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ESPON InTerAlp [Interface territories across the Alpine region] - Policy Brief

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ESPON

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POLICY BRIEF

Interface territories across the Alpine region

A new geography



The ESPON InTerAlp project aims at a better understanding of interface territories between the peri-Alpine lowlands and the inner-Alpine highlands. By mapping patterns, flows and spatial development trends, this project supports the development of appropriate governance and policy approaches. Alpine interface territories are a spatial category that has hardly been object of analytical reflections. While extensive knowledge exists for many spatial categories, including mountain, urban, rural and lake areas (e.g. ESPON Alps2050, ESPON LAKES, ESPON METRO, ESPON PROFECY), the spatial dynamics of the transition areas between inner and outer Alpine zones have yet to be subjected to systematic analysis. These regions are often perceived either as peripheral from a mountain perspective or as suburban from a core city perspective. Putting them at the focus of regional development and policy analyses is a novel approach.

Alpine interface territories link mountainous and inner-Alpine areas with pre-Alpine lowlands and, thus, are a very specific territorial type: Highly dynamic flows and interdependencies as well as controversial stakeholder interests meet in a rather limited spatial framework. Organizing sustainable spatial development in this geographical context is a challenge. These challenges extend beyond administrative boundaries and require pan-Alpine strategies and cross-border instruments in spatial planning and development (e.g. in relation to ecological fragmentation, sharp socio-economic disparities and multi-level governance obstacles).

The ESPON InTerAlp project provides a systematic exploration of the specific spatial dynamics, challenges and opportunities associated with Alpine interface territories. The analysis addresses a number of key questions, including the definition and delineation of Alpine interface territories, the identification of common challenges and opportunities, and the review of governance frameworks and instruments for Alpine spatial planning and development. The InTerAlp project contributes to a comprehensive understanding of the functional territorial development dynamics and flows that characterise Alpine interface territories. In addition, the project analysed the types and quality of governance and policy mechanisms that are currently in place. The project provides evidence-based guidance towards a more integrated, sustainable and inclusive development of the Alpine region, with particular reference to Alpine interface territories, for the benefit of both urban and rural areas in the Alpine context.

The ESPON InTerAlp Policy Brief provides regional and national stakeholders across the Alpine region with new territorial evidence to address the specific challenges and opportunities of Alpine interface territories to facilitate integrated and sustainable spatial development.

KEY POLICY MESSAGES

- It is essential to **recognise interface areas as a specific geographic category**. Interface territories are a unique spatial category due to their funnel positions, gateway functions, and high territorial diversity, which often leads to significant socio-economic and environmental contrasts. Recognising this specific geography is necessary to develop effective policies and strategies tailored to the needs of these regions.
- It is crucial to **address the common challenges faced by interface areas**. These regions are characterised by a high density of important functions, flows, and dynamics, such as transport infrastructure and services of general interest, but often face limited space for development. Spatial planning strategies need to address the challenge of 'double demand on half the space', balancing development with environmental protection and conservation.
- The **governance of Alpine interface areas requires a tailor-made approach**. Administrative boundaries in these regions often do not correspond to functional flows and interdependencies, making governance particularly challenging. The concept of 'soft spaces' is crucial for managing interface territories, as it emphasises flexibility and the importance of cooperation between different administrative levels. Inter-municipal and cross-border cooperation, as well as multi-level governance, must be fostered to address the unique challenges of these regions.

1 Introduction

The ESPON InTerAlp project aims to improve the understanding of interface areas between the peri-Alpine lowlands and the inner-Alpine highlands (see Figure 1). By mapping patterns, flows and spatial development trends, this research aims to provide a basis for improving governance and policy approaches. Alpine interface areas are a highly relevant spatial category: In those territories highly dynamic flows and interdependencies as well as controversial stakeholder interests meet in a rather limited spatial framework. The focus on the combination of mountain and lowland areas constitutes a new, very specific spatial type.

The ESPON InTerAlp project is strongly oriented towards stakeholder and policy needs. The project aims to facilitate the integration of policy uptake, in particular in spatial development and planning across the system of multi-level governance, as well as sectoral policies related to transport, energy, and water management. The policy implications of the project for Alpine interface areas are based on the existing knowledge base on Alpine spatial development, drawing on the findings of key initiatives such as the ESPON Alps2050 project, the EUSALP Joint Paper on Spatial Planning, the 9th Report on the State of the Alps (RSA), focusing on Alpine Towns, the RSA10 on Quality of Life, and the Interreg Alpine Space Programme.

In order to enrich this knowledge base with a spatial perspective on Alpine interface territories, the policy implications of the InTerAlp project are informed by an extensive participatory process. This process included several feedback loops with the members of the project Steering Committee and expert interviews with stakeholders involved in Alpine spatial planning and development. A major output of the project is the ESPON InTerAlp Policy Brief, which summarises the main research findings and formulates policy recommendations. This policy brief integrates elements from a participatory process that sought to involve stakeholders in the development of policy recommendations for Alpine interface areas.

During the course of the project, a number of events and consultations contributed to the development of the policy brief. At the second Steering Committee meeting, held in Vienna on 11 June 2024, the project team presented initial 'lines of thought' to pave the way from analysis to policy recommendations. These discussions were incorporated into a background paper, which highlighted key starting points for policy guidelines and presented three postulates for Alpine interface areas, along with several analytical arguments. This document was shared with the Steering Committee in August and returned to the project team with comments in September. On 30 September, an online workshop was held with about 50 experts in Alpine spatial development. The workshop provided an opportunity to present the analytical results and draft policy guidelines, with constructive feedback from stakeholders enriching the policy perspectives for Alpine interface areas. This feedback was documented and incorporated into the further development of the policy brief.

Figure 1
The 'mountain-lowland' perspective: Turin and Grenoble/Rhône-Alpes as two examples for Alpine interface territories





Photo left: View of the metropolitan area of Turin, with the mountain valleys in the background (Source: Andrea Mucelli, CC BY-NC-SA 2.0, https://www.flickr.com/photos/bluestardrop/8296928890; Photo right: Air photo of the Presqu'île, Grenoble Metropolitan Area, North-West Territory (Source: Agence d'urbanisme de la région grenobloise).

In addition, an online survey was conducted from 2 October to 23 October, inviting participants, including the online workshop participants and a wider group of Alpine spatial development experts, to refine the InTerAlp policy recommendations. A total of 21 experts provided a comprehensive feedback, which was reviewed and integrated into the policy brief. Following the feedback from the Steering Committee, the project team undertook a final revision of the policy guidelines. The workshop participants' feedback provided valuable insights into regional contexts and enriched the research findings with local and regional examples, thereby strengthening the relevance and applicability of the policy recommendations. The feedback gathered from the online survey highlighted several key themes regarding the challenges and opportunities in Alpine interface areas. These regions are recognized for their diversity, encompassing peri-Alpine, inner-Alpine, and cross-border areas. The feedback highlighted the ecological sensitivity and socio-economic contrasts of these areas, which require tailor-made spatial development strategies. Participants emphasised the need for innovative governance models, in particular 'soft governance' approaches that promote cooperation and adaptability rather than top-down structures.

Overall, the ESPON InTerAlp project contributes with its findings and territorial evidence to the Alpine Spatial Development Perspective (ASDP), initiated by the Alpine Convention Working Group on Spatial Planning and Sustainable Development (AC WGSPSD). The first possibilities of integrating the results of the project into the ASDP have already been explored in an online meeting with members of the AC WG SPSD (13/11/24). The ASDP aims at developing a common vision for the long-term spatial development of the Alpine area. This perspective emphasises the need for policy recommendations and practical implementation strategies to address the unique challenges and opportunities across the Alpine region, promoting sustainable development and cross-border cooperation. The findings of the ESPON InTerAlp project are an element for shaping the future of Alpine spatial planning and development with a special perspective on Alpine interface areas.

2
Mapping interface areas across the Alpine region

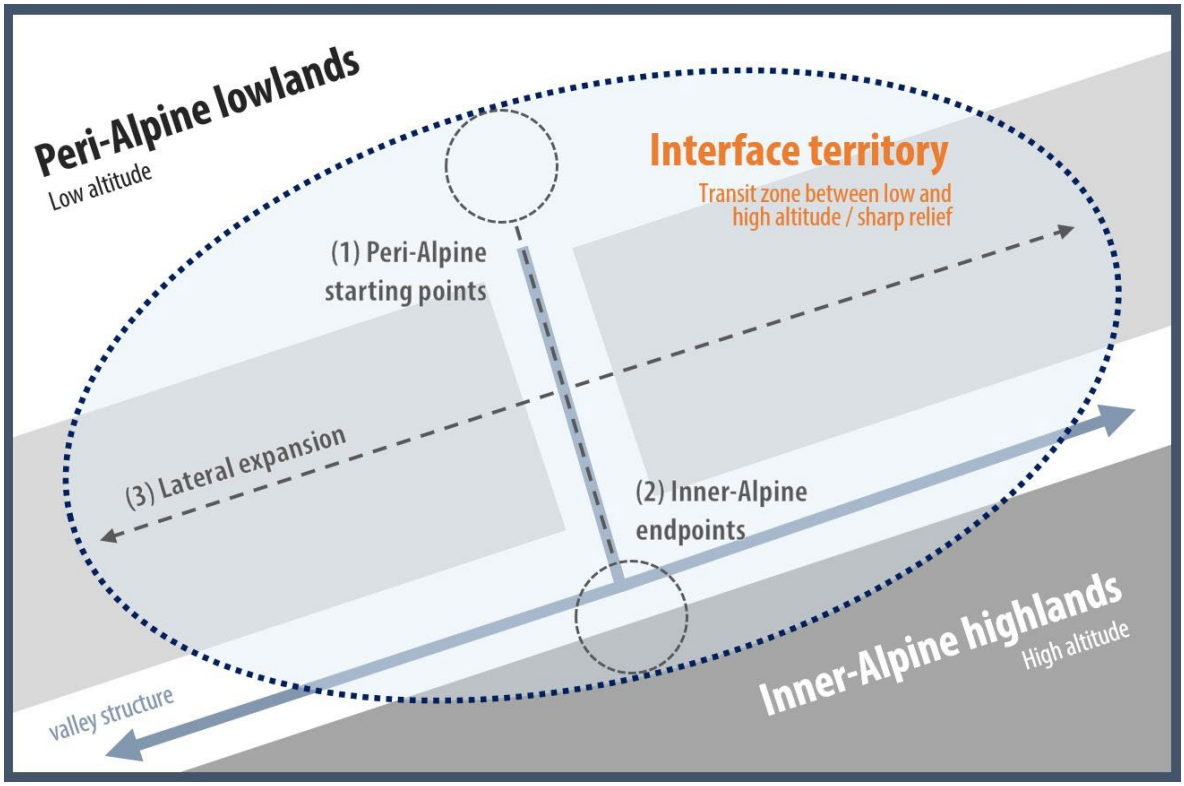
Interface areas are a very specific type of territory, linking mountainous inner-Alpine areas with pre-Alpine lowlands: Highly dynamic flows and interdependencies as well as controversial stakeholder interests meet in a rather complex spatial framework (see Figure 2). The definition and delineation has to go beyond existing administrative boundaries and capture the complex functional dynamics that transcend these boundaries. Organizing sustainable spatial development in this geographical context is a challenge. Alpine interface areas show a high degree of spatial diversity, including natural and vulnerable mountain areas as well as economically strong lowland areas and large urban centres. The spatial development dynamics of the areas situated between the inner and outer parts of the mountain areas have not yet been subjected to a comprehensive analysis. General criteria for the spatial concretisation include the following aspects:

1) Interface territories link the peri-Alpine lowlands (low altitude) with the inner-Alpine highlands (high altitude). They involve several kinds of flows and relations, such as transport flows, demo-graphic interlinkages and ecosystem-services.

2) Interface territories represent the transition zone between low and high altitude, encompassing areas with sharp relief.

3) The definition of interface territories is based on characteristics of the Alpine settlement system, the transport infrastructure and morphological aspects such as topographical elevation and the river system. Spatial patterns in demographic organisation, environmental regionalisation and transport infrastructure provide the data framework (e.g. accessibility to central places, functional urban areas, water catchment areas, transport infrastructure, geomorphological characteristics like altitude and slope).

Figure 2
Schematic of the definition of interface territories

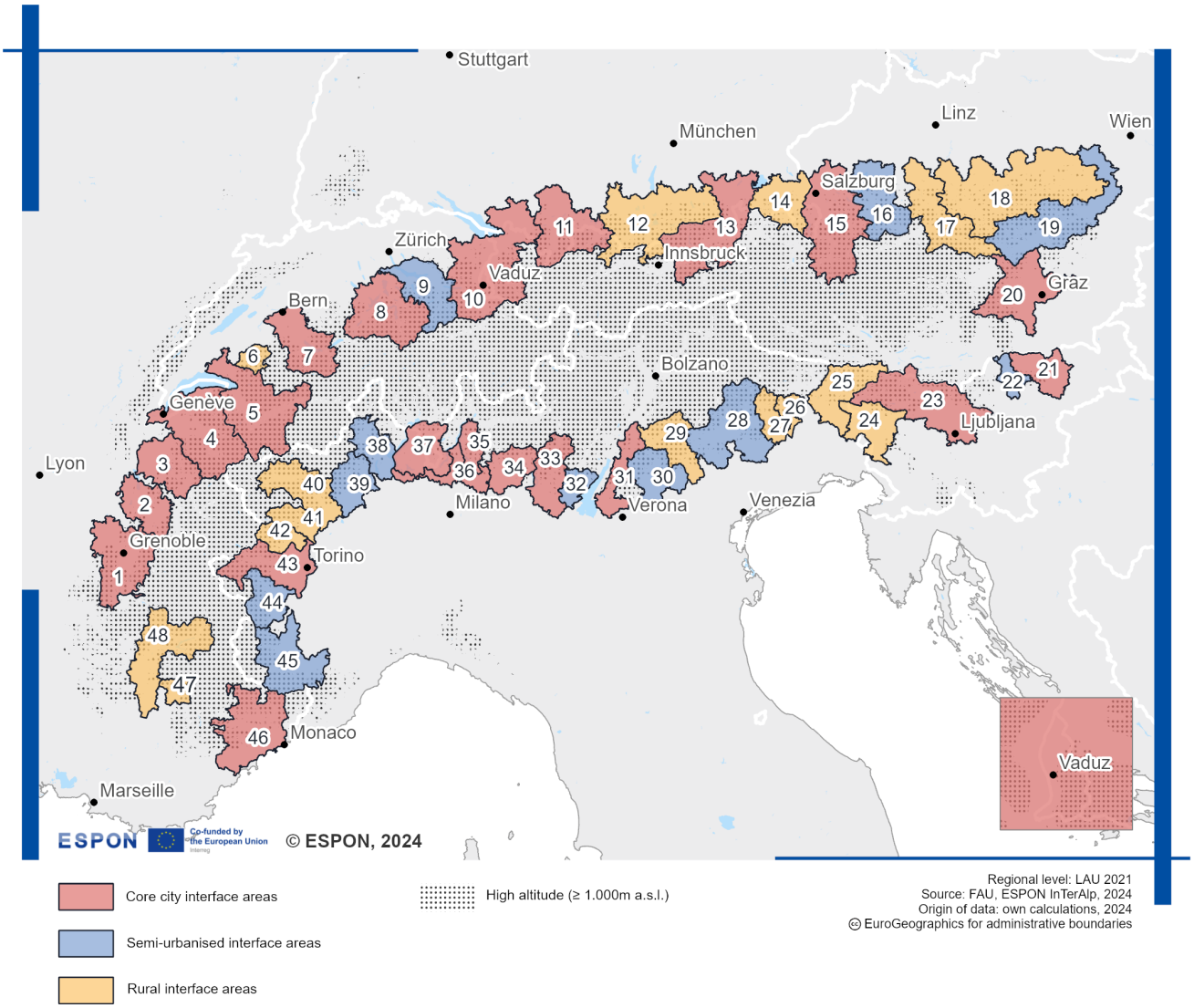


The concrete methodological definition is based on (1) peri-Alpine 'starting points', (2) inner-Alpine 'end points' and (3) the lateral expansion of interface territories. By definition, interface areas do not overlap.

Map 1 illustrates the delineation of Alpine interface territories. These interface areas are part of several overlapping governance frameworks (e.g. Alpine Convention, EUSALP). They are often addressed by different spatial planning systems and are characterised by flows and interdependencies that go beyond their perimeters. The map shows that interface areas almost form a 'ring' around the morphological Alps, given the relatively high density of settlements in this area.

The map shows that interface areas almost form a 'ring' around the morphological Alps even if this ring is not 'closed'. Some areas do not have any interface areas like those south of Grenoble, north-east of Ljubljana or near Bern. These 'interruptions' can be explained by the spatial structure: The interface areas are based on characteristics of the Alpine settlement system, transport infrastructure and morphological aspects such as topographic relief and the river system. The natural barriers (steep topography and altitudes above 1,000 m) interrupt settlement and infrastructure links.

Map 1
Interface territories across the Alpine region



The interface territories are of different characteristic and can be categorized in three spatial groups:

- Core city interface areas have a densely populated core city within their perimeter (e.g. Turin, Ljubljana/Julian Alps, Grenoble/Rhône-Alpes region, Bern/Thun, Salzburg). Those territories show a high gradient from densely populated to sparsely populated natural areas.
- Semi-urbanized interface areas bring together intermediately populated areas (e.g. Vienna/Mürz Valley, Zürich/Schwyz/Glarus, Vicenza/Schio). The semi-urbanized interface territories have a medium population density in more than half of their area. These areas mostly comprise a comprehensive transport infrastructure (railway and primary roads) and are linked by transport infrastructure to at least one Functional Urban Area (mostly in the peri-Alpine lowlands).
- Rural interface areas are rather sparsely populated (e.g. Sisteron/Gap, Aosta Valley, Liezen, Bulle, Bad Reichenhall/Berchtesgaden Alps, Gorizia/Nova Gorica). The rural interface territories have a transport system based at least on primary roads (but not motorways). Whereas the core city and semi-urbanized interface territories are linked to large transport corridors, this is different for the rural interface territories.

The table assigns the interface territories to these spatial typologies.

Spatial typology	Interface areas
Core city interface areas	(01) Grenoble/Rhône-Alpes region (FR), (02) Chambéry (FR), (03) Annecy (FR), (04) Geneva/Annemasse/Thonon-les-Bains (CH/FR), (05) Rhone Valley (CH/FR), (07) Bern/Thun (CH), (08) Zug/Luzern (CH), (10) Alpine Rhine Valley (DE/CH/AT/LI), (11) Allgovia (DE/AT), (13) Rosenheim (DE/AT), (15) Salzburg (AT/DE), (20) Graz (AT), (21) Maribor (SI), (23) Ljubljana/Julian Alps (SI/AT), (31) Trento (IT), (33) Brescia (IT), (34) Bergamo (IT), (35) Lecco (IT), (36) Milano fringe (IT), (37) Lugano (CH/IT), (43) Turin (IT), (46) Nice (FR)
Semi-urbanised interface areas	(09) Zürich/Schwyz/Glarus (CH), (16) Gmunden (AT), (19) Vienna/Mürz Valley (AT), (22) Velenje (SI), (28) Belluno/Piave Valley (IT), (30) Vicenza/Schio (IT), (32) Gavardo/Salò (IT), (38) Domodossola (IT), (39) Biella/Borgomanero (IT), (44) Pinerolo (IT), (45) Cuneo/Cottian Alps (IT)
Rural interface areas	(06) Bulle (CH), (12) Munich fringe (DE/AT), (14) Bad Reichenhall/Berchtesgaden Alps (DE/AT), (17) Liezen (AT), (18) Vienna/Lower Austria fringe (AT), (24) Gorizia/Nova Gorica (IT/SI), (25) Udine (IT), (26) Maniago (IT), (27) Pordenone (IT), (29) Bassano del Grappa (IT), (40) Aosta Valley (IT), (41) Cuorgnè (IT), (42) Ciriè (IT), (47) Digne-les- Bains (FR), (48) Sisteron/Gap (FR)

3
Policy guidelines for interface areas

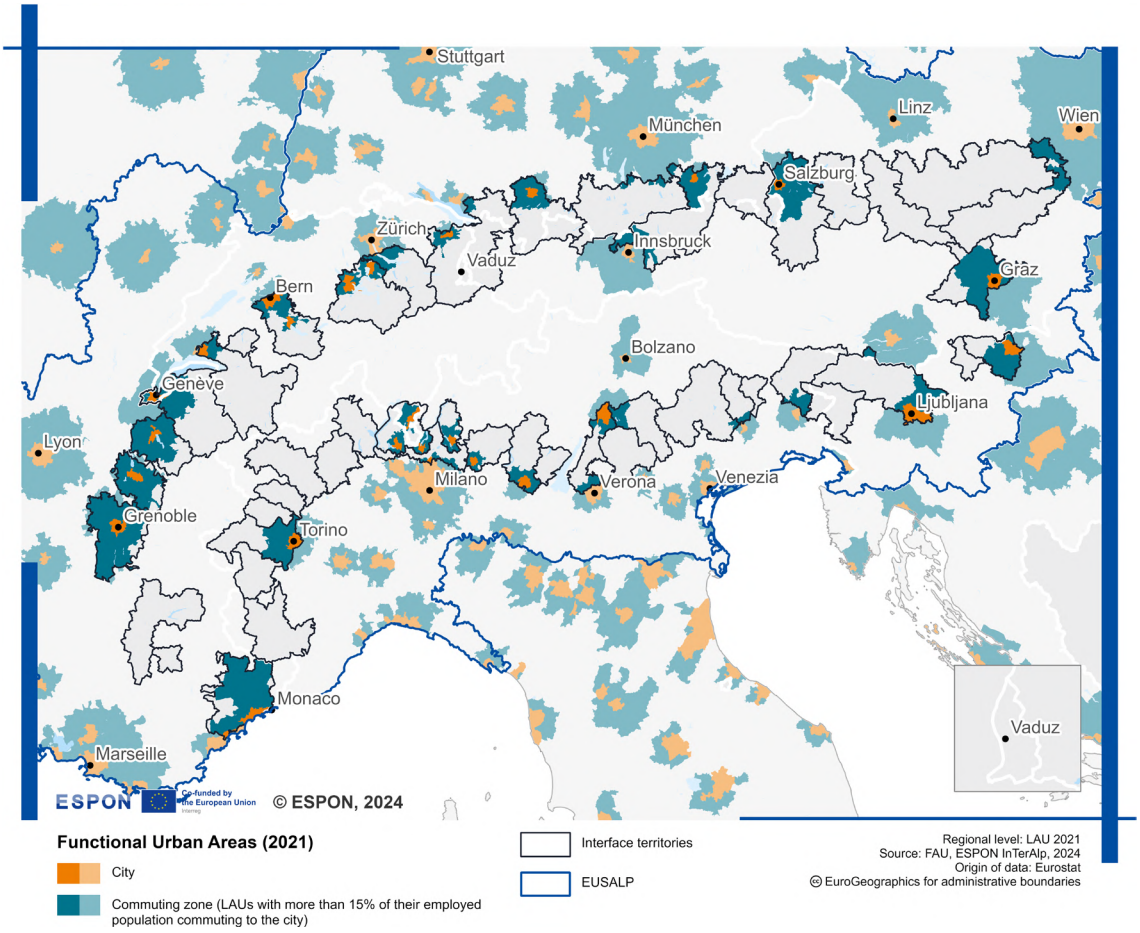
Recognise Alpine interface areas as a specific geographic category

Alpine interface areas: A new geography

Interface areas are a particular spatial category that has not yet been explicitly framed from a policy perspective. Policy framing has to consider the following key points: Especially core city and semi-urbanized interface areas are characterized by funnel positions and gateway functions. They are areas of high territorial diversity, where lowland meets mountains and the degree of urbanization is very often heterogeneous. Due to this geographical structure, the areas often comprise sharp socioeconomic and ecological contrasts (e.g. in terms of ecological connectivity, opportunities for recreation, population development). This positioning comes along with a territorial challenge for all interface areas, as there are often very limited options for dealing with a high number and variety of land use demands due to the scarcity of space. This is even more challenging as functional characteristics and administrative structures are not always a good fit.

Recognizing this specific geography means to understand interface areas as a relevant spatial category across the Alpine region alongside Functional Urban Areas (FUAs), high mountain areas, metropolitan regions and transnational corridors. Map 2 pictures both, the delineation of Alpine interface territories, as well as Functional Urban Areas across Europe. The map shows very little overlap between Alpine interface territories and existing Functional Urban Areas – which is striking, as the settlement system is the backbone of the interface definition. Addressing interface areas as a new geography is a precondition for the development of effective policies. Focusing on the relevant flows, structures as well as potentials and challenges means to aim at a tailor-made strategy of territorial development.

Map 2
The Alpine region beyond Functional Urban Areas



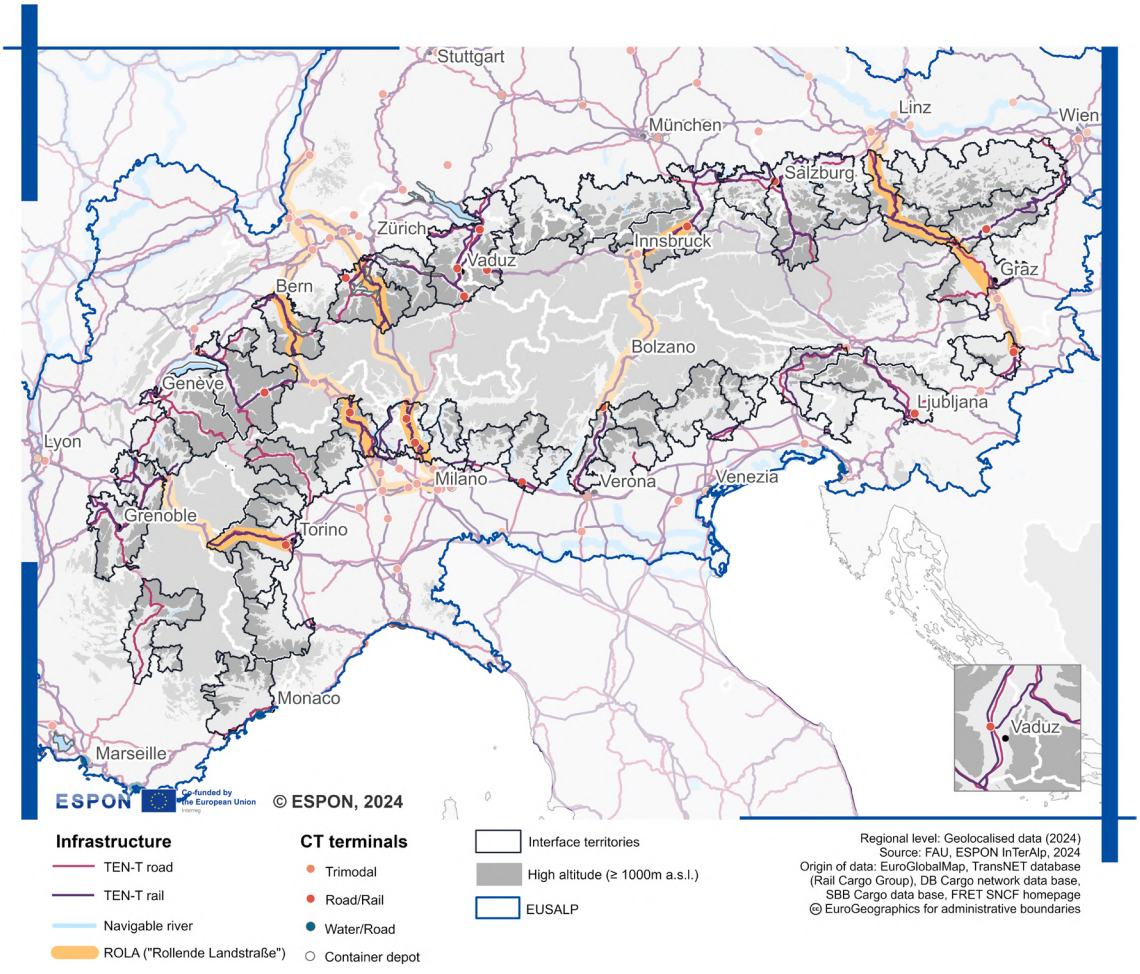
Interface areas as geographic funnels

Interface areas take a special role as gateways in the European spatial structure. They are areas where the main European transport infrastructure enters the Alpine highlands. The most frequented transalpine corridors originate and terminate within interface areas (e.g. Brenner, Gotthard, Fréjus). Others show 'bottleneck constellations' (e.g. German Autobahn 7 ends in interface territory Allgovia near Füssen). Many areas have an important cross-roads function, in particular when connections entering the Alpine area cross those going in parallel to the relief (e.g. Geneva, Grenoble, Alpine Rhine Valley). Moreover, transit flows can also hinder intra-regional accessibility (towns along transit corridors often suffer traffic jams due to transit traffic and by-passing, e.g. Steinach am Brenner).

Map 3 shows TEN-T axes for rail and road as well as combined transport terminals and 'Rollende Landstraße' axes (rolling road is a transport system for intermodal transport on rail, i.e. a train that transports trucks on rail). Across the Alpine area, combined transport terminals are mainly located in interface areas, where space is getting 'narrower'.

Only a limited number of road and railway axes carry the flows, often in rather small corridors. In this situation, especially core city and semi-urbanized interface areas tend to be 'hot spots' of transport and mobility policies. In the InTerAlp case regions, the debate on transport and mobility in spatial development is intense (e.g. in the Alpine Rhine Valley, Grenoble Rhône-Alpes, Ljubljana/Julian Alps, Munich-Tyrol, Turin). The argument of 'double demand within half the space' captures this situation in a condensed way. It reflects that in interface areas the demand for transport infrastructure is often much higher than in most other spatial categories. It also refers to the fact that interface areas combine high intensities of recreational demand and opportunities for recreation in close proximity to each other. In addition, all case regions are part of the wider TEN-T network and are 'gateways' for lowland-mountain transit mobility and transport across the Alpine region (see Box 1).

Map 3
Geographic funnel situations within interface areas



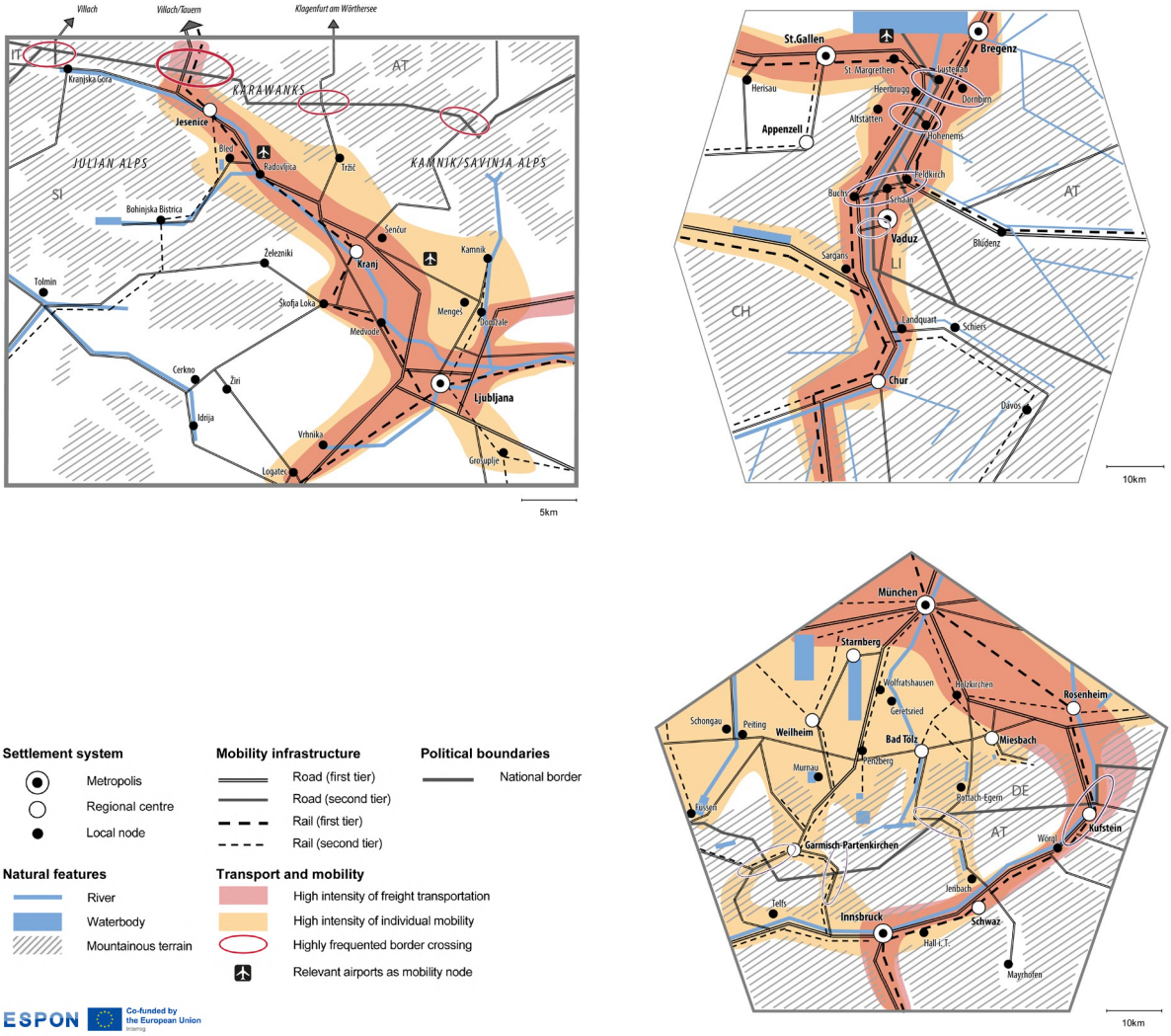
BOX 1

Gateway functions and funneling situations in interface areas

Interface territories of Ljubljana/Julian Alps (upper left), Alpine Rhine Valley (upper right) and Munich-Tyrol (lower right)

In the Alpine region, interface areas are those regions where available space is becoming increasingly limited. Only a modest number of road and rail axes serve to facilitate the movement of people and goods, frequently operating within relatively narrow corridors. In such circumstances, interface areas frequently emerge as focal points for transport and mobility policy. In the majority of the InTerAlp case regions, the debate surrounding the relationship between transport and mobility in spatial development is a prominent feature of the regional policy landscape. This is evidenced by the high levels of freight transportation and individual mobility observed for example in the case regions of Ljubljana/ Julian Alps, Alpine Rhine Valley and Munich-Tyrol. These interface areas are part of the wider TEN-T network and act as 'gateways' for lowland-mountain transit mobility and transport across the Alpine region. Furthermore, these interface areas exhibit a high level of recreation demand and opportunity in close proximity to each other.

Source: ESPON InTerAlp Case study portfolio, 2024.



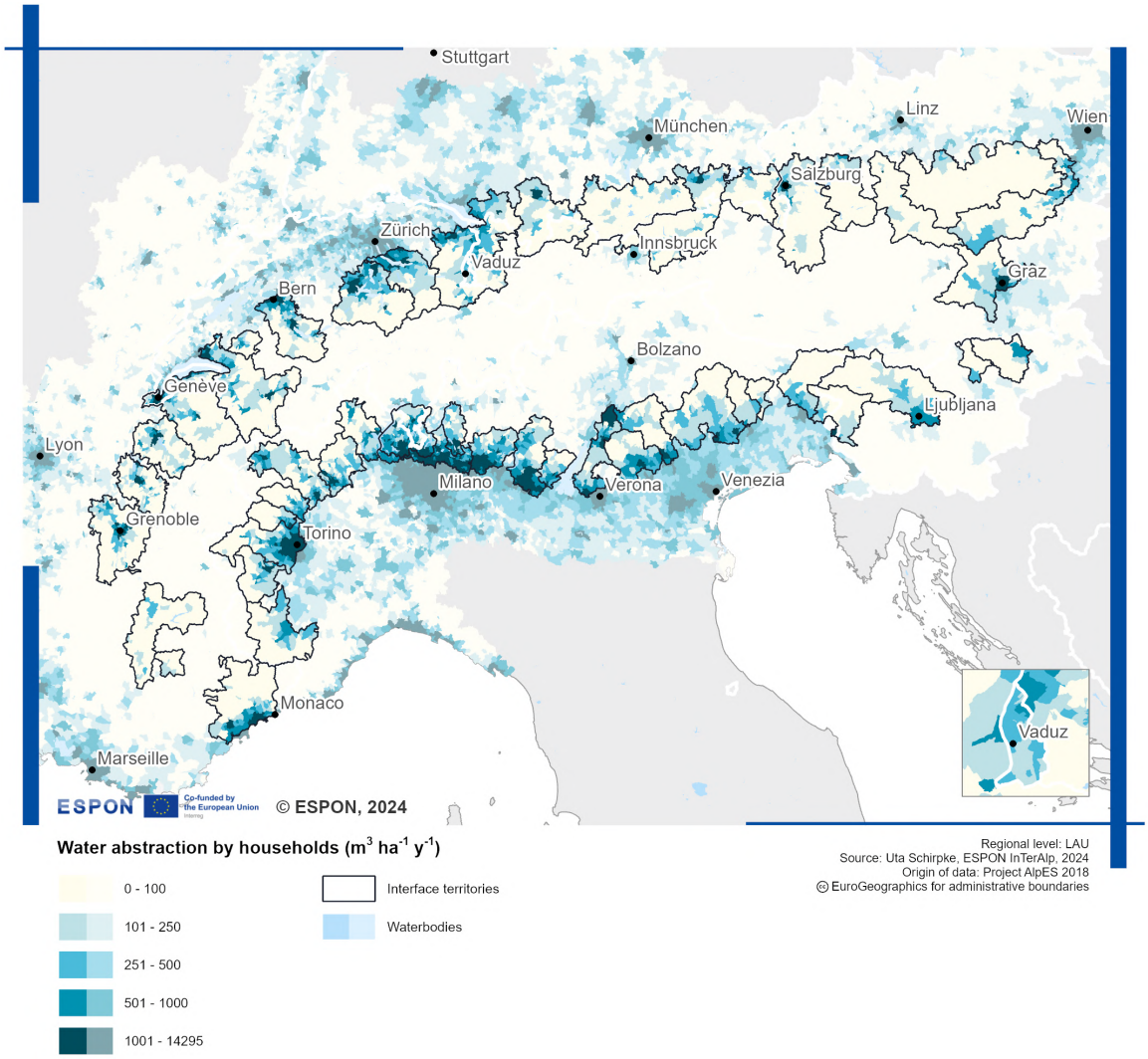
Territories with sharp contrasts

Interface areas represent strong 'connectors' situated between high mountain regions and the surrounding lowlands. This is linked to one of the main findings of the 9th Report on the State of the Alps highlighting that Alpine towns are 'brokers' between rural areas and the main metropolises in and around the Alps.

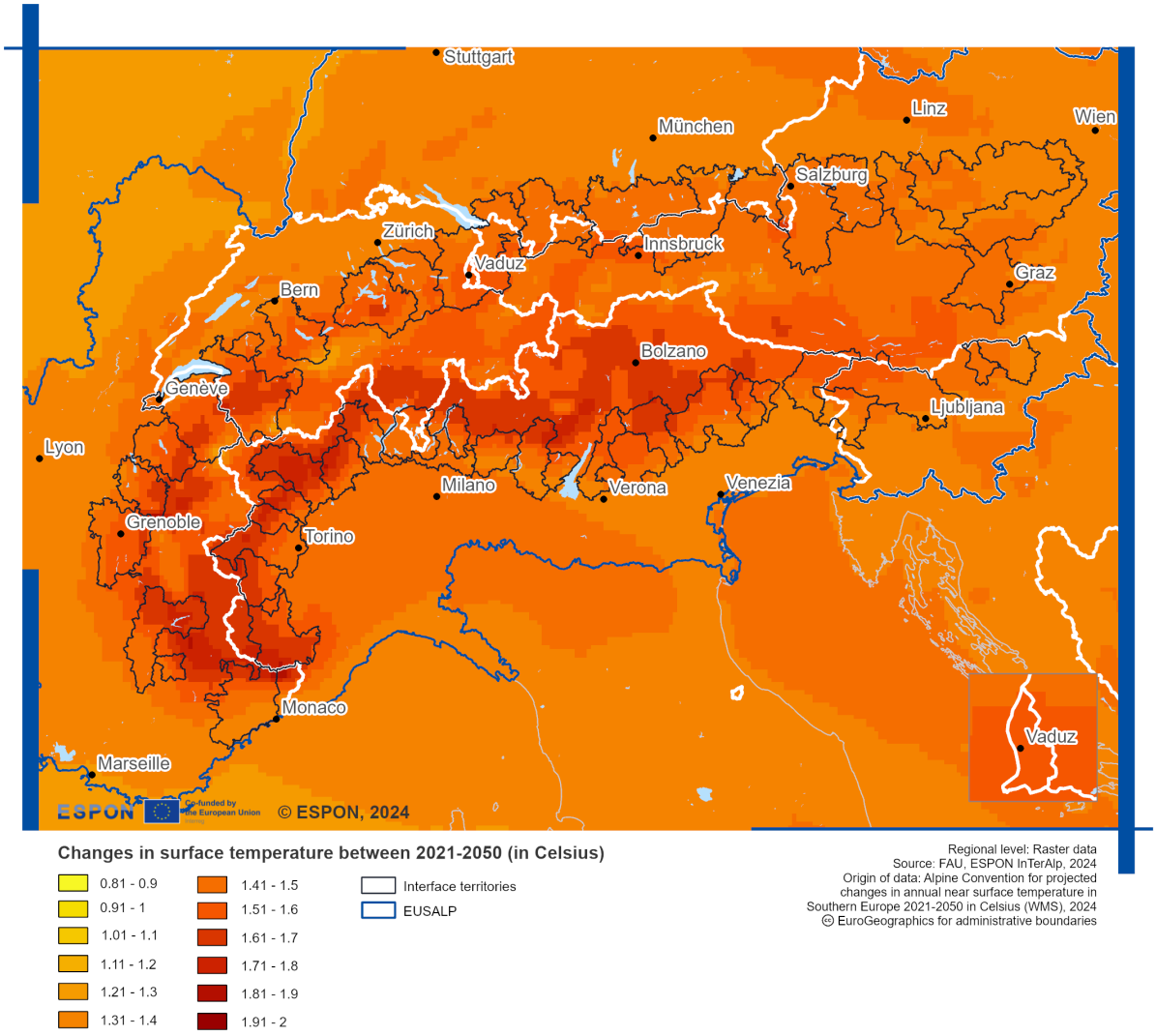
Transport connectivity is crucial for socio-economic prosperity. At the same time, ecological connectivity is crucial for wildlife plagued by habitat fragmentation (i.e. the physical disintegration of contiguous habitats into smaller patches) induced by land use dynamics, urban sprawl and human activities. Core city interface areas see particularly sharp contrasts between low and high connectivity areas, even if the other spatial types of interfaces are concerned as well.

Map 4 shows the sharp contrasts in interface areas exemplified by water abstraction. The range of values within the interface areas connects lowland areas that have the highest abstraction rates with mountainous areas that are generally characterized by low abstraction rates due to low population density. This spatial pattern is particularly evident, for example, in the interface areas of the Lombardy region or in Turin, Grenoble/Rhône-Alpes and Graz.

Map 4
Water abstraction in interface areas

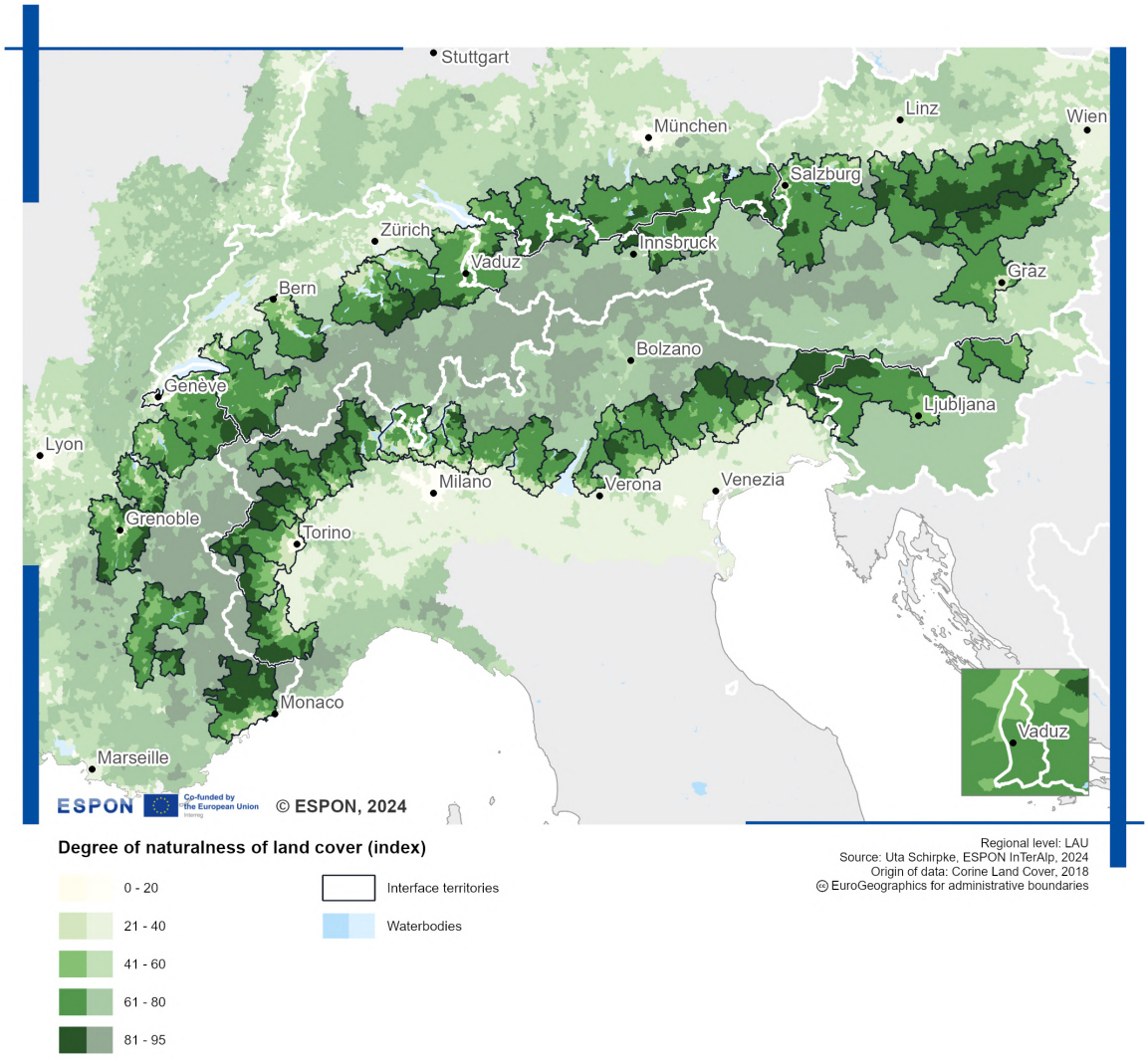


Map 5
Temperature change until 2050 in interface areas



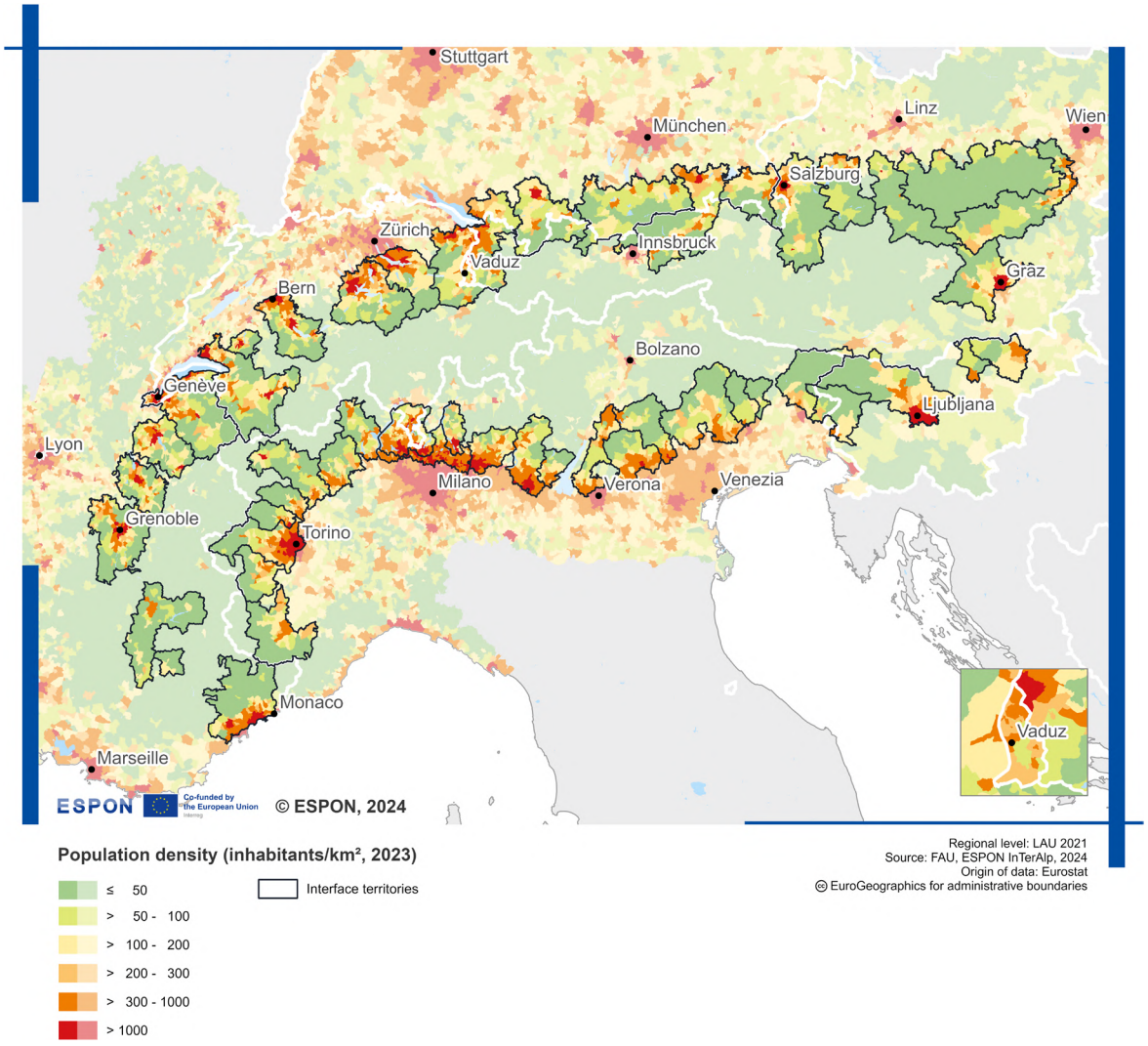
It is worth mentioning that a series of further indicators display similar patterns of sharp contrasts. Map 5 shows the projected changes in surface temperature between 2021-2050 (in Celsius). The temperature increase by 2050 is particularly pronounced in the interface areas. The spatial pattern shows that the inner-Alpine areas will have a higher surface temperature rise than the surrounding lowlands, or their temperature will change earlier. This is particularly true for the Italian and French interface areas. In these areas, the rural and natural parts are most vulnerable to rising temperatures. This implicates that towns and cities in interface areas have to play a pioneering role in addressing climate change and the economic, social, cultural and environmental impacts of increasing urbanisation. Early adoption strategies in the face of climate change might create 'first mover advantages' in transformation times.

Map 6
Naturalness in interface areas



At the same time, interface areas comprise a high diversity of natural and densely populated areas in immediate proximity. Map 6 shows the degree of human impact on the natural environment. This index is an integrative measure of the impact of all human intervention on ecosystems. High index values indicate less human impact and more natural ecosystems, while low index values represent highly modified ecosystems. Inner-Alpine areas generally host more natural ecosystems than peri-Alpine lowland areas. This contrast is reflected in the interface territories, which include the entire gradient from highly natural areas to highly modified ecosystems. It is particularly apparent in the Italian interface territories. Near-natural and semi-natural ecosystems are essential to preserve biodiversity, providing suitable habitat for plant and animal species. Such ecosystems are also more resilient towards natural hazards and vital to support human-wellbeing. However, human activities lead to direct and indirect changes of the biophysical environment and the ecosystems. Sustainable management practices in agriculture and forestry have thereby less impact on ecosystems than intensive farming practices, intensive forestry, and urbanization.

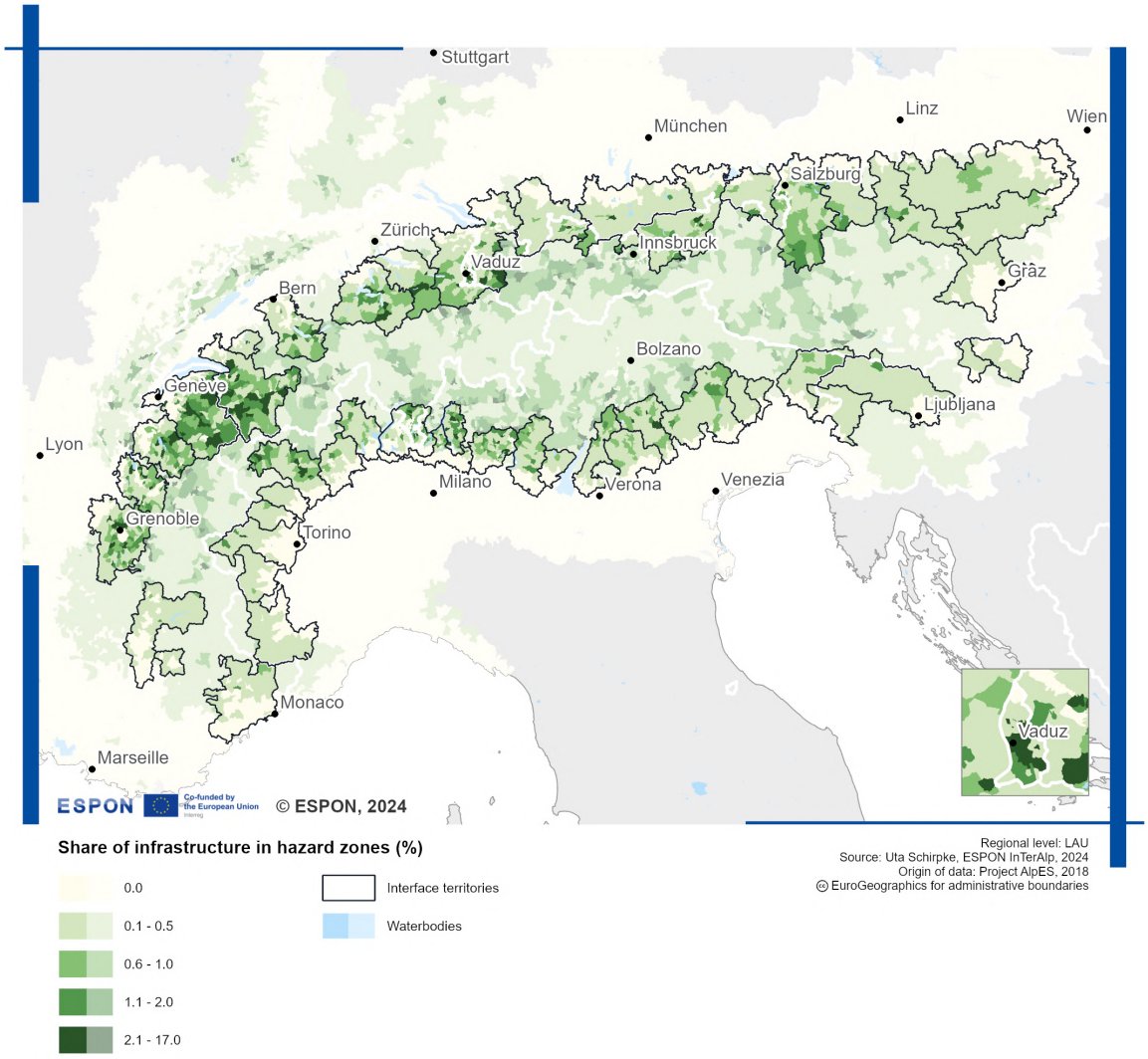
Map 7
Population density in interface areas



Map 7 shows the population density in 2023 at the municipal level. Despite differences in national and regional contexts, the Alpine settlement system shows considerable similarities. Compared to the peri-Alpine lowlands, the inner-Alpine areas show a predominantly lower population density. This reflects the constraints imposed by the mountainous terrain, which limits the extent and intensity of human settlement. Accordingly, the morphological structure of the inner-Alpine region has a strong influence on settlement patterns, whereas the peri-Alpine areas are characterised by a ring of agglomeration around the mountain region. The interface areas show a strong contrast between densely and sparsely populated areas, highlighting the heterogeneity of settlement patterns in these transition zones between the peri-Alpine low-lands and the inner-Alpine highlands. The map also illustrates the fundamental influence of the valleys on the configuration of the settlement structure. Examples include the Inn valley, east of Innsbruck; the Alpine Rhine valley, which ex-tends north and south of Liechtenstein; the Isère valley, between Geneva and Grenoble; and the Sava valley in Slovenia. These valleys act as focal points for population concentration, underlining their importance within the wider Alpine settlement system.

Map 8 shows the share of infrastructure located in avalanche and rock-fall hazard zones, representing the demand for protection forest. The indicator quantifies the share of human infrastructure within each municipality located in avalanche and rock-fall hazard zones. The map clearly depicts again sharp contrasts between inner-Alpine and peri-Alpine areas. Due to the high elevation contrasts particularly in the interface territories, these areas show a high demand for protection forest. Mountain hazards such as avalanches and rockfall can threaten human infrastructures and lives. By quantifying the share of human infrastructure located in avalanche and rock-fall hazard zones, the need for protection measures, such as protection forests, becomes relevant.

Map 8
Infrastructure in hazard zones in interface areas



Moreover, the InTerAlp case studies also display striking differences between lowlands and mountain areas, especially regarding tourism intensities, energy production capacities, drinking water supply and transport networks. These contrasts come along with a series of challenges for spatial development, that can be grouped in four arguments:

First, transport facilities and technical infrastructure experience peak demand. Given the limited space for infrastructure enlargements and the high financial burdens, there are no easy solutions in most cases. Second, energy and drinking water are sensitive issues in most cases. Interface areas serve also as energy transit zones that need effective networks. At the same time, power-lines in direct proximity to Alpine settlement areas in valleys are a sensitive planning object. The dependencies of larger cities on water and energy sources from mountainous areas is also a prominent infrastructure issue in most interface areas. Moreover, climate change and melting glaciers increase the challenges. Third, the balance between tourism and environment is a multifaceted issue. On the one hand, tendencies of overtourism can occur in natural places (e.g. lakes, mountain peaks, hiking trails, skiing areas, etc.). On the other hand, traffic flows from and to the attractions can result in traffic jams within settlement areas or by-passing roads. Generally speaking, linear transport infrastructure plays a role for natural habitat fragmentation processes. Fourth, many interface territories are economically successful areas, embedded in a highly attractive natural setting. This certainly makes interface areas attractive locations for economic development. At the same time, ensuring effective organization of services of general interest, affordable housing and interregional accessibility easily becomes a challenge – but is a prerequisite for attracting a skilled labour force.

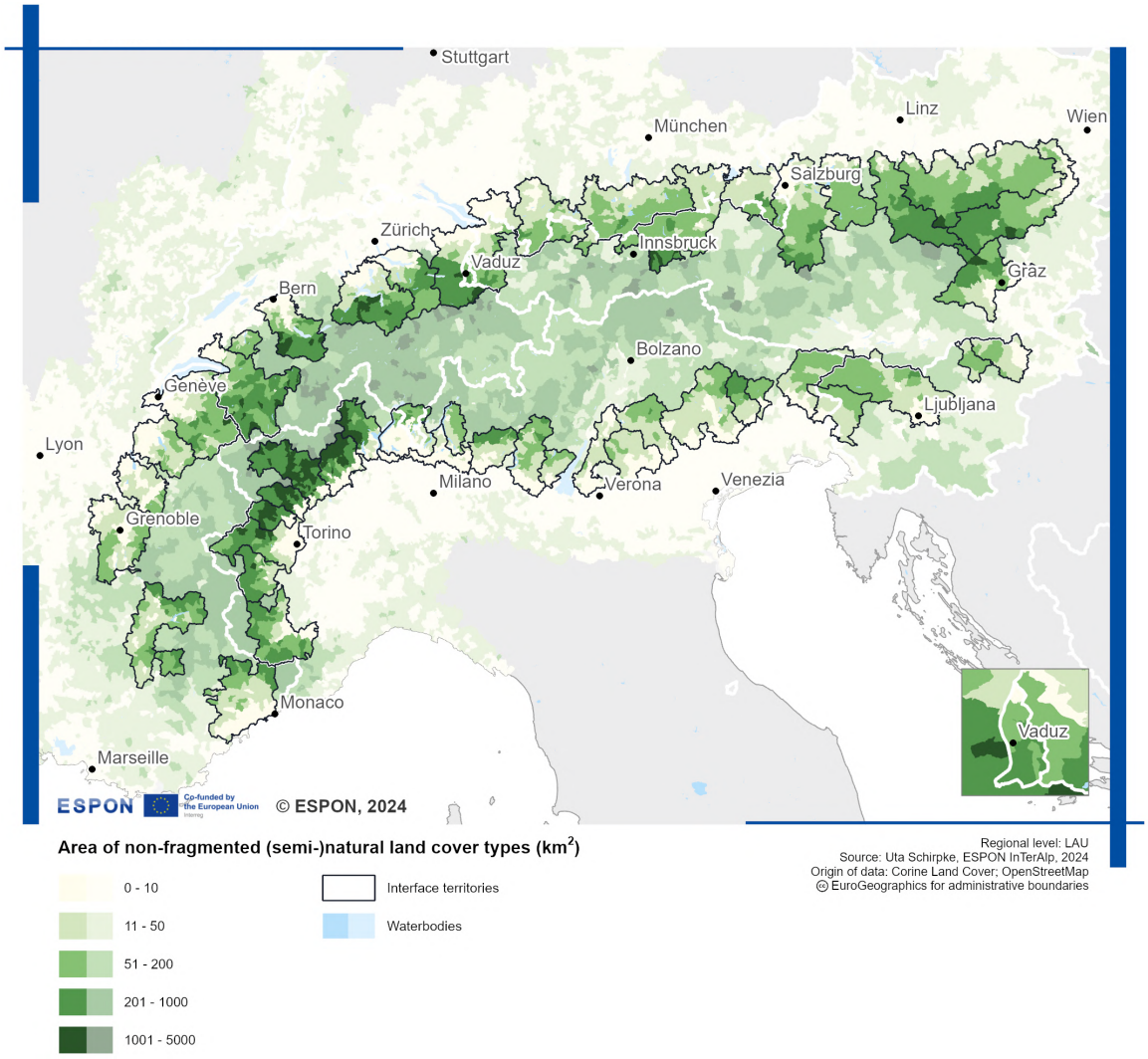
Address the specific common challenges of interface areas

Common challenges

Recognising the geographic specificities of these areas also means acknowledging that there are a number of common challenges. As these areas have a high degree of territorial diversity, the challenges of green infrastructure, transport, tourism, energy and natural hazard management are very much the same. At the same time, measures like smart grids or advanced public transport systems can be common opportunities to address these challenges.

An important example for a 'common challenge' is to ensure and enhance ecological connectivity while maintaining transport connectivity. Map 8 shows sharp contrasts of ecological connectivity within most interface areas. This index represents the average size of (semi-) natural land cover types that are not cut by transportation infrastructure. Land use, urban sprawl and human activities lead to habitat fragmentation, which is the physical disintegration of continuous habitats into smaller patches, decreasing the resilience of ecosystems and threatening biodiversity. Landscape connectivity is therefore highly relevant for maintaining species dispersal and sustaining ecological processes and functioning. – The following sections dive deeper into further examples of common challenges.

Map 8
Ecological connectivity in Alpine interface areas



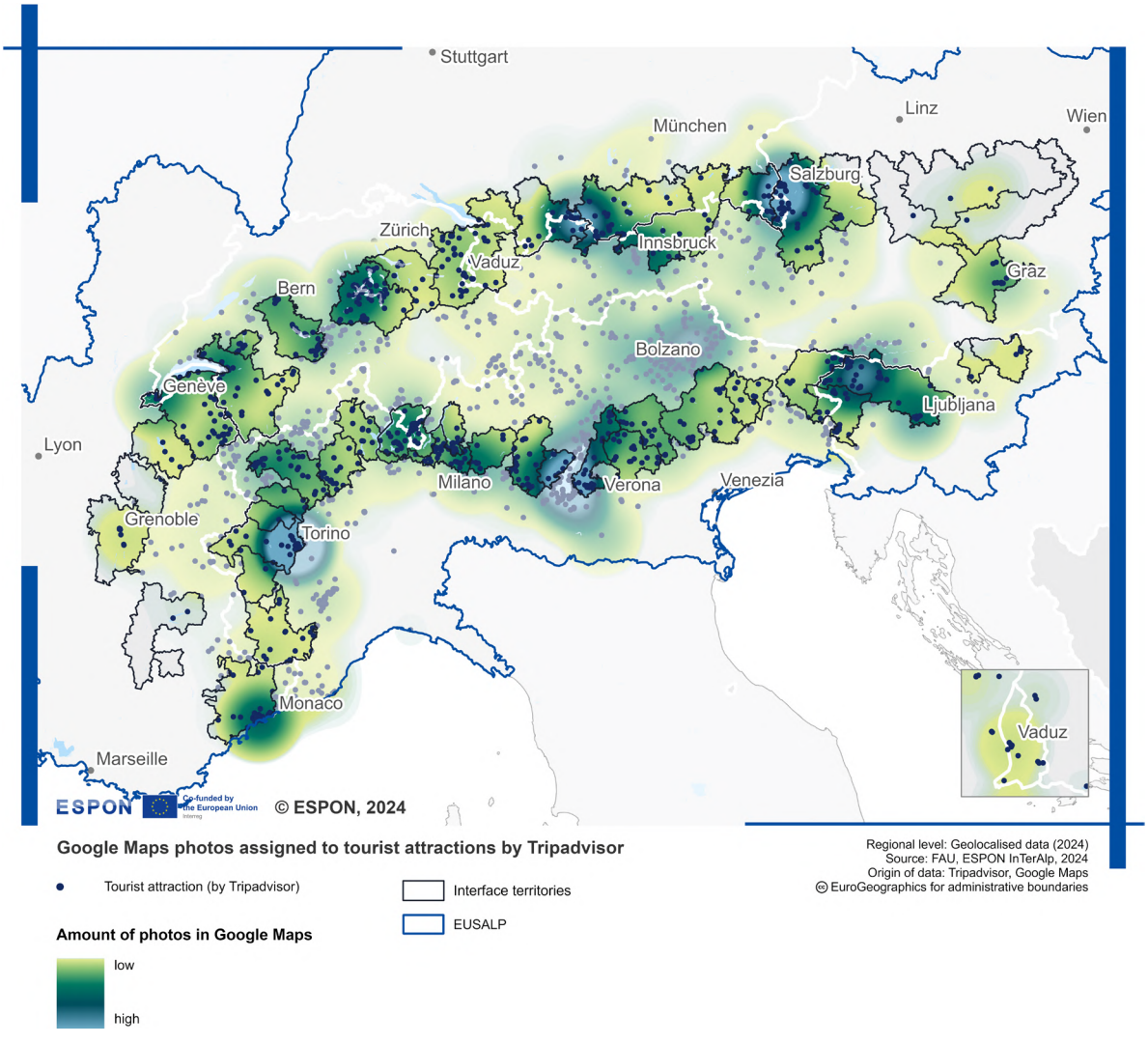
Examples of sectoral challenges

The specific character of interface areas comes along with particular sectoral challenges. Even if the national affiliations and contexts vary largely across the 48 Alpine interface areas, there are a series of parallels. The density of important functions, flows, and dynamics is a characteristic feature. Transport infrastructure links places on various scales; freight flows represent the backbones of an integrated economy; and settlement systems typically develop along the topographic axes. Interface areas also host attractive magnets for flows (e.g. tourism, recreation, commuting). Map 9 shows tourism hotspots from a pan-Alpine perspective based on Tripadvisor and Google Maps data. The visualization demonstrates particularly high numbers of photos uploaded on Google Maps at tourist attractions within interface areas.

This magnet function for international tourist (longer stays) or local visitors from adjacent urban areas (short but frequent stays) results in challenges for sustainable transport – both in terms of modal shift and accessibility measures. The channeling of flows from pre-alpine areas into narrow transport axes in mountainous areas requires a high level of territorial knowledge for spatial development. As such, effective spatial planning is essential for the transport and mobility sector, particularly in interface areas.

However, the scope for development is rather limited, given the topographic context with often steep relief, and the numerous elements of protection regimes (habitats, green corridors, etc.). Simplifying to a certain extent, this challenge can be captured as 'double demand on half the space'. Addressing this challenge calls for a systematic spatial planning and development approach.

Map 9
Tourism hotspots across the Alpine region

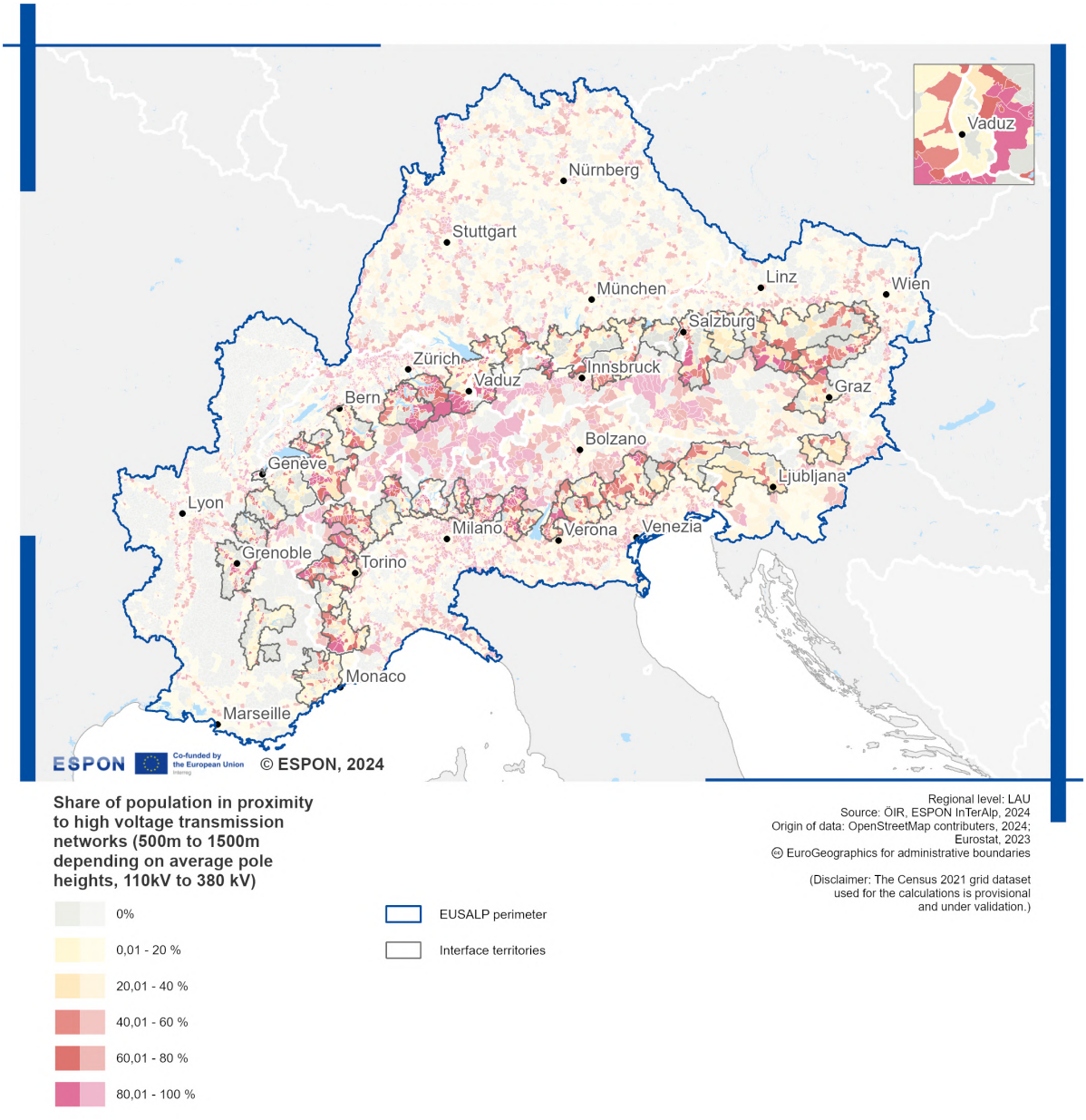


Map 10 visualizes the share of population living within visual range of energy infrastructure, inside and outside of interface areas. The results are striking: In Alpine interface areas, about 7,7% of the population live in direct proximity to high-voltage networks (200 m), and 27% are within visual range (500-1500m dependent on the height of the poles).

Alpine interface areas function as 'energy transit zones', linking the power plants from inner-Alpine regions with the surrounding lowlands (see Box 2 as example of the interface area of the Alpine Rhine Valley).

Large-scale infrastructure, in particular very high voltage transmission networks (380-400kV), can be perceived as visually disturbing. Also, they are often seen as a nuisance in terms of noise or (perceived) risk of electromagnetic fields. In confined valleys, the negative effect of such infrastructure on land prices can be an issue

Map 10
Alpine interface areas as energy transit zones



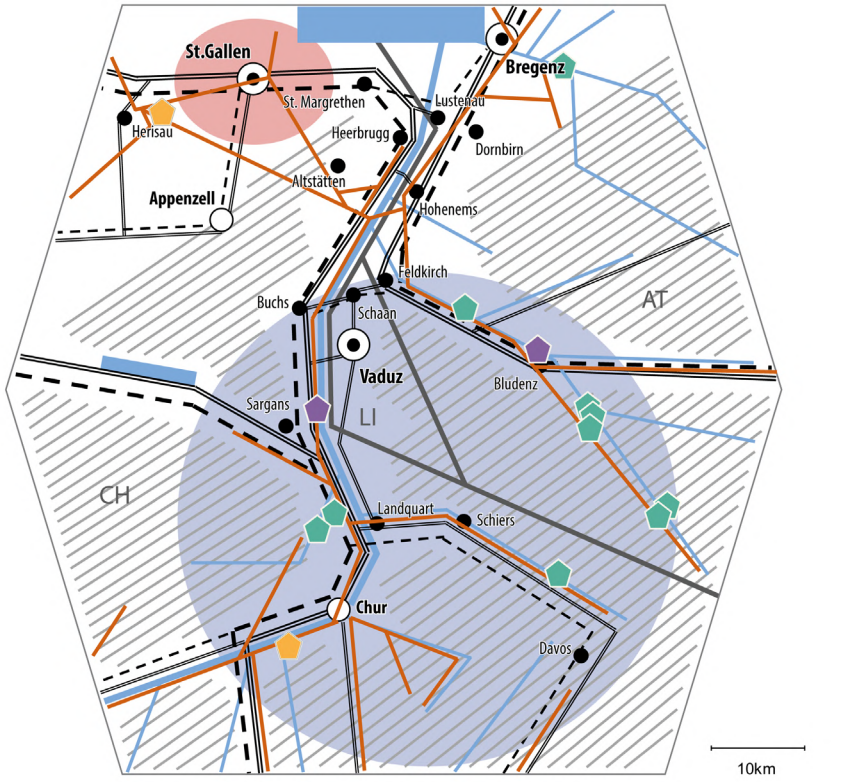
BOX 2

Interface areas as energy transit zones

The case region Alpine Rhine Valley

The Alpine Rhine Valley interface is characterized by a high cross-border relevance. Mapshot 2 shows the energy infrastructure of the interface area in an abstract manner. Hydropower is a central energy supply within the Alpine Rhine region. Hydroelectric plants with an output capacity of over 100 million kwh/a are mainly concentrated in the mountainous regions of Vorarlberg (AT). Additional facilities are to be built near Chur and Herisau to ensure energy security throughout the region. These plants pose ecological challenges such as nature conservation. The map clearly demonstrates that the interface area functions as an 'energy transit zone'. Several power lines (≥ 110kV) link the power plants from within the mountainous terrain with the surrounding lowlands.

Source: ESPON InTerAlp Case study portfolio, 2024.



Settlement system
- Metropolis
- Regional centre
- Local node

Mobility infrastructure
- Road (first tier)
- Road (second tier)
- Rail (first tier)
- Rail (second tier)

Political boundaries
- National border

Natural features
- River
- Tributary river
- Waterbody
- Mountainous terrain

Energy infrastructure
- Hydroelectric plant (≥ 100 mio. kWh/a)
- Hydroelectric plant with hydrogen production facility (≥ 200 t/a)
- Planned hydroelectric plant (≥ 50 mio. kWh/a)
- Power line (≥ 50 kV)
- Main region of energy demand
- Main region of energy production

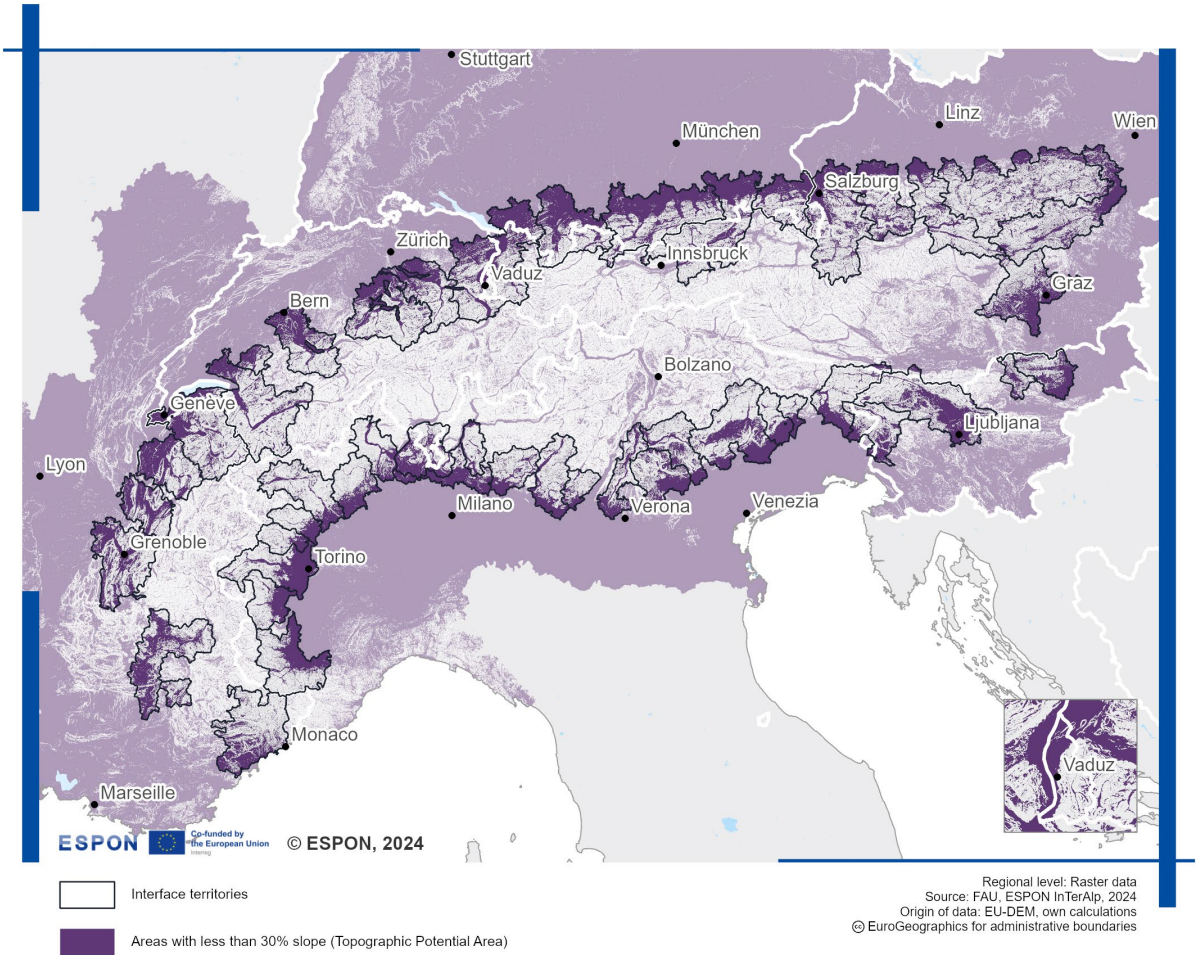
ESPON Co-funded by the European Union Interreg

FAU & Strauss - Raumentwicklung, ESPON InTerAlp, 2024

Scarcity of land and competing interests

The areas between the peri-Alpine lowlands and the inner-Alpine highlands face significant land scarcity and competing interests for land use. Map 11 highlights regions with less than 30% slope steepness in a raster resolution of 25 meters, indicating theoretical availability for agriculture, infrastructure and other human activities. This spatial pattern shows how limited flat or gently sloping land is within the interface areas and that it is largely in close proximity to peri-Alpine lowlands. At the same time, competition amongst land use interests is high, with strong demand from housing, energy and tourism. This poses challenges for nature conservation and open space protection. The fact of limited land availability combined with already sealed soils in valley locations leads to particular 'pressure' in interface areas. This combination of limited topographic suitability, competing demands and the need for environmental protection creates a complex set of priorities for land management in interface areas. This demanding spatial setting means that interface areas are particular 'test-cases' at the forefront of sustainable spatial development.

Map 11
Degree of inclination in Alpine interface areas



Develop tailor-made governance for interface areas

Interface areas do not systematically exist at any governance level

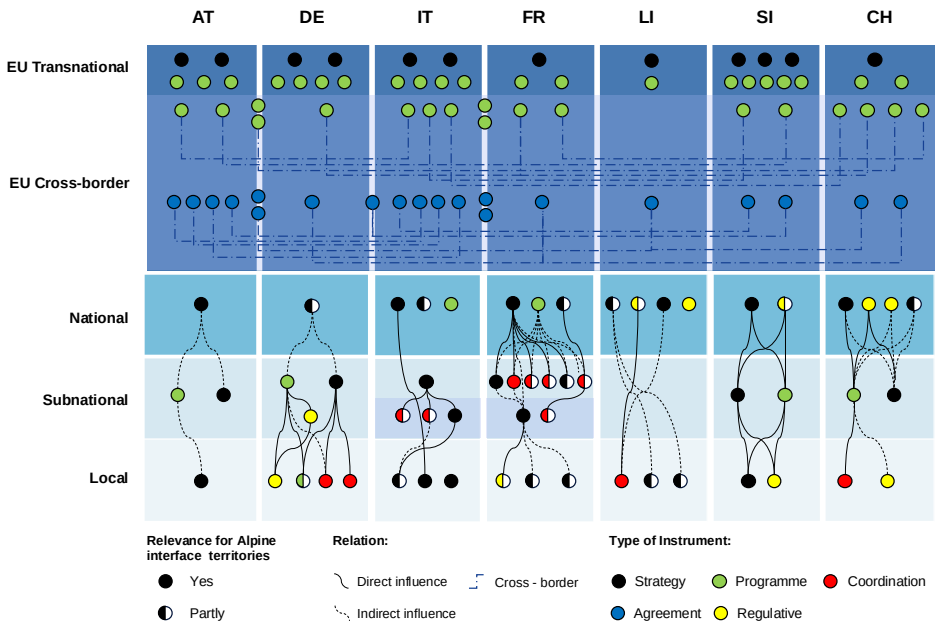
Spatial governance and planning systems in the Alpine region show a wide range of approaches, reflecting the historical, institutional and cultural contexts of each country. While some countries emphasize decentralization and local autonomy, others maintain a rather strong central governance. Figure 3 provides an overview of the spatial planning instruments in the Alpine region that are relevant for Alpine interface territories. The figure illustrates the interrelations between the different types of instruments (strategy, programme, coordination, agreement, regulative) and indicates whether they are fully applicable or only partially relevant for Alpine interface territories.

Furthermore, the figure presents a synthesis of the relevant instruments in the Alpine multi-level governance system:

- The transnational level, in particular the Alpine Convention, the EUSALP macro-regional strategy, the Alpine Space Programme.
- The cross-border level, which is characterised by a high number of 'soft' cooperation formats and funding options, even if also the more formalised EGTCs have to be institutionalised (Europaregion Tirol-Südtirol-Trentino, EGTC Go, Rhine-Alpine Corridor on a larger scale).
- The national level, involving seven countries (some of them with the complete territory, others only partly included): Austria, France, Germany, Italy, Liechtenstein, Slovenia and Switzerland;
- The regional and provincial levels (depending on the country: Cantons, Länder, Régions, Metropolitan Cities and provinces etc.).
- The local level, concerning a plethora of municipalities ranging from the dense urban areas of Torino and Munich to dispersed mountain inner municipalities, that enjoy a rather large autonomy in the definition of their local development priorities and the regulation of land-use and spatial planning.

The figure demonstrates the high number of instruments at the EU level that are fully applicable to interface areas. Within the multi-level governance system of the Alpine countries, a number of instruments are only relevant for specific parts of Alpine interface areas. The overview also illustrates the considerable complexity of the spatial planning and development instruments that are in play within the Alpine multi-level governance system. Interface areas are territories with no specific governance, situated within a landscape of several spatial planning and development instruments.

Figure 3
Multilevel institutional mapping of spatial governance and planning in the Alpine region



Thus, interface areas are a somewhat 'implicit' spatial category and they are not systematically addressed in governance formats. They are often confronted with issues of mandate perimeters: administrative delineations are not always congruent with functional flows and interdependencies. Some of these issues are linked to municipal and regional perimeters, e.g. an interface area may close to pre-Alpine metropolitan regions; others are part of Alpine border regions. As a completely optimal governance perimeter can hardly be defined, the concept of soft spaces comes into play. Forms of soft governance allow for dealing with existing (administrative) boundaries in an open, flexible way: linking existing territorial entities and tools is important in order to come to new perspectives for Alpine spatial development. Inter-municipal cooperation, cross-border cooperation and other multi-level governance elements have to work towards good solutions. Developing 'interface governance' includes political recognition and awareness, learning processes across different interface areas, and the testing of specific instruments (Local Action Groups, sectoral cooperation, etc.).

This leads to three main avenues for further development of interface areas. First, the integration of interface areas into existing governance structures. Second, testing specific governance forms for interface areas. Third, exploring 'soft' forms of governance.

Integrate interface areas into existing structures

Existing formats of (territorial) governance have a huge potential of addressing the concerns of interface areas. Be it regional planning authorities, cross-border cooperation programmes or structures (Interreg, EGTC), etc. – many issues are classical objects of spatial planning and development. In many cases, however, the potential is large to make the specificity of interface areas more explicit. In interface territories, the territorial contrasts are often stronger, the number of borders tends to be higher, and the spatial scope tends to be smaller. The competing land use demands are in principle similar to standard spatial development situations. However, the intensity of the issues is larger.

These challenges come along with several potential contributions of the Alpine Convention, EUSALP and INTTEREG that are of high relevance for pan-Alpine spatial development with a particular focus on interface territories (see Box 3).

Test specific governance forms

In some cases, it might not be sufficient to integrate the concerns of interface areas in standard development tools and planning procedures. It can be helpful to create and establish new tailor-made formats that bring territories together within the interface areas. This can include partners across borders and from different institutional levels. Agreeing on formal mandates and allocating resources is then part of the establishment.

These processes might be inspired by the Swiss agglomeration programmes that start with functional integration patterns and result in specific target formulations for new perimeters (see Box 4). The agglomeration project Werdenberg-Liechtenstein is an example of cross-border governance in the Alpine Rhine Valley interface area to coordinate transport and settlement development.

BOX 3

Pan-Alpine potentials for spatial development in Alpine interface territories

Alpine Convention

The Alpine Convention is conceived as an intergovernmental treaty for the protection and sustainable development for the Alps. It has the potential to significantly contribute to the agenda setting and recognition of interface territories. Across the different sectoral and working groups and activities, the Convention could emphasise the importance of these interface territories as part of a new spatial and governance geography. Amongst others, Alpine interface territories can also be considered in Reports on the State of the Alps. This geography could be central in fostering a more place-based and territorially sensitive approach:

- Identifying territorial dynamics that stem from existing planning and cooperation practices (whether formal or informal) within interface territories.
- Investigating and testing the existence of any political convergence (explicit or implicit) towards this new geographical framework.
- Involving local actors in the Alpine Convention's governance process through specific tools, such as establishing a "Forum of Alpine interface territories."
- Encouraging local actors to adopt a proactive approach, raising awareness of the strategic and operational importance of Alpine interface territories.

EUSALP

The EUSALP offers an important platform for discussing Alpine interface territories, in particular as its perimeter comprises all interface territories. By promoting transnational cooperation, this strategy can develop a common approach to support the Alpine interface territories through a cooperative perspective. Across the EUSALP's sectoral Action Groups, it might contribute to:

- Providing technical and political support to solidify the role of Alpine interface territories, in line with EU strategies and policies.
- Building a common (transnational) approach to this new "geographic category" by acknowledging their unique status.
- Understanding and promoting their needs and potential in terms of fair and balanced territorial development.
- Targeting these territories with specific, ad hoc initiatives. This could become easier if they are included in post-2027 discussions.

INTERREG Alpine Space and cross-border programmes

The Alpine Space programme as well as the cross-border cooperation programmes offer relevant platforms of territorial cooperation: this can actively promote tailored-made projects within interface territories. The programmes' scale and objectives align well with the geographic distribution of many Alpine interface territories. In this respect, territorial cooperation programmes can support the Alpine interface territories when it comes to:

- Promote new forms of formal (or informal) cooperation values through which emerge or consolidate existing cooperation initiative formats.
- Promote ad hoc projects or a set of projects that specifically target these territories.
- Funding new emerging governance experiences which implement various models (see the case of PITER promoted by the ALCOTRA programme).

Source: ESPON InTerAlp Final report, 2024.

BOX 4

Federal Agglomeration Policy, Switzerland

Politica degli agglomerati / Politique des Agglomérations / Agglomerationspolitik (AggloPol) (Federal Agglomeration Policy), Switzerland

With the Agglomeration Policy the Swiss Federal Government aims to promote the sustainable development of agglomerations, including the cities and municipalities that are part of them. This transversal policy is implemented with a series of specific measures and instruments that complement other sectoral policies (i.e., transport policy or social policy) and that, in turn, contribute significantly to the development of agglomerations. Implementation requires the involvement of actors at the level of the Confederation, cantons, regions, cities, municipalities, and the bodies and organisations responsible for development in functional spaces. Together and in collaboration with private actors, they contribute to the development of agglomerations and the coherent territorial development of the country. The updated Federal Agglomeration Policy has a "networks of cities" approach. It is based on a tripartite system including confederation, cantons, cities, and local government.

What are the benefits of the Agglomeration Policy for Alpine interface territories?

- Improved coordination of settlement development and transport: The Alpine interface territories can benefit from better integrating transport infrastructure with settlement planning, ensuring more efficient and sustainable mobility options supporting regional development.
- Comprehensive development support: Through specific measures and instruments that complement sectoral policies (such as transport and social policy), AggloPol provides holistic support for the development of Alpine territories, fostering sustainable growth.
- Enhanced collaboration and governance: The policy promotes efficient collaboration across multiple levels of governance (Confederation, cantons, cities, municipalities) and private stakeholders, enabling more coordinated and effective territorial development for the Alpine regions.

Source: ESPON InTerAlp Scientific annex X Governance report for Switzerland, 2024.

Soft spaces

Not all interface concerns might be addressed by institutionalised governance but need ad-hoc formats. In these situations, 'soft' forms of governance (so called 'soft spaces') come into the game. Soft spaces allow for processes beyond formal perimeters, pre-defined resources, and hierarchical negotiation procedures. Instead, more flexible processes can develop and formulate (variations of) solutions that later enter formal implementation processes. Soft spaces can lead to a 'hardening' in terms of institutionalisation, but that does not have to be the case. The Schéma de Cohérence Teritoriale (SCoT) in the Greater Grenoble area is an example of a soft spatial planning instrument introduced into French law (Loi Solidarité et Renouvellement Urbains, 2000). The instrument has hardened over time with the adoption of new spatial planning and environmental legislation relevant to the whole Grenoble/Rhône-Alpes interface area – covering both, mountain and lowland areas. Once interface territories are more acknowledged as a geographic category, an in-depth exchange between interface territories regarding governance-related experiences could be helpful.

Obviously, there will not be a one-size-fits-all solution, given the diversity of interface territories and the involved governance contexts. However, the three indicated avenues offer multiple options that also can be combined.

For further information on Alpine interface territories, see the other outputs of the project:

ESPON InTerAlp Final report

ESPON InTerAlp Case study portfolio

ESPON InTerAlp Spatial and sectoral governance in Alpine interface territories

ESPON InTerAlp Scientific annex I: Definition and delineation of Alpine interface territories

ESPON InTerAlp Scientific annex II: Metadata overview

ESPON InTerAlp Scientific annex III: Transnational and cross-border governance

ESPON InTerAlp Scientific annex IV: Governance report for Austria

ESPON InTerAlp Scientific annex V: Governance report for France

ESPON InTerAlp Scientific annex VI: Governance report for Germany

ESPON InTerAlp Scientific annex VII: Governance report for Italy

ESPON InTerAlp Scientific annex VIII: Governance report for Liechtenstein

ESPON InTerAlp Scientific annex IX: Governance report for Slovenia

ESPON InTerAlp Scientific annex X: Governance report for Switzerland

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