Mountains: globally important ecosystems

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An overview of the importance of mountains in sustainable development and their place on the global political agenda.

Mountain ecosystems are found throughout the world, from the equator almost to the poles, occupying approximately one-fifth of its land surface. Beyond their common characteristics of having high relative relief (or very marked topographic variation) and steep slopes, mountains are remarkably diverse (Ives. Messerli and Spiess, 1997). They are found on every continent, and at every altitude, from close to sea level to the highest place on the earth - the summit of Mount Everest (Sagarmatha or Qomolangma) on the border between Nepal and the Tibet Autonomous Region of China.

Half of the world's population depends on mountain water

An estimated one-tenth of the human population derive their life-support directly from mountains. Yet, mountains are important not only for their inhabitants, but for millions of people living in lowlands. At the global scale, mountains' greatest value may be as sources of all the world's major rivers, and many smaller ones (Mountain Agenda, 1998). Mountains play a critical role in the water cycle by capturing moisture from air masses; when this precipitation falls as snow, it is stored until it melts in the spring and summer, providing essential water for settlements, agriculture and industries downstream - often during the period of lowest rainfall. In semi-arid and arid regions, over 90 percent of river flow comes from the mountains. Even in temperate Europe, the Alps that occupy only 11 percent of the area of the Rhine river basin supply 31 percent of the annual flow - and in summer more than 50 percent.

Mountain water is also a source of hydroelectric power, most of which is used on the plains below. Historically, water wheels have provided energy in mountain regions, mainly for grinding grain. In rural Nepal there are an estimated 25 000 water wheels and over 900 micro-hydropower turbines - a more recent technology - that provide a critical source of energy, mainly for agroprocessing (Schweizer and Preiser, 1997). Such local renewable energy is a vital catalyst for economic development in areas that are at the far ends of the distribution networks for the fossil fuels on which most urban dwellers depend. In developing countries, wood fuel is the predominant energy source in mountain settlements, but it is also essential - whether as wood or charcoal - to many people living in urban centres in the lowlands and on the plains. For example, any visitor to Marrakech can observe the large piles of fuelwood stacked outside communal bakeries, to which every household brings its daily bread to be baked; the wood comes from the forests in the Atlas Mountains.

Mountain wood also has many other uses, including timber and wood products both for local use and, where road, rail or water networks permit, for export. It is significant to note, however, that, while deforestation of the tropical rain forests remains most visible

in the global media, the highest rate of deforestation in any biome occurs in tropical upland forests -1.1 percent per year. Rates of clearing are particularly high in Central America, East and Central Africa, Southeast Asia and the Andes (FAO, 1993).

CENTRES OF BIODIVERSITY

Mountain ecosystems are globally important as centres of biological diversity. The greatest diversity of vascular plant species occurs in mountains: Costa Rica, the tropical eastern Andes, the Atlantic forest of Brazil, the eastern Himalaya-Yunnan region, northern Borneo and Papua New Guinea (Barthlott, Lauer and Placke, 1996). Other important centres are found in arid subtropical mountains. Many of these areas with the greatest biological diversity are designated as national parks or other types of protected area.

Mountains are important centres of biodiversity: mowing mountain meadows to maintain biodiversity, La Vanoise National Park, France

It is not only the diversity of natural mountain species that is of value to humankind, both intrinsically and as a source of "wild foods" such as mushrooms, game and birds, and many other non-timber forest products. Mountains are also important as centres of crop diversity. The maintenance and expansion of mountain populations in many parts of the world have been made possible by the introduction of potatoes and maize from Latin America. The original precursors of wheat came from the mountains of the Near East. These original varieties maintain their importance in the breeding of new varieties of major food crops. Equally, species that are not widely known but are adaptable and nutritious - such as many of the Latin American root and tuber crops which are the focus of research at the International Potato Center (CIP) in Peru - may be potential major sources of food.

INFLUENCE OF CHANGES IN GLOBAL SYSTEMS

The economic relationships of mountain communities are also undergoing transformation. Even the most remote mountain community has always been linked to regional or global markets for essential commodities such as salt. Until quite recently, however, the economies of most mountain societies in the developing world were largely internal, based on the complementary use of resources in different altitudinal zones. Connections to outside economies have been driven by a number of factors, notably increases in accessibility owing to the construction of new road networks and the rapid expansion of air transport since the Second World War. In Nepal, the availability of surplus military helicopters from the former Union of Soviet Socialist Republics means that small villages, formerly many days' walk from Kathmandu, are now accessible in an hour or less. Similarly, small communities in the mountains of Siberia and in the Tien Shan of Kyrgyzstan may no longer be isolated.

While the helicopters carry some local people, their principal passengers are usually tourists from all parts of the world - the latest followers of a trend that began in the early nineteenth century with the discovery of the Swiss Alps by English travellers. In an increasingly urbanized world, the importance of mountain regions as global centres of tourism continues to grow. The reasons for travel are highly diverse. Old forms, such as pilgrimage, still exist and have major influences on regional economies; for example, 9.3

million pilgrims arrive each year at Hardwar-Rishikesh, the entry point into the Garhwal Himalaya. Badrinath, one of the major sites, is visited by about 450 000 people a year, representing a threefold increase in two decades (Academy for Mountain Environics, 1995). The growing number of tourists attracted by the remarkable scenery and unfamiliar cultures of Nepal has been even greater - from 9 526 in 1964 to 293 567 in 1993. Relatively few governments have taken the steps of the Royal Government of Bhutan or the Zuni Nation of New Mexico to limit the number of tourists; the world's largest industry is widely seen as a motor for economic development (Price, Moss and Williams, 1997).

Yet tourism is a fickle industry. As Nepali Sherpas noted in the 1980s, "tourists are like so many cattle, representing highly mobile, productive, and prestigious, but perishable, forms of wealth. Like cattle, tourists give good milk, but only if they are well fed" (Fisher, 1990, p. 123). A decline in the reliability of tourism had already been noted in the Swiss Alps, where the industry is undergoing a period of reorganization. Many people will always want to visit the mountains to test their physical endurance, escape from the pressures of everyday life, or visit sacred sites and places of inspiration, but the vagaries of tourism are as dynamic as the physical environment to which long-established mountain communities have learned to adapt. In a world increasingly influenced by global forces, highland people need to find new ways to survive and prosper. In the new parlance, this is sustainable development, and its fostering is vital not only to mountain people, but to the billions living downstream or farther away but linked through the global transportation network.

Mountain tourism is becoming increasingly important: a small hotel in the Himalaya, Nepal

Mountain agriculture and forestry

PUTTING MOUNTAINS ON THE AGENDA

The global importance of mountains has only recently been widely recognized. While scientists have been active in mountain regions for over two centuries, each typically focused on his or her own specialization in one or more mountain valleys or ranges. From the 1930s, mountain scientists particularly in France, Germany and the former USSR - increasingly recognized the interrelationships of mountain ecosystems, and also of the people who inhabit them. These developments were first brought together in a coordinated way in 1973 when Project 6 of the United Nations Educational, Scientific and Cultural Organization (UNESCO) Man and the Biosphere (MAB) programme "Impact of human activities on mountain and tundra ecosystems" was introduced.

MAB-6 was the first international interdisciplinary research programme on mountain regions, with projects in the Andes, the Himalaya, many Alpine countries and the Spanish Pyrenees (Price, 1995). This programme was central to the development of what became known as the Mountain Agenda.

Its underlying concepts were recognition of the interactions of all facets of mountain ecosystems, including their human inhabitants, and of the key values of mountains at the global scale. These concepts have been developed and promoted through a number of other initiatives and institutions (Ives and Messerli, 1990). They include:

• Commission on Mountain Geoecology and Resource Management (now Mountain Geoecology and Sustainable Development) of the International Geographical Union (IGU), established in 1968;

• International Potato Center (CIP) in Lima, Peru, founded in 1971;

• United Nations University (UNU) project on Highland-Lowland Interactive Systems in 1977 (now Mountain Ecology and Sustainable Development);

• International Mountain Society (IMS), founded in 1980;

• International Centre for Integrated Mountain Development (ICIMOD) in Kathmandu, Nepal, founded in 1983.

In addition, a number of meetings in the 1970s and 1980s considered various aspects of what has come to be called sustainable mountain development. Scientific meetings and workshops were organized with a focus on various aspects of development. Important early examples included a meeting on the development of mountain environments, organized by the German Agency for Technical Cooperation (GTZ) in Berlin in 1974; and the Council of Europe's seminar on pressures and regional planning problems in mountain regions, held in Grindelwald, Switzerland in 1978. During the same period, the need for regional cooperation was also recognized by regional governments in various European mountain ranges, with the establishment of regional working committees for the central Alps in 1972, the eastern Alps in 1978, the western Alps in 1982, the Pyrenees in 1983 and the Jura in 1985. Government recognition of the importance of mountains was raised to a new level in 1989 when the Minister of Environment of the Federal Republic of Germany convened a Conference of Alpine States. This led to the signing of the Alpine Convention by the Alpine states and the European Community in 1991.

Monitoring mountain conditions: a meteorological station in the French Alps

Mountain Agenda

All of these various developments over the past three decades implicitly or explicitly recognized that, although mountain regions tend to be far from centres of decision-making, they are important not only to mountain people, but also to far wider communities, and therefore should not be relegated to a marginal status in policy-making and implementation. The opportunity to bring this perspective on to the global stage was presented by the United Nations Conference on Environment and Development (UNCED) in June 1992. In the preparatory meetings, many argued that a special chapter on mountains was not needed, as the major issues of concern there were included in other chapters or conventions to be included in the final document. However, with the support of the Swiss Agency for Development and Cooperation (SDC), a small group of development experts and academics -who had been involved in the activities of the MAB-6 programme, the IGU Commission, ICIMOD, IMS and UNU - were able to introduce a chapter on mountains into the draft final document at the fourth Preparatory Commission meeting in April 1992.

This group, calling itself Mountain Agenda, supported the inclusion of this chapter with two documents: a 391-page book, *The state of the world's mountains,* with chapters on the world's mountain regions (Stone, 1992); and the 44-page *An appeal for the mountains* (Mountain Agenda, 1992). These efforts were successful in ensuring that Chapter 13 of Agenda 21, the plan of action endorsed at UNCED by the Heads of State or Government of most of the world's nations, had the title, Managing fragile ecosystems: sustainable mountain development. The inclusion of this chapter placed mountains on an equal footing with climate change, tropical deforestation, desertification and similar issues in the global debate on environment and development.

MOUNTAINS ON THE GLOBAL AGENDA

Chapter 13 of Agenda 21 marked a change from a sectoral approach that focused, for instance, on water, forestry, agriculture or tourism, to a more integrated approach to sustainable mountain development. In September 1993, the UN Inter-agency Committee on Sustainable Development appointed FAO as Task Manager for Chapter 13. The responsibilities allocated to FAO are to:

- encourage and support initiatives in relation to the sector;
- facilitate interagency cooperation and liaison;
- report to the UN Commission on Sustainable Development (CSD).

In March 1994, FAO convened in Rome the first meeting of an ad hoc interagency network on follow-up to Chapter 13. The meeting was attended by representatives of not only a number of UN organizations, but also other international organizations and non-governmental organizations (NGOs), including CIP, ICIMOD, IMS, IUFRO and The Mountain Institute (TMI). This ad hoc group was intentionally pluralistic, recognizing that although NGOs had not been significantly involved in the preparation of Chapter 13 (in contrast to most chapters of Agenda 21), they would play crucial roles in its implementation. The participants in the meeting made a number of recommendations. One of the most important outcomes has been a series of meetings in a two-track process, involving consultations at the governmental and non-governmental levels, as described in the following sections. The issues discussed in these consultations are reported by Price (1998).

Since 1994, the network has remained in contact via fax and e-mail, allowing FAO to circulate drafts of documents such as reports to the third and fifth sessions of CSD, principles and operational guidelines for comprehensive mountain development programmes and criteria and indicators for sustainable mountain development. The group has also held three further meetings in 1995 and 1996. Over time, the number of international organizations and NGOs involved has increased considerably: later members include the African Mountains Association, the International Centre for Alpine Environments (ICALPE), IUCN-World Conservation Union, and the International Mountaineering and Climbing Federation (UIAA).

Regional intergovernmental consultations

Regional intergovernmental consultations on sustainable mountain development have taken place for all regions of the world except North America, where a planning meeting was held in April 1997 and a regional conference will take place in 1998. The sequence

of meetings (Table 1) was determined to some extent by the availability of funding and appropriate convening organizations. In total, representatives from 62 countries and the European Union attended these meetings, which should ensure that national governments give consideration to sustainable mountain development. In addition, representatives of a wide number of international, regional and non-governmental organizations were present and provided substantive contributions to the debates.

Concurrently, certain governments have moved forward towards sustainable mountain development at various levels. A number of countries, including Bulgaria, Romania, Slovenia, Viet Nam and The Former Yugoslav Republic of Macedonia, have established national-level institutions whose aims contribute to sustainable development. Similar subnational or local institutions have been created in other countries, such as Honduras, South Africa and the United Kingdom. There are also a number of recent national laws (e.g. in Bulgaria, Italy and Japan) and subnational or local legal, land use and planning instruments (e.g. in Austria, France, Germany, Greece, Ireland, Norway and Spain) which provide various means of support for mountain communities. Mexico is also moving in this direction with assistance from FAO. In the Alps, a number of thematic protocols to the Alpine Convention have been prepared, although none has yet been ratified. A draft Charter for European Mountain Regions, prepared by the Council of Europe, has been discussed at the highest levels.

Non-governmental consultations and the Mountain Forum

Three non-governmental consultations have complemented the five intergovernmental meetings (Table 2). While all of these built on existing networks, two have been associated with other substantial activities. The International NGO Consultation in February 1995 led to the establishment of the Mountain Forum, a diverse and non-hierarchical network of networks, providing mutual support, information sharing and advocacy for mountain peoples and environments. Over the past three years, the structure of the Mountain Forum has developed to include a global node at TMI for coordinating international organizations and entities; and regional nodes for the Asia-Pacific, Latin American and European regions, hosted by ICIMOD, CIP and IUCN, respectively. This has required considerable resources - more than US$1.1 million, mainly from SDC.

Mountain Forum's accomplishments have included the establishment of the most complete Internet site on sustainable mountain development (http://www.mtnforum.org), with a searchable on-line library and reference database, electronic discussion lists, publications and meetings. In addition, four electronic conferences have been held:

- Investing in Mountains: Innovative Mechanisms and Promising Examples for Financing Conservation and Sustainable Development, July/August 1996, with more than 200 participants;

- Mountain Policies and Laws, March/April 1997, with 276 participants;

- Conservation and Development of Paramos and Punas in the Andes, August 1997, with 150 participants;

- Community-Based Mountain Tourism, April/May 1998.

TABLE 1. **Regional intergovernmental consultations on sustainable mountain development**

Region	Location and date	Organizer(s) (proceedings)	Participating countries
Asia and the Pacific	Kathmandu, Nepal, December 1994	ICIMOD (Banskota and Karki, 1995)	Bangladesh, Bhutan, China, India, Indonesia, Iran, Kyrgyzstan, Laos, Mongolia, Myanmar, Nepal, New Zealand, Pakistan, Papua New Guinea, Philippines, Russian Federation, Thailand, Viet Nam (18)
Latin America and the Caribbean	Lima, Peru, August 1995	CIP (Mujica and Rueda, 1996)	Argentina, Bolivia, Chile, Colombia, Costa Rica, Ecuador, Guatemala, Honduras, Mexico, Peru, Venezuela (11)
Europe (Session I)	Aviemore, UK, April 1996	IUCN, ICALPE, Scottish partners	Austria, Cyprus, European Commission, France, Italy, Norway, Poland, Romania, Russian Federation, Slovenia, Switzerland, United Kingdom, Yugoslavia (13)
Africa	Addis Ababa, Ethiopia, June 1996	ILRI, Environmental Protection Agency of Ethiopia (ILRI, 1997)	Burundi, Cameroon, Ethiopia, Kenya, Malawi, Nigeria, Rwanda, Sierra Leone, South Africa, Tunisia, Uganda, Zaire, Zimbabwe (13)
Europe (Session II)	Trento, Italy, October 1996	IUCN, ICALPE, Government of the Autonomous Province of Trento (Backmeroff, Chemini and La Spada, 1997)	Austria, Bulgaria, Cyprus, European Commission, Finland, France, Georgia, Germany, Hungary, Italy, Monaco, Norway, Poland, Portugal, Russian Federation, Slovenia, Switzerland, Turkey, Ukraine, United Kingdom, Yugoslavia (21)

TABLE 2. **Non-governmental consultations on sustainable mountain development**

Geographical focus	Location and date	Organizer(s)	Participants
Indian Himalaya	Dehra Dun, India, September 1994	Sri Bhunaneshwari Mahila Ashram	65 regional NGOs and social activists
Global	Lima, Peru, February 1995	CIP, TMI	110 participants from 40 countries, including representatives of mountain NGOs from 23 countries
	Toulouse, France, July 1996	ARPE, CIAPP	110 representatives of NGOs from 24 countries

The first of these resulted in the publication of a report in collaboration with FAO (Preston, 1997) which has achieved wide recognition and dissemination.

In Europe, preparation for the July 1996 conference by the Agence Régional pour l'Environnement (ARPE) of Midi-Pyrenees, France and the Conseil International Associatif pour la Protection des Pyrénées (CIAPP) included the preparation of a detailed questionnaire with 81 questions. This was produced in 16 languages and sent

to more than 5 000 mountain NGOs in Europe. Nearly 1 000 replied - a very high response rate. One of the clear conclusions was that political decisions and legal prescriptions (or their absence) are principally responsible (67 percent) for environmental degradation in the mountains; these factors are far more significant than developers/road construction (43 percent) or tourists (33 percent), the next most important causes. The results of the questionnaire were used to structure the conference, and thereby to develop a detailed set of recommendations which were sent to the second session of the European intergovernmental consultation (ARPE/CIAPP, 1996).

New international initiatives

Many international organizations, including FAO, IUCN, TMI, UNESCO and the World Meteorological Organization (WMO), as well as regional centres, such as CIP and ICIMOD, bilateral aid agencies and NGOs have long-established programmes in mountain regions. In the period since UNCED, many of these have been strengthened, and CIP, ICIMOD and TMI, at least, have significantly increased their budgets. In addition, Chapter 13 has been the catalyst to a number of new initiatives on various aspects of sustainable mountain development. At the global level, perhaps the most important development is that in October 1995 the Council of the Global Environment Facility (GEF) identified mountain ecosystems as the subject of one of ten operational programmes. Mountain ecosystems also fall into, or interact with, the other ecosystems identified as priorities for GEF biodiversity projects, and may also be considered in projects relating to climate change and international waters. As of late 1997, GEF was implementing biodiversity projects in the mountains of 21 countries and renewable energy projects in the mountains of four countries.

Two examples of rather different international programmes that address issues of sustainable mountain development are the Mountain Workplan of the International Geosphere-Biosphere Programme (IGBP) and the Global Mountain Initiative (GMI) of the Consultative Group on International Agricultural Research (CGIAR). Both of these are at an early stage of development but show the recognition that diverse communities worldwide need to work together. The IGBP project, Global Change Impacts on Mountain Hydrology and Ecology, associates four of IGBP's core projects and brings together social and natural scientists from a wide range of disciplines. Three planning meetings have been held, resulting in a comprehensive agenda for research on indicators of global environmental change, concepts for sustainable development and the interactions of hydrological and ecological processes along altitudinal gradients (Becker and Bugmann, 1997).

The Global Mountain Initiative is a global ecoregional research programme for sustainable mountain agricultural development, coordinated by CIP. Its goal is to improve the management of natural resources on which sustainable supplies of food, clean water, energy, minerals and forest products depend. A primary emphasis will be on developing, testing and validating methodologies in one region and adapting them to sites in other regions. Biodiversity research will also make possible germplasm exchange between regions. The African component, the African Highlands Initiative, which is convened by the International Centre for Research in Agroforestry (ICRAF), implemented its first phase in the mountains of Ethiopia, Kenya, Madagascar, the United Republic of Tanzania and Uganda in 1995-97.

MOUNTAINS IN THE POST-UNGASS (RIO+5) PROCESS

A review of the implementation of Agenda 21 and its individual chapters has been carried out by CSD which considered Chapter 13 at its third session in April 1995 and at its fifth session in April 1997. In June 1997, the UN General Assembly held a Special Session (UNGASS) for the same purpose. The final document of this meeting specifically mentions mountains in relation to four issues:

- the continued deterioration of mountain ecosystems, resulting in diminishing biological diversity (paragraph 9);

- the need to formulate and implement policies and programmes for integrated watershed management (paragraph 34);

- the need for ecosystem approaches to combat or reverse soil degradation, recognizing the multiple functions of agriculture (paragraph 62);

- the need for national policy development and implementation to ensure sustainable patterns of consumption and production in tourism (paragraph 68).

These concerns relate very closely to many of the values of mountain regions examined in the first section of this article.

According to the UNGASS final document, all countries are expected to have prepared national strategies for sustainable development by 2002, involving all interested parties and integrating economic, social and environmental objectives. Networks such as the Mountain Forum will have a clear role to play in such initiatives. UNGASS also defined a programme of work for CSD for the period 1998-2002. Each year, one sectoral theme, one cross-sectoral theme and one economic sector or major group are to be addressed. Many of these are particularly relevant to Chapter 13 (see Box).

Mountains at centre-stage

Chapter 13 has been the catalyst to much debate, and many governments and organizations have contributed significant financial and other resources to activities contributing to its implementation. However, in order to move closer to sustainable mountain development, clear prioritization of activities is needed. Each of the intergovernmental and NGO consultations presented a different set of recommendations and priorities, and others were included in the state-of-knowledge review *Mountains of the world: a global priority* which was prepared for UNGASS (Messerli and Ives, 1997).

Since the first meeting of the ad hoc network in March 1994, there have been calls for an international technical meeting on mountains, to bring together recent and ongoing experiences and to continue to raise global awareness of the importance of mountains. This may be organized in conjunction with an International Year of Mountains, which has been proposed by the Government of Kyrgyzstan. However, regional initiatives are also important, recognizing the great diversity of mountain environments around the world. FAO, as Task Manager for Chapter 13, has a vital role in catalysing and linking these various initiatives, in collaboration with regional and global structures such as CIP,

ICIMOD and the Mountain Forum. In this role, FAO must also ensure that mountain issues remain on the global agenda through well-organized undertakings linked to activities associated with future sessions of CSD, the Intergovernmental Forum on Forests and the various relevant conventions on biological diversity, desertification and climate change.

CSD work programme, 1998-2002: relevance to Chapter 13 of Agenda 21

SIXTH SESSION: 1998
Sectoral theme. Strategic approaches to freshwater management
Cross-sectoral theme. Transfer of technology, capacity-building, education, science, awareness-raising
Economic sector/major group. Industry

SEVENTH SESSION: 1999
Sectoral theme. Oceans and seas
Cross-sectoral theme. Consumption and production patterns
Economic sector/major group. Tourism

EIGHTH SESSION: 2000
Sectoral theme. Integrated planning and management of land resources
Cross-sectoral theme. Financial resources, trade and investment, economic growth
Economic sector/major group. Agriculture

NINTH SESSION: 2001
Sectoral theme. Atmosphere, energy
Cross-sectoral theme. Information for decision-making and participation in international cooperation for an enabling environment
Economic sector/major group. Energy, transport

TENTH SESSION: 2002
Comprehensive review, including forestry, which is excluded from the above because it will be considered through an Intergovernmental Forum on Forests under the aegis of CSD.

Until now, the mountain agenda has largely been set by a relatively small number of active regional and national governments (and their agencies), international organizations, scientists and NGOs at various levels. It is not only the "development" and "conservation" NGOs that have interests in sustainable mountain development; increasingly, members of NGOs that are recreation-and tourism-based are recognizing the need to understand their impacts on mountain communities and environments. As is recognized in Agenda 21 as a whole, the private sector also has a major role to play, yet it has not been particularly well integrated in the implementation of Chapter 13.

Chapter 13 has been the impetus for one of the most innovative initiatives to emerge from Agenda 21 - the Mountain Forum. Yet information and networking are only the means to an end, and these and other resources must be carefully coordinated and harnessed, building on the long-established role of mountains as cradles of innovation. Further progress in ensuring that sustainable mountain development is not only a policy imperative but also a concept of practical relevance to all who depend on the mountains will require the mobilization and long-term commitment of stakeholders in all sectors

worldwide. Mountains are no longer on the periphery of the global debate on development and environment: they have moved to centre-stage.

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Mountain ecosystems are an important source of biological diversity, along with water and mineral resources where mountains are ecosystems with a distinct identity just like the flood plains, deltas, mangroves, wetlands, and deserts. Mountain ecosystems are particularly fragile, subject to both natural and anthropogenic drivers of change. Therefore, their effective management is not only important for mountain communities, but also for a sizeable proportion of the global population. Body. Ecosystems are of fundamental importance to environmental functioning and sustainability, and they provide Mountain ecosystems are globally important as centres of biological diversity. The greatest diversity of vascular plant species occurs in mountains: Costa Rica, the tropical eastern Andes, the Atlantic forest of Brazil, the eastern Himalaya-Yunnan region, northern Borneo and Papua New Guinea (Barthlott, Lauer and Placke, 1996). Other important centres are found in arid subtropical mountains. Many of these areas with the greatest biological diversity are designated as national parks or other types of protected area. Mountains are important centres of biodiversity: mowing mountain meadows to mai Mountain grasslands are globally important ecosystems. They are considered as heritage sites with â€œoutstanding valuesâ€ to ecological communities by adding a further â€œlayer and support to the existing protection measures.â€ However, mountain grasslands are increasingly under threat from human activities and impacts of climate change.