (point data)	Natural values (polygons)
Spatial Development sources for ecological corridors	Freiraumkerne Carinthia (Study)	Functional ecotopes	
Data on selected species	Green Lizard Birds (citric finch)	Ecological corridors lizard Ecological corridors smooth snake	Lynx

The data result from various projects with different focus, approach, methodology, scale and target. However, general observations can be derived from them.

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3.3 Working steps

The analysis of the pilot area corridors was done in several steps, according to the Plan to Connect project requirements. However, due to the trilateral situation of the huge pilot region and the focus on connectivity at the border situation a deviation of the standard was necessary.

Table 2: Working steps according to Plan to Connect partner agreement

Working Step	Description
1	<p>Compilation of the protected areas within the pilot region and the selected corridor</p> <p>In a first step, all known core areas within the pilot study and the chosen corridor are compiled and briefly described.</p>
2	<p>Compilation and analysis of GBI elements within the corridor (connectivity evaluation)</p> <p>In a second step, all GBI elements (based on the categories of CORINE Land Cover 5 ha CLC5 (2018) within the corridor are listed and summarised according to the main categories:</p> <ul style="list-style-type: none"> • Natural/ Semi-natural grassland • Sparsely vegetated areas • Forests and other wooded lands (shrubs, hedges, trees) • Water bodies (flowing and standing water) • Wetland (marshes, peatbogs)
3	<p>Definition / refinement of objectives for ecological connectivity</p>

Working Step	Description
	Based on the evaluation of spatial data within the selected corridor the objectives for ecological connectivity were defined in more detail.
4	Compilation and analysis of regional and local data
	<p>The landcover data categories provide an overview but are a bit unspecific for detailed planning. Therefore, additional areal image interpretation was done within the selected corridor, based on Esri satellite data and the knowledge of the area.</p> <p>Regional datasets on all existing ecological corridor approaches were gathered in all three countries and compiled to find out the gaps at the borders. Regional data were prepared for Workshops and verified with regional stakeholders. During a Workshop in Bled in April 2024 international conservation and spatial planning experts verified and supplemented the potential linkages of the modelled Plan to Connect corridor and gave hints to additional data.</p> <p>For the selected corridor in Austria a consultation Workshop was held in Villach in June 2024 with local ecological, connectivity and wildlife experts and an expert from Slovenia. Additionally regional data were collected in detail for like the biotope files of Carinthia.</p> <p>The ecological quality of the area is still quite good; therefore, the focus of the analysis is more on the stakeholder consultation and securing the corridor for the future via placing the topic into planning processes. At the stage of the project, the actual dataset gives enough information for further planning.</p>
5	Barrier Analysis (based on D 1.2.1 and 1.3.1)
	In a further step possible threats and barriers in the selected corridor are compiled and analysed. The barrier analyses were done in a mixture of stakeholder consultation, using local knowledge in workshops (Bled and Villach 2024). Additionally, areal image interpretation within the selected corridor area was done. Also, excursions were made to the mentioned barriers in Austria.

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Table 3: Specific working steps for pilot region

Working Step	Description
6	Identification of bottlenecks
	The requirements for a corridor also depend on the radius of action of the respective species and whether the corridor only serves as a migration route or also has to fulfil a temporary habitat function for the species. With the definition “everything bigger than a hare” and especially the lynx as mobile and shy animal, a certain size of forested areas must be given. In the selected corridor, mainly forested areas are included. A bottleneck is the area in the Valley floor of Carinthia, which the settlements around. Measures of the bottleneck points were taken.
7	Identification of priority areas for conservation
	A map of areas of special interest for conservation was generated to identify the areas where measures are appropriate.
8	<p>Recommendations for securing the corridor</p> <p>At the end of the analyses, recommendations for securing the corridor in future were given.</p>

4 Results

4.1 Identification of the GBI elements

4.1.1 Legally established protected areas in the region

Important GBI elements in the pilot area already reflected in the good protection status of the pilot region in Slovenia and in Italy. The Transboundary UNESCO Biosphere Reserve Julian Alps, which its three zones of different protection (SI, IT), the Triglav National Park (SI) and the Giulian Alps Nature Park are a backbone to secure core areas for protected species in the region. Therefore, a structure for collaboration in terms of ecological connectivity is given. Additionally, several natura 2000 sites are in the area.

The selected corridor is partly protected as natura 2000 site in Slovenia (Zelenci, Julian Alps) and connects to the SACA 1 Triglav National Park. The Italian part of the pilot area is not directly targeted on the selected corridor, but the natura 2000 site Conca di Fusine directly connects to Triglav National Park in the west of the selected corridor.

In Austria, the situation is different. There is the Dobratsch Nature Park, which protection status is quite low except of the core area around the nature conservation area at the mountain ridge of Dobratsch mountain and the natura 2000 sites Dobratsch, Schütt/Graschelitzen and Kokra exists. At the eastern corner of the Austrian part of the study area another Natura 2000 site Mittagskogel Karawanken west is in place. At local level, a variety of biotopes area also mapped.

Despite of having protected areas on the corridor area, the bigger part of it is not protected. There is missing link between the Nature conservation area of Dobratsch, Austria and the Triglav national Park in Slovenia.

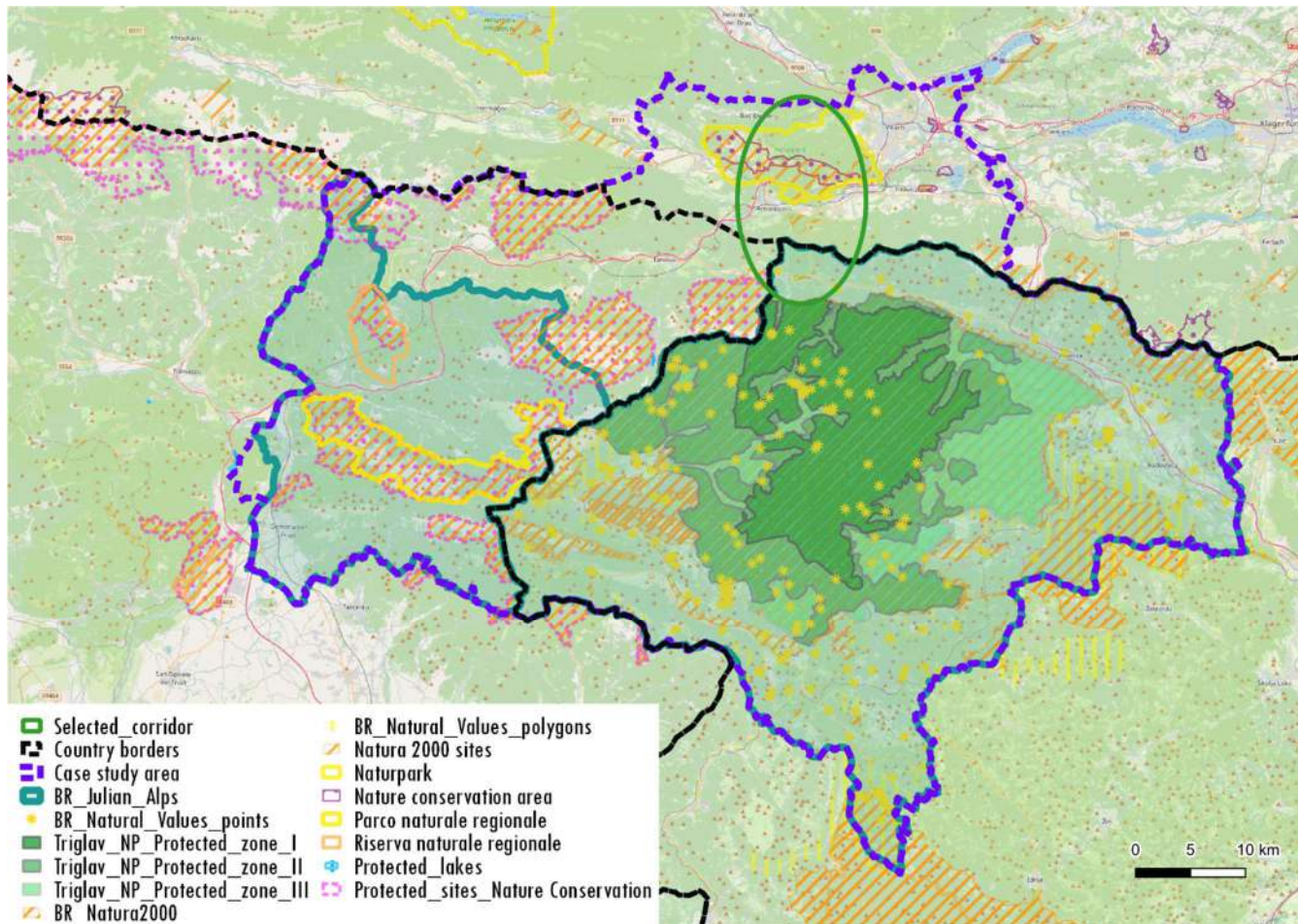


Figure 8: Overview of legally protected areas in the pilot region

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As blue elements, the river Gail, the river Gailitz in Austria, the Sava River in Slovenia and the Fella in Italy with their tributaries can be found in the area. Additionally, there are several lakes within the pilot region. In the selected corridor River Gail and its outlet channel exist in Austria. On the Slovenian site, River Sava and its source Zelenci lay within in the selected corridor area.

4.1.2 Existing national or regional corridors

All three countries have a network of ecological corridors already worked out at national or regional level. The networks are based on functional connectivity aspects and derive from different national projects done by forest and wildlife departments in the last years. Target species for these corridors were mainly ungulates.

In Austria, the project lebensraum.at provides a variety of national and regional corridors. They are based on “everything bigger than a hare” and are already valuated with wildlife specialists. However, the legal implementation is still pending, but the layer is provided to be considered in spatial planning.

In Slovenia important corridors are additionally shown for bears. Additionally, telemetry data of lynx movement provide valuable information about the functionality of the existing corridors especially for this species, which represents a very shy animal which does not leave the dense forest.

In Italy, the permeability of the landscape was validated, and corridors in the pilot region are given for selected species like smooth snake and lizard.

Within the selected corridor area in Austria three national ungulate corridors connecting north and a third one connecting east and west along the mountain ridge of the border exist. In Slovenia a bear corridor is identified by national forest to connect north of Podkoren.

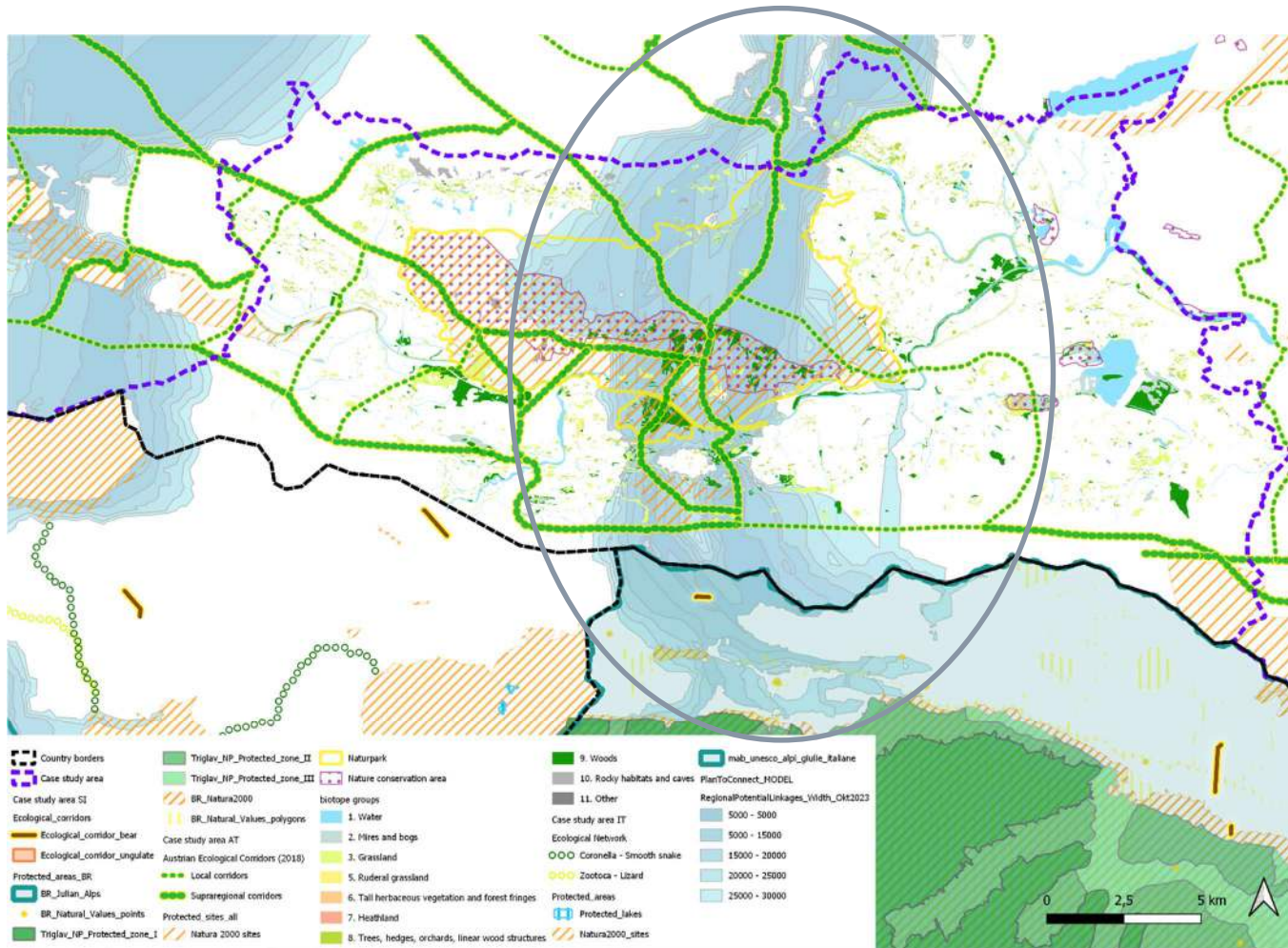


Figure 9: Protected areas, ecological corridors and mapped biotopes in Austria and Slovenia on the selected modelled corridor within the pilot region.

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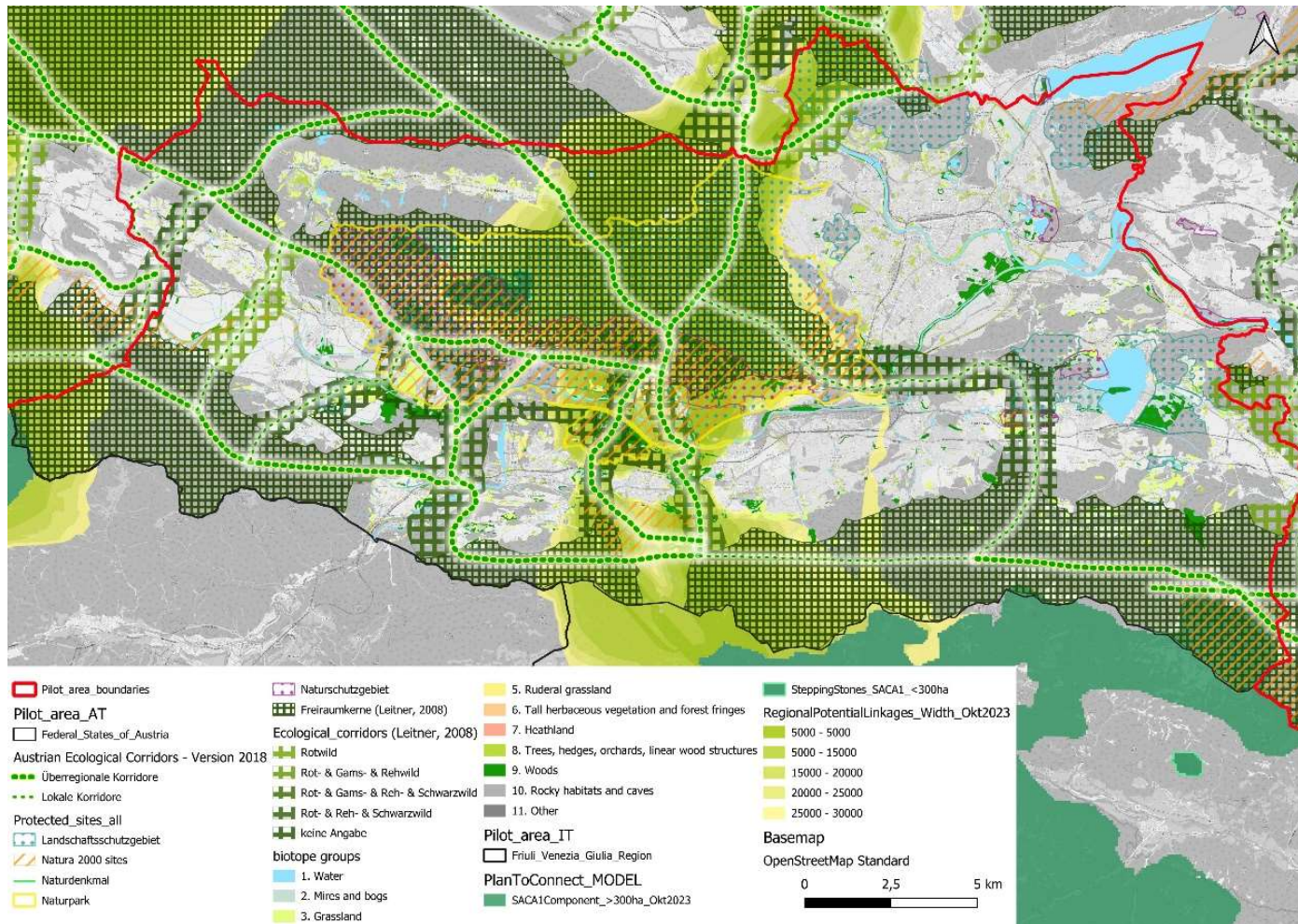


Figure 10 GBI elements and Corridor system in Austria overlaid with the potential linkage of macroregional model Mapping report identifying the GBI elements, barriers, connectivity measures in the pilot area Trilateral transboundary pilot site (Austria-Italy-Slovenia). Glatz-Jorde, S; Wuttej, D.; Baumgartner, J., 2024.

4.1.3 Natural feature and Land cover

The analyses of the land use classification (Corine 2018) shows that the trilateral cross boundary pilot region is dominated by land classes of high natural value and good connectivity. The anthropogenic influenced land cover types like “discontinuous urban fabric”, “industrial or commercial units” can be basically found at the corners of the pilot area and cover just 2,7 % of it. They represent the cities of Villach and settlements of lower Gail valley in Austria, Jesenice and the settlements of Sava valley in Slovenia, and the area around Tarvisio and Gemona in Italy. Additionally, the “road network” covers just 0,30 % although important traffic connections like highways cross the three countries. 64 % of the pilot region is covered by “forest”. 30 % is “mixed forest”, 20 % is covered by “beech forest” and 15 % by “coniferous forest”. The latter also include the huge pine forests patterns on the steep slopes of Dobratsch mountain in Austria and belongs to a natural coniferous type due to the rocky environment. Therefore, it is of high natural value, and the indicator value could be raised to 7 or even higher.

In terms of agricultural land use types like “Fruit trees and berry plantations” and “complex cultivation patterns” cover just 2,7 % and are connected to the settlements in the periphery of the pilot area. “Pastures”, and “land principally occupied by agriculture with significant areas of natural vegetation” cover 7 % in total. Besides forests, 23 % of the area are covered by types connected to the steep mountains with high indicator values. The map on the next page proofs that high naturalness of the pilot area.

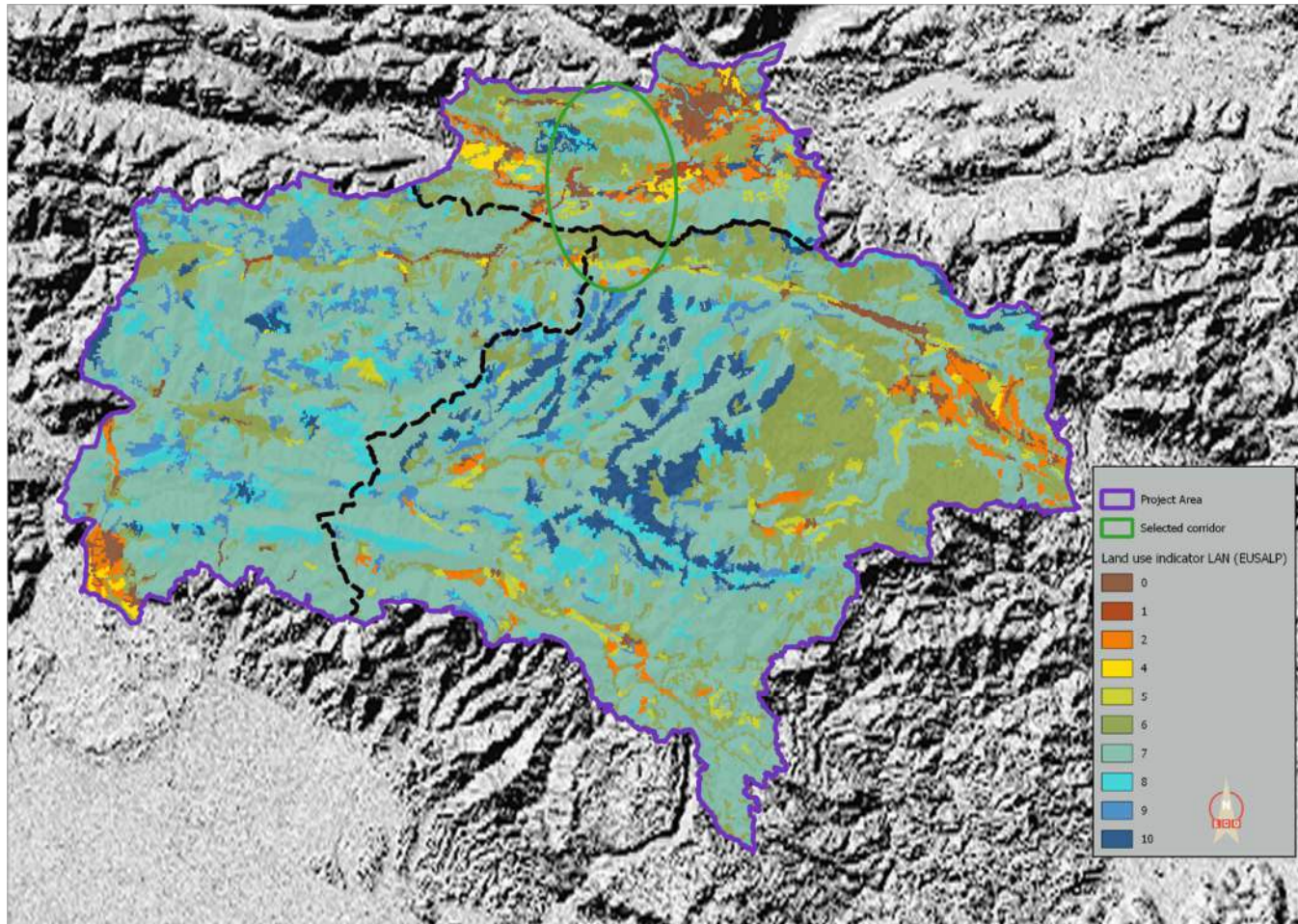


Figure 11: Land use classification of pilot area – showing anthropogenic uses basically at the periphery

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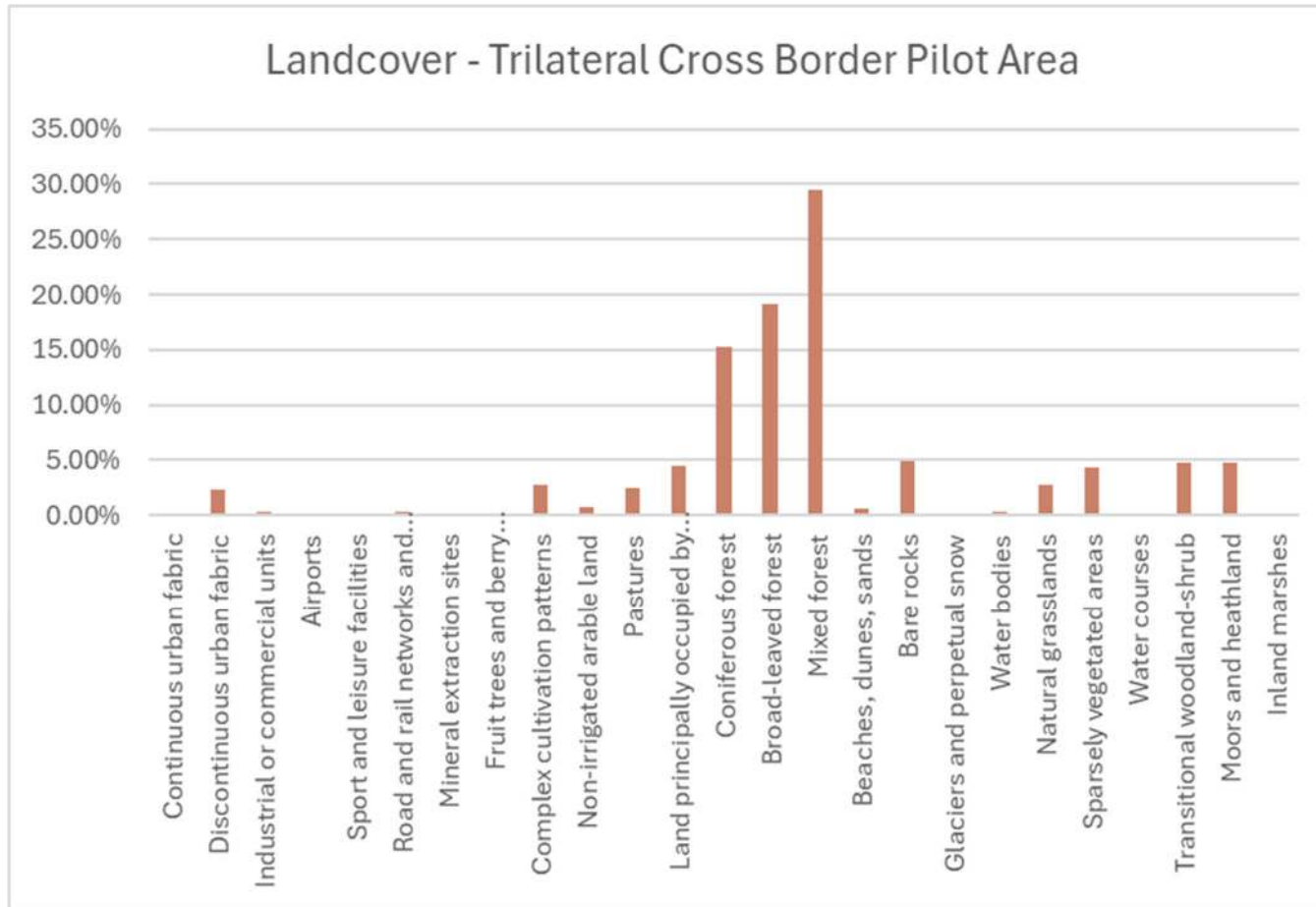


Figure 12: The land coverage of the pilot area is dominated by forest, which allows good connectivity

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Within the selected corridor connecting Austria to Slovenia, the land use types are again dominated by forest which covers 73 %. However, anthropogenic land use types with lower connectivity indicator values cover 5,16 %, roads cover 1 % and also agricultural types cover more than in the pilot region. This shows the necessity of keeping natural structures and preserving the corridor for the future.

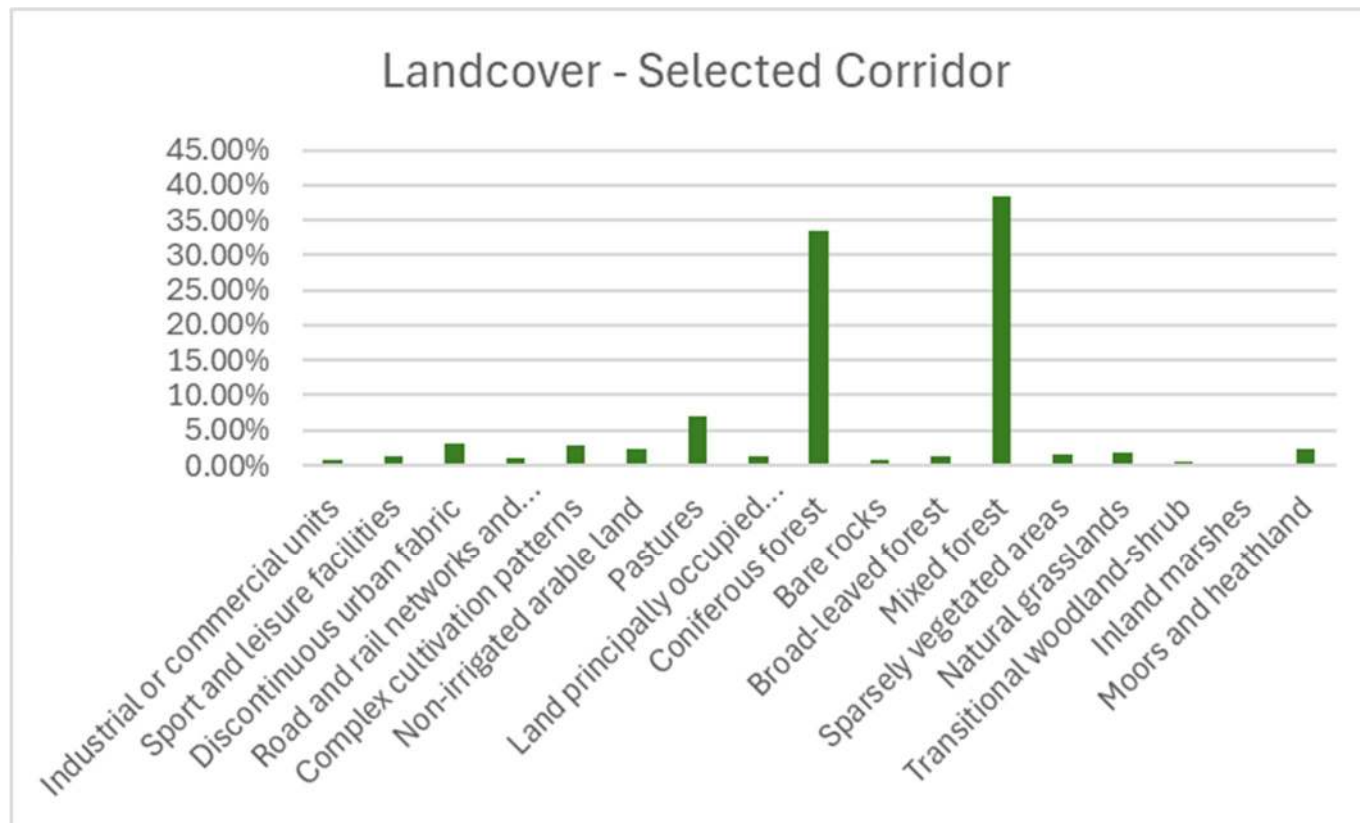


Figure 13: Land use type within the selected corridor. Types with high indicator value are dominating.

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Table 4: Corine Land Cover category

Main GBI Category	Indicator value	Area (hectare) Pilot region	Percentage (%) Pilot region	Area in selected Corridor (ha)	Percentage (%) Corridor
Industrial or commercial units	0	893	0.25	155	0.89%
Sport and leisure facilities	0	533	0.15	209	1.20%
Continuous urban fabric	0	30	0.01 %		
Discontinuous urban fabric	0	8086	2.27%	534	3.07%
Airports		45	0.01%	0	0
Road and rail networks and associated land	1	1056	0.3/	186	1.07%
Mineral extraction sites		86	0.02%		
Fruit trees and berry plantations		30	0.01%		
Complex cultivation patterns	2	9646	2.71%	493	2.83%
Non-irrigated arable land	4	2617	0.74%	389	2.24%
Pastures	5	8602	2.42%	1207	6.94%
Land principally occupied by agriculture, with significant areas of natural vegetation	6	15808	4.45%	234	1.34%
Coniferous forest	6	54140	15.23%	5817	33.44%

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Main GBI Category	Indicator value	Area (hectare) Pilot region	Percentage (%) Pilot region	Area in selected Corridor (ha)	Percentage (%) Corridor
Broad-leaved forest	7	68005	19.12%	239	1.38%
Mixed forest	7	104604	29.42%	6676	38.38%
Beaches, dunes, sands	7	2392	0.67%		
Bare rocks	7	17718	4.98%	129	0.74%
Glaciers and perpetual snow	7	215	0.06%		
Water bodies	7	1185	0.33%		
Natural grasslands	8	9825	2.76%	309	1.78%
Sparsely vegetated areas	8	15254	4.29%	248	1.43%
Water courses	8	256	0.07%		
Transitional woodland-shrub	9	17055	4.80%	91	0.52%
Moors and heathland	10	17152	4.82%	414	2.38%
Inland marshes	10	349	0.10%	64	0.37%
Sum		355584	100.00%	17395	100%

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Within the selected corridor, following GBI elements occur:

Table 5: GBI elements in the selected corridor

Main GBI Category	Area in selected Corridor (ha)	Percentage (%) Corridor
Forests and other wooded lands (shrubs, hedges, trees)	12823	73%
Natural/ Semi-natural grassland	309	2%
Agricultural land	2324	14%
Scattered settlements and roads	1084	6%
Sparsely vegetated areas	248	1%
Water bodies (flowing and standing water)		>1
Wetland (marshes, peatbogs)	478	3%
Bare rocks	129	1%
Total	17395	100%

Generally, the corridor is dominated by “forest and wooded land”, which can be considered as permeable. Additionally, 14 % is used as “agricultural land”, including alpine pastures, extensive meadows and small patterns of crop fields, structured by hedges and trees. However, settlements east and west of the corridor especially tend to develop closer to the corridor area. Especially in Austria, when the corridor crosses the community of Arnoldstein, the area around Pöckau is already a bottleneck. Therefore, immediate action is needed to secure the functionality of the corridor for the future.

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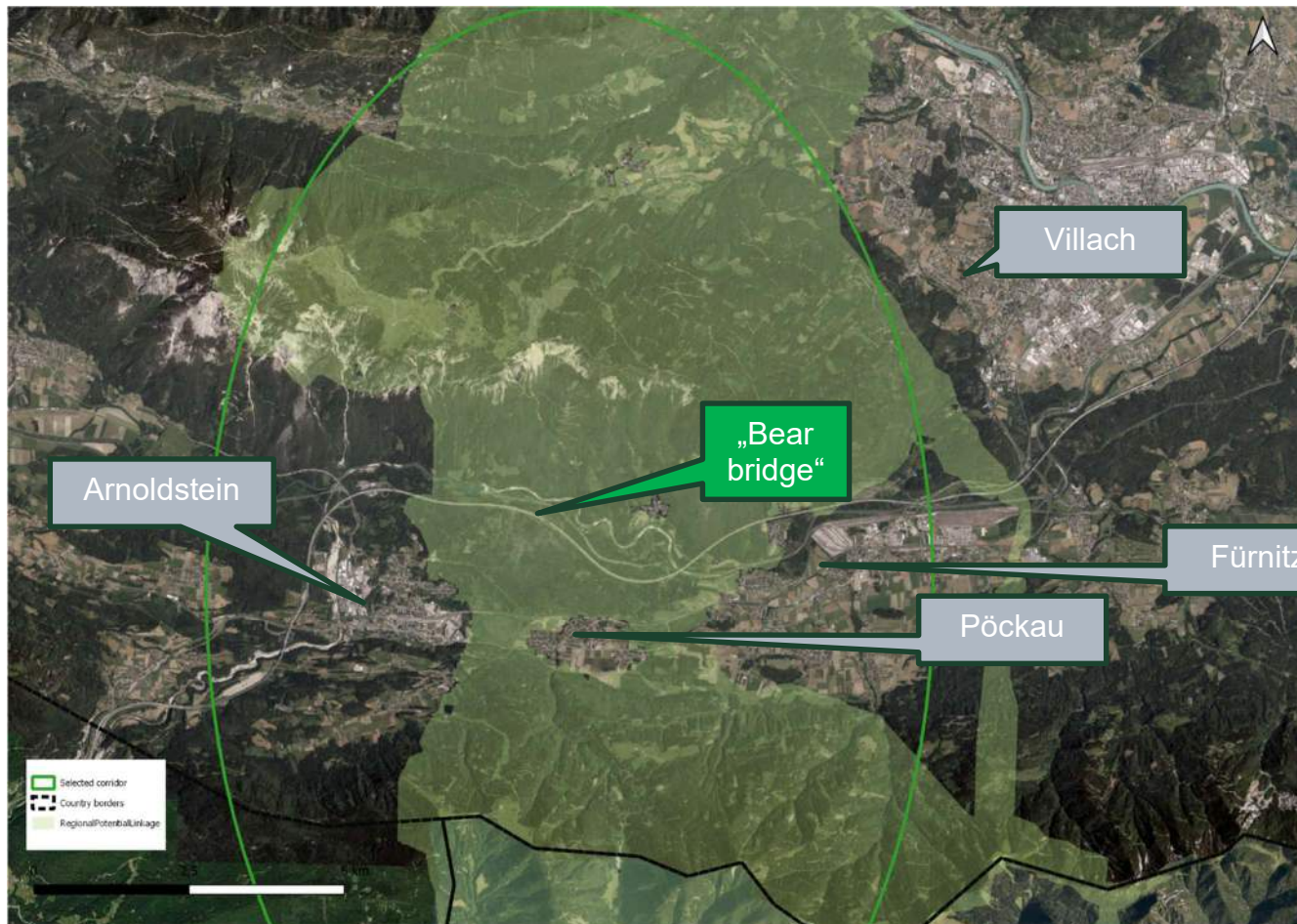


Figure 14: Selected Corridor east of Villach in the border triangle of Austria, Italy and Slovenia

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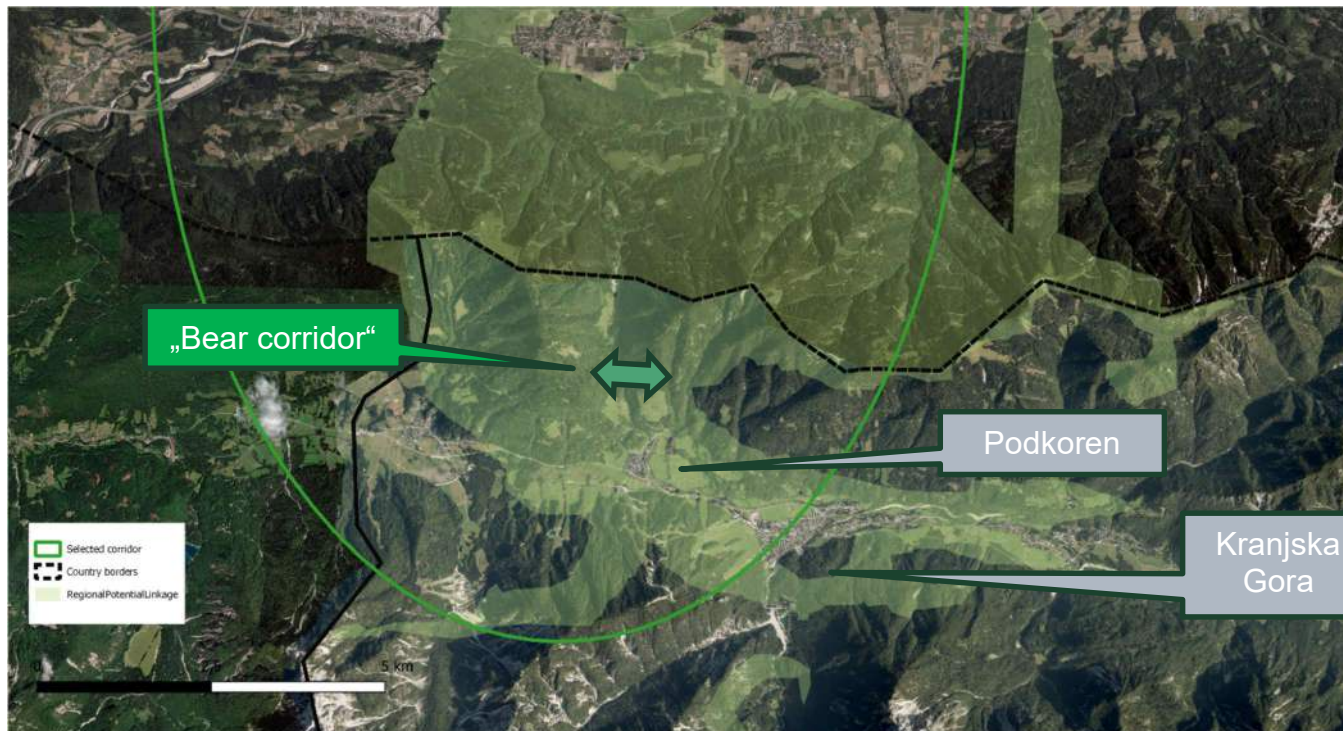


Figure 15: Selected corridor in the area of Upper Sava valley in Slovenia

In Slovenia the area is dominated by forest and extensive meadows and pastures. However, the town of Kranjska Gora and the Settlement of Podkoren are also close to the ecological corridor areas. Contrary to Austria, core areas of connectivity and corridor options are all around. The satellite images above show that bottlenecks to the potential corridor lay especially in Austria. At the moment, the corridor is still functional, and the landscape is still permeable. However, the land use of the area within the corridor is key to secure the functionality also in future. A clear spatial development plan is required.

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4.2 Threats and barriers

Ecological connectivity areas are crucial for the conservation of biodiversity. In the case study, several obstacles and threats affect this connectivity. Physical barriers such as roads, urban development and agricultural expansion fragment habitats and restrict the movement of wildlife. Depending on whether structural or function connectivity for target species is considered, there are very different threats or barriers in the landscape.

Barriers to ecological connectivity were discussed during the "PlanToConnect" workshop in Bled, Slovenia 2024. These barriers, which were identified in interactive sessions with regional groups from Austria, Italy and Slovenia, can be categorized into infrastructural and natural barriers.

- Infrastructural barriers:

Although, the area is quite natural, there are several infrastructural barriers in the pilot region and within the selected corridor as well.

In Austria barriers include waterpower infrastructures such as those near the Gail and Drava rivers, which interrupt wildlife corridors because they are not passable. Additionally, the riverbed in the oxbow generally has higher water levels than natural river parts. The lack of bridges over these rivers exacerbates fragmentation. A major current barrier in the selected corridor is the closed down wooden bridge over the Gail outlet channel. It hinders the functionality of the near bear bridge, which was constructed to allow ecological corridors crossing the highway two decades ago. Settlement and infrastructure development, especially around Villach and Arnoldstein pose an additional threat to connectivity, if the corridor is not considered in spatial planning in future. Tourist developments are a potential threat in the surroundings of the skiing resorts of Dreiländereck, although is a small resort and actually not running. However, the area is surrounded by huge forests, and the threat is currently not severe. The potential threat depends on their further development. An additional pressure in Austria is the growing density of the forest roads network presented recently by WWF. The forests became more fragmented, and also intensive cutting due to wind breaks and bark beetle management opens up old grown forest stands, which compromises the habitat quality and functionality for some species.

Additionally, there are discussions arising about wind parks in the surrounding of the nature park. They might become a major threat to connectivity due to their size, the connected road and power grid development in future. A new regulation in Austria was recently put in place.

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Figure 16: Gail outlet channel with fences as barriers



Figure 17: Bear bridge as connectivity element in the study area

In Italy the Val Canale and Val di Ferro valleys with their important road infrastructures such as the A23 and SS13 represent barriers that in some areas lead to frequent accidents involving wildlife. Linear infrastructures in these valleys create significant barriers for animal movement. However, huge parts of them are in tunnels and allow good connectivity.

In Slovenia in the Triglav National Park region, highways and settlements, especially along the Sava River, can be a threat to ecological corridors. However, many of those infrastructures are partly on bridges and partly in tunnels.

Dams on the Sava further hinder the movement of animals by dividing the river and reducing its role as a blue infrastructure corridor.

Within the selected corridor, tourism development around Kranjska Gora might become a threat, if the corridor is not considered in planning. At the moment, the surroundings of this tourism hot spot allow good connectivity.

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Within the protected areas, the visitor pressure was also mentioned as a barrier for sensible species like lynx or capercaillie and should be considered in ecological planning.

- Natural barriers:

The Julian Alps themselves act as a natural barrier, particularly affecting the movement of species between the northern and southern sections of the ecological zones. Natural topography plays a role in impeding animal movement in some regions, and certain barriers, such as the mountain passes between the Karawanks, need to be considered to maintain connectivity. However, experts highlighted in the workshop in Bled, 2024, that those steep and rough mountains do not play a big role for most of the species.

- Species-specific barriers:

The lack of suitable infrastructure such as green bridges and fish ladders prevents species such as otters and fish from migrating, especially in river systems affected by dams and other structures. Although fish ladders were established in the river Drava recently, other rivers are still not passable.

The following map shows the ecological connectivity and barriers within the case study area between Austria, Italy and Slovenia. The map highlights critical points where infrastructure or environmental factors affect wildlife corridors, particularly in terms of fish and bear movement. The points marked with red dots are the points where bear accidents have occurred and confirm that the animals cross these points. The light purple area is the regional connectivity model in the case study area. The southern part of the pilot region is handled in another case study by lead partner UIRS, therefore it is not addressed in this study.

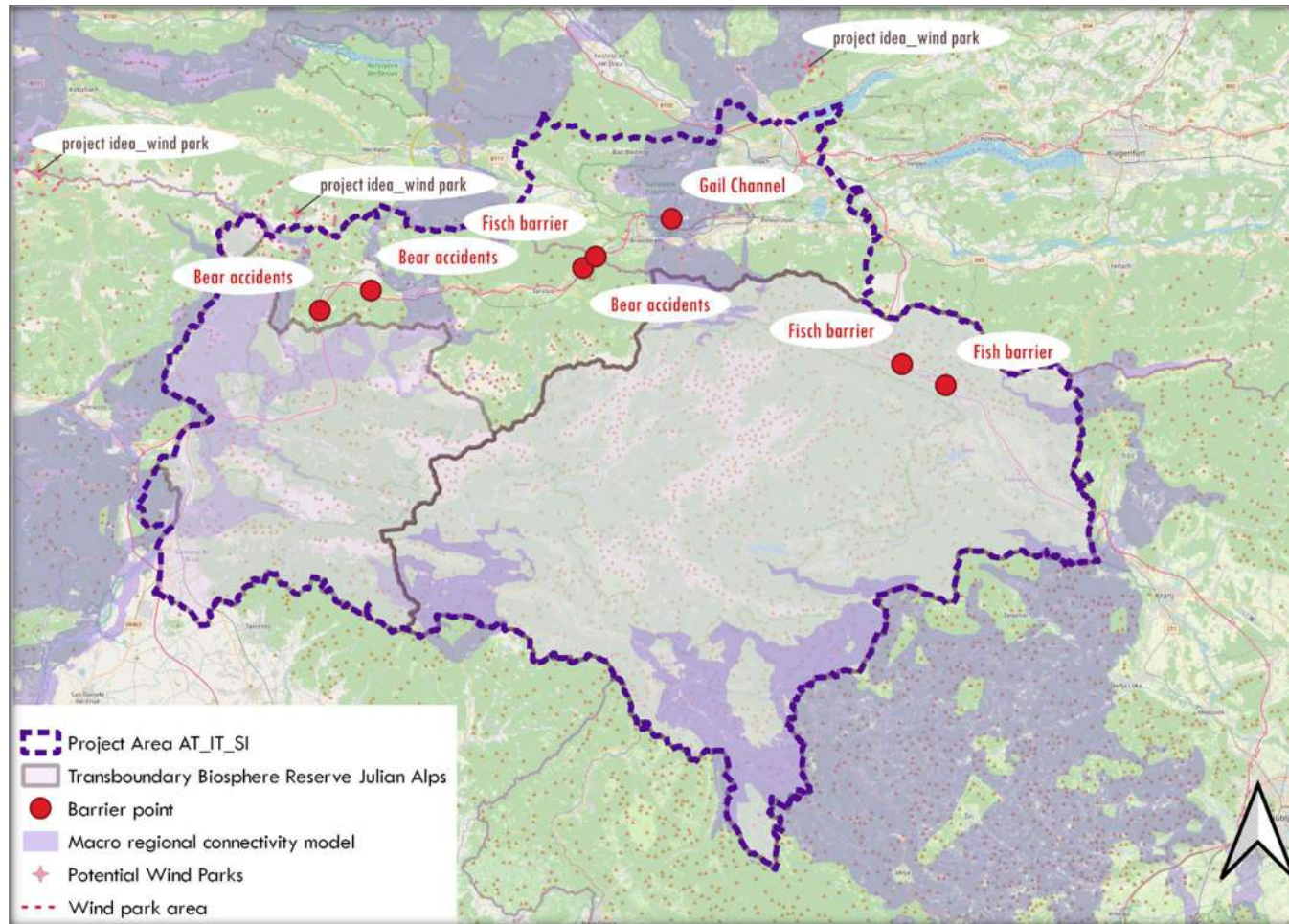


Figure 18: Stakeholders identified barriers in the case study area.

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4.3 Results and Evaluation of Data Analysis

A lot of different data on structural and functional with different approaches area available for the pilot area region. The pilot area generally is quite natural (below 10 % of the area fall in anthropogenic land use classes) with large natural habitats like forests and rocky areas. Additionally, it is well covered with protected areas, especially in Italy and in Slovenia the UNESCO Biosphere reserve with its different zonation give a frame for sustainable development.

At the country borders connectivity is given through large, forested areas. However, the forest quality differs, and in Austria protected areas do not directly connect to protected forests in Slovenia. In Austria, the Dobratsch Nature Park region is neighbouring with a remarkable core zone on and at the bottom of Dobratsch mountains. However, the main corridor for connecting the three parks west of Villach is situated in a highly dynamic environment. The potential for securing the corridor is huge, but also various threats and barriers must be overcome. There is a gap of protected areas exactly in the selected corridor area.

On the Austrian side there is a bottleneck in the area around Pöckau, Arnoldstein, where corridor elements cross the valley floor on maximal 1 km. This might be enough to develop, establish and secure a structural and a functional corridor; but there is not much flexibility. The connection to the neighbouring Biosphere Reserve is given in wide forest areas along the borders in Slovenia and Italy. For crossing the valley floor and connecting the Natura 2000 areas, there are more options. There is a direct connection east of Fusine in Val Romana towards the Austrian modelled corridor via Italy. The area is basically forested. From Slovenia, direct connection via the forest along the whole mountain ridge is given in east west direction. On the valley floor, there is the Natura 2000 area of Zelenci, and forests stands as well as traditional agriculture along Ratece which still allows good connectivity in the vicinity of Ratece. To Slovenia there is a direct connection via Podkoren to Zelenci, however there is the skiing resort, which might be a barrier for some species.

Focussing on the selected modelled corridor between the Biosphere Reserve and especially Triglav NP and Natura 2000 area and Dobratsch, the direct connection to Slovenia is limited due to the skiing resort. However, the areas around allow best connectivity.

Following maps show the actual situation on the selected corridor.

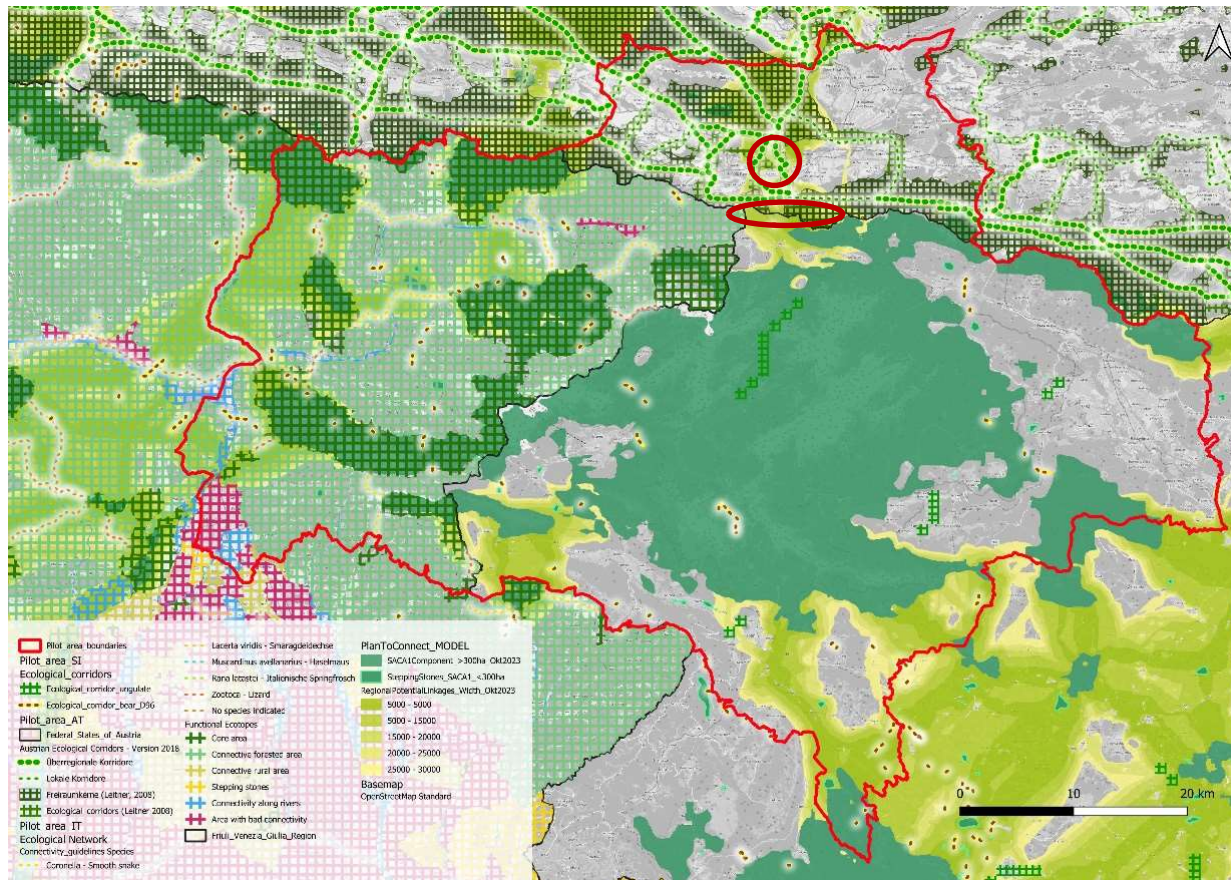


Figure 19; Existing core areas and connectivity elements in the region. In green core areas and yellow the potential linkage areas without protection are visible, in red colour conservation gaps on the selected corridor are indicated.

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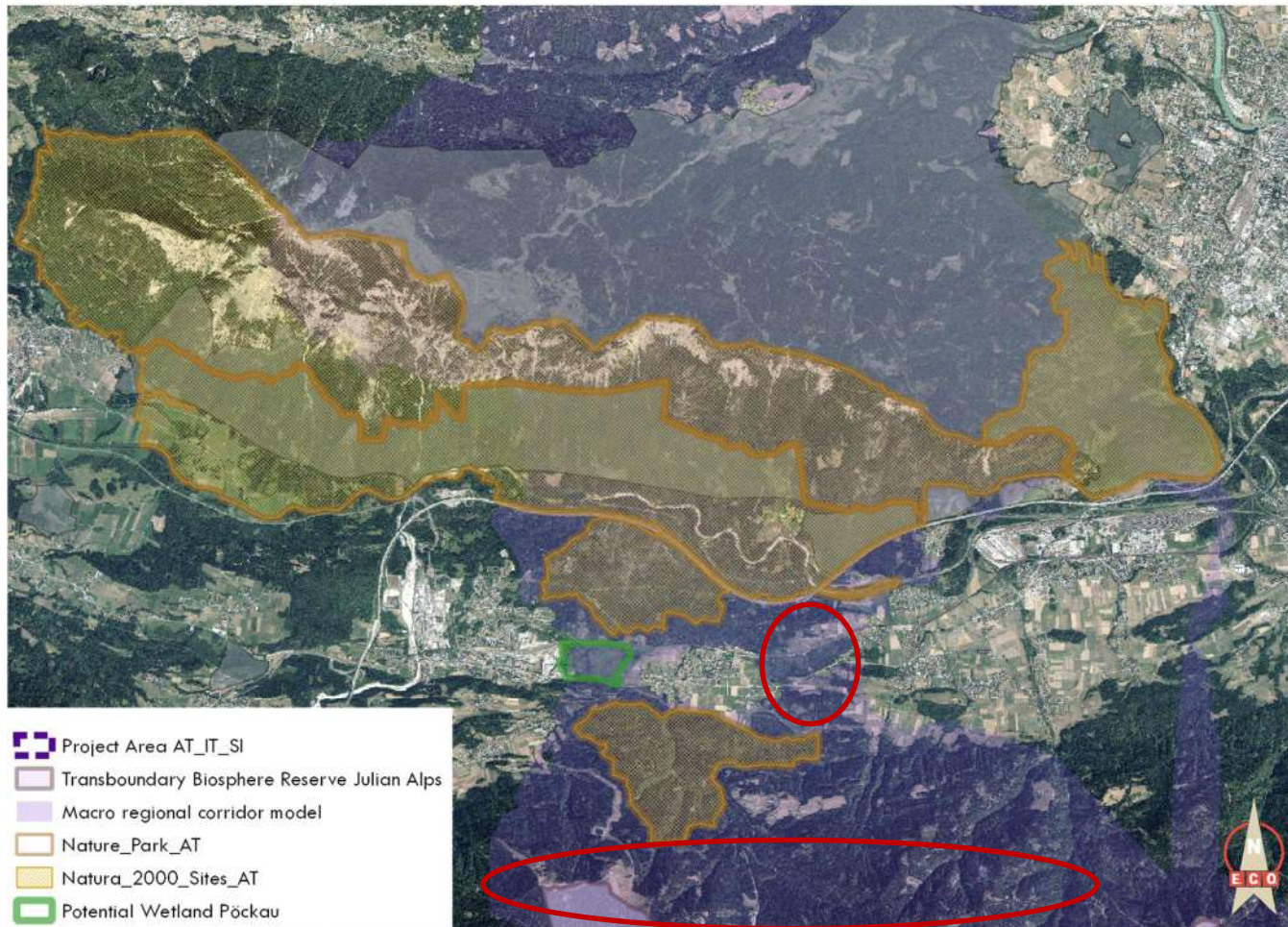


Figure 20: Protected areas, gaps and potential conservation sites on the selected corridor in the Austrian area

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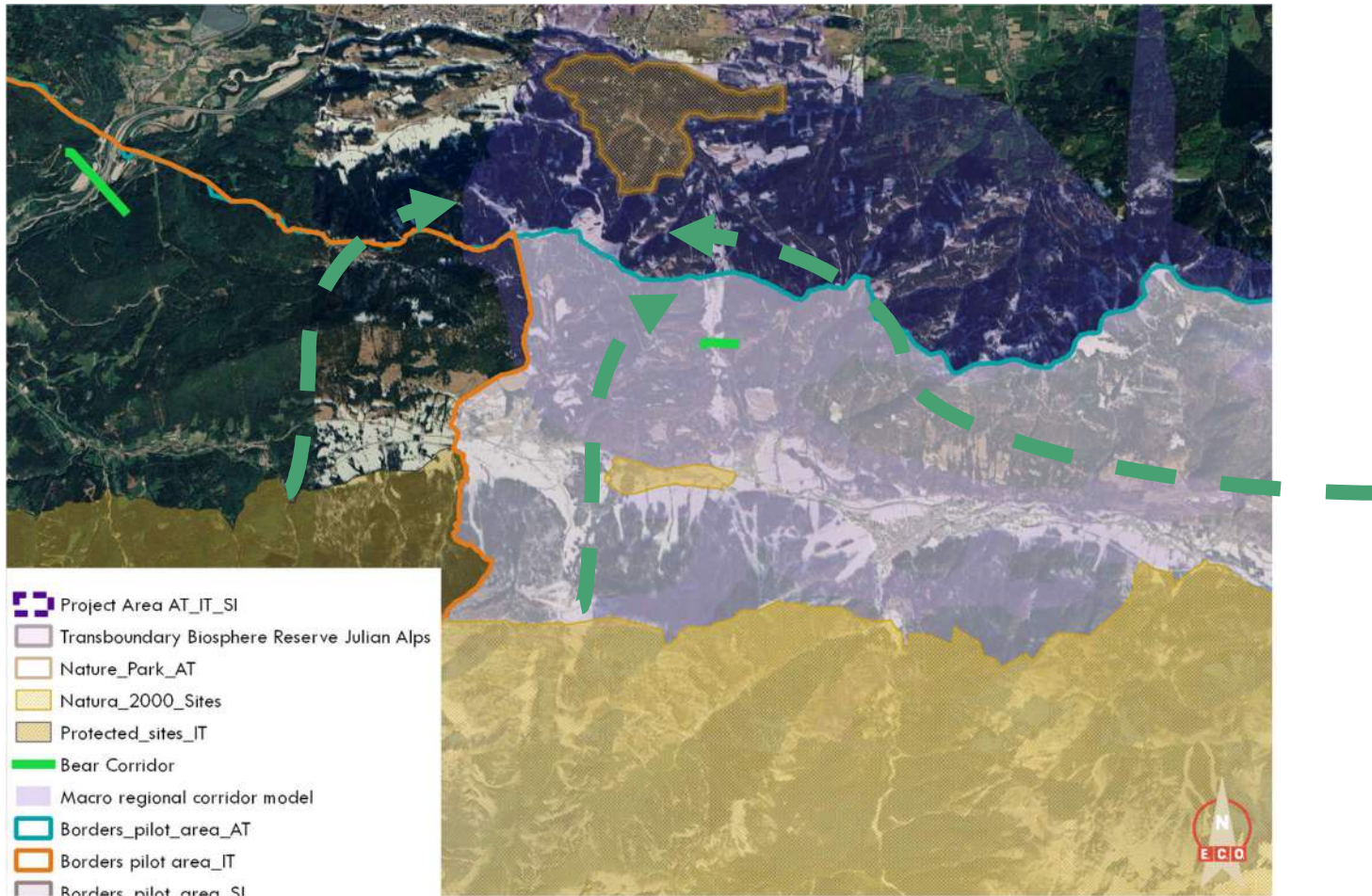


Figure 21: Protected areas on the selected corridor in Slovenia and Italy and possible connection to Austria.

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5 Recommendations for possible connectivity measures

- *The selected corridor is suitable for the movement of mammals bigger than a hare but has its limitations. The bottlenecks and barriers should be addressed by the park and wildlife experts*
- *The protected area gaps in the selected corridor area should be closed as soon as possible, to avoid further development within the potential corridor.*
- *Especially in Austria, the corridor should be addressed in a wider stakeholder process*
- *Fragmented forest areas should be improved and restored, especially on the Austrian side*
- *Open areas within the corridor should be managed in an adapted way*
- *The importance of the corridor in this area should be communicated in a stakeholder process to relevant sectors to hinder conflicting development*
- *A “Memorandum of understanding” should be drafted and signed by Austrian and Slovenian politicians as a base for further planning and for legal establishment of the core areas and corridors for connectivity*
- *Cross-border collaboration should be established more closely*
- *The functionality of the proposed corridor should be discussed in detail with wildlife experts and further measures for specific species developed.*

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