



Food and Agriculture Organization  
of the United Nations



UNIVERSITY  
*of York*



**2022**  
International Year of  
SUSTAINABLE  
**MOUNTAIN**  
DEVELOPMENT

Policy Brief  
**Ecosystem restoration  
in the mountains**

# Ecosystem restoration in the mountains

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## Introduction

Due to their cultural significance, unique ecosystems, and contributions to people and the planet, mountains are increasingly gaining political attention. The year 2022 represents a turning point for mountains as the United Nations General Assembly declared it the International Year of Sustainable Mountain Development (IYM 2022). It also represents the second year of the UN Decade on Ecosystem Restoration (2021–2030). One of the key initiatives of IYM 2022 is the establishment of an Open-Ended Scientific Committee (OESC) and the production of several policy briefs on sustainable mountain development.

This policy brief focuses on ecosystem restoration in the mountains. It highlights the role of healthy mountain ecosystems and their services and provides a set of recommendations to help design effective restoration plans.

It also reflects on the achievements made during the last 20 years. The year 2022 marks the 20th anniversary of the first International Year of Mountains, as well as the 20th anniversary of the Mountain Partnership. During these years, several milestones have

been achieved to restore mountain ecosystems. These include:

- The development of two Sustainable Development Goal (SDG) indicators (15.4.1 and 15.4.2) that monitor the status of the conservation of mountain environments
- The growth of the Mountain Partnership and its commitment to projects dedicated to ecosystem restoration in the mountains
- The inclusion of mountains in international processes, such as the Nairobi work programme under the UNFCCC
- The development of a chapter entirely dedicated to mountains in the Sixth Assessment Report by the Intergovernmental Panel on Climate Change (IPCC)
- The production of a comprehensive assessment of the Hindu Kush Himalayan (HKH) region, which spans Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan
- The commitment by the eight HKH countries (Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan) to the Hindu Kush Himalaya Call to Action<sup>11</sup>
- The development of a mountain portal dedicated to mountain biodiversity<sup>12</sup>

**Mountains play a crucial role for both the highlands and lowlands, but are particularly vulnerable to climate change and human interventions.**

<sup>11</sup> For more information, please refer to HKH Call to Action.

<sup>12</sup> For more information, please refer to the GMBA Mountain Portal.



While the achievements listed above reflect considerable progress, a lot of work lies ahead. Mountains play a crucial role for both the highlands and lowlands as they are water towers, host about half the world's biodiversity hotspots and 30 per cent of all Key Biodiversity Areas, and contain vital genetic resources for locally adapted crops and livestock.

Due to their biological, cultural, and environmental uniqueness, mountains are particularly vulnerable to climate change and human interventions. These threaten the globally important ecosystem services that mountains provide. However, although the importance of mountains is widely recognised, sustainable mountain development and mountain ecosystem restoration are not getting the necessary policy attention and investments needed.

## **Main characteristics of and threats faced by mountain ecosystems**

Mountain environments have diverse micro-climates compared to the surrounding lowlands, hence their vegetation differs as well. As the climate rapidly changes with altitude over relatively short horizontal distances, vegetation and hydrology in mountains vary across short distances as well, resulting in highly unique ecosystems (Adler et al., 2022). In addition, the complex topography

in mountain environments allows mountains to support great biodiversity (Winkler et al., 2016) as well as provide refugia for species to buffer them from elevation-dependent warming (Chettri et al., 2020).

Mountain ecosystems are also characterised by harsh environmental conditions, including long-lasting snow cover, short growing seasons, and topographically-related disturbances such as avalanches, rock fall, and landslides. Mountain ecosystems and the unique animal and plant species that inhabit them are generally well adapted to these conditions. However, they may react sensitively to changes in climate, land use, and disturbance regimes, and there is already evidence of plants and animals shifting to higher elevations due to climate change (Xiao et al., 2020).

The Sixth IPCC Assessment on mountains indicates that climate change impacts and their attribution to human influence have increased in recent decades (IPCC, 2021). Increases in temperatures, precipitation, and climate variability will continue to induce changes in mountain regions, with negative consequences for the mountain cryosphere, biodiversity, ecosystem services, and human well-being (Adler et al., 2022). The loss of glaciers and changes in snow cover and snowmelt have serious implications for water availability, especially for irrigation in dry,

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downstream lowlands. Finally, climate change is increasing the exposure to hazards such as landslides, droughts, floods, wildfires, changes in seasons, and the timing and availability of water. These factors, along with the increasing prevalence of pests and decreasing pollinator diversity affect mountain agricultural production in negative ways (Yao et al., 2022).

As far as rainfall is concerned, climate change scenarios in general predict a greater frequency and intensity of rainfall events but also longer periods of dry spells and more erratic rain. Well-functioning mountain ecosystems are more resilient to climate extremes as they can buffer shocks such as high intensity rainstorms or prolonged dry spells due to their increased capacity to store water, reduced surface run-off and soil erosion, increased recharge of groundwater, and an increased and prolonged flow of water in rivers during the dry season. They also have beneficial impacts beyond the mountain region such as larger stores of carbon, and a strengthened resilience to climate extremes and trends, thereby securing downstream spring and dry season flows, and reducing disastrous floods in the watershed. This would help disaster risk reduction in downstream areas and the lowlands of the watershed (Liniger et al., 2020).



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## Mountain ecosystem restoration and land degradation: The need for action

Land degradation results from weak policies and tenure laws, as well as from unsustainable land management, including uncontrolled grazing, deforestation, intensive farming, or even inappropriate afforestation. Additional trends such as population growth and rapid economic development, leading to increased urbanization and haphazard infrastructure development, may further contribute to land degradation in mountain environments (Moreda, 2018).

Land degradation also has a negative impact on the livelihoods of mountain communities as it seriously impacts agriculture, and endangers the sustainability of crop production, animal husbandry, and water security (Chettri et al., 2021). Globally, approximately 311 million



people (half the rural mountain population in developing countries) live in areas exposed to progressive land degradation. In turn, an increase in land use change, such as the transformation of natural land cover into farmlands and grazing lands that are not well-managed, as well as into human settlements and urban centres, stresses soil fertility and the water cycle, thus exacerbating surface run-off, soil erosion, and landslides in mountains (FAO & UNCCD, 2019).

Mountain ecosystem restoration aims to recover degraded ecosystems and the services they provide (such as biodiversity, soil fertility, water quality and regulation, disaster risk reduction, production benefits, and food) as well as to conserve ecosystems that are still intact. The restoration of mountain ecosystems is imperative because it has the potential to benefit the broader community and environment both in the mountains and further downstream (UNEP & GRID-Arendal, 2019; Xu et al., 2019)

Successful mountain ecosystem restoration activities have been carried out worldwide, ranging from small projects by research institutions to large-scale implementation activities with broad stakeholder participation. It is necessary to build on the lessons learned, evaluate them critically in terms of their impacts on the natural and human systems, increase efforts across all mountain regions, and institutionalise mountain restoration in

national planning and policy processes (Xiao et al., 2020). Restoration initiatives need to be implemented with a landscape approach and encompass all habitats available in mountain ecosystems, including forests, grasslands, wetlands, streams, rivers, lakes, peatlands, fens, and others.

## Recommendations

Mountain ecosystems face growing threats due to climate change and human activities, and are in need of immediate restoration support. Identifying the different and unique mountain ecosystems, understanding their functioning, assessing their health and potential for improvement, and designing catered restoration plans with sustainable land management practices for each of them remains an important task. To achieve this, the following recommendations are suggested:

- **Data collection and information-sharing**

More data on climate change, ecosystem dynamics, land use and its impacts on land degradation and ecosystem services, and other drivers of degradation

Greater documentation and sharing of sustainable land management practices and their impacts both onsite (within the mountain region where they are applied) and offsite (outside the area where they are applied)

**Restoration initiatives need to be implemented with a landscape approach and encompass all habitats available in mountain ecosystems.**



Photo: Robert Marchant,  
University of York

Greater availability and accessibility of adequate and long-term mountain-specific data and experiences to inform mountain-specific policies for evidence-based decision making in the planning and implementation of restoration and conservation programmes

Information on and monitoring of current restoration initiatives of mountain ecosystems to evaluate the success of restoration methods, identify their limitations, learn lessons, and promote adaptive management measures

- **Implementation of adaptation and mitigation policies**

Formulate effective and efficient climate change mitigation and adaptation plans and policies that consider mountain specificities and are implemented at larger landscape and watershed levels

Establish strong land tenure laws to prevent poor land transformation and reduce land degradation in mountain regions

### **Mobilisation of funding and investments for mountain ecosystem restoration**

Long-term and adequate funding and investment based on urgency and vulnerability

Investment by countries and other stakeholders along with use of funds to engage in mountain ecosystem restoration activities

- **Utilisation of traditional innovation and knowledge**

Better incorporation of the existing wealth of knowledge – including traditional, indigenous, and experiential local knowledge as well as knowledge related to innovation and adaptation – into the development of effective policies and activities.

- **Improving awareness and capacities**

Tailored awareness-raising campaigns and capacity-building events that are targeted at a range of audience groups – the larger public, land users, planners, decision-makers, and policy makers.



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International Centre for Integrated  
Mountain Development



Mountain Partnership  
Secretariat