Special feature

The vulnerability of mountain environments and mountain people

THIRTEEN PERCENT of the nearly 5 billion people in the developing world and Commonwealth of Independent States (CIS) live in mountain areas, many of which are isolated and environmentally fragile. Overcrowding has increased pressure on resources, leading to migration to cities and lowlands, erosion of traditional livelihood systems and greater food insecurity among those who remain.

A multidisciplinary FAO study, undertaken as a contribution to the International Year of Mountains, used newly available georeferenced data and maps to produce detailed information on the numbers, location, livelihoods and vulnerability of mountain people.

Mountain environments

The World Conservation Monitoring Centre (UNEP-WCMC) has defined six classes of mountains, together covering about 22 percent of the Earth's surface. Areas with an altitude of 2 500 metres or higher are always classified as mountains. Between 300 and 2 500 metres, areas are considered mountainous if they exhibit steep slopes or have a wide range of elevation in a small area (local elevation range or LER) or both. Many highland valleys and plateaus below 2 500 metres that lack slope and/or local elevation range are not classified as mountains.

Because temperatures decrease as altitude increases, mountain regions exhibit a wide variety of climate conditions and vegetation. Mountain ecosystems also vary depending on the nature of the terrain, the degree of exposure to sun and wind and the latitude at which they are located in temperate, subtropical or tropical regions.

Despite their rich biodiversity, mountain ecosystems are generally fragile. At high altitudes, many are battered by high winds and torrential rains, while others receive almost no precipitation. Other hazards include exposure to intense solar radiation and natural disasters such as avalanches, landslides, earthquakes and flash floods. The cooler temperatures of many mountain areas contribute to slow soil formation and vegetation growth, while the slopes facilitate erosion. Poor soil quality is typical of such environments.

Where mountain people live

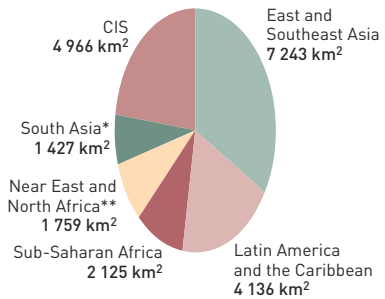
FAO estimated the total number of mountain people at 718 million in 2000. Of these, 625 million live in developing countries and the CIS.

Sixty percent of the total mountain area in these countries is located at altitudes below 1 500 metres, and 70 percent of the mountain population lives there. By contrast, only 15 percent of the mountain area is situated above 3 500 metres, and only 2.5 percent of the population inhabits these heights.

Although urbanization and the growth of mountain cities is important in some regions, more than three-quarters of mountain people in developing countries and the CIS are still rural. Traditionally, they have obtained their livelihoods from a combination of agriculture, forestry, herding, hunting, fishing and collecting wild plants. Commodities particularly suited to commercial development in mountain ecosystems include indigenous grains, tree crops such as tea and apples, medicinal herbs and other forest products, and freshwater fish.

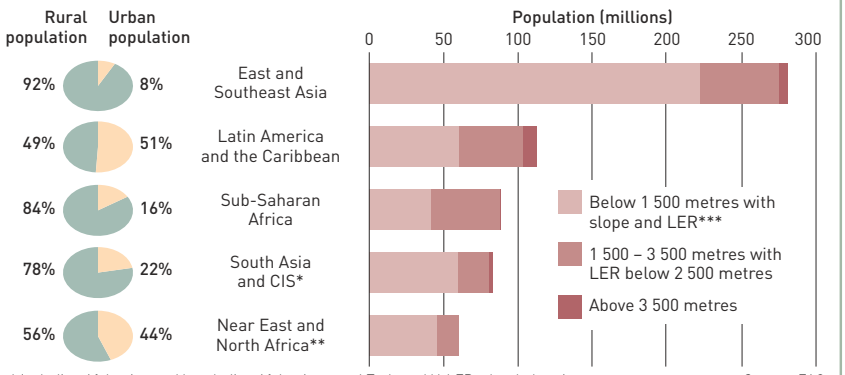
FAO estimates that about 40 percent of the mountain area in developing countries and the CIS produces less than 100 kg of cereals per person per year. Another 30 percent is covered by closed forests or nature preserves. Rural people living in such locations have difficulty obtaining an adequate livelihood from agriculture. FAO has used estimates of their number together with other qualitative information to arrive at a preliminary estimate of the number of mountain people who are vulnerable to food insecurity.

Mountain areas by region



* including Afghanistan
** excluding Afghanistan and Turkey
Source: FAO

Mountain population by subregion, 2000



* including Afghanistan ** excluding Afghanistan and Turkey *** LER = local elevation range
Source: FAO

Vulnerability of mountain people

Based on information currently available, FAO estimates that more than half of the mountain population in developing and CIS countries (in the range of 250–370 million people) are vulnerable to food insecurity. (This estimate of vulnerability is not be confused with FAO's estimates of the undernourished population. Typically about half of those identified as vulnerable are actually undernourished.)

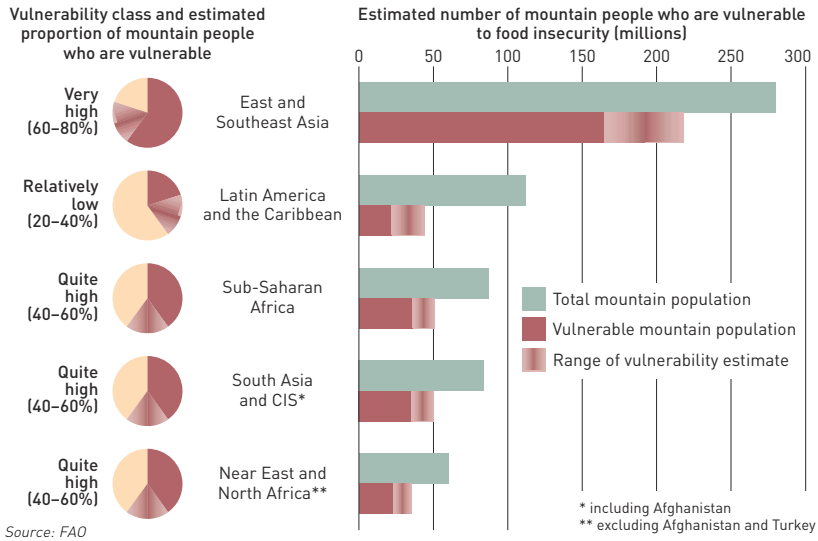
As noted above, mountain environments differ according to altitude, latitude and terrain. These differences influence both livelihood opportunities and sources of vulnerability for mountain people. Many other factors also play an important role, including the difficulty of access and relative isolation of many areas, the degree to which they are integrated into national societies, links between mountain regions and the national economy, and overall economic performance.

Cultural traditions in mountain regions are often strong and resilient. Yet lack of crop diversity and limited access to current information and knowledge about good nutrition and health care practices expose mountain people to high rates of malnutrition and disease. Traditional attitudes and beliefs may also lead people to maintain land-use practices that are no longer suitable to evolving conditions in mountain environments.

In many places traditional livelihood strategies are no longer sustainable because of mounting demographic pressure, rapid deforestation, erosion and loss of soil quality. Where this is so, conflict over control of increasingly scarce resources has become frequent.

Mountain cities offer economic opportunities but bring with them pollution, increased need for cash and weakening of indigenous highland institutions.

Vulnerable mountain people, by region, 2000



Source: FAO

Resources and opportunities for vulnerable mountain people

Water – Water is an important natural resource found at high elevations. Mountain springs and snowmelt are the two main sources. Capturing the value of this resource is an important issue for mountain people, since much of the demand originates from people living in the surrounding lowlands. Use of mountain water for generating electricity, for irrigating crops, for sale as bottled water and for other industrial uses is common. However, conflict over water rights between downstream users and mountain peoples living at points of origin are increasingly frequent, and public policy is not adequate to deal with the issue.

Agriculture – Even though mountain water is plentiful, mountain land at higher elevations may be arid. In many areas, mountain farmers have developed quite sophisticated water management and small-scale irrigation techniques. Where soil quality has been maintained or can be economically restored, crop agriculture remains a viable option. Livestock and aquaculture offer opportunities to diversify income and contribute high quality, protein products to mountain food systems.

Conservation and tourism – The natural beauty and biodiversity of many mountain environments offers good possibilities for the development of eco- and ethno-tourism, as well as for providing employment to caretakers in protected areas. Capital investment in infrastructure and training programmes to support the tourist industry will be required to realize these possibilities.

Forestry and pasturelands – The potential for forestry development in many mountain areas is high. Exploitation of this potential has been hampered, however, by the pressing need of mountain people to use trees as a source of immediate cash income (for sale as firewood and lumber, or for grazing of livestock). Introduction of forest management practices that allow people to manage herds and maintain cash flow without cutting trees at an unsustainable rate is a prerequisite for success.

Mountain industry – Growth of urban centres is occurring naturally in some mountain areas and could be encouraged in others. Cities provide diverse employment opportunities to mountain people and can help to maintain the equilibrium between the mountain population and the carrying capacity of the natural resource base. Investing in the development of transport infrastructure and in industries that add value to local resources and reduce bulk prior to shipment to markets in non-mountain areas can contribute to healthy urbanization in mountain areas.

Special feature

Vulnerability and sustainability of mountain livelihood systems

FAO's study has focused on 18 mountain ranges that are home to almost 90 percent of mountain people in developing countries and the CIS. The analysis looks at a number of factors that determine the vulnerability and sustainability of mountain livelihoods. These factors include elevation, population density, degree of urbanization, land-use patterns, agricultural productivity and cultural traditions.

Maps on these pages depict the mountain areas by mountain class, the population density and the land-cover patterns and rainfed cereal production per person. Texts summarize the sources of vulnerability specific to each major mountain range and highlight actions that could help reduce vulnerability.

Latin America: Sierra Madre and Andes

In general, the 112 million mountain people of Latin America and the Caribbean are the most urbanized and least vulnerable in the developing world. The proximity of economically dynamic mountain cities opens up more income-generating options, but pockets of people at high elevations in the Andes remain isolated and extremely vulnerable. Rural mountain people in Central America and Mexico are also quite vulnerable. Agricultural land has been very unevenly distributed, restricting many farmers to tiny plots of land and forcing them to sell their labour to survive.

In the northern Andes, two-thirds of the mountain population live in or near large cities. Most rural mountain people practice intensive, commercial agriculture at moderate altitudes. On the lower slopes and valleys, coffee and horticultural crops are grown for local sale and export. In the higher valleys, maize, other temperate crops and pigs predominate. Vulnerability to food insecurity is relatively low.

Urbanization is also significant in the high Andes. Around half the mountain population lives in or near cities or on lower-elevation slopes where access to jobs and markets helps keep vulnerability relatively low. But the other half consists of extremely poor indigenous farming families, who grow traditional grains (quinoa) and potatoes and raise sheep and llamas in the steep valleys and vast, treeless tableland above 3 500 metres. Isolation, population pressure and soil erosion have seriously undermined their traditional livelihood systems and vulnerability is very high. Specialized markets exist for llama and alpaca wool, woven goods, quinoa and selected potato varieties. But the information and skills needed for effective participation are lacking.

In the Sierra Madre of Central America and Mexico, more than 40 percent of mountain people live in urban areas, where recent surveys indicate that the incidence of vulnerability is quite low. But most of the rural mountain population is not so fortunate. Farmers grow maize and beans and migrate seasonally to work as labourers on large coffee and sugar estates. But earnings are low and demand for migrant labour is declining. To cope, many families send members to cities and neighbouring countries to find jobs and send back remittances. And

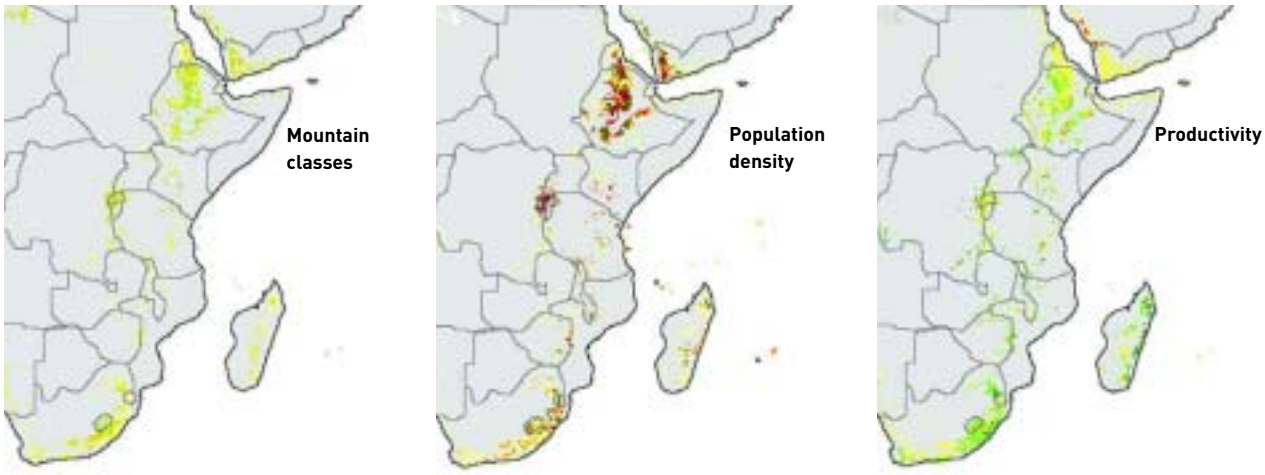
Latin America: Sierra Madre and Andes

Mountain classes

Population density

Productivity

Eastern and southern Africa: Rift Valley



entire families are migrating to new areas and clearing forests to obtain land. Overall, the incidence of vulnerability in this subregion is quite high.

Mountain people in Latin America face a number of major challenges, including lack of access to land, unsustainable land-use practices, poor integration of indigenous peoples into national societies and economies, and lack of technical skills.

Land reforms are being introduced in some countries. But they will only make a lasting impact on poverty and hunger if coupled with better agricultural extension and marketing services for small mountain farmers. The potential contributions of indigenous cultures to sustainable mountain development also need to be more widely recognized and supported. Likewise, new migrants in mountain cities will need support.

Key to maps, pages 16–19

Mountain classes: elevation

- 300 – 1 000m and LER* > 300m
- 1 000 – 1 500 and slope > 5 or LER > 300m
- 1 500 – 2 500 and slope > 2
- 2 500 – 3 500
- 3 500 – 4 500
- > 4 500
- Non-mountain area

* LER = local elevation range

Source: UNEP-WCMC

Population density: people per km²

- 0
- 0 – 1
- 1 – 25
- 25 – 50
- 50 – 100
- 100 – 300
- > 300
- Non-mountain area

Source: LandScan2000/FAO

Productivity: rainfed crop production per person / other land use

- < 100 kg
- > 100 kg
- Closed forest
- Protected area
- Irrigated area (over 35%)
- Non-mountain area

Source: FAO/ UNEP-WCMC/ Univ. Kassel

Eastern and southern Africa: Rift Valley

More than 90 percent of the 88 million mountain people in sub-Saharan Africa live in the ranges of the East African Rift at altitudes that rarely exceed 2 500 metres. Although these ranges include some of the most densely populated mountain areas in the world, less than 15 percent of the mountain population lives in cities and the incidence of vulnerability is quite high.

Almost half the mountain population in the region lives in the densely populated Ethiopian highlands. In an area frequently ravaged by drought, the traditional farming system, based on local grains, cattle, sheep and goats, cannot reliably support the existing or projected population. The number of landless peasants is growing and their future is very bleak. Vulnerability to food insecurity is high. Long-term survival hinges on community-based action to strengthen non-farm activities and local infrastructure.

Population density is also extremely high in the mountains of Burundi, Rwanda and the eastern Democratic Republic of Congo. Deforestation and soil erosion are widespread and conflict between settled farmers and pastoralists can be intense. Vulnerability is quite high, but almost one-third of the mountain population lives in urban areas which provide more livelihood options. More sustainable management of farmland and open pastures, and reclamation of marshlands, could yield significant gains in food security if backed by strong efforts to improve infrastructure and extension services.

From Kenya to Zimbabwe, mountain and non-mountain people share a common farming system. All grow maize, tobacco, cotton and oilseeds for cash sale. But productivity has deteriorated since structural adjustment brought an end to fertilizer subsidies. Droughts, livestock diseases, scarcity of wild foods and the spread of HIV/AIDS have further destabilized this farming system. Although the incidence of vulnerability is now quite high, prospects for sustainable development are good if investments are made to improve management of soil and water resources and provide participatory extension and rural services.

Special feature

Near East and North Africa: Atlas, Zagros and Caucasus

The mountain population in the Near East and North Africa of 60 million people is the smallest in the developing world, and more than half live in cities. But farming and herding practised by rural mountain people from Morocco to Iran has become increasingly stressed, and vulnerability to food insecurity is quite high.

Most rural mountain people in the region plant cereal and fodder crops each autumn. The crops – mainly rainfed wheat, barley and legumes – lie dormant through the cold winter months before completing their growth in the spring. Tree crops, fruits, olives and vineyards are grown on terraces. Herds of goats and sheep are common throughout the region, often grazed on communally managed lands.

Environmental degradation, caused mainly by poor maintenance of terraces and overgrazing, is widespread. The resulting decline in productivity, combined with long distances to markets, increasing competition from subsidized food imports and growing incidence of drought, has led to increasing poverty and food insecurity. Many men are leaving mountain areas to find employment opportunities elsewhere and a significant number of households are likely to shift out of agriculture.

For those that remain, a number of measures could yield important gains in sustainability and food security. Improved watershed planning and management are needed to protect both existing levels of productivity and downstream rural and urban water users. Introduction of conservation tillage and better integration of crop and livestock production systems could boost both productivity and sustainability. More equitable regulation and control of common grazing resources (often officially classified as state forest) would also reduce both environmental damage and food insecurity. Action is also needed to facilitate land consolidation, forge stronger linkages between farm and off-farm economies and promote local off-farm employment.

South and Central Asia: Hindu Kush, Pamirs, Himalayas, Tibetan Plateau and Kunlun Mountains

Mountains dominate the landscape of Afghanistan, Pakistan, northern India, Nepal, Bhutan, northwestern China, and the Central Asian Republics. Although this region features the world's highest mountains and most populous countries, the mountain population of South and Central Asia is not much larger than that of the East African Rift. Nearly 90 percent of the mountain people inhabit the high ranges in the north. The vast majority are rural and live at elevations below 3 500 metres, where they practise various combinations of crop agriculture and herding. The incidence of vulnerability is quite high, exacerbated, as elsewhere, by increasing population pressure and environmental degradation.

Deforestation poses a major threat. As populations grow, remaining forests are being cut down at a rapid rate to open up new agricultural land. This leads to soil erosion and depletion of soil moisture, reducing productivity and forcing women to walk ever longer distances for fuelwood and water.

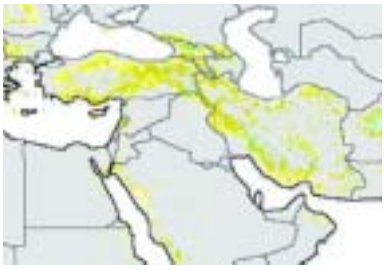
Traditional cultures are deeply rooted and often dictate local practices governing the use of land, water and forests. But with many men migrating away, social cohesion in some areas is breaking down, making it more difficult to resolve disputes over land ownership and use of common resources. The role of women as farmers and social leaders has become increasingly important. Improving their access to training and resources will be critical for overcoming environmental, economic and social problems.

Although higher altitudes also suffer from serious erosion, population density is lower and people have more livelihood options. Many families graze livestock on higher slopes and supplement their farm income with cross-border trade, tourism and mountaineering. The incidence of vulnerability is still quite high, however.

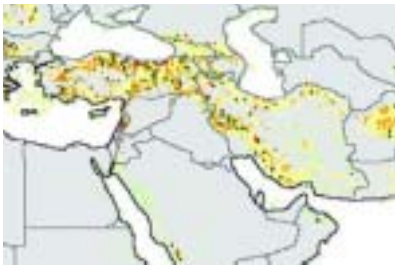
The pastoral system predominates in mountain areas in Central Asia, as well as in non-mountainous high flatlands. Sheep and cattle are grazed on open pastures in high areas or adjacent dry zones, while cereals, fodder crops and potatoes are cultivated for subsistence in mountain valleys. Meat and wool production are the main sources of income from this system. But excessive animal population and poor grazing techniques have caused serious erosion and degradation of open pastures. Wool production has fallen sharply and vulnerability to food insecurity is now quite high. Restoration and sustainable management of grazing land are essential for improving conditions.

Near East: Zagros and Caucasus

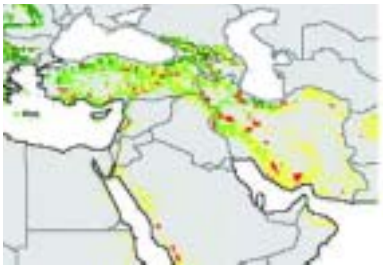
Mountain classes



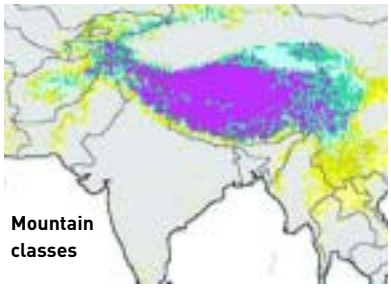
Population density

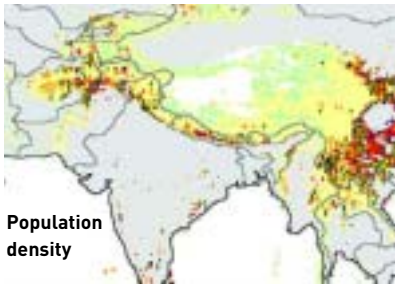


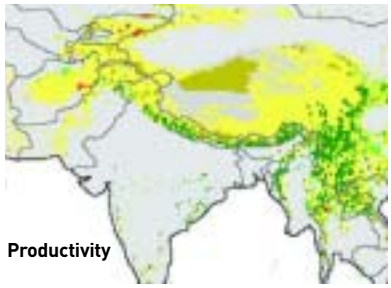
Productivity



South and Central Asia: Hindu Kush, Pamirs, Himalayas, Tibetan Plateau and Kunlun Mountains







East and Southeast Asia: Ningling Shan and Truong Son

Although not nearly as tall or as famous as the Himalayas and the Hindu Kush, the mountains of East and Southeast Asia are vast and far more heavily populated. Nearly half of all the mountain people in the developing countries and the CIS live in the mountains of southern China, the Indochinese Peninsula and the larger Pacific islands. For the most part, these areas are both densely populated and overwhelmingly rural, with very few people living in cities. As a result, landholdings are extremely small, crop production per person is low, and farmers are increasingly moving into marginal sloping lands to survive. The number of people living in forests and protected areas is also quite large. Vulnerability to food insecurity is very high, probably affecting 170 to 220 million people.

Crop and farm production intensity varies considerably. In southern China, mountain farmers have developed sophisticated terracing and water management techniques and make effective use of crop and animal wastes to preserve soil quality. Elsewhere, intensive production technologies are less developed and productivity is lower. Vulnerability is more widespread.

Two distinct farming systems are found throughout the region. At moderate altitudes with gentle slopes, farmers grow a wide variety of crops, with rice used as the staple in the south and wheat in the north. Livestock are used as draught animals, for meat and as wealth. Pigs and poultry provide an important source of cash income. This system can be highly productive, as demonstrated by the mountain farmers of southern China, whose intensive farming also benefits from good links to markets where they can buy inputs and sell produce. In other locations, semi-subsistence farming with limited sales is common. These areas can also be highly productive, if supported by investments in infrastructure and participatory extension.

On higher slopes in tropical areas, tribal groups farm extensively through both permanent and shifting cultivation. Typically, they supplement their crops by grazing cattle and buffalo in the forests and gathering other forest products for home use. Poor soil quality, low levels of inputs and isolation from markets constrain progress, and poverty and food insecurity are widespread. Improved forestry management and agroforestry offer the best prospects for improving conditions.

East and Southeast Asia: Ningling Shan and Truong Son