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Europe's ecological backbone: recognising the true value of our mountains

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European Environment Agency

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Contents

Executive summary

Introduction and background

Europe's mountain areas have social, economic and environmental capital of significance for the entire continent. This importance has been recognised since the late 19th century through national legislation; since the 1970s through regional structures for cooperation; and since the 1990s through regional legal instruments for the Alps and Carpathians. The European Union (EU) first recognised the specific characteristics of mountain areas in 1975 through the designation of Less Favoured Areas (LFAs). During the last decade, EU cohesion policy and the Treaty of Lisbon have both focused specifically on mountains.

A wide range of policies, from numerous sectors and levels of governance, influence the management of Europe's mountains. The key EU policy domains address agriculture and rural development, forestry, regional and cohesion policy, and nature conservation and biodiversity, although numerous other relevant and interacting policy domains exist. Some European countries have enacted specific legislation areas addressing their mountainous regions; others address them through sectoral or multisectoral approaches. There are also two regional agreements for the Alps and the Carpathians. Given the range and complexity of these various policies, there is a need to understand their interactions in order to formulate effective policy responses to contribute to sustainable development.

Europe's mountains have been delineated in various ways, for example:

- for the purposes of national and EU policies, particularly regarding agriculture and, more recently, territorial cohesion;
- for the purposes of regional conventions;
- for the purposes of studies commissioned by the European Commission in 2004 and the present EEA report.

The present report delineates Europe's mountain areas according to topography and altitude criteria, based on data from digital elevation models. For the purposes of this study, 36 % of Europe's area is defined as mountainous, including 29 % of the EU-27. Massifs also served as a unit of analysis and 15 were defined.

This report is based on a highly variable evidence base. For certain variables, comprehensive datasets are only available for EU Member States. Comprehensive Europe-wide datasets are only available for a few variable and topics, often only for one point in time. To help overcome these data gaps, many issues are illustrated through regional, national or sub-national case studies.

Mountain people: status and trends

Mountain areas often have low population densities because much of their area is unsuitable for human habitation. Densities in valleys may, however, be as high as in lowland areas. In total, 118 million people live in Europe's mountains (17 % of Europe's population), including 33 million in Turkey. In the EU, 63 million people (13 % of the population) live in mountain areas.

Ten European countries have at least half of their population living in mountains: Andorra, Liechtenstein, Monte Carlo, Switzerland, the Faroes, San Marino, the former Yugoslav Republic of Macedonia, Bosnia and Herzegovina, Slovenia and Austria. The highest population densities are found in very small states: Andorra, Liechtenstein, Monte Carlo, and San Marino. Except for such small countries, population densities in the mountain parts of countries are always less than outside the mountains.

Economic and political changes have influenced mountain populations significantly. From 1990 to 2005, population density across Europe's mountains as a whole increased considerably, although at the level of both massifs and countries, there were both increases and decreases. The differences cannot easily be clustered in north-south, west-east or other terms, such as formerly socialist or not. In

general, population trends in mountain areas were similar to those in the country as a whole. In Poland, Serbia, Slovenia and Switzerland, however, relative population increases were higher in mountain areas. In Finland, Italy, Portugal and Sweden, they were lower there.

Mountain economies and accessibility

The economic structures in Europe's mountains vary greatly and many have changed rapidly in recent years, especially in new EU Member States. While the primary (natural resource) sector remains important for cultural identity and as a source of employment, especially in southern and eastern Europe, the tertiary (service) sector is the greatest source of employment in the mountains of all EU Member States except the Czech Republic and Romania, as well as in Norway and Switzerland.

There is high heterogeneity in economic density within and between massifs, deriving both from internal national differences and the proximity of major urban centres. Generally, mountain areas are less accessible than non-mountain areas but there is great variability within both massifs and countries. One EU initiative to decrease such disparities is the Trans-European Transport Network (TEN-T). The massifs whose populations are most influenced are in the more densely populated parts of Europe: the Alps, Pyrenees, French/Swiss middle mountains; and Iberian mountains.

Ecosystem services from Europe's mountains

Europe's mountains provide a wide range of ecosystem services, although these vary greatly at all spatial scales. Provisioning services come from agricultural and forestry systems; natural ecosystems; and rivers, which provide water and hydroelectricity. Regulating services relate particularly to climate, air quality, water flow, and the minimisation of natural hazards. Cultural services are associated with tourism, recreation, aesthetics, protected areas and locations of religious importance. Services of increasing importance relate particularly to water regulation, protection against natural hazards, tourism, recreation, and forests. It is important to recognise that mountain ecosystems are highly multifunctional. Because the benefits of services accrue to both mountain and lowland populations, maximising highland-lowland complementarities is important to all. However, trade-offs may often have to be made.

Climate change and Europe's mountains

The climate of Europe's mountains has changed over the past century, with temperatures and snowlines both rising. Changes in precipitation have varied regionally. The availability of climatic data varies greatly between regions, with the longest records and most dense recording networks in the Alps, followed by the Carpathians and the mountains of the British Isles and Scandinavia. The availability of such data, as well as the technical challenges of using climate models — especially for regions with complex topography — mean that predicting future climates is uncertain.

It is likely that temperatures will continue to increase, especially at higher altitudes, and that summer precipitation and wind speeds will increase in northern Europe and decrease in southern Europe. In the Alps and Pyrenees, snow fall and snow cover decreased during the last century and these trends are predicted to continue. The lower elevation of permafrost is likely to rise by several hundred metres. All these changes will significantly affect diverse ecosystem services and economies across Europe.

The water towers of Europe

Europe's mountains are 'water towers', providing disproportionate amounts of runoff in comparison to lowland areas and, hence, diverse ecosystem services at all spatial scales. Changes in land use, hydropower development, and climate change may all affect the provision of these services.

Mountains are major sources of hydropower. Most potential sites in the Alps, and many in other massifs, have been developed. The associated reservoirs and dams affect both hydrological and ecological systems. Water quality has improved in mountain lakes, rivers and streams following the implementation of policies to decrease water and air pollution from diverse sources.

Floods, often originating in mountain areas, are the most common natural disaster in Europe, leading to widespread impacts. The number of reported flood events has risen for various reasons, including better reporting, and changes in land-use and climate. Most of the damage is caused by a few severe events. Better flood protection requires not only structural changes along river systems but also better monitoring, prediction, coordination and information exchange.

The temperature of mountain lakes, rivers and streams has increased in recent decades. This trend,

together with receding glaciers, seasonal changes in runoff and more frequent and severe floods, will lead to significant changes in water availability, with impacts on both human and natural systems. Conflicts between sectors are likely to increase. All of these changes imply a greater need for more effective processes and policies to address uncertainty.

Land cover and uses

The land cover of Europe's mountains largely reflects complex interaction of cultural factors over very long timescales. Forests cover 41 % of the total mountain area — over half of the Carpathians, central European middle mountains, Balkans/South-east Europe, Alps, and Pyrenees — and are the dominant land cover except in the Nordic mountains. Three land-cover types each cover just under one sixth of Europe's total mountain area:

- pasture and mosaic farmland, especially in central and south-eastern Europe;
- natural grassland, heath and sclerophyllous vegetation, especially in the Nordic mountains, Turkey, and the Iberian mountains;
- largely unvegetated open space, especially in the Nordic mountains and Turkey. Arable land is most common in southern Europe.

From 1990 to 2006, the greatest changes in land cover were in the central European middle mountains, the Iberian mountains and the Pyrenees. Overall, the dominant change was forest creation and management. In new EU Member States, changes in types of farming were also important, especially from 1990 to 2000.

In total, 69 % of the mountain area of the EU-25 has been designated as Least Favoured Area under Article 18 (mountains) of the LFA regulation, although none in Hungary, Ireland or the United Kingdom. A further 23 % is designated under Articles 16, 19 and 20. High Nature Value (HNV) farmland covers 33 % of the total mountain area of the EU — almost double the proportion for the EU as a whole. LFA and HNV designations overlap considerably: only 5 % of the area designated as HNV is not designated under LFA.

Biodiversity

Most European biodiversity hotspots are in mountain areas. Among the 1 148 species listed in Annexes II and IV of the Habitats Directive, 181 are exclusively or almost exclusively linked to mountains, 130 are mainly found in mountains and 38 occur in mountains but mainly outside them. These include 180 endemic species found only in one country, including 74 found only in Spain. Of the 214 mountain species restricted to a particular biogeographic region, 114 are endemic to the Mediterranean, 51 to the Macaronesian region and 42 to the Alpine region.

Of the 231 habitat types listed in Annex I to the Habitats Directive, 42 are exclusively or almost exclusively linked to mountains and 91 also occur in mountain areas. Almost half of these are forests. Only one habitat group — temperate heath and scrub — has most of its habitat types in mountains. The majority of natural grassland habitat types are also found in mountains. For mountain habitat types as a whole, 21 % are assessed as having a favourable status, 28 % an unfavourable-inadequate status, 32 % an unfavourable-bad status, and 18 %, mainly in Spain, as unknown. In most countries except for Ireland and the United Kingdom, the proportion of habitat types with a favourable status is higher in the mountains than outside them.

Mountain areas provide favourable habitats for many bird species but can also be significant barriers to migration. The Eurasian high-montane (alpine) biome is one of the five biome types containing species that are seldom found elsewhere. Based on the existing classification of habitats for birds and available data it is difficult to present information about the status of mountain birds and their habitats.

Climate change has already caused treelines to shift upwards and will affect biota both directly and indirectly. For plants and other species with restricted mobility, upslope migration is a limited option. Europe's mountain flora will therefore undergo major changes, with increased growing seasons, earlier phenology and upwards shifts of species distributions. Such changes will be influenced by inter-specific interactions and land uses. It is likely that many species will become extinct.

Protected areas

For centuries, specific parts of Europe's mountains have been protected to ensure continued provision of ecosystem services. Of the total area designated as Natura 2000 sites, 43 % is in mountain areas, compared to 29 % for the EU as a whole. These sites cover 14 % of the mountain area of the EU.

Among all Europe's massifs, the Iberian mountains have the greatest proportion of their area in Natura 2000 sites. Nationally, Slovenia has the greatest proportion of its mountain area in these sites, followed by Slovakia, Spain and Bulgaria. In general, countries with a high proportion of their area in mountains have an even greater proportion of their Natura sites in mountains.

Between 1990 and 2000, artificial and agricultural land cover changed less in Natura 2000 sites than outside them. This was generally also true for forests. In the EU as a whole, Natura 2000 sites cover a smaller proportion of mountain land than HNV farmland, although the relative proportions vary considerably across massifs and countries.

In total 15 % of Europe's total mountain area lies within sites that countries have designated for conservation (nationally designated areas, NDAs). The highest proportions are in the small massifs of central Europe. Among larger massifs, proportions are particularly high in the Alps and the Nordic mountains. In most EU Member States, the proportion of mountain land within NDAs is higher than that within Natura 2000 sites. The extent to which these national and EU designations overlap varies considerably.

Integrated approaches to understanding mountain regions

Three typologies are presented to provide greater understanding of interactions between human populations and their environments. Most of Europe's mountain areas are 'deep rural', with low economic density and accessibility. In all countries with a significant mountain area, deep rural zones account for a greater proportion of the mountains than of other regions. However, some countries, especially Alpine countries, have high proportions of rural and even peri-urban areas in their mountains.

In EU Member States, mountains account for a greater proportion of a country's natural and environmental assets than non-mountainous areas. In terms of wilderness, the greatest proportion and area in Europe is found in the Nordic mountains. Elsewhere, only Spain has more than 10 000 km^2 of mountain wilderness.

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