5.4 Alpine connectivity – A green island?

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Map 14 gives an overview of the current status of connectivity in the Alps according to an analysis using the JECAMI tool coupled with expert knowledge. The extrapolation for the Alps shows an image where large inner Alpine areas are still well connected, while outer-Alpine surroundings are largely affected by fragmentation hindering the migration of species to and from the Alps.

5.4.1 The aim of the map

The intention of the map is to illustrate the Alpine situation as a whole in a very general way. Local situations and regional contexts are not considered and need to be evaluated in a more precise way by local visits and territorial analyses. Nevertheless, the picture is interesting and reveals a lot about the Alpine situation of connectivity confirming that, beside some very fragmented inner Alpine valleys, the main barriers to connectivity are those surrounding the Alps, and these create real obstacles for an exchange with the extra-Alpine regions.

The map illustrates the ecological connectivity potential, the barriers and possible wildlife corridors by taking into account the land use, expert-knowledge about barriers and the technical JECAMI analysis based on scientific and statistic indicators.

5.4.2 The approach of the map

In order to evaluate the coherence of activities within the type of landscape according to principles of sustainability, a classification scheme of land use data has been implemented. Corine Land Cover data available for the whole of Central Europe was classified according to impact on the natural environment.

Three reference scales were considered for three classifications:

1. The Cost Surface Classification of the Southeastern Ecological Framework (Carr *et al.* 2002)

2. Mean Species Abundance relative to land cover/land-use of Cross-roads of Planet Earth's Life-Project (ten Brink et al. 2006)

3. Habitat Protection and Spatial Planning (Kias 1990)

This classification method was developed in an earlier project called "The Continuum Suitability Index" (CSI), a model approach of ecological connectivity across the Alps that was carried out under the Interreg IV B project ECONNECT in 2010 for the indicator land use. Table 8 shows the classification scheme.

Additionally, the major motorways of central Europe have been overlaid. European data of traffic volume was available for visualisation of main traffic arteries across the Alps (UNECE, 2005). Unfortunately, traffic census data from Italy was missing, so that motorways are mapped with a constant line width for this country.

Data Source

Land use: Corine Land Cover European seamless 100 metres raster database (Version 18.5), European Environment Agency
Roads: United Nations – Economic Commission for Europe, Census of Motor Traffic 2005

To further highlight the importance and impact of dense demographic features, a second map (map 15) illustrates quite clearly the situation of Alpine demography within the context of ecological connectivity.

Table 8: Corine Land Cover nomenclature classification

	Land Cover Class	Classification (0–100)
1.1.1.	Continuous urban fabric	0
1.1.2.	Discontinuous urban fabric	0
1.2.1.	Industrial or commercial units	0
1.2.2.	Road and rail networks and associated land	40
1.2.3.	Port areas	5
1.2.4.	Airports	5
1.3.1.	Mineral extraction sites	0
1.3.2.	Dump sites	0
1.3.3.	Construction sites	0
1.4.1.	Green urban areas	40
1.4.2.	Sport and leisure facilities	0
2.1.1.	Non-irrigated arable land	10
2.1.2.	Permanently irrigated land	5
2.1.3.	Rice fields	10
2.2.1.	Vineyards	10
2.2.2.	Fruit trees and berry plantations	20
2.2.3.	Olive groves	20
2.3.1.	Pastures	50
2.4.1.	Annual crops associated with permanent crops	10
2.4.2.	Complex cultivation patterns	10
2.4.3.	Land principally occupied by agriculture, with significant areas of natural vegetation	50
2.4.4.	Agro-forestry areas	70
3.1.1.	Broad-leaved forest	60
3.1.2.	Coniferous forest	60
3.1.3.	Mixed forest	60
3.2.1.	Natural grasslands	70
3.2.2.	Moors and heathland	100
3.2.3.	Sclerophyllous vegetation	60
3.2.4.	Transitional woodland-shrub	60
3.3.1.	Beaches, dunes, sands	60
3.3.2.	Bare rock	100
3.3.3.	Sparsely vegetated areas	100
3.3.4.	Burnt areas	100
3.3.5.	Glaciers and perpetual snow	100
4.1.1.	Inland marshes	100
4.1.2.	Peat bogs	100
4.2.1.	Salt marshes	100
4.2.2.	Salines	100
4.2.3.	Intertidal flats	100
5.1.1.	Water courses	60
5.1.2.	Water bodies	60
5.2.1.	Coastal lagoons	100
5.2.2.	Estuaries	100
5.2.3.	Sea and ocean	100

Source: ALPARC Alpine Protected Areas database, January 2016. ALPARC makes no claim of exhaustivity.

5.4.3 The interpretation of the maps

The maps illustrating both the importance of the land use impact and that of the main transit and transport axes on ecological connectivity clearly demonstrate that the most important challenges are not within but outside of the Alps. Indeed, only the most populated and fragmented inner Alpine valleys have an impact on connectivity comparable to that of the very important barriers in areas surrounding the Alps.

This statement leads to the acknowledgement that the future challenges to Alpine biodiversity have to be evaluated, at least partially, in regions outside of the Alpine space proper. It is not realistic to regard the Alps as an autonomous functioning entity when considering its biodiversity.

The conservation of the enormous diversity of life within the Alps as well of fauna and flora depends largely on the management of those areas on the outer edge of the Alpine range that are economically intensively used. Of greatest concern here are the large flood plains of important European rivers like the Po, the Rhône and finally the Rhine and the whole riverine system of the Danube.

The important peripheral Alpine cities such as Marseille, Lyon, Torino, Milano, Geneva, Zurich, Munich, Venice, Ljubljana, Graz and Vienna have a significant impact on ecological fragmentation through their relative dispersal of human settlements, their conurbanisation and satellite towns needing transport and energy infrastructure, as well as via their large footprints of economic activities (industry, commercial areas and more).

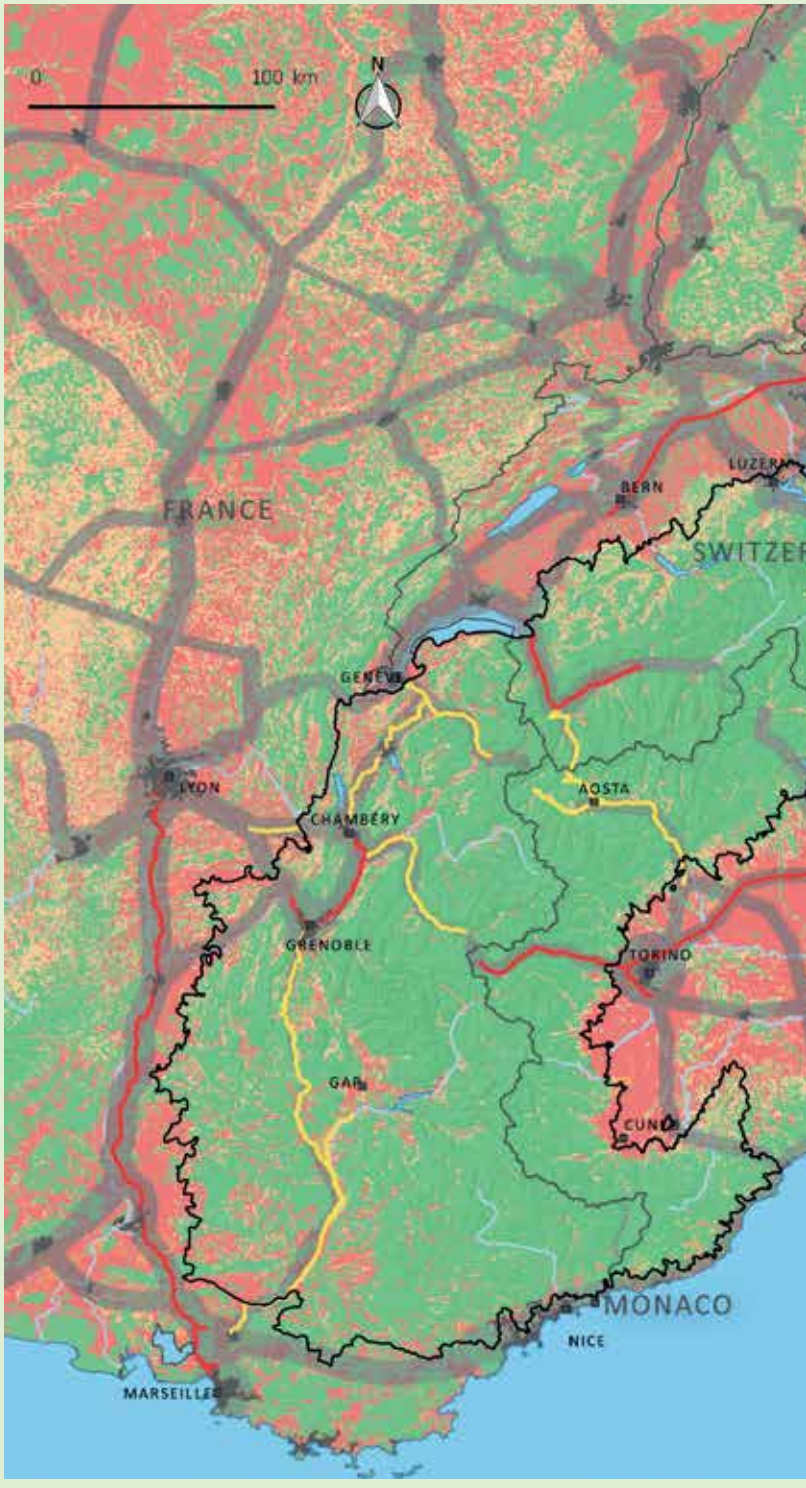
The population density layer in map 15 shows this fact in a very impressive way: the Alpine surroundings are like a continuous belt of towns with some more or less important hot-spots of settlements (see map 15).

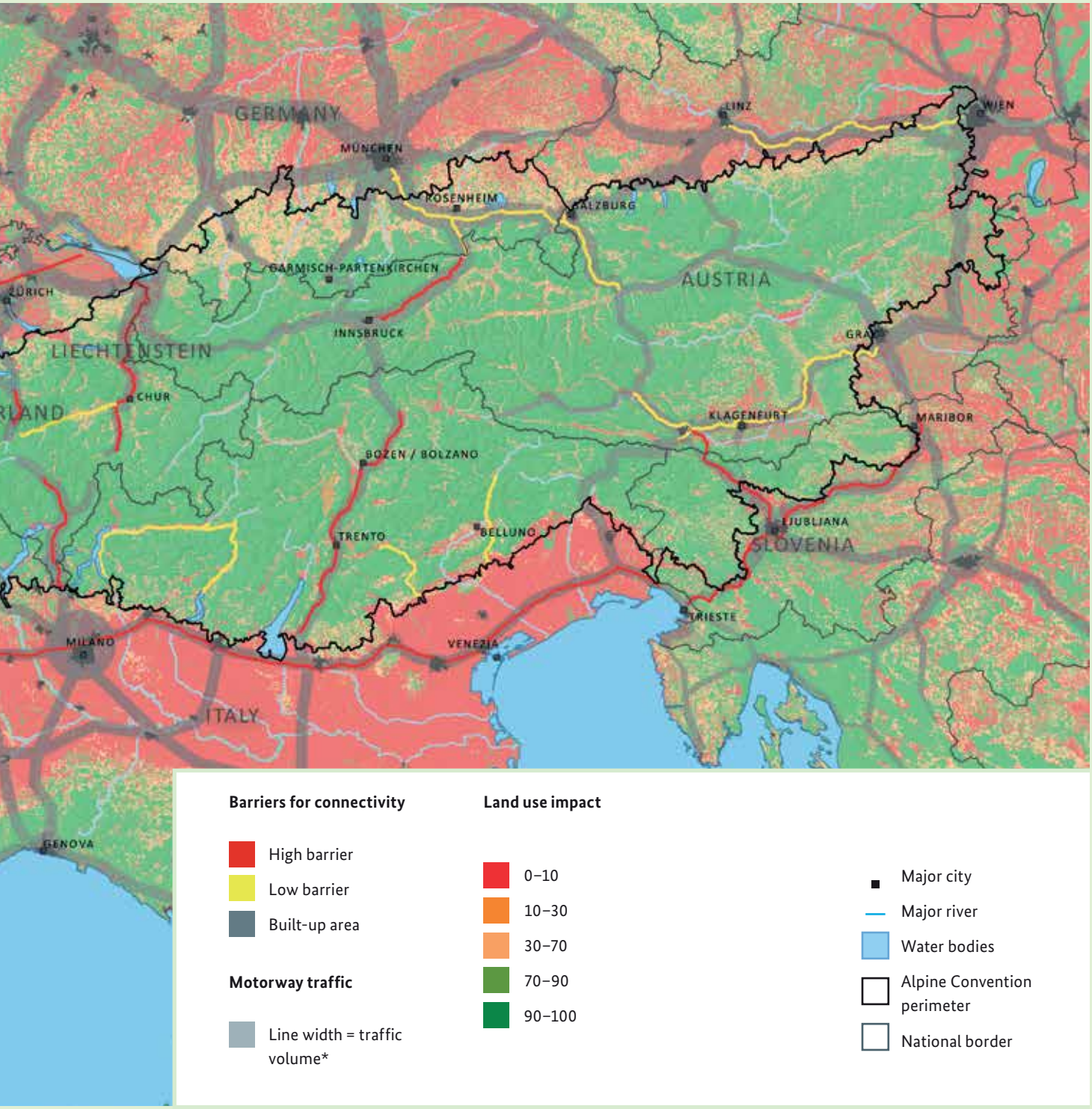
This impact combined with an intensive land-use in the respective valleys, as shown on the map (red surfaces of land-use impact), sometimes leads to complete fragmentation of the space, creating barriers of highest importance for wildlife migration.

It is evident that those extra-Alpine areas with such important urban areas and activities are generating high transport flows, of both people and merchandise, as well as of energy (high tension lines for example). The high volume traffic lines providing connectivity for human populations are creating barriers to the ecological connectivity needed for wildlife migration. In this respect, the Alps seem to be more and more isolated from their surrounding regions..

Even if Alpine connectivity still seems to be functioning in large parts of the Alps, this connectivity increasingly resembles a tenuous thread loosely linking a series of habitats, as connections to the surrounding European landscapes and mainly neighbouring massifs like the Jura, the Central Massif, the Apennines and the Carpathians are more and more disrupted. In any case, Alpine biodiversity will not survive in the long term if it is completely isolated from the outside, inaccessible for any kind of gene exchange. The growing disconnection in very large parts of the Alpine surroundings needs to be addressed through adapted measures. Especially the west (Rhone valley – France), the south (Po plain – Italy) and the east (axis Trieste – Ljubljana – Maribor) face major barriers. The northern part of the Alps seems more open to connectivity with its surroundings.

Map 14: Land use and ecological connectivity





Source: ALPARC work on barriers and connectivity potentials; United Nations – Economic Commission for Europe, Census of Motor Traffic 2005; Eurostat, EFGS for the population grid information; Permanent Secretariat of the Alpine Convention for the Alpine Convention perimeter; © Euro Geographics EuroGlobalMap opendata (original product is freely available) for rivers, lakes, built-up areas and localities; European Environmental Agency/SRTM for the digital elevation model; © EuroGeographics for the administrative boundaries. **Note**: *unique line width for Italian motorways. **Design**: Dominik Cremer-Schulte, ALPARC-Alpine Network of Protected Areas.

The inner Alpine situation is different: all important communities are situated in the large Alpine valleys such as the Isere valley (France), the Aosta valley (Italy), the Valais (Switzerland), the valley of Adda and Oglio (Italy), the valley of Adige (Italy), the valley of the Rhine (Switzerland-Austria-Liechtenstein), the valley of the Inn (Austria) and the basin of Klagenfurt to mention only the most important. In these valleys, barriers (red colour) are sometimes important due to infrastructure and settlement and in some cases to high traffic.

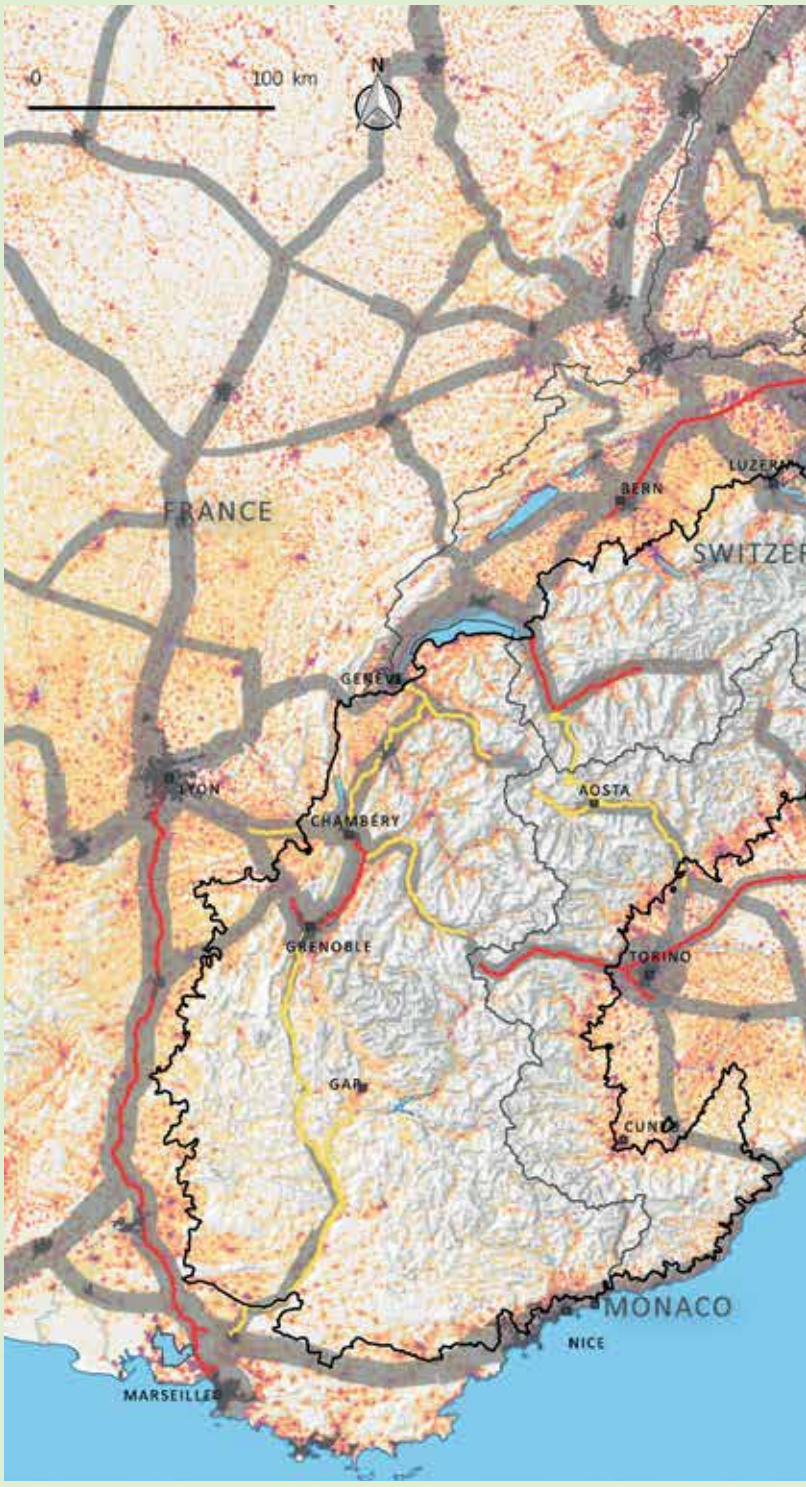
Nevertheless, they are never as significant as those involved in the outer Alpine fragmentation as mentioned above. All barriers of lower impact (yellow colour) are within the Alps (excluding the highway from Munich to Salzburg), while all barriers of high importance (red colour) are either surrounding the Alps or linked mostly to the Alpine periphery area.

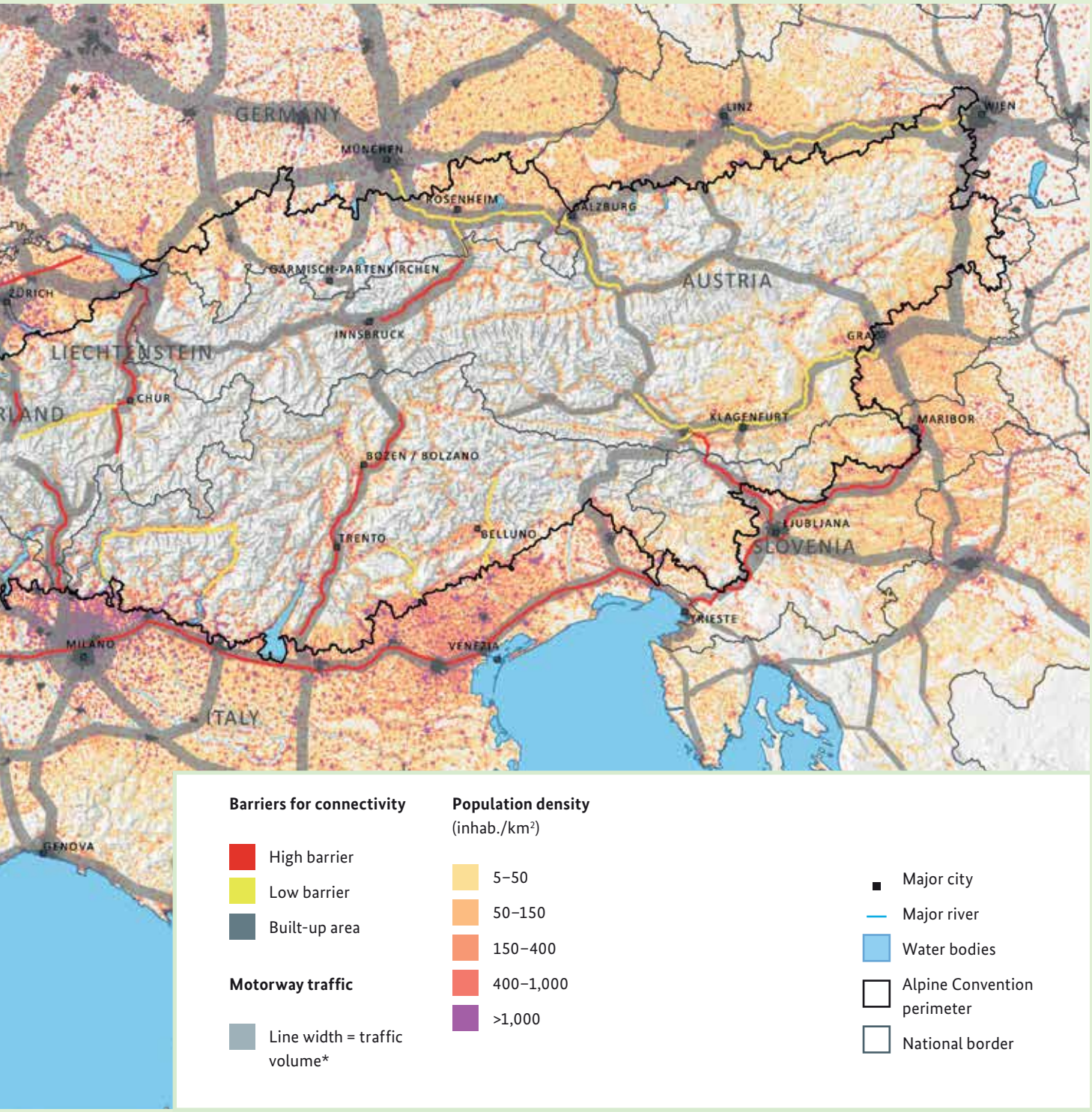
In some inner Alpine situations the fragmentation may be important, in contrast to the statement above, such as in the Isere valley, the Rhine valley and the Adige valley. In all three cases the problem results from a combination of several factors such as high traffic of persons and merchandises, important settlement with all the economic activities linked, intensive agriculture, canalisation of riverine systems, monocultures (often fruits protected by nets and more), and of course heavy infrastructure, such as highways and railways protected by fences and energy lines. As important as these phenomena may be, they are located in a punctuated fashion and do not present a continuous belt like the fragmentation that encircles the Alpine arch.

For almost all Alpine regions it is true that wildlife corridors may be in conflict with more or less important barriers within the Alps. However, the larger obstacle to connectivity exists at the periphery where links to and from the Alps are negatively impacted.

Maps 14 and 15, combining on a very large scale the connectivity potential, the importance of barriers, demography, wildlife corridors and the land use impact, provide a synthesis of inner and outer Alpine ecological connectivity. For this reason, they are one of the major results of this publication. The maps will be completed with other elements and analysed in a more detailed way in the next chapter allowing the elaboration of scenarios of Alpine ecological connectivity for the coming decades.

Map 15: Population density and ecological connectivity





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