THE WAY FORWARD

The cost of inaction is much higher than that of timely and appropriate investment in climate change management. Sensitization of the general public about the urgency of action is essential; it is encouraging to see that in recent years, numerous initiatives have emerged in many countries with exactly this aim. Many countries have also established task forces to assess climate change and its impacts, and to propose appropriate action. The involvement of mountain populations is a must, as they will be among those most directly affected.

- At the global level, Chapter 13 of Agenda 21, with its focus on mountain areas, and more importantly the UN Framework Convention on Climate Change and the Kyoto Protocol with its Clean Development Mechanism (CDM), provide frameworks for concrete action to tackle the drivers of climate change and to mitigate its impact. The mechanism allows industrialized countries that have ratified the Kyoto Protocol to invest in emission-reducing projects in developing countries as an alternative to more costly emission reductions in their own countries. However, poor countries and mountain communities have not benefited much from the CDM programme and the carbon market due to institutional constraints and complexity of accessing funds. This requires urgent re-examination.
- At the national level, actions must reduce emissions of the greenhouse gases that contribute to global warming and climate change. Climate change issues should be considered in all planning and decision making, including infrastructure development. The National Adaptation Programmes for Action presents an opportunity for adoption of good practices at the community and grassroots levels.
- With regard to research, there is a need to develop more accurate scenarios of climate change and its multiple impacts, and to document existing coping strategies. Such information is largely lacking, especially for mountain areas of the South. Research has a responsibility for helping sensitize the public about the far-reaching implications of climate change in mountains. It should also get involved in designing integrated mitigation and adaption measures.

The lion has left – global warming in the Andes of Peru

In the mountain regions of Peru, ice above 5 000 metres is rapidly disappearing. An example is one ice cap known as "the sleeping lion" around the Cordillera Blanca, which has melted away leaving the bare peak. As glaciers have retreated, drainage channels have become intermittent or dry. The pastoral economy has been significantly affected by the need to seek new grazing land or reduce herd size. Important for irrigation, meltwater is also used for electricity generation and mining. Local communities are now afraid that towns and mines will get priority if water becomes scarce.

Changes in rainfall regimes are another matter of concern. Based on the well-integrated livelihood strategies that have evolved in these mountain environments, collaboration with local communities might be the right pathway to follow in order to accommodate the big changes likely to be associated with climate change and variability in the years to come.

Source: Ecoagriculture Partners, (from: Kenneth R. Young and Jennifer K. Lipton 2006. Adaptive governance and climatic change in the tropical highlands of western South America. Climatic Change 78: 63-102).

International Mountain Day 2007, with its theme of **Facing Change: Climate Change in Mountain Areas**, presents an opportunity to increase awareness that global climate change is a reality now, that mountains are particularly affected, and that this has important implications for humankind beyond mountain areas. It is also an opportunity to promote action at all levels and confront the effects of climate change in mountain areas.

Photos: (cover, left) Glacier, Nepal - CDE/S.K. Nepal; (cover, right, top to bottom) Climate variability, USA - AFP/Tony Ranze; Mudslide, Honduras - AFP/Yuri Cortez; Drought, Philippines - AFP/Romeo Gacad; Floods, Mozambique - FAO/Clive Shirley; (inside spread, top to bottom) Blue Nile, Ethiopia - AFP/HEMIS.FR/Jean du Boisberranger; Wild fire, Portugal - AFP/Cristina Quicler; Impact on tourism, Switzerland - AFP/Fabrice Coffrini; Livestock, India - AFP/HEMIS.FR/Jean Baptiste Rabouan.

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11 December International MOUNTAIN DAY

FACING CHANGE

CLIMATE CHANGE IN MOUNTAIN AREAS

11 December International MOUNTAIN DAY

Climate change is a fact – noticeably in mountain regions

Climate change is a reality today, and some of the best evidence comes from mountain areas: mountain glaciers in nearly all parts of the world have been retreating for decades and, in some cases, have disappeared. Evidence comes from the Alps where detailed records of certain plants show that they have been moving upwards.

The principal reason for climate change is increasing concentrations of greenhouse gases, such as carbon dioxide, in the atmosphere since the beginning of the Industrial Revolution in the eighteenth century. The Intergovernmental Panel on Climate Change in 2007 confirmed that the increased greenhouse gases are due to human activities and the average temperature of the Earth will continue to rise. The best evidence comes from mountains. The longest record of direct measurements of carbon dioxide comes from the summit of Mauna Loa in Hawaii. Climate change is not only about changes in temperature, but also in rainfall and snowfall, and the frequency of extreme events, such as storms, droughts, floods and heat waves.

Mountains themselves play major roles in influencing regional and global climates. Mountains force air to rise, increasing the amount of rain and snow on their windward side and creating drier areas or "rain shadows" downwind. There would be no monsoon, for example, without the high mountains of the Himalayas to intercept air masses coming from the south. The water falling as rain in the mountains, or stored there as snow and ice in glaciers and released by melting in the spring and summer, is a vital resource for over half of the global population.

Mountain areas have very complex terrains and so their climates vary considerably over short distances. And unfortunately, reliable long-term records of mountain climates, especially from high altitudes exist only for very few areas, such as the Alps. Climate change will also mean changes in the hydrological cycle with less snow and more rain, as well as extreme and more frequent events such as fires, floods, droughts and storms. Such changes could occur even with relatively small increases in temperature and could have serious impacts on agriculture-based livelihoods, infrastructure and health.

Threats of climate change

People living in most mountain areas are used to the fact that the climates of these areas vary considerably from year to year, season to season, day to day, at different altitudes, and even on slopes with different exposures. Traditional land-use systems have considered this variability, for instance, through growing sun-loving plants on the warmest slopes and moving livestock to graze on the high summer pastures after the snow has melted.

In the future, climate change may increase climate variability beyond the limits of past experience. Most critically, extreme events are likely to become more common and more intense in mountain areas, threatening the livelihoods of both mountain people and those who depend on mountain areas for water quality and quantity, food and other resources. Travellers using vital communication corridors may face more frequent natural hazards, including rockfall and landslides resulting from increasing slope instability due to permafrost decay.

In the short term, the melting of glaciers may provide more water for both mountain people and those living downstream. But as the glaciers disappear and snowlines move upwards, river flows are likely to change, and lack of water may become an increasing problem. Higher temperatures will mean more rain than snow, raising the risk of flooding for both mountain and lowland farmers. The trend will also affect hydropower generation, forestry and water-dependent ecosystems such as wetlands. In general, changes in water availability downstream from mountain areas are likely to lead to greater conflict. Higher temperatures may also affect the health of both livestock and people; for instance, malaria is likely to continue moving to higher altitudes, as already reported from East Africa and the Andes. For wild plants and animals, a warmer climate may mean extinction as their habitat disappears.

At the same time, climate change may bring regional and local benefits. In the mountains, higher temperatures may mean that trees produce higher yields of timber and that crops can be grown at higher altitudes, if water and soils are adequate. But for many mountain areas of the South, present models predict water availability will be lower and rainfall more erratic. As cultivation moves uphill, the pressure may create conflicts with those managing national parks and other types of protected areas.

Managing climate change in mountains

Until recently, economic, political or social changes such as globalization and migration were taken to be the main drivers of change in mountains. Today, it is increasingly realized that climate change and its consequences are likely to have similar or even greater impacts. As this is a relatively new insight, climate change has so far not been adequately included in planning and decision-making processes – this is also true for mountain regions.

However, there is a growing body of adaptive action relating to climate change in mountains. These include technological measures, such as prevention of glacial lake outburst in the Himalaya, or safeguards against slope instability due to permafrost decay in the Alps and northern Europe. Mountain resorts in Europe and North America have started diversifying their services to compensate for the loss of winter tourism caused by the lack of snow – an example of adaptive management in the face of climate change. At the policy level, a number of countries are reviewing land use plans and zoning, a crucial measure for both mountains and surrounding lowlands, as floods, landslides and avalanches are likely to become more severe and affect areas so far considered safe.

Adaptation will have to be supported by mitigating measures that address the root causes of climate change: the emission of greenhouse gases and other substances that might cause global warming. Key issues are the reduction of these emissions and the improvement of energy efficiency. Promising recent actions include:

- the promotion of energy-saving buildings in the Alps, Central Asia and the Himalayas;
- the shift from road to rail of long-distance freight transport including Alpine transit traffic;
- the development of emission-free energy production, such as medium-size or micro-hydropower, as promoted in China, India and Nepal.

The involvement of economic and population centres outside mountain regions in industrialized, emerging and developing economies will be critical for achieving a tangible reduction of emissions, as a significant proportion of the greenhouse gases are released in these areas. One way is through Payment for Environmental Services (PES) relating to watershed management, biodiversity conservation, carbon sequestration and water regulation for hydropower. There are a growing number of PES programmes where mountain communities are benefiting in implementing adaptation measures to maintain environmental services of mountain ecosystems. ⟹

National committee formed to deal with climate change in Bhutan

Bhutan is a mountain country and one of the world's biodiversity hotspots. The most dramatic threat posed by climate change and global warming are glacial lake outburst floods. The country has over 500 lakes associated with glaciers. Of these 24 are considered potentially dangerous. When these floods occur, lives are lost, crops and pasture land destroyed, houses and infrastructure devastated. Bhutan has already witnessed catastrophic floods from such outbursts in 1960, 1968 and 1994. Some of the glaciers in Bhutan are now retreating 20-30 metres a year, with devastating effects downstream.

To address this threat, Bhutan has formed a National Climate Change Committee. Joint efforts have been made with India, Japan, Austria and other countries to identify safe and unsafe zones for settlement in potential flood-affected areas. Plans exist to relocate some of the settlements considered unsafe. People in remote places have been given radios as a rudimentary early warning measure. Activities considered for the future include artificial lowering of glacial lake levels, hazard zoning plans, improvement of weather forecasting and assessment of glacial lakes outburst for hydropower, an important earner of foreign exchange for Bhutan.

Source: Mountain Forum, Pankaj Thapa, Sr. Lecturer, Royal University of Bhutan.