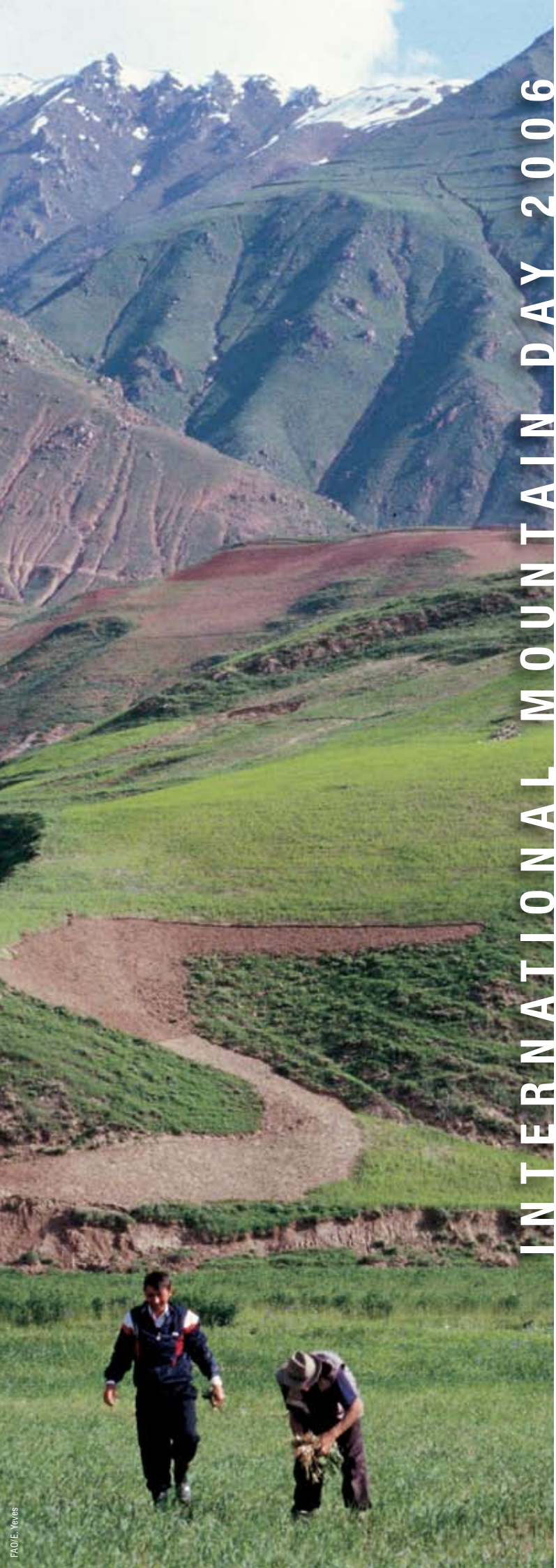

FAO/E. Yevtes

MANAGING MOUNTAIN BIODIVERSITY FOR **better lives**

Mountains are storehouses of global biodiversity. They support approximately one quarter of terrestrial biological diversity, with nearly half of the world's biodiversity hot spots concentrated in mountains. Mountain biodiversity supports the livelihoods of mountain populations and provides basic ecosystem services, such as fresh water, timber, medicinal plants and recreation for the surrounding lowlands and their increasingly urbanized areas.

Mountains are unique islands of biodiversity, often exceeding the diversity of adjacent lowlands. Isolated mountains are often rich in endemic species, i.e. plants and animals that occur nowhere else. Mountain areas have also acted as refuges from environmental change and are also characterized by moderate disturbances such as landslides, avalanches and grazing, which often increase biological richness and habitat diversity.

Mountains are storehouses of the genetic diversity that helps feed the world. Several crops – maize, potatoes, barley, sorghum, tomatoes and apples – and a large portion of domestic animals – sheep, goats, yaks, llama and alpaca – originated in mountains. Other crops – wheat, rice, beans, oats, grapes, oranges and rye – found new homes in the mountains and evolved into many different varieties. Furthermore, waterbodies in mountains also harbour fish.

But biodiversity is not only about plants, animals and micro-organisms, and their ecosystems – it is about mountain people and their need for food security, medicines, fresh air and water, shelter, and a clean and healthy environment in which to live; it is about their cultural and social traditions, environmental knowledge and habitat adaptations. Mountain populations have developed highly diverse systems of land use which are locally adapted and which feature a great variety of

11 December
International MOUNTAIN DAY

CASE STUDY 1

Conservation landscapes to safeguard mountain biodiversity

▶ *The Case of the Kigezi Highlands, Southwestern Uganda*

Conservation landscapes that include biodiversity sanctuaries within a pattern of agricultural and other land uses have been increasingly recognized as an instrument for achieving both biodiversity management and improvement of local livelihoods. The Kigezi Highlands in Southwestern Uganda are an example of such a conservation landscape. These highlands include the Bwindi Impenetrable National Park (BINP), a World Heritage Site which features an exceptional diversity of flora and fauna and is home to half of the population of the world's remaining mountain gorillas. Despite intensive use and a high population density of over 250 people per km^2, the regional agricultural production system supports biodiversity management, based on a wide variety of crops and agroforestry. Close to one-fourth of the 324 woody species found in the BINP can also be found in the agricultural landscape as farmers are deliberately planting trees on farms. Thus the native tree species in the BINP further enhance farm tree diversity, wood cover and the livelihoods of local farmers.

(Source: *Mountain Research and Development*, Vol.25/3:212-218. 2005)

Mountain biodiversity – *shared he*

site-specific plants and animals. This heritage represents a global asset that needs to be managed for the benefit of humankind and future generations.

Threats to biodiversity

There has been a substantial and largely irreversible loss in the diversity of life on Earth due to human action. Mountain areas have been particularly affected by this loss, which is largely due to changes in land use and climate.

Land use has shaped mountain biodiversity for centuries and millennia. Traditional upland grazing systems and sustainable management of arable land and forests in mountains have led to the establishment of rich biota and enhancing ecosystem services such as water supply and soil stability. In recent decades, easier access through road construction, population pressure, migration and exposure to the wider world have led to the collapse of traditional modes of land and resource use in many mountain areas worldwide. Mining, industrialization and tourism have led to pressures on biodiversity that were unknown before on this scale. Movements of people and goods will trigger further spread of invasive species. Moreover, widespread poverty in many mountain regions further endangers fragile mountain ecosystems and significantly reduces biodiversity in mountain areas.

Mountain biodiversity is also threatened by global warming, which will reduce available land area for organisms adapted to the cold, and threaten the richness of mountain plant species. With higher temperatures predicted, longer summers with a greater incidence of drought are expected in many mountain regions worldwide. Plant invasions into higher mountain areas may be promoted by climate warming.

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What is Biodiversity?

Biodiversity, or **biological diversity**, is the term used to describe the diversity of life on Earth. Commonly, three levels of biodiversity are acknowledged:

- Genetic diversity – variability among the populations and individuals of the same species.
- Species diversity – diversity among species in an ecosystem.
- Ecosystem diversity – diversity at the level of whole ecosystems.

(Source: adapted from the *Convention on Biological Diversity*, 1993)

The costs of losing biodiversity in mountains

The costs of replacing the services provided by mountain biodiversity are immense – both in economic and other terms. The ecosystem services of mountains, often ignored, provide greater economic benefits than extractive resource use in most cases. In the United States, recreation and tourism accounted for 78 percent of Forest Service income in 1995, while timber sales provided 2.7 percent, with a great proportion of these forests being in mountains. Intact biodiversity protects watersheds and attracts tourism, as well as furnishing rich natural resources for key industries. It provides the basis for the production of diversified and healthy food, with increasing markets worldwide.

Streams and lakes, but also water reservoirs, depend on the integrity of upslope systems. Landlocked countries, with no access to marine fishery resources, depend on mountain waters for fish production as additional protein supply. Mountain freshwater supplies, which are crucial for downstream areas, greatly depend on intact vegetation and its stability. A highly structured, diverse ground cover with different root systems is

ritage, global potential

probably the best insurance for slope stability and for securing railway lines, roads and settlements worth billions of dollars.

Managing mountain biodiversity successfully

Mountains are hot spots of global biodiversity. This global heritage has to be managed for the benefit of mountain populations and the surrounding lowlands with their increasingly urbanized areas. Managing mountain biodiversity with the aim of maintaining ecosystem integrity as a basis for the provision of crucial ecosystem services is a major challenge, requiring greater awareness and action at global, national and local levels.

Managing mountain biodiversity has increasingly been recognized as a global responsibility in recent decades. Globally, **protected areas** have increased sixfold to eightfold in the last 40 years, largely in mountain areas. While protected areas are essential, they alone cannot achieve biodiversity or cultural heritage conservation. Mountain places where people live and work require **innovative approaches to conservation**, engaging local people in the stewardship of the natural and cultural heritage – within working landscapes. The concept of stewardship, with its focus on community-based management and local leadership, holds great promise for conservation of those mountain areas around the world, where the biological, cultural and scenic qualities of the mountain landscape are the result of the interactions of people with nature over time. UNESCO's **Man and Biosphere (MAB) Programme** is successfully integrating sustainable use of biodiversity with conservation.

Conservation landscapes are increasingly recognized for their potential to maintain high levels of biodiversity in combination with intensive but diversified small-scale agriculture, in densely populated mountain areas where the establishment or extension of protected areas is not feasible. It incorporates mixed cropping, agropastoral and agroforestry components, and soil and water conservation. The case of the Kigezi highlands in Southwestern Uganda is a good example highlighted (see box at left).

Mountain forests are among the most biologically diverse but at the same time most threatened biota worldwide. Uphill expansion of agriculture and settlements, logging for timber and fuel wood, and replacement by highland pastures are threatening these ecosystems. For example, evergreen tropical cloud forests, occurring in mountains where there is frequent cloud or mist, make up no more than 2.5 percent of the world's tropical forests; however, they harbour a disproportionately large number of the world's species, including the wild relatives and sources of genetic diversity of important staple crops such as beans, potatoes and coffee.

Medicinal plants are one of the most valuable resources at high altitudes. For example, 1 748 species from the Indian Himalaya are used for local medicinal treatment or for trade, involving the pharmaceutical industry. Roughly a third of them grow in the subalpine or alpine zone. Cultivation of medicinal plants instead of harvesting wild plants, which often causes local extinction of highly priced medicinal species, and local processing instead of exporting raw material, are two strategies that can ensure the sustainable use of medicinal plants and increase the income of mountain dwellers.

Animals in mountain regions play a fundamental role in people's livelihoods. Yaks in Himalaya and guanacos, vicuñas and llamas in the Andes are good examples.

Mountain streams, rivers and lakes need to be managed in a way as to preserve their ecological value and also for fish production as fish is an important source of food, income and employment.

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MDGs and the importance of mountain biodiversity

Countries with a high proportion of mountain areas very often face extraordinary challenges in terms of achieving the Millennium Development Goals (MDGs). Successful mountain biodiversity management can make a significant contribution to poverty alleviation in mountain ecosystems and in lowlands dependent on the goods and services provided by mountain ecosystems, and thereby contribute to MDG 1 (Eradicate extreme poverty and hunger). It will also contribute to MDG 7 (Ensure environmental sustainability) as land productivity in mountains is often low due to environmental degradation. Mountain ecosystems provide medicinal herbs and non-timber forest products, which is often the task of local women. An improved management of these resources for production and conservation could also help secure gender balance and empower women (MDG 3).

CASE STUDY 2

Payments for Environmental Services (PES)

▶ *Experience in Colombia, Costa Rica and Nicaragua*

Mountain communities often derive few or no benefits from mountain biodiversity management. The end result is that biodiversity is lost, as are other benefits such as the regulation of water flow. Payment for Environmental Services (PES), which compensates local land users for environmental services, has increasingly been used to manage biodiversity in mountains in recent years. For example, the Regional Integrated Silvopastoral Project, initiated by local NGOs and financed by GEF, uses PES to encourage silvopastoral practices in degraded pastureland in the mountains of Colombia, Costa Rica and Nicaragua. Participating land users receive direct annual payments for the environmental services they generate. To provide payments that are proportionate to the services provided, the project developed indices of biodiversity management services. Since its inception in 2003, the project has made average payments of US$ 350–550 per farm per year. Initial results show that PES has induced positive land use changes such as improved water quality and increased bird and ant species diversity.

(Source: *Mountain Research and Development*, Vol.25/3:206-211. 2005)

FAO/R. Faidutti

Participation of mountain populations at all stages is crucial in the sustainable management and use of biodiversity. **Payment for environmental services (PES)** has increasingly been used to compensate upland land users for the lack of on-site benefits. There is a considerable body of experience from developing and industrialized countries showing that such payment for ecosystem services has the desired effect on land use and biodiversity management. Moreover, PES is an innovative tool for enacting much needed resource transfer to upland communities, which are often socially and economically disadvantaged, compared to surrounding lowland areas. An example of recent experience of PES is presented (see box at left).

The way forward

- Managing mountain biodiversity will require a global alliance of international organizations, national governments, civil society, the private sector and, most importantly, mountain populations as stewards and beneficiaries of biodiversity in mountains.
- The path of action is clearly indicated. At the *global level*, Chapter 13 of Agenda 21, with its specific focus on mountain areas, and the Convention on Biological Diversity, signed by 150 governments worldwide, with its specific Programme of Work on Mountain Biodiversity, provide accepted frameworks for concrete action. The International Treaty on Plant Genetic Resources, which went into effect in 2004, provides new rules and procedures that govern access, use and benefit sharing of the world's genetic resources, including those in mountain areas.
- The *national level* will be crucial for managing mountain biodiversity sustainably and finding lasting solutions to satisfy the needs of both mountain and lowland populations. Key elements of national action include sensitization, participation and capacity building, and provision and implementation of laws and regulations that include benefit sharing arrangements such as PES.
- *Research* has several important roles to play. Inventorying is a key task, as in some regions only a small fraction of mountain species are known to the global community. Ecosystem services, such as the productivity of upland pastures, water supply or erosion control, need to be demonstrated and quantified. Management scenarios need to be explored in participatory processes which serve both biodiversity conservation and human needs – for example, relating to the use of fire, the effects of grazing and other key issues.

International Mountain Day 2006, with its theme "Managing Mountain Biodiversity for Better Lives," is an opportunity to increase awareness of the many crucial roles of mountain biodiversity and to promote action for its sustainable management for the benefit of all.

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MOUNTAIN DAY

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