



## **Focus Issue: Pastoralism and Rangelands in Mountains**

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# Focus Issue: Pastoralism and Rangelands in Mountains

Dear Readers,

Mountain rangelands (open grasslands, mixed forest meadows, closed forests, and alpine lakes and wetlands) play vital roles for humans, supporting livestock grazing, hunting, and harvesting of plants. They thus provide livelihoods for a large number of rural mountain communities across the globe. These systems are also key for water supply to lowland areas and watershed health, carbon sequestration and storage, fire regulation, and, increasingly, recreational use and tourism. They are vital for the conservation of mountain species and habitats, including endemic species and habitats exclusive to mountains. Many of these ecosystems require management to maintain species diversity and productivity and supply a range of high-quality ecosystem services.

Pastoralism in mountains is a unique cultural way of life and production system. It encompasses diverse herding practices that link natural and social systems at several scales. Mountain pastoralists often move their livestock seasonally to respond to ecological variability and take advantage of new pastures, a practice known as transhumant pastoralism. Pastoral systems can be complex and frequently rely on multiple types of social institutions and knowledge (eg traditional, ecological, and indigenous) for managing mountain environments, including specific, often gender-based, sharing of labor and kin relationships. Pastoralism may also involve sophisticated technology and innovative management practices to improve feeding patterns and strategies, track animal locations and movement, implement rotational grazing systems, or prevent attacks from large carnivores.

Pastoral systems in mountains are changing rapidly. In some parts of the world, this change results from overgrazing, overharvesting, or intensification of livestock production related to growing populations and market demands; further drivers of change include competing land uses encroaching on pastoral territories and resources, as well as new borders restricting the movement of transhumant populations. In other regions, depopulation, abandonment, and undergrazing lead to new land uses and landscapes, favoring the spread of alien invasive species, causing biodiversity loss, and altering fire regimes. Coupled with climate change and other drivers and disturbances, changes in mountain pastoral social-ecological systems can affect their resilience. This in turn leads to degradation, thereby reducing the supply of ecosystem services, causing loss of livelihoods, and most importantly, threatening the maintenance of these systems. Changing markets and demand for sustainable products in other, interlinked, world regions, as well as new forms of communication, can have negative or positive impacts on pastoralists' lives.

The global relevance and urgency of addressing the challenges for pastoral social-ecological systems is widely acknowledged. The United Nations 2030 Agenda for Sustainable Development (UNDESA n.d.), the United Nations Decade on Ecosystem Restoration 2021–2030 (UNEP and FAO n.d.), and the proposal for an International Year of Rangelands and Pastoralists to be celebrated in 2026 (MNSG and ISG n.d.) all emphasize the importance of pastoral systems and the need to find knowledge-based solutions to tackle increasing degradation and poverty in these systems. For this purpose, the science community, governments, practitioners, and policymakers should be aware of the historical and current interactions of social and ecological components of pastoral systems in mountain areas. Similar attention ought to be paid to the interlinkages between these mountain systems and other regions (eg supply of and demand for ecosystem services, labor force, and mountain products). Stakeholders should also better understand the drivers of change in mountain pastoral social-ecological systems—especially climate and economic and sociopolitical factors—as well as the interactions among drivers and their impacts. Equally relevant are pressure-response dynamics, particularly at the pastoralist community level, including innovative adaptive responses and feedback.

With this focus issue, MRD intends to contribute to better understanding of pastoralism and rangelands in mountains, factors affecting pastoral social-ecological systems, responses from society, and how innovative solutions can effectively help respond to environmental, socioeconomic, and political changes. Our initial call was met with many manuscript submissions, from which 10 were selected for publication. The articles included in this issue mostly focus on Asia and South America (with one contribution from northern Africa). In this regard, the issue complements the recent special issue on montane rangelands of the African Journal of Range and Forage Science (March 2021).

In the MountainDevelopment section, Joanne Millar and Karma Tenzing discuss the practice and results of a community-based rangeland restoration project in degraded high-elevation rangelands in eastern Bhutan. They highlight that pastoralists' willingness and ability to restore mountain rangelands depends on the security of their use rights to graze and manage high-elevation areas. Building trust with mountain communities and staying committed to long-term social and environmental change are essential for practitioners and policymakers.

The 8 articles in the MountainResearch section cover diverse topics in 4 geographic regions (South Asia, North Africa, southern Europe, and South America). However, they share a holistic integrated social-ecological approach to identifying and accessing drivers of change and their impacts on pastoral systems. All studies address responses from communities and present recommendations for action, especially toward enhancing resilience in mountain social-ecological pastoral systems. In particular, climate change is a major process or driver directly and indirectly addressed across these studies.

The study by Ranbir Singh Rana and colleagues assessed climate vulnerability of farming and livestock production in Himachal Pradesh, India, identifying the most conspicuous manifestations of climate change in these production sectors. This was also the goal of the study by José Castro and coauthors, who analyzed the impacts of past and future climate change on traditional small ruminant production systems in the Montesinho mountains of Portugal and how these systems adapt to climate change. Binaya Pasakhala and colleagues analyzed socioeconomic, political, institutional, ecological, and climatic drivers of decline of transhumant pastoralism in Bajhang, Nepal, and the responses of communities to these.

Similarly, María E. Fernández-Giménez and coauthors studied the interrelations of traditional ecological knowledge practices and institutions in transhumant *Ilemchane* herders in Morocco's High Atlas Mountains, as well as how climate and social changes are affecting the pastoral social-ecological systems of which they are part.

Rangeland use under changes in social, environmental, and climatic contexts in Lotkuh Valley, Chitral, Pakistan, was analyzed by Zahir Ahmad and colleagues, highlighting the diversity of strategies adopted by mountain pastoralists. Likewise, Audrey Joslin analyzed how local contextual factors affect the dynamics of wild cattle maintained by indigenous communities in the páramo high-altitude ecosystem in Ecuador and the implications of removing these animals for the sustainability of the system. Yanina Arzamendia and coauthors characterized the traditional pastoralist system of the Argentine Puna based on an ecosystem services assessment, stressing its dependence on interacting natural and anthropic processes and pinpointing drivers threatening its sustainability. Finally, Carlos Matovelle and colleagues analyzed the dynamics of native grasslands and cattle pastures, as well as how these affect water supply and quality, in the Rircay River subbasin of southern Ecuador.

In the MountainAgenda section, Karina Yager and colleagues focus on bofedal wetlands in the Andes and their relationship with pastoral systems. They conceptually reframe bofedales as sociohydrological constructs to identify actionable knowledge and water conservation practices applied by pastoralists across Andean water tower regions.

Most of this issue's articles are in the MountainResearch section (8 articles), with only 1 article each in MountainDevelopment and MountainAgenda. This imbalance among sections may seem to indicate higher interest from the mountain community in exploring pastoralism in mountains from a systems research perspective than in creating transformative or target knowledge about what should be done and how to achieve it. However, this is only apparent, as all research publications place a strong focus on social, economic, and political components of pastoral systems. They debate sustainable socioeconomic development in these systems and present solutions to problems identified during the research.

The MountainPlatform section offers a platform for the members of the International Mountain Society to communicate their mountain-related activities, achievements, and upcoming milestones. In this issue, the International Centre for Integrated Mountain Development presents its #HKH2Glasgow campaign. The campaign aims to promote ambitious climate action in the Hindu Kush Himalaya and has launched a framework to scale up investment in mountain-specific climate priorities at and beyond the 26th session of the Conference of the Parties to the UN Framework Convention on Climate Change in Glasgow, UK.

This issue's MountainMedia section contains 4 reviews of recent books relevant to sustainable development in mountains. Two of these focus on photography and art. They highlight the value of engaging with the arts and humanities as a means to conceptualize and express global change phenomena in mountains, complementing often more conventional empirical scientific inquiry.

It is our expectation that the interesting articles in this focus issue's peer-reviewed sections will spark multistakeholder collaboration and innovation to tackle the challenges facing pastoral social-ecological systems.

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