# The evolution of open spaces in the Alps – between land-use and conservation for generations to come

The Alpine Network of Protected Areas - ALPARC

European Regional Development Fund

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# Executive Summary

Near natural open spaces in the Alps are a key aspect for biodiversity conservation strategies. However, these spaces are threatened by diverse human activities and the resulting land use conflicts and fragmentation of habitats. The OpenSpaceAlps project addresses this issue from the perspective of spatial planning, with a group of supporting governance and decision-making tools. Alps-wide mapping is a main planning tool for spatial planners and natural conservation experts that makes it possible to identify different levels of spatial development through the calculation of an indicator based on the observed area covered by 11 infrastructure components.

The Alps-wide mapping method uses a geographical information system (GIS) spatial analysis to identify spaces presenting a low presence of infrastructure in the Alps. This report presents the mapping methodology and processes the different steps of the indicator calculation as well as the data sources.

The report further focuses on the drawing up of thematic cartography on common criteria for open spaces and an analysis of the situation of remaining near natural spaces from several viewpoints, including land use, nature protection, altitude and ecological connectivity.

Finally, scenarios present possible evolutions and risks for open space in a near future due to human land use and economic activities.

# 1 BACKGROUND

The OpenSpaceAlps project aim is "*to foster sustainable development of the Alpine Space by maintaining open spaces as a part of Alpine Green Infrastructure through an interlinked, multi-level transnational spatial governance taking into consideration the integration of ecosystems functions and needs into policies.*"

Within the different activities defined to achieve this objective, mapping has been developed through two complementary approaches: the first one consisted of a methodology applied to Switzerland by Job, Nischik, Mayer and Pütz to identify open spaces, the second approach focused on the definition of common criteria to better characterise the spaces with a low level of development and to identify the activities that threaten these spaces.

The main cycle of data processing worked as follows:

- Data sources selection and harmonisation
- Open spaces coverage identification
- Identification of common criteria for open spaces characterisation and the defining of indicators

Besides information gathering and processing on a European level, mapping activities in pilot sites are a main input for the data testing and selection. The OpenSpaceAlps Project shows three regional pilot sites: The Mont Blanc region between Italy and France, the Prealpi Giulie and Triglav National Parks at the national border between Italy and Slovenia and the Berchtesgadener Land Biosphere Reserve (D) with the Tennengau region (A) within the Federal State of Salzburg.

The limitations and issues concerning the data sources on a local and European scale will be explained in detail in the chapter dedicated to the data selection.

The Open Spaces coverage identification and calculation in the EUSALP area is based on the methodology developed by Nischik, G. & Pütz, M. in Switzerland. The main purpose of the first phase of the Alps-wide mapping was then to identify 11 disruptive infrastructure components and their spatial disturbance represented by a set of buffer categories.

This methodology analyses open spaces using different dimensions:

- quantitative (areas free from the presence of infrastructures),
- structural (that describes spaces large enough and therefore functional spaces)
- qualitative (through the improvement or development of open space functions).

The elaboration of common criteria is the result of internal and external exchanges between experts on the different factors that may affect the situation of open spaces in the Alpine context in the near future. The indicators were used as a tool to represent the different qualitative and quantitative criteria.

# 2 METHODOLOGY

## 2.1 Open Spaces Identification

### 2.1.1 Data Selection

Initially it was intended that the mapping process be based on a compilation of national data for the countries and areas concerned. The data selection started by running tests over the pilot areas with the intention, if possible, to replicate the process on an Alps-wide level. Due to major difficulties related to data precision, uniformity, and availability of the information on this level, other data sources were incorporated into the analysis.

The test in the pilot regions consisted of overlapping the national data and other data sources (e.g. Openstreetmaps, Corine Land Cover, Google maps) see Appendix 1. This step made it possible to confirm the data sources availability for a comparative analysis on a European level. Such data sources are summarised in the following table.

Table 1 Alps-wide Open Spaces Mapping Data Sources

| No | Layer (Infrastructure Component) | Sub-categories | Source |
|---|---|---|---|
| 1 | Buildings | | Impervious Built-up Impervious Built-up 2018 — Copernicus Land Monitoring Service |
| 2 | Roads | Motorway/ primary | OSM (Roads and Links) |
| | | Trunk | |
| | | Secondary/ tertiary | |
| | | Unclassified | |
| | | Residential | |
| 3 | Railways | | OSM |
| 4 | Cable cars, Ropeways, Ski lifts (Linear Infrastructure Provision) | Ski lifts/facilities | OSM |
| | | (Other) Cable cars | |
| | | Material Cableway/ Ropeway | |
| 5 | Airport/ Airfield | | CLC |
| 6 | Mine, Stone Quarry, Raw Material Extraction Site | | CLC |
| 7 | Artificial Leisure Areas (Golf Course, Amusement Park, Campsites, Swimming Pools, etc.) | | CLC |

| No | Layer (Infrastructure Component) | Sub-categories | Source |
|---|---|---|---|
| 8 | (High-voltage) Power Supply Lines | | OSM |
| 9 | Dams, Hydropower Facilities | | OSM |
| 10 | Landfill/ Waste Disposal Sites | | CLC |
| 11 | Power Plants, Waste Incineration Plants etc. (High Emission Facilities) | | OSM |

Roads, power supply and cable car infrastructure were extracted from Open Street Map (OSM), the remaining infrastructures were identified from Corine Land Cover (CLC) 2018, Version 2020_20u1, and, in the case of buildings, the information was extracted from the high-resolution raster of the Copernicus Land Monitoring Service. These datasets cover the European and the EUSALP perimeters. (Copernicus Land Monitoring Service, 2020)

### 2.1.2 Data Processing

Two main categories of geometry were used in the mapping process:

Vector geoprocessing:

- Selection of lines and polygons related to the infrastructure component.
- Creation of buffer zones around the selected infrastructures.

Raster geoprocessing:

- Rasterization of buffer zones
- Merging of the resulting layers

**Vector geoprocessing**

The datasets mentioned contained information from all over Europe, the first step consisting of the extraction of the 11 infrastructure components for the EUSALP perimeter. The Alps-wide mapping used some of the categories defined for the Swiss study of Open spaces as an orientation, but due to the different data structures, the resulting categories are not identical with those suggested on the Swiss approach.

The identification of the infrastructures is not sufficient to determine the location and other main attributes of Alpine open spaces. The development of infrastructures produces effects on the landscape that go beyond the physical installation; this environmental effect is called the spatial disruptive effect. In the GIS process, this effect is represented through buffer zones drawn around the geometry, as each infrastructure produces a different level of impact - this differentiation is expressed in the buffer sizes.

The differential in buffer categories was produced according to the level of disturbance around an infrastructure component, as showed in table n° 2:

Table 2 :Layer Infrastructure

| No | Layer (Infrastructure Component) | Buffer Size (in metres) |
|---|---|---|
| 1 | Buildings | 25m |
| 2 | Roads | Motorways/ primary: 200m |
| | | Secondary/ tertiary: 100m |
| | | Residential/ other: 100m |
| 3 | Railways | 200m |
| 4 | Cable cars, Ropeways, Ski lifts (Linear Infrastructure Provision) | Ski lifts/facilities: 500m |
| | | (Other) Cable cars: 500m |
| | | Material Cableway/ Ropeway: 200m |
| 5 | Airport/ Airfield | 1000m |
| 6 | Mine, Stone Quarry, Raw Material Extraction Site | 500m |
| 7 | Artificial Leisure Areas (Golf Course, Amusement Park, Campsites, Swimming Pools, etc.) | 200m |
| 8 | (High-voltage) Power Supply Lines | 200m |
| 9 | Dams, Hydropower Facilities | 200m |
| 10 | Landfill/ Waste Deposit Sites | 500m |
| 11 | Power Plants, Waste Incineration Plants etc. (High Emission Facilities) | 1.000m |

Source: Adapted from Gero Nischik; Marco Pütz[1]

**Geoprocessing with Rasters**

The size of the EUSALP perimeter, the extraction of infrastructures for each component and the representation of their disruptive effect involves the processing of a huge amount of data, as explained before, most of the data (infrastructures and buffers) was on a vectorial format, this data was rasterized.

[1] Due to data availability and structure, there are some differences between the Alpswide mapping and the Swiss approach.

It is possible to merge them to get a single layer to identify the zones with a low probability of presence of the selected infrastructures. The process consists of comparing and adding the different layers in order to get a single raster that shows the presence of selected infrastructures.

| | | |
|---|---|---|
| 1 | 1 | 1 |
| 0 | 1 | 1 |
| 0 | 1 | 0 |

The resulting raster is a layer of a pixel size of 100m where the value 1 represents the presence of at least one of the selected components and the value 0 a low probability of finding these infrastructures.

The buffered infrastructures layer is the main input for the identification of open spaces. However, even if a space is free from infrastructure presence, it may not be large enough, and therefore not functional. A further step is needed to identify spaces to accomplish the three dimensions of analysis of open spaces (quantitative, structural and qualitative).

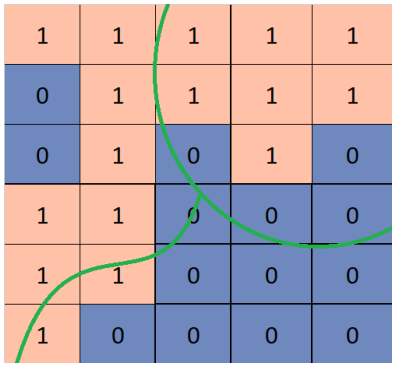
***Level of Spatial Development***

A further mapping work is carried out to have a better perspective of the open spaces for the study area, as proposed in the Nischik, G., & Pütz, M. methodology: it is possible to calculate an indicator of spatial development according to the level of coverage of the buffered components inside a territorial subdivision or reference area. The methodology favours an analysis based on a natural distribution of land represented by the watershed demarcation.

The same limitations indicated concerning the infrastructures data collection were given for the hydrological demarcations on a European level. A more precise watershed demarcation would be an important tool to better calculate the spatial development indicator. The data sources used for the analysis make it possible to have an overview of the distribution and coverage of the spaces with a low infrastructure presence but the size of the watershed demarcation and the process and result of the indicator of spatial development do not allow us to make inferences for the local level.

The European Catchments and Rivers Network System is a geographical information system developed by the European Environment Agency. This dataset contains the topological information for the continent. The process of spatial development calculation was made for the demarcation of functional elementary catchments (FECs), a layer with polygons of an average size of ~62 $km^2$ (European Environment Agency, 2012).

The spatial development percentage is calculated according to the level of coverage of the pixels inside each polygon. The input for this calculation is the raster layer in map 2 and the vector layer with the reference area (functional elementary catchments); the level of coverage is then calculated by identifying the proportion of the catchment surface covered by the buffered infrastructure.




The buffered infrastructure layer has two values obtained from the calculation: first a count of the number of raster cells inside each catchment, second the addition of the number of cells with the buffered infrastructure. The raster layer has only 0 and 1 values.

$$Spatial\ coverage = \frac{Addition\ cells\ with\ infrastructure}{Total\ number\ of\ cells}$$

A percentage of coverage is obtained for each catchment accordingly to the vector layer used.

The polygons with a spatial development of between 0 and 20% are extracted to identify the areas that remain with a low presence of the selected infrastructure components.

The reference area (watersheds-basins) study gives a clearer vision of the level of presence of the infrastructures inside the EUSALP perimeter and the importance of the Alpine Convention for safeguarding the semi-natural remaining spaces throughout the Alps by representing a high number of them.

## 2.2 Common Criteria on Open Spaces

The open spaces identification process gave as a result a first overview about the less disturbed areas inside the EUSALP perimeter. After several internal and external exchanges between experts a different approach involving other indicators was developed to better represent the criteria discussed during these exchanges.

The set of maps drawn up are an attempt to illustrate a set of preliminary conditions, quantitative and qualitative common criteria to get a common understanding on Alpine open spaces spatial planning:

- The preliminary conditions imply that there will not be any soil sealing.
- The quantitative criteria include indicators related to the physical characteristics of the selected spaces.
- The qualitative criteria include indicators related to the functions accomplished by the open spaces.

### 2.2.1 Data Selection

- Quantitative criteria

  The data sources for representing the quantitative criteria are: CORINE Land cover and the digital elevation model from Copernicus Land Monitoring Service.

- Qualitative criteria

  Included data from: Alpine protected areas from the ALPARC database, NATURA 2000 and Emerald network sites, High nature value farmland from the European Environment Agency, green infrastructure from ESPON database, the degree of urbanisation from EUROSTAT and the Strategic connectivity areas from the ALPBIONET2030 project.

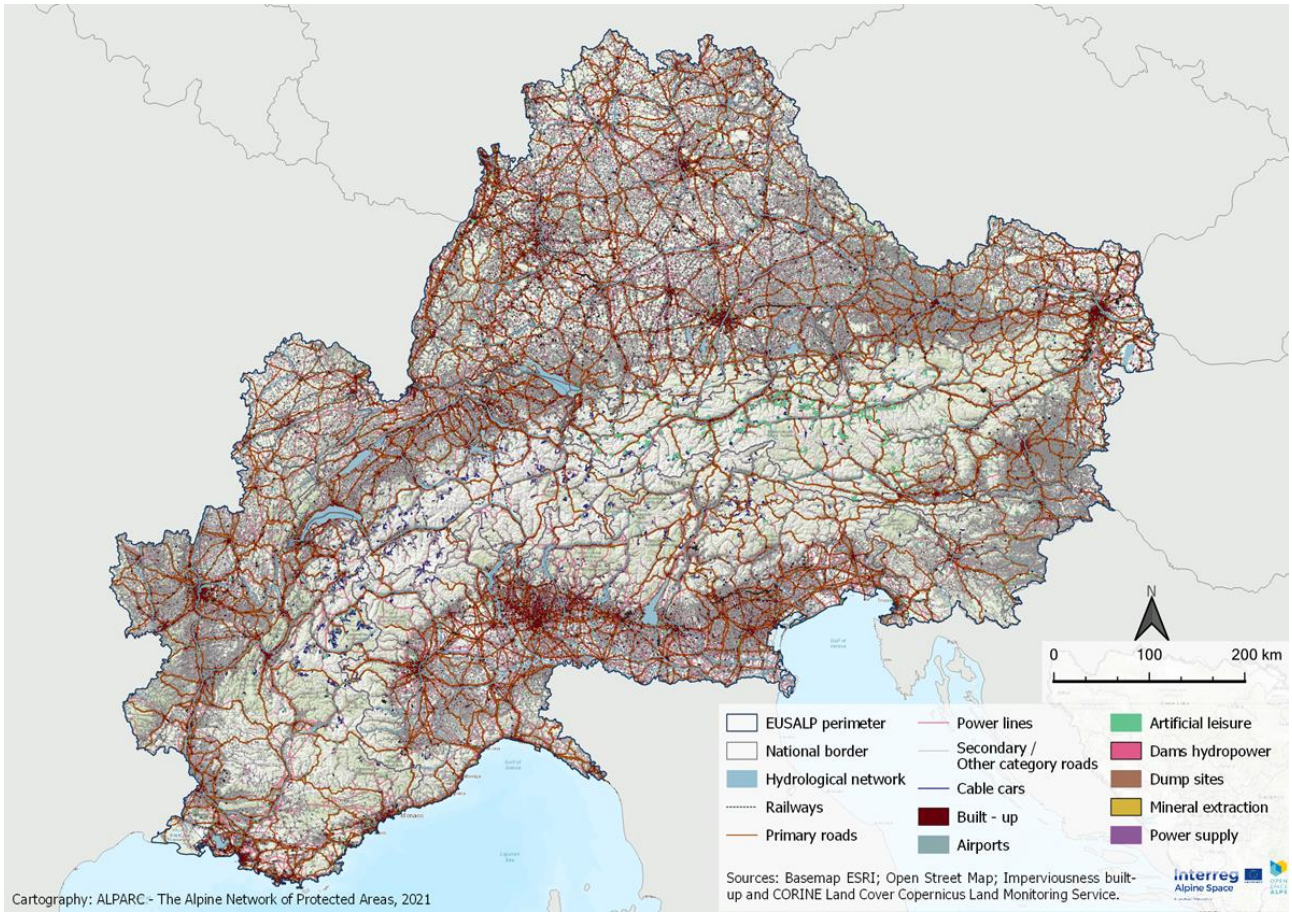
### 2.2.2 Data processing

The quantitative and qualitative criteria were represented through the available indicators and the results from previous projects. This information was compared with the spaces with a level of spatial development of under 20% and 10%, which could serve as an input to identify through an integral perspective the current state of open spaces in the Alpine arc.

# 3 THEMATIC MAPPING

## 3.1 Spatial Development Calculation

Map 1 Infrastructure Components inside the EUSALP Perimeter

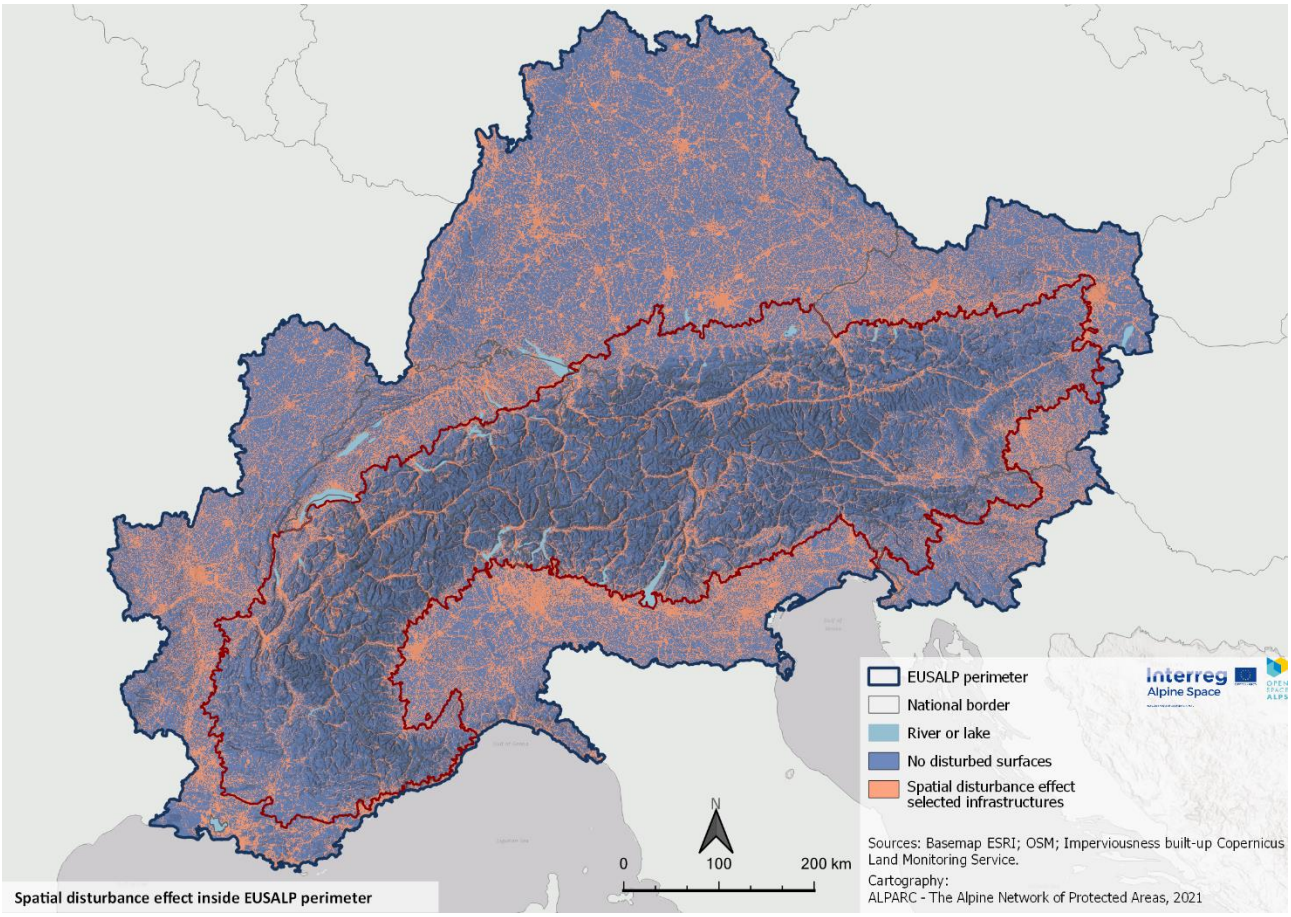



The infrastructure components map makes it possible to visualize their level of coverage inside the EUSALP perimeter. The coverage of infrastructures varies according to the category: roads are the category that covers most of the territory inside the EUSALP perimeter. Within this category, the residential roads are the subcategory that has a major coverage. The settlements are also a key component in terms of occupation.

Inside the Alpine Convention perimeter – (AC), the participation of the infrastructure component varies: the primary, secondary roads and railways are still present, the residential roads have not spread inside this perimeter and there is a reduced built-up surface in comparison with the surface outside the AC.

The cable cars component was considered for the total surface of the EUSALP space but as evidenced on the components map, this kind of infrastructure belongs exclusively to the Alpine arc; the other categories are distributed throughout the surface area inside the EUSALP perimeter.

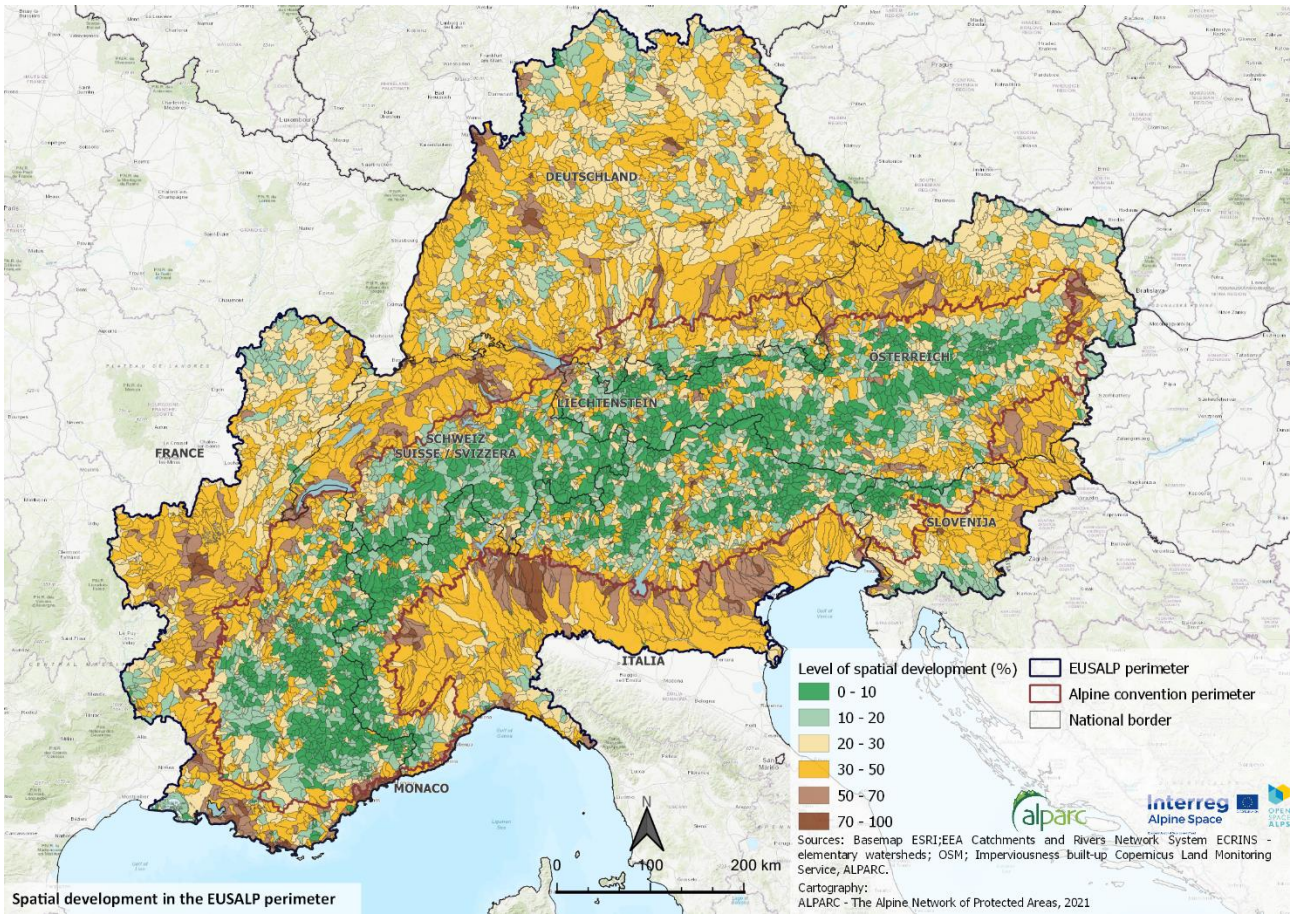
Map 2 Buffered Infrastructures




After the identification of the presence of these infrastructures, the next step consists in identifying the spatial disruptive effect. The effect is represented by a differential buffer; each component buffer size is described in the methodology chapter.

The map makes it possible to identify a detailed vision of the infrastructure presence and disruptive effect represented in orange and the spaces free from the selected components in blue. The layer serves as basis for the spatial development indicator calculation.

## Map 3 Level of Spatial Development

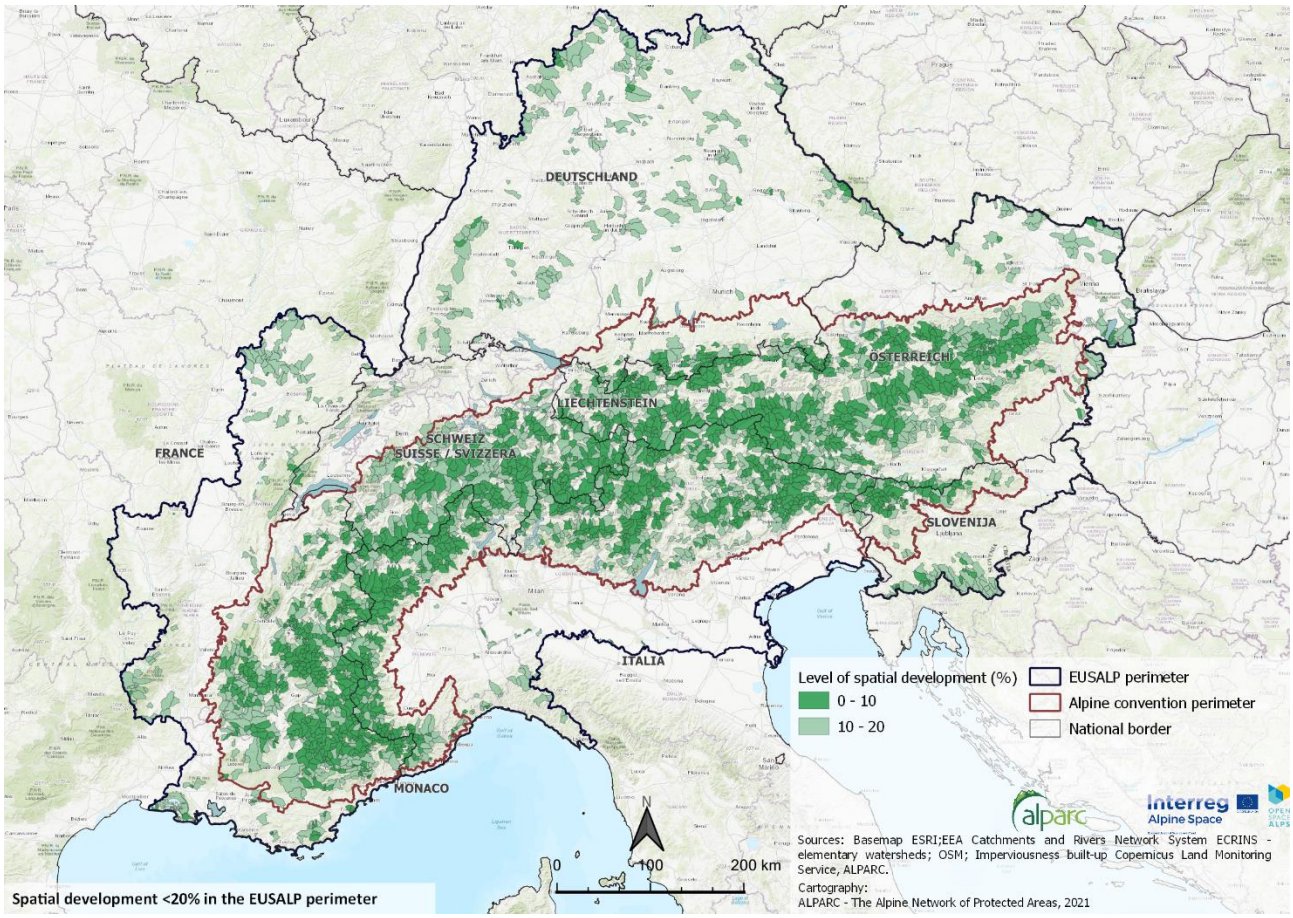



The level of the spatial development indicator uses a natural demarcation (watersheds) to represent the infrastructure coverage inside the spatial unit. Spaces with a spatial development of under 20% were subdivided into two categories: the “under 10% category” was created to identify the most natural spaces to better differentiate them from all other categories.

Even though most of the Alpine Convention perimeter is covered by spaces having under 20% of spatial development (55%), there are areas near and inside the perimeter with a larger infrastructure presence fragmenting the near natural landscapes and threatening still intact habitats and ecosystems.

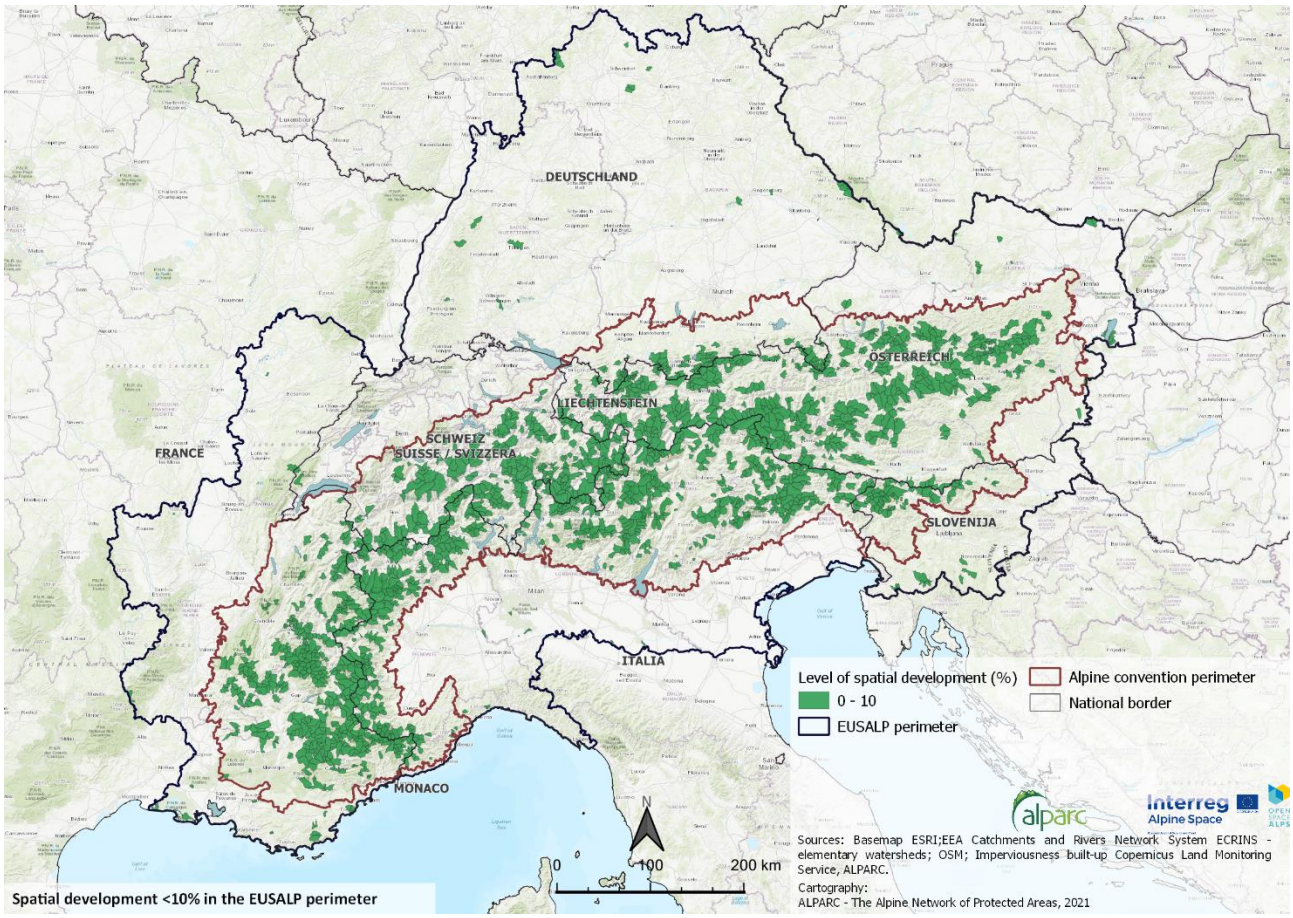
On a bigger scale, 29% of the EUSALP space is covered by areas with a spatial development of under 20%. When excluding the areas inside the AC this proportion decreases to 6%. In the case of spatial development under 10% the coverage goes to 14%. Without the areas inside the AC the coverage falls to 1%. **This clearly indicates the importance of the Alpine space as a retreat area for biodiversity.**

## Map 4 Open Spaces and Spatial Development under 20%




The map of spatial development under 20% makes it possible to identify the areas less disturbed through the identification of zones with a low level of development in terms of infrastructure. The differences in the disruptive effect produced by each infrastructure are expressed by the buffer distances (map 2) and in the spatial development calculation. The areas selected correspond to a smaller surface covering 55% of the Alpine Convention perimeter with less fragmentation and anthropogenic pressure.

## Map 5 Open Spaces and Spatial Development under 10%

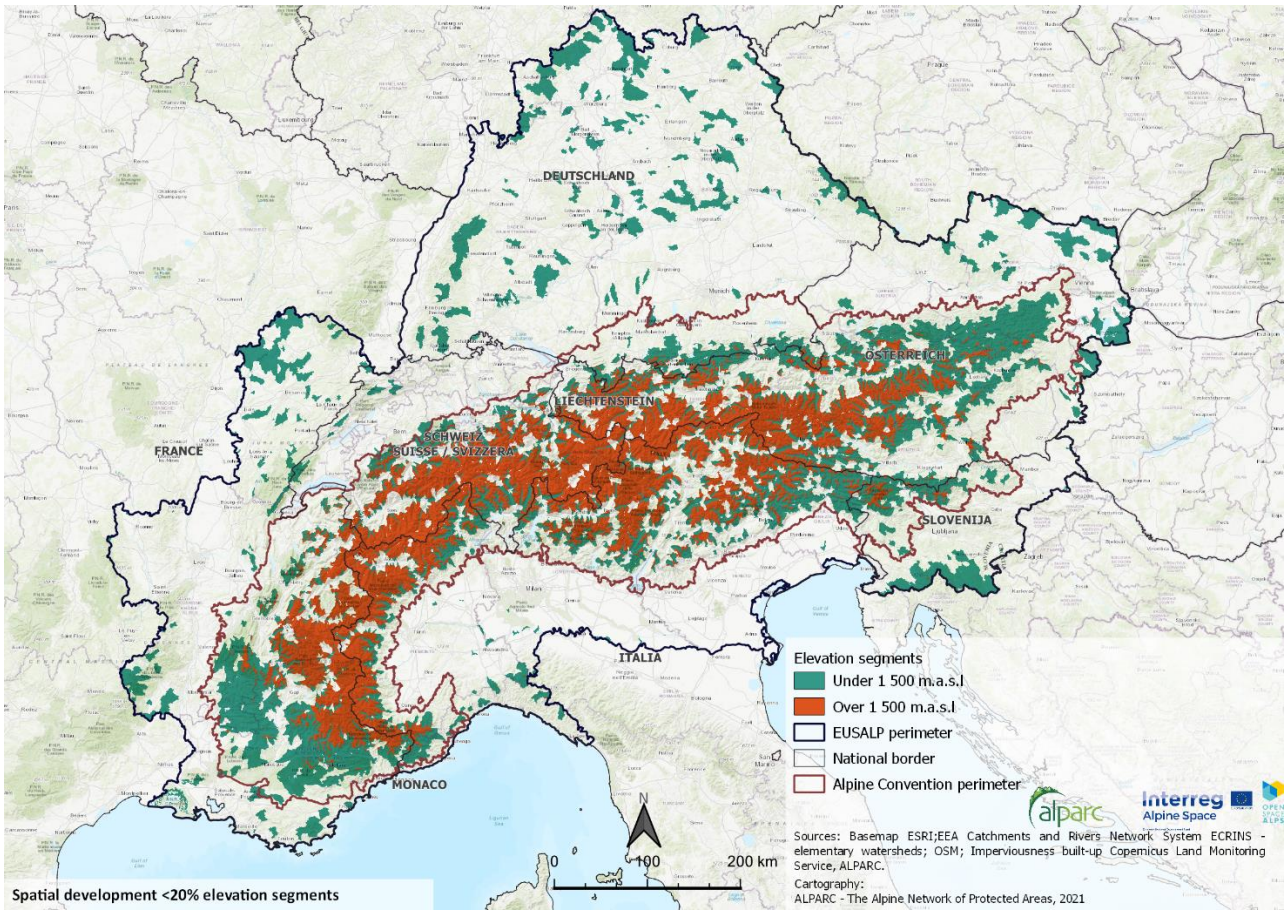



The map of spatial development under 10% identifies the zones with the lowest presence of infrastructures. Due to the size of the spatial unit of the indicator it was necessary to extract this layer to have two different and complementary layers to compare with the available information on elevation, protected areas, ecological connectivity, green infrastructure, etc.

Most of the spaces with a spatial development of under 10% are concentrated inside the AC perimeter (97%); when identifying the coverage for this perimeter more than 31% of the AC surface is covered by spaces of the category mentioned.

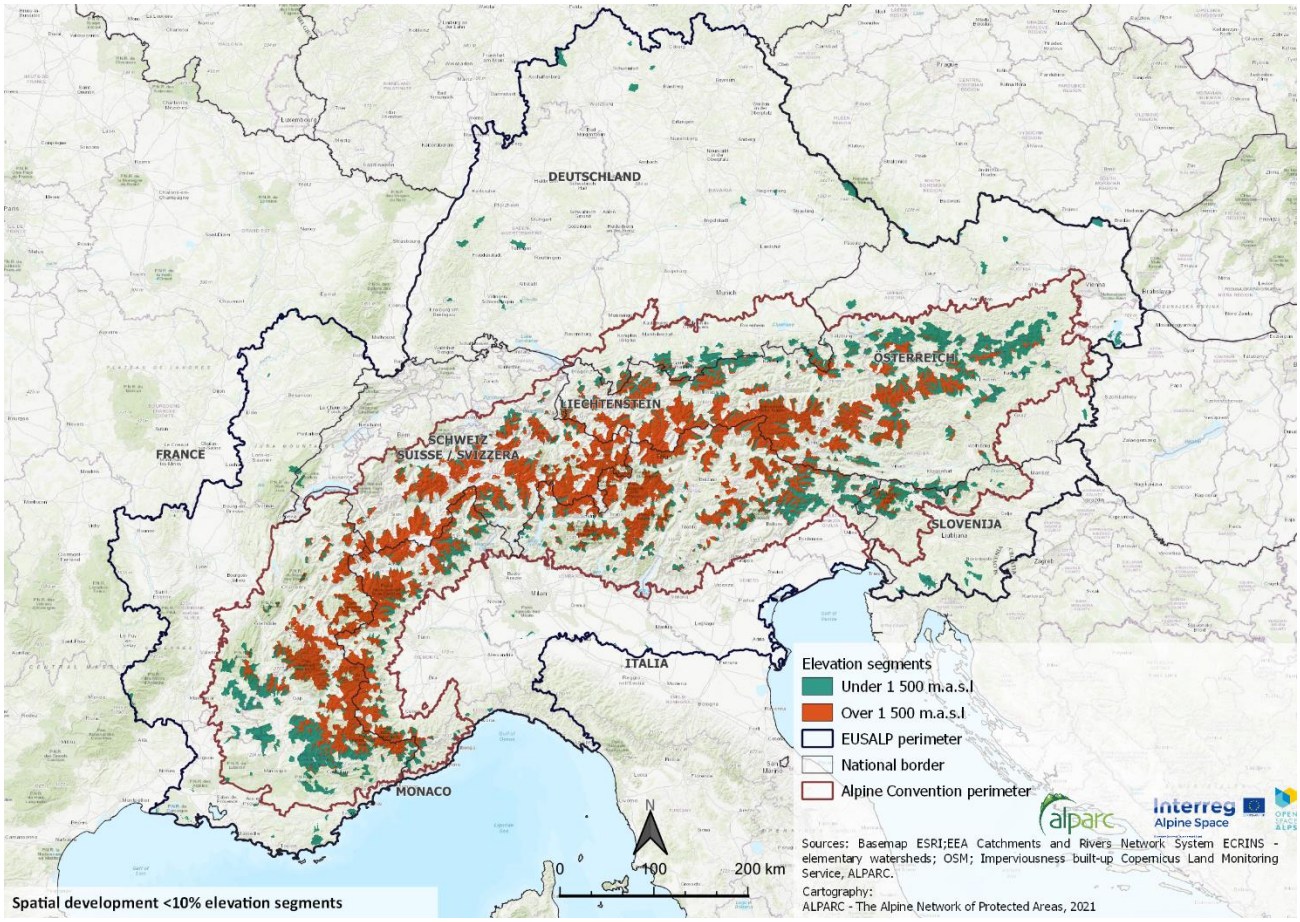
## 3.2 Elevation Segments

Map 6 Elevation Segments of Spaces with a Spatial Development of under 20%




The elevation factor is important for the analysis of the geographical situation of open spaces and their functions. This characteristic can also determine the activities potentially to be developed in a specific location and which may increase land use conflicts within a territory. The presence of zones with a level of spatial development of under 20% inside the Alpine Convention perimeter amounts to: 47% for areas under 1 500 m.a.s.l (in green) and 53% for areas located in an altitude higher than 1 500 m.a.s.l. (in orange).

## Map 7 Elevation Segments of Spaces with a Spatial Development of under 10%




However, the proportions are different when analysing the spaces with a spatial development of under 10%, The map 7 shows how most of the surface of the category mentioned inside the Alpine Convention is located at an altitude higher than 1 500 m.a.s.l (65%) and only a proportion of around 35% is under this elevation segment.

Table 3 Altitudinal Segments - Spatial Development Distribution by AC and EUSALP Perimeters

| | Alpine Convention | | EUSALP | |
|---|---|---|---|---|
| | **Spatial Development under 20%** | **Spatial Development under 10%** | **Spatial Development under 20%** | **Spatial Development under 10%** |
| Under 1 500 m.a.s.l | 47% | 35% | 44% | 37% |
| Over 1 500 m.a.s.l | 53% | 65% | 56% | 63% |
| Coverage | 55% | 31% | 29% (6%[2]) | 14% (1%) |

This illustrates how much the Alpine valleys and the mid altitudinal segment are already used for human activities and the linked infrastructure. Moreover, settlement in these favourable altitudinal segments is an important phenomenon. Indeed, real natural spaces with no or very low presence of anthropogenic activities and settlements in altitudes below 1500 metres are rare.

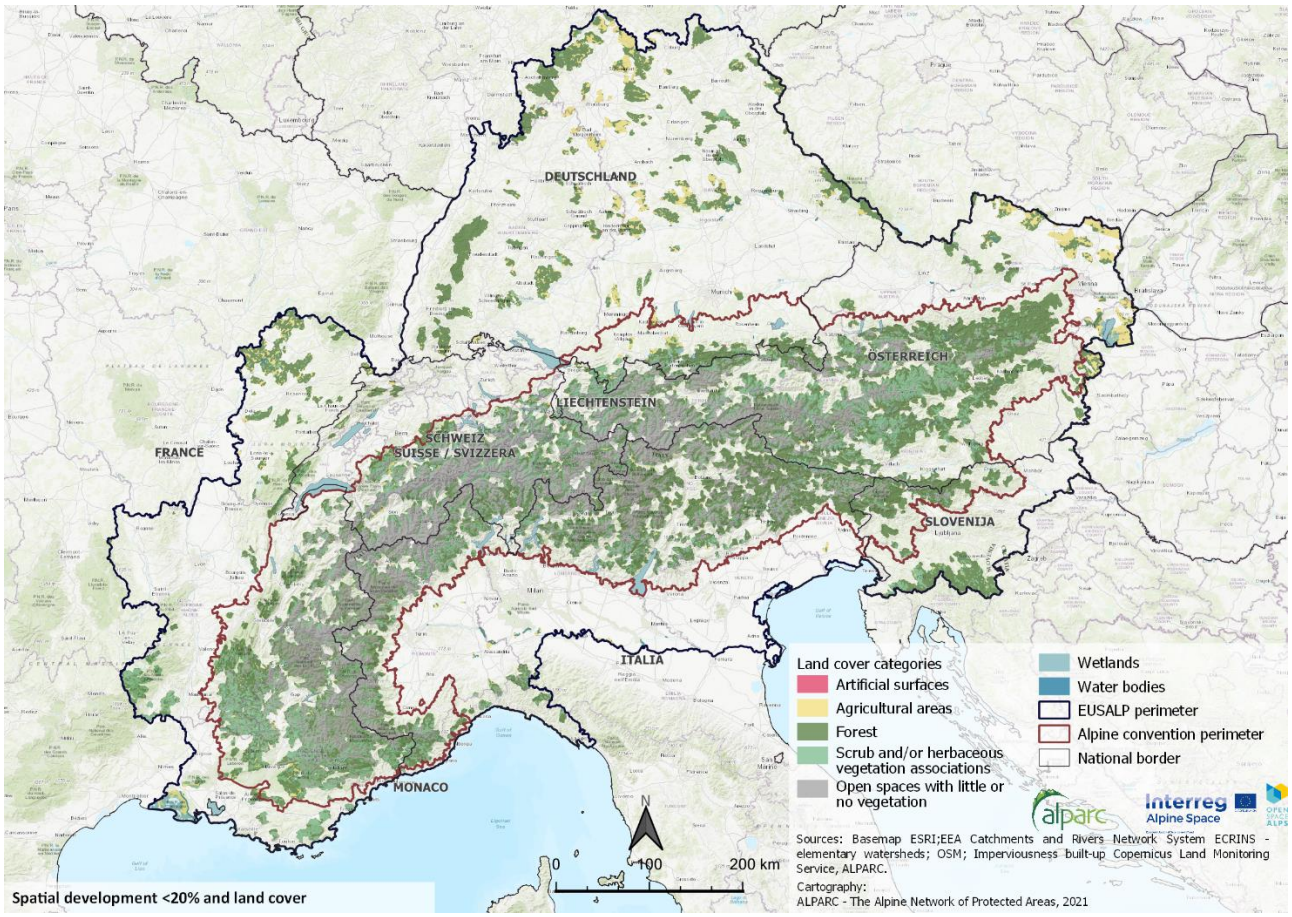
[2] If calculated without the Alpine Convention perimeter

## 3.3 Land Use

The Corine Land Cover layer from the Copernicus Land Monitoring Service was integrated to the infrastructure identification process, it is a fundamental data resource with a minimum mapping unit of (MMU) of 25 ha, the selected data corresponds to 2018 and as described on the table 2 it was used in the process of identification of infrastructures.

The spaces with a low level of development (under 20%) are identified through the described methodology. It is possible to develop further analyses to get a better characterization of this surface: once the layer has been compared with the land cover database the space was classified into 7 categories.

Map 8 CORINE Land Cover Categories



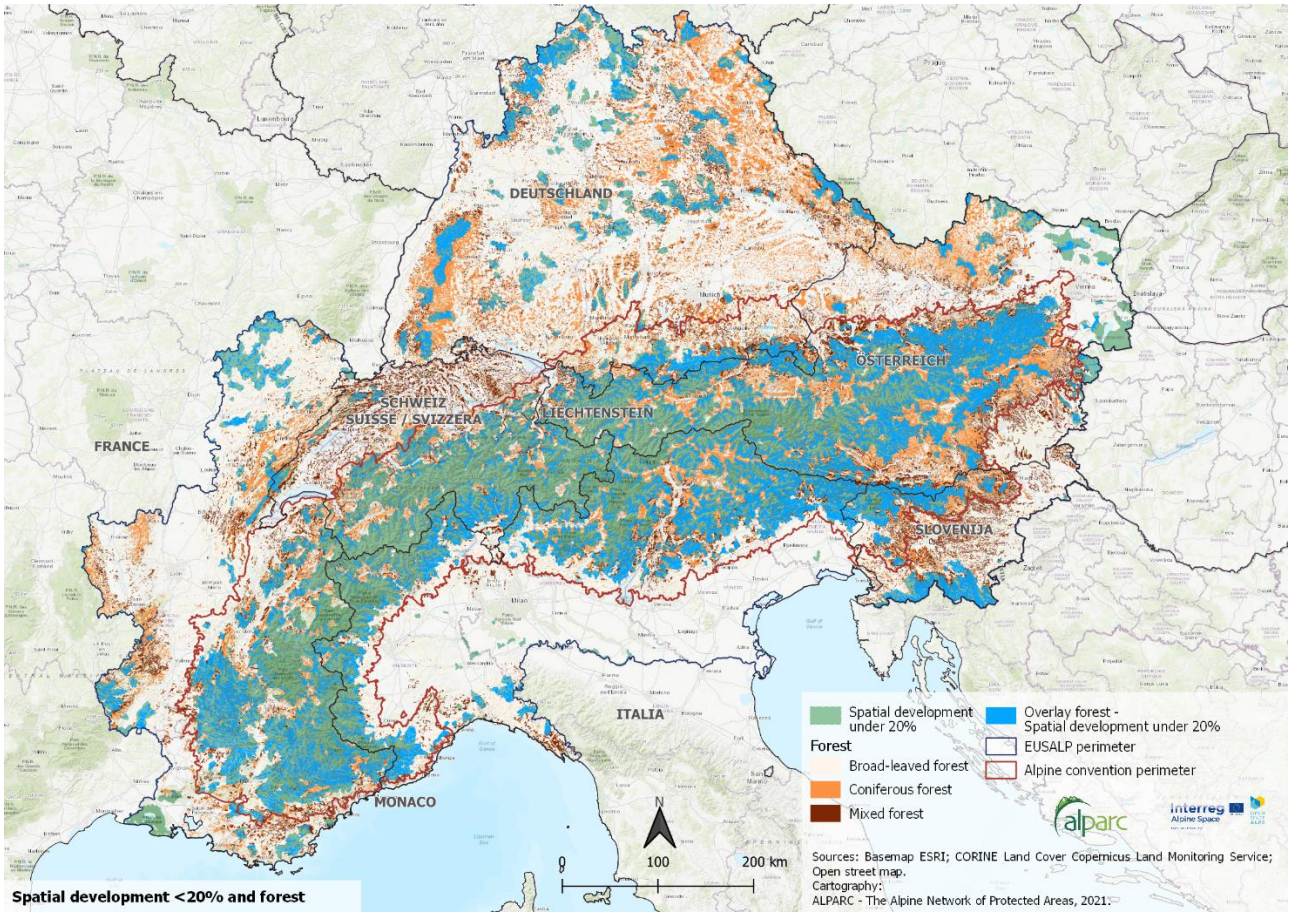

On average 95% of the surface with a low level of development of under 20% is located on surfaces classified under the forest and semi natural areas category. In a further analysis this surface is categorized into two and three levels from the Land Cover Database. This process makes it possible

to identify how the land is distributed between more specific categories and to explain how there are surfaces that are hardly exploitable or less suitable for the development of certain economic activities.

According to the CORINE Land Cover Nomenclature, the forest and semi-natural areas are grouped into three main categories: forests (40%), scrub and/or herbaceous vegetation associations (26%), open spaces with little or no vegetation (34%) and inside these categories in the case of forest, there are coniferous (61%), mixed (26%) and broad-leaved forest (13%).

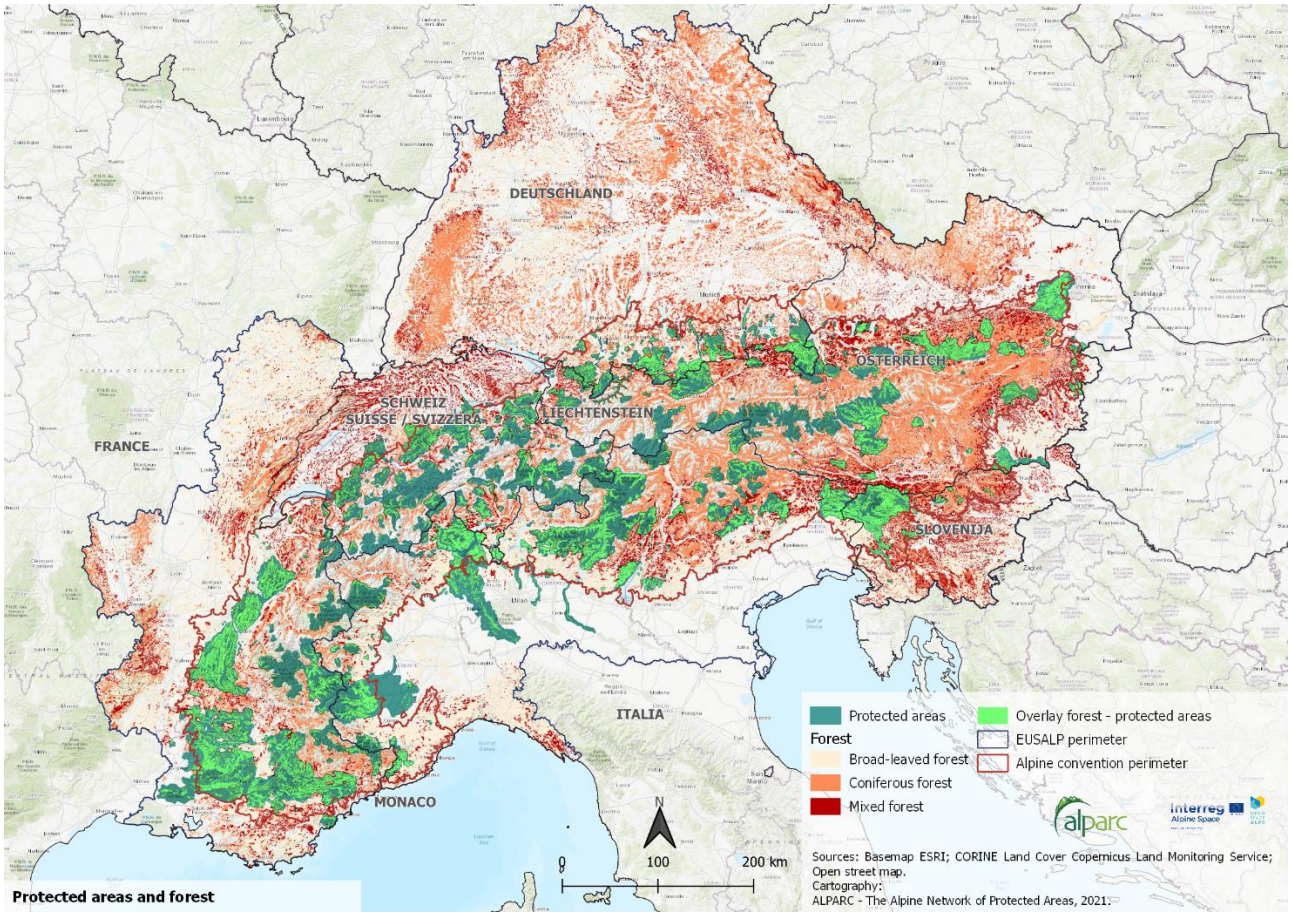
The open spaces category (spatial development under 20%) is covered by bare rocks (47%), sparsely vegetated areas (45%) and glaciers and perpetual snow (8%). For the scrub and/or herbaceous category, more than the half of this surface corresponds to natural grasslands (58%), the remaining surface being divided into moors and heathland categories (23%) and transitional woodland-shrub (17%).

## Map 9 Spatial Development under 20% and Forest



The forest covers a big portion of the areas with a low level of spatial development, as already discussed in the chapter dedicated to indicator calculation. These areas are selected on the condition of having a low infrastructure presence, which makes it possible not only to identify potentially low or non-developed surfaces but also to ensure that there is an important surface around the patches of near natural spaces allowing the continuity of their ecological functions.

## Map 10 Protected Areas and Forest

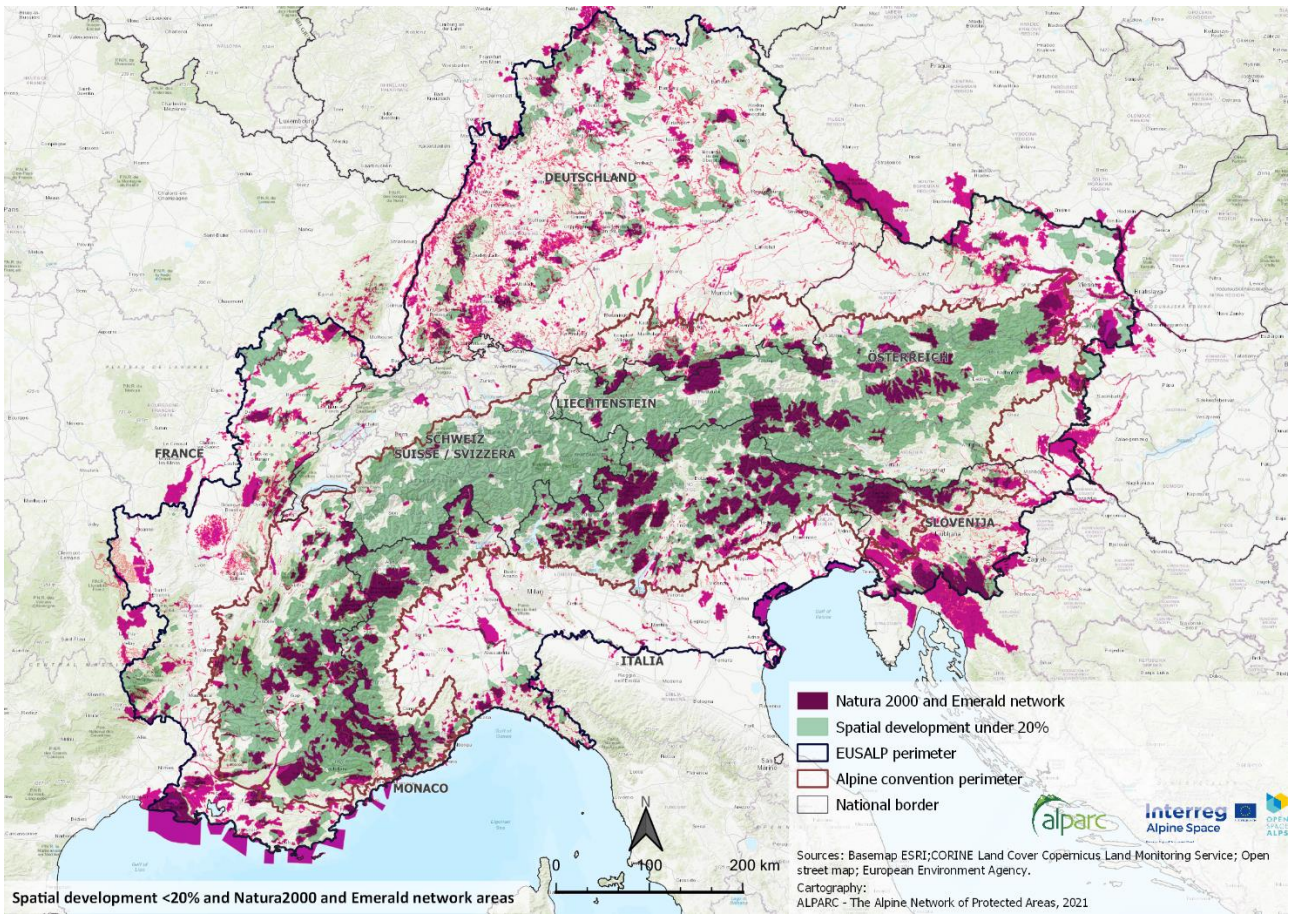



A similar analysis was made for the Alpine protected areas, with nearly 38% of the surface covered by a forest category. This proportion allows to evidence how Alpine protected areas are in different land use categories and stresses their importance for safeguarding diverse biodiversity habitats and patterns according to geographical locations and situations in the Alpine arc.

## 3.4 Protected Areas

The overlay of areas with a low level of spatial development and protected areas is particularly interesting for nature protection concerns and the open spaces status will have to resist development policies supposed to modify the characteristics of such open spaces. The analysis was conducted with the EU layer of NATURA2000 and Emerald sites and the ALPARC layer with Protected areas from all categories (protection status).

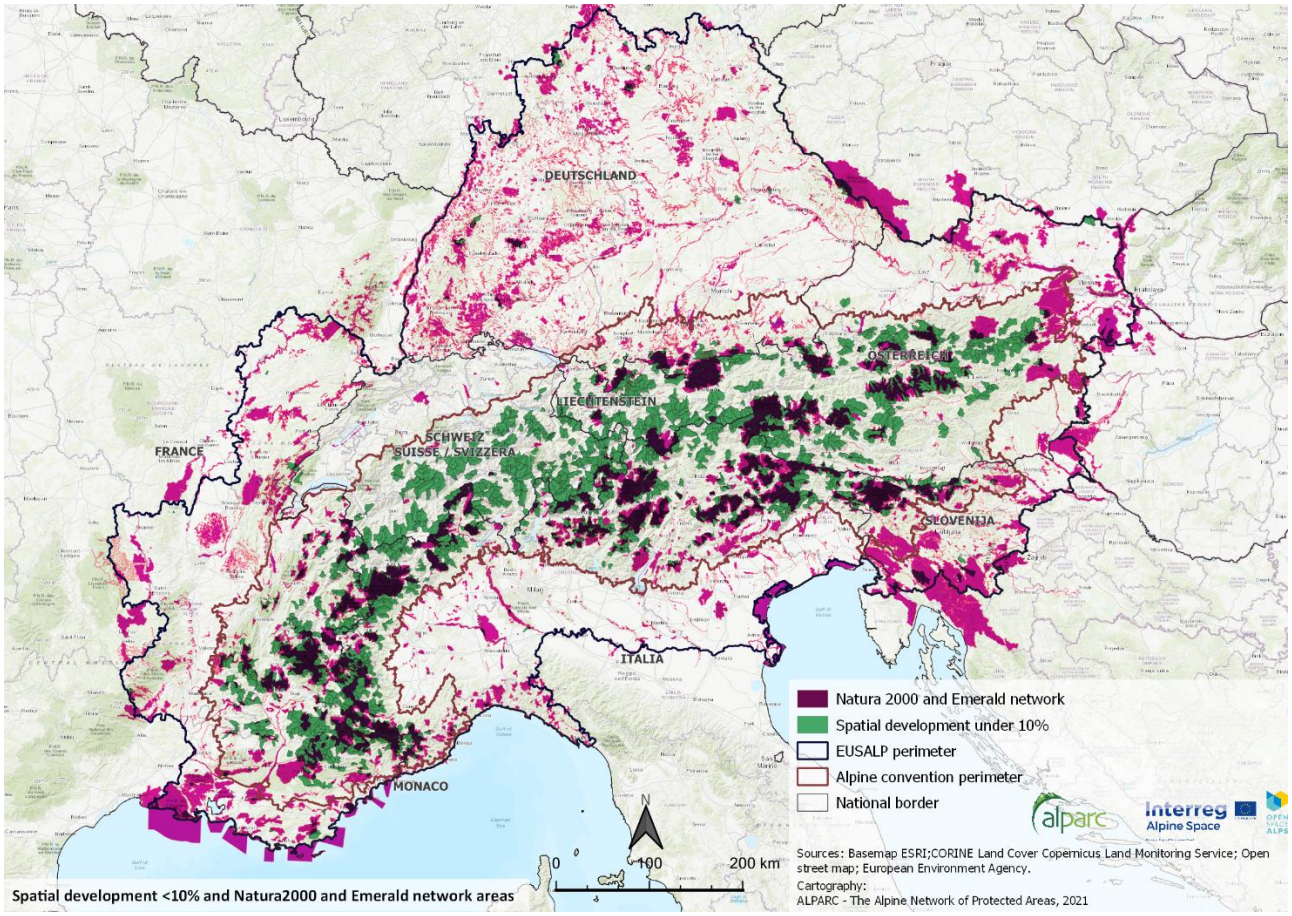
Map 11 Natura2000 / Emerald Network Areas – Spatial Development under 20%




The spaces with a level of under 20% of spatial development were compared with the Natura 2000 and Emerald network areas, as shown on map 11 and 12. The overlay is not as representative as in further comparisons with other protection categories. This could indicate that even with a specific status such as NATURA2000, the development of infrastructure is a potential threat to areas with a high biodiversity value.

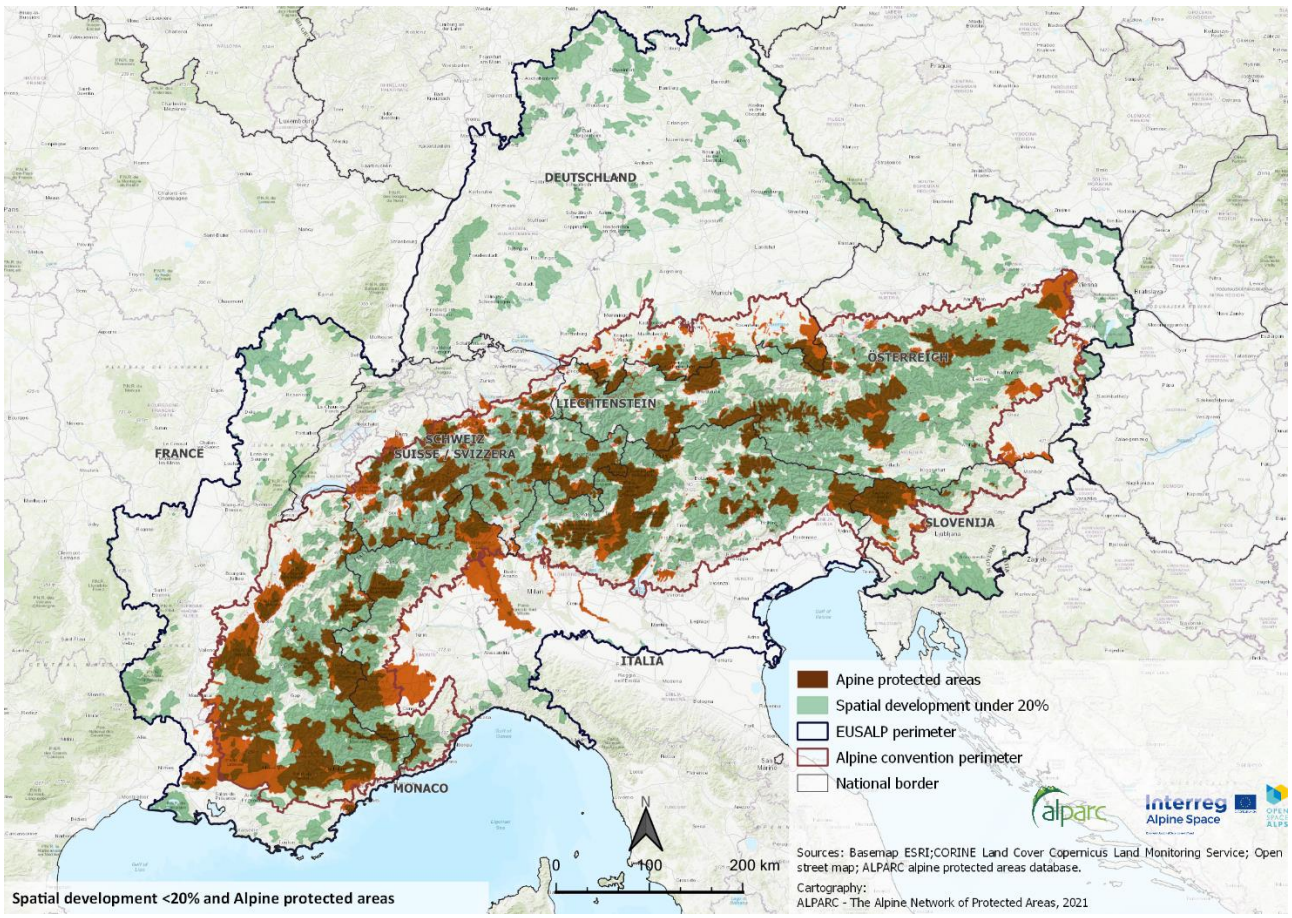
But interpretations of this situation may be various – the NATURA2000 network is not directly comparable to protected areas but to areas specifically managed to achieve a favourable conservation status in reference to the reason (habitat, species) for which they have been classified.

Map 12 Natura2000 / Emerald Network Areas – Spatial Development under 10%



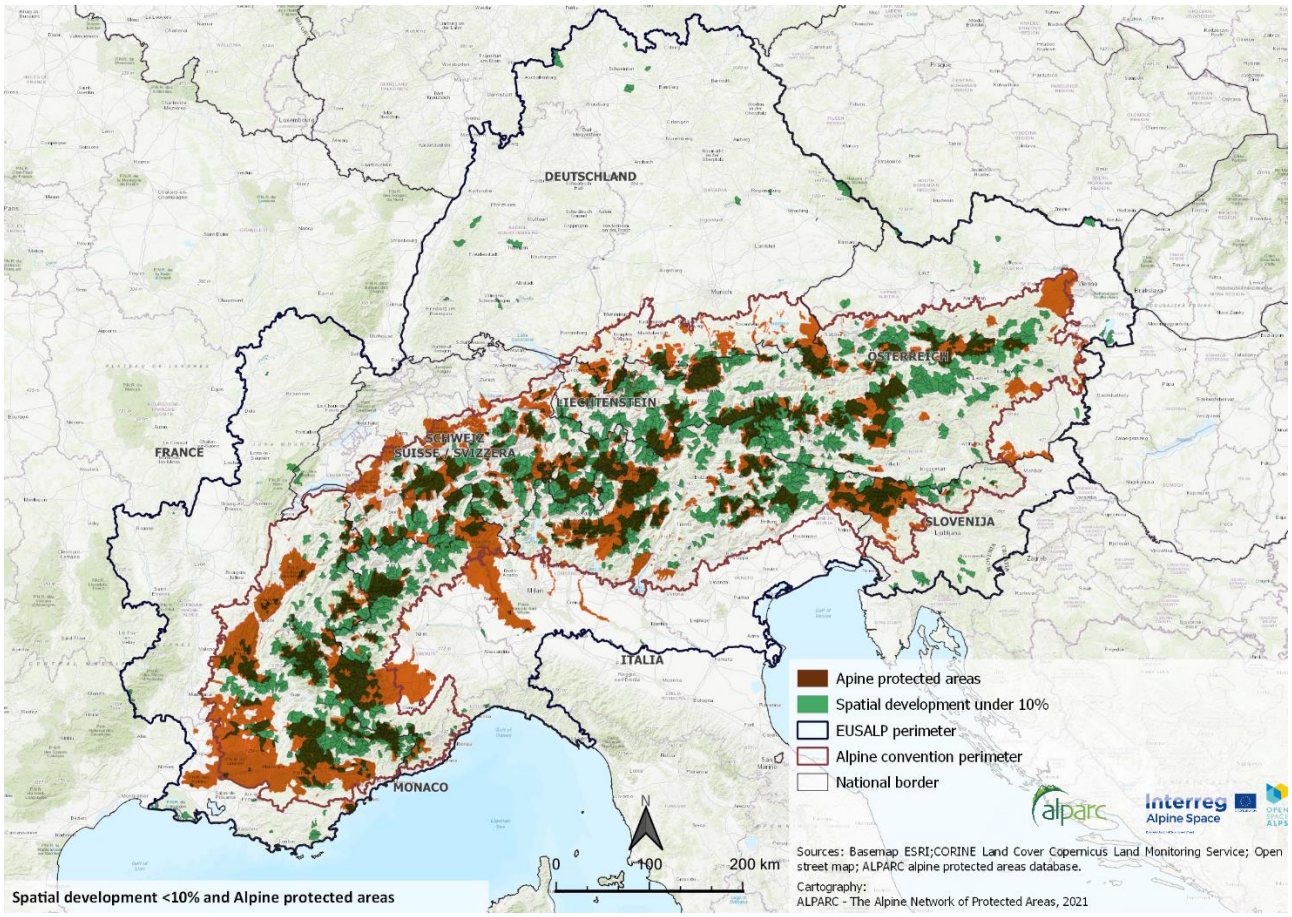

A similar result is obtained for the spaces with under 10% of spatial development. As mentioned before, the Natura 2000 and Emerald network are not comparable with the protected areas. Switzerland, e.g., has more protected areas than spaces identified under the Emerald network layer, which confirms that the analysis of the different levels of protection involves the study of different categorisations to avoid the exclusion of areas that already enjoy some conservation measure before proceeding to interpretations.

## Map 13 Open Spaces and Alpine Protected Areas – Spatial Development under 20%




The comparison of Alpine protected areas with those presenting a spatial development of under 20% (map n°13) indicates that most of these areas are located within the geographical scoop of areas with a low level of spatial development. Comparing the protected areas (National parks, Nature/Regional parks, Nature reserves, UNESCO Biosphere reserves, UNESCO World heritage, and Special protection zones) with areas presenting a spatial development of under 10% (map n°14), results in a change on the trend and nearly half of the spaces are outside this category. This could indicate on the one hand that there are some activities that are modifying the natural conditions of these spaces and on the other hand that numerous protected areas do not have a sufficient degree of protection to be located exclusively in areas with a low level of spatial development. Such areas mostly have a central mission in sustainable regional development and not in strong nature protection.

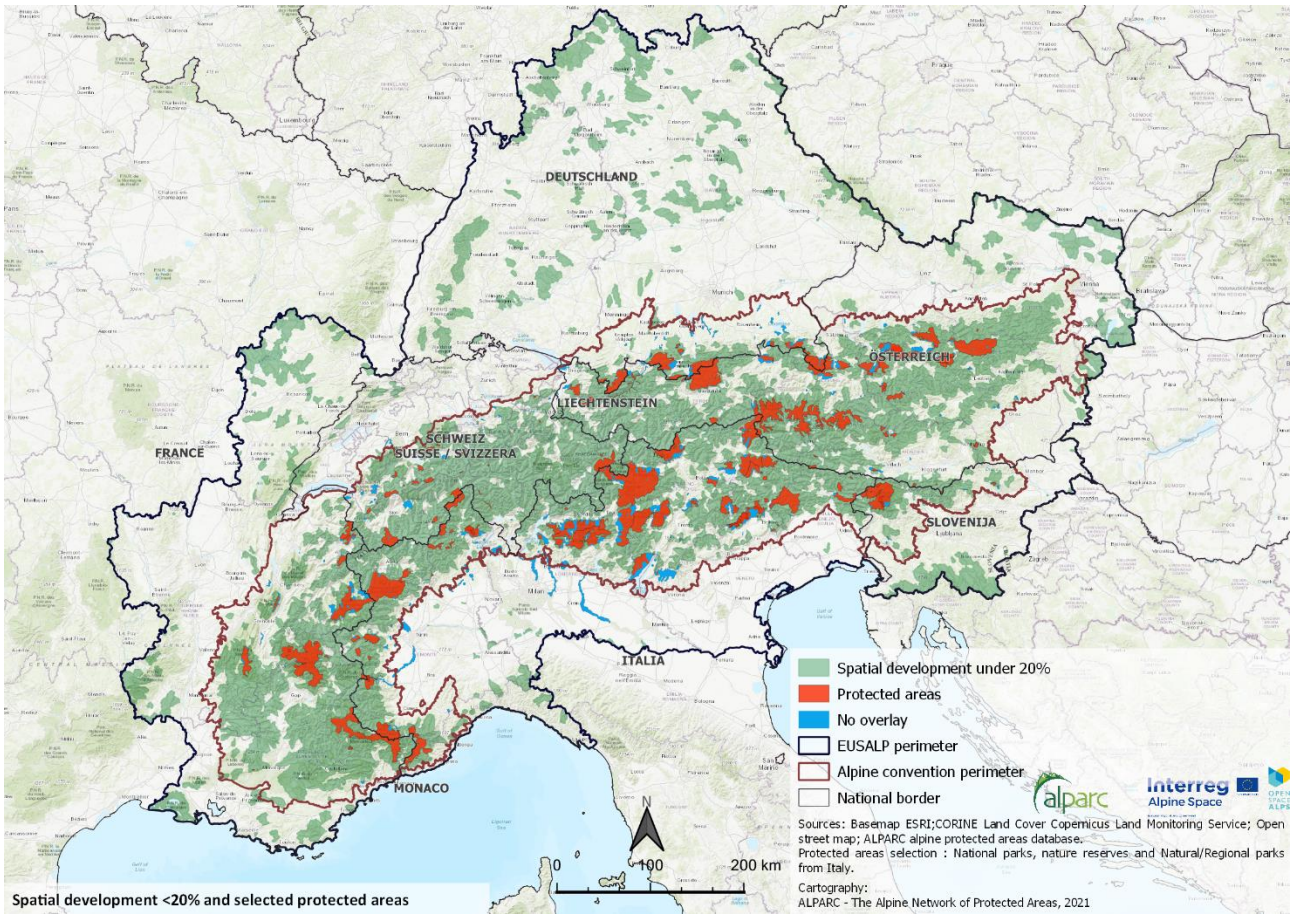
## Map 14 Open Spaces and Alpine Protected Areas – Spatial Development under 10%




A deeper analysis was conducted with some selected protected areas supposed to present a stronger level of protection by their status and mission.

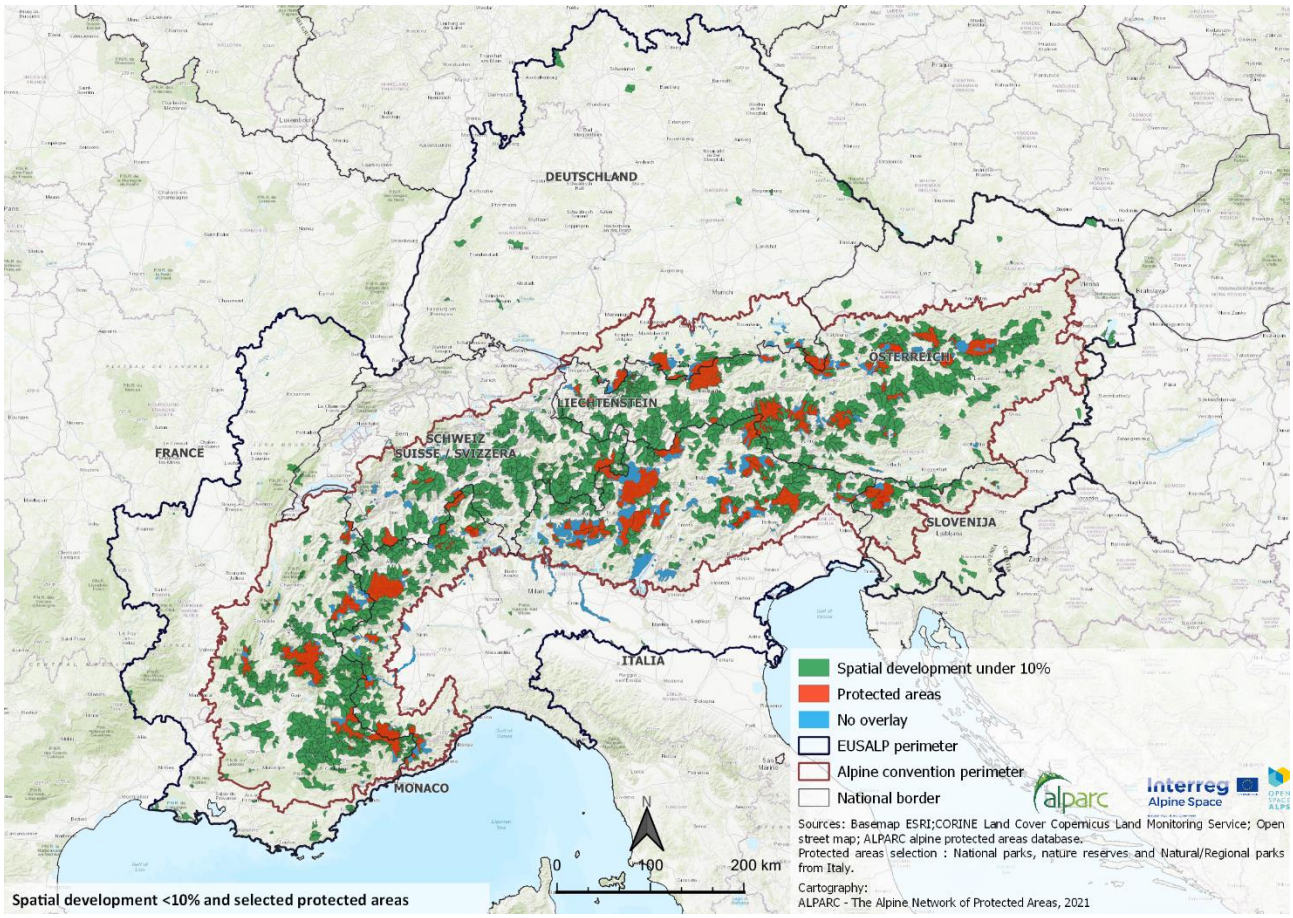
The spatial development layer was in this case intersected with the layer of selected Alpine protected areas. The result shows a layer identifying the level of influence of the infrastructure development inside three categories of protected areas (National parks, Nature reserves, Regional/natural parks in Italy) inside the Alpine Convention perimeter.

## Map 15 Open Spaces and Selected Protected Areas – Spatial Development under 20%




Most of these selected protected areas (83%) are inside a surface with a spatial development of under 20% and at least half of the areas that do not overlap completely belong to the natural / regional parks of Italy, some of which are located outside the AC perimeter.

## Map 16 Open Spaces and Selected Protected Areas - Spatial Development under 10%

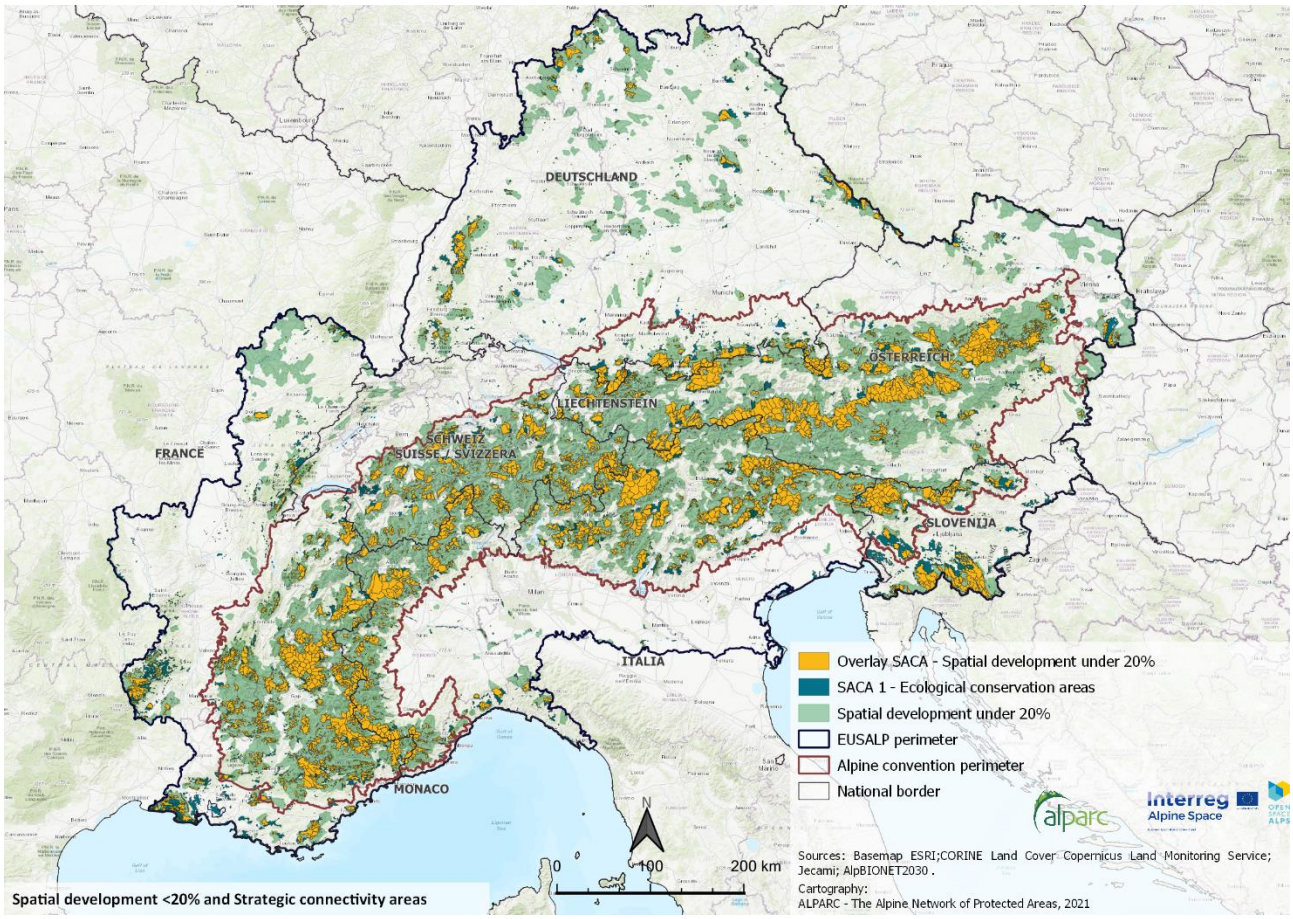



As expected, the selection of protected areas makes it possible to exemplify the differences between high and other levels of protection. Most of the surface area of this selection is even inside the category of spatial development under 10%, these spaces being, among the other categories, the ones that are the closest to natural, undisturbed protected areas. This is the case of all national parks and most of the surface of Alpine nature reserves.

## 3.5 Potential of Ecological Connectivity

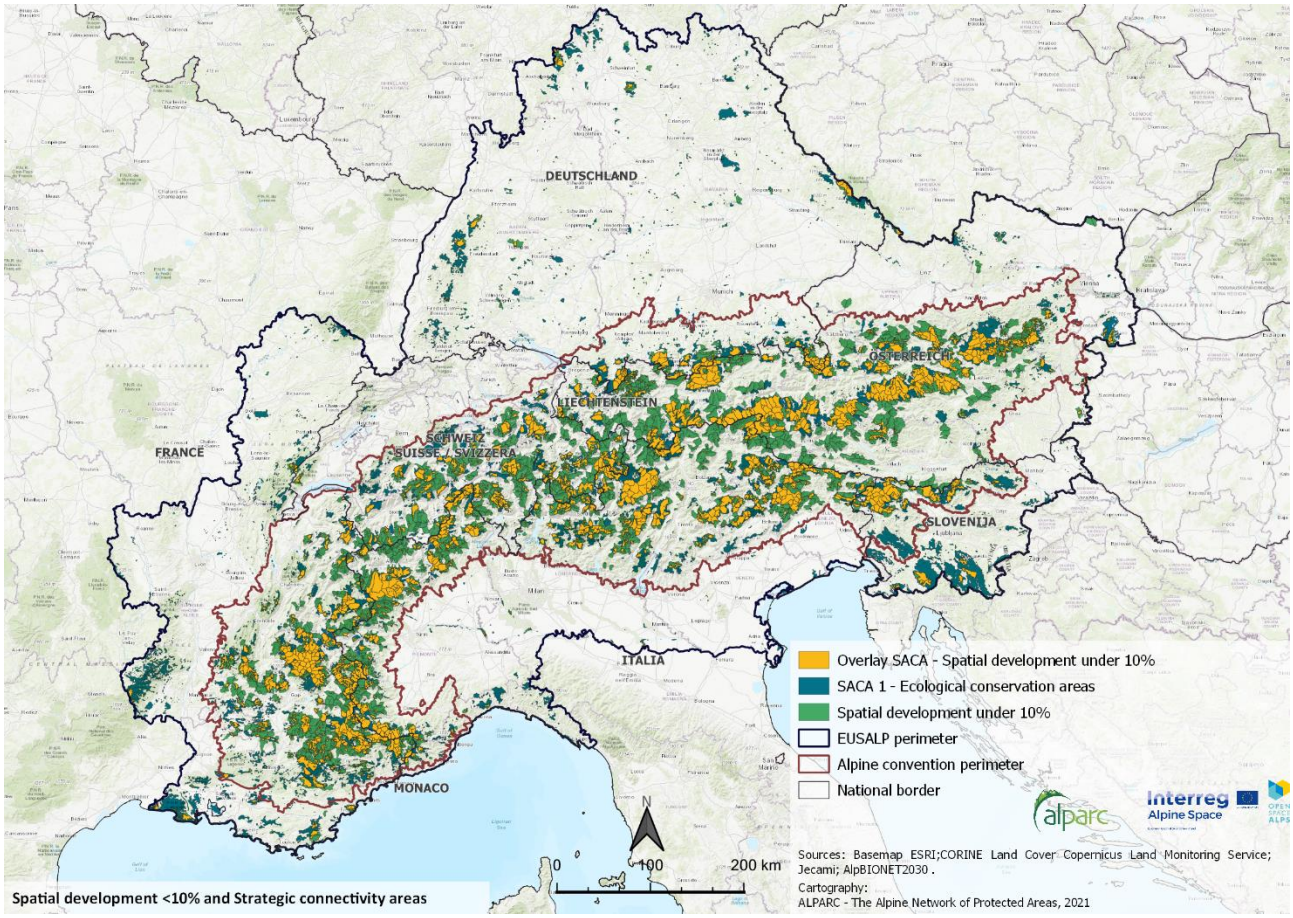
Ecological connectivity should be a main feature of open spaces to contribute to the ecological functionality of the Alpine space. The degree of this connectivity function depends on the potential open spaces may have for it. To analyse this connectivity function of spaces with a low level of spatial development, results from a former Alpine Space project (ALPBIONET2030) having the capacity to determine the potential of connectivity of a given area were introduced: the so-called “Strategic Alpine Connectivity Areas” (SACA).

Map 17 Spatial Development under 20% and Strategic Alpine Connectivity Areas



This result makes it possible to confirm the relation between the SACA 1 areas[3] and the areas with a low infrastructure development. The ecological connectivity function is fully accomplished in the intersected areas as the infrastructure presence is low and the continuum suitability indices (CSI)[4] have a higher result. The locations identified by this analysis should be prioritized for ecological connectivity conservation.

## Map 18 Spatial Development under 10% and Strategic Alpine Connectivity Areas




The strategic connectivity areas are also compared with the areas presenting a level of spatial development under 10%. On average 53% of the SACA 1 surface area is covered by the compared

3 Ecological conservation areas where ecological connectivity already works quite well (CSI ≥ 8). Ecological connectivity should be conserved in these areas.

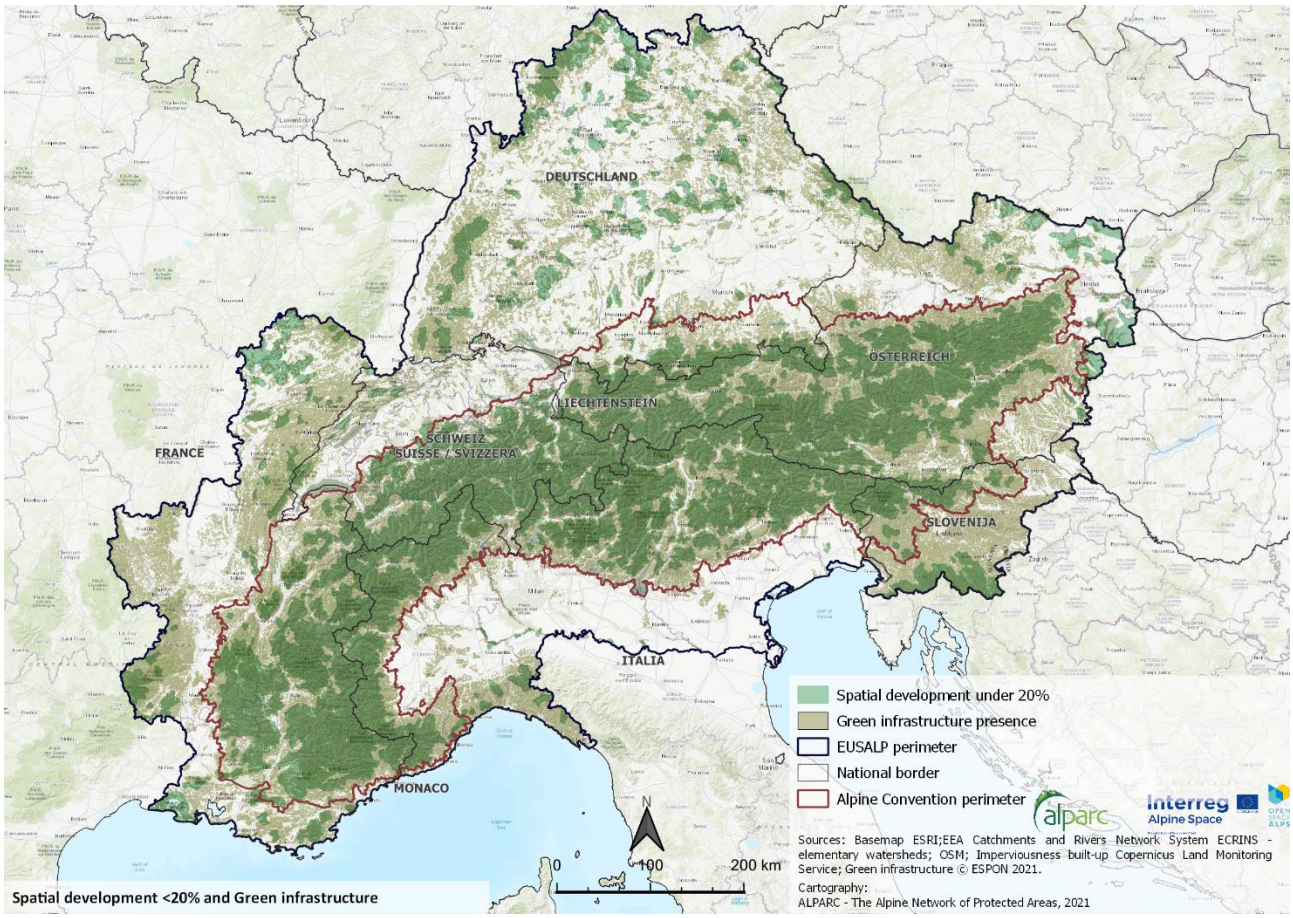
[4]The CSI is a combined analysis of structural landscape connectivity and landscape permeability. The landscape is considered as a Matrix where each part or patch potentially contributes in different degrees to ecological connectivity.

layer; a larger coverage (80%) is obtained when comparing to spaces with a spatial coverage of under 20%. The situation shows that a verification on the ground is necessary to have a clear picture of the local situation, especially for areas presenting a high potential of ecological connectivity but a spatial development of higher than 10%.

## 3.6 Green Infrastructure

In previous chapters the protected areas and the areas with a spatial development of under 20% were compared to identify how the development is related to the status of protection. Inside all the categories of protected areas it is important to identify them as multifunctional spaces. From this perspective the GRETA - Green Infrastructure: Enhancing biodiversity and ecosystem services for territorial development ESPON project has made an initial identification of Green Infrastructure (GI).

Map 19 Spatial Development under 20% and Green Infrastructure




The ESPON database integrates a layer that makes it possible to visualise the presence of green infrastructure throughout Europe. This map does not contain information about the multifunctionality of the surface but is a first step in the analysis of how green infrastructure and spaces with a low level of development are related.

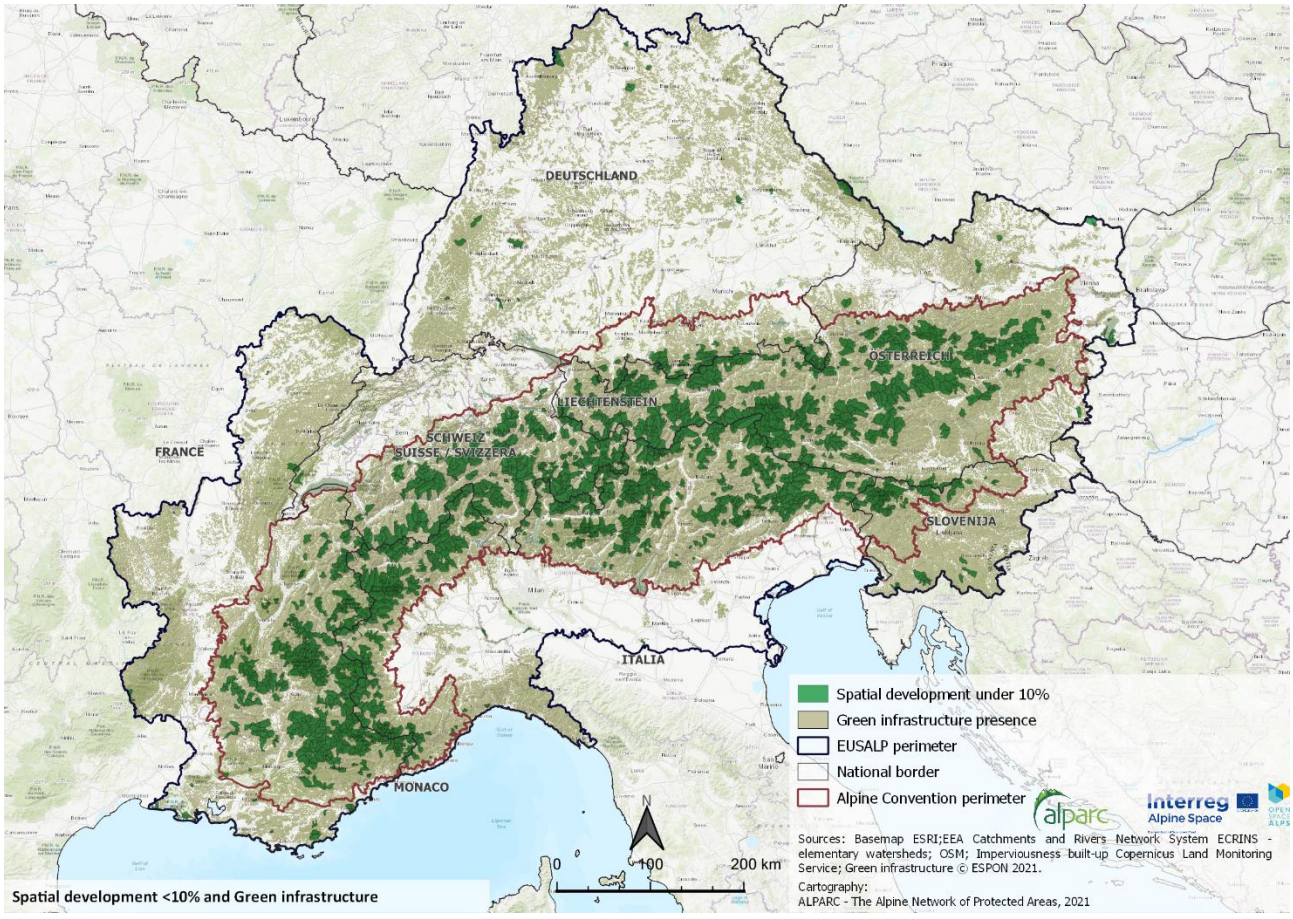
*"The Green Infrastructure (GI) is mapped as a network of contiguous patches of natural and semi-natural areas outside Functional Urban Areas that connect two or more Natura 2000 and/or Emerald Network protected sites."* (ESPON database, 2012).

Most of the surface with a level of spatial development of under 20% is covered by the presence of green infrastructure which indicates in this case that the land identified under these two overlapping categories has an important role in terms of ecological connectivity.

The spaces identified under the category of Green infrastructure excludes:

- Artificial Surfaces, Arable land, permanent crops that are not classified as High Nature value (HNV) farmland.
- Other Artificial Surfaces, such as those covered by the Imperviousness layer, isolated patches of natural and semi-natural areas, not connecting protected sites.
- By size: patches of natural and semi-natural areas smaller than 25ha or with a minimum mapping width less than 100m. (ESPON database, 2012)

## Map 20 Spatial Development under 10% and Green Infrastructure



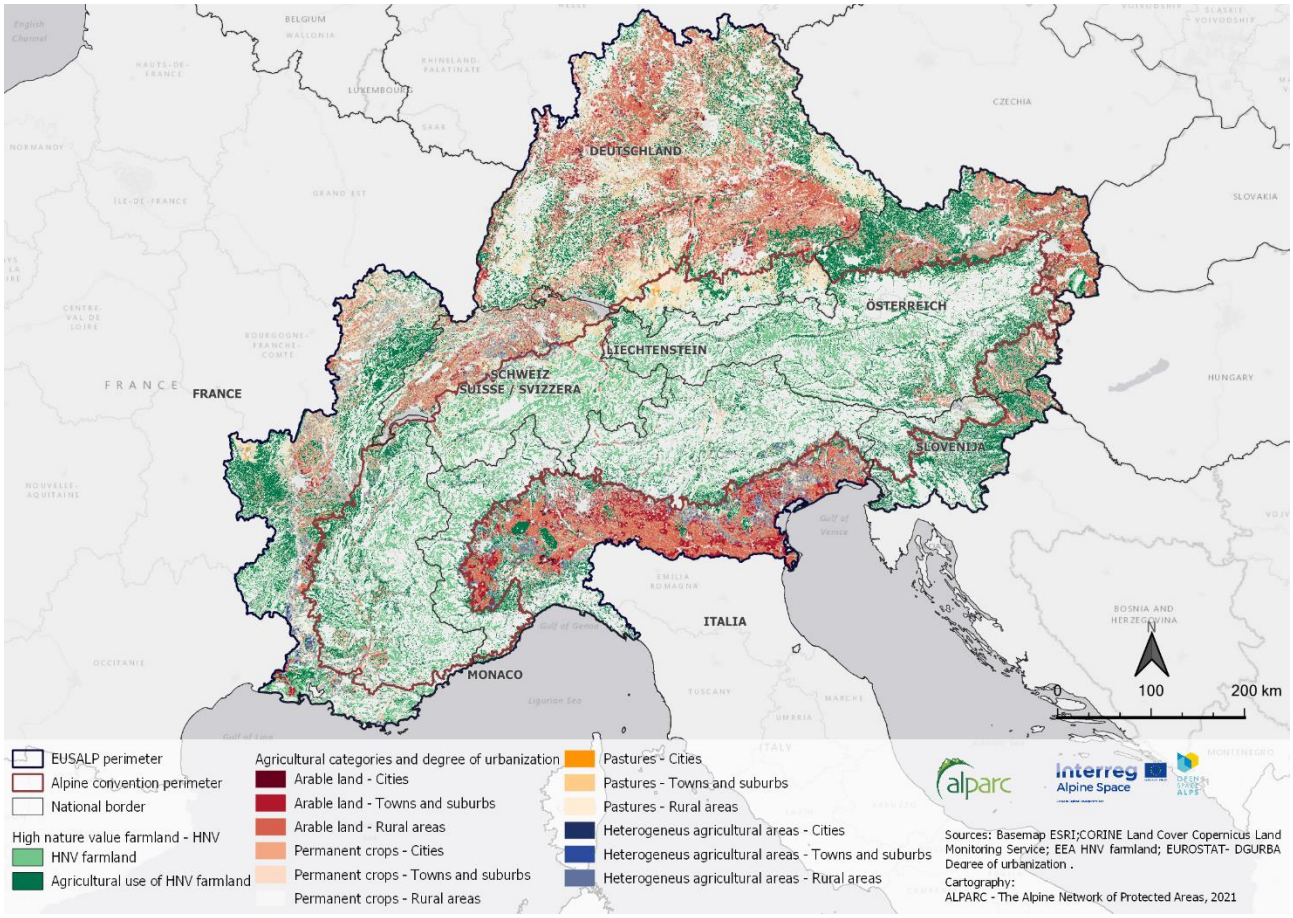
When comparing the areas with a level of spatial development of under 10% and the green infrastructure layer, there is a total coverage which shows that these areas can be catalogued as green infrastructure.

The green infrastructure analyses are not comparable to the protected areas comparison insofar as the latter considers the patches where two or more Natura 2000 or Emerald network spaces can connect and, when compared with the level of spatial development layers, it is possible to evidence the extent to which this connectivity can be achievable under the current infrastructure presence.

## 3.7 Pressure on Ecosystems by Agriculture and Urbanisation

The objective of this mapping procedure is to achieve a planning basis for further analysis and proposals for linking Urban and Inner-Alpine Green Infrastructure (GI) as multifunctional ecosystems by conserving open spaces and green infrastructure.

Map 21 Selected CLC Agricultural Activities - Degree of Urbanisation - HNV




The mapping result is based on the intersection of two different indicators:

1- The degree of urbanisation.
2- The Corine Land Cover agricultural activities.

The degree of urbanisation is an indicator developed by the European Commission, Eurostat (ESTAT) and GISCO. This classification is based on a population distribution grid and consists of three categories:

- Cities: Densely populated areas: at least 50 % of the population lives in urban centres.

- Towns and suburbs: Intermediate density areas: less than 50 % of the population lives in rural grid cells and less than 50 % of the population lives in urban centres.
- Rural areas: Thinly populated areas: more than 50 % of the population lives in rural grid cells. (European Commission; Eurostat (ESTAT); GISCO, 2016)

Table 4 CLC Agricultural Categories.

| Level 1 | Level 2 | Level 3 |
|---|---|---|
| Agricultural areas | Arable land | Non-irrigated arable land |
| | | Permanently irrigated land |
| | | Rice fields |
| | Permanent crops | Vineyards |
| | | Fruit trees and berry plantations |
| | | Olive groves |
| | Pastures | Pastures |
| | Heterogeneous agricultural areas | Annual crops associated with permanent crops |
| | | Complex cultivation patterns |
| | | Land principally occupied by agriculture, with significant areas of natural vegetation |
| | | Agro-forestry areas |

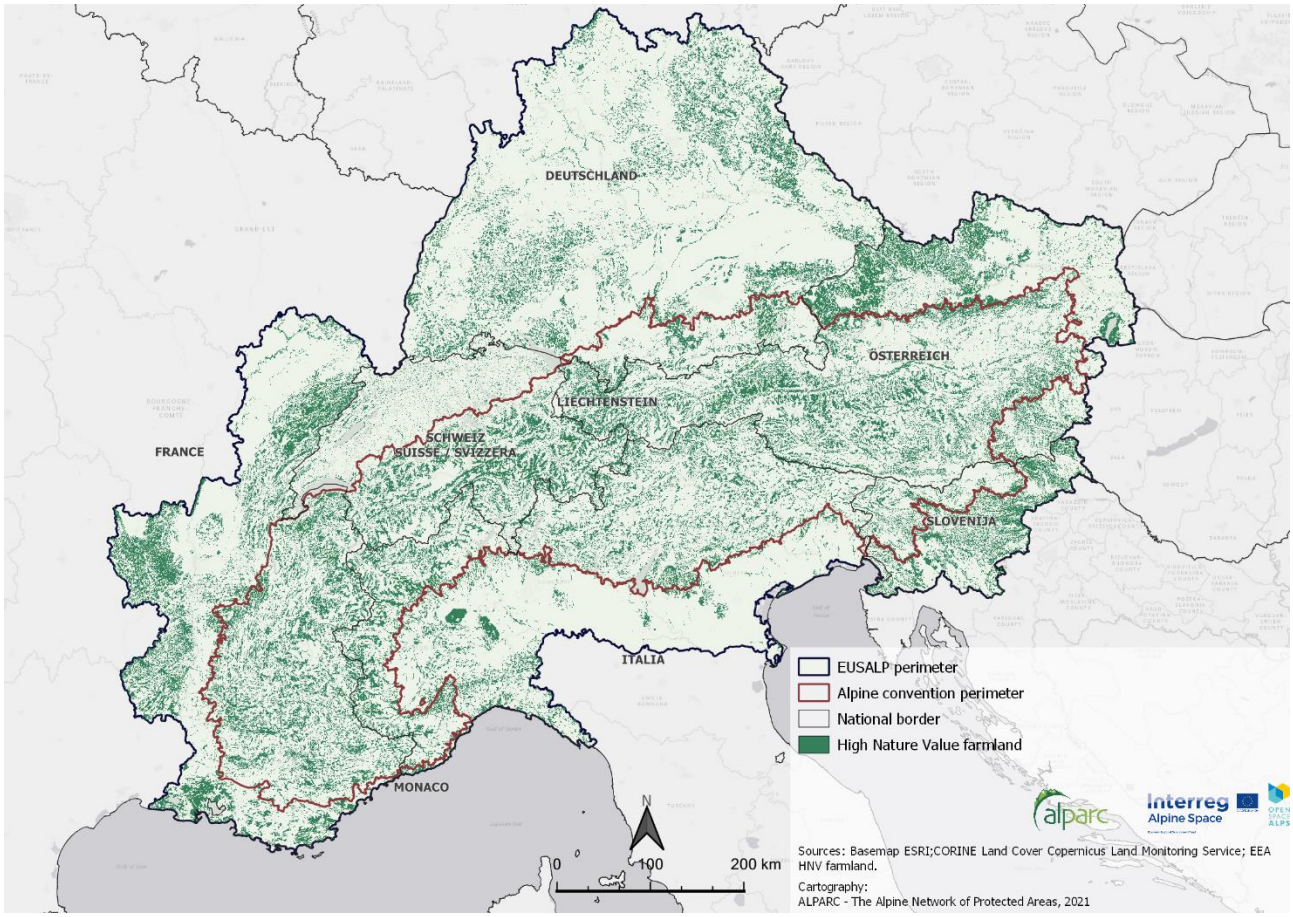
Source: CLC 2018

Once all the agricultural categories have been identified, it is possible to incorporate an additional variable. The European Environment Agency has developed a High Nature Value farmland indicator which makes it possible to identify farmland with a high biodiversity value. Combined with the selected activities it is possible to establish an indicator of land pressure: this under the hypothesis that if the agricultural area intersects with a HNV farmland, the activity will generate less pressure.

As explained in the indicator documentation, this farmland is integrated under 3 categories: *"Type 1 - Farmland with a high proportion of semi-natural vegetation. Type 2 - Farmland with a mosaic of low intensity agriculture and natural and structural elements, such as field margins, hedgerows, stone walls, patches of woodland or scrub, small rivers etc. Type 3 - Farmland supporting rare species or a high proportion of European or world populations."* (European Environment Agency, 2006)

The HNV farmland is not necessarily classified under some agricultural category as shown on map 22; these spaces are multifunctional and are spread all over the surface area contained within the EUSALP perimeter.

Map 22 HNV Farmland - EUSALP




The map is a representation of the distribution of HNV farmland inside the EUSALP perimeter. This indicator, developed by the European Environment Agency, is an estimation of the distribution patterns based on a selection on a national level of CORINE Land Cover 2006 categories[5] and other biodiversity data (Natura 2000, Important Bird Areas, Prime Butterfly Areas and National Biodiversity Datasets)[6].

[5] Appendix 2

[6] Appendix 3

A first comparison between the degree of urbanisation (2018) and the HNV indicator (2006) can be made to identify the location of the urbanisation category of the HNV land. Nevertheless, the differentiation between the northern part of the Alpine Space and the southern part seems to indicate that further indicators need to be associated or the HNV indicator needs to be pondered over or adapted to the context of the EUSALP region.

The HNV farmland seems to be well distributed all over the EUSALP surface area and in the different urbanisation categories, but when an additional indicator such as land cover is integrated, it is possible to evidence that in the southern part some of this farmland is near or already classified under the arable land category, and in the northern part this agricultural use varies widely.

Further analysis can be performed integrating the CORINE Land Cover 2018 data. Map 21 includes all the agricultural activities categorised by the degree of urbanisation overlaid with the HNV farmland.

The categories were organized according to their level of pressure regarding two factors: the location (urban degree categories) and the agricultural categories. Less pressure was shown by a lighter colour for all the rural areas and a darker colour for the urban areas. The categories were placed in order according to the classification of the agricultural activities as indicated in Table 4.

The categorised information was overlaid with the HNV farmland to identify the remaining land classified as HNV represented by a light green colour on map 21.

# Conclusions

Comparing the EUSALP and the Alpine Convention space a clear gap is visible concerning the evolution of spatial development. While the Alpine Convention space, by its character of a high mountain range and where the main anthropogenic activities are mostly located in the inner-Alpine valleys and tourist activities in middle or high altitudinal levels with less spatial development (except ski areas and energy supply), shows very important surfaces with low spatial development, this feature is almost absent in the EUSALP area.

The spatial development situation of the Alps is also covered by more nature protection instruments (protected areas) and by the Alpine Convention as the major international and legally binding tool for nature protection and sustainable development for the Alpine countries.

Concerning the altitudinal distribution of open spaces within the Alpine Convention perimeter, more than half of the surface with a spatial development under 20% is located over 1 500 m.a.s.l. The valleys have an important infrastructure presence which evidences the need of intervention and implies a challenge for spatial planning at all elevation levels.

The near natural spaces are heterogeneous, not only by their topography but also by their land uses: at least a third of these spaces have little or no presence of vegetation and these surfaces may be less likely to be the object of land use conflicts, this surface area being in most cases already under some protection measure.

Analysing the protected areas under their different categories, the result shows that these areas are not always exempt from disruptive effects. Even with the establishment of protection tools and measures, some spaces are still affected by an important infrastructure presence. Nevertheless, inside the Alpine Convention space most of the protected areas can be classified under a low level of spatial development (<20% and often < 10%).

Protected areas considered as presenting a high protection status are clearly identified as open spaces. A selection of protected areas (national parks, nature reserves and Italian regional/natural parks) are among all categories of protected areas the ones with the lowest level of spatial development (mostly <10%).

Considering ecological connectivity, the areas with a low level of spatial development as part of the European green infrastructure have a high potential of such ecological connectivity. This function increases massively if the surface is located inside the spaces with a level of under 10% of spatial development.

Urbanisation and agricultural activities are creating major pressure on areas of low development. A possible extension of these activities threatens the subsistence of the remaining near natural spaces. To illustrate the progression of those phenomena, two different scenarios have been established based on three indicators (environmental protection, degree of urbanisation and land use).

The identification of spatial development on the Alps-wide level requires an analysis of different factors. As examined in previous chapters, the infrastructure presence is only one of the criteria for the identification of open spaces.

Based on this acknowledgment two scenarios will be developed within the following maps, through a multicriteria analysis based on data from 2018 to 2050 projection and focussed only on the spaces with a spatial development under 20%. The first one - a trend scenario that indicates by a multivariable analysis (land cover, nature protection and urbanisation) how many open spaces run the risk of being degraded if the infrastructure growth trend goes on at a speed like nowadays.[7]

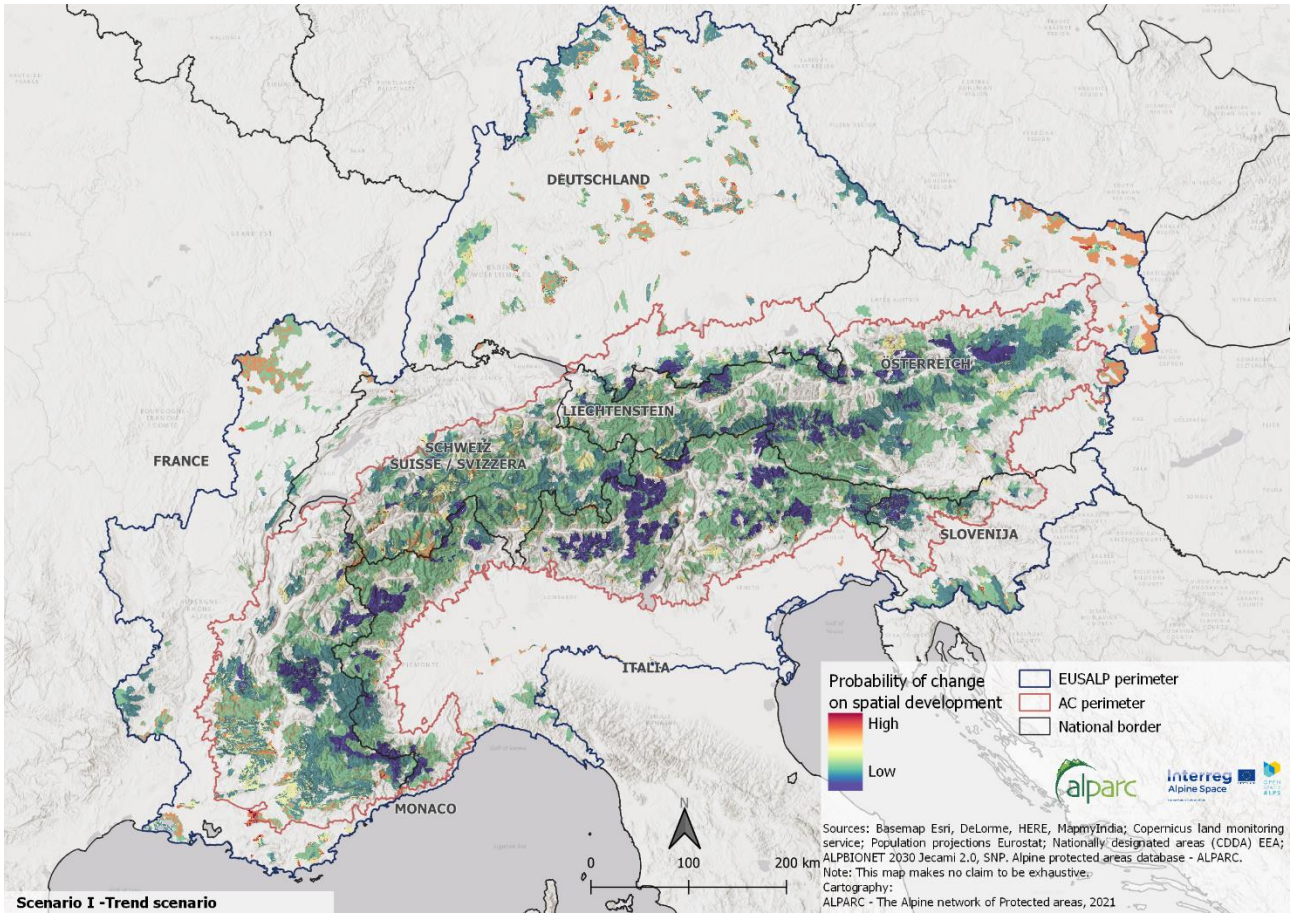
The second scenario regroups different indicators (land cover, nature protection and population density). Compared to the first one, this scenario takes into consideration a demographic growth and land uses bringing as a result a significant loss of areas with a spatial development under 20%.

The purpose of the drawing up of the scenarios consists in identifying the spaces with a higher risk of disturbance produced by the increase of agricultural and artificial lands and demographic changes.

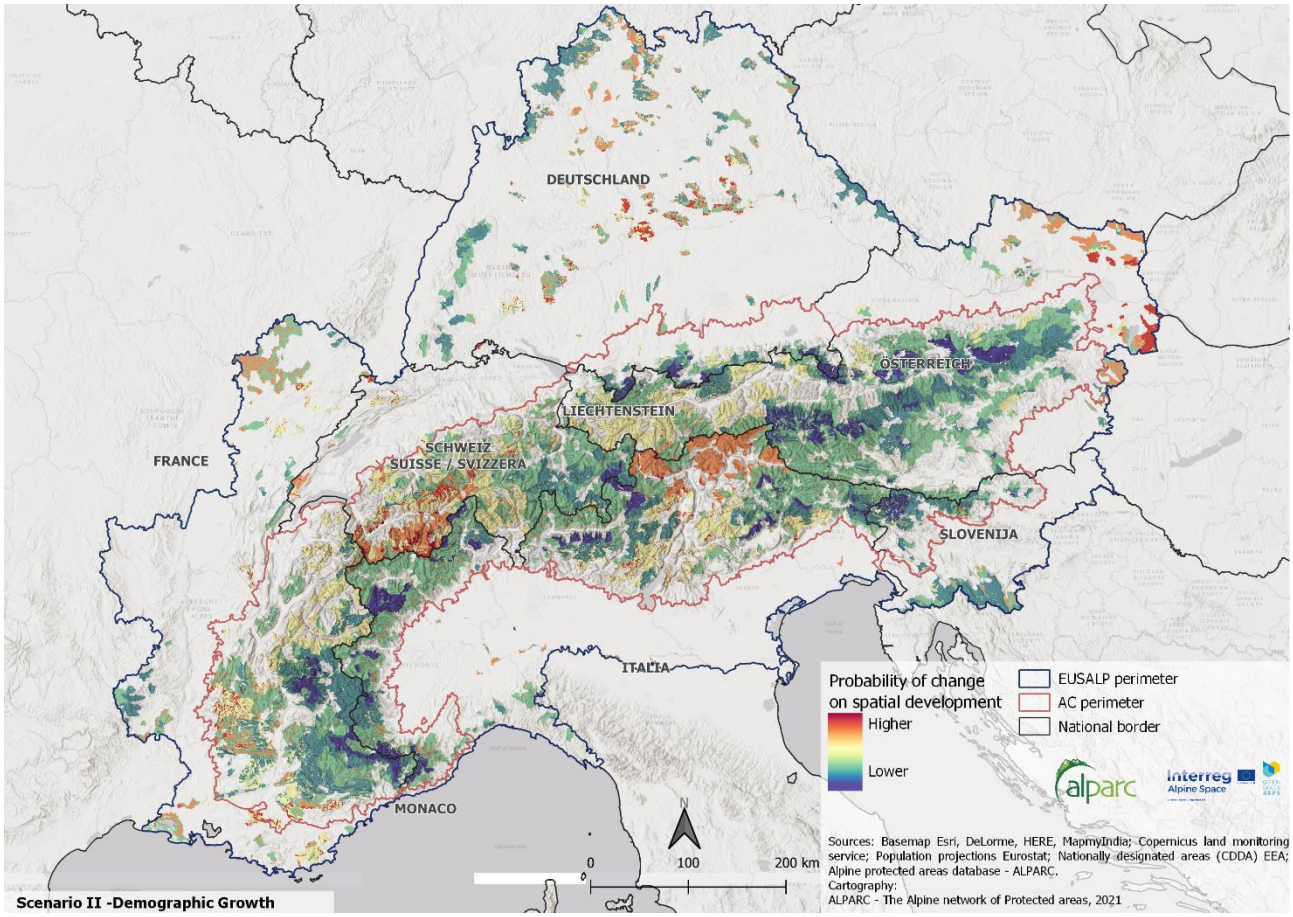
In the first scenario the spaces with a higher probability of change in their spatial development is explained by their proximity to spaces with more infrastructure presence that may evolve in the coming years.

[7] The scenarios were developed as a first stage analysis only. The information contained in the scenarios analysis is not intended to predict actual results, which may differ substantially from those reflected on the field, nor is it intended to be a complete analysis of every chosen criteria. Hypothetical risk analysis is based on certain assumptions, on the limit in terms of precision and availability of each data source that might not reflect what might happen.

## Map 23 Scenario 1 – Trend Scenario



## Map 24 Scenario 2 – Demographic growth




These tentative scenarios were developed on the hypotheses that:

- The artificial surfaces and the agricultural land represent a possible disturbance for spaces of low development.
- The protected areas and in particular the selection made in the previous chapter are spaces that in a near future may not be disturbed by infrastructures.
- The proximity of a city can produce a higher level of disturbance.
- A demographic growth will involve a loss in the lands with a spatial development under 20%.[8]

[8] The demographic growth scenario is a result from the combination of three indicators: Land cover, Nature protection and Population density. In particular, the population layer is distributed by NUTS3 regions having surfaces that go from 36 km$^2$ to 7880 km$^2$, which implies that the density values will cover a wider territory than the two other indicators that address more specific criteria (Presence of protected areas and presence of artificial or agricultural land).

The three layers were reclassified and ordered accordingly to these criteria:

Table 5 Layer Values

| Layer | Values | | |
|---|---|---|---|
| Land cover - CLC | 0<br>Presence of artificial land or agricultural activities | 1<br>Other land cover categories | |
| Protected areas - PA | 0<br>No protected area | 0.5<br>Some type of protection | 1<br>National parks, nature reserves and Natural/Regional parks in Italy |
| Degree of urbanisation - DGU | 0<br>Cities | 0.5<br>Towns and suburbs | 1<br>Rural areas |
| Population density variation 2020 – 2050 - DEV[9] | 0<br>Population variation >15% | 0.5<br>Population variation >0 and <=15 | 1<br>Population variation <=0 |

- The probability of change for the first scenario was calculated as follows:

PC (Probability of change) = (CLC + PA +DGU) / 3

The result was a layer with values from 0 to 1, which represents the probability of change in the spaces with a level of spatial development under 20%. A lower value will indicate that the zone is located near an urban zone covered by agricultural or artificial land categories and that do not have any form of nature protection and in consequence there is a higher probability of changes on the level of spatial development. On the other hand, the higher value indicates that without an identified proximity to cities, no agricultural or artificial land, and in some cases, specific protection measures, a spatial development change is less probable.

- The probability of change for the second scenario was calculated as follows:

PC (Probability of change) = (CLC + PA +DEV) / 3

The result of the calculation is a layer with values from 0 to 1, which represents the probability of change in the spaces with a level of spatial development of under 20%. A lower value will indicate a

[9] Population density by NUTS 3 region

zone with a demographic increase or a zone in the agricultural or artificial land categories which could imply that there is a higher probability of spatial development change.

Interpretation of the two scenarios:

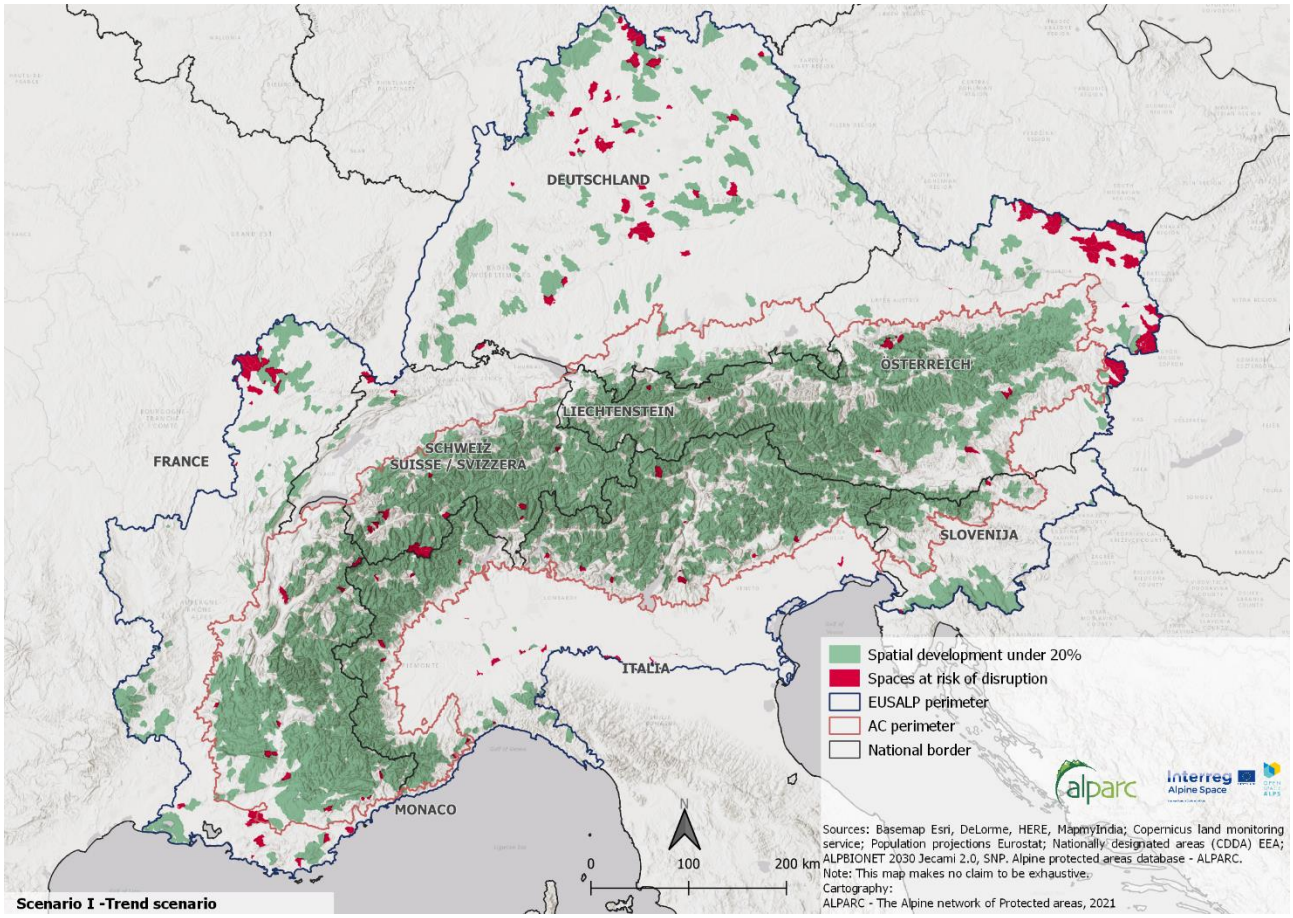
The difference of the two scenarios relies on two factors: demography and the land use layer.

For the first scenario, the selection of agricultural lands and artificial surface categories from land cover from the 2018 layer was used for the calculation. The result of this trend scenario shows where a disruption is inside the low developed spaces. Nevertheless, only a few areas would be disrupted by the presence of infrastructure. This is illustrated on map 25.

The threshold value for identifying the spaces at risk was equivalent to 0.5 for both scenarios, the values from the calculation from maps 23 and 24 respectively were regrouped on the watersheds and an average value was calculated, if this value was under the threshold, then the spatial unit was identified as a zone with a higher risk.

For the second scenario the selected land cover categories remained the same as for the first one, but the layer corresponds to a projection for 2050 produced by ESRI and Clark University. This layer is the result of the development of a predictive model based on the 2010 and 2018 land cover by the European Space Agency. (Clark Labs; Clark University; Esri) and an estimation of the demographic evolution.

Map 25 Spatial Development - Scenario 1

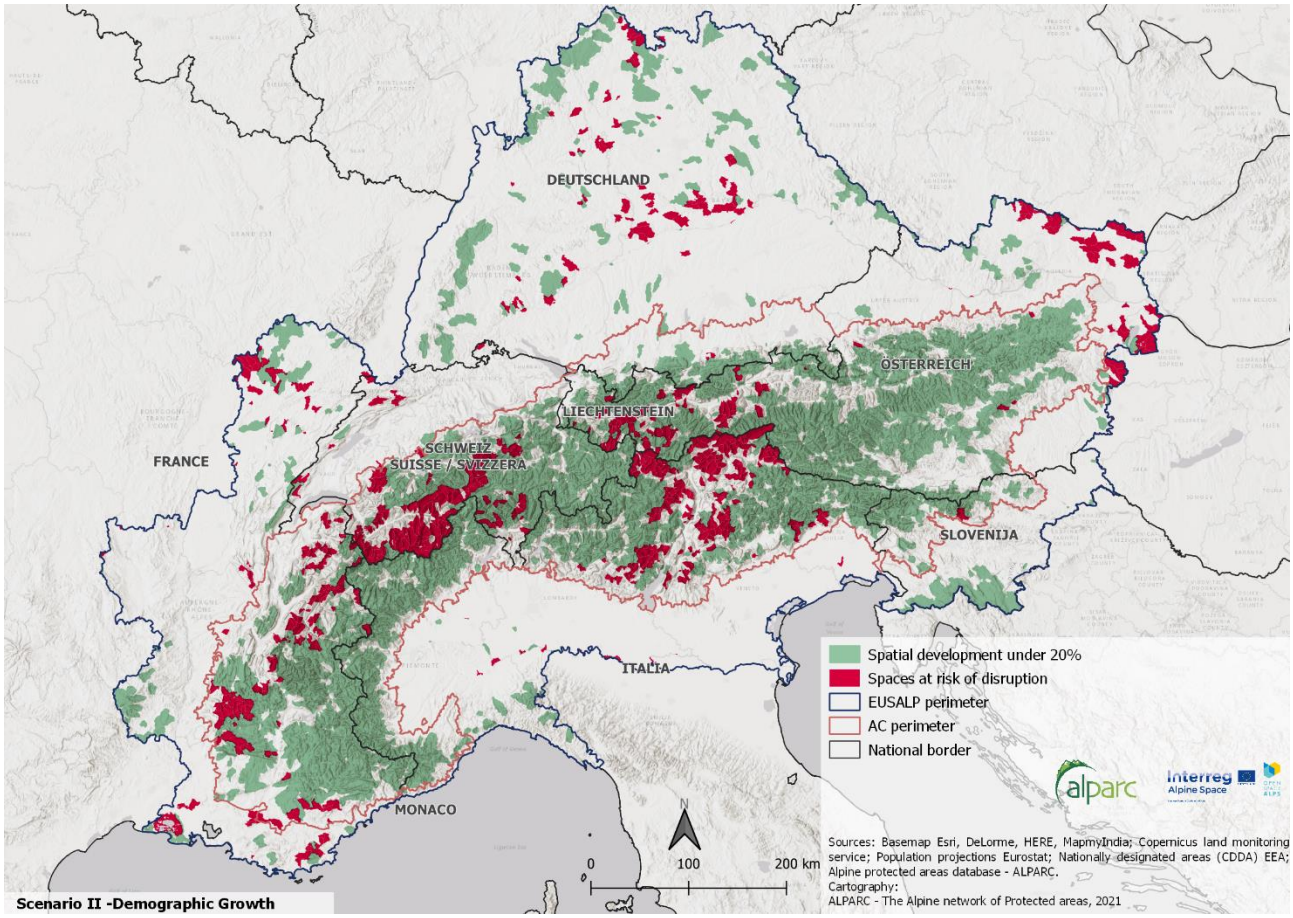



Long term result of scenario 1 and geographical location of risks:

It is important to remember that the layer of spaces with a low level of spatial development has 4,030 entities. According to the analysis of the scenario 1, 3809 entities retain a high probability of not being affected by an important infrastructure disruption.

The red polygons are the zones with a higher risk of change to their level of spatial development respecting the logic of the results obtained by the selection of the indicators previously explained, implying a loss of near natural spaces. Green areas would in this scenario remain stable in their role of open spaces (no disruption of the % of spatial development).

## Map 26 Spatial Development - Scenario 2




Long term result of scenario 2 and geographical location of risks:

According to the analysis of the second scenario considering a small increase in agricultural and artificial land, and the variation in population density from 2020 – 2050, the number of stable entities falls to 3291.

The areas demarcated in red represent the probable loss of areas of low development (loss of open spaces under 20% of spatial development).[10]

[10] The result of the scenario is mainly explained by the evolution on the population density 2020-2050 as the red zones are the NUTS 3 with the highest values on this indicator. This tendency applies for units with a low level of spatial development <10% such as the Canton of Valais (CH) or the region of Trentino – Alto Adige/Südtirol (IT), which indicates that there is a value generalization over a big surface which could lead to a misleading on the risk calculation. A more precise population indicator would be suitable in order to obtain a better scenario.

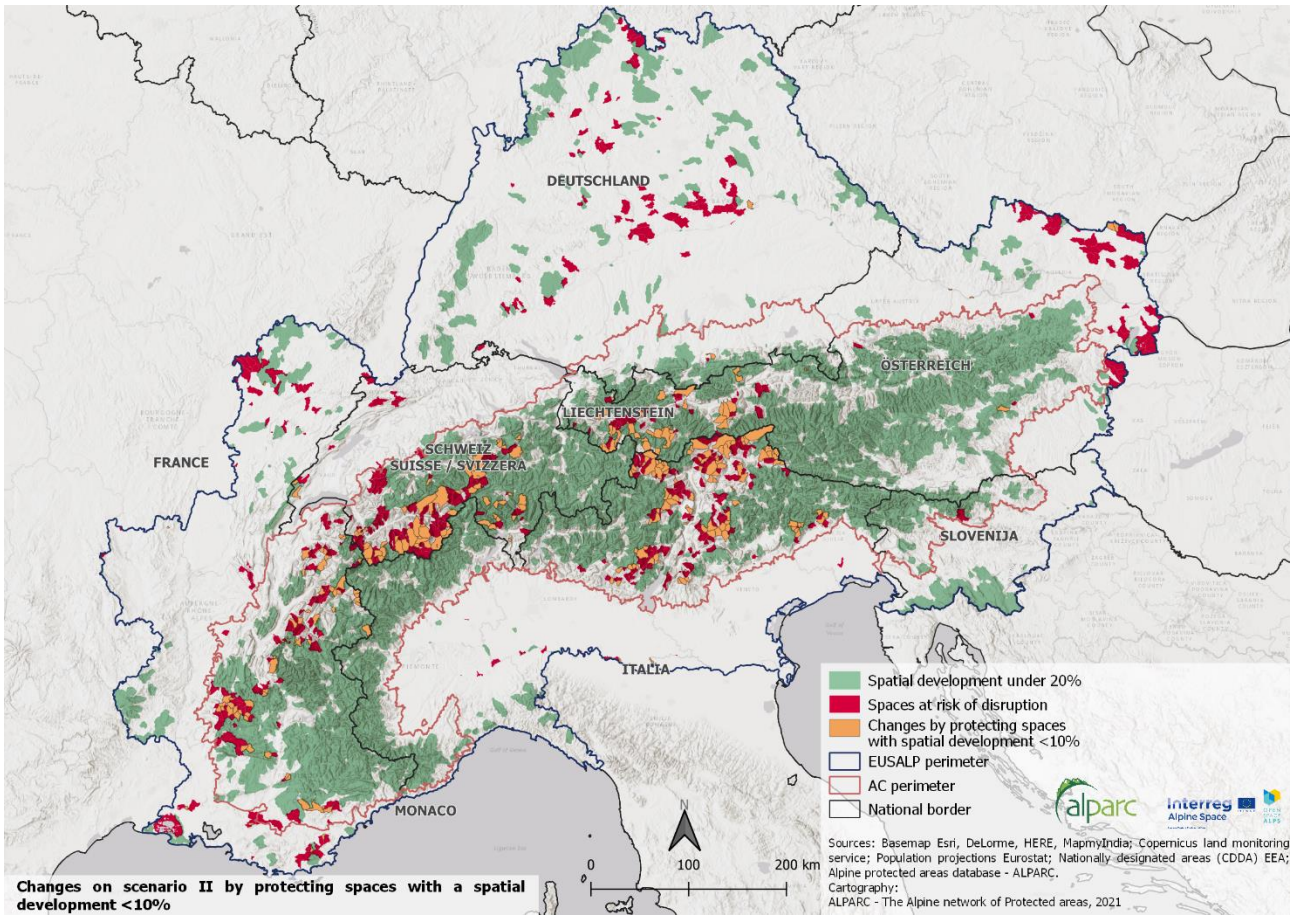
As each scenario was built with different indicators and timeframes, they are not directly comparable. However, they can give an idea of analyses that can be carried out with spatial development layers and to evidence how chosen variables have an important impact on the results.

Identifying priority zones scenario 2

As evidenced on the results from both scenarios, the impacts on the demographic increase scenario imply a larger loss of surface with a low level of spatial development, additional analysis were carried out to determine how a stronger protection level of the spaces with a level of spatial development under 10% could change this tendency.

The zones in orange colour represent the changes on scenario 2 by protecting the areas with the lowest level of spatial development. This is the result of an overlay between the areas with a spatial development under 10% and the zones presenting a risk of disruption which results from the identification of priority zones.

Map 27 Changes on scenario 2 by protecting the zones with a spatial development under 10%



A second analysis was made by identifying which Strategic Alpine Connectivity Areas category corresponded to the spaces with a spatial development under 20% and 10%, this step was made as an attempt to study the relation between nature protection and connectivity.

The table 6 resumes the proportion of coverage for the two levels of spatial development by the three SACA categories. This allows to better characterise these spaces in terms of ecological connectivity one of the quality key functions of open spaces.

Table 6 Level of spatial development distribution by SACA category

| | Spatial development 10-20 | Spatial development 0-10 | Spatial development total |
|---|---|---|---|
| SACA 1 – Ecological Conservation Areas | 9,9% | 19,7% | **29,6%** |
| SACA 2 – Ecological Intervention Areas | 38,5% | 22,5% | **61,0%** |
| SACA 3 – Connectivity Restauration Areas | 0,5% | 0,1% | **0,6%** |
| No SACA areas * | 3,8% | 5,0% | **8,8%** |

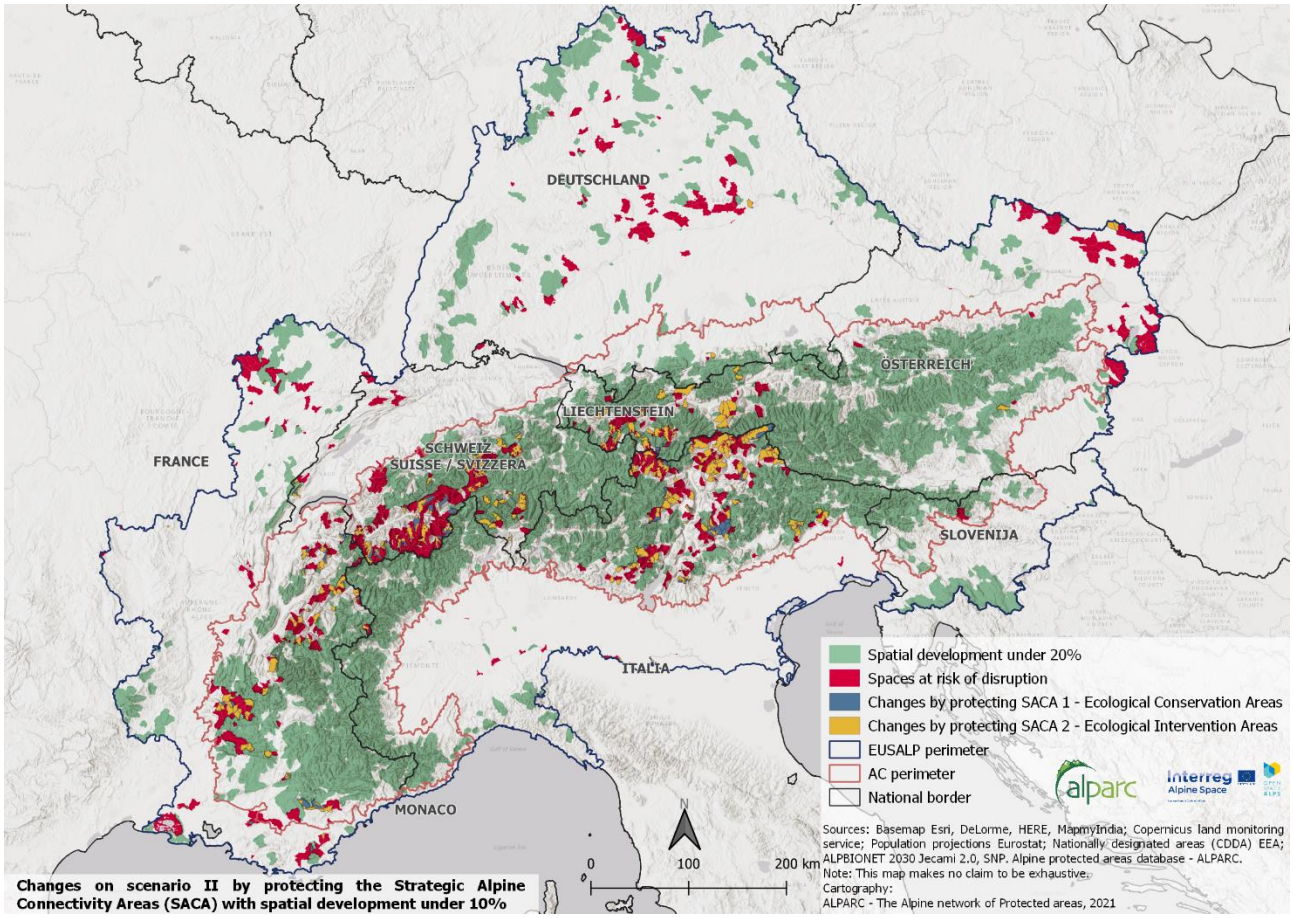
*No SACA Areas: Areas with CSI > 5 and < 8 which are not belonging to the category SACA 2

A key result from this analysis is that most of the area with a low level of spatial development belongs to the category of Ecological Intervention Areas, this evidences the importance of improving the protection on these spaces to keep them free from the infrastructure presence and to enable the accomplishment of their ecological functions.

The spaces with a spatial development under 10% and under the categories SACA 1 and SACA 2 were overlayed with the risk zones from scenario 2, the changes are different from the selection from those evidenced on map 27 because even though the selected SACA categories cover most of the land, there are some surfaces that are not classified under neither of the three SACA categories and that were not represented on the map.

The resulting map allows to define the key zones for reducing the negative impacts from scenario 2 by underlining the importance of connectivity for open spaces. This scenario combines two indicators: spatial development and ecological connectivity.

## Map 28 Changes on scenario 2 by protecting the SACA with spatial development under 10%




More variables, methods and scientific approaches could be developed to obtain more precise results. The use of these resources cannot and do not intend to replace the empirical observations. Both the scenarios and the identification of priority areas are the product of the analysis of data obtained from available sources of potential key dimensions for the study of open spaces.

The intention of the drawing up of these tentative scenarios is to get a basis for further analysis and to incorporate different perspectives on spatial development calculations making it possible to identify areas where action is needed to preserve nature for generations to come.

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# Annexes

## Annex 1 Results from Test Run with National Datasets

**Comparing the "GemeindeStrasseSonstige" Shapefile (German official geodata) vs different Shapes from the OSM Roads layer:**

The shapes were overlaid on top of the data from official/federal sources in order to recognise differences:

- *Residential*: Conformities in residential areas, no other deviations
- *Unclassified*: some/ many similarities in residential areas, some deviations in forest areas
- *Living street*: The few data are completely covered by official data
- *Track grade 1&2 north*: Many forestry roads in forest areas which are not covered by official data -> many deviations mostly by *track grade 2*
- *Track grade 1&2* south: many deviations of *track grade 2*, hardly any coverage by official data. Outside villages, mostly access roads for Alpine pastures
  - ➔ There will not be much relevant traffic
  - ➔ Similarities with "Hauptwirtschaftswege" from the official data -> not relevant
- *Service* north: Many matches, also outside residential areas, only slight deviations
- *Service* South: Many matches, also outside residential areas
- *Track* north: rarely conformities, often located in forestry areas
- *Track* south: also no conformities, mainly paths in forest areas
- *Track grade 3, 4,5* north: no conformity with official data
- *Track grade 3,4, 5* south: many deviations as well, hardly any conformity

**Conclusion:** The shapefiles *service, residential*, and *unclassified* represent in their sum the German official data set of municipal and "other" roads best (view the map "summary"). Most of the differences to the official data are due to the *unclassified* shape, which is, however, important and covers a large part of the data set.

Therefore, we **would like to propose using the following OSM feature classes** to represent road infrastructures in the Alpswide mapping approach as a starting point of the discussion:

- Motorway (+ motorway link)
- Trunk (+ trunk link)
- Primary (+ primary link)
- Secondary (+ secondary link)
- Tertiary (+ tertiary link)
- Unclassified
- Residential
- Living street
- Service

**OpenSpaceAlps_AT3.2_Mapping of Open Spaces in the Aosta and Friuli Venezia Giulia (IT) Pilot Sites**

**Open Spaces GIS Analysis.**

**Experiences from the Aosta test run:**

- For Aosta, tunnel tracks of the **motorway** were not concerned as disturbing. Only the tracks which are built on the existing surface level were considered for buffering.
- Only major roads and motorways were extracted from the regional database of the landscape plan. For **local/ municipal** roads, it was not possible to filter them from the Regional Technical Map (Carta Tecnica Regionale), because they are too precise and represent only borders of streets, no single continuous middle line.
- **Cable cars** were extracted from OpenStreetMap and cross checked with the Regional Technical Map. In OpenStreetMap the cable car Skyway Mont Blanc was missing, one of the most popular and biggest cable cars around Mont Blanc, which has a huge impact on the environment. Also, some minor cable cars were missing.
- **Power lines** were extracted from the Regional Technical Map, because they are not fully represented on OpenStreetMap.
- **Sports areas, camping places, etc.** were extracted from the Regional Technical Map. A cross checking with OSM was not conducted.
- **Wastewater treatment plants** were buffered generally with 200m. For this infrastructure, a threshold would be needed for minor installations with lower impact on the surroundings.
- **Material extraction sites and deposit sites:** A threshold for very small sites or giving them a smaller buffer would be needed to exclude them.
- **Power plants:** It is difficult to find data. Only installations for hydropower were available.

**Experiences from the Friuli Venezia Giulia test run:**

- To make a differentiation between **street levels** was a minor problem because of the clear differentiation in the dataset by municipal roads, provincial roads, national roads, and motorways.
- The main problem was to filter **cable cars**. The regional dataset for cable cars from the IRDAT database was very precise. Material ropeways were differentiated by technical characteristics like single rope, double rope, triple rope, etc. We did not consider cable cars with a single rope as disturbing infrastructure for forestry, because of their small size.
- The data on **power lines** in OpenStreetMap were more precise as the one taken from the regional landscape plan. It was verified by Google Street View.
- **Sports areas, camping places, etc.** were successfully extracted from the IRDAT database. A cross checking with OSM was not conducted.
- **Wastewater treatment plants** were not available in the IRDAT database.

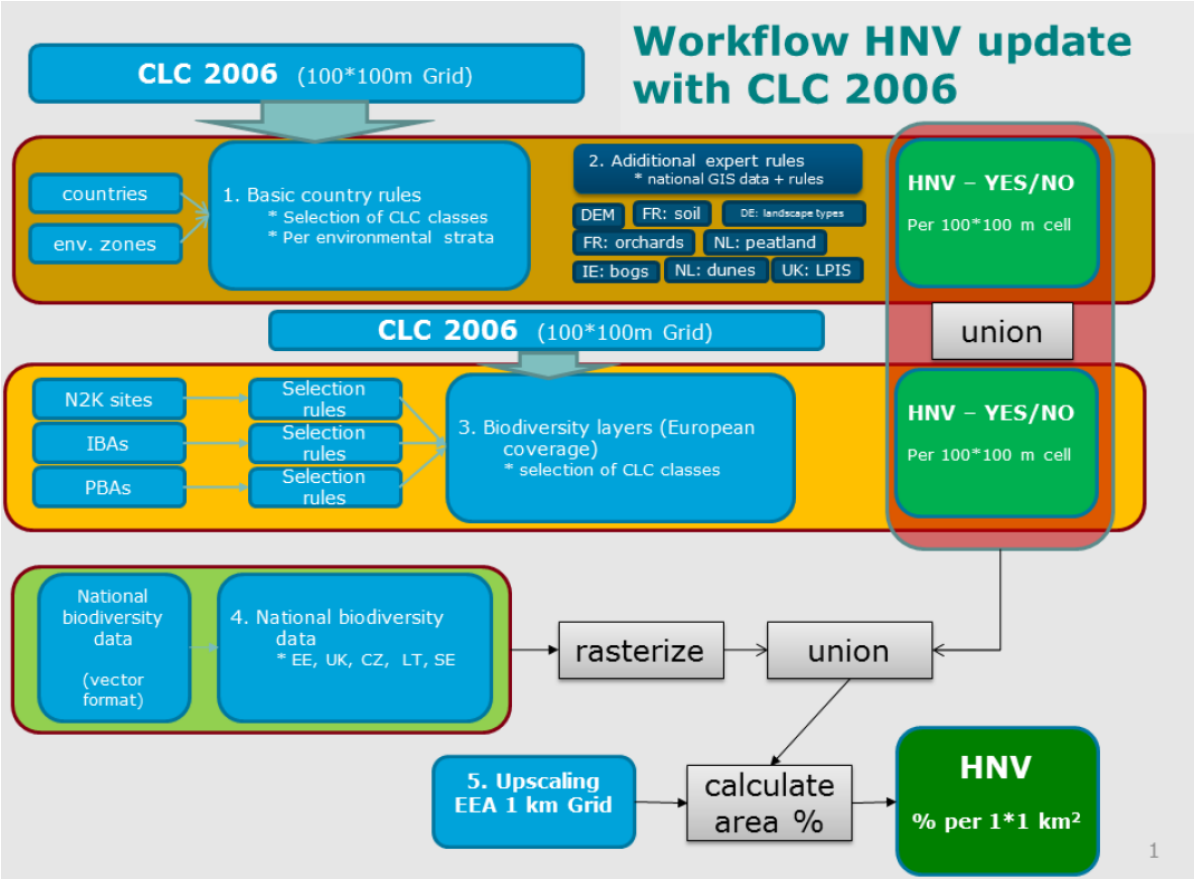
- **Material extraction sites and deposit sites:** A threshold for very small sites or giving them a smaller buffer would be needed to exclude them.
- **Power plants:** It is difficult to find data.
- It was not possible to exclude **tunnels** for motorways and streets as disturbing infrastructure with the regional dataset. Open Street Map data is better suited for considering only surface road sections. It would have been possible to exclude underground railway sections by regional data, but this detail was not considered in the test run for Friuli Venezia Giulia.

## Annex 2 CORINE Land Cover Classification System

| LEVEL 1 | LEVEL 2 | | LEVEL 3 |
|---|---|---|---|
| 1. Artificial Surface | 1.1 Urban fabric | 1 | 1.1.1 Continuous urban fabric |
| | | 2 | 1.1.2 Discontinuous urban fabric |
| | 1.2 Industrial, Commercial and transport units | 3 | 1.2.1 Industrial or commercial units |
| | | 4 | 1.2.2 Road and rail networks and associated land |
| | | 5 | 1.2.3 Port Areas |
| | | 6 | 1.2.4 Airports |
| | 1.3 Mines, dumps and construction sites | 7 | 1.3.1 Mineral extraction sites |
| | | 8 | 1.3.2 Dump sites |
| | | 9 | 1.3.3 Construction sites |
| | 1.4 Artificial non-agricultural vegetated areas | 10 | 1.4.1 Green urban areas |
| | | 11 | 1.4.2 Sport and leisure facilities |
| 2. Agricultural areas | 2.1 Arable land | 12 | 2.1.1 Non-irrigated arable land |
| | | 13 | 2.1.2 Permanently irrigated land |
| | | 14 | 2.1.3 Rice fields |
| | 2.2 Permanent crops | 15 | 2.2.1 Vineyards |
| | | 16 | 2.2.2 Fruit trees and berry plantations |
| | | 17 | 2.2.3 Olive groves |
| | 2.3 Pastures | 18 | 2.3.1 Pastures |
| | 2.4 Heterogeneous agricultural areas | 19 | 2.4.1 Annual crops associated with permanent crops |
| | | 20 | 2.4.2 Complex cultivation patterns |
| | | 21 | 2.4.3 Land principally occupied by agriculture, with significant areas of natural vegetation |
| | | 22 | 2.4.4 Agro-forestry areas |
| 3. Forest and semi-natural areas | 3.1 Forests | 23 | 3.1.1 Broad-leaved forest |
| | | 24 | 3.1.2 Coniferous forest |
| | | 25 | 3.1.3 Mixed forest |
| | 3.2 Scrub and/or herbaceous vegetation associations | 26 | 3.2.1 Natural grassland |
| | | 27 | 3.2.2 Moors and heathland |
| | | 28 | 3.2.3 Sclerophyllous vegetation |
| | | 29 | 3.2.4 Transitional woodland-scrub |
| | 3.3 Open spaces with little or no vegetation | 30 | 3.3.1 Beaches, dunes, sands |
| | | 31 | 3.3.2 Bare rocks |
| | | 32 | 3.3.3 Sparsely vegetated areas |
| | | 33 | 3.3.4 Burnt areas |
| | | 34 | 3.3.5 Glaciers and perpetual snow |
| 4. Wetlands | 4.1 Inland wetlands | 35 | 4.1.1 Inland marshes |
| | | 36 | 4.1.2 Peat bogs |
| | 4.2 Coastal Wetlands | 37 | 4.2.1 Salt marshes |
| | | 38 | 4.2.2 Salines |
| | | 39 | 4.2.3 Intertidal flats |
| 5. Water bodies | 5.1 Continental waters | 40 | 5.1.1 Water courses |
| | | 41 | 5.1.2 Water bodies |
| | 5.2 Marine waters | 42 | 5.2.1 Coastal lagoons |
| | | 43 | 5.2.2 Estuaries |
| | | 44 | 5.2.3 Sea and ocean |
| | | | *Highlighted classes are those related to HNV farmland* |

Source: Updated High Nature Value Farmland in Europe, European Environment Agency.

## Annex 3 Workflow of the HNV Farmland Update Procedure




Source: Updated High Nature Value Farmland in Europe, European Environment Agency.

All results of the project see: OpenSpaceAlps-website

**The evolution of open spaces in the Alps – between land-use and conservation for generations to come**

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**OpenSpaceAlps project partners:**

OpenSpaceAlps – Sustainable development of alpine open spaces by enhancing spatial planning governance
https://www.alpine-space.eu/projects/openspacealps/en/home