Enhancing landscape multifunctionality and ecological connectivity across the Alps

Policy brief for stakeholders and decision makers

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South Tyrol

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Overview

Why should I read this document?

This policy brief is written for decision makers, public authorities, and practitioners working at local and regional level, and provides an overview of some of the main results of the Interreg Alpine Space Project LUIGI. The assessment of the **capacity of a region to ensure ecological connectivity and the provision of socio-ecological benefits** presented here can support regional spatial planning, the management of natural resources, and the development of policies that promote a sustainable and strategic use of our natural capital. In particular, this information can help **design, plan and develop regional Green Infrastructure networks** that support climate change mitigation and adaptation, foster an efficient use of the natural capital, halt biodiversity loss, enhance the liveability and attractiveness of a region, and maximize synergies among different policy goals.

Why are these topics important?

In the last decade, European and international institutions have been calling for actions that support the achievement of the **Sustainable Development Goals** (SDGs). The European Commission launched the EU Green Deal and the EU Strategy on Green Infrastructure to foster sustainable development and incentivize the adoption of innovative and integrative approaches that address the several challenges faced by society. In particular, the alpine region needs to address the anthropization of valley floors, rural abandonment, the management of tourism, and the impacts of climate change on the Alps. In this context, a sustainable and forward-thinking land management approach is of highest importance. For this reason, the European Strategy for the Alpine region (EUSALP) encourages the development of a strategically planned Green Infrastructure network of interconnected natural and semi-natural areas.

What will this policy brief tell me?

This brief presents the key components of an **innovative spatial planning approach in line with** EU policy guidelines and goals that can be applied by local practitioners to identify strategic and critical areas that should be **protected, restored, or sustainably managed** as part of a Green Infrastructure network. In particular, the brief will:

- Describe the project **case study region** and provide some context information
- Present the components of the regional Green Infrastructure proposed by LUIGI: a map of the **ecological network** and a map of the hotspots of **landscape multifunctionality** of the region
- Illustrate the key **ecosystem services** that underpin landscape multifunctionality.

How can I use this information?

The results and the **high-resolution** (10m) geo-data presented here can support regional territorial planning and policy development. They can be used to **identify regional and transboundary Green Infrastructure networks**. These data could moreover guide the allocation of subsidies, landscape protection measures, land zoning regulations, disaster risk reduction plans, forest management, and the identification of optimal locations for wildlife crossing points, planting of hedgerows or ecological restoration activities.

Where can I find more information?

- What are Green Infrastructures, ecosystem services, multifunctionality and ecological connectivity? →Link to LUIGI introductory concepts report
- Which are the ecosystem services provided by common alpine landscape elements? →Link to LUIGI factsheets
- Which tools can I use to conduct analyses similar to those shown in the maps? →Link to LUIGI guide to useful free and online tools
- Which methodologies were used for the mapping of the corridors and multifunctionality? →Link to LUIGI technical annex
- Where can geospatial raster files be downloaded? →Link to data repository
- Where can other LUIGI outputs and resources be found? →Link to LUIGI outputs webpage

South Tyrol

The case study region of *South Tyrol* lies within the central and eastern areas of the Alpine bow. Notably, the Ortles mountain group (3,905 m) and part of the Dolomites Unesco World Heritage are found here. Given the great differences in elevation (Figure 1) and climatic conditions, the landscape composition of *South Tyrol* is quite diverse. The rocky dolomitic landscapes contrasts with the intensive permanent cultures of apple and wine grapes in the valley floors and makes this area a very attractive tourist destination.

As a very important component of the regional economy, tourism shaped the landscape of *South Tyrol*. An extensive network of hiking trails, ski areas and other tourism infrastructure often leads to human disturbance and structural problems. Settlement pressure also increased as the result of high economic growth and urban sprawl.

Compared to all the LUIGI case study regions (for an overview refer to map 3), *South Tyrol* is characterized by a large share of sparsely vegetated areas, natural grassland and shrubland, permanent snow and forests in the mountain belt (Figure 2).

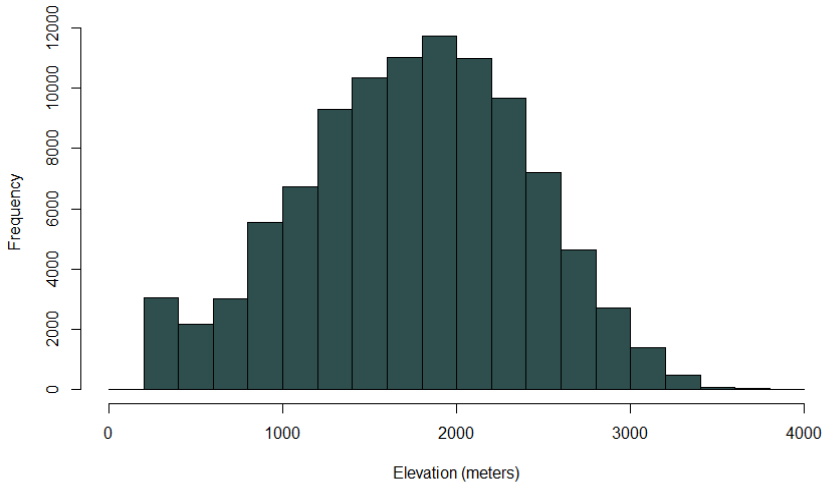

Figure 1. Elevation distribution in *South Tyrol*

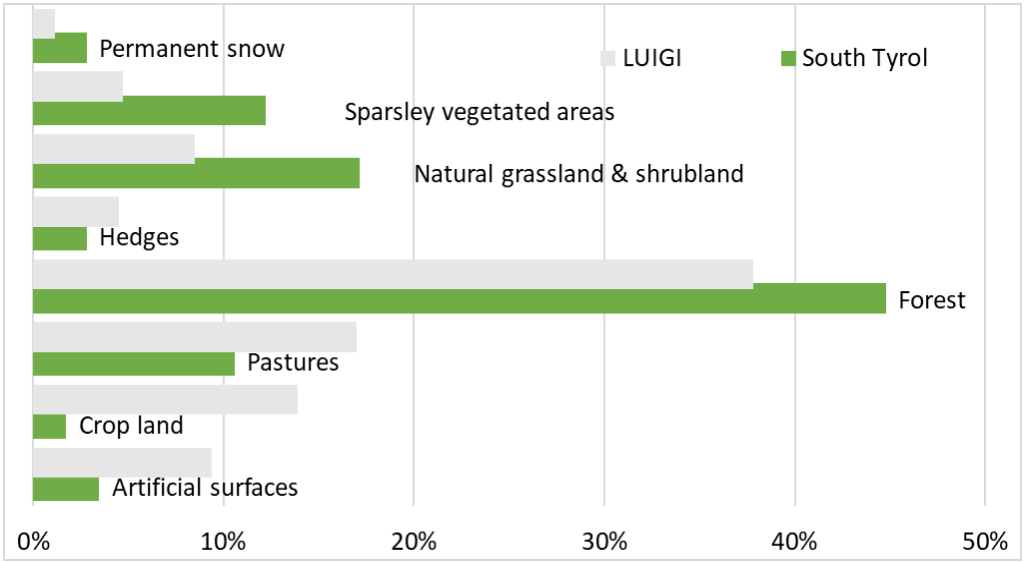

Figure 2. Distribution of different land uses in *South Tyrol* compared to the distribution in all the LUIGI case study regions.

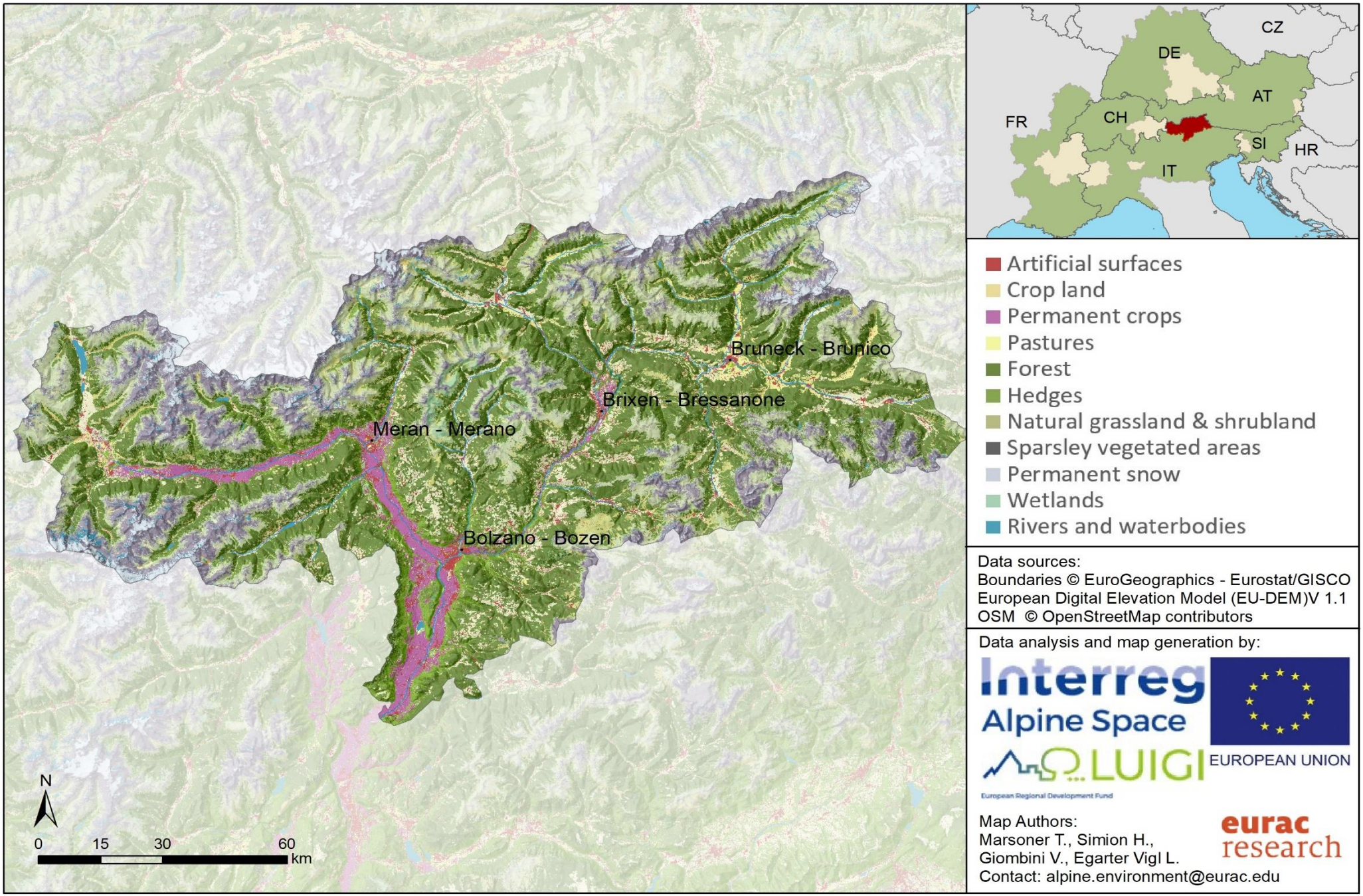

Figure 3. Map of the main land uses found *South Tyrol*. The insert map displays the location of *South Tyrol* in the Alpine region and in comparison to other case study regions of the LUIGI project.

Ecological network

The European Union is committed to address **biodiversity loss**, and the EU Biodiversity strategy for 2030 is one of the main pillars of the EU Green Deal. An **ecological network**, typically composed of protected areas and ecological corridors, represents the first component of the spatial planning approach proposed by LUIGI to identify regional Green Infrastructure. Protected **areas** provide habitat to important or rare species and are managed to maintain or improve their high ecological value. However, protected areas only cover a small percentage of the land, and biodiversity is still declining due to anthropization and land use intensification. **Ecological corridors** contribute to halt biodiversity loss by connecting protected areas and by fostering land management practices that support biodiversity and ecosystem service provision.

What are Ecological Conservation Areas?

Ecological Conservation Areas are **areas of high natural, ecological and cultural value.** For the Alps, they were mapped by the Alpbionet 2030 project to identify zones that should be conserved or protected (Figure 4). They include protected areas, but also those areas important for biodiversity that are located where there is little human disturbance (see here for more details). In our spatial planning approach, they represent the core elements of Green Infrastructure networks.

How can ecological corridors support biodiversity?

Establishing corridors between Ecological Conservation Areas helps animals to move across the landscape to find resources, shelter, and mates. This increases genetic variability and the persistence of animal populations over time. Moreover, corridors allow species to move their range in response to climate change. Management actions that support biodiversity include limiting the use of pesticides and fertilizers, increasing the proportion of hedgerows and natural vegetation in agricultural landscapes, restoring natural ecosystems, and creating opportunities for animal crossing.

What is the added value of this map?

While ecological connectivity has been assessed in many ways by different actors across the alpine space, the map shown here presents a **standardized and harmonized approach** for the alpine region that identifies a **common and transboundary** ecological network. It can be used for comparing previous work conducted at the local level, and for identifying regional Green Infrastructure networks that take in account transboundary alpine dynamics. In the present approach, ecological connectivity has been defined as a function of both the spatial configuration of the landscape and of the resistance of land uses to the movement of medium-large forest mammals, such as deer (Figure 5).

Which are the main ecological corridors and barriers in the region?

The Adige valley represents the main barrier to animal movement. Currently there are the lowest levels of connectivity, and the establishment of corridors is hardly feasible. Better opportunities arise in the Vinschgau/Venosta valley and south of Bolzano, near the Monticolo forest, and the Caldaro biotope. The centre and eastern areas of *South Tyrol* display high levels of ecological connectivity outside of bigger urban settlements such as Bressanone/Brixen or Brunico/Brunek.

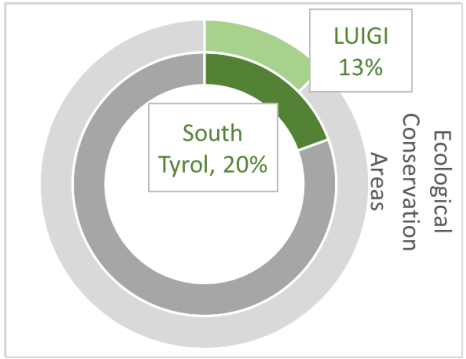

Figure 4. Ecological Conservation Areas represent 20% of the territory of the *South Tyrol*. For comparison, in the LUIGI case study regions, 13% of the territory lies within Ecological Conservation areas.

What does this map tell me?

Ecological corridors (in blue) are the areas that, if managed well, could favour the movement of medium-large forest mammals between **Ecological Conservation Areas** (dark green), improving the current degree of **connectivity** (beige to bright green). Sections of the corridors in darker blue represent **pinch-points** and areas that are particularly important. **Barriers** (in red) are areas that affect the location or quality of ecological corridors.

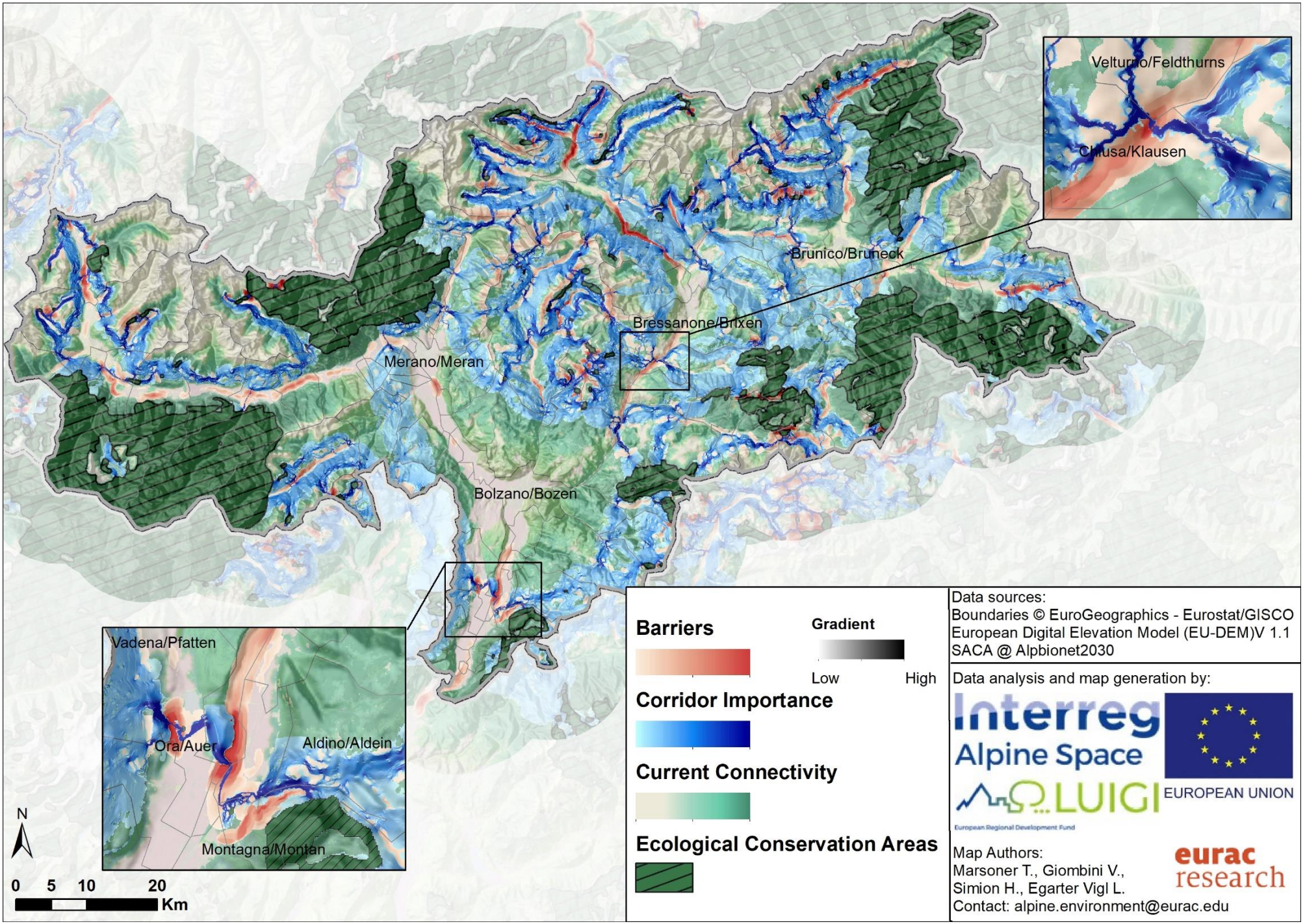

Figure 5. Ecological Conservation Areas (dark green), ecological corridors (blue), and barriers to animal movement (red) in *South Tyrol*. Labels refer to municipalities.

Landscape Multifunctionality

The capacity to provide multiple functions and services on the same spatial area is commonly referred to as multifunctionality. Multifunctionality allows to use space and resources in an efficient and sustainable way and provides win-win solutions to several policy requirements and societal needs. **Green Infrastructures** aim **to foster multifunctionality**: instead of being managed to reach a single purpose (e.g., monocultures), natural and semi natural elements of the landscape can be designed and managed to maximise the quality and quantity of the functions and ecosystem services they provide (e.g., multifunctional forests). Here, we propose an **ecosystem service-based approach** to highlight landscape elements that currently display high multifunctionality.

What is the added value of this map?

The map allows to identify **multifunctional areas** that should be sustainably managed or protected as part of a Green Infrastructure network. This map allows to find the **synergies** occurring between different ecosystem services and policy goals, and to recognise the most multifunctional areas in agricultural landscapes, forests, cities, and areas above the tree line, at high-resolution.

What does this map tell me?

The map displays landscape multifunctionality calculated as the average between the following ecosystem services indicator maps: **water provision, crop potential, timber production, fodder provision, pollination potential, carbon sequestration, nitrogen retention**, **natural hazard mitigation, runoff retention, outdoor recreation, and landscape aesthetics**. Areas that should potentially be part of a Green Infrastructure network are characterized by high values of multifunctionality (bright spots) (Figure 7). Dark spots identify areas of low multifunctionality. The map does not consider land use intensity and management (e.g., organic or conventional) and represents the natural potential for multifunctionality given the current land use and its composition.

Which are the most multifunctional areas in the region?

Based on the range of ecosystem services mapped in LUIGI, some of the most multifunctional areas in *South Tyrol* are mixed patches of woody features, vineyards and extensive pastures at mid-low elevations (Figure 6). These areas deliver provisioning crops, are reachable and attractive to tourists, support pollination, sequester carbon and mitigate natural hazards. The Alpi di Siusi/ Seiser Alm are for example “bright spots” of multifunctionality. Urban areas or mountain tops are instead dark spots of ES based multifunctionality.

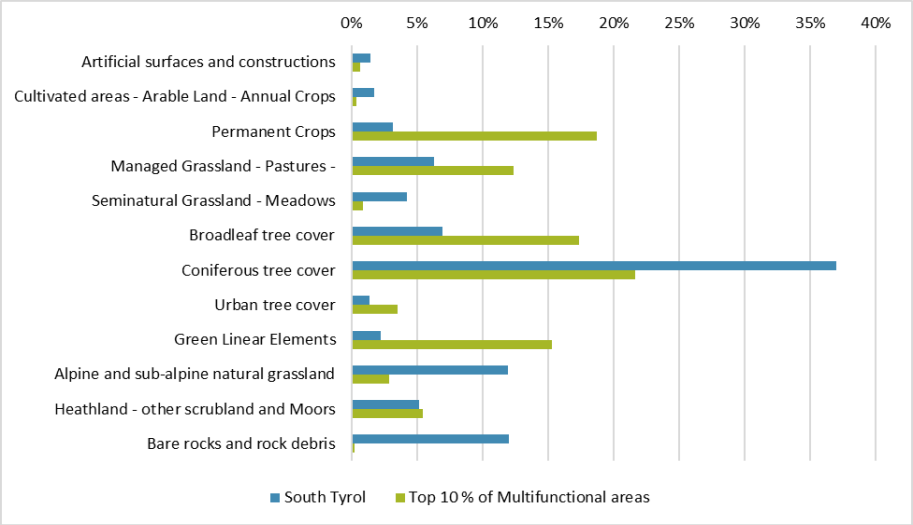

Figure 6. Land use composition (%) of the most multifunctional areas (green) and of *South Tyrol* (blue). Broadleaved forests, and green linear elements, such as hedgerows or small woods, permanent crops and pastures are particularly multifunctional landscape elements that would become part of a Green Infrastructure network**.**

What are ecosystem services?

Ecosystem services (ES) are the **environmental**, **social,** and **economic benefits** humans receive from healthy and functioning ecosystems. Humans are dependent on the flow of these services, which represent the foundation of our society. Ecosystem services are grouped into three main categories:

- **Provisioning services** such as food, water, and timber provision
- **Regulation and maintenance services** such as climate, flood, and water quality regulation, nutrient cycling, and soil formation
- **Cultural services** such as recreation and spiritual benefits

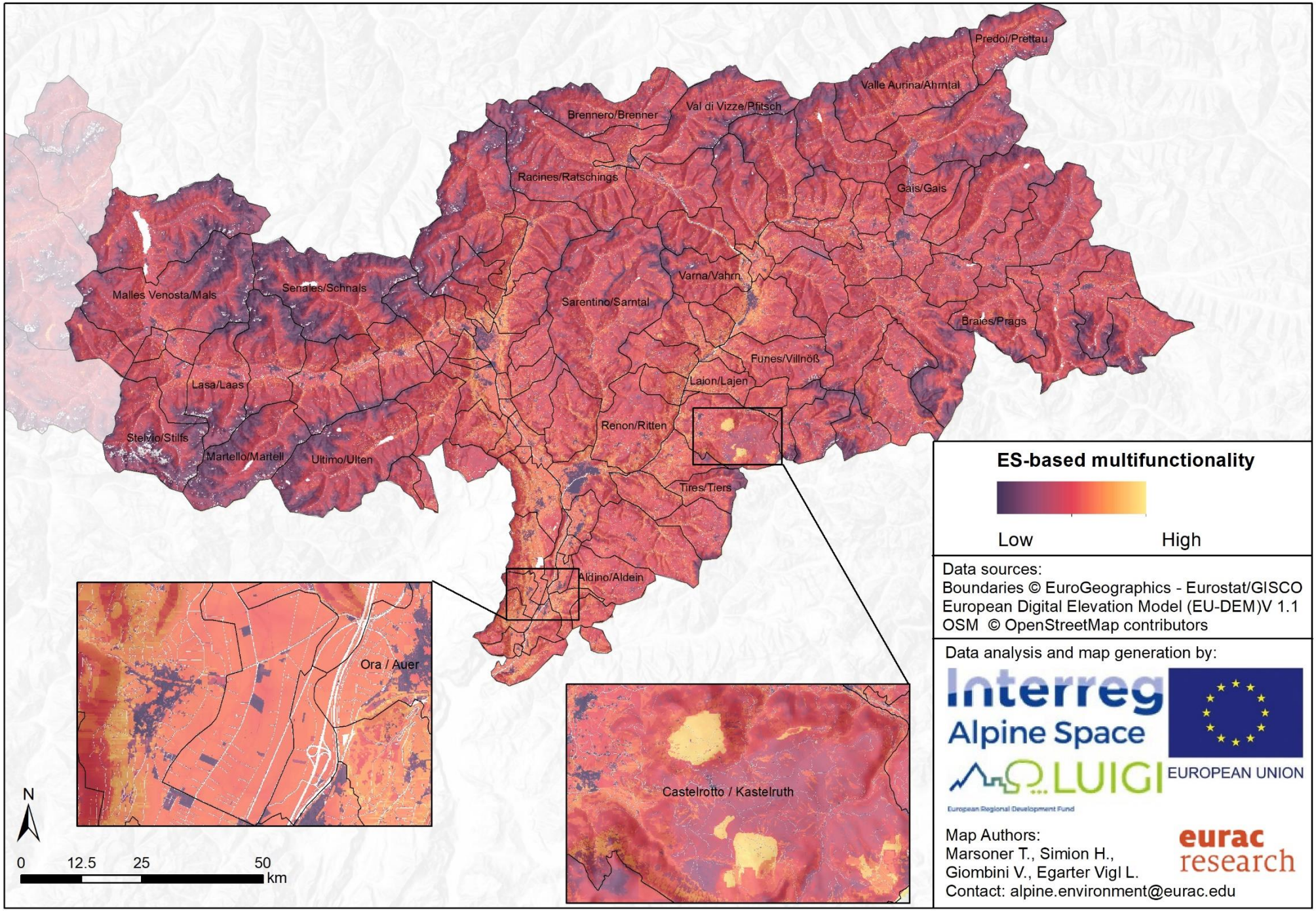

Figure 7. Landscape multifunctionality in *South Tyrol*, based on an ecosystem service approach**.** Bright spots in light colors, dark spots in dark colors. Labels refer to municipalities.

Ecosystem services for Societal challenges

This section intends to **disentangle** the ecosystem services-based landscape multifunctionality map into five thematic maps, and to provide an overview on how the cultural landscape of a region can help to address important societal challenges. For this purpose, 11 ecosystem services indicator maps, including four provisioning, five regulating and two cultural services have been aggregated into five **thematic maps**: 1) Crop potential, 2) Ground water recharge, 3) Nature-based recreation, 4) Climate mitigation, and 5) Disaster risk reduction (Figure 9).

What is the added value of these maps?

The maps aim to facilitate the understanding of how alpine regions face important socio-ecological challenges and to highlight the **relationships** between multiple ecosystem services. Moreover, by relating the thematic maps with local spatial planning and management instruments (e.g., forestry plans) possible **synergies and trade-offs** could be identified, and the importance of multifunctional landscape be documented.

What do these maps tell me?

Each thematic map describes the average value among the ecosystem services associated to a particular thematic field. The map for **crop potential (1)** depicts the potential capacity of the region to ensure food security. The map is composed of the following ecosystem service datasets: crop potential, fodder provision, nitrogen retention rate and pollination potential. The map for **ground water recharge (2)** represents the capacity of the region to ensure water supply and is described by the amount of water that infiltrates the soil. The map for **nature-based recreation (3)** shows the capacity of the region to support leisure activities and includes the ecosystem services on outdoor recreation and landscape aesthetics. The map for **climate mitigation (4)** shows the capacity of the region to mitigate the negative effects of climate change by fixing carbon from the atmosphere. It is described by the ecosystem service carbon sequestration. The map for **disaster risk reduction (5)** shows the capacity of the region to mitigate the effect of extreme weather events and natural hazards such as floods, avalanches and mudslides. The map includes ecosystem services on runoff retention and natural hazard mitigation.

What is the provision of ecosystem services in the region?

South Tyrol provides especially high ecosystem service values for natural hazard mitigation. The average ecosystem service value of 27/100 is lower than the LUIGI case study regions average score of 31/100 (Figure 8).

The contribution of different ecosystems to societal challenges depends strongly on an elevational and, to some extent, latitudinal gradient. In the productive valley bottoms with a milder climate, such as the Adige valley, agricultural areas provide food, while forests sequester carbon (especially in the broadleaves forests in the southern region of *South Tyrol*). Extensively managed valley slopes featuring patches of pastures, woods, and vineyards support nature-based recreation, disaster risk reduction, and food provision. Mountain tops above the timber line support pollination and groundwater recharge. The north-east receives more rain and is more productive compared to the Vinschgau/Venosta valley in north-west.

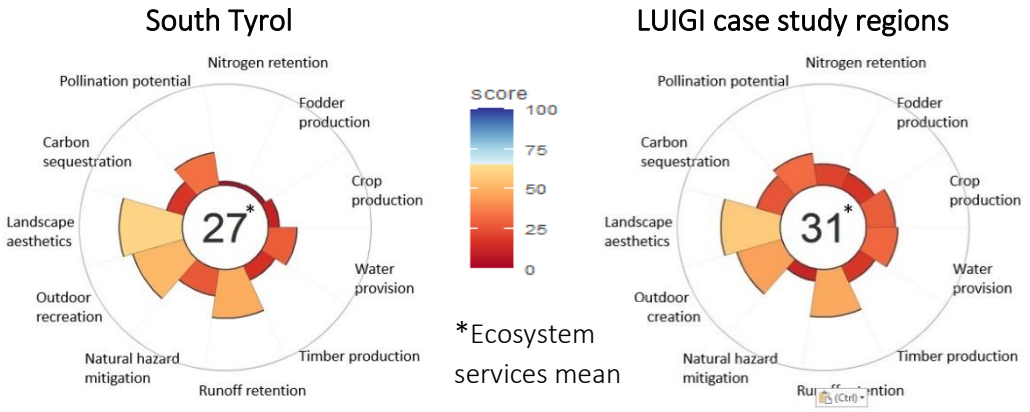

Figure 8. Ecosystem service provision in *South Tyrol* compared to the provision in all LUIGI case study regions.

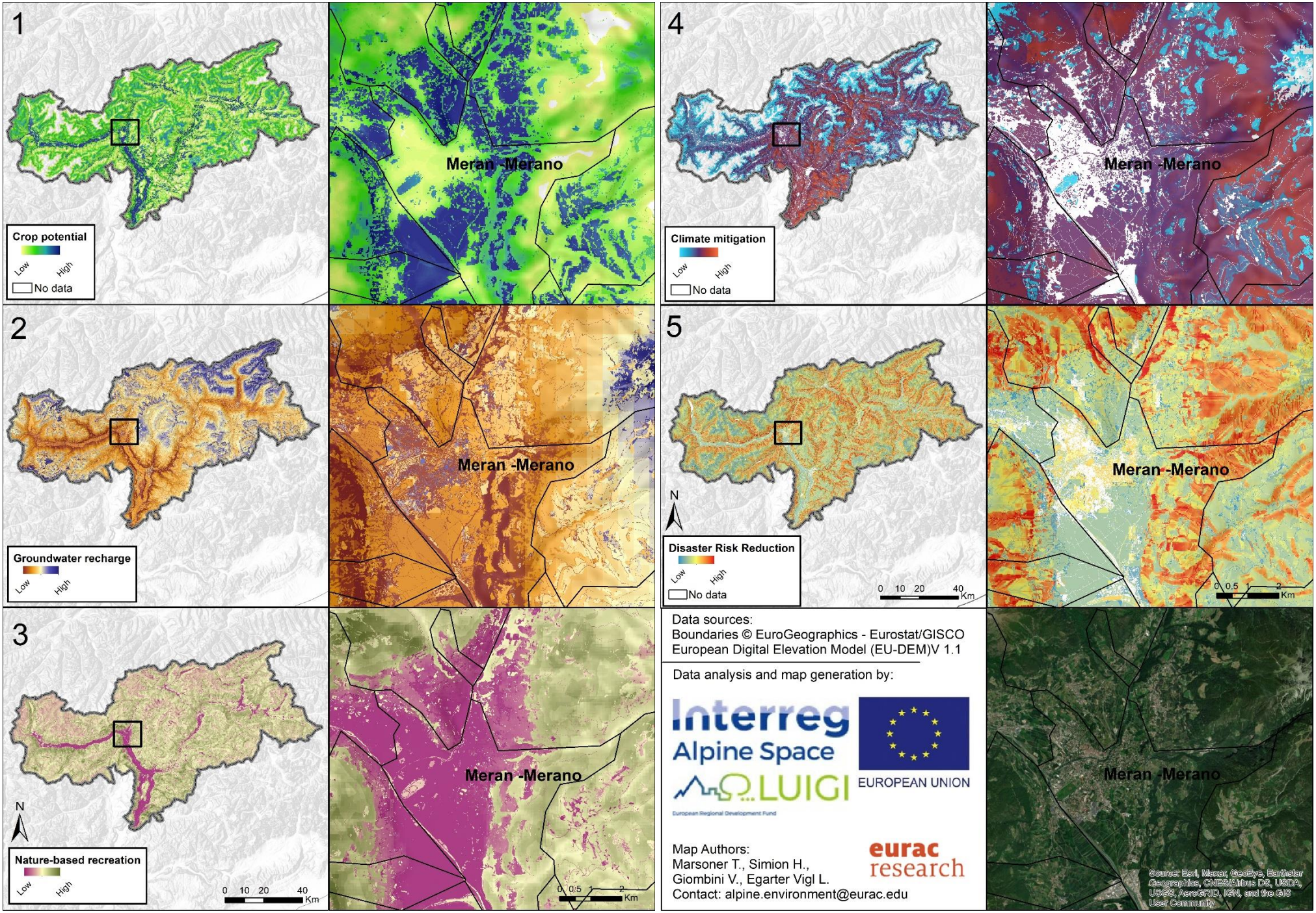

Figure 9. The contribution of the ecosystems in *South Tyrol* to 1) Crop potential, 2) Groundwater recharge, 3) Nature-based recreation, 4) Climate mitigation, and 5) Disaster risk reduction. Labels refer to municipalities.