Focus Issue: Restoring Mountain Systems for Social–Ecological Resilience

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Editorial

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Dear Readers,

Anthropogenic and environmental pressures on mountains result in land degradation, as well as in the loss of species and critical ecological functions and services. Concomitantly, average temperatures continue to rise and fluctuations in the amount and spatiotemporal distribution of precipitation increase (eg Hock et al 2019), exacerbating these trends. Hence, the urgency of restoring mountain ecosystems and landscapes is indisputable. Action is needed to safeguard mountain species and ecosystems as the fabric of life on which mountain dwellers depend for their livelihoods and from which remote beneficiaries in distant lowlands derive essential ecosystem services, such as climate regulation through carbon sequestration (Parisi et al 2022). Action is needed to ensure that mountain ecosystems as well as mountain societies can adapt to these novel socio-environmental conditions and are safe in the face of growing uncertainties. However, given the diversity of natural environments in mountains—ranging from arid shrublands to montane wetlands and alpine ecosystems—there is no one-size-fits-all solution to mountain ecosystem restoration. Tailor-made initiatives and approaches are needed that can be as simple as reducing invasive plant presence or removing grazing pressure, such as in the mountains of southern Kyrgyzstan (see FAO and UNEP 2023). At the other end of the spectrum, restoration approaches can be as complex as major geoengineering initiatives to restore large-scale mining scars or necromass incorporation and manure fertilization to improve soil quality in the páramo *(Christmann and Oliveras Menor 2021).*

The dependency of local communities on their mountains' healthy ecosystems and the need for action to address the consequences of anthropogenic and environmental factors on mountain social–ecological systems are well illustrated in this focus issue by Thapa and colleagues. In the Nepalese Himalaya, where they work, the gradual drying out of spring sources leads to increasing water scarcity. This, in turn, affects drinking water, irrigation, and sanitation, as well as livestock, and ultimately represents a disproportionate burden on women and children, as well as a threat to livelihoods. As such, the gradual disappearance of these water sources undermines the country's progress toward Sustainable Development Goals (SDGs) 3 and 6 on good health and wellbeing and clean water and sanitation, respectively, but also progress toward SDG 5 on gender equality. Whereas solutions such as water transportation from distant sources or boring exist, they are temporary, bear environmental and social costs, and are insufficient. In the context in which Thapa and colleagues work, restoration consists primarily of spring conservation, in addition to the use of recharge ponds for the revival of dried-up springs, plantations, and afforestation. With their work, Thapa and coauthors contribute to a growing body of literature and case studies on the degradation and restoration of mountain springs in the Himalayan region and elsewhere (eg Tambe et al 2012; NITI Aayog 2018; Buono et al 2019).

In the Himalaya and more generally in mountains worldwide, plantations and afforestation are prevalent forms of active restoration with benefits for soil stability and natural hazard mitigation, as well as, importantly, for carbon storage. Recent developments in global carbon markets and the potential for restoration to yield carbon offsets have substantially bolstered the attractiveness of such practices and led to increasing interest in funding restoration from powerful financial actors in the global North (Löfqvist and Ghazoul 2019). But these developments have also fueled the debate around practices that have been labeled "carbon colonialism" (see eg Parsons 2023) for claiming space in the global South to meet the needs of the global North in the name of carbon dioxide reduction (Löfqvist and Ghazoul 2019). Issues of benefit sharing and, more broadly, of social justice are numerous in the context of afforestation and plantations, and in restoration at large. Much land with restoration potential is crucial to the livelihoods of people who are often excluded from decision-making and from the restoration processes (see Löfqvist et al 2023). Accordingly, many authors have recognized the importance of social considerations and codesign with local communities for improving the equity and effectiveness of ecosystem restoration (see Christmann and Oliveras Menor 2021; Elias et al 2022; Löfqvist et al 2023). In the present issue and alongside these authors, Holterman and colleagues, as well as Torres and colleagues, place people, local communities, and their integration in restoration projects at the heart of the research they present. Holterman and colleagues do so by proposing a social science research agenda for the Yellowstone to Yukon region of North America. This is organized around the 4 themes of institutional barriers to conservation actions, mobilization of (local) support for conservation, adaptive capacities of local people, and human dimensions of outdoor recreation. Torres and coauthors, in turn, start with the observation that measures adopted for the management of the Andean páramo *are seldom participatory or inclusive of local communities. Based on this observation, their work consists of determining whether existing approaches to protect the Ecuadorian* páramo *present the characteristics of so-called social technologies, defined as "a way of designing, developing, implementing, and managing technology [. . .] to solve social and environmental problems and, at the same time, generate social and economic dynamics of social inclusion, solidarity, and sustainable development" (Torres et al 2023: D2). The association detected between a gradual slowing of the rate at which the* páramo *of central Ecuador is being lost and a growing empowerment and sense of responsibility of local populations in its management confirms the critical role of local populations as custodians of mountain ecosystems and the importance of social inclusion in restoration. Local participation and involvement in all stages of rehabilitation processes and across scales are equally important in Mendoza-Ato and colleagues' conceptual model for the rehabilitation of hydrological services in puna grasslands and for the adaptive ecosystem-based management practices they promote. The adaptive practices by which each component of the rehabilitation processes is monitored in a participatory process, iteratively evaluated against codefined objectives and indicators, and repeatedly adjusted, is a particularly interesting and timely contribution to the literature on managing nature. Whereas the need for the adaptive monitoring of ecosystems has long been emphasized (eg Lindenmayer and Likens 2009), examples of such monitoring are still few. Effective adaptive management is very rarely truly enacted, even less so as a participatory process.*

Next to the social challenges it brings, the planting of trees raises many additional issues of an ecological nature. Much depends on which tree species are planted, in what spatial arrangement, and on their combinations with other plants. Plantations are particularly challenging because they often consist of nonnative species and are frequently set up on "available" restoration land, such as natural grasslands and other systems that are naturally only lightly woody or not woody at all. Moreover, they are often not adequately managed to prevent subsequent invasions, fires, or disease outbreaks, and they replace native trees and agroforestry systems of great use value to local people with systems of comparatively high commodity value for corporations and nonresidents (see eg Christmann and Oliveras Menor 2021). In their contribution, Nigussie and colleagues look at tree plantations in the Highlands of Ethiopia through both a social and an ecological lens, with the objective of investigating the impacts of plantations on human and plant communities. The results of their interviews and vegetative sampling suggest that in their study area, well-planned and maintained forest plantations can complement native vegetation by lowering human pressure on natural ecosystems through the provision of equally important, although not as unique, ecosystem services. Interestingly, social and ecological benefits from tree plantations accrue at different scales, locally for communities who extract wood for timber and charcoal, for example, and at landscape scale for species that might more readily provide a more diverse habitat structure. Acknowledging and accounting for the spatial distribution of restoration benefits and the inevitable trade-offs between different types of benefits and between different beneficiaries is essential to ensure effective and sustainable restoration. Restoration interventions often simultaneously produce diverse outcomes linked to food production, carbon sequestration, biodiversity, or livelihoods, for example, that are valued differently by distinct actors with individual vulnerabilities to restoration outcomes (see Löfqvist et al 2023). Accordingly, navigating trade-offs across scales and within complex matrixes of stakeholders represents a largely unresolved challenge and calls for the rigorous and holistic codefinition and assessment of social–ecological and economic objectives from the onset.

Large-scale policy pledges such as the 2011 Bonn Challenge, the proclamation of the UN Decade of Ecosystem Restoration in 2021, and recently the Glasgow Climate Pact, which emphasizes the importance of protecting, conserving, and restoring ecosystems to meet the Paris Agreement (UNFCCC 2021), are useful instruments for raising awareness and mobilizing agencies, policymakers, scientists, and stakeholders at large. Yet, policies are required at the scale at which restoration happens or needs to be implemented, calling for decentralized governance and the devolution of power to local bodies. Thapa and colleagues describe how policies are in place in about 50% of the local government units surveyed, but the lack of nongovernmental structures to carry out the implementation impedes effective restoration. Ultimately, although policies, governance levels, and institutions are important, the success and impact of restoration measures require action and commitment at the individual level. However, both awareness and community participation are often lacking, as Thapa and colleagues found, and local support is needed, as shown by Holterman and coauthors. Raising awareness among local populations about the importance of ecosystem restoration in supporting human wellbeing appears in various contributions to this focus issue as a critical lever to achieving progress toward safeguarding nature. However, for this to be effective, it needs to be "encultured," that is, highly attuned to people's cultural and social concerns and context.

The UN Decade on Restoration provides a policy window for promoting ecosystem restoration in mountains and incorporating many diverse kinds of restoration approaches. In the MountainDevelopment section, Mendoza-Ato and colleagues acknowledge the existence of a growing number of initiatives to restore mountain ecosystems and their services, but the authors recognize the need for a conceptual model for the rehabilitation of hydrological systems in puna grasslands that capitalizes on these initiatives. By doing so, they echo Parisi and coauthors (2022), who stressed the need to build on lessons learned and evaluate them critically. In the MountainResearch section of this focus issue, contributions from Nepal, Ethiopia, and Ecuador exemplify very different contexts and restoration challenges with a common denominator: the importance of accounting for the societal, historical, economic, and ecological context in which restoration takes place, embracing the fact that different value systems and interests coexist and need to be accounted for. The social dimension of restoration is unpacked in further detail by Holterman and colleagues in the MountainAgenda section, with a research agenda that highlights the critical challenge of interdisciplinary work in nature conservation and management. International Mountain Day 2023, on 11 December, with its focus on mountain ecosystem restoration, served as a timely opportunity to acknowledge the tremendous work carried out by practitioners and citizens to restore uniquely valuable mountain ecosystems (see FAO and UNEP 2023). Many of these custodians on whom we rely for the safeguarding of our mountains and their biodiversity have useful and inspiring examples of good restoration practices to share. Engaging with them to garner their knowledge and expertise and share it with a broad readership in a process of mutual exchange and learning is a challenge that needs to be more systematically addressed to magnify the long-term impacts of restoration on mountain social–ecological systems.

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REFERENCES

Buono J, Kumar A, Mahamuni K, Bisht B, Adiraju S, Shabong L, Kasturirangan A. 2019. Spring protection and management: Some case histories from across India's mountainous regions. *In*: Ray S, editor. *Ground Water Development: Issues and Sustainable Solutions*. Singapore, Singapore: Springer, pp 329–337. https://doi.org/10.1007/978-981-13-1771-2_20.

Christmann T, Oliveras Menor I. 2021. A synthesis and future research directions for tropical mountain ecosystem restoration. *Scientific Reports* 11:23948. https://doi.org/10.1038/s41598-021-03205-y.

Elias M, Kandel M, Mansourian S, Meinzen-Dick R, Crossland M, Joshi D, Kariuki J, Lee LC, McElwee P, Sen A, et al. 2022. Ten people-centered rules for socially sustainable ecosystem restoration. *Restoration Ecology* 30(4):e13574. https://doi.org/10.1111/rec.13574.

FAO [Food and Agriculture Organization of the United Nations], UNEP [United Nations Environment Programme]. 2023. *Restoring Mountain Ecosystems: Challenges, Case Studies and Recommendations for Implementing the UN Decade Principles for Mountain Ecosystem Restoration*. Rome, Italy and Nairobi, Kenya: FAO and UNEP. https://doi.org/10.4060/cc9044en.

Hock R, Rasul G, Adler C, Cáceres B, Gruber S, Hirabayashi Y, Jackson M, Kääb A, Kang S, Kutuzov S, et al. 2019. High mountain areas. *In:* Pörtner H-O, Roberts DC, Masson-Delmotte V, Zhai P, Tignor M, Poloczanska E, Mintenbeck K, Alegría A, Nicolai M, Okem A, et al, editors. *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate*. Cambridge, United Kingdom: Cambridge University Press, pp 131–202. https://doi.org/10.1017/9781009157964.004.

Lindenmayer DB, Likens GE. 2009. Adaptive monitoring: A new paradigm for long-term research and monitoring. *Trends in Ecology & Evolution* 24(9):482–486. https://doi.org/10.1016/j.tree.2009.03.005.

Löfqvist S, Ghazoul J. 2019. Private funding is essential to leverage forest and landscape restoration at global scales. *Nature Ecology and Evolution* 3:1612–1615. https://doi.org/10.1038/s41559-019-1031-y.

Löfqvist S, Kleinschroth F, Bey A, de Bremond A, DeFries R, Dong J, Fleischman F, Lele S, Martin DA, Messerli P, et al. 2023. How social considerations improve the equity and effectiveness of ecosystem restoration. *BioScience* 73(2):134–148. https://doi.org/10.1093/biosci/biac099.

NITI Aayog. 2018. *Inventory and Revival of Springs in the Himalayas for Water Security*. New Delhi, India: NITI Aayog, Government of India.

Parisi F, Lee Y, Bitsch J, Schmoeker G, Quenta Herrera E, Wang J, Hofer T, Marchant R, Chettri N, Liniger H. 2022. *Ecosystem Restoration in the Mountains: Policy Brief*. Kathmandu, Nepal: International Centre for Integrated Mountain Development and Mountain Partnership Secretariat. https://lib.icimod.org/record/36105; accessed on 19 December 2023.

Parsons L. 2023. *Carbon Colonialism: How Rich Countries Export Climate Breakdown*. Manchester, United Kingdom: Manchester University Press.

Tambe S, Kharel G, Arrawatia ML, Kulkarni H, Mahamuni K, Ganeriwala AK. 2012. Reviving dying springs: Climate change adaptation experiments from the Sikkim Himalaya. *Mountain Research and Development* 32(1):62–72. https://doi.org/10.1659/MRD-JOURNAL-D-11-00079.1.

Torres MC, Naranjo E, Fierro V, Carchipulla-Morales D. 2023. Social technology for the protection of the *páramo* in the Central Andes of Ecuador. *Mountain Research and Development* 43(4):D1–D11. https://doi.org/10.1659/mrd.2022.00022.

UNFCCC [United Nations Framework Convention on Climate Change]. 2021. *Glasgow Climate Pact: Draft decision -/CMA.3*. FCCC/PA/CMA/2021/L.16. Bonn, Germany: UNFCCC. https://unfccc.int/sites/default/files/resource/cma2021_L16_adv.pdf; accessed on 19 December 2023.