

SUSTAINABLE MOUNTAIN DEVELOPMENT IN EUROPE

M.F. Price

Centre for Mountain Studies, Perth College, UHI Millennium Institute, UK

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Summary

While there is no general agreement on the definition of mountains, Europe has many mountain ranges. Mountains are found in nearly all European countries. They are highly diverse in almost every characteristic, including climate, ecosystems, demography, and economic situation. While a relatively small proportion of Europeans lives in the mountains, they have four key values for Europe as a whole: as water towers, centers of diversity, locations for tourism and recreation, and indicators of environmental change.

The concept of sustainable mountain development (SMD) was first used in Chapter 13 of *Agenda 21*, and is a regionally specific process of sustainable development that concerns both mountain regions and populations living downstream or otherwise dependent on these regions in various ways. Around the world, a number of intergovernmental and nongovernmental consultations have considered SMD, each arriving at different sets of priorities. Since UNCED, initiatives and activities connected with SMD have been implemented in Europe by pan-European institutions, European Union institutions, regional institutions, and national governments. However, much scope remains for cooperation and multisectoral action.

The greatest prospects for fostering SMD may lie with individual states, cooperating when appropriate and necessary across mountain frontiers, recognizing local

specificities, and building on three concepts: identity, quality, and multiplicity. As flexibility to address change is essential, widespread cooperation, communication, and information exchange are vital. The assessment of progress is essential, and will require both more consistent definition of mountain regions, and agreement by stakeholders on criteria. The International Year of Mountains (2002) provided an important opportunity to assess progress and further foster SMD in Europe.

1. The Mountains of Europe

In spite of its small size in relation to other continents, Europe has many mountain ranges. They occur in almost all parts of the continent, and most of Europe's countries have at least some mountains. The northernmost mountains are those of Iceland and Scandinavia; the southernmost are those along the northern shores of the Mediterranean, on the many mountainous islands of the Mediterranean from the Balearic Islands to Cyprus, and in much of Turkey. On the western side of the continent are the mountains of Portugal and Spain (more than half of the Iberian Peninsula is mountainous) and the British Isles. The Urals define the easternmost extent of the continent, and to their southwest are the Caucasus, which include the continent's highest peak (Mt. Elbrus at 5633 m). The longest chain is found along the spine of Scandinavia; the second longest is the Urals, and the third longest is the Caucasus. Perhaps the most famous, and certainly the most visited, mountains are the Alps, rising to 4807 m at the summit of the Mont Blanc massif, shared by France, Italy, and Switzerland. Yet, in addition to those mentioned above, there are also other mountain chains in Western Europe, such as the Pyrenees, the Apennines, and the many older and lower mountains that stretch from the Massif Central in France to the Sudetes on the Czech-Polish border. Central and Eastern Europe also have many mountain ranges, including the Carpathians and the Dinaric and Balkan mountains, which cover a large part of the Balkan states.

As discussed below, there is no standard definition of a mountain on the European scale, and national definitions vary considerably. Research, using a global database recording the average altitude of every square kilometer on Earth, has defined mountains as occurring in every square kilometer where any of the following criteria are satisfied:

- > 2500 m; or
- between 1500 m and 2499 m if slope is $>2^\circ$; or
- between 1000 m and 1499 m if slope is $>5^\circ$ and local elevation range (radius 7 km) > 300 m; or
- between 300 m and 999 m if local elevation range (radius 7 km) > 300 m.

According to these criteria, Europe's mountains cover 19% of the continent (excluding the Russian Federation and the states of the Caucasus). The proportions vary considerably: mountains occupy 15% of the area of northern and western Europe, and 24% of eastern and southern Europe.

Stretching from the Arctic to the Mediterranean, and even subtropical areas in the Caucasus, and with climates also ranging from oceanic to continental, the physical conditions of Europe's mountains are diverse. Added to the factor of location within any

particular mountain range or massif is the range of microclimates resulting from variations in altitude, slope, and aspect. The range of microclimates is one of the factors leading to the great diversity of both ecosystems, as discussed below, and land uses. These are highly varied across the mountains of Europe, which include some wealthy communities with highly industrialized and/or tourism-based economies in parts of western and northern Europe, but also poor regions with subsistence-based economies, particularly in southern and Eastern Europe. Yet throughout Europe, the mountain landscape reflects the interactions of human beings with biophysical systems over centuries, whether one considers, for instance, the forests of Scandinavia, the smooth green pastures of the Alps, or the barren grazing lands of much of the Balkans. To some extent, the impact of extremes of climate on livelihoods and quality of life can be mitigated by investment in transport, communications, and other types of infrastructure. Nevertheless, the marked diurnal and seasonal variability of the climate is always a factor that has to be borne in mind when considering options for land use and economic development.

The proportion of the European population living in the mountains is difficult to estimate for two reasons. First, individual countries and the EU do not have consistent criteria for defining their mountains; both altitude and steepness are used. Second, most census-reporting districts that include mountains also include adjacent lowlands. In a highly urbanized continent, the proportion of the population living in the mountains is far smaller than the proportion of the area occupied by mountains. Also, there are many large cities in and close to mountain areas: at least 38 with populations greater than 250 000 in the countries of the EU and the Accession States. In general, in Europe, in contrast to many tropical regions, population density decreases with altitude. More mountain people now tend to live at lower altitudes than a century ago, and population densities in densely inhabited valleys can be similar to those in lowland areas. For example, while the population of the Alps increased from 7 million to 11 million from 1870 to 1990, the proportion living in the mountains decreased from 7.4% to 5.8%. By 1990, only 7% of the Alpine population lived at an altitude above 1000 m. While consistent population trends are difficult to discern across Europe's mountains, the overall distribution of population is nearly always shifting from rural to urban.

In general, in mountain regions that primarily depend on agriculture and forestry, populations are declining and becoming older, largely due to emigration. Where a well-developed tourism economy exists, populations may be stabilized or increasing. Good accessibility is a key factor in economic development. Locations close to large urban centers, or with particularly attractive climates or landscapes, are increasingly attracting new residents, or amenity migrants, who come to enjoy the possibilities of mountain life and sports (often commuting during the week to urban centers) or to retire. Population changes are closely linked to changes in employment opportunities and structures. Across Europe's mountains, but especially in the EU, there has been a tendency for traditional patterns of multisectoral and multifunctional work to be replaced by dependence on employment in one sector, often outside the mountains. Many people who still cultivate land, keep animals, or use forest resources do so only in the evenings, at weekends, and/or during holiday periods. They maintain links to the mountains that are primarily cultural, rather than income-generating. At the same time, new communications technologies, such as the Internet and mobile phones, are starting to

remove traditional barriers of inaccessibility, leading to changing patterns of employment, and are often viewed as one way to stem or reverse emigration from rural areas.

1.1. Key Values of the Mountains

While a relatively small proportion of Europeans actually lives in the mountains, they are of vital importance to the continent's population in many ways, and have been described as "the undervalued ecological backbone of Europe." Perhaps most important is the role of mountains as water towers, intercepting water from air masses and storing it either as snow or in lakes and reservoirs. In spring and summer, water coming from mountain rivers supplements the earlier high flows from the lowlands, which typically occur in autumn and winter. For example, even though only 11% of the Rhine River basin is in the Alps, these mountains supply 31% of annual flow and, in summer when water is particularly needed for agriculture, more than 50% of flow. In the drier areas of Mediterranean and Balkan Europe, mountain water is of even greater significance. Mountain water is also a source of hydroelectric power, and most of the sites in the Alps have already been developed. The electricity is used not only in the Alpine countries, but is also exported across European grids. While many sites have been developed for hydroelectric generation in other mountain regions, many potential sites remain. However, although the economic costs of production may be relatively low, the environmental costs are often high. These may include sediment discharge, bank erosion, altered biological diversity of riparian zones, changes in microclimate, and eutrophication in reservoirs. Consequently, fewer reservoirs are being built than in previous decades, and many proposed projects are unlikely to be implemented.

On both continental and regional scales, a second key role of Europe's mountains is as centers of diversity. The mountains include many of the continent's centers of biological diversity, and a significant proportion of these are conserved as national parks, nature reserves, and other types of protected areas. The reasons for the high biological diversity include evolution and migration over geological time, contrasting conditions across the wide range of altitudes and on different aspects, and the existence of many microhabitats. In addition, many of Europe's mountains south of the Arctic contain species that are relics of the Ice Age—left behind as the glaciers retreated—and many habitats and species that have been lost through centuries of human activities in the adjacent lowlands. One measure of the high biological diversity is that two-thirds of Europe's flora is found predominantly or completely in mountain areas. While the existence of a significant number of species depends principally on the occurrence of specific biophysical factors, some mountain habitats and species are the result of, and must be maintained by, human activities: such as meadows and pastures maintained by haymaking and grazing. These habitats and species are often endangered by depopulation and changing land-use practices driven, particularly in Central and Eastern Europe, by the transition toward a market economy. Yet, Europe's mountains are also the centers of occurrence for many of the continent's remaining large animals, some of whose populations are growing where pressures on habitat are decreasing.

As in many parts of the world, biological and cultural diversity are closely related in Europe's mountains. They are the home of many of Europe's ethnic minorities, with

specific cultures, languages or dialects, and traditions. However, this remarkable cultural diversity is being diluted in many areas by external influences and the loss of local people, especially from younger generations. This affects not only mountain people's sense of identity, but also the ways in which they use the landscape, the crops they grow, and the food they produce. Yet, there is increasing recognition of the market values of goods that can only be produced in specific mountain environments, often from particular breeds of animals or varieties of plants, with limited distribution. The (re)discovery of the economic value of many of these mountain products is leading to both an economic and a cultural renaissance in a number of mountain regions and suitable approaches for production, processing, and marketing—e.g., through labeling of products of restricted origin—which increasingly may be one key to the future of many mountain communities.

Tourism and recreation are the third key value of Europe's mountains for the entire continent, and even the world. Many of the aspects of endangered cultural heritage mentioned above are key attractions for people coming from increasingly homogeneous urban centers. Mountains represent places for escape, for people to experience different life-styles and customs, to enjoy attractive landscapes that combine human land uses and relatively natural ecosystems, or to find inspiration.

They also provide opportunities to take part in a wide range of sporting activities. Downhill skiing is perhaps the most visible of these, but the list of mountain sports is endless, from hiking and snowshoeing to the more extreme sports of kayaking, whitewater rafting, and canyoning. All of these require specific conditions, which are often found only in the mountains at certain times of the year. Yet sports go in and out of fashion, and the mountain tourist season is often quite short, so that it is essential for communities that invest in this sector to also maintain other means of livelihood.

Despite of the importance of European mountain areas for tourism, the degree of tourism development varies considerably at every scale. Even in one small part of a mountain range, one valley may have well-developed resorts and infrastructure for skiing and other activities, while an adjacent valley may have limited or no facilities. Even in the Alps, one of the global centers of tourism, only 10% of communities have a large monostructured tourist infrastructure, and 40% have no tourism. Yet it is increasingly recognized that the value of the mountain landscape for tourism depends not just on facilities specifically for tourism, but also on the quality of the mountain landscape, which is maintained by a wide range of land uses. For this reason, in some parts of the Alps, tourism-dependent communities have begun to support landscape-maintaining activities in adjacent communities without tourist facilities.

A fourth key value of Europe's mountain regions is their sensitivity to environmental change. The sharp climatic and ecological gradients of mountain areas mean that relatively small changes in global climate may be translated into significant changes in local environmental conditions. Consequently, mountain geosystems and ecosystems have considerable potential as indicators of climate change—yet their sensitivity to climate change may also decrease their vital ability to protect settlements and infrastructure (especially roads and railways) against natural hazards, such as floods, landslides, and avalanches. The likely increase in the frequency of extreme weather

events means that it may become increasingly difficult to cope with such natural hazards, all of which may have severe downstream effects. A critical threshold is the freezing point, as above this point, precipitation falls as rain, and below it, as snow. As temperatures rise, shifts from snow to rain will have major influences on the runoff and storage of water, affecting both mountain and downstream regions. In particular, the winter tourism industry may become nonviable at lower altitudes, leading to economic losses and greater pressures on higher-altitude locations. Downstream droughts may also become more frequent. Important evidence of climate change has already been provided by the upslope melting of glaciers in most parts of Europe, and by the upward movement of plants on many summits in the Alps. The magnification of global climate change along steep mountain gradients means that careful monitoring of the distribution and phenology of mountain plant species can be of great value in providing early warning of climate change, and as the basis for appropriate policies of mitigation.

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Biographical Sketch

Dr. Martin Price is Director of the Centre for Mountain Studies at Perth College, UK, and an academic partner of the developing University of the Highlands and Islands, UK. His research focuses on the interactions of resident and visiting people with mountain environments, and policies for the management of these environments. He has published numerous papers on these topics, and on the human dimensions of environmental change. He is author of *Mountain Research in Europe* (UNESCO and Parthenon, 1995), and editor of books including *Forests in Sustainable Mountain Development: A State-of-knowledge Report for 2000* (CAB International, 2000), *People and Tourism in Fragile Environments* (John Wiley, 1996), and *Mountain Environments and Geographic Information Systems* (Taylor and Francis, 1994). He is chairman of the Royal Geographical Society's Mountain Research Group, the Board of the European Mountain Forum, and the Committee of Management of the Mount Everest Foundation, and Vice-Chair of the Scientific Council of the Institut de la Montagne, Chambéry, France.