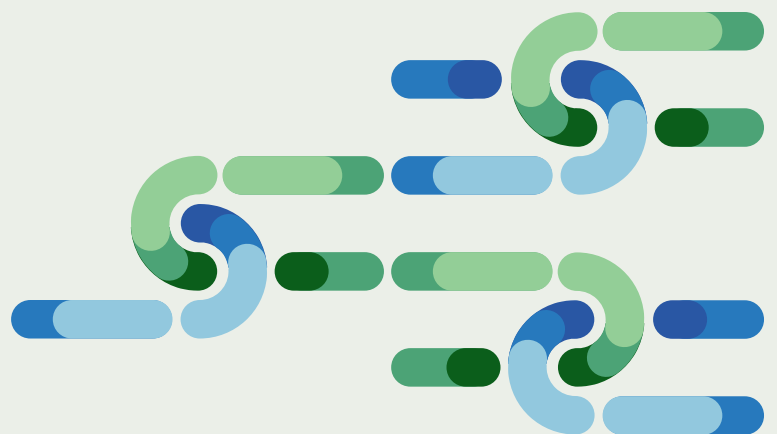


Red deer habitat network South Tyrol: Threats of land use conflicts with renewable energy productions and other infrastructure

Mapping report outlining GBI network elements and areas of land use conflicts for renewable energy production and other major developments that may threaten connectivity functions



Red deer habitat network South Tyrol – Threats of land use conflicts with renewable energy production and other infrastructures

Mapping report outlining GBI network elements and areas of land use conflicts for renewable energy production and other major developments that may threaten connectivity functions

Activity 2.4 Case Studies 3rd step: Identify unsuitable locations/mitigation measures for impact assessment of renewable energy systems and other major developments that may threaten GBI connectivity function

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Eurac Research – Institute for Regional Development

Bolzano, 31st of March 2025

Reference in AF: D.2.4.1

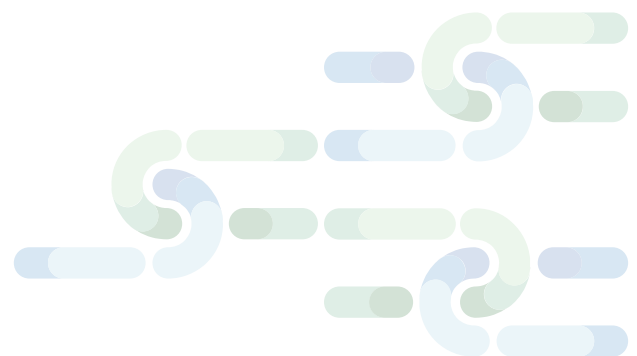


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EXECUTIVE SUMMARY

The report focuses on the threats posed to the modelled Red Deer habitat network in South Tyrol due to land use conflicts, particularly with renewable energy production and other infrastructural developments. As the Autonomous Province of Bolzano - South Tyrol is the last region in the Alpine Space without a formal or informal regional ecological connectivity concept, the primary aim of the report is to assess the potential impacts of infrastructural developments on the network, which was elaborated in the previous activity of this project, to find out which corridors are primary at risk.

Key objectives of the report include:

- Collecting potential development projects, with a special focus on renewable energy infrastructures on identified ecological corridors.
- Collecting and evaluating criteria for unsuitable locations for various types of infrastructures, with a focus on renewable energy infrastructure.
- Mapping land use conflicts for the main emerging infrastructural developments, considering renewable energy production installations with identified ecological linkages.
- Suggesting possible mitigation measures.

The report covers both existing pressures and future threats to ecological connectivity, addressing the impact of renewable energies and other infrastructural developments.

The stakeholder involvement revealed that ecological corridors in the valley bottoms of South Tyrol will experience additional barrier effects mainly by the expansion and improvement of transport infrastructure, that are mainly concerning railways in the upcoming years. There are still many cable car developments ongoing, concerning higher altitudes and based on an investigation of a list of projects which were subject to EIA, the main threats are coming from the field of tourism in first place, followed by transport and extraction of resources. Based on the mapping approach, the threats regarding settlement development and extraction of resources were revealed: Eight out of 16 corridors, which were more deeply analysed, are at risk of getting further impaired. Four corridors are at risk of being further impaired by extraction of minerals or gravel production sites. The expansion of intensive apple farming could potentially harm the corridor near Prad am Stilfser Joch in the Venosta Valley.

It is recommended to protect the identified corridors in the valley bottoms by landscape planning and to focus on those which are at risk in the upcoming years. The report provides a list of possible mitigation measures to improve landscape permeability for red deer species.



REPORT



1 Introduction

The aim of the PlanToConnect project is to develop and test an Alpine spatial planning strategy for ecological connectivity in cooperation with stakeholders in pilot areas. Proposals for the adaption of spatial planning systems and territorial policies will be developed.

As part of the PlanToConnect project, Eurac Research is conducting a case study on the creation of a GBI network in the Autonomous Province of Bolzano-South Tyrol, as it is the last region in the Alpine Space without a formal ecological connectivity concept, or which is included in a national connectivity concept, which can be downloaded from an official website of a public authority.

The design of a GBI network for connectivity in the pilot region has been developed and described in the [report D2.3.1](#).

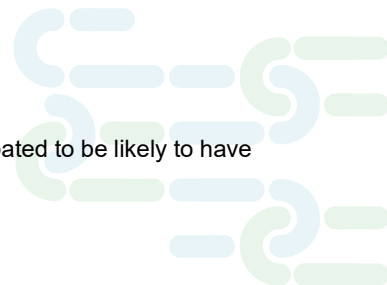
The network design is made on two levels: an ecological connectivity concept for the new Provincial Strategic Plan (PSP) was proposed, using the macroregional structural model of the PlanToConnect project. At the provincial level an analysis regarding ecological connectivity for target species is made to formulate a more detailed network design proposal. This could be used for the new provincial landscape guidelines and to focus on some specific measures to implement ecological connectivity in the municipal development programs, especially for the in-depth landscape analysis for some municipalities.

This report (D2.4.1) focuses on the land-use conflicts arising from renewable energy facilities and other infrastructural developments and land uses that may threaten the identified ecological corridors in the pilot region. The objectives are:

- to assess potential impacts of renewable energy infrastructures, other infrastructures and land uses that may threaten identified ecological corridors,
- to collect and assess evaluation criteria for unsuitable locations for the various types of infrastructures with a focus on renewable energy,
- to map the land use conflicts for renewable energy production with the identified ecological linkages and
- to suggest possible mitigation measures.

This report covers spatially relevant infrastructures, and land uses that have already had a negative impact on connectivity (pressures) as well as those that pose a threat to connectivity in the future (threats)¹. The collection of infrastructures does not claim to be exhaustive. The report addresses the impact of renewable energies, but in the pilot site also other infrastructural developments will have an important impact and need to be considered. For this reason, further pressures and future threats are outlined.

¹ Pressures are factors that have affected habitats and species, threats are factors that are anticipated to be likely to have an impact in future (European Environment Agency 2020).



The structure of this report is organized as follows: Chapter 2 provides a brief description of the pilot region. Chapter 3 details the methodological approach employed in the study. Chapter 4 presents the key findings regarding the main pressures and threats to ecological connectivity in the pilot region. Chapter 5 discusses the exclusion zones and opposing factors for major developments and renewable energy facilities within the pilot region. Finally, Chapter 6 outlines the potential mitigation and compensation measures for both existing and planned infrastructures in the pilot area.



2 Pilot region South Tyrol

The geographic scope of the study includes the Autonomous Province of Bolzano-South Tyrol, with consideration for connections to surrounding regions. The area covers an area of 7,400 km² with 536,933 inhabitants (2023) and has a protected surface area of 1.867,39 km², equal to 25.24% of the total area (Vitangeli & Laner, 2024). More than half of South Tyrol's territory is covered by forested areas. Most of the 14,700 animal species documented to occur in South Tyrol live permanently or partially in forests. More than 1,100 plant species also grow in the forested areas of South Tyrol, including 173 mosses, 49 tree species and 23 shrub species, as well as about 6,000 species of fungi (Autonomous Province of Bolzano – South Tyrol, 2023).

South Tyrol is characterized by the alternation of valleys and mountainous areas and the transition from forest associations to alpine grasslands. The uniqueness of the South Tyrolean landscape is given by the combination of strongly characterizing forms of use such as fruit growing, viticulture, and forage farming. Changing agrarian structure, intensive land use, has induced a noticeable change in the landscape (Autonomous Province of Bolzano, 2002). In South Tyrol, land use/ land cover types of forested areas and (alpine) open land are dominating in higher altitudes, in the valley bottoms, anthropogenic infrastructure and intensive agriculture is prevailing.

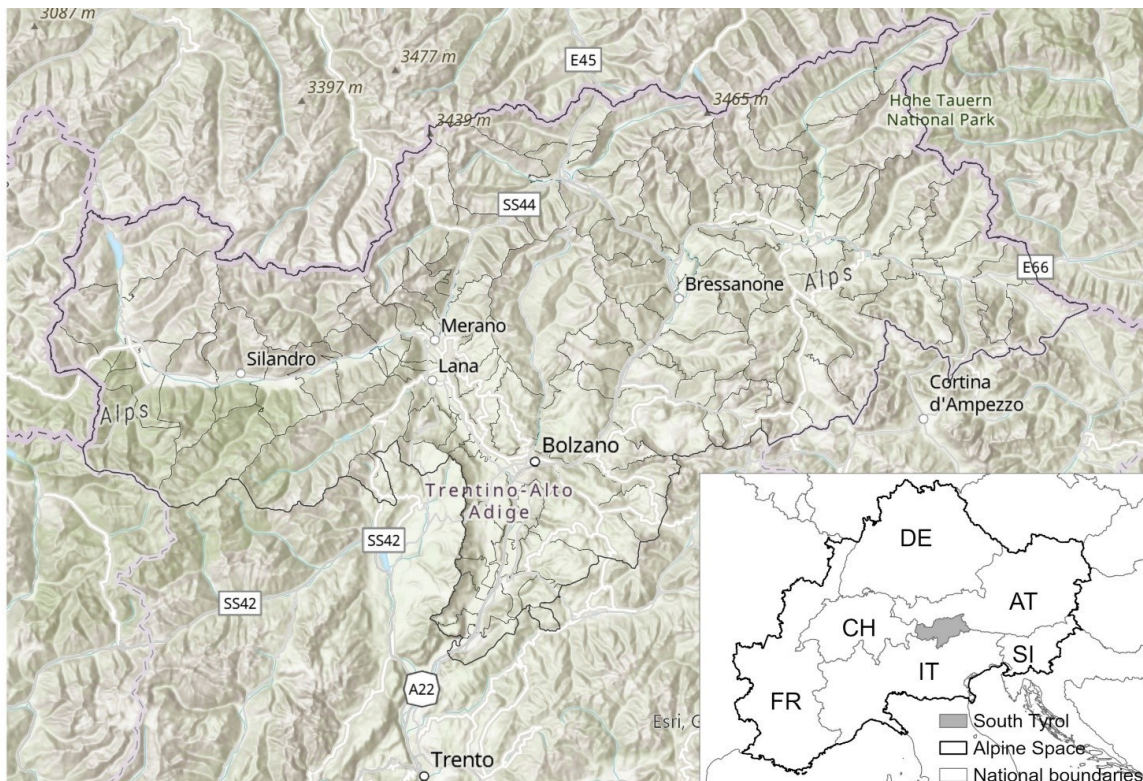


Figure 1: Overview – Location of pilot area

3 Methodological steps

3.1 Description of the approach and working steps

Working Step	Description
1 General threats of infrastructures and land uses posed to GBI ecological networks	The first step is to identify which types of infrastructure projects or land uses generally have a negative impact on ecological connectivity and which thresholds exist. This step is based on the general threats report D1.3.1 , which refers to the EUSALP level.
2 Definition of relevant infrastructures	The second step is to identify which existing or planned infrastructures in the pilot region are spatially relevant. For this purpose, threshold values from EU's Environmental Impact Assessment Directive and the German Environmental Impact Assessment Act are compiled and analysed.
3 Existing pressures and expected major threats in the pilot region	The third step was the identification of major infrastructural developments or planned infrastructures projected for the coming years in the pilot site. For the evaluation of these future threats, a workshop was carried out on 05.11.2024 in person with planning experts from the Regional Connectivity Working Group. The creation of the ecological connectivity concept in South Tyrol and related future risks for ecological connectivity were discussed. Concrete infrastructural projects that are planned or will be implemented in South Tyrol were collected by the experts from spatial planning and landscape planning offices, representatives from the office for road infrastructure, representative from the nature museum, the hunter's association and the office for wildlife management. Additionally, desk research for official, publicly available lists of planned projects, required to conduct an EIA, was made. The description of the development of agricultural intensification was supported by maps from a study elaborated in 2018.
4 Compilation of general criteria for unsuitable locations	General criteria for unsuitable locations were retrieved from the threats report D1.3.1.



Working Step	Description
5 Development of specific criteria for unsuitable locations in the pilot region (exclusion zones)	Exclusion zones in this context are areas where certain infrastructures are not allowed to be built or operated (unsuitable areas). For the definition of exclusion zones, it is not sufficient to use only the boundaries of the developed GBI network for connectivity (including priority areas for conservation and restoration). Protected areas under landscape and nature protection, as well as other protected sites, such as hazard zones that are unsuitable for infrastructural development (Other Effective Conservation Measures), may overlap with ecological linkages. For this purpose, a review of the law has been conducted at the state and provincial levels. In general, the protected areas under the legislation have been defined, followed by a specification of the provisions for renewable energy production plants. As an autonomous province, the Autonomous Province of Bozen/Bolzano – South Tyrol can enact regulations that differ from those of the state, based on its specific territorial needs. To summarize, the aspects considered (if existing) are: • Compilation of existing standards or guidelines for determining unsuitable areas for a certain type of infrastructure and • Compilation of the maximum impact ranges of infrastructure projects used as a buffer around ecologically valuable areas
6 Mapping the land use conflicts for renewable energy production and other infrastructural developments	With regard to ecological connectivity, maps of the exclusion zones for each corridor were elaborated using simple overlay functions and proximity tools. We tried to consider relevant types of infrastructure (wind power, solar power, biomass power plants, settlements, urban/industrial development), which can be a threat for the modelled red deer species. Roads, railways and agricultural developments are not considered in the maps, but are reported with descriptions. High voltage transmission lines, and hydropower plants are not considered in this report because we focus on species on land.
7 Possible mitigation and compensation measures	Possible mitigation or compensation measures for renewable energy facilities (existing and planned) in the pilot region “South Tyrol” are proposed referring to the threats report (D.1.3.1) and the report on conflicting land uses (D1.2.1).

3.2 Data used

The Table 1 – “*Overview of regional data used*” shows the data that were used and were available for analysing the pilot region.

Table 1: Overview of regional data used

Data	Source	Description (see section 5.2.2)
Red Deer Ecological Network South Tyrol	Eurac Research – Institute for Regional Development, Calculation with Linkage Mapper 3.1. programme.	The ecological network for red deer defines core area, island habitats and stepping stones in South Tyrol and collected them based on least-cost-path analysis (see report D.2.3.1 – Project for ecological network South Tyrol).
Biotopes	Geo-Catalogue South Tyrol	File: LandscapePlan-Biotopes_polygon.shp
National and Nature Parks		File: LakesProtectionAreas_polygon.shp
Natura 2000 areas		File: LandscapePlan-Natura2000_polygon.shp
UNESCO world heritage sites		File: UNESCO-Sites_polygon.shp
Protected Landscape Elements		File: LandscapePlan-LandscapeProtectedElements-Polygons_polygon.shp
Protected areas by the Landscape plans		File: LandscapePlan-ProtectedAreas_polygon.shp, including • Landscape protected areas • Respect zones • Landscape protection authorization
Hazard zones (hydrogeological areas)		Category H4 of the hazard zoning plans with strict protection status. File: UrbanPlan-HazardZonePlan-Hydrology_polygon.shp
Lake's protection areas		LakesProtectionAreas_polygon.shp
Water courses		Watercourses_line.shp (germ. "Fließgewässer Südtirols")



4 Major pressures and threats to ecological connectivity

Pressures are factors that have affected habitats and species, threats are factors that are anticipated to be likely to have an impact in future (European Environment Agency 2020).

This chapter firstly lists general threats towards ecological connectivity and secondly it explains the major threats in South Tyrol. Next to the most important type of renewable energy installations in South Tyrol, which is hydropower and therefore mainly problematic for aquatic connectivity, there are other important existing infrastructural barriers and anthropogenic pressures on land. Therefore, we consider a certain range of infrastructures as potential threat for ecological connectivity. The aim is to investigate not only existing, but also possible future threats to reveal why protection measures should be established, and in which areas.

4.1 General threats to GBI ecological networks posed by infrastructure and land uses

The table below lists infrastructures and land uses (analysed in [report D1.3.1](#), along with others specific to South Tyrol) and assesses their general impact on connectivity across the landscape. A distinction is made between structural and functional connectivity.

Table 2: Infrastructures and land uses with their impact on connectivity

Sector	Type of infrastructure/ Land use	General impact on connectivity
Renewable energy	Hydropower - hydroelectric reservoir (dam)	High impact on structural and functional connectivity because of usually large land take and barrier/ fragmentation effects
	Hydropower - Run-off-river power plants	Low impact on structural connectivity because of minimal land take High impact on functional connectivity because of barrier/ fragmentation effects in the water body
	Windpower - windmills	This type of infrastructure is not considered as relevant in South Tyrol at the moment. Furthermore, migration routes of birds were not revealed during the PlanToConnect project. Low impact on structural connectivity because of minimal land take. Partly high impact on functional connectivity because of collisions (birds, bats)



Sector	Type of infrastructure/ Land use	General impact on connectivity
	Solar Power - Photovoltaics: Ground-mounted solar panels	Mostly low impact on structural and functional connectivity because of usually low soil sealing and marginal barrier effects. Effects depend on the area size and design. Large area photovoltaics: high impact due to extensive habitat changes (structural connectivity) and to fragmenting effects if fenced (functional connectivity). Above a length of 500 metres, fragmenting effects on large mammals are to be expected.
	Bioenergy - Biomass	Bioenergy plants: Mostly low impact on structural and functional connectivity because of usually low land take and marginal barrier effects. Effects depend on the area size of the facility. Change of land management and land use: no general statements possible because effects depend on the area size, the location and intensity of the biomass production.
Renewable energy and agriculture	Agrivoltaics: dual use of land for solar energy production and agriculture	Mostly low impact on structural and functional connectivity due to the fact that the panel is raised from the ground. Effects depend on the area size and design. However, functional connectivity can be affected by cultivation position (e.g. use of horizontal espaliers)
Energy sector as a whole	Transmission of electricity - High voltage transmission line	Low impact on structural connectivity because of minimal land take outside of forests; partly high impact on functional connectivity because of collisions (birds)
Transport	Roads/ highways	High impact on structural and functional connectivity because of usually large land take, high barrier effects, wildlife mortality due to traffic and impacts due to noise, dust and pollutants
Transport	Railway	High impact on structural and functional connectivity because of land take (habitat loss), barrier effects, wildlife mortality due to traffic and impacts due to noise, dust, pollutants and vibrations
Transport	Sky lift - Cable car	Medium impact on structural connectivity because of minimal land taken. However, cable car pylons can fragment the habitat. High impact on functional connectivity because of collisions (birds, bats and for migration route) and the movement of the cable cars can disturb wildlife behaviour.
Urban /industrial development	General urban/ industrial development	High impact on structural and functional connectivity because of land take (habitat loss), barrier effects and impacts due to noise and other pollutants

Sector	Type of infrastructure/ Land use	General impact on connectivity
Urban/industrial development	Ski resort expansion	Related to the construction of new ski lift – cable car. High impact on structural and functional connectivity because of land take (new building at the valley bottom connects to the upper mountain) and habitat fragmentation and impacts due to noise and pollutants.
Agriculture	Intensive agriculture	Intensive apple orchards: High impact on functional connectivity because of land take/ habitat loss. Medium impact on structural connectivity: The cultivation through espaliers can have a physical barrier effect, especially for medium to large mammals.
Extraction of resources	Mineral extraction	High impacts on structural and functional connectivity because of land take (habitat loss), fragmentation and barrier effect, impacts due to noise, dust, machine and pollutants.

4.2 Definition of relevant infrastructures

As already described in report [D1.3.1](#) and in Table 2, the potential impacts of infrastructure depend on its size and design.

Therefore, it must first be analysed which infrastructures generally pose a pressure or a threat to connectivity and are relevant for spatial planning. The question is if there are threshold values for projects to which significant negative effects on the environment can be assumed.

The EU's Environmental Impact Assessment Directive provides specifications for which projects an Environmental Impact Assessment (EIA) are obligatory. These specifications can be interpreted as an orientation for the spatial planning significance of different infrastructures. In the EU's Environmental Impact Assessment Directive relevance thresholds are not specified for all project types. EU Member States can provide further details regarding the necessity of an environmental impact assessment or a preliminary environmental impact assessment (on a case-by-case basis or by setting specific criteria such as the location, size or type of project).



Italy defines project types for which an EIA or a preliminary assessment must be carried out in Annexes of Part II to the Environment Code (to D.lgs. No. 152/2006 and following integration²).

The EIA is an important tool as it describes, identifies and assesses the direct and indirect effects of projects by examining their impact on the population and human health, biodiversity, land, soil, water, air and climate, as well as on cultural and landscape heritage.

When assessing this series of impacts, it is necessary to consider specific criteria. These are essential to determine whether a project requires an initial phase of evaluation (screening), and they are:

1. **Characteristics of the project:** size and design of the project as a whole, accumulation with other projects, whether natural resource are used, whether waste and pollution are produced and the related risk to environmental and human health
2. **Location of the project:** consider the environmental sensitivity of geographic areas that may be impacted by projects
3. **Typologies and characteristic of the potential impact**

For the purposes of the deliverable, projects for which an EIA or a preliminary environmental impact assessment is mandatory are spatially relevant. The explanation of the reference legislation and the complete derivation of these threshold values can be found in the Annex 1.

The following table shows the project types that are considered to be spatially relevant in South Tyrol and thus may have negative impacts on the environment and connectivity. The derivation of these threshold values can be found in the Annex III and IV of Dlg 2006.

Table 3: Identification of projects thresholds for spatial planning taken from Dgls. 152/2006 and following integrations (Attachment III and IV)

	Relevance for spatial planning
Windpower (windmills)	Screening: Wind power plants with a total capacity exceeding 1 MW
Solar power (ground mounted photovoltaic systems)	Screening: photovoltaic systems with a capacity equal to or greater than 15 MW and 12 MW based on the classification of the area EIA: Photovoltaic solar plants placed in a floating mode on the water surface of reservoirs created by dams (specified in Article 1 of D.L. 1994).
Biomass (biogas plant)	It falls under state competence, screening: Thermal plants for the production of electricity, steam, and hot water with a total thermal power output exceeding 50 MW

²The latest integration took place with the amendments introduced by Legislative Decree No. 190 of November 25, 2024, on the *Regulation of administrative regimes for the production of energy from renewable sources*, implementing Article 26, paragraphs 4 and 5, letters b) and d), of Law No. 118 of August 5, 2022.

	Relevance for spatial planning
Roads/ highways	Screening: Secondary suburban roads and urban roads with a length of more than 1500 meters EIA: Urban arterial roads
Railways	Screening: regional or local railway lines
Tourism (Ski slope, cable cars...)	Screening: Ski slopes longer than 1.5km or covering an area greater than 5 hectares, captive guided transportation systems
Extraction of resources	Screening: caves and peat bogs Any extraction site needs a special designation in the municipal land-use plan
<u>Settlement development</u>	Each spatial municipal development program, need to be undertaken a strategic environmental assessment (SEA) ³ . (Provincial law n°17/2017) which define settlement boundaries Screening: Development projects for industrial or productive areas involving a surface area exceeding 40 hectares; Development projects for urban areas involving surface areas exceeding 40 hectares; redevelopment or development projects within existing urban areas involving surface areas exceeding 10 hectares; construction of shopping centers [...], public parking facilities with a capacity exceeding 500 parking spaces

³ All plans and programmes shall be subject to SEA in accordance with the provisions of this title:

which are drawn up for agriculture, forestry, fisheries, energy, industry, transport, waste and water management, for the assessment and management of ambient air, telecommunications, tourism, spatial planning or land use, and which set the framework for the authorisation of projects

4.3 Existing pressures and expected major threats in the pilot region

Major infrastructure development projects in South Tyrol were revealed by an expert workshop on the 5th of November 2025. It is based on the knowledge of workshop participants who are representative organisations: The Hunter's association, the Nature Museum, the Provincial Offices for road constructions, landscape planning, regional planning, and wildlife management, and the Biologist association. Along the Adige Valley, there could be a possible integration of agri-voltaic systems, as some pilot plants are already in place. For now, it is not possible to define the potential negative effects and therefore they are not included in the map. This chapter qualitatively describes which relevant projects will occur in the study area.

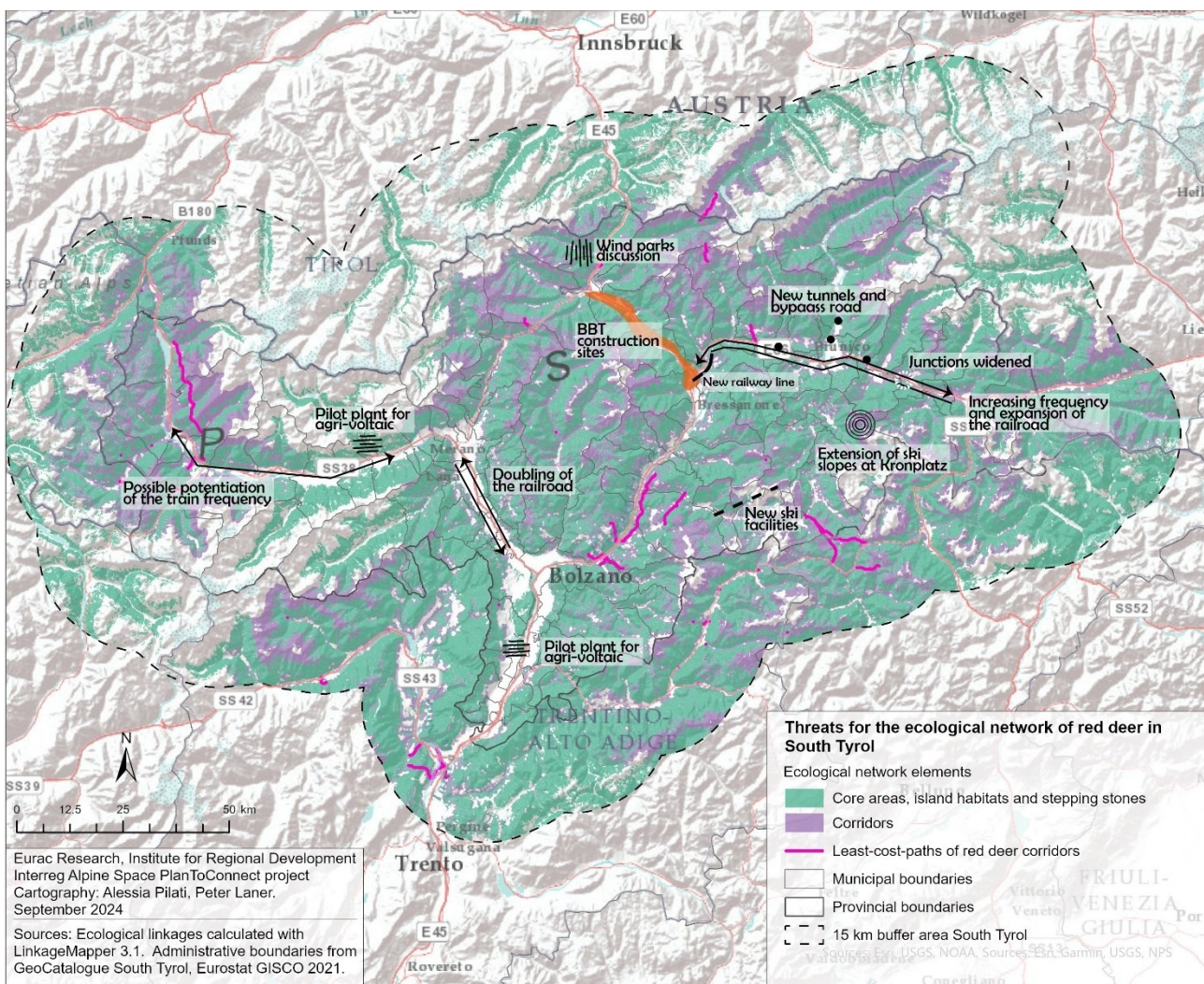


Figure 2: Localisation of the main projects resulted from the expert workshop

The following paragraphs are divided into categories of threats and describe the future infrastructures, their planned locations and a reflection on possible impacts.

GBI network South Tyrol: Threats of land use conflicts

Peter Laner, Vittoria Vettorazzo, March 2025

4.3.1 Renewable Energy installations:

Agrivoltaics: The discussion regarding Agri-voltaic systems is going in the direction to provide the possibility to farmers for establishing photovoltaic panels on the top of orchard fields, substituting hail nets. Some pilot plant for testing the system is already active in South Tyrol. However, it is not yet clear how the legal situation will develop.

Possible impacts and considerations: The combination between energy production and agriculture is an emerging experimental field. Depending on the type of structure, as well as the choice of crop or grazing under the panels, possible advantages will be possible. Precisely for this reason a deep understanding of the AV on energy, plant and animal productions as well as biodiversity across a wide range of environments, soil types and plant species is needed (Gomez-Casanovas et al., 2023).

Wind parks: A recent project plans a wind park at Brenner and Pfunder mountains, the area is in rocky and high elevated mountains at the national boundary towards Austria (see also Neue Südtiroler Tageszeitung 2024).

Considerations: Several years ago, the Sattelberg and the Sandjoch were locations for a study regarding wind parks in South Tyrol. The project faced strong opposition from environmental committees such as Alpine club, CAI, Austrian Alpine Club (ÖAV) and the Arc Alpin Club (CAA), which criticized the project for the environmental impact due to the wind turbines that would also have an impact on the migration routes of the birds. Until now, no decision has been made. (Sattelberg (AT-IT), 2019).



Error! Reference source not found. Agri-PV testing station in Naturno/ Naturns. Foto: Peter Laner, 2023

4.3.2 Transport infrastructure:

The major threats regarding the improve of transport infrastructures refers for the train connections in South Tyrol.

Railway expansion projects and their possible impacts:

A general problem is the increase for train frequencies on many train lines and the future forecasts concern the creation of new railway lines. These projects often increase the frequency of trains and therefore it increases also the risk of animal collisions.

Following are the planned railway projects:

- Doubling of the railroad between the two main cities of South Tyrol, Merano and Bolzano.
- Increasing of the frequency in Pusteria Valley and expansion of the railroad.
- A potentiation of the train frequency in the Venosta Valley is likely but must be verified together with the transport agency of South Tyrol (STA).
- The planned construction of the train connection “Riggertalschleife” could potentially impact on the wildlife passages between Bressanone/ Brixen and Rio Pusteria/ Mühlbach. The Pustertal railway link is planned at Natz-Schabs.
- The Brenner Base Tunnel (BBT) is under construction, and it would actually improve the situation for ecological connectivity in general because train traffic will be moved underground. However, the constructions sites of the BBT are producing significant barrier effects in the upper Isarco Valley, between Bressanone/ Brixen and Vipiteno/ Sterzing, near Mules, during the long-lasting construction phase. The BBT construction site near the highway- exit of Varna/ Vahrn will create a new barrier.

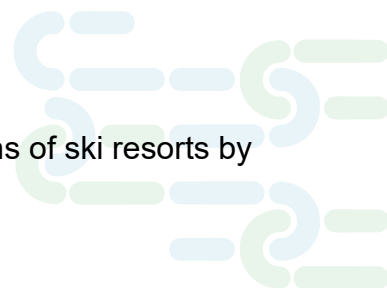
Road expansion projects:

Road infrastructure is widely established in South Tyrol. Currently, approximately 40 punctual construction interventions are active. New construction sites for roads are focusing mainly on punctual interventions and bypass roads to remove the through-traffic from villages which are currently on main roads. Those bypass roads sometimes can have positive effects for connectivity, because of new road tunnelling.

- Some examples are the tunnelling of the State Road near Chienes/ Kiens (before Brunico/ Bruneck) and the tunnelling of Perca/ Percha, after Brunico/ Bruneck, as well as the bypass road “Nordring Bruneck/ Brunico” and S. Giorgio.
- The junctions of Olang and Rasen-Antholz will be widened. (Autonomous Province of Bolzano – South Tyrol, 2024)

4.3.3 Tourism infrastructure:

In general, a lot of infrastructure for tourist facilities, especially connections of ski resorts by ski lifts, are threatening ecological connectivity at higher elevations.



- A special case is the planned connection of the ski facilities between Saltria on the “Seiser Alm” and Monte Pana in the municipality of St. Christina in Val Gardena, which could potentially harm a forested area on important relatively natural mountain slopes.
- Other connections of ski resorts are the one of Ladurns (Pflersch) – Rosskopf) and the extension of ski slopes at Kronplatz (near Brunico/ Bruneck).

Considerations: The impact of tourism is a hot topic in South Tyrol, especially during peak season. Winter sports in particular call into question the sustainability of the mountains in a wider view. In this case for avian species, they are not able to see the iron cable if it is smaller than 6 cm. The same problem is the tree canopies, if they are behind the cable, bird cannot see them.

4.3.4 Mineral extraction:

A new provincial plan for mineral extraction sites (or quarry plan) is currently in elaboration. It will indicate which materials are available in which locations of the province, but not the maximum or indicative quantity to be mined. Sensitive sites are excluded.

Considerations: A plan for ecological connectivity could possibly inform the plan about additional sites which should be avoided.

4.3.5 Agriculture:

During the Regional Connectivity Working Group meetings it was mentioned several times that intensive agricultural areas, like apple orchards e.g. are fenced, to protect them from wildlife species. The areas of the middle and lower Venosta Valley, where intensive apple farming is already fully developed, was widely fenced for several kilometres. The fences are separating the forested mountain slopes at the north and the south side of the valley from the valley bottoms, to protect the apple orchards from damages by wildlife species. This creates a significant barrier for many species on land.

These existing barriers are creating problems for connectivity especially in the Vinschgau Valley. The extension of intensive agriculture, especially intensive apple orchards, can be a threat for ecological connectivity in higher elevations, especially for the Upper Venosta Valley:

The expansion of intensive agriculture in the valley bottoms of South Tyrol was present over the last decades and therefore represents a growing threat in future too. An analysis from 2018 shows the expansion in the Upper Venosta Valley between the 1950ies and 2015. While in the 1980ies, continuous pure permanent cultures were only present up to the Latsch village, in 2015 it has expanded up to “Prad am Stilfser Joch”, which is located approximately 25 km towards west and approx. 300m higher in altitude (See series of maps in this section below). Drivers for this development can be found in the profitability of apple farming, supported by economic incentives (Brühl et al. 2024), as well as advanced agricultural techniques. The use of advanced agricultural techniques and technologies, such as

precision irrigation, has made it feasible to expand intensive agriculture into areas that were previously less suitable (Grashey Jansen, 2012). Also, climate change might affect the apple farming conditions. Farmers are adapting by moving their orchards to higher altitudes where the conditions are now more favourable. (Tragliavini & Niedrist in Hechensteiner et al., 2024).

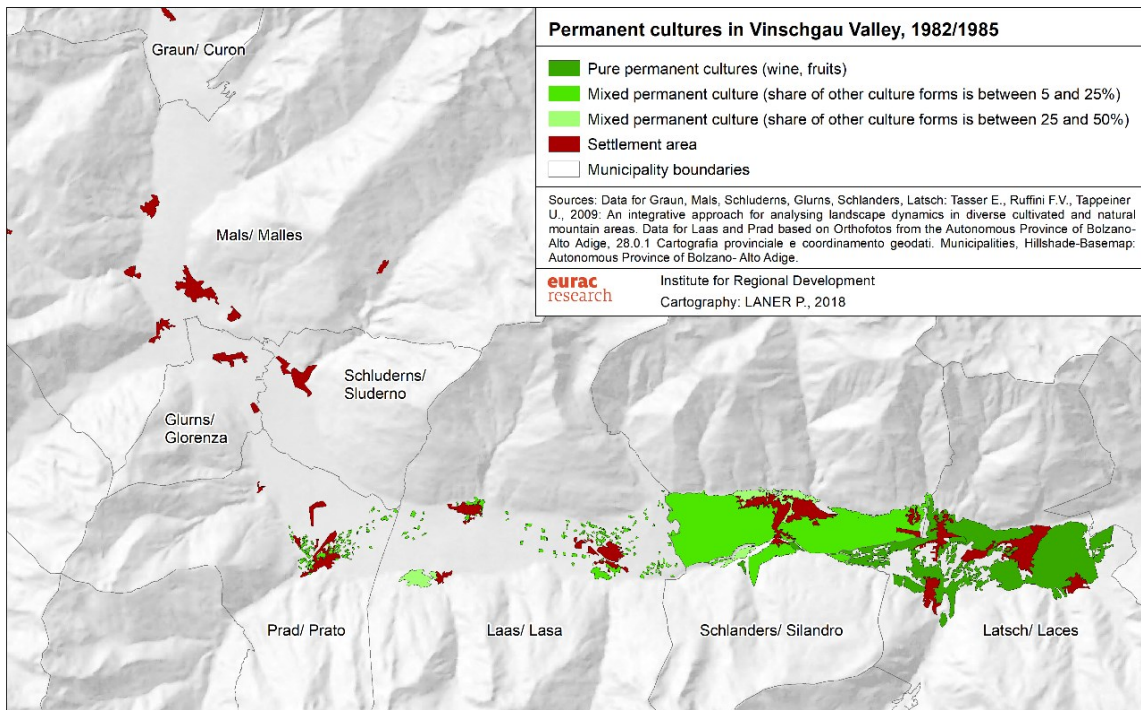


Figure 3: Permanent cultures in Vinschgau Valley, 1982/1985



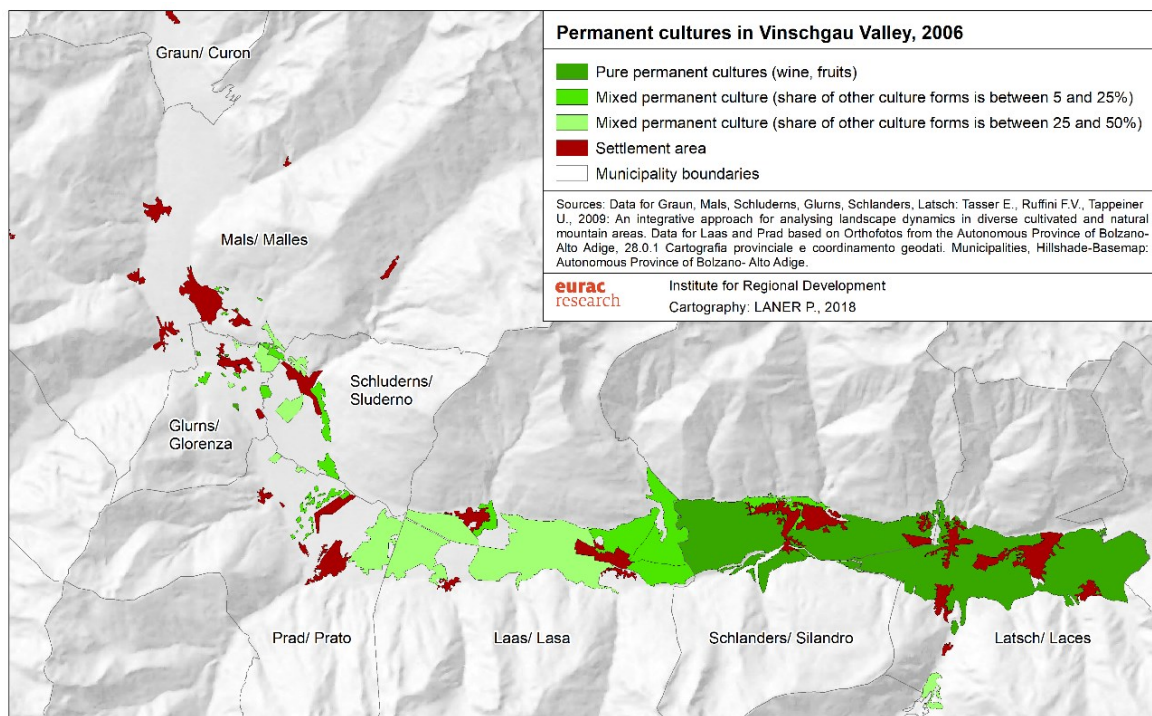


Figure 4: Permanent cultures in Vinschgau Valley, 2006

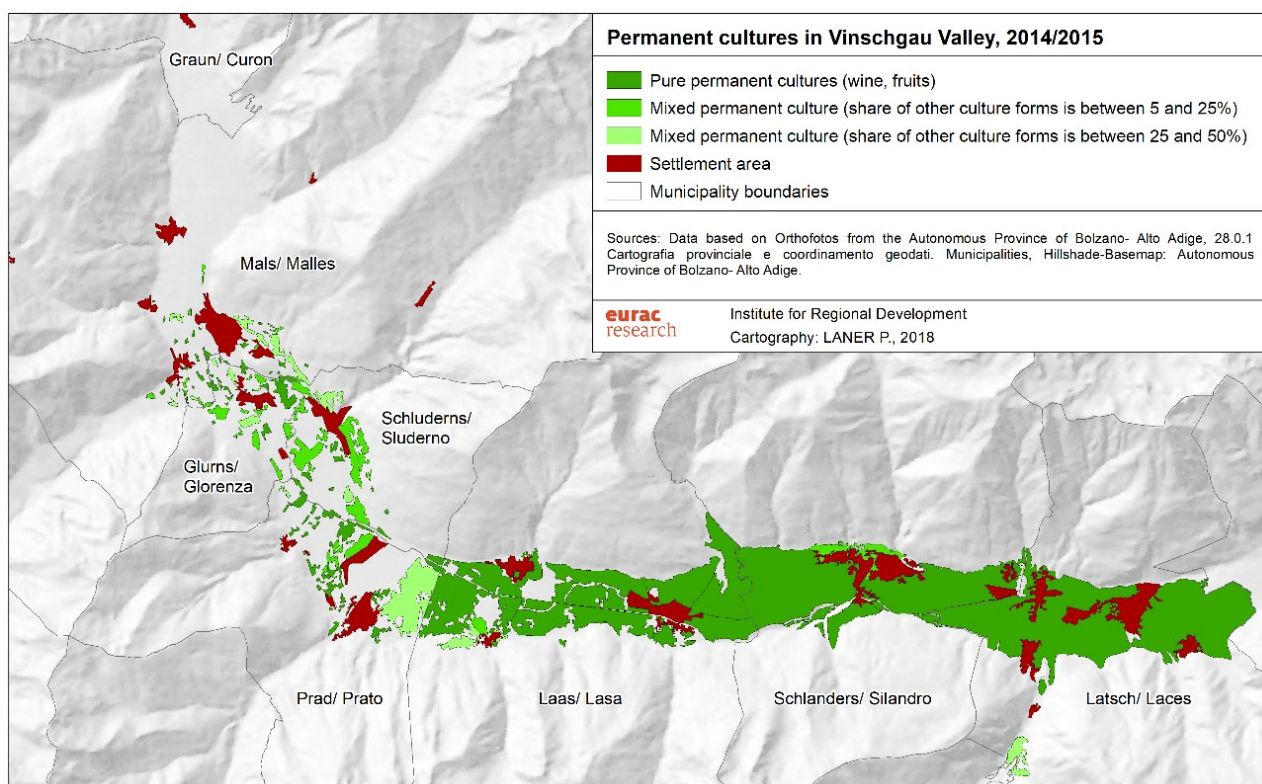


Figure 5: Permanent cultures in Vinschgau Valley, 2014/15

4.3.6 Overview

The following table lists all projects with spatial relevance in the pilot region, based on the results of the workshop and other provincial projects that were not mentioned during it. A distinction is made between existing infrastructure (pressures) and planned projects (threats).

Table 4: Overview – Existing pressures and expected major threats in the pilot region Autonomous Province of Bolzano - South Tyrol

Type of infrastructure/ Land use	Existing (pressures)	expected (threats)	Description
Hydropower - Hydroelectric reservoir (dam)	The Hydropower plants are widely established in South Tyrol. So far in Province of South Tyrol there are 601 plants for a total of 1.740 MW ⁴	Projects for pumped storage power plants	In 2024, projects for pumped storage power plants were tried to bring forward, especially in Val d'Ultimo, but have met resistance from the local population.
Windpower - windmills	So far in the Province of South Tyrol there are 2 of plants for a total of 0 MW ⁴	Possible wind park project at Brenner and Pfunder mountains	Study to examine wind power potential in the municipality of Brenner
Solar Power - Photovoltaics: Ground-mounted solar panels	By 2024, 4 Solar panel fields of a size above 1.000 m ² , outside settlement areas exist in South Tyrol: 3 fields in Verano/ Vöran on grassland near farms on 1.100 m.a.s.l. Sizes: 3.500 m ² , 15.125 m ² and 20.300 m ² . One in Taufers im Münstertal near settlements with a size of 2.360 m ² .	Possible integration of an agri-voltaic system in the Adige Valley. By now (February 2025) there are no specifications regarding the implementation. Theoretically various parts of the whole valley can be affected.	For research purpose, Agri-voltaic systems are allowed in the province's agricultural fields. (DPP. n.13/2020). Until now there aren't other planned project. However, a cooperation agreement (focused on solar panels) was signed to promote the production throughout renewable energy, to achieve the "Piano Clima Alto Adige 2040" objectives. An objective is e.g. to take up an additional 400 MW of PV power by 2030 and an additional 400 MW by 2037. (Autonomous Province of Bolzano -South Tyrol (2024). Suitable locations will be defined for the installation of solar panels by public institutions and private actors.

⁴ The number of plants and the power are updated as of 2023. (GSE 2025)

Type of infrastructure/ Land use	Existing (pressures)	expected (threats)	Description
	So far in the Province of South Tyrol there are 15.067 of plants for a total of 377 MW ⁴		
Bioenergy - Biomass	So far in the Province of South Tyrol there are 143 of plants for a total of 77 MW ⁵		No existing or planned major Biogas plants found.
Transmission of electricity - High voltage transmission line		Construction of new underground high-voltage line.	New underground high-voltage line, with the length of 10km, its under Constuction and will be finished by 2025. (Autonomous Province of Bolzano - South Tyrol, 2023) The same project in the route: Dobbiaco, San Candido and Sesto (Autonomous Province of Bolzano - South Tyrol, 2024). In the long term, it would improve ecological connectivity compared to the classic high voltage transmission line, but in the short term, its construction will produce barrier effects
Roads/ Highways	Highway A22, Freeway (Superstrada) Merano-Bozen (MeBo)	Tunnelling of the State Road near Chienes/ Kiens Tunnelling of Perca The junctions of Olang and Rasen-Antholz will be widened.	No further major roads or highways are planned
Railway	The constructions sites of the BBT are producing significant barrier effects.	Doubling of the railroad between Merano and Bolzano. Planned construction "Riggertalschleife" between Bressanone and Rio Pusteria.	In addition to the new expansion, a potentiation of the frequency is planned in Pusteria and Venosta Valley.

⁵ The number of plants and the power are updated as of 2023. (GSE 2025)

Type of infrastructure/ Land use	Existing (pressures)	expected (threats)	Description
Urban/ industrial development	The settlement structures, developing along the valley bottoms created a linear barrier in some cases. Some specific settlements are representing a barrier for ecological corridors, e.g. the industrial zone at Prad am Stilfser Joch (see corridor 10).	Settlement developments in the valley bottoms, which generate the risk of bottlenecks for specific corridors, including the risk exists of entirely losing them.	Settlement developments on following corridors in the valley bottoms generate the risk of bottlenecks or the risk of getting lost: • Corridor 5 - Naz-Sciaves – Rio di Pusteria • Corridor 6 - Perca–Rasun Anterselva • Corridor 10 - Sluderno–Prato • Corridor 17 - Corvara • Corridor 20 - Renon–Sciliar/ • Corridor 24 - Campo di Trens
Tourism and leisure	Tourism infrastructure and connection between the valley and mountain area are widely established in the territory.	Planned cable car between Saltria and Monte Pana Extension of ski slopes at Kronplatz New cable cars In Ladurns (Pflersch) Planned construction of the new San Genesio cable car.	As of December 31, 2023. There were 357 cableways in the Autonomous Province of Bolzano – South Tyrol (2024). New projects are planned, therefore, all modifications and expansions in the mountain areas will continue to have an impact on landscape fragmentation.
Mineral extraction	47 zones for gravel production/ gravel processing are currently designated in Autonomous Province of Bolzano - South Tyrol. It can be assumed that most of the quarries in these zones are active.	New provincial plan for mineral extraction sites (or quarry plan) is currently in elaboration.	No further quarriers appear in the EIA list. However, potential expansions of existing caves with gravel production on the following corridors could threaten wildlife passages: Corridor 5: Naz-Sciaves – Rio di Pusteria. Corridor 6 Perca – Rasun – Anterselva. Corridor 10 - Sluderno – Prato. Corridor 8 – In the section Monguelfo – Villabassa: On the southern side of the Rienz river, near the Biotope Rienzaue-Niederdorf, the expansion of a gravel production site has taken significant dimensions, impairing areas for possible crossings for wildlife. At the moment some of the caves are surrounded by landscape protected areas.

Type of infrastructure/ Land use	Existing (pressures)	expected (threats)	Description
Agricultural	The whole Adige Valley, as well as the middle and lower Venosta Valley	Extension of intensive agriculture in the Upper Venosta Valley. New fences around agricultural fields.	Agricultural fields are largely established in the territory, if their expansion grows along with the fences around the fields, the barrier effect will be stronger

4.4 Planned projects required to conduct an EIA in the Autonomous Province of Bolzano - South Tyrol

The list of projects and plans subject to an Environmental Impact Assessment, screening, strategic environmental assessment, namely SEA procedure can be found on a dedicated page of the Autonomous Province of Bolzano – South Tyrol. The table below outlines only the ongoing projects and those currently published with the opportunity to make comments. To provide an overview of the projects that have impacted the Autonomous Province of Bolzano - South Tyrol, Annex 2 lists all the projects from the last five years that automatically required an EIA, which in total are 29.

Based on the two tables, we observed, that the main projects that may have an environmental impact on the territory, fall under the category of pressures listed during the workshop: **tourism in first place, followed by transport and extraction of resources.**

Being a province with a strong tourism vocation, in the tourism sector, new constructions, modifications, or expansions have mainly focused in mountain ski areas. Mostly the projects involve the construction or expansion of ski slopes, funicular and cable cars and new accommodation infrastructure.

In the transport sector, the projects are related to the enhancement of the railway well as improving the city's traffic flow.

Finally, the extractive sector has experienced an expansion of quarries in the area and the execution of some of the projects started in previous years.

Furthermore, it is useful to highlight that, according to D.lgs. No. 152/2006, Article 6, paragraph 7, an EIA is required for all the projects listed in annex II-bis and IV (projects under competence of province or regions) when new works or interventions, fall, even partially, within protected natural areas as defined by Law No. 394 of December 6, 1991, namely within Natura 2000 network sites.



Table 5: Projects currently under approval (2025)

Project	Sector	Type of approval
Project for the extension of the chairlift warehouse and increase of capacity to 2800 P/h at GRAN PARADISO in the Piz Sella ski area	Tourism	Screening for EIA
Forecast of a retail area in the 'La Villa 2' production zone - Municipality of Badia.	Commercial	Screening for SEA → The project is not subject to the SEA procedure
Renovation of the RUIS ski lift in the municipality of Marebbe	Tourism	Screening for EIA
Extension of the DREIZINNEN ski slope for safety reasons in the 3 Zinnen ski area	Tourism	Screening for EIA → The project is not subject to the EIA procedure



5 Unsuitable locations of potential major developments

5.1 General criteria for unsuitable locations

The PlanToConnect project proposes general criteria for unsuitable sites. They are compiled in the following table, and are based on the corresponding chapters of the [report D1.3.1](#).

Table 5: General criteria for unsuitable sites (D1.3.1)

	Unsuitable locations
Hydropower	- protected areas (e.g. Natura 2000 areas, nature reserves, ...) - natural or semi-natural rivers
Windpower	- protected areas (e.g. Natura 2000 areas, nature reserves, core areas of national parks and biosphere reserves, protected archaeological sites) - in residential areas - European bird protection areas with occurrences of wind energy-sensitive bird species, breeding areas of important birds of prey. - designated bird migration routes - density centres of collision-sensitive bird species - old natural or semi-natural forests - forested ridgelines because of high collision rates of birds and bats - areas with high perceived scenic quality (landscape quality) - water bodies (Georgiadis, 2024) - road and railway network, airports and settlement areas (Georgiadis, 2024) - for mountainous areas: Areas with elevated slope (Georgiadis, 2024) - areas with High Nature Value (e.g. HNV Farmland) (Georgiadis, 2024)
Solar power fields	- protected areas (i.e. Nature 2000 areas, nature parks, water protection areas, protected biotopes, natural monuments, extended natural monuments, UNESCO sites). - Protected areas by the landscape plans (respect zones, landscape protected areas, protected landscape elements). - riparian buffer zones, floodplains (at least risk zones of the H4 level) - natural watercourses and lakes (natural and artificial), including the respective buffer zones of 150 m and 300 m (Landscape Code) - soil with very high significance for natural soil functions - areas of high nature conservation value - agricultural soil with high degree of productivity - Rural road network, roads close to alpine pastures

	Unsuitable locations
Biomass (bioenergy plant)	- protected areas (e.g. Nature 2000 areas, nature reserves, core areas of biosphere reserves, water protection areas) - areas of high nature conservation value
High voltage transmission line	- European bird protection areas (Important Bird Areas (IBAs) or Special Protection Areas (SPAs)) - wetlands of international importance according to the Ramsar Convention - designated bird migration routes - near large bodies of water and reservoirs - protected areas specifically for landscape (UNESCO World Heritage Sites, Landscape conservation areas, priority areas for tourism) - other protected areas (e.g. Natura 2000 areas, nature reserves, core areas of national parks and biosphere reserves) - old natural or semi-natural forests - water protection areas of zones I and II (no construction of transmission poles in waterways or banks of waterways)
Roads/ highways	- protected areas (e.g. Nature 2000 areas, nature reserves, core zones of national parks and biosphere reserves, water protection areas) - areas of high nature conservation value like old-growth forests or wet- and peatland - soil with very high significance for natural soil functions
Railways	- protected areas (e.g. Nature 2000 areas, nature reserves, core zones of national parks and biosphere reserves, water protection areas) - areas of high nature conservation value like old-growth forests or wet- and peatland
Cable cars	- European bird protection areas (Important Bird Areas (IBAs) or Special Protection Areas (SPAs)) - areas of high nature conservation value
Urban /industrial development	- protected areas (e.g. Nature 2000 areas, nature reserves, core zones of national parks and biosphere reserves, water protection areas) - areas of high nature conservation value like old-growth forests or wet- and peatland - existing ecological corridors, especially in bottleneck areas
Mineral extraction	- Protected areas (e.g. Natura 2000 areas, nature reserves, core zones of national parks and biosphere reserves, water protected area) - Existing ecological corridors - Near water bodies and lakes



5.2 Development of specific criteria for unsuitable locations in the pilot region (exclusion zones)

Exclusion zones in this context are areas where certain infrastructures are not allowed to be built or operated. Exclusion zones are the most common planning instrument to mitigate environmental impacts of human land-use, including the deployment of renewable energies.

As can be seen from the table above, the unsuitable locations are often identical. They include mainly protected areas of various types: e.g. Natura 2000 areas, nature reserves, core zones of national parks and biosphere reserves, water protection areas or the developed GBI network for connectivity (including priority areas for conservation and restoration). For the definition of exclusion zones, however, it is not sufficient to use only the boundaries of ecologically valuable areas. Many infrastructure projects have far-reaching effects (for example wind turbines or roads), so that positioning them directly next to an ecologically valuable area can affect the area in a negative way. As described in report D1.3.1, edge effects and barrier or fragmentation effects influence not only the habitats adjacent to an infrastructure, but also the ecosystems and living conditions of wildlife in wider areas (see [report D1.3.1](#)). An additional question is what distances must be kept ensuring that an ecologically valuable area is not adversely affected by a certain infrastructure. This distance depends on the type of area and species occurring in the area as well as the type of infrastructure.

Two approaches can be considered to answer this question:

- compilation of existing standards or guidelines for determining unsuitable areas for a certain type of infrastructure and
- compilation of the maximum impact ranges of infrastructure projects used as a buffer around ecologically valuable areas.

With regard to the existing standards for South Tyrol, firstly we have adopted the relevant exclusion zones from the provincial spatial planning law. Secondly, we considered also other effective conservation measures (OECMs) like Hazard zones.

Relevant buffer distances in South Tyrol derive from the Italian Landscape Code, which is specifying distances to rivers and Lakes, thus we considered Lake protection areas that are specifying buffer zones around lakes and 150m distances to rivers of 1° and 2° class.

The 500m minimum distance of wind parks and biomass energy plants towards residential areas were neglected in the mapping analysis, because the aim was to identify common exclusion zones for a wider range of infrastructures (see Table 6).



5.2.1 Regulations regarding renewable energies

At a state level the latest law on renewable energy is the Ministerial Decree 21/06/2024 published in the Official Gazette No. 153 on July 24 contains the regulations for the identification of suitable surfaces and areas for the installation of renewable energy plants (Hereinafter called “Decree Suitable Areas”). It is in implementation of the article 20, paragraph 1-2 of the Legislative Decree n. 199 on 8 November 2021, which provides the identification of suitable areas and surfaces for the installation of renewable infrastructure. Within the Decree Suitable Areas, several laws are highlighted to define suitable or unsuitable areas.

Article 1 underline that it's mandatory to all the regions to reach the national target of 80 GW by 2030. To achieve this, every region will specify four different typologies of area:

- A. **suitable surfaces and areas:** The areas in which an accelerated and facilitated process is provided for the construction and operation of renewable energy plants and related infrastructure
- B. **unsuitable surfaces and areas:** areas and sites whose characteristics are incompatible with the installation of specific types of facilities
- C. **ordinary surfaces and areas:** are the surfaces and areas other than those referred to in (a) and (b) and for which the ordinary authorization regimes set forth in Legislative Decree No. 28 of 2011, as amended.
- D. **areas** where the installation of **photovoltaic systems** with **ground-mounted** modules is prohibited: agricultural areas where the installation of photovoltaic systems with ground-mounted modules is forbidden pursuant to Article 20, paragraph 1-bis, of Legislative Decree No. 199 of November 8, 2021.

Letter B follows the indication established by paragraph 17 and Annex 3 of the guidelines for the “Authorisation of installations powered by renewable energy” issued by the decree of the Ministry of Economic Development of 10 September 2010. The mentioned paragraph, entitled “Criteria for the individuation of unsuitable areas” under letter F lists the areas and sites not allowed for installation:

- i. sites included in the UNESCO World Heritage list, areas, and assets of significant cultural interest as per Part Two of Legislative Decree No. 42 of 2004, as well as properties and areas declared of significant public interest pursuant to Article 136 of the same legislative decree;
- ii. areas within visual cones whose image is historically recognized and identifies the locations also in terms of international notoriety and tourist appeal;
- iii. areas located near archaeological parks and in adjacent areas to sites of particular cultural, historical, and/or religious interest;
- iv. protected natural areas at various levels (national, regional, local) established under Law No. 394/1991 and listed in the Official Register of Protected Natural Areas, with particular reference to integral reserve areas and general oriented reserve areas as per Article 12, paragraph 2, letters a) and b) of Law No. 394/1991 and equivalent areas at the regional level;
- v. wetlands of international importance designated under the Ramsar Convention;

- vi. areas included in the Natura 2000 Network designated under Directive 92/43/EEC (Sites of Community Importance) and Directive 79/409/EEC (Special Protection Areas);
- vii. Important Bird Areas (I.B.A.);
- viii. areas not included in the aforementioned categories but which play a crucial role in biodiversity conservation (buffer zones or contiguous areas of protected natural areas); newly proposed protected natural areas subject to Government proposal or regional legislative bill approved by the Regional Council; **ecological-functional connection** and continuity areas between various natural and semi-natural systems; breeding, feeding, and transit areas of protected wildlife species; areas where the presence of animal and plant species protected by international conventions (Bern, Bonn, Paris, Washington, Barcelona) and EU Directives (79/409/EEC and 92/43/EEC), rare, endemic, vulnerable, or endangered species has been confirmed;
- ix. agricultural areas involved in high-quality agricultural-food production (organic products, D.O.P., I.G.P., S.T.G., D.O.C., D.O.C.G., traditional products) and/or of particular value in relation to the landscape-cultural context, in line with and for the purposes of Article 12, paragraph 7, of Legislative Decree No. 387 of 2003, including areas, if provided by regional planning, characterized by high land use capability;
- x. areas affected by hydrogeological instability and/or risk as outlined in the Hydrogeological Structure Plans (P.A.I.) adopted by the competent Basin Authorities pursuant to Decree-Law No. 180/1998 and subsequent amendments;
- xi. areas identified under Article 142 of Legislative Decree No. 42 of 2004 by assessing the presence of particular characteristics that render them incompatible with the construction of plants.

In addition to the above-mentioned categories, paragraph 3 of Article 7 of the above-mentioned decree (d.mn. 21/06/2024) stipulates that "Surfaces and areas that are within the perimeter of properties protected under Article 10 "Cultural heritage" and Article 136 "Buildings and areas of significant public interest", paragraph 1, letters a) and b) of Legislative Decree No. 42 of January 22, 2004 (Code of cultural heritage and landscape), **are considered unsuitable**. Regions can designate additional unsuitable areas, which are mentioned in other parts of the Landscape Code (Legislative Decree No. 42 of January 22, 2004). Furthermore, the law introduces a new element: Regions may establish a buffer zone around the perimeter of protected properties (heritage sites), with a varying width depending on the type of facility, proportional to the protected asset, up to a maximum of 7 kilometers".

It's important to underline that the legislation requires the maximisation of the areas to be identified in order to achieve the national objective. However, this must take into account the need to protect the cultural heritage and landscape, which will have a buffer zone of a maximum of 7 km from the perimeter. The distance depends on the type of source, size and type of plant.

The Autonomous Province of Bolzano - South Tyrol passed a law related to this topic: "Use of renewable energy sources" on 8 April 2020 n. 13. Unfortunately, until now, there is no information about the transposition of the D.m 2024 n. 153 regarding the suitable or

unsuitable areas. The elements of the national legislation defined above are applied to the South Tyrol area, but the Autonomous Province of Bolzano – South Tyrol may define other provisions. As an example, with regard to agri-voltaics, the Autonomous Province of Bolzano – South Tyrol has made its agricultural areas available as pilot areas to evaluate its future application.

The table below shows the unsuitable places that are specific to the Autonomous Province of Bolzano - South Tyrol, as defined by the law (DPP. n.13/2020). In some cases, unsuitable locations and buffer aren't specified.

Table 6: Compilation of unsuitable locations and their corresponding buffers in the pilot region South Tyrol

	Relevant dimension	Unsuitable location	Buffer (m)	Reference or notes
Hydro-power	Hydropower plants with an average nominal capacity of up to 3,0 MW may be authorised irrespective of the land use	Unspecified		Decree of the President of the Province, April 8, 2020, No. 13 "Use of Energy from Renewable Sources"
Wind-power	Unspecified	Windpower infrastructure is not allowed in the following areas: a) Natural parks, Natura 2000 sites, biotopes, areas classified as natural monuments, in the National Park, in the Dolomites - UNESCO World Heritage Site, in landscape protection zones, and in landscape conservation areas; b) In all areas where the average annual wind speed, measured at the hub height or at the average height of the rotor of the planned wind power plant, is less than 6 m/s; c) In all areas above 2,600 meters above sea level; To meet the needs of mountain and alpine refuge not connected to the electricity grid, it is also permitted in the areas defined above (a,b)	D) <u>500 m distance</u> from residential building and accommodation facilities	Decree of the President of the Province, April 8, 2020, No. 13 "Use of Energy from Renewable Sources". In addition, the decree mentions "The construction of wind power plants can be authorized without power limits and regardless of the area's intended use".

	Relevant dimension	Unsuitable location	Buffer (m)	Reference or notes
Solar-power	Except projects subject to the assessments and authorisations required for the intervention, photovoltaic panels and solar collectors may only be installed on buildings	By 2025, the identification of special use zones for the installation of photovoltaic systems is prohibited in South Tyrol. In any case, the installation of photovoltaic panels and solar collectors is not permitted within protected biotopes and extended natural monuments, as well as on all natural or artificial water bodies, regardless of their urban or landscape use. Along rural viability and road close to alpine pasture (Art. 4, DPP 18/2020)	No buffer distances are specified.	Decree of the President of the Province, April 8, 2020, No. 13 "Use of Energy from Renewable Sources
Biomass (bio-energy plant)		In green agricultural area are authorised plants with a nominal heat output of less than 1 MW: Biomass cogeneration plants: capacity > 0.30 MW permitted only if ≥ 60% of primary energy is used as heat and electricity. Exception for biogas plants from anaerobic digestion. Geothermal plants may be authorised without a power limit and regardless of the use of the area, subject to the rules on the use of water	In green agricultural area with a <u>buffer of 500m</u> from residential building and leisure and sport facilities	Decree of the President of the Province, April 8, 2020, No. 13 "Use of Energy from Renewable Sources



5.2.2 Exclusion zones in South Tyrol, considering provincial regulations:

In the following, protected areas are listed with a descending protection status.⁶

Protected areas by the nature protection law (Provincial law of 12 May 2010, No. 6)

- Biotopes
- National and Nature Parks
- Natura 2000 areas

UNESCO sites – natural world heritage

UNESCO world heritage sites are almost completely covered by nature parks in South Tyrol. Therefore, they are not shown in the map.

Protected areas by the Landscape Plans: (Provincial Law for Territory and Landscape 2018, No. 9)

- Protected Landscape Elements:

Protected landscape elements are parts of the landscape that contribute to biodiversity and landscape diversity as well as to ecological stability or permeability in the biotope network (Art. 11, §1, lit. d). The protection status is very high, because the included dry grasslands, wetlands and chestnut fields are also protected by the nature protection law. They consist of areal landscape elements like wetlands, riparian forests, as well as linear natural landscape elements like shrubs and groups of trees. The sub-category of the archaeological protected areas can rather be considered as an Other Effective Conservation Measure (OECM) because they protect mainly cultural sites. However, they often protect also historical sites, which are currently not in use anymore and are overgrown by forests or other vegetation.

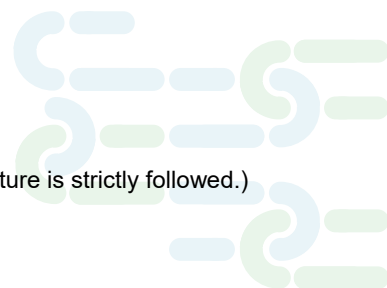
- Landscape protected areas:

Landscape protection areas, i.e. areas that have been partly shaped by man, are protected because of their scenic beauty and character, their natural features or their importance for the typical local settlement structure and agriculture and because of their particular suitability for recreation or suitability for protecting the surroundings of other landscape assets in order to preserve their function (Art. 11, §1, lit. g)

- Respect zones:

Landscape respect zones are landscape areas that are to be kept free of development in order to preserve the land for agricultural use and to avoid urban sprawl (Art. 11, §1, lit. h).

⁶ (An exception is made for Hazard zones - category H4, where avoidance of additional infrastructure is strictly followed.)



- Landscape protection authorisation:

Special authorisation from the provincial offices needs to be obtained for interventions (Art. 69).

Forested areas

The Cultural Heritage and Landscape Code of Italy was integrated into the provincial spatial planning law 9/2018. Under Article 12 (protected landscapes) Lit. f) it is defined that the forest and wooded areas, even if they are destroyed or damaged by fire, and those areas subject to afforestation, are protected in any case.

Riverbanks and buffer strip of 150m:

The Galasso Law of 1985 was integrated in the Cultural Heritage and Landscape Code. Art. 142, §1 defines protected areas by law. Lit. (c) defines the following: *“rivers, streams, watercourses registered in the lists provided for in the consolidated text of the legal provisions on water and electrical installations, approved by Royal Decree No 1775 of 11 December 1933, and their banks or the foot of their banks for a strip of 150 metres each”*.⁷

This legislation is integrated by the provincial spatial planning law 9/2018.

A database of watercourses of landscape importance registered in the lists provided for by Royal Decree No. 1775/1933, like the one of the Regione Emilia-Romagna (2025) is not findable for the Autonomous Province of Bolzano - South Tyrol. Therefore, it was assumed that at least the main rivers are of landscape importance. All rivers of hierarchy “1” and “2” were taken from the Catalogue of geographic data and a buffer strip of 150m each side was applied. An authorisation from the provincial offices is needed for interventions.

Other Effective Area-Based Conservation Measures - OECMs

⁷ The Landscape Protection Act of 1970 adopted the Galasso Law and the Landscape Guidelines (2003) state that the principles of the Galasso Law must also be taken into account by the Autonomous Province of Bolzano - South Tyrol in accordance with the Constitutional Court Decision of July 26, 1986, No. 151.

The Law on Space and Landscape of 9/2018 repeals the Landscape Protection Act, but integrated the Landscape Code directly to the law.

The Decree of the Provincial Governor of June 26, 2020, no. 241) (Ordinance on Construction) states the following for implementation: Article 4, § (1): For [...] the categories of dedication of natural and agricultural areas referred to in Article 13(2) of the Act, to the extent compatible with the landscape protections approved on the basis of the Provincial Act of July 25, 1970, No. 16, as amended, until the landscape planning instruments and park plans are adapted to the provisions of the Act, the implementing provisions of the land-use plans corresponding to the categories of dedication in force on June 30, 2020 shall continue to apply.

OECMs is a geographically defined area other than a protected area, which is governed and managed in ways that achieve positive and sustained long-term outcomes for the in situ conservation of biodiversity with associated ecosystem functions and services and, where applicable, cultural, spiritual, socio-economic and other locally relevant values are also conserved (IUCN WCPA, 2019 in Hilty et al., 2020).

- Hazard zones (hydrogeological areas) with strict protection status

Category H4 of the hazard zoning plans are indicating “Very high danger”. The regulations state that the designation for new constructions are not permitted: Demolition, maintenance and renovation of existing buildings are permitted, but not extensions or new buildings. Measures to reduce the vulnerability of buildings and other structures are permitted. The designation of new construction zones is not permitted (DLH No. 23/ 2019, Art. 4). If there are no alternative solutions for the construction of essential public infrastructure, this is permitted following a compatibility check (Autonomous Province of Bolzano - South Tyrol 2025). The hazard zones of landslides, floodings, avalanches and geological risks (rockfalls) are considered.

In zones of categories H3-H1 the construction of new infrastructure is not completely excluded from infrastructural interventions, therefore it will not be considered as unsuitable location for the mapping analysis.

- Lake’s protection areas

*“In order to ensure the maintenance or restoration of the biotic and abiotic components in the waters, on the banks and in the strip immediately adjacent to the surface waters, which perform both filter functions for suspended solids and pollutants of diffuse origin and bank stabilisation and biodiversity conservation functions, the transformation and management interventions of the waters, banks, soil and topsoil envisaged in the **strip of at least ten metres** from the banks of the surface waters are regulated by implementing regulations.” (Art. 6, §3, of the provincial law of 17th of October 2019, No. 10)*

- Drinking water protected areas

Zone I - catchment area: It is the actual catchment area, ranging in size from 100 - 1000 m². It protects the drinking water catchment facilities and their immediate surroundings. Access is prohibited, which is why it must be fenced. Only activities associated with the collection of water are permitted. The surface must be designed in such a way that surface water can run off quickly, i.e. no puddles can form. The area must be greened, and the introduction of any fertilisers is prohibited.

Zone II - Inner protection zone: among other restrictions, a maximum permissible excavation depth may be prescribed, and the erection of buildings may only be

possible to a limited extent. (Provincial Agency for the Environment and Climate Protection, 2025)

- Protected archaeological areas:

These areas can have a wide extent, but the protection status is rather low because “interventions in the terrain on protected plots must be authorised” and are potentially possible. Therefore, it will not be considered in this analysis.

5.3 Mapping the land use conflicts

This chapter reveals the existing and potential corridors in South Tyrol which are at risk of additional anthropogenic pressures or barriers. It is qualitatively estimated which corridors are at risk of getting lost.

5.3.1 Corridors potentially in conflict with urban/industrial development, and installations for wind power, solar power, and biomass power plants

Since many infrastructures are not allowed in the named protected areas, the following maps are showing the elaborated network model for red deer, overlapped with the explained protection status. We selected in total 18 locations in South Tyrol which are important locations crossing the valley bottom. They include existing corridors with GBI elements, existing corridors with minor barriers, and existing problematic corridors, as well as potential corridors.



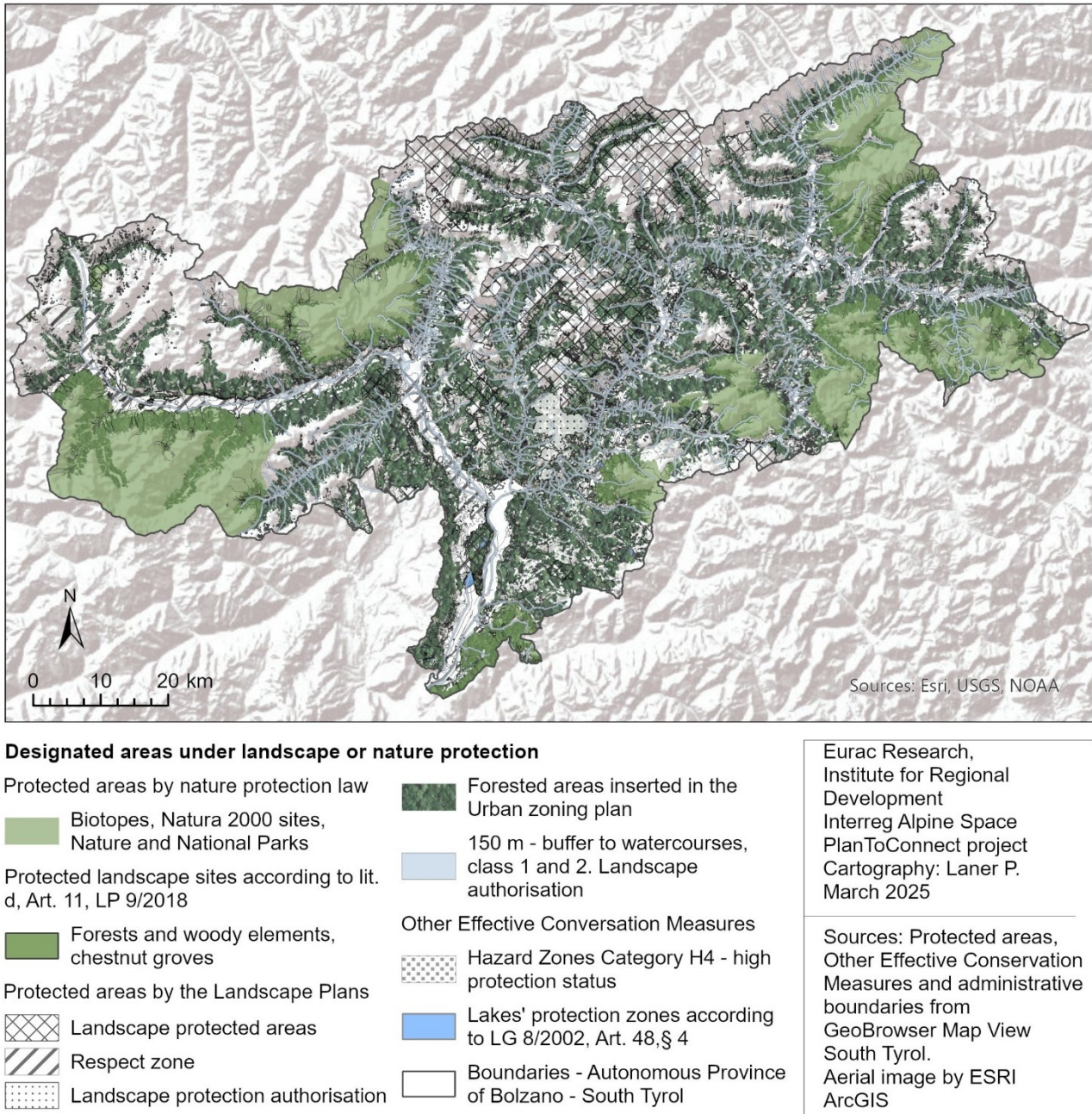


Figure 6: Designated areas under nature or landscape protection with descending protection status



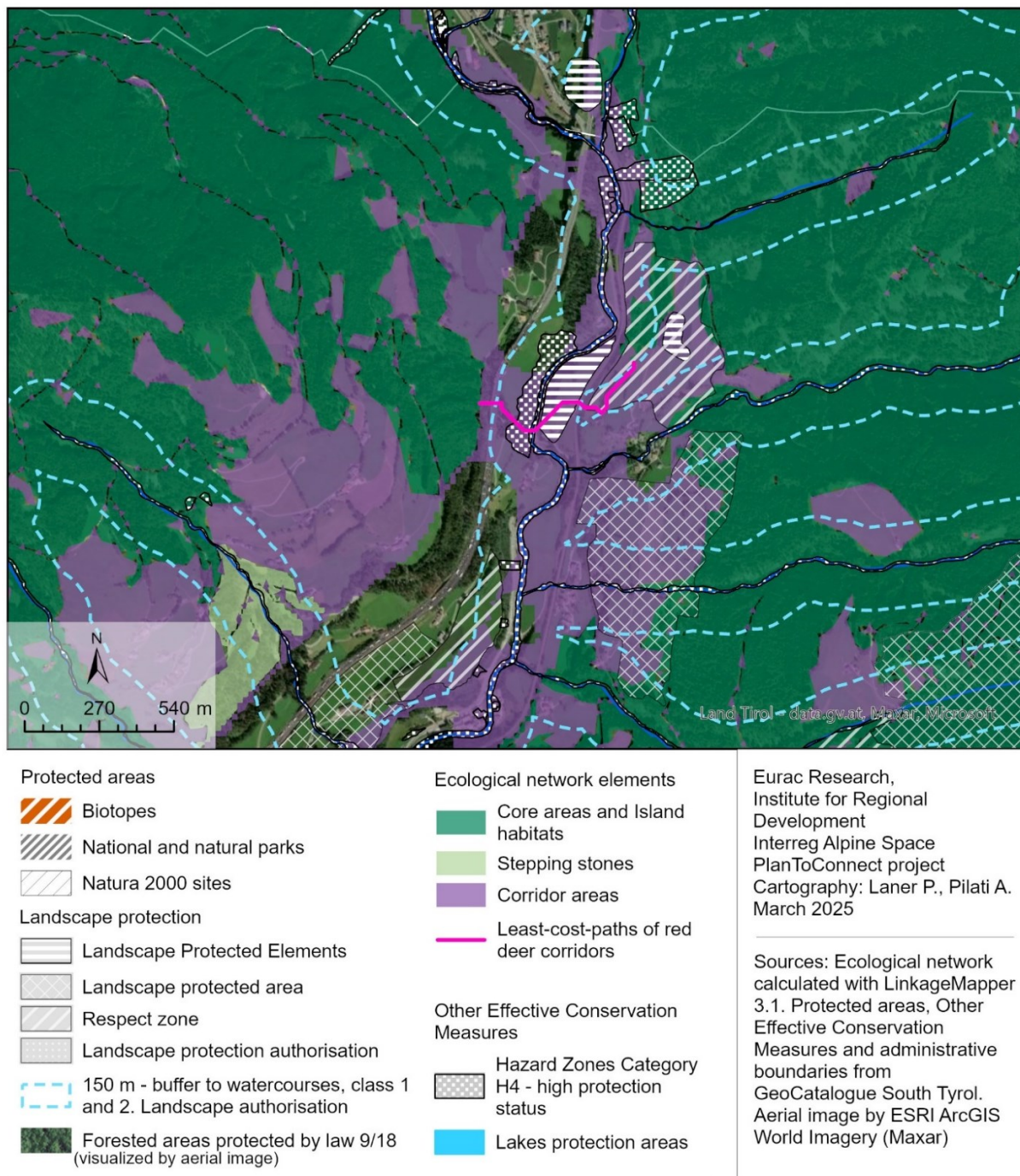


Figure 7: Protected areas on corridor 1 - North of Vipiteno / Sterzing

The corridor is protected by three landscape areas on the east side of the Eisack River. There is an archaeological site directly next to the river, which in this case is an Other effective Conservation Measure (OECM). Nearby is a respect zone and the south-east of the corridor is protected by a landscape protection area. Forested areas are part of the corridor. However, all these areas cannot protect the entire corridor.

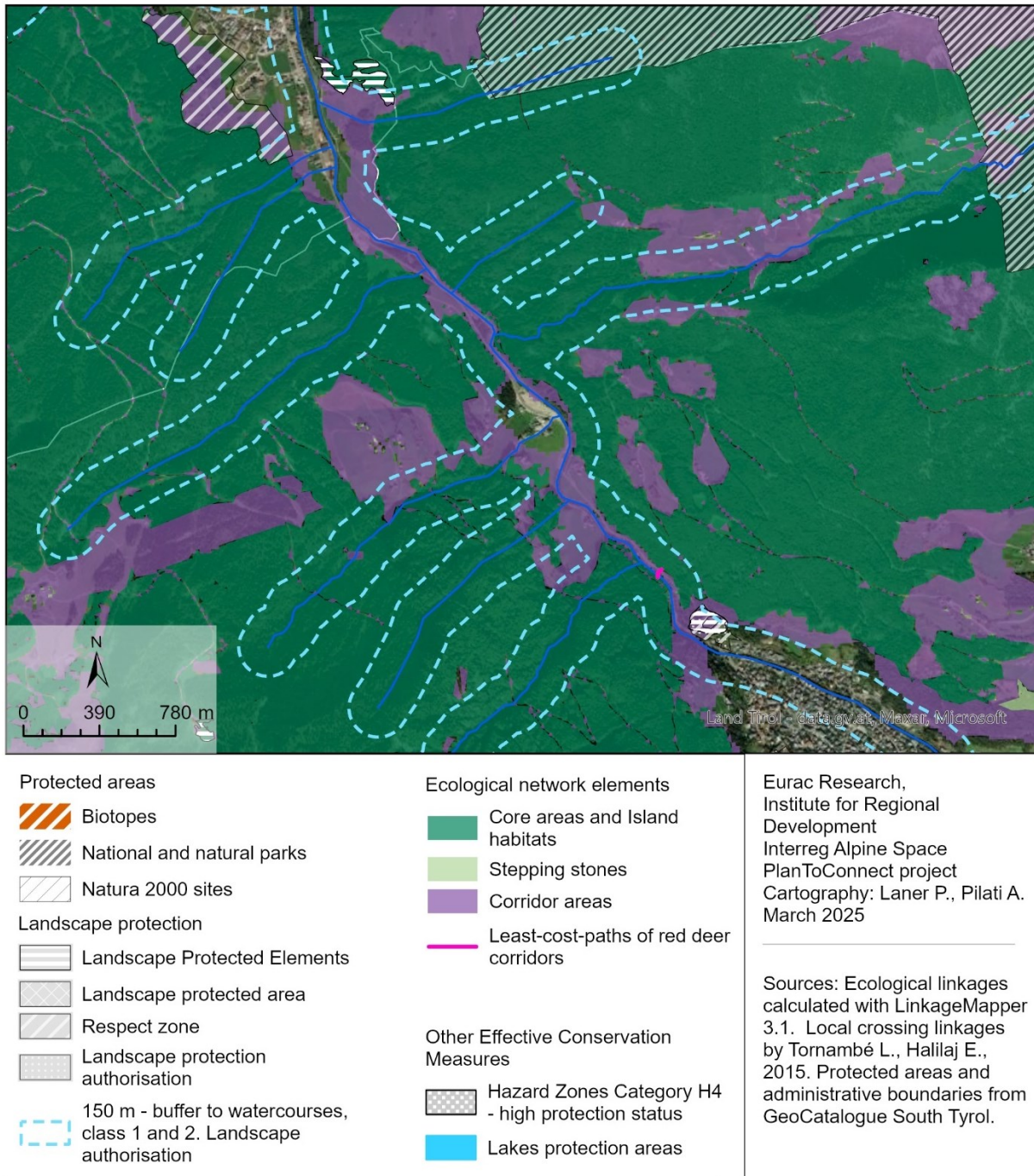


Figure 8: Corridor 2 – Campo Tures/ Sand in Taufers

The corridor is crossed by the Aurino stream, which has a 150 m buffer zone for protection. The Rieserferner-Ahrn Nature Park is located at the northeast slope of the mountain. However, parts of the corridor near Lutago/ Luttach are threatened by the expansion of settlements.

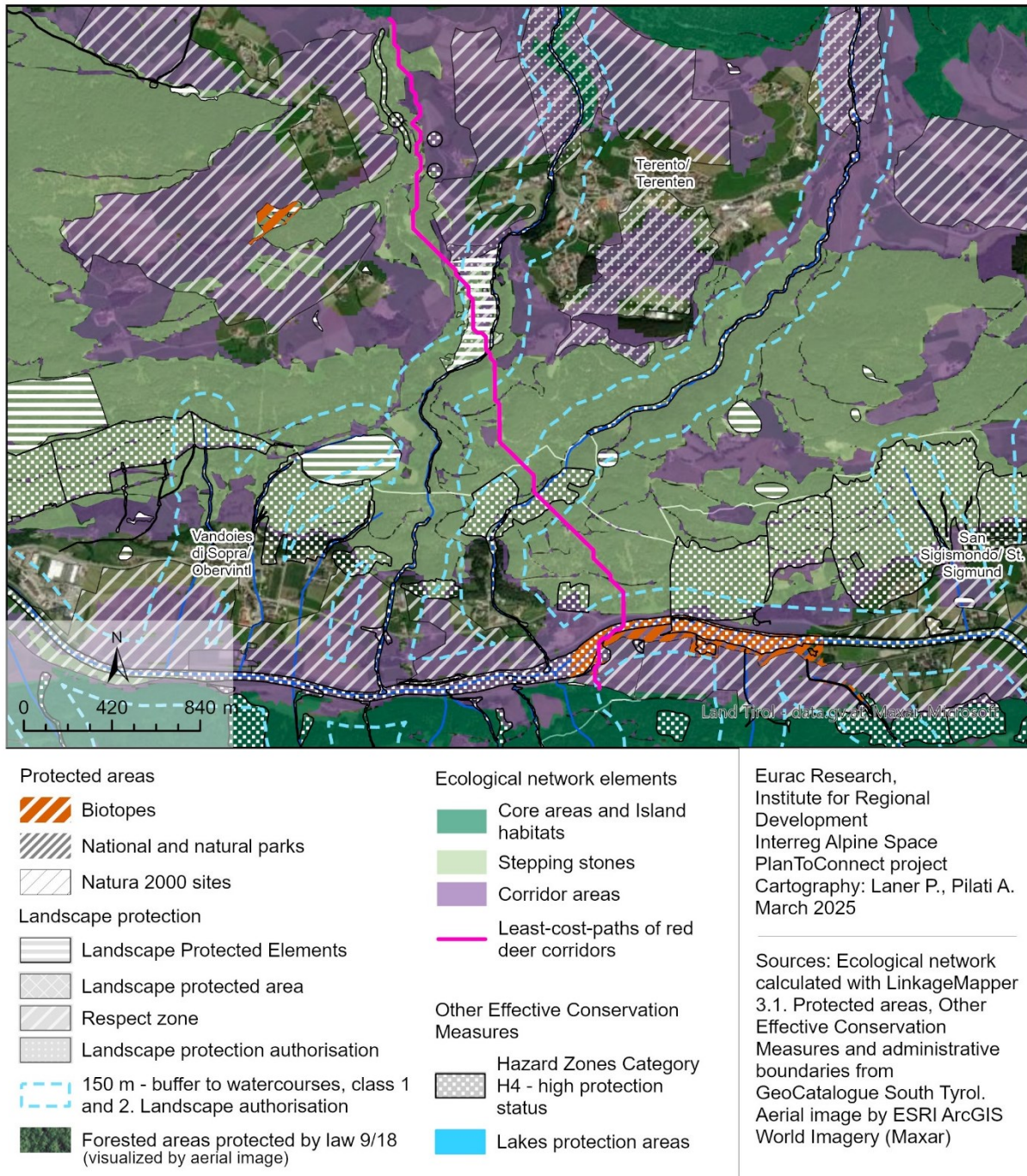


Figure 9: Corridor 3 - Lower Pusteria Valley

The corridor is widely protected, including different protected areas. It starts from the Ilsterner Au biotope, continues on forested areas along the protection buffer of Rienza and other rivers/streams, and ends on major forested areas in higher altitudes. It is surrounded by several Respect Zones.

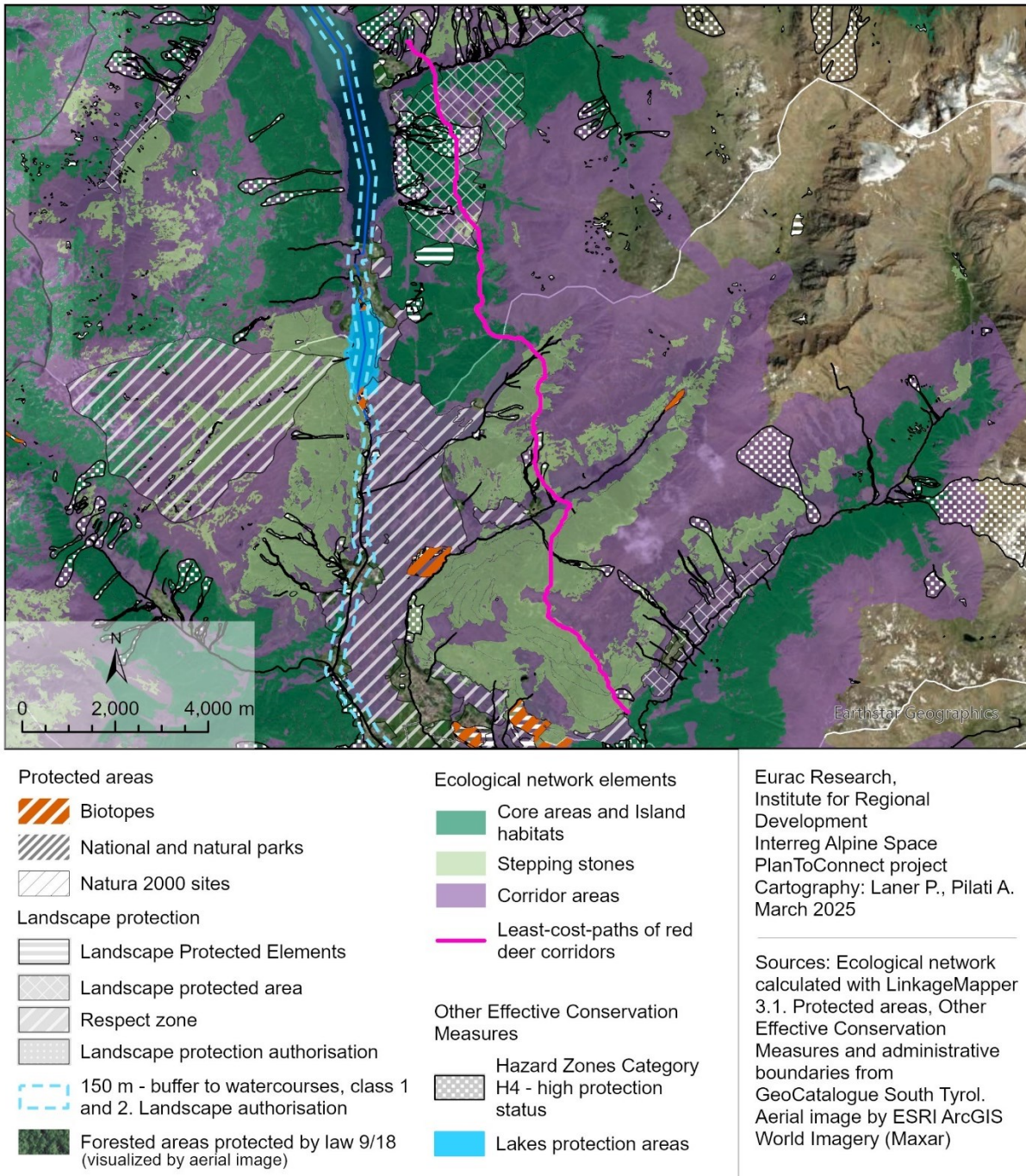


Figure 10: Corridor 4 – Upper Val Venosta

The main part of the corridor doesn't run directly through any special protected areas, only in the northern part there is a landscape protected area. However, it is widely covered by forests, which should be protected by the spatial planning law (9/18). The main obstacle is the road infrastructure passing through Curon Venosta or Vallelunga.

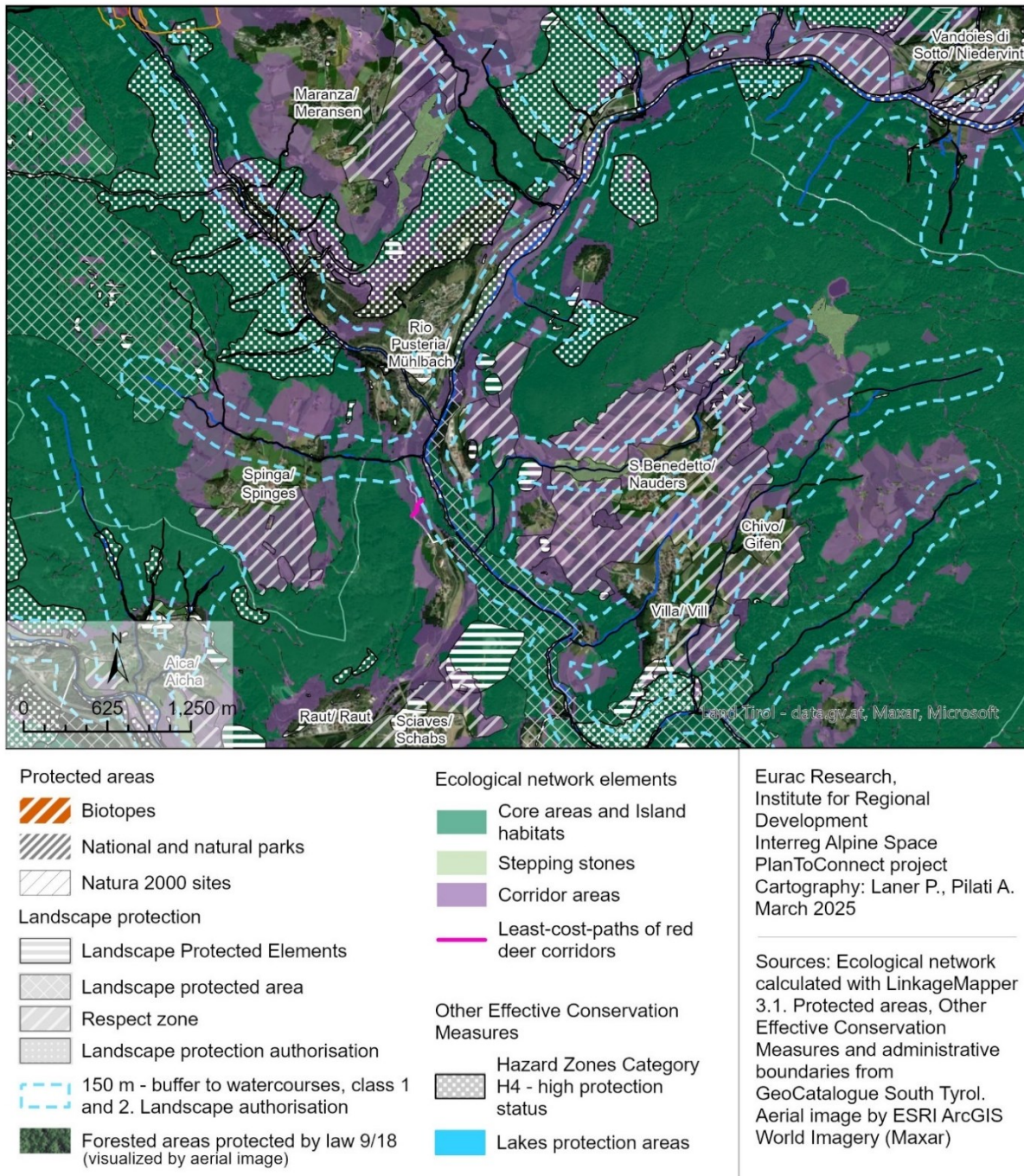


Figure 11: Corridor 5 - Naz-Sciaves – Rio di Pusteria

Although various areas are part of Respect Zones and Hazard Zones (H4), Landscape protected areas, as well as Landscape Protected Elements, the potential corridor is impaired by several anthropogenic infrastructure, especially for transport. Construction sites of the Brenner Base Tunnel BBT and the new railway link ("Riggertalschleife") are major threats.

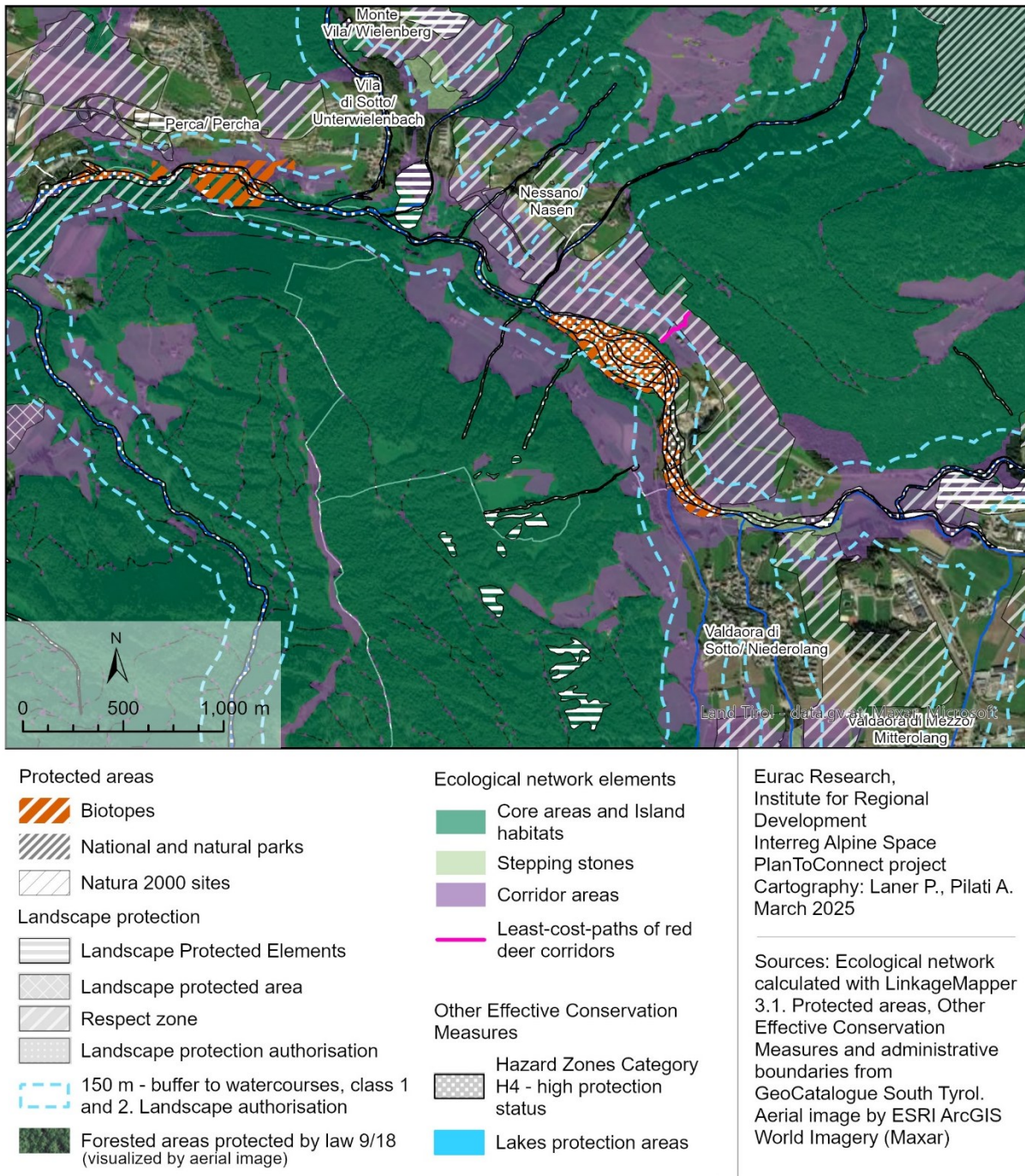


Figure 12: Corridor 6 - Perca – Rasun Anterselva / Percha – Rasen Antholz

The corridor is widely protected, and a low number of barriers is present. Between the two sides of the mountain, buffer zones of the Rienza river and its wetland biotope, as well as Natura 2000 sites are connecting elements in the valley bottom. However, it cannot fully protect the permeable area, which was modelled as red deer corridor.

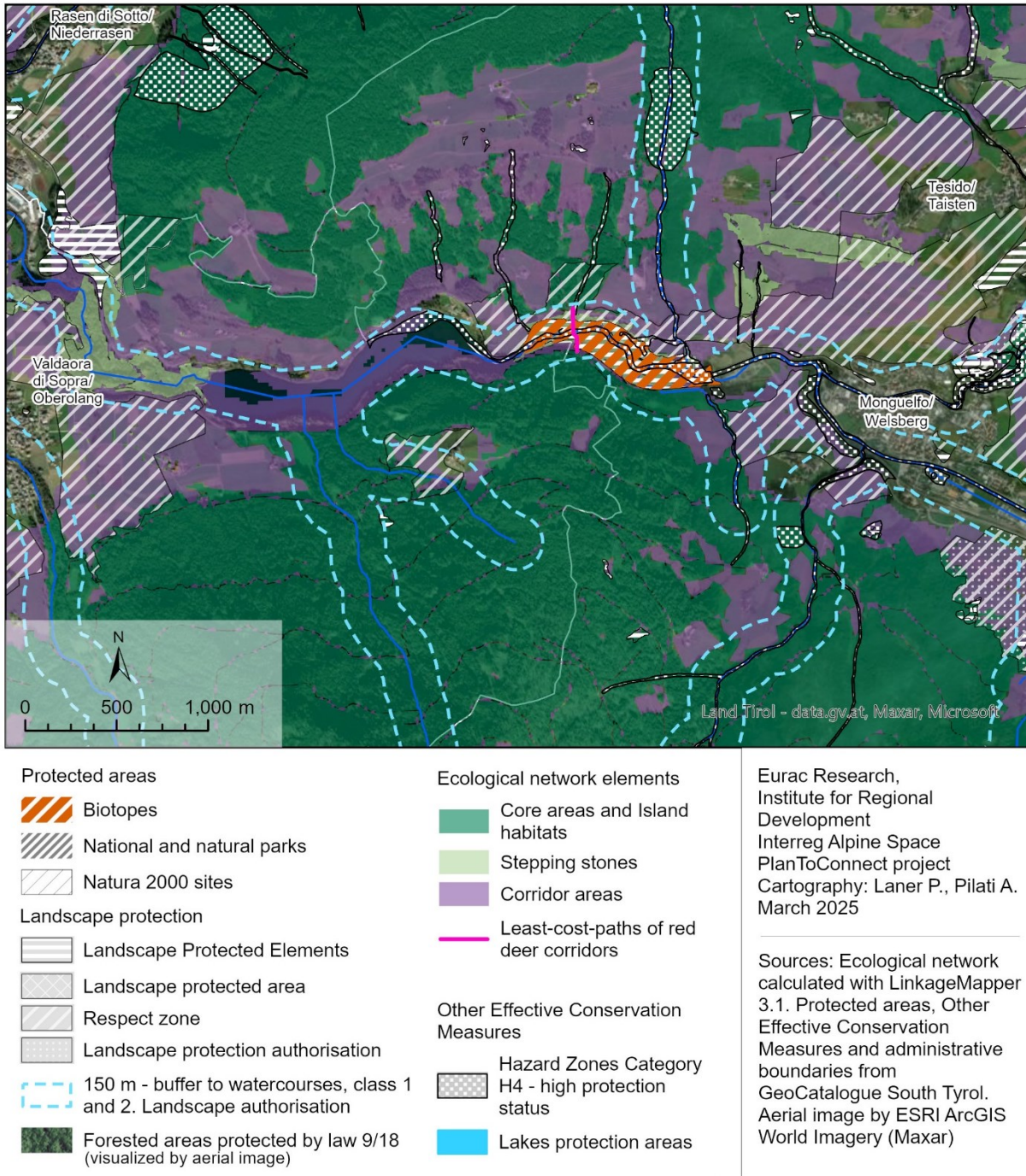


Figure 13: Corridor 7 - Braies - Vedrette di Ries/ Prags -Rieserferner

The nature park Rieserferner-Ahrn starts only 1,6 km from the valley bottom and protects the core areas at the northern mountain slope. The wetland biotopes Fuchsnau and Rienzau Percha are located at the southern side of the valley bottom. Wide areas of the corridor are designated as respect zone. Landscape protected elements in the area are mainly archeological sites.

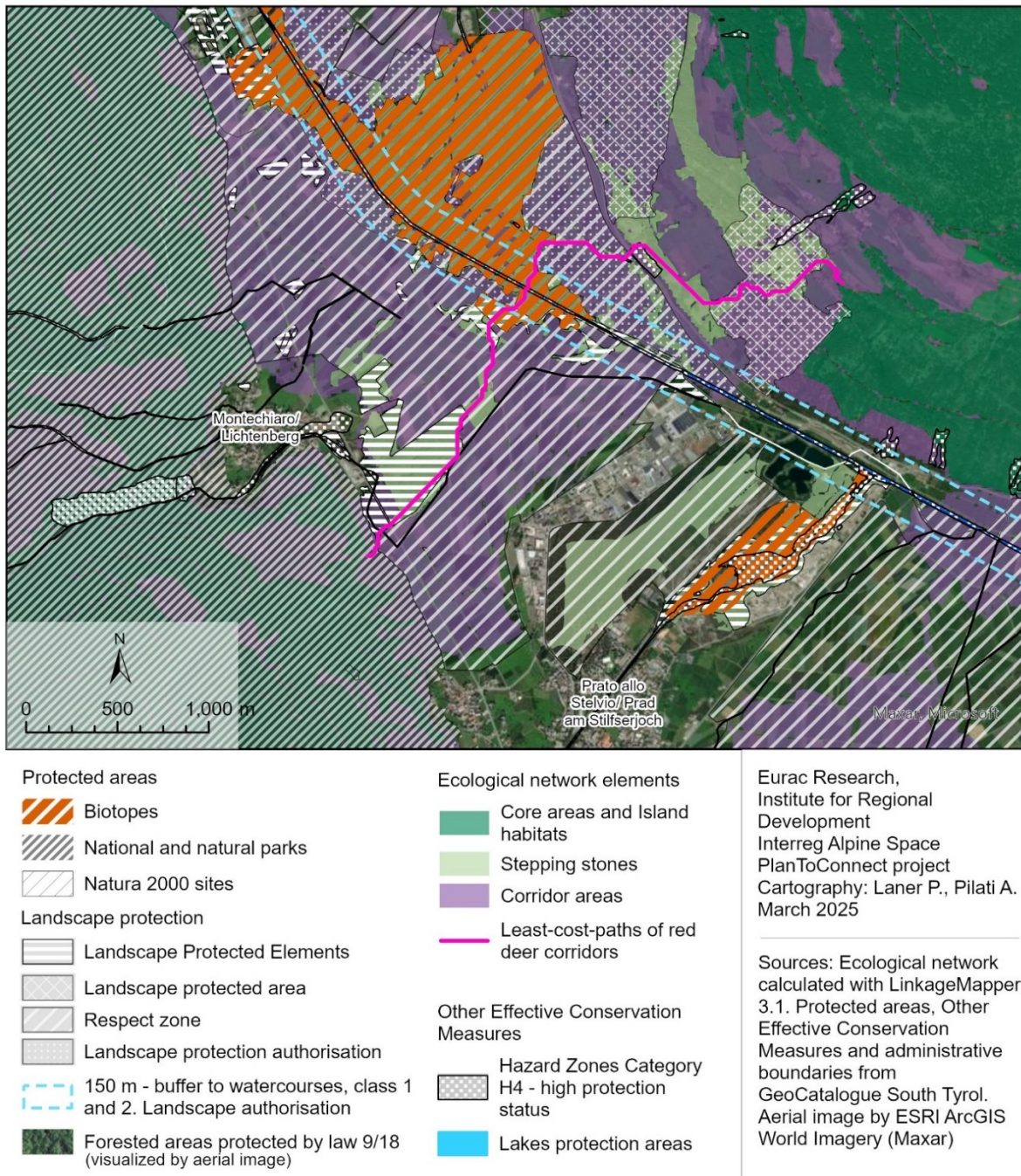


Figure 14: Corridor 10 - Sluderno – Prato/ Schluderns - Prad

The Stelvio National Park is present at the western mountain slope. The Biotope Ontaneto di Sluderno/ Schludernser Au in the Valley bottom is functioning as a connecting element in the Valley bottom. The Respect Zones between the Biotopes and the National Park are preventing further settlement expansions. The Landscape protected areas with special authorizations at the north-eastern side of the State Road SS40 protects stepping stones and connects the biotope in the valley bottom with the northern slope.

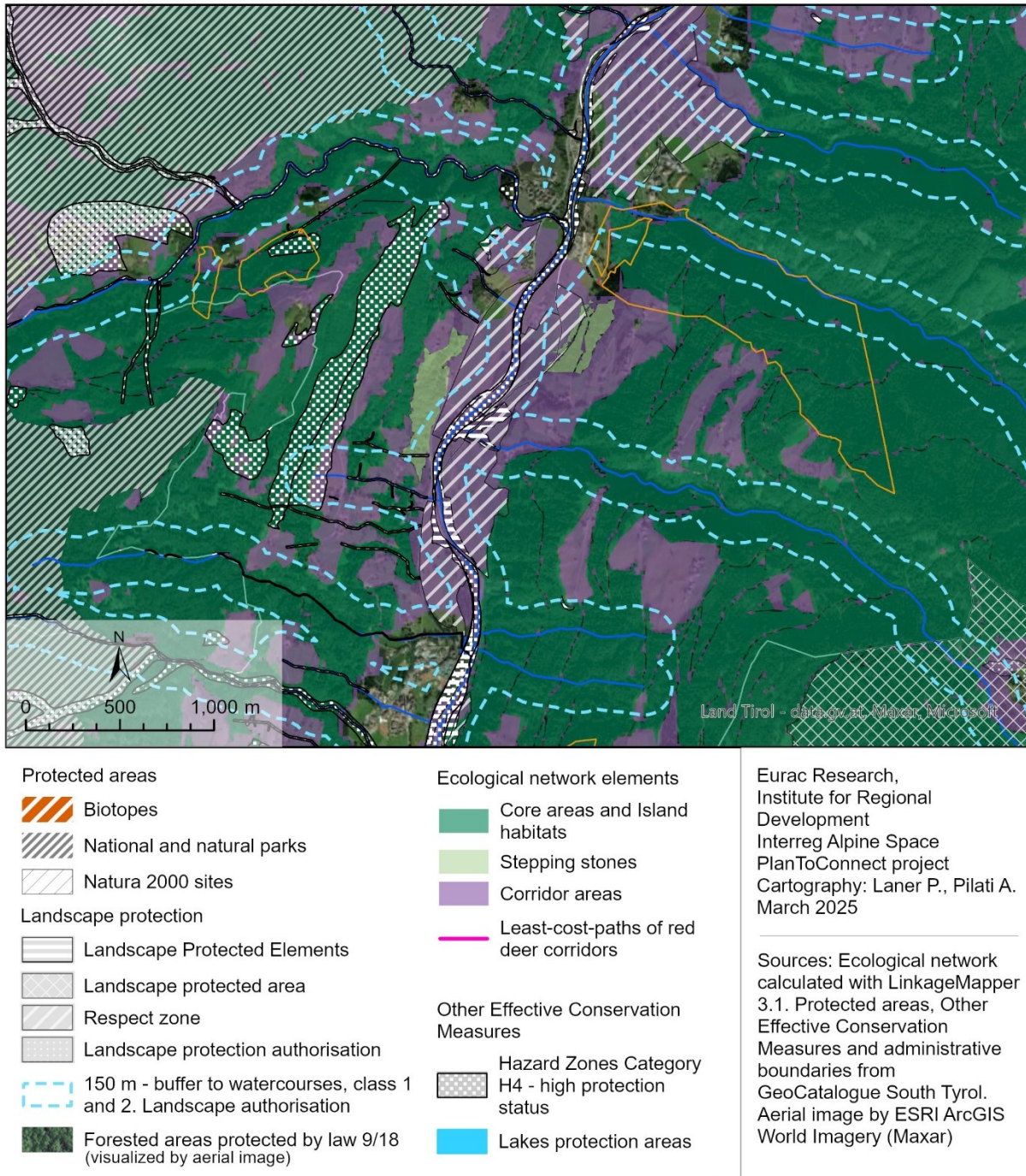


Figure 15: Corridor 12 – Passiria Valley

The valley bottom is widely protected by respect zones, and hazard zones of category H4. Landscape protected sites are present near the river. Large forest areas (that are protected by spatial planning law no 9/18) are covering both mountain slopes, which are reaching far down into the valley.

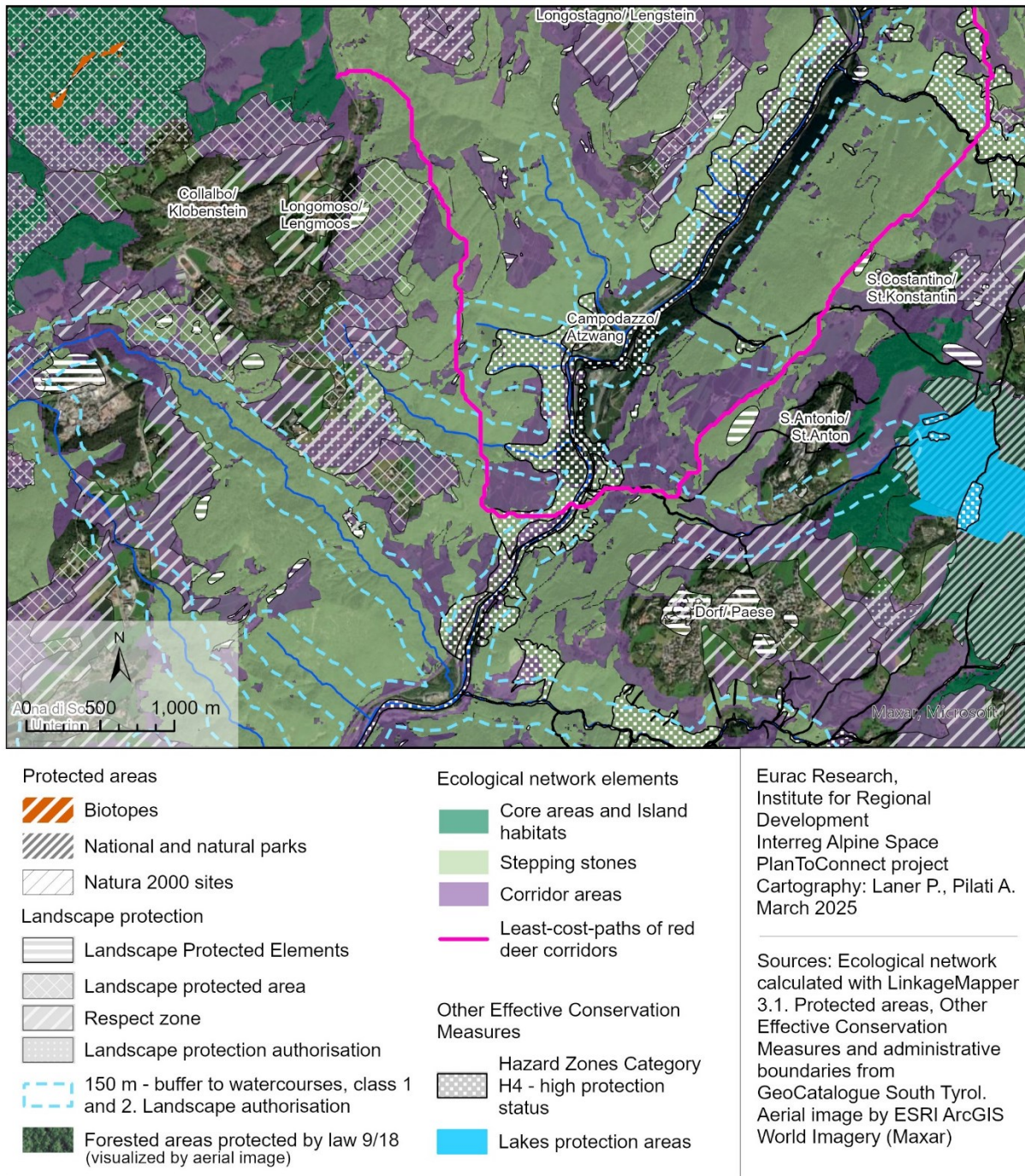


Figure 16: Corridor 14 - Renon – Castelfrotto – Laion/ Ritten – Kastelruth - Lajen

The corridor is widely covered by forest areas that are protected by spatial planning law no 9/18. H4 hazard zones in the valley bottom with large extensions represent other effective conservation measure, not directly linked to nature protection, but able to prevent further major infrastructure installations.

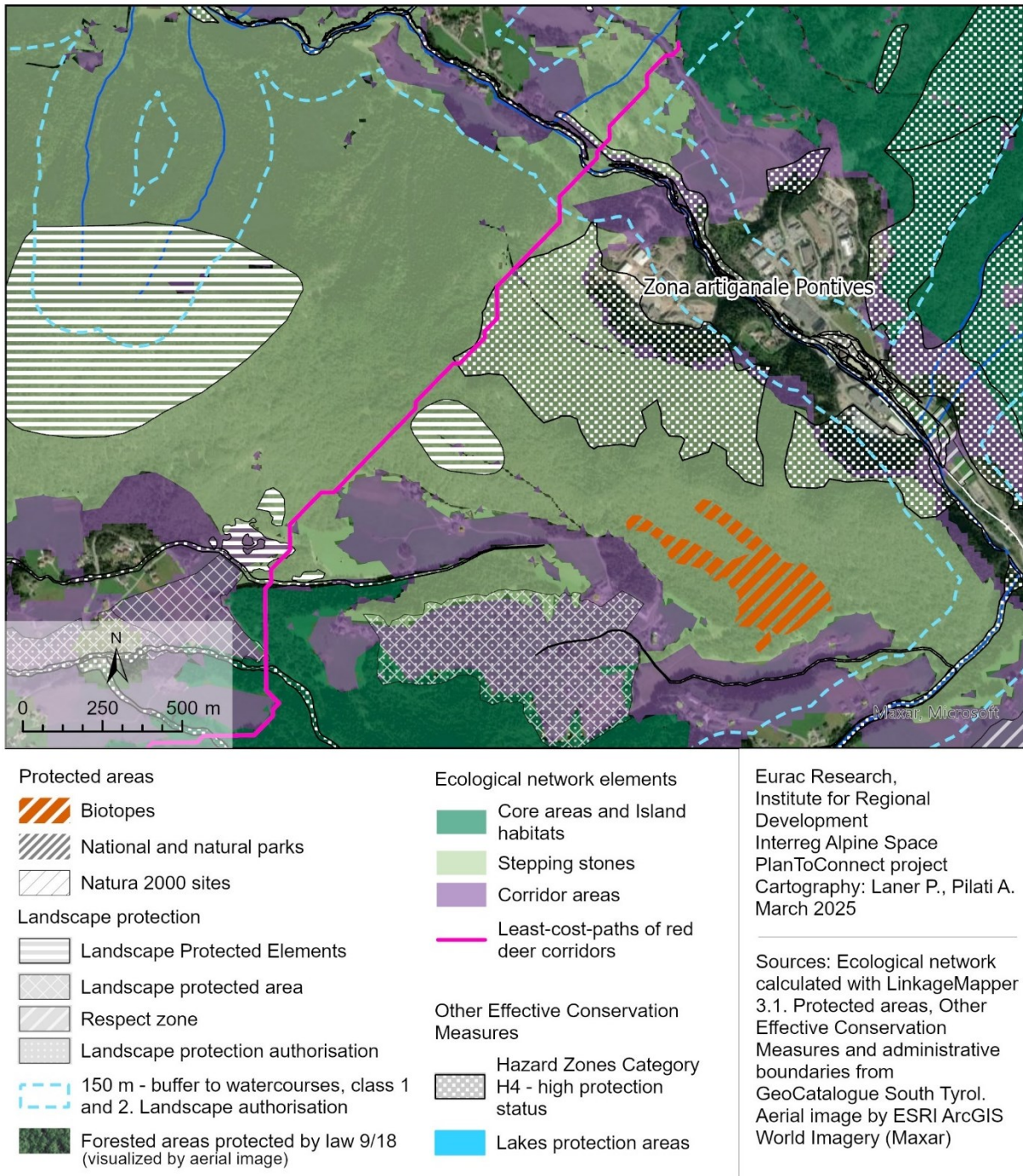


Figure 17: Corridor 15 – Sciliar – Laion / Schlern - Lajen

The corridor is widely covered by forest areas that are protected by spatial planning law no 9/18. However, large parts of the corridor are not protected by special designations, therefore the corridor is potentially at risk by infrastructure expansions. More specifically, the corridor is potentially at risk by expansions of the industrial zone “Pontives”.

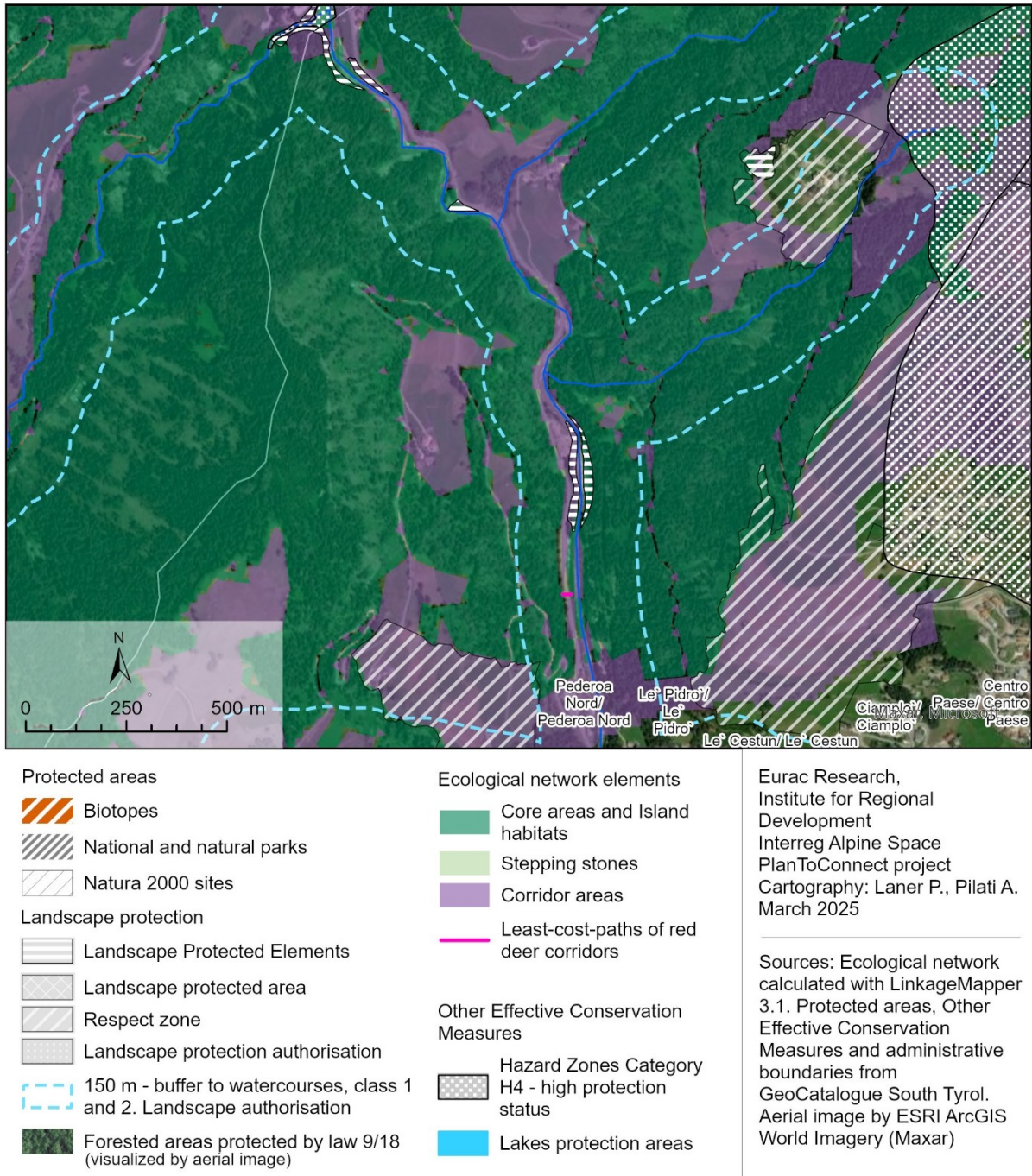


Figure 18: Corridor 16 - Pederoa

The corridor is widely covered by forest areas that are protected by spatial planning law no 9/18, which are covering both mountain slopes, reaching far down into the valley. However, the corridor is not widely protected with special designations. Only two smaller riparian forests near the river are designated as Landscape protected elements/ sites.

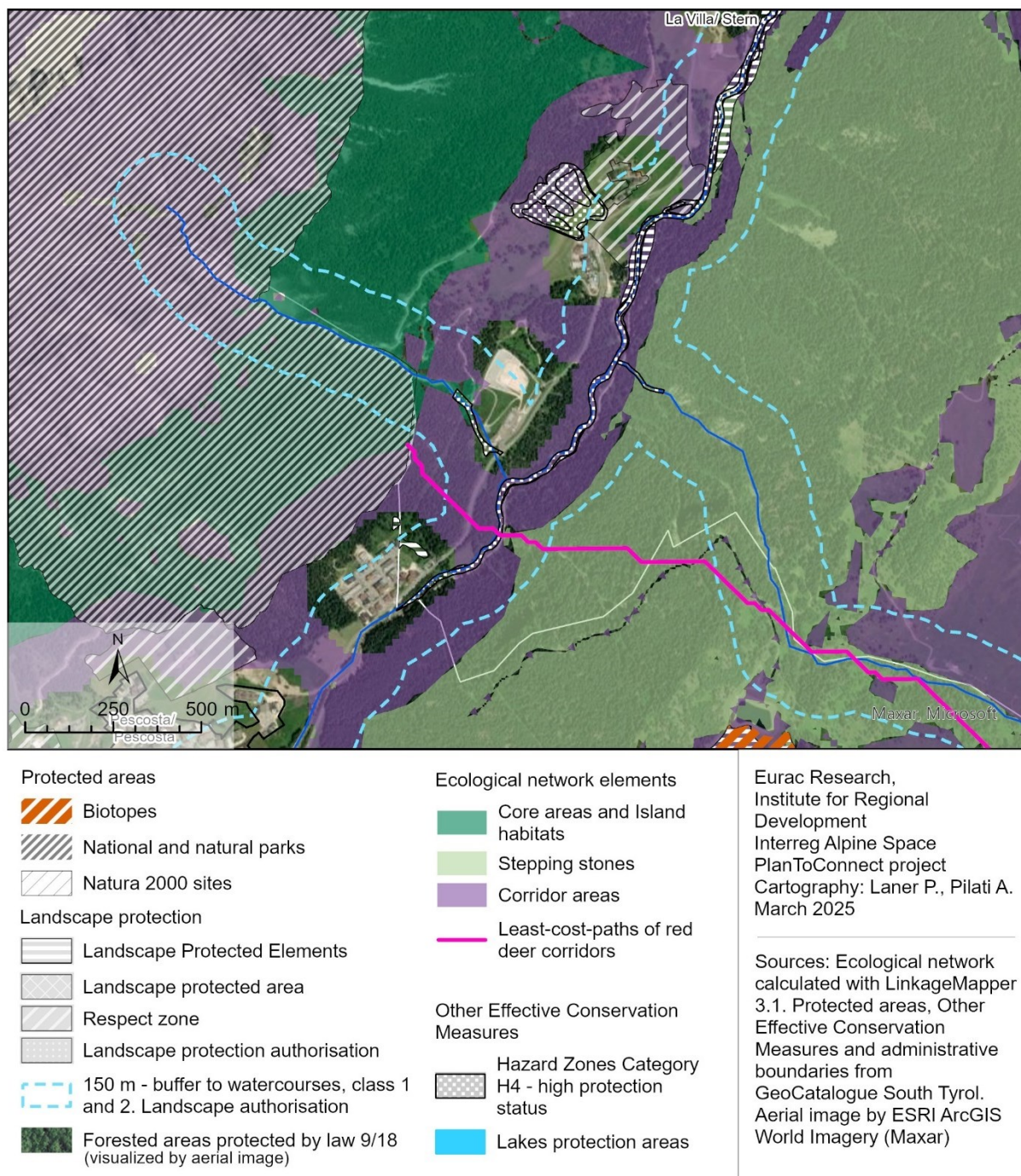


Figure 19: Corridor 17 - Corvara

The corridor starts directly from the nature park Puez- Odle/ Puez-Geisler on the north-western mountain slope of the valley. The corridor runs through forested areas that are protected by spatial planning law no 9/18. However, it is potentially threatened by settlement development.

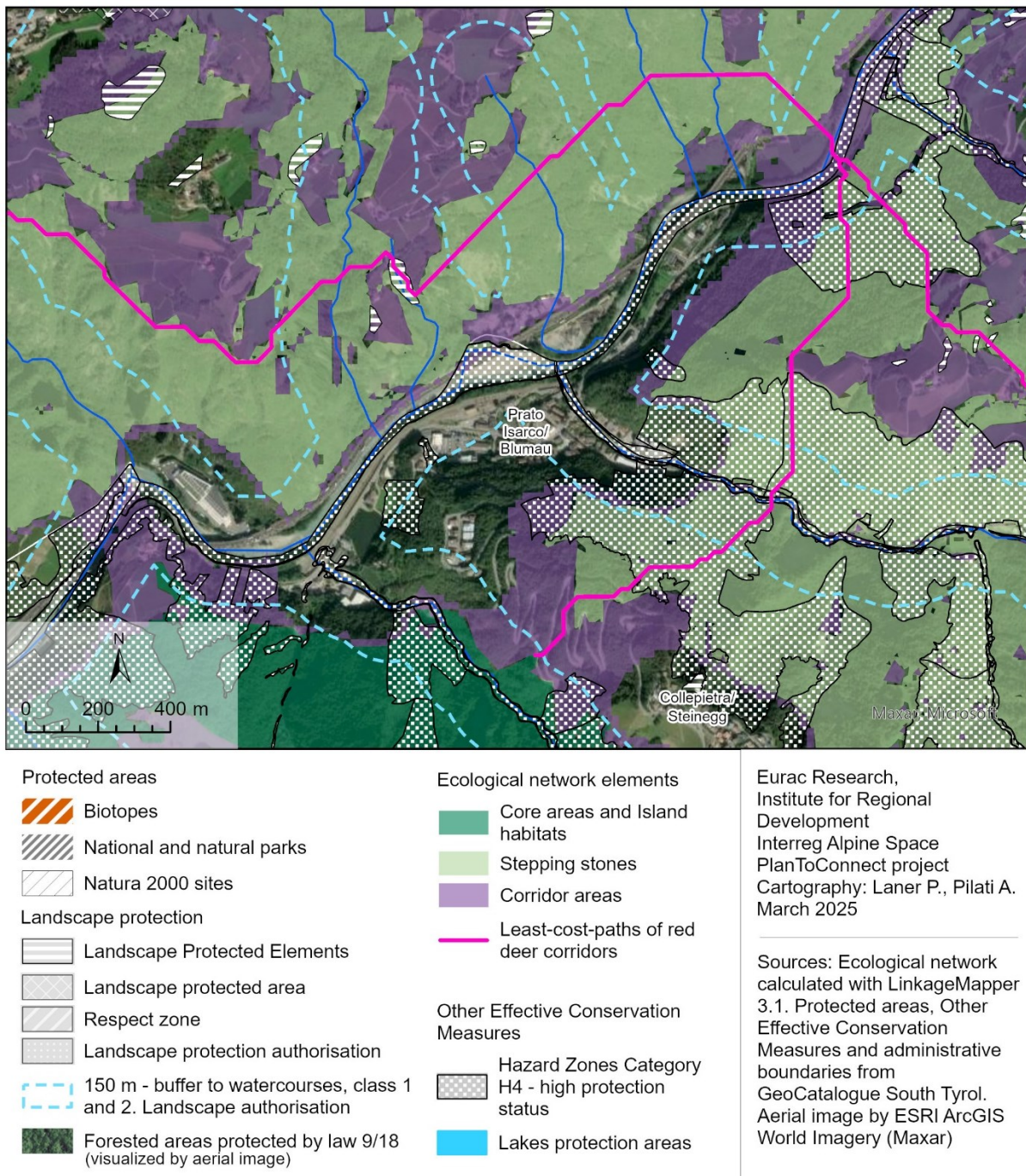


Figure 20: Corridor 20 - Renon – Sciliar/ Ritten - Schlern

Several hazard zones (H4) are on the path of the corridors. It widely covered by forests that are protected by spatial planning law no 9/18. Extension of settlements are difficult in the given terrain, but potentially possible.

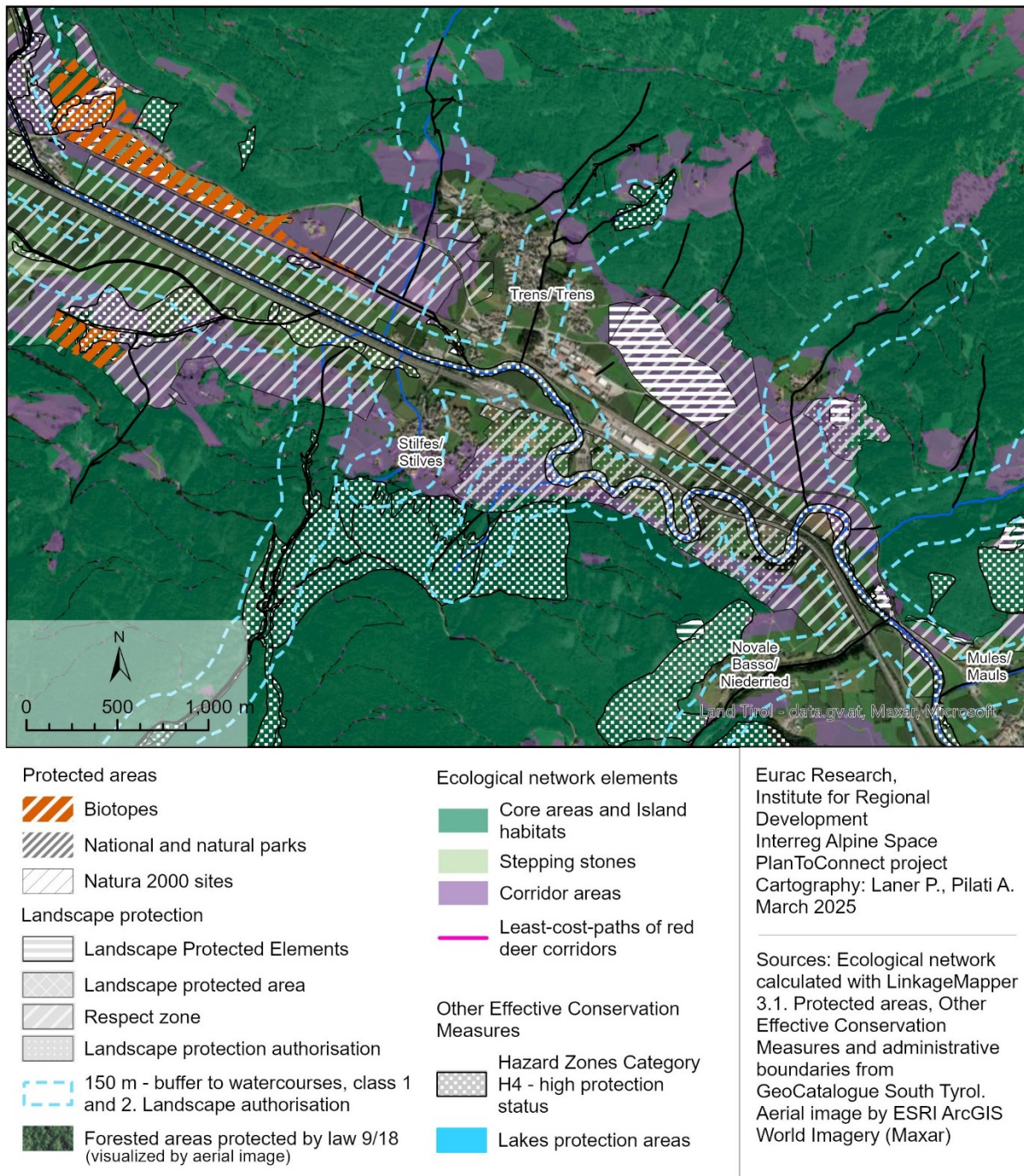


Figure 21: Corridor 24 - Campo di Trens/ Freienfeld

Wide parts of the corridor are designated as Respect Zones, where partly special landscape authorization is needed. Landscape protected elements, that have a stricter protection are present near Trens. Settlement expansions are still possible, but the corridor is widely protected.

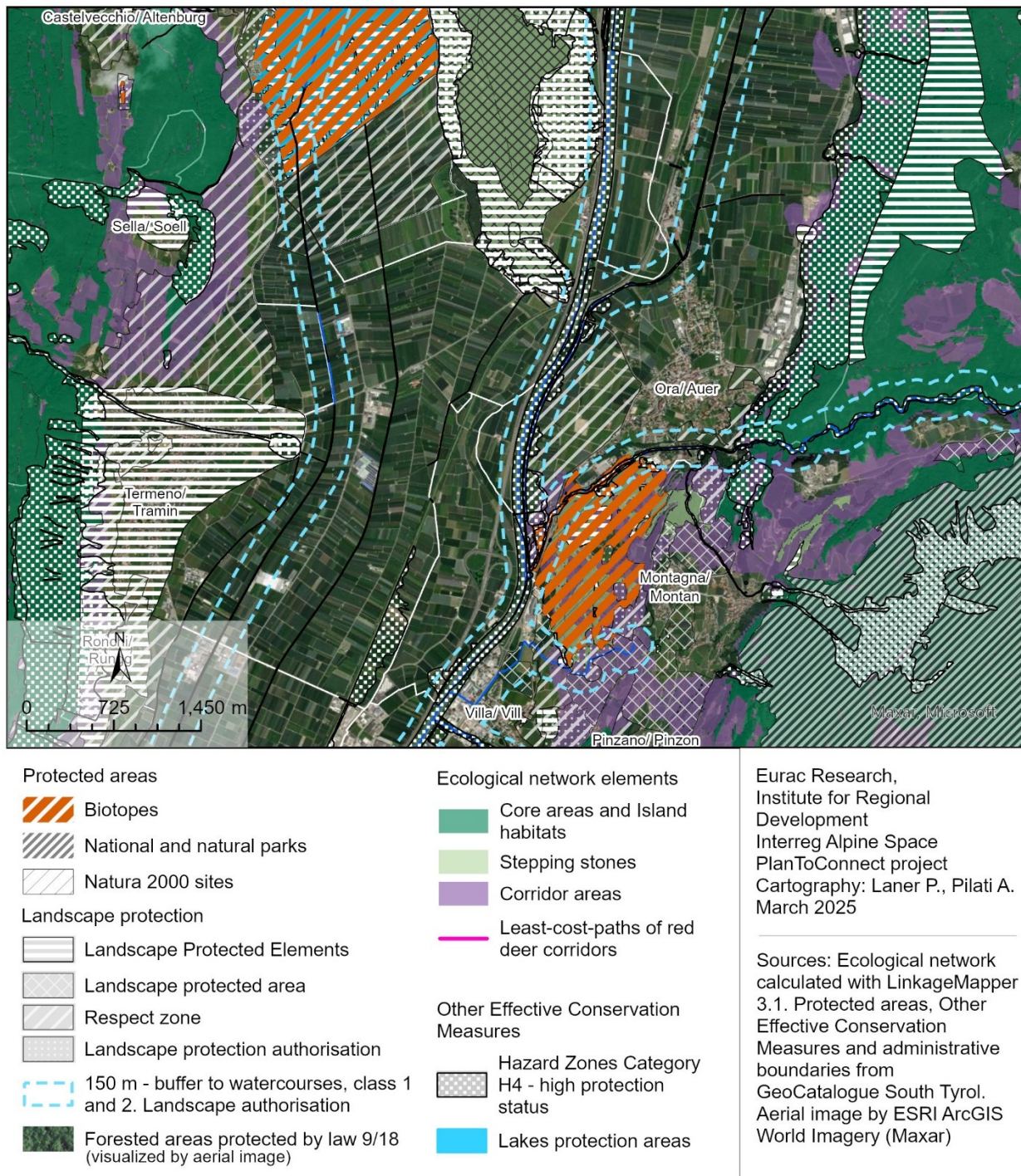


Figure 22: Corridor 26: Mendel-Mitterberg-Castelfeder/ Mendola–Monte di mezzo-Castelfeder

The areas of this potential corridor are already widely protected. The connection between the forested areas of the Mendola slope near Castelvechio/ Altenburg and the biotope Caldaro Lake is protected by a respect zone. They are directly connected to the landscape protected elements and the landscape protected area of the Monte di mezzo/ Mitterwald.

The further connection to the biotope Castelfeder is connected by the Hazard zone of the Adige River and another respect zone nearby.

The forest near Castelvechio/Altenburg is highly threatened by reservoir projects for irrigation water, which should serve for the irrigation of intensive apple orchards in the Valley bottom.

Corridor 19 - Stelvio is located entirely within the National Park Stilfser Joch and additionally the area of the least-cost-path falls in a risk zone H4. The area is widely protected, and major infrastructural developments from settlements or renewable energy infrastructure are not expected. It remains the risk of the extension for infrastructure regarding the security of the road network, e.g. by retaining walls, fences, etc.

The potential corridor 23 – Töllgraben near lagundo/ Algund is widely covered by a landscape respect zone and by a hazard zone H4.

5.3.2 Transport infrastructure

Transport infrastructure expansions are mainly affecting following corridors:

- Corridor n°3, Lower Pusteria Valley:
Increasing of the frequency of trains in Pusteria Valley and expansion of the railroad and tunnelling of the State Road near Chienes/ Kiens.
- Corridor n°5, Naz-Sciaves – Rio di Pusteria:
The planned construction of the train connection “Riggertalschleife” could potentially impact on the wildlife passages between Bressanone/ Brixen and Rio Pusteria/ Mühlbach. The Pustertal railway link is planned at Natz-Schabs.
- Corridor n°6, Perca – Rasun Anterselva / Percha – RasenAntholz:
Increasing of the frequency of trains in Pusteria Valley and expansion of the railroad. Tunnelling of Perca/ Percha, after Brunico/ Bruneck, as well as the bypass road “Nordring Bruneck/ Brunico” and S. Giorgio. The junctions of Olang and Rasen-Antholz will be widened.
- Corridor n°7, Braies - Vedrette di Ries/ Prags-Rieserferner:
Increasing of the frequency of trains in Pusteria Valley and expansion of the railroad. The junctions of Olang and Rasen-Antholz will be widened.
- Corridor n°8: Tre cime – Valle Silvestro/ Drei Zinnen – Silvestertal:
Increasing of the frequency of trains in Pusteria Valley and expansion of the railroad.
- Corridor n°10, Prad am Stilfser Joch:
A potentiation of the train frequency in the Venosta Valley is likely.

- Corridor n° 23, Töllgraben:
A potentiation of the train frequency in the Venosta Valley is likely.
- Corridor n° 24, Campo di Trens:
The constructions sites of the BBT are producing significant barrier effects in the upper Isarco Valley, between Bressanone/ Brixen and Vipiteno/ Sterzing, near Mules. The corridor is not affected so far, but the constructions sites are a potential threat.

5.3.3 Intensive agricultural land uses

Intensive agriculture affects mainly the corridor n° 10 near Prad am Stilfser Joch. Apple orchards are approaching the revealed corridor. It is already a highly problematic corridor possibility with fenced orchards, alternating with open agricultural areas urban development, as well as some significant transport barriers. If investments will be made to restore the corridor, it has to be protected from intensive agricultural practices.

In a long-term perspective, it might be possible that apple orchards will affect also the east-west alternative connection of the existing corridor n°4, in the north of Malles/ Mals, if they continue to expand with the same velocity as they did in the last decades. However, this is less likely because of the higher altitudes of this area.

Corridors n° 23 - Töllgraben, 25 - Piana Rotaliana, and 26 - Mitterberg/ Montiggl, evaluated a s potential, are strongly affected by intensive agriculture. There is the risk of expansions of agricultural land, which means more land take near the agriculture fields., as well as the loss of still existing hedge rows or woody patches within them.



6 Possible mitigation and compensation measures

The following table lists possible general mitigation and compensation measures for the renewable energy infrastructures and other threats in the pilot region. They are based on Threats Report (D.1.3.1) and the report regarding anthropogenic pressures (D.1.2.1). For the pressures related to agriculture, tourism and urban development, only the most significant ones are outlined. To see the complete lists check the D.1.2.1. report.

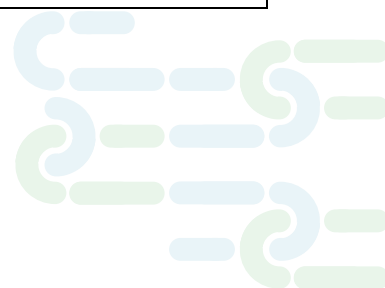
Table 7: Mitigation / compensation measures for existing threats in the pilot region Autonomous Province of Bolzano – South Tyrol”

	Mitigation / Compensation
Windpower	- turbine design optimization - switch off systems at times of increased bird/bat activity to prevent/avoid collisions (Automatic anti-collision systems) - unattractive design of the environment at the base of the mast and in surrounding fields for wind energy-sensitive birds (red kites)
Solar power	- landscape-oriented design of the facility, visual integration into the environment: suitable arrangement of the solar panels (e.g. “Solar biotope network”) - sufficiently large (wide) open spaces between the rows of solar panels (sunlit strips at least 3 m wide between the rows) - elevation of the solar panels (panel distance to the ground at least 0.8 m) - no fencing or at least permeable for small and medium-sized mammals (15 cm distance between the fence and the ground), migration corridors as crossing aids for large-scale facilities - development and maintenance of extensively used species- and flower-rich grassland in the solar park ➤ using seeds from local species or locally obtained mown material ➤ no fertilization, no use of pesticides or use of organic farming pesticides ➤ up to 2 mowing intervals (use of insect-friendly mower, cutting height 10 cm) with removal of mowed material or/and site-adapted grazing ➤ no mulching



	Mitigation / Compensation
Roads/ highways	• appropriate route alignment • traffic management measures: reducing traffic volume or speed • fencing combined with wildlife passages • wildlife passages as overpasses (e.g. green bridge, fauna overpass, multiuse overpass) or as underpasses (e.g. viaduct, fauna underpass, multiuse underpass, small fauna underpass, adapted culverts, fish passage, amphibian passage) reducing the barrier effect and providing a safe crossing • embankments to mitigate noise and provide new habitats for endangered flora species • adapting infrastructure verges • mechanical methods for vegetation control or grazing as alternative methods to the use of chemical substances in the management of green areas • adapting road lighting for mitigating light pollution • noise screens, placing the road between cuttings or earthen mounds, silent pavements for mitigating noise • runoff water management: Retention ponds
Railways	• appropriate route alignment • fencing combined with wildlife passages • wildlife passages as overpasses (e.g. green bridge, fauna overpass, multiuse overpass) or as underpasses (e.g. viaduct, fauna underpass, multiuse underpass, small fauna underpass, adapted culverts, fish passage, amphibian passage) reducing the barrier effect and providing a safe crossing • embankments/ earthworks to mitigate noise and provide new habitats for endangered species • adapting infrastructure verges • mechanical methods for vegetation control or grazing as alternative methods to reduce the use of chemical substances in the management of green areas • noise screens, placing the road between cuttings or earthen mounds, rail noise absorbers for mitigating noise • runoff water management: Retention ponds
Urban /industrial development	• appropriate location of new urban/industrial development (avoid areas of high nature conservation value including ecological corridors) • preservation of large, undissected open spaces, safeguarding inner-urban trees (particularly large/mature trees) • minimizing the road infrastructure associated with urban/industrial development, keeping vehicle speeds low • reducing use of fertilizers and pesticides in maintenance of public and private green • minimizing artificial lighting • good pet ownership to reduce domestic animal damages to wildlife • runoff water management: minimize water runoff into streams • Integration of connectivity elements in zoning plans / optimising connectivity planning and interfaces between regional concepts and municipal planning

	Mitigation / Compensation
Agricultural related practices	• buffer strips of natural vegetation between agricultural fields and wildlife-sensitive areas • no-till farming practices (farming without turning the soil) • tree maintenance and preservation of pollarded trees. • land set-aside (leave a proportion of their land out of intensive production) • maintenance of traditional irrigation systems • the measures can be combined with compensations to farmers. • restoration or creation of other natural habitats outside the affected area • restoration or replacement of removed landscape elements on another (or nearby) plot of land • creation of protected areas: if it is unavoidable to remove small landscape features, it may be useful to compensate for this loss by protecting other areas of ecological value • use of extensive livestock and scrubland clearing in selected areas with abandoned fields • encourage collective approaches (pastoral groups, land improvement consortia, collective ownership, associations, etc.) with a wider impact on the territory • precision farming • phytodepuration system, optimisation of the fertilisation, water protection plan
Extraction of resources	• environmental compensation measures in cases of landscape restoration or mine closures. • strictly controls on the specifications and requirements, as well as on compliance with deadlines regarding the start of activities and their completion date • legislation for lower extraction sites, regulated and rigorous access. • mining concession should be allowed only to cover proven needs. Speculation and land grabs should be avoided. • when peat extraction is ceased, multiple after-use options exist, including abandonment, restoration, and replacement • monitoring of hazardous chemical substances in mineral waste and application of technologies that reduce their concentration; • reduction and prevention of waste storage drains from entering ground water
Recreational infrastructure and areas for tourism	• <u>access and infrastructure management</u>: limitation of the quantity of new accommodation. Shift touristic demand from peak seasons to low seasons, limit the touristic traffic in sensitive areas during peak seasons • <u>education and awareness, regulation of recreational activities</u>: promoting awareness • <u>incentives for sustainable tourism projects and promotion of low-impact activities</u>: strengthen the public transport infrastructure • restoration of landscape/area damaged by tourist activities • landscape tourism taxes



7 Conclusions

The undertaken investigations were firstly based on a stakeholder workshop, and secondly on the collection of legislation regarding Environmental Impact Assessments (EIA), followed by a mapping approach.

Based on the stakeholder workshop, it was revealed that existing and potential ecological corridors in the valley bottom will experience additional barrier effects mainly by the expansion and improvement of transport infrastructure, that are mainly concerning railways in the upcoming years. Many tourism and cable car developments were named for areas in higher altitudes.

Based on an investigation of a list of projects which were subject to EIA, the main threats are coming from the field of tourism in first place, followed by transport and extraction of resources. The legislation on renewables is still evolving and developing. For this reason, the Autonomous Province of Bolzano - South Tyrol will have to adapt to the principles of current legislation. For example, in the definition of suitable areas and for the adaptation of the 'Legislative Decree 25 November 2024, no. 190' to simplify the authorization process for renewable energy plants, the province needs to define further specifications.

Based on the mapping approach, the threats regarding settlement development and extraction of resources were revealed: Eight out of 16 corridors, which were more deeply analysed, are potentially at risk of getting further impaired by settlement development. Four corridors are potentially at risk of being further impaired by extraction of minerals or gravel production sites. The expansion of intensive apple farming could potentially harm corridor near Prad am Stilfser Joch in the Venosta Valley (corridor n°5).

The construction of new transport infrastructures, such as railways and roads, and settlement development along the valley bottoms are the drivers to further fragment the landscape, creating significant barriers for wildlife movements. If spatial planning will be inactive to integrate ecological corridors which are crossing the valley bottoms, connecting mountain slopes on both sides of the valley, in a long-term perspective, there is a high risk of getting more than half of the existing permeable areas lost. Such processes are ongoing, e.g. on the identified potential corridor in the north of Brixen.

To give an overview, the corridors were evaluated based on their level of protection and future risk for several sectors, estimating potential future risk of cumulative barrier increase.



Table 8: Overview of future threats by corridor

Corridor number	Location name	Future threats				Risk of cumulative barrier increase
		Settlement development	Transport	Caves/ gravel production/ deposit sites	Agri-culture	
3	Lower Pusteria Valley	/	Train frequency	/	/	Low
5	Naz-Sciaves – Rio di Pusteria	Risk of further expansions	New railway connection	BBT deposit sites	/	Very high
6	Perca–Rasun Anterselva	Risk of causing bottlenecks	Train frequency	Gravel production site expansion	/	High
7	Braies – Vedrette di Ries	/	Train frequency	/	/	Low
8	Tre cime – Valle Silvestro	/	Train frequency	Deposit sites in the section Monguelfo – Villabassa)	/	Moderate
10	Sluderno–Prato	Wide protection, expansion likely on the edges of the corridor	Possible expansion of train frequency	Gravel production site	Intensive apple orchards	Moderate
15	Sciliar – Laion	industrial zone “Pontives”	/	/	/	Moderate
16	Pedeora	Not widely protected, but settlement development not probable	/	/	/	Low
17	Corvara	Risk of further expansions of settlements	/	/	/	Moderate
20	Renon–Sciliar/	Extension possible but not probable	/	/	/	Low
23	Töllgraben	/	Train frequency possible	/	/	Low
24	Campo di Trens	Low probability of settlement expansions	/	Barriers during construction site of BBT	/	Low

The corridors with the highest estimated risk are the potential corridor number 5 - Naz-Sciaves – Rio di Pusteria, and corridor 6 - Perca–Rasun Anterselva. We recommend giving highest priority for the protection and the restoration of these corridors, and to implement mitigation measures of future infrastructural projects.

Despite the corridor in Sluderno–Prato (n°10) has many expected threats for anthropogenic infrastructure and land uses, it is rated moderate, because it is widely protected, and the cumulative impact is expected to be limited. The corridors of Corvara (n°17) and Sciliar – Laion (15) were rated as moderate, because only settlement expansion is representing a future threat, but with possible major impacts. The Tre cime – Valle Silvestro corridor (n°8) was rated as moderate because of a few risks, which can have moderate impacts.

For future planning of protection and mitigation measures, we recommend giving priority to these six corridors.

Landscape planning professionals should introduce a category for ecological corridors when updating the municipal landscape plans, which are designed based on the identified corridors of the red deer model. It is recommended to specify that settlement and touristic development, the extraction of resources or gravel production, as well as installations to produce renewable energy should be prohibited on these sites. Agricultural practices should guarantee a permeable landscape with reintroducing woody landscape features for improving connectivity.



8 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) (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) (see also Deliverable 1.1.1, chapter 6)
Hydropower (dams, weirs, run-off-river power plant)	Power derived from the energy of falling water or fast running water to generate electricity Hydropower generation including development and use of associated infrastructure (e.g. building dams or weirs, changes of hydrological functioning rivers or chemical and thermal properties of water due to operation of dams and weirs).
Hydroelectric dam	A barrier that stops or restricts the flow of water; used to create energy in the water flow that can be captured by a turbine to generate electricity
Pressures and Threats	Definition by the European Environment Agency 2020 (State of nature in the EU - Results from reporting under the nature directives 2013-2018): <i>“Pressures are considered to be factors that have affected habitats and species within the current reporting period, while threats are factors that are anticipated to be likely to have an impact during the subsequent two reporting periods.”</i>
Solar PV panel – Agri-photovoltaics system	An arrangement of PV materials that absorbs and converts sunlight into electricity. Agri-Photovoltaics (Agri-PV) consists in the simultaneous use of land for both solar photovoltaic power generation and agricultural production. (Chatzipanagi et al; 2023)
Transmission lines	Power lines used to move electricity from a generating site (e.g., a power plant) to an electrical substation, which often transforms the voltage from high to low before reaching consumers
Wind farm	A group of wind turbines used to produce electricity
EIA, Screening	EIA: The Environmental Impact Assessment (EIA) of projects aims to protect human health, contribute to a better environment for quality of life, ensure the maintenance of species, and preserve the reproductive capacity of ecosystems as essential resources for life. To this end, it identifies, describes, and appropriately evaluates the environmental impacts of a project. (Ministero dell’Ambiente e della Sicurezza Energetica)

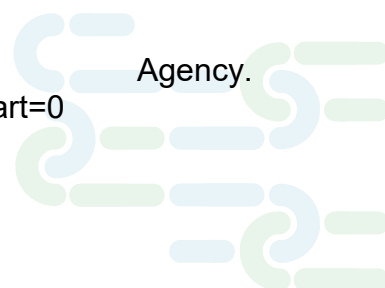
	Screening: The assessment of the obligation to undergo an EIA (Environmental Impact Assessment) procedure aims to evaluate whether a project may cause significant and negative environmental impacts and therefore must undergo the EIA process (ibidem)
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ANNEXES

Annex 1 Identification of projects thresholds for spatial planning

In Italy the EIA (Environmental Impact Assessment) is an environmental authorisation that is regulated in the Environment Code in Part II, Title III (Legislative Decree No. 152 of 3 April 2006). It defines the competence, distinguishing projects subject to regional or state approval:

- Projects listed in Annex II of Part Two of the decree are subject to EIA at the national level, while projects listed in Annex II-bis are subject to screening to determine the need for EIA at the national level.
- Projects listed in Annex III are subject to EIA at the regional level, while projects listed in Annex IV are subject to screening to determine the need for EIA at the regional level.

The Regions and Autonomous Provinces must define this regulation through specific laws; in the case of South Tyrol, it came into force the Provincial law of October 13, 2017, No. 17 focuses on “Environmental assessment for plans, programs, and projects”. Annex A defines the projects subject to an EIA or a screening, however it refers to the Legislative Decree No. 152 as the main source. In same Annex, article 15, paragraph 2, number 2, letter b, states that projects subjects to EIA screening which fall or are partially, within protected natural areas required an EIA. The same article, letter c), states that the criteria and thresholds to be applied to EIA screening are set in the “Guidelines for the Verification of Subjection to Environmental Impact Assessment of Projects under the Responsibility of the Autonomous Regions and Provinces”.

The guidelines define specific criteria that are relevant for the identification of projects subjects to a screening: characteristics of the project, localisation of the project, characteristics of potential impact (Ministerial Decree No. 52 of 30 March 2015). Existence of the set of conditions listed above results in a 50% reduction in the thresholds for the specific project category listed in Annex IV (projects subject to screening).

Instead, in Annex A, paragraph 3 of article 15, it is defined that screening is in any case carried out for:

- “Modifications or extensions of the projects listed in Annex III and IV to Part Two of Legislative Decree No. 152 of April 3, 2006, and subsequent amendments, the implementation of which has the potential to produce significant and negative environmental impacts, with the exception of modifications or extensions that are in themselves in compliance with any thresholds established in the same Annex III”
- “Projects listed in Annex IV to Part II of Legislative Decree No. 152 of April 3, 2006, and subsequent amendments, in application of the criteria and thresholds established by the guidelines, issued pursuant to Article 6, paragraph 7, letter f), of Legislative Decree No. 152 of April 3, 2006, and subsequent amendments” are subject to screening.

The table below presents only regional projects subjects to an EIA and screening listed in Environmental Code and following integrations.

	Relevance for Environmental Impact Assessment (EIA) Competence of the Autonomous Province of Bozen	Projects subject to EIA screening under the competence of the Autonomous Province of Bozen – South Tyrol
Windpower (windmills)	In the EU's Environmental Impact Assessment Directive windpower is not mentioned as a subject to an obligatory Environmental Impact Assessment (EIA). Projects subject to an EIA within the competence of the Autonomous Province of Bolzano/Bozen – South Tyrol: Wind power plants for the production of electricity on land with a total capacity exceeding 1 MW, if ordered as a result of the screening determination pursuant to Article 19;	Wind power plants for electricity generation onshore with a total capacity exceeding 1 MW
Solar power (ground mounted photovoltaic systems)	In the EU's Environmental Impact Assessment Directive solar power is not mentioned as a subject to an obligatory Environmental Impact Assessment (EIA). Projects subject to an EIA within the competence of the Autonomous Province of Bolzano/Bozen – South Tyrol: - Photovoltaic solar plants placed in a floating mode on the water surface of reservoirs created by dams other than those referred to in Article 1 of Decree-Law No. 8 of August 8, 1994, converted, with amendments, by Law No. 584 of October 21, 1994 - Photovoltaic plants with a capacity of 10 MW or more, placed in floating mode on the water surface of reservoirs and water basins on public or state-owned areas, including water reservoirs in disused or active quarries, or installed to cover irrigation canals, other than those referred to in Annex II, number 2), and in letter c-ter.	- Photovoltaic systems with a capacity equal to or greater than 15 MW, installed on existing structures or buildings, on their related appurtenances, or placed on structures or above-ground constructions other than buildings. - Photovoltaic or agrivoltaic systems with a capacity equal to or greater than 12 MW in areas classified as agricultural, ensuring effective compatibility and integration with agricultural activities - Photovoltaic systems with a capacity greater than 12 MW in areas classified as suitable pursuant to Article 20 of Legislative Decree No. 199 of November 8, 2021 - Ground-mounted photovoltaic systems with a capacity equal to or greater than 15 MW, located in industrial, artisanal, and commercial areas, as well as in landfills or closed and restored landfill lots, or in quarries or portions of quarries that are no longer exploitable



	Relevance for Environmental Impact Assessment (EIA) Competence of the Autonomous Province of Bozen	Projects subject to EIA screening under the competence of the Autonomous Province of Bozen – South Tyrol
Biomass (biogas plant)	In the EU's Environmental Impact Assessment Directive, bioenergy plants are not mentioned as a subject to an obligatory Environmental Impact Assessment (EIA). It falls under state competence Screening: Thermal plants for the production of electricity, steam, and hot water with a total thermal power output exceeding 50 MW EIA: Thermal plants for the production of electricity, steam, and hot water with a total thermal power output exceeding 150 MW	
Roads/ highways	According to the EU's Environmental Impact Assessment (EIA) Directive motorways and express roads must be assessed for their impact on the environment (Environmental Impact Assessment - EIA). Projects subject to an EIA within the competence of the Autonomous Province of Bolzano/Bozen: Urban slip roads;	Secondary suburban roads not included in Annex II-bis, and urban roads with a length of more than 1,500 meters not included in Annex III (Annex refers to D.L April, 2006 n. 142)
Railways	According to the EU's Environmental Impact Assessment (EIA) Directive quarries or peat extraction must be assessed for their impact on the environment (Environmental Impact Assessment – EIA) Not mentioned, it falls under the competence of the State	Regional or local railways line
Mineral extraction	According to the EU's Environmental Impact Assessment (EIA) Directive long-distance railways must be assessed for their impact on the environment (Environmental Impact Assessment – EIA) Projects subject to an EIA within the competence of the Autonomous Province of Bolzano/Bozen: Caves and peat bogs with more than 500,000 m³/year of material extracted or an affected area greater than 20 hectares.	Caves and peat bogs



	Relevance for Environmental Impact Assessment (EIA) Competence of the Autonomous Province of Bozen	Projects subject to EIA screening under the competence of the Autonomous Province of Bozen – South Tyrol
Tourism and leisure	In the EU's Environmental Impact Assessment Directive tourism and leisure are not mentioned as a subject to an obligatory Environmental Impact Assessment (EIA). Regarding the competence of the Autonomous Province of Bolzano – South Tyrol, tourism infrastructure are not explicitly listed in the D.L 2006, in the section on EIA	• Ski slopes longer than 1.5 km or covering an area greater than 5 hectares, as well as mechanical ski lifts, excluding ski tows and permanently connected single-cable lifts with an inclined length of no more than 500 meters and a maximum hourly capacity exceeding 1.800 people • captive guided transportation systems (tramways and subways), funiculars or similar lines of a special type, exclusively or primarily used for the transport of passengers • Tourist villages with an area exceeding 5 hectares, residential tourist centers, and hotel establishments with more than 300 beds or a built volume exceeding 25,000 m³ or occupying an area greater than 20 hectares, excluding those located within urban centers • Permanent camping and caravanning grounds with a capacity of more than 300 caravan pitches or an area exceeding 5 hectares
Settlement development	In the EU's Environmental Impact Assessment Directive settlement development is not mentioned as a subject to an obligatory Environmental Impact Assessment (EIA).	• Development projects for industrial or productive areas involving a surface area exceeding 40 hectares; • Development projects for urban areas, whether new or expanding, involving surface areas exceeding 40 hectares; redevelopment or development projects within existing urban areas involving surface areas exceeding 10 hectares; construction of shopping centers as defined by Legislative Decree No. 114 of March 31, 1998, "Reform of the regulations concerning the commercial sector, pursuant to Article 4, paragraph 4, of Law No. 59 of March 15, 1997"; public parking facilities with a capacity exceeding 500 parking spaces



Annex 2: Projects subject to EIA in the last 5 years

Project	Sector	Year
New 10-passenger cable car "Ruacia-Sochers-Bruno" and repositioning of the 6-passenger automatic attachment chairlift "Sochers-Ciampinoi" in the municipality of Selva di Valgardena.	Tourism	2025
Construction of the new "Bodensee" storage reservoir for snowmaking at Plan de Corones in the municipalities of Valdaora and Brunico.	Tourism	2024
Quadrupling of the Munich-Verona railway line in the territory of the Autonomous Province of Bolzano/Alto Adige - base tunnel section	Transport	The project dates back to 2008 with related variants until 2024
Final project of the Verona-Brenner railway line and the Fortezza-San Candido line: new railway connection "Variante Val di Riga.	Transport	2024
Bolzano-Merano railway line: Construction of the new three-track Virgolo Tunnel and relocation of the Merano line junction	Transport	2024
Expansion of the waste treatment plant - Modification of the integrated environmental authorization	Waste management	2024
Perca bypass	Transport	2024
Opening of a gravel quarry on parcels 598/1 and 598/75 in the municipality of Gais	Extraction	2024
Renewal of the KRONPLATZ 1+2 ski lift system with a new connection of the slopes at Plan de Corones	Tourism	2024
Quadrupling of the Munich-Verona railway line in the territory of the Autonomous Province of Bolzano/Alto Adige - Verona-Fortezza access line section	Transport	2023
Renovation and expansion of the Porzen ski lift with the improvement of the piste connection in the Croda Rossa ski area.	Tourism	2023
Renovation of the Sonnenlift ski lift with the expansion of the associated ski slopes	Tourism	2023
Measures to reduce flood risk in San Candido and the eastern bypass	Flooding	2023
Construction of a ski lift and a ski slope 'Tre Cime II', an integral part of the connection between the 'Tre Cime Dolomites' ski area and the 'Sillian Alta Val Pusteria' ski center	Tourism	The project dates back to 2019 with related variants until 2023
Implementation of a high-load anaerobic plant for the treatment of industrial wastewater at the Merano wastewater treatment plant	Waste management	2022
Waltherpark - Bolzano Shopping Center - Urban Redevelopment Plan	Urban development	The project dates back to 2018 with related variants until 2022

Construction of a funicular between the Iman sports area and Monte Pana in the Municipality of Santa Cristina Valgardena	Tourism	2022
Expansion and modification of the marble quarry 'Kristallina and Pardaun' at Mareiter Stein	Extraction	The project dates back to 2017 with related variants until 2022
Construction of a ski lift and ski slopes on "Piccolo Monte Cuzzo" in the Monte Cuzzo ski area in Maranza, Municipality of Rio di Pusteria	Tourism	2021
Relocation of the Monte Pana ski lift in the Monte Pana-Ciampinoi-Passo Sella ski area in the Municipalities of S. Cristina and Selva di Val Gardena	Tourism	2021
Reorganization of the RTN in Val di Isarco for the BBT connection	Transport and energy demand	2022
Deep geothermal drilling	Extraction	The project dates back to 2008 with related variants until 2022
Construction of the "Lärchwiese" campsite in Valles	Tourism	The project dates back to 2016 with related variants until 2021
Waste-to-energy plant for all sewage sludge in South Tyrol at the IDA-Tobl treatment plant in the municipality of San Lorenzo di Sebato	Waste management	2021
Renovation and expansion of the existing "Pilat" ski slope	Tourism	The project dates back to 2017 with related variants until 2021
Project for the opening of the peat bogs called FONDAZIONE and DIUKE in the municipality of Salorno	Extraction	2021
Construction of the "Villaggio Alpino" hotel complex in the locality of Maso Corto	Tourism	2021
Extraction of gravel and boulders on parcels 615/2, 615/3, and 622 of the C.C. Varna I	Extraction and transport	The project dates back to 2015 with related variants until 2020
Construction of the "Wallpach" reservoir for snowmaking, irrigation, and fire suppression in the Merano 2000 ski area	Tourism	2020



Annex 3: Results of expert workshop



PlanToConnect

Mainstreaming ecological connectivity in spatial planning systems of the Alpine Space

Project partners:

Urban Planning Institute of the Republic of Slovenia (SI)
Veneto Region (IT)
ALPARC – the Network of Alpine Protected Areas (FR)
Asters, organisation for the conservation of natural areas in Upper Savoy (FR)
Eurac Research (IT)
ifuplan - Institute for Environmental Planning and Spatial Development (DE)
University of Würzburg (DE)
Salzburg Institute for Regional Planning and Housing (AT)
E.C.O. Institute of Ecology Ltd. (AT)
Fondazione Politecnico di Milano (IT)

Red deer habitat network South Tyrol: Threats of land use conflicts with renewable energy productions and other infrastructure

Mapping report outlining GBI network elements and areas of land use conflicts for renewable energy production and other major developments that may threaten connectivity functions

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