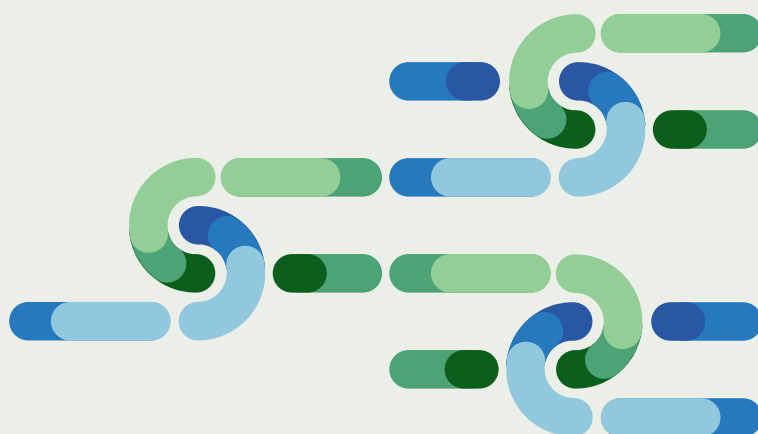


Summary of technical proposal for implementing red deer habitat network in spatial plans and sector instruments

South Tyrol

Reference in AF: D2.5.1 including outcomes of D2.2.1, D2.2.2, D2.3.1, D2.4.1

Peter Laner, Alessia Pilati, Vittoria Vettorazzo, Filippo Favilli
Eurac Research, Institut for Regional Development



Case Studies 4th step: Draft a technical proposal integrating the project for a GBI connectivity network into planning tools/sector plans in pilot areas. A2.2, A2.3 and A2.4 deliverables are parts of it.

Summary of technical proposal for implementing red deer habitat network in spatial plans and sector instruments

South Tyrol

Authors:

Peter Laner, Alessia Pilati, Vittoria Vettorazzo, Filippo Favilli

Bolzano, August 2025

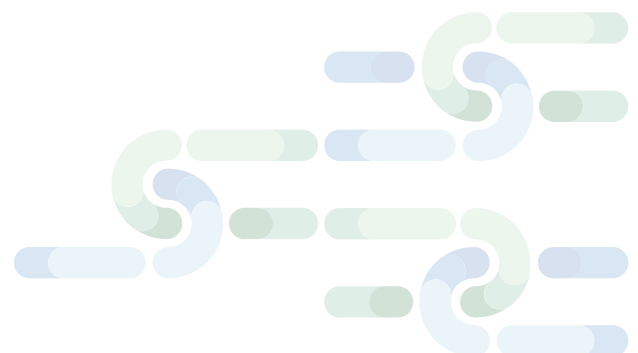


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Executive summary

South Tyrol is one of the last regions in the Alpine Space that has not yet developed a provincial ecological connectivity concept that can be downloaded from an official public authority website. The province cannot even refer to a connectivity concept at the national level. The aim of this technical proposal is therefore to provide an impetus for integrating an ecological network into regional and local spatial and landscape plans.

The first part of the report describes the ecological connectivity of habitats suitable for red deer in South Tyrol, divided by valleys and with a focus on corridors identified using a spatial model.

Fifteen corridors were analysed in detail and described using a diagram with the following content:

- Overview of location, municipality, corridor type, map and/or photos of the situation
- Information gathered from the analyses: importance for the Alpine ecological network, use by wild animals, current status (2025) of corridor area protection, anthropogenic elements and barriers, green and blue landscape elements, potential new barriers.
- Objectives for improving connectivity and proposals for measures to maintain and improve landscape permeability.

The measures focus on protection in landscape plans, mitigation of road accidents through the creation of overpasses and underpasses, elimination/limitation of fences, and restoration of forest elements in the corridor area.

Several corridors have emerged as priorities for the implementation of measures:

- Measures for corridor no. 5 Naz-Sciaves – Rio di Pusteria are urgent in view of future anthropogenic pressures. Corridor No. 6 – Perca – Rasun Anterselva is very important for ensuring Alpine connectivity and will be under pressure in the future due to various infrastructure developments.
- Confirmed use is an indication of high protection priority. Snow tracking during field visits confirmed the movement of deer and other wild animals on corridors No. 1 – Vipiteno Nord, 6 – Perca – Rasun Anterselva, 7 – Braies – Vedrette di Ries, and 10 – Prato allo Stelvio.

The second part presents a proposal on how to integrate ecological connectivity areas into South Tyrol's spatial planning tools. The Provincial Strategic Plan should integrate ecological connectivity as one of the objectives supporting the maintenance of biodiversity, to be considered in municipal spatial and landscape plans and programmes. The new Landscape Guidelines should specify which existing corridors at the provincial level are to be protected and which potential corridors are to be restored, including mapping for geographical identification. At the municipal level, Municipal Development Programmes should take into account the ecological network and corridors defined at the provincial level and follow the Landscape Guidelines. Municipal Landscape Plans should take into account

the defined ecological network and ensure the protection of existing corridors through a new urban planning designation in the category of “protected landscape sites” as defined by the provincial law on territory and landscape (LP 9/18).

Since ecological connectivity is an interdisciplinary topic, provincial offices and stakeholders from different sectors should work together to implement an ecological network in South Tyrol. Municipal and landscape planning offices and provincial planning offices should work together with the wildlife management office, the nature office, and various infrastructure and other anthropogenic use offices. Among these, the road service and the agriculture and tourism sectors are important to consider. The challenge of addressing this issue in public administration lies in the collaboration of various offices belonging to three different divisions, three departments and three different councillors.

During the meetings of the South Tyrol working group, the provincial administration expressed the need to identify priority corridors to be protected, to implement measures to improve the ecological network, and to carry out pilot projects. The measures proposed in this report can be a starting point for these activities.



REPORT



1 GBI network project

To analyse ecological connectivity in South Tyrol, a habitat network model for red deer was developed using the criteria land use, topography (altitude and slope), and disturbance factors to anthropogenic infrastructure (motorways, roads, settlements). The in-depth analysis was made for 26 focus areas in the valley bottoms because there, the main problems exist in South Tyrol.

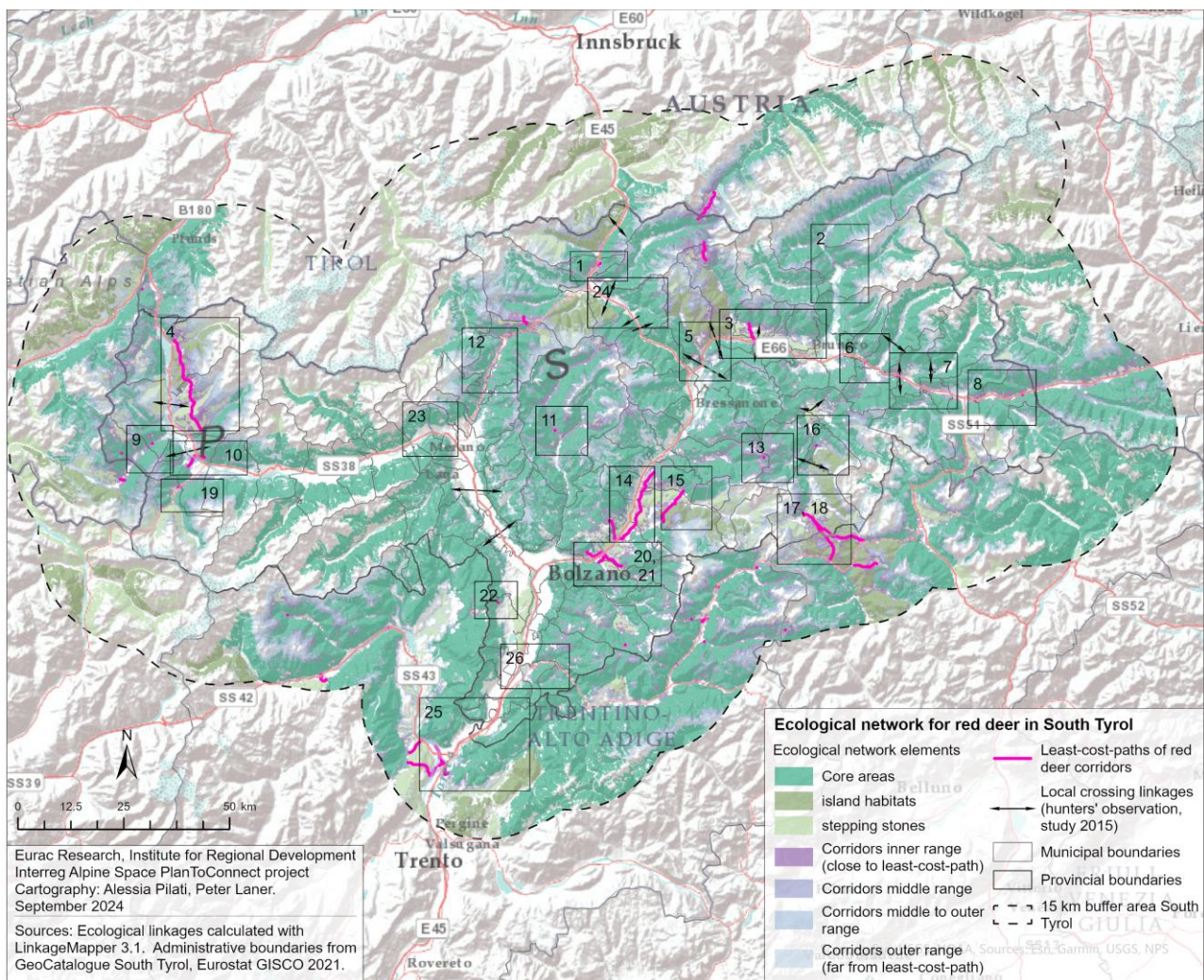


Figure 1: Project of ecological network of Red Deer in South Tyrol.

The data can be viewed and downloaded online via the following link:

<https://doi.org/10.48784/g23a-kh26>

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The alpine model highlights high-priority connections in South Tyrol.

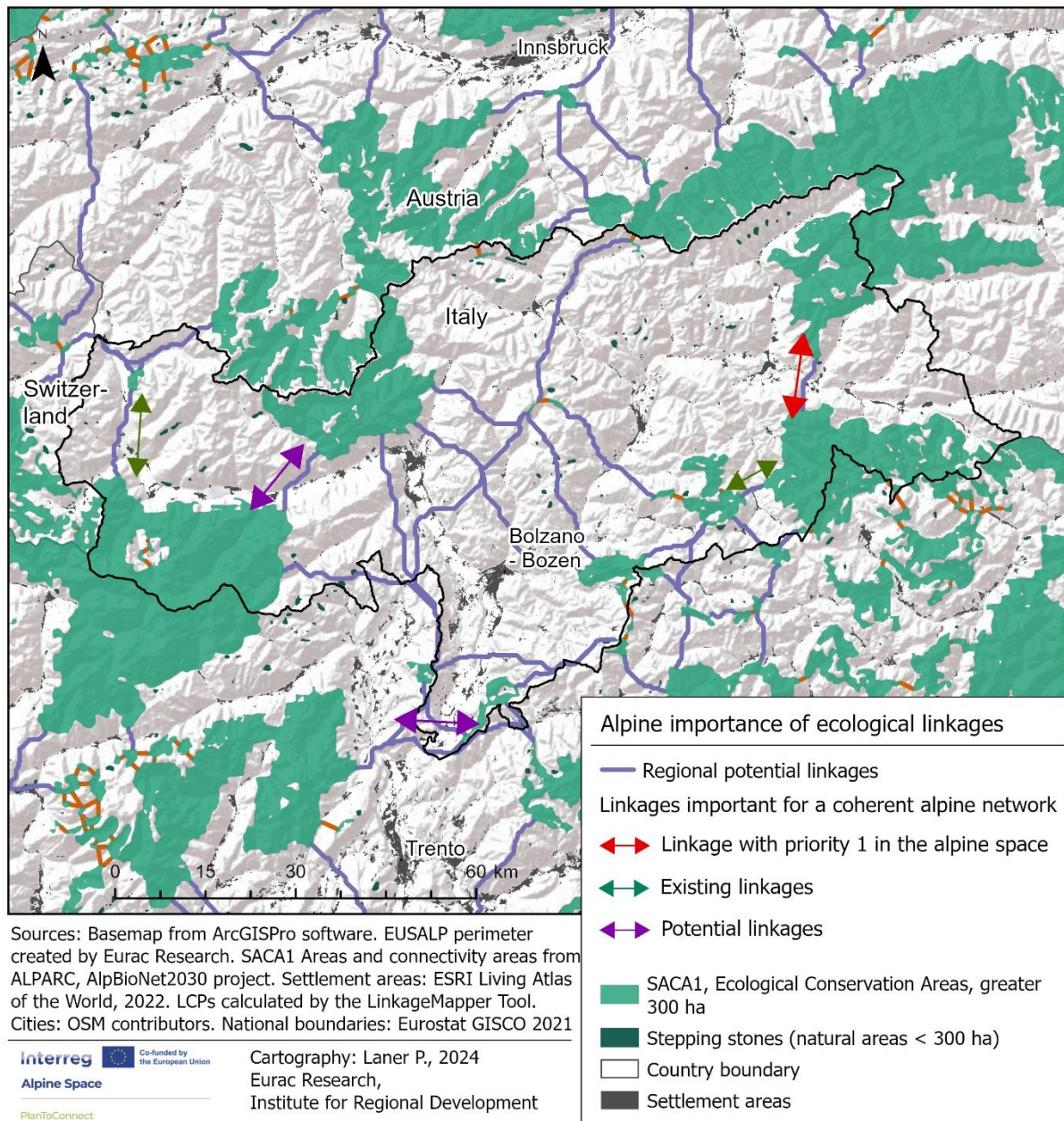


Figure 2: Downscaling of Alpine connectivity model to South Tyrol



A categorization of corridors was developed according to their characteristics regarding barriers.

Existing corridors with wide and permeable areas:

- 8 – Tre cime – Valle Silvestro
- 9 – Val Müstair

Existing corridors with minor barriers:

- 1 – Vipiteno Nord
- 2 – Campo Tures
- 6 – Perca – Rasun Anterselva
- 7 – Braies – Vedrette di Ries
- 17/18 – Alta Badia
- 19 – Stelvio e Prato allo Stelvio

Problematic existing corridors:

- 12 - Val Passiria,
- 14 - Renon – Castelrotto,
- 20/21 - Renon – Sciliar
- 3 - Bassa Val Pusteria

Potential corridors:

- 5 - Naz - Sciaves, Rio di Pusteria
- 10 - Sluderno - Prato
- 23 - Lagundo (Töllgraben)
- 24 - Campo di Trens
- 26 – Monte di Mezzo

For corridors 4 – Alta Val Venosta, 11 – Val Sarentino, 13 – Funes – Badia, 15 – Sciliar – Laion, 16 – Pederoia, and 22 – Mendola, no in-depth analysis was carried out because they already represent permeable areas with no insurmountable barriers. These corridors were identified by modelling, are located in valleys with little human impact, and in the Funes-Badia corridor, located in the Puez-Odle Nature Park, connectivity functions.

Corridor 25 – Piana Rotaliana is not examined in detail because it is not located in the territory of the Autonomous Province of Bolzano – South Tyrol.



Movement of wildlife species were verified on following corridors by snow tracking:

- 1 – Vipiteno Nord,
- 6 - Perca–Rasun Anterselva (Nasener Länge),
- 7 - Braies - Vedrette di Ries/ Prags,
- 10 - Prato allo Stelvio



Picture 1 a&b: Corridor between Vipiteno and Colle Isarco (Vipiteno Nord)



Picture 2, a,b,c: Wildlife tracks on corridor 7 - Val Pusteria, between Monguelfo and Valdaora Lake

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Laner Peter, Alessia Pilati, Vittoria Vettorazzo, Filippo Favilli, August 2025

2 Pressures and Threats to connectivity conservation and restoration areas

2.1 Main pressures

The main pressures in South Tyrol, according to an explorative survey with twelve experts from planning and nature conservation, are agricultural practices, urban development, transport infrastructure, and human-induced changes in water regimes.

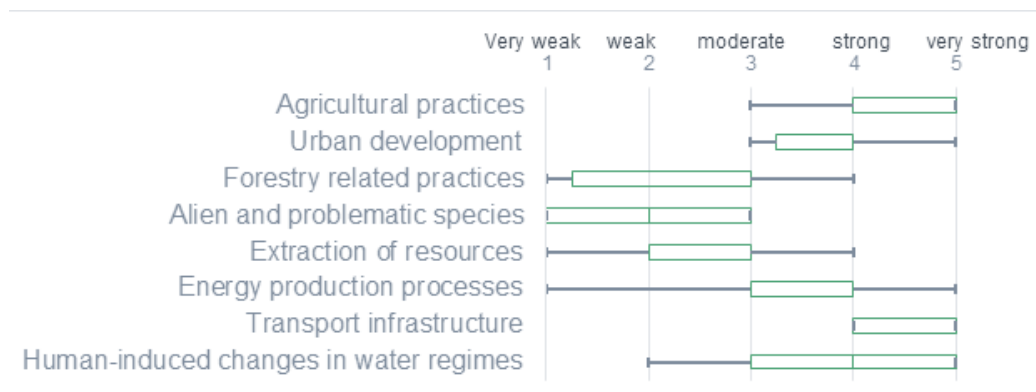


Figure 3: Result of expert evaluation of most important anthropogenic pressures in valley bottoms of South Tyrol

“Urban sprawl, extensive transportation infrastructure, intensive apple cultivation with hail nets, and increasingly cleared landscapes (removal of hedges, lack of vegetation along ditch banks, etc.) are probably the main causes of limited (or missing) natural corridors on land in our region.”

The valley bottom in South Tyrol is often the most significant barrier, not only because of infrastructure barriers, but also because of intensive agriculture. Linear semi-natural structures in the valley bottom such as for example hedges, rows, shrubs, forests, natural channels with riparian vegetation, or wetlands are very important for habitat connectivity for a wide variety of species but tend to decline (Autonomous Province of Bolzano-South Tyrol, 2003), as do semi-arid grasslands. Intensive agriculture has certainly optimized economic productivity, but at the same time it has severely compromised the natural diversity present on the sites. This has reflexively caused a decrease in the variety of animal and plant species. The use of fertilizers and pesticides further contributes to the naturalistic depletion of cropland areas.

2.2 Threats to connectivity conservation and restoration areas

Threats to the corridors were evaluated in a stakeholder expert workshop of the Regional Connectivity Working Group.

Table 1: Future threats on corridors in valley bottoms of South Tyrol

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

3 Connectivity measures and governance settings

3.1 Connectivity measures / action plan

For each focus area, a standardized “sheet” with descriptions of the current situation was provided, including location, overview-map, importance of the corridor on alpine level, the utilization by wildlife species, the actual status of protection by landscape and nature protection, as well as anthropogenic barriers (existing and potential) and green and blue landscape elements. The fact sheet concluded with connectivity conservation objectives and proposals for implementation measures.

Most of the measures to improve ecological connectivity for red deer focus on protection in landscape plans, mitigation of road accidents through the creation of overpasses and underpasses, elimination/limitation of fences, and restoration of forest elements in the corridor area.

A short version is given as an example for Corridor N°1 – Vipiteno Nord.

3.1.1 Example

Corridor N°1 – Vipiteno Nord

Location: Eisack Valley between Sterzing and Klausen

Municipality: Sterzing

Corridor type: Existing corridor with minor barriers



Picture 3: Landscape on corridor 1



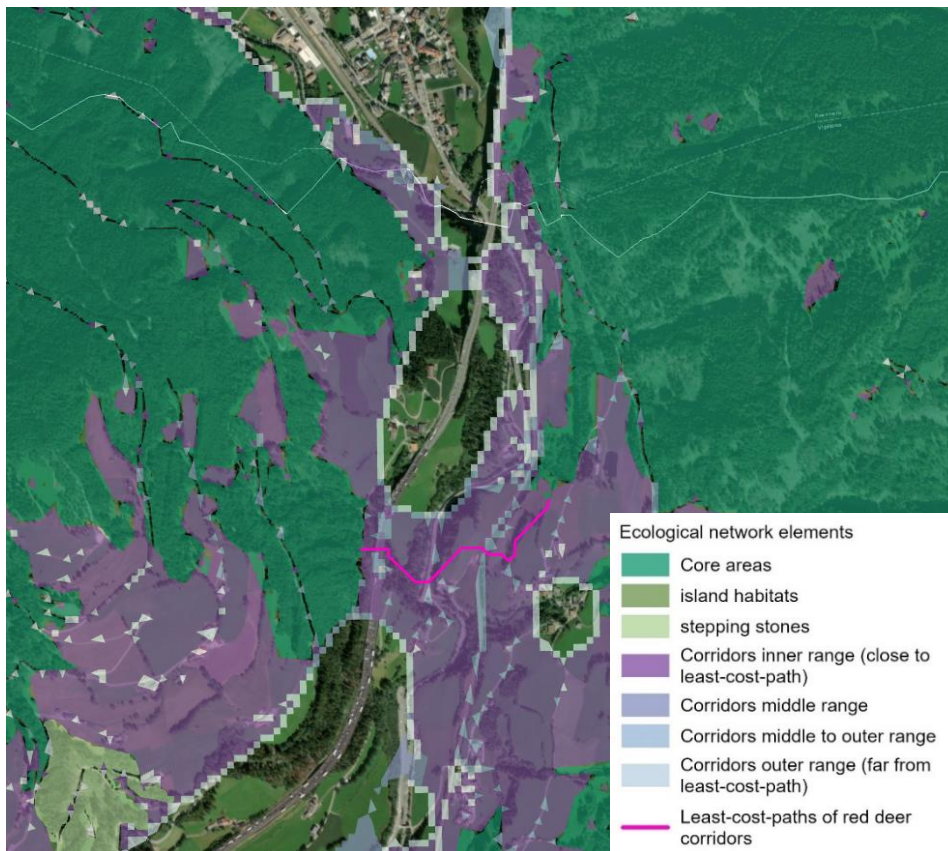


Figure 4: Map of corridor n°1

Importance for the Alpine ecological network:

According to the macro-regional model, important Alpine corridors are located in the Gossensass area and towards the Brenner Pass. The east-west connection has emerged as an important connection for the Alpine network, with few barriers and a low risk of urbanisation.

Utilization by wildlife species:

Snow tracking has confirmed that the corridor is used by several animal species. Traces of deer, roe deer and foxes have been found. Use of the passage is particularly intense in the area near the motorway underpass.

Current status (2025) of protection of the corridor area:

The corridor is protected by the categories “landscape conservation areas”, and “landscape protection sites”, as well as forests and river buffer zones. However, the modelled corridor is not protected across the entire identified area and there remains a risk of new barriers being created.

Anthropogenic elements and barriers:

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On the route between Vipiteno and Colle Isarco, eight collisions between wild animals and trains were recorded between 2021 and 2024, three of which involved deer. In some places, wild species have to cross the railway line.

In 2024, the SS12 state road in this section had an average daily traffic volume of 7,974 vehicles per day (ASTAT 2024). According to the Biodiversity and Infrastructure Manual “IENE” (Rosell 2023), this means that the section has “limited permeability for most species” and a “high risk of death” (Rosell 2023). There have been a few road accidents involving roe deer along the SS12 state road, and one involving a badger in 2021. There have been no recorded accidents involving deer on the road.

Green and blue landscape elements:

Corridor 1 features areas of permeable meadows and pastures. An element of natural ecological connectivity present in the corridor are linear wooded areas approximately 60 meters wide, which connect the two sides. An element of artificial connectivity is the presence of several passages under the motorway between Vipiteno and Colle Isarco.

Potential new barriers:

Today (2025), the area is not threatened by any major future construction projects.

Objectives for improving connectivity:

The objective for the Vipiteno Nord corridor is to protect ecological connectivity. The permeability of the landscape must be maintained, and settlement expansion from Vipiteno and Colle Isarco must be developed with caution. Settlement developments between the hamlet of Oberried and the Steckholz farmstead in the hamlet of Ceves should take landscape permeability into account. In general, a permeable landscape should be maintained for all sections of motorway underpasses between Vipiteno and Colle Isarco. It is recommended that the wooded elements in the shaped corridor that already connect the two sides be maintained.

Proposals for implementation measures:

Since the municipal border between Vipiteno and Brennero runs very close to the south of the village Colle Isarco, the municipality of Vipiteno is advised to focus on implementing measures in order to improve the ecological connectivity of the entire area.

- Measure 1: Protection of the corridor

Planning tool: Municipal landscape plan



It is recommended that the areas highlighted below be protected, especially those that are not covered by any form of landscape protection. It is recommended that they be protected as protected landscape sites to prevent any expansion of settlements or infrastructure. It is advisable to specify that the landscape must ensure permeability for the passage of wildlife.

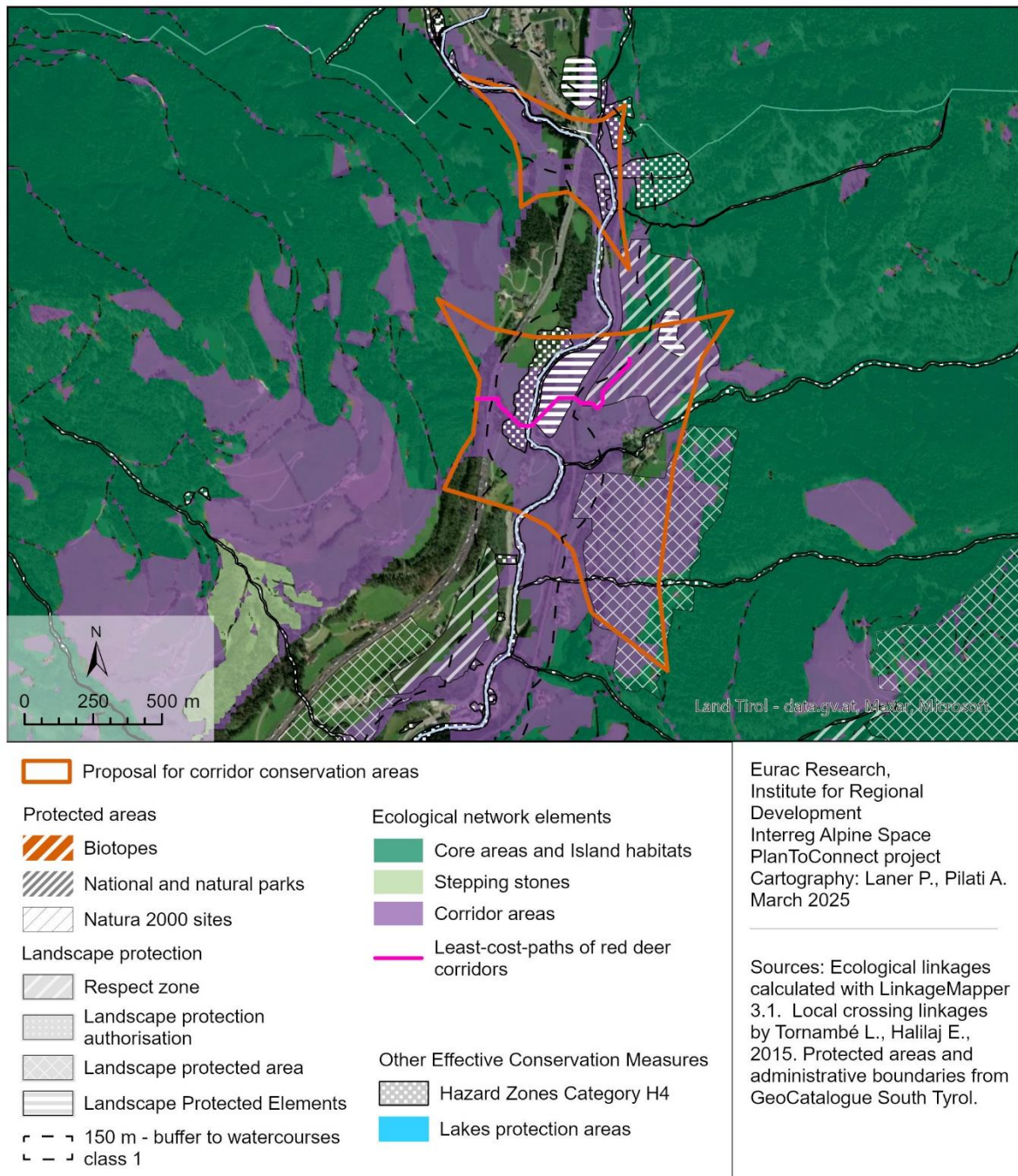


Figure 5: Proposal of area to designate as “ecological corridor”

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- Measure 2: Development of forest edges and structural elements

Planning tool: Municipal development program

To minimize possible future impacts on ecological connectivity, the municipal development program should include additional measures to improve connectivity. For example, measures could include the conservation and reinforcement (where possible) of forest edges and structural elements of the landscape.

- Measure 3: Mitigation of the impact of transport infrastructure

Since this section has a traffic intensity of more than 100 trains per day, according to the Biodiversity and Infrastructure Manual “IENE” (Rosell 2023), it is necessary to focus on accident prevention. The implementation of safety measures such as the installation of thermal cameras, acoustic signals, or other technological innovations on the railway line between Vipiteno and Colle Isarco would help reduce the likelihood of accidents involving wildlife (Bhardwaj et al. 2022). Feasibility must be verified in agreement with RFI (National Railway Network Group). The future construction of the underground high-speed railway line (BBT) could partially mitigate the problem of train collisions with wildlife in this area.

Since train accidents are more problematic than road traffic accidents in the area, it is recommended that alternative solutions be implemented: for example, reducing the speed limit on the road in the corridor area.



3.2 Key Stakeholders

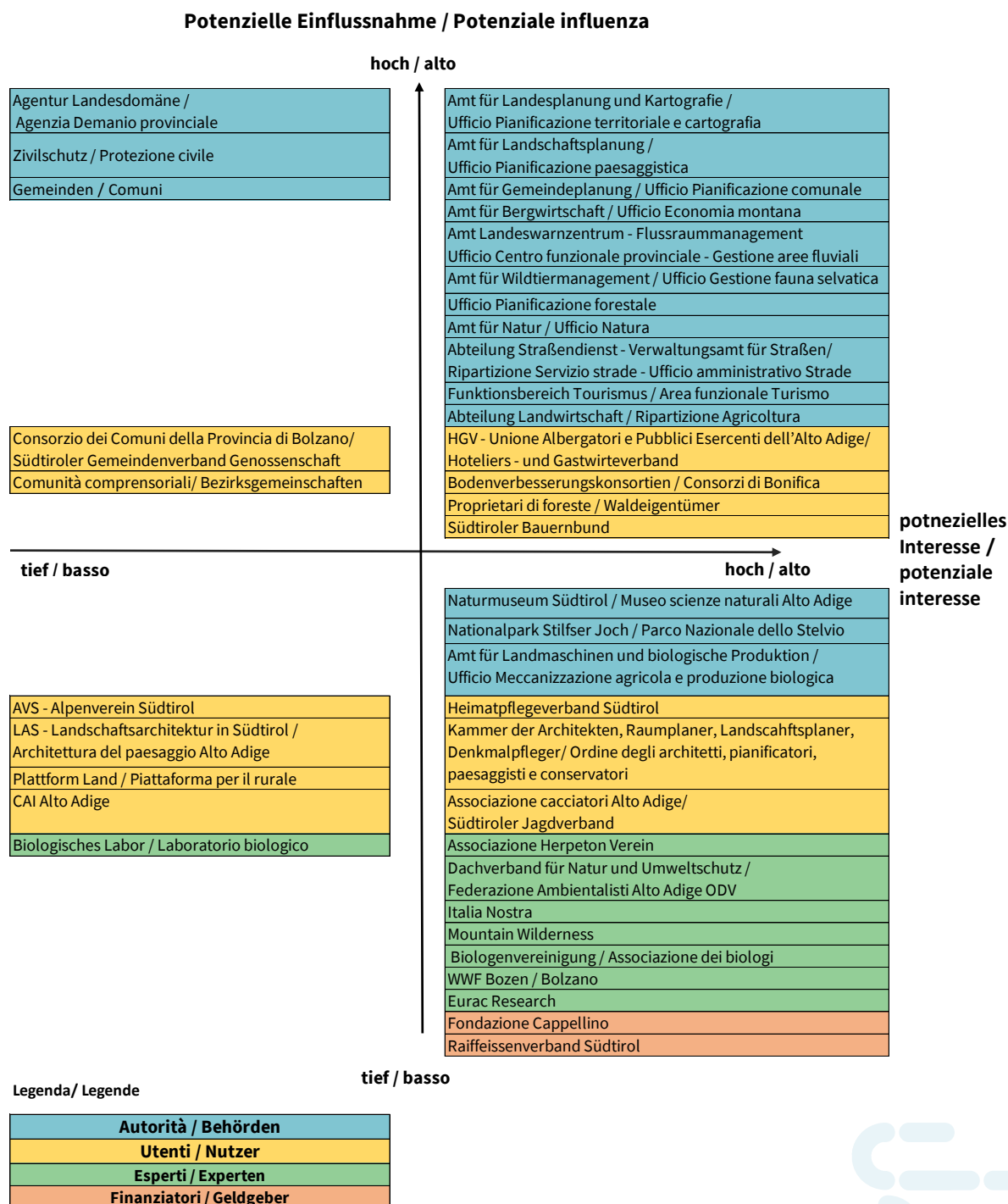


Figure 6: Potential stakeholders for the planning and implementation of ecological networks

3.3 Governance settings

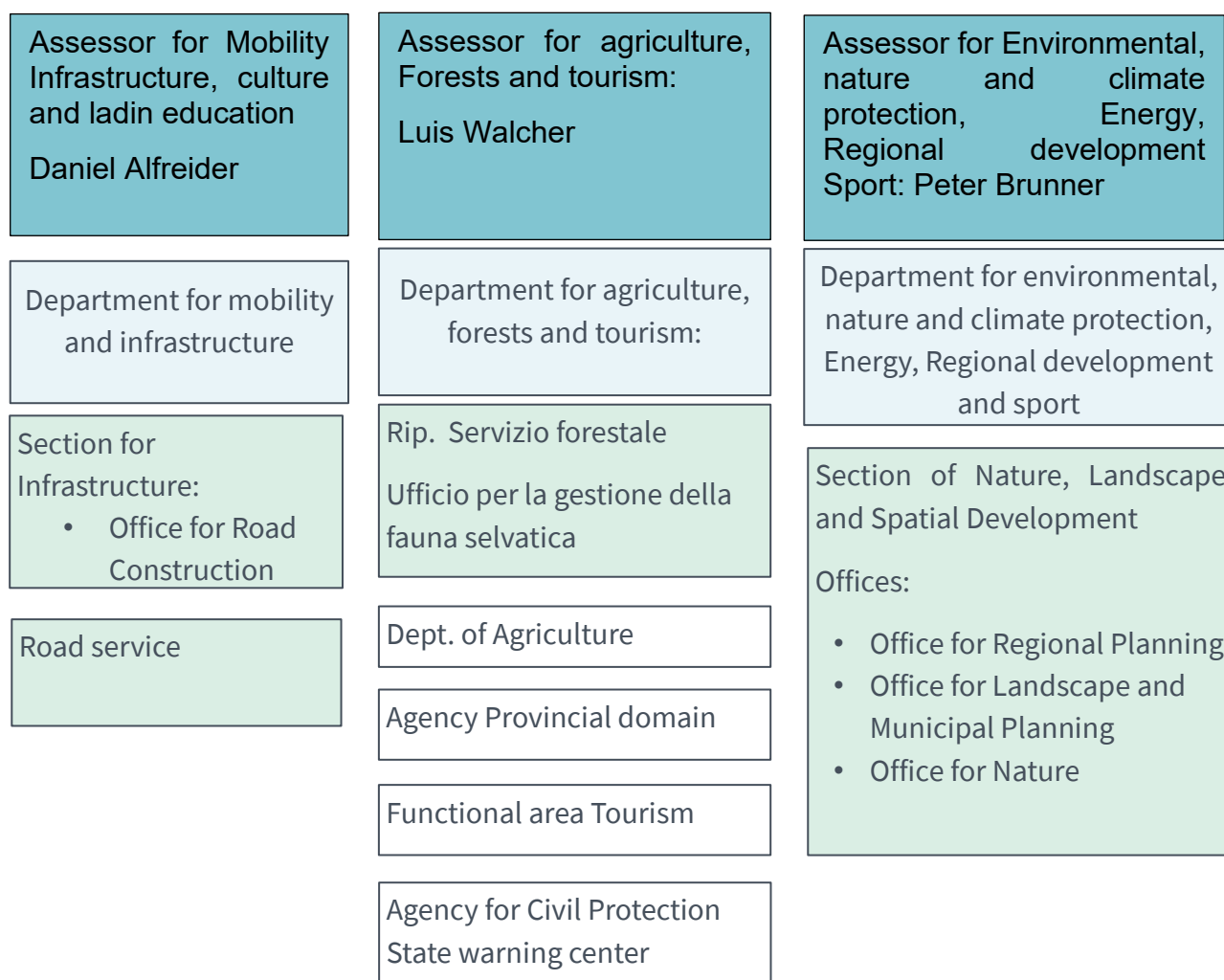


Figure 7: Structure of the provincial administration, with offices important for ecological network implementation

Cooperation between offices within the provincial administration on the implementation of an ecological network of South Tyrol must respect the above-mentioned offices. Collaboration between various offices of three different divisions, three different departments, and three different councilors is a challenge to be resolved, which was tested in the case of the planning of the first green bridge in South Tyrol. However, a point of reference for the coordination of ecological connectivity issues, that is in contact with the offices concerned, would be useful. Currently a good collaboration exists between the office for wildlife management, the landscape planning office, and the road service.

3.3.1.1 Mechanisms for implementing ecological corridors:

Regardless of the various possibilities and forms of protection, the following mechanisms are conceivable for the implementation of ecological networks:

The first refers to a bottom-up approach:

The prerequisite is the provision of geographic data with a layer of green passages for wildlife on a public platform, or better still on the Province's GeoBrowser. In this way, municipalities can integrate ecological corridors as “protected landscape sites” into municipal landscape plans based on the data provided. The measures of municipal development programs could be aligned, respecting the identified passages. (Example: align settlement boundaries).

The second refers to the logic of the territorial planning system:

In order to follow this formal approach, interest from politicians and decision-makers at the provincial level would be required. The inclusion of an objective linked to the creation of an ecological network in the Provincial Strategic Plan could emphasize the public interest in safeguarding the landscape elements that belong to the networks. The objective should then be implemented with a map (a digital layer or a map) indicating green passages for wildlife, included in the Landscape Guidelines (Provincial Landscape Plan). This would oblige municipalities to comply with the predefined objectives and implementation rules.



4 Proposal(s) for the implementation of the GBI network plan into spatial and sector planning tools

4.1 State of art of connectivity planning and implementation in the pilot area

Currently, South Tyrol is one of the last regions in the Alpine Space that doesn't yet have spatial planning that integrates a formal or informal concept of ecological connectivity at a provincial level, and a national connectivity concept is missing. Therefore, spatial planners have no possibility to download and refer to an ecological network plan from an official website of a public authority.

Some minor experiences were made, where ecological corridors were inserted as respect zones in landscape plans. However, this happened occasionally during an update of diverse municipal landscape plans.

4.2 Key spatial (and urban) planning instruments

Provincial Strategic Plan:

The plan has a strategic approach that guides territorial development with a long-term vision. It can be useful for outlining guidelines or recommendations to be followed for “the preservation of local characteristics and the protection of biodiversity.”

Landscape guidelines:

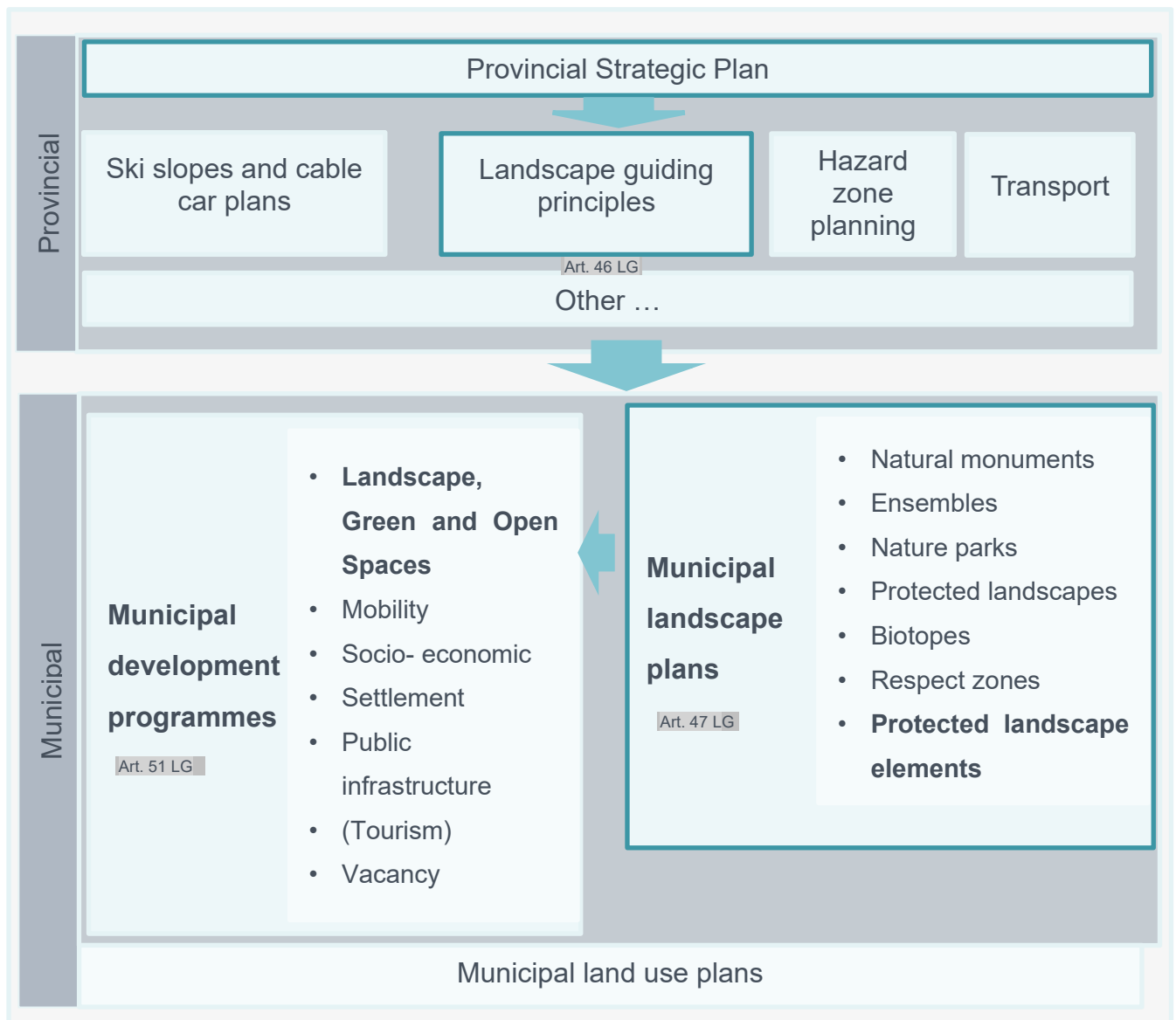
A network plan with corresponding measures for the whole of South Tyrol can be incorporated into the revision of the landscape guidelines. The landscape guidelines would be best suited to this, as they correspond to a landscape plan based on the Italian model, which includes ecological network plans. This would give municipalities a reference plan that they could use as a basis for defining ecological corridors at the municipal level.

Municipal landscape plan

It is advisable to add a new category of ecological network to this plan, preserving and protecting the area in question. It is recommended that a new category, “ecological corridor,” be added at the provincial level as an urban planning designation for “protected landscape sites.”

Municipal development programs

It is recommended to insert the defined corridors into the development program for protection, adopting safety measures, limiting artificial barriers, and above all restore potential corridors.



Other sector instruments to be coordinated or upgraded are the provincial plan for sustainable mobility, the forest plans and the Program for Rural Development.



5 Future developments

During the Regional Working Group meetings, concrete proposals were discussed for continuing the work after the PlanToConnect project.

The need emerged for a more concrete and approved catalogue of measures for public administration, containing several points:

- Delineation and protection/safeguarding of priority corridors with concrete mapping and visualisation, and data collection at different levels and for different animal groups.
- Define more concrete measures to improve corridors in coordination with the various provincial offices (infrastructure, guidance systems, technology, information, awareness raising).
- Implementation of pilot projects with monitoring (for different situations and approaches): functional monitoring of corridors should be coordinated with the Forestry Department, including the Wildlife Management Office.

The need for coordination at various levels has emerged:

- A coordination between municipal ecological networks, which will be defined in municipal development programmes, is necessary in order to avoid harmonisation problems.
- A coordination between neighbouring provinces and regions is necessary to harmonise ecological networks at national and transnational level.
- A coordination at Alpine level with the network of spatial planners in the Alps – AlpPlan, CIPRA, the Alpine Convention and EUSALP – can be further established to bring experiences and objectives from the international level to the provincial level.

It is proposed that regular meetings continue to be held every six months.



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)

Summary of technical proposal for implementing red deer habitat network in spatial plans and sector instruments - South Tyrol

Authors:

Peter Laner, Alessia Pilati, Vittoria Vettorazzo, Filippo Favilli
Contact: peter.laner@eurac.edu

Eurac Research – Institute for Regional Development

Layout

Peter Laner, Eurac Research – Institute for Regional Development

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