

Common Challenges and Differing Responses: Reflections about Sustainable Mountain Development

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Abstract

Looking back at decades of rising awareness of mountain challenges and constraints in the framework of a half-century-long Man and the Biosphere Programme by UNESCO, and anniversaries such as 30 years of the UNDP Conference on Environment and Development in Rio de Janeiro and 20 years since the inauguration of the International Year of Mountains, it is high time for assessing the achievements and shortcomings over these years and for projecting a future vision for coping with climate and social changes and striving for sustainable mountain development. Coping strategies need to be adapted to local conditions; many challenges are similar, but solutions can differ over a wide spectrum of policy-making and development-package designing. Shrinking available spaces in conjunction with high demand for building plots, infrastructure expansion, tourist facilities and leisure and recreation areas have increased the existing tension with mountain agriculture's paramount role in traditional land use. Its valuable contribution to ecosystem services, food security and cash crop production requires a cautious approach for safeguarding rural livelihoods. Enhanced out-migration and other forms of multi-directional mobility affect the maintenance of cultural and natural landscapes. Political conflicts in border regions indicate an urgent need for negotiations and reconciliation on the way to creating cross-boundary cooperation and professional exchange on the path to sustainable mountain development.

Key words: food security, High Asia, migration, mobility, Pamir Peace Park, sustainable mountain agriculture, water

1. Introduction

The year 2022 was of significant importance to the international mountain community. Half a century ago, UNESCO initiated the Man and the Biosphere Programme with a pioneering section on relevant mountain studies hinting exemplarily at these vulnerable landscapes and stimulating a rising interest since then in special challenges in mountain settings. Its World Heritage Programme was initiated in the same context. Thirty years ago, the United Nations staged the Rio Conference on Environment and Development; twenty years ago, its International Year of Mountains triggered a growing awareness of the crucial interdependence of mountain landscapes with their rimlands. Anniversaries provide a welcome occasion to reflect on gains and deficits during the periods passed, and offer an opportunity to reshape programmatic approaches and to reflect on new venues for operation and visionary future

paths of development (Fig. 1).

All these efforts have purposefully led to a comprehensive approach and fostered combined efforts to identify goals for sustainable development. The first target of the Sustainable Development Goals within its Goal 15—"Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss"—explicitly addresses "mountains among the ecosystems to be conserved, restored and sustainably used in line with international agreements" (United Nations, 2015). Over a span of half a century awareness has grown and culminated in the designation of 2022 as the International Year of Sustainable Mountain Development (United Nations, 2022). The global community of mountain researchers and policy makers is invited to evaluate previous achievements and to define future challenges leading to adaptive packages and programmes.

The concentration on conservation, restoration and sustainable use is an attempt comprehensively to grasp the challenges of our time. Significant sets of data have been gathered in the framework of climate change assessments.

The tipping points causing accelerated environmental change and triggers for change in socioeconomic systems have been identified, qualified in impact dimensions and arranged into a risk matrix (Fig. 1, Table 1).

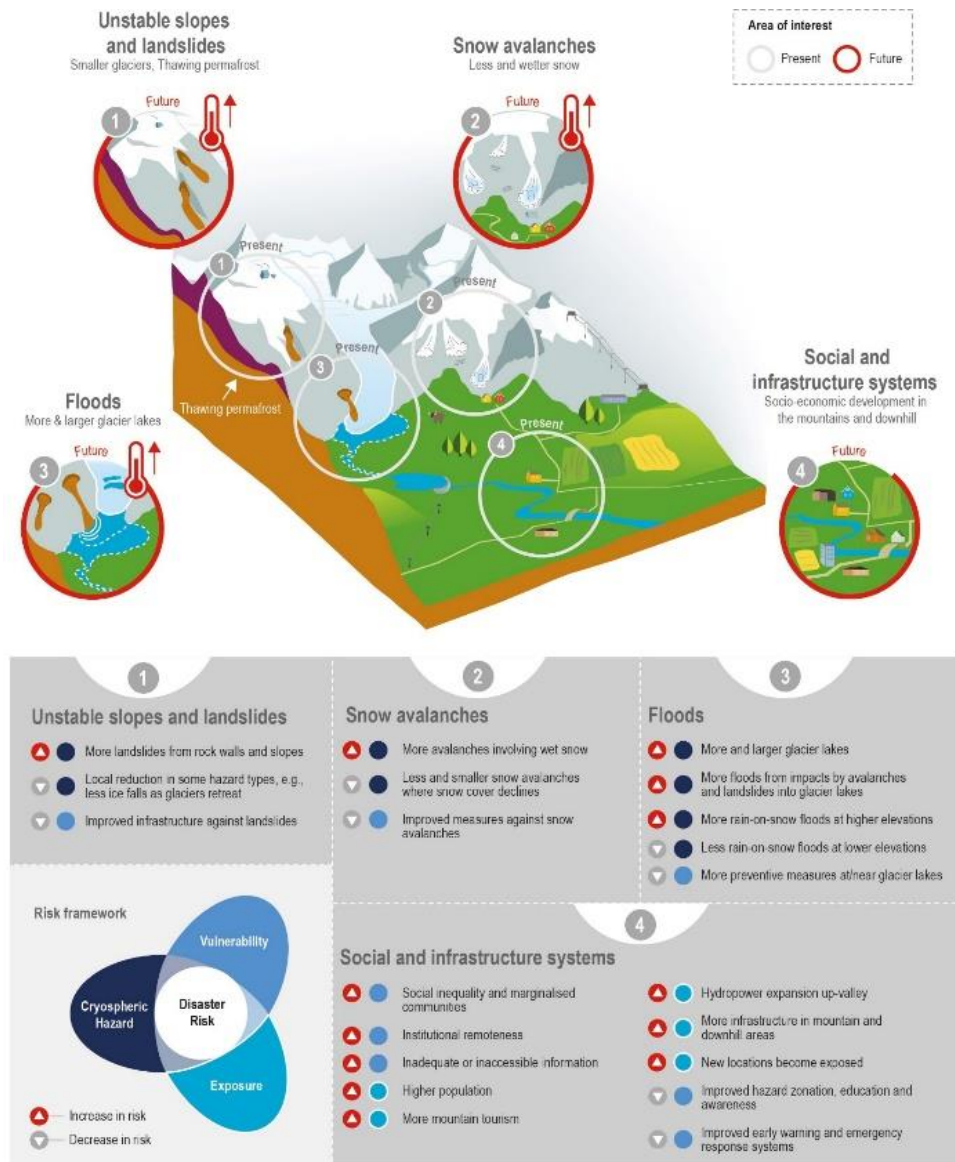


Fig. 1 Existing and future physical and human system challenges in mountain systems based on the Intergovernmental Panel on Climate Change (IPCC, 2019) in its special report on the ocean and cryosphere in a changing climate (Hock *et al.* 2019).

Table 1 Common challenges: different contexts and strategies.

	High mountain regions	IPCC: European Alps	IPCC: High Mountain Asia	Alpine Convention countries ¹	High Asia ²
Physical challenges	Water availability Floods Landslides Avalanches Ecosystems services	Gain and loss Increase and decrease Increase Increase and decrease Gain and loss	Gain and loss Increase Increase Increase Gain and loss	Water scarcity Control measures Destructive Endangering Important	Drought, floods Increasing events Loss of land Threat to habitat Undeveloped
Human systems challenges	Agriculture Tourism Infrastructure Mobility Cultural services	Decrease Negative impact Negative impact No change Gain and loss	Decrease Negative impact Negative impact Growth Loss	Ecosystem services Eco-tourism Shrinking spaces High demand Promotion	Food security Over-tourism Expansion Multi-locality Rapid loss

Note 1: The Alpine Convention comprises eight European countries: Austria, France, Germany, Italy, Liechtenstein, Monaco, Slovenia and Switzerland.

Note 2: High Asia comprises mountain regions of Central, East and South Asia surrounding the Tibetan Plateau. The table composition is based on Intergovernmental Panel on Climate Change (IPCC, 2019) assessments by Hock *et al.* (2019) and results from the author's own fieldwork.

The evaluation of parameters enables risk exposures to be combined with hazard and vulnerability assessments. It has become common knowledge that mountainous areas are prone to rapid change processes. Previously a long list existed of certain topics related to mountain issues: salient sources of water for human consumption and irrigation in highlands and lowlands; high potential for hydraulic energy generation to supply grid-linked areas; valuable reserves for biological diversity as assets for a wider spatial range; target areas of exploitable natural resources such as minerals, forest products and agricultural goods for extra-montane markets; and increasingly a resource for domestic and international recreation. Significant human impacts were visible in mining and agricultural activities as well as in infrastructure development and tourism.

The present-day challenges posed by global warming and land degradation need to be identified, analysed and embedded in comprehensive adaptation and mitigation strategies. Significant work has been done by multi-disciplinary groups of scientists from various backgrounds leading to an analytical focus on sustainable mountain development that informs policy-makers and planners.

Agricultural practices of crop farming and animal husbandry have been a prime object of mountain research. In earlier studies these dominant practices were taken to describe mountain habitats as places generating basic livelihoods from local resources. Scientific attention was centred on localized mountain settings and neglected outward relations as a substantial component of survival strategies. For most mountainous regions, a sole dependence on mountain agriculture has never been sufficient to provide adequate livelihoods. Non-agrarian resources augmented mountain households' ability and capacity to maintain a living at higher altitudes. Such connotations were taken to categorize and identify development gaps between Asian and European mountains (Table 1). Since mountain development has taken various paths differentiated by regional socioeconomic and geopolitical settings, the importance of agriculture as the fundamental source of income is shrinking. Nowadays mountain households depend on a multitude of income sources generated within and outside of mountainous areas. Infrastructure development, resource exploitation, urbanization and a fast-growing tourism industry have exerted major pressures on mountain environments and resources. Challenges increase when it comes to defining pathways for sustainable mountain development and strategies for coping with climate change effects. Several European countries have acknowledged that cross-boundary cooperation and knowledge exchange will be instrumental and the key to a homogeneous, unified strategy for tackling present-day challenges. The Alpine Convention and Carpathian Convention are eminent examples of these

efforts (Alberton *et al.*, 2017; Permanent Secretariat of the Alpine Convention, 2021).

The High Asian mountains are exposed to a different set of challenges. Agricultural, hydrological and mineral resources are of prime importance for the countries involved. Stakes of multi-national corporations and international development agents focus on hidden treasures in mountain valleys which were difficult to access in former times due to missing roads and lacking infrastructure. Geopolitical and economic crises, unresolved boundary disputes and armed conflicts, domestic tensions and regional separatism describe part of the multiple challenges and constraints that hamper efforts for cooperation and mutually profitable exchange. Outmigration and multi-local income generation contribute to a complex web of interlinkages.

The service industries, primarily driven by tourism, mountaineering and trekking, have been identified as valuable sources of income and attract significant numbers of holiday-makers, leading to the question of how to cope with over-tourism and recreation-led urbanization. Europe's mountains are reaching their limit primarily during winter, although the previously observed seasonality has shifted to prolonged tourism periods, putting higher pressure on local resources.

High Asia is facing different tourism challenges such as water and energy scarcity, uncontrolled urban sprawl and suburbanisation of agricultural lands, conversion of valuable agricultural resources and the selling-out of cultural artefacts.

2. Shrinking Space in European Mountains

The major European mountain systems such as the Alps, Carpathians and Pyrenees are centrally located where borders of neighbouring countries meet, and where traffic arteries lead through a growing number of tunnels and across high passes enabling commodity exchange and personal communication by connecting markets and migratory paths. After prolonged periods of confrontation and conflict, the post-World War II politics of balancing and reconciliation have resulted in mutual agreements and cross-boundary cooperation.

Initially this began with common efforts in nature and wildlife protection, later it expanded to tourism and traffic regulations, defining common standards of maintaining biodiversity and recreational practices. Despite all of these agreements, the pressure on valuable mountain resources has not been alleviated; to the contrary, the mountainous areas have become more attractive to tourists and enterprises. Consequently, all efforts for sustainable development have had to cope with shrinking space for a multitude of activities, interests and stakes. Coping with natural hazards such as avalanches, floods and landslides is among the leading physical challenges that have resulted in packages for control

measures and mitigating destructive and endangering forces.

The incorporation of local stakeholders residing in the mountains and engaging them in nature conservation by offering payments for ecosystem services has opened-up a path towards sustainable mountain development. The programme for “Common spatial perspectives for the Alpine area” reflects the shrinking space and an attempt at reconciling different stakeholders’ interests. Various space-requiring actors and their demands such as for nature protection and conservation, maintaining agricultural practices, providing space for recreational and tourist activities, permitting urban growth and providing space for traffic arteries have to be met and merged. The Alps2050 main report (Chilla *et al.*, 2018) has taken up the challenge of suggesting potential space allocation and use for all contenders (Fig. 2).

To give an example: Within the countries of the

Alpine Convention covering 190,600 km², more than 1,000 protected areas exist – each more than 100 hectares in size – that cover 28% of the Alps (The Alpine Network of Protected Areas, 2019). Several countries have emphasized their common interest in protecting traditional cultural landscapes to preserve the important function of the Alps’ streams, rivers, lakes and glaciers as an important reservoir of drinking water. Mountain forests contribute significantly to air purification, climatic compensation and the protection of mountain slopes.

The spatial and resource demands for recreation and tourism are competing for space and resources. Watershed management is challenged by water resources tapped for making artificial snow and high demand from hotels and guesthouses. Pasture preservation and soil protection are hampered by alpine sports and leisure activities such as skiing and other forms of holiday entertainment.

Here the question arises of what kind of ecotourism

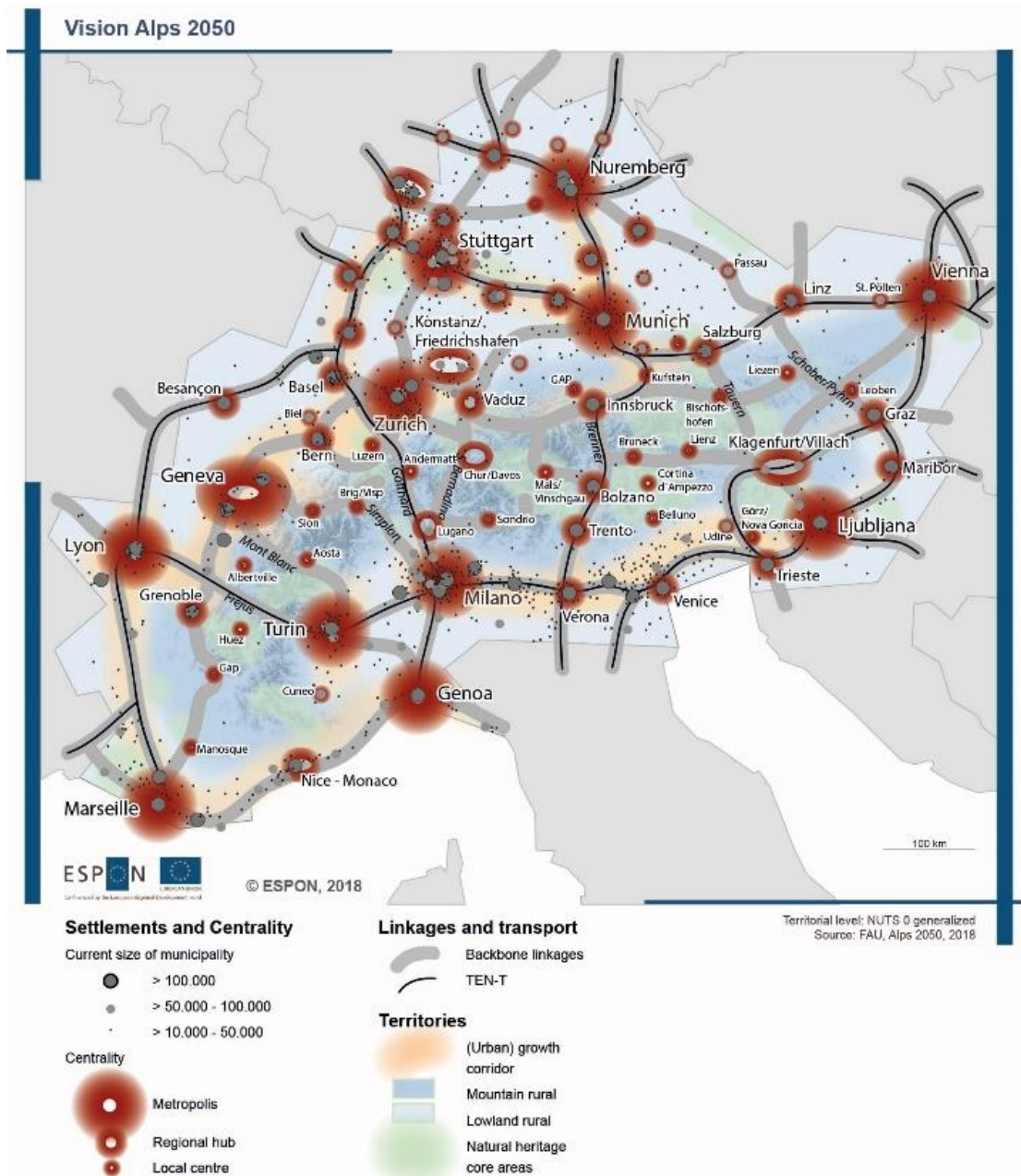


Fig. 2 The Alps 2050 vision attempts to reconcile spatial demands of various stakeholders (Chilla *et al.*, 2018).

within the framework of sustainable resource utilization is applicable for meeting the demands of winter sports in an age of shrinking glaciers, loosening soil and rock due to thawing permafrost, reduced seasonal snow coverage and rising snowlines.

A substantial turn in spatial use is envisaged when policies in response to global warming are framed. Here the future of alpine agriculture re-enters the debate as development packages for mountain farmers provide a mix of various resources. They have become welcome actors who permanently reside and work in the mountains, have personal and societal stakes to preserve, and maintain the (agri-) cultural landscape. Farmers are supposed to make an adequate living within the mountains by being provided with cash payments for ecosystem services including environmentally friendly management of a variety of landscape elements such as hedges, woody plants and walls.

Other subsidies by programmes and packages financed by the European Union along with national and regional governments include direct payments for maintaining traditional cultivation techniques, compensation for unfavourable environmental conditions in disadvantaged regions, renovation and repair of rural road infrastructure including restaurants and holiday infrastructure, and financial support for alpine pastures and pastoralists. All these direct and indirect remunerations are augmented by a second pillar making use of non-farm assets which include rural family-based tourism and entertainment (Wanner *et al.*, 2021).

Severe challenges exist and will continue to lead to

estranged relations between certain stakeholders in the field. The latter has remained a bone of contention until today. Consequently, disputes about boundary delineation hamper trans-boundary cooperation and professional exchange, for example, in the context of the Pamirian Crossroads (Fig. 3). Confrontation has taken the place of cooperation (Kreutzmann, 2013). Therefore, it is laudable that repeated efforts are on record in which mountain researchers and civil society representatives have suggested a Pamir Peace Park (Ali, 2002; Kreutzmann, 2015, 2021; Schaller, 2007). It would constitute a wide trans-boundary range within the Pamirian Crossroads from the Afghan Hindukush to Tajikistan's Pamirs, covering parts of the Chinese Kun Lun Shan and Pakistan's Karakoram and crossing the line of control into the Western Himalayas, controlled by India and Pakistan (Fig. 3).

There is hardly any country that does not have border disputes or undeclared delineations with neighbouring China. India and Pakistan have not amicably settled their outer limits; only Pakistan, Tajikistan and Kyrgyzstan have come to terms with China by ceding land to their mighty neighbour. Such regions have been separated since the 19th century and excluded from accessibility and transboundary exchange until the end of the Cold War. They should enter the focus when discussing the possibility of creating a peace park with traffic infrastructure and industrial and urban expansion. Tensions are unavoidable, but the compromises found are often the result of active people's participation and interest-led involvement in local and regional



Fig. 3 Disputed boundaries and territories in High Asia represent a high-tension conflict zone centred around the Pamirian Crossroads (Kreutzmann, 2020).

decision-making processes. The European Alps have a long tradition of mountain research and policy implementation. Located in an affluent environment, they represent a constellation of trans-boundary neighbours with self-confident actors controlled by strong civil societies (Brugger *et al.*, 1984; Moser and Moser, 1986).

The resulting Alps 2050 vision (Fig. 2) is a reflection of a fine-tuned agenda representing lobbying and power structures. The challenges for High Asian mountains might be similar on the path to sustainable development; the responses are embedded in a set of constraints and experiences that strongly influence possible adaptation processes and mitigation packages. Blueprints for wider mountain ranges do not exist as specific constellations, and changing conditions need to be respected. Only anecdotal evidence can be presented here to substantiate this argument. To understand the limitations and opportunities for mountain development, our focus is directed on the historical and political context.

3. Conflicts over Mountain Spaces in High Asia

Path-dependency in High Asia's mountain development is characterized by geopolitical constellations that have shaped the creation and existence of neighbouring countries. Colonial and imperial competition has contributed to spatial appropriation and boundary-making; the latter has remained a bone of contention until today. Consequently, disputes about boundary delineation hamper trans-boundary cooperation

and professional exchange, for example, in the context of the Pamirian Crossroads (Fig. 3). Confrontation has rather taken the place of cooperation (Kreutzmann, 2013). Therefore, it is laudable that repeated efforts are on record of mountain researchers and civil society representatives suggesting a Pamir Peace Park (Ali, 2002; Kreutzmann, 2015, 2021; Schaller, 2007). It would constitute a wide trans-boundary range within the Pamirian Crossroads from the Afghan Hindukush to Tajikistan's Pamirs, covering parts of the Chinese Kun Lun Shan and Pakistan's Karakoram, crossing the line of control into the Western Himalayas controlled by India and Pakistan (Fig. 3). There is hardly any country among these that lacks border disputes or undeclared delineations with neighbouring China. India and Pakistan have not amicably settled their outer limits; only Pakistan, Tajikistan and Kyrgyzstan have come to terms with China by ceding land to their mighty neighbour. Such regions have been separated since the 19th century and been excluded from accessibility and transboundary exchange until the end of the Cold War. They should get attention when discussing the possibility of creating a peace park. Peacebuilding, communication and transboundary exchange would support communities that have been separated by contested boundaries and would enable the implementation of common projects in nature protection, mutual understanding and ecotourism.

An additional benefit of a Pamir Peace Park would be that it would integrate a number of existing national parks and biosphere reserves (Fig. 4) and thus foster greater

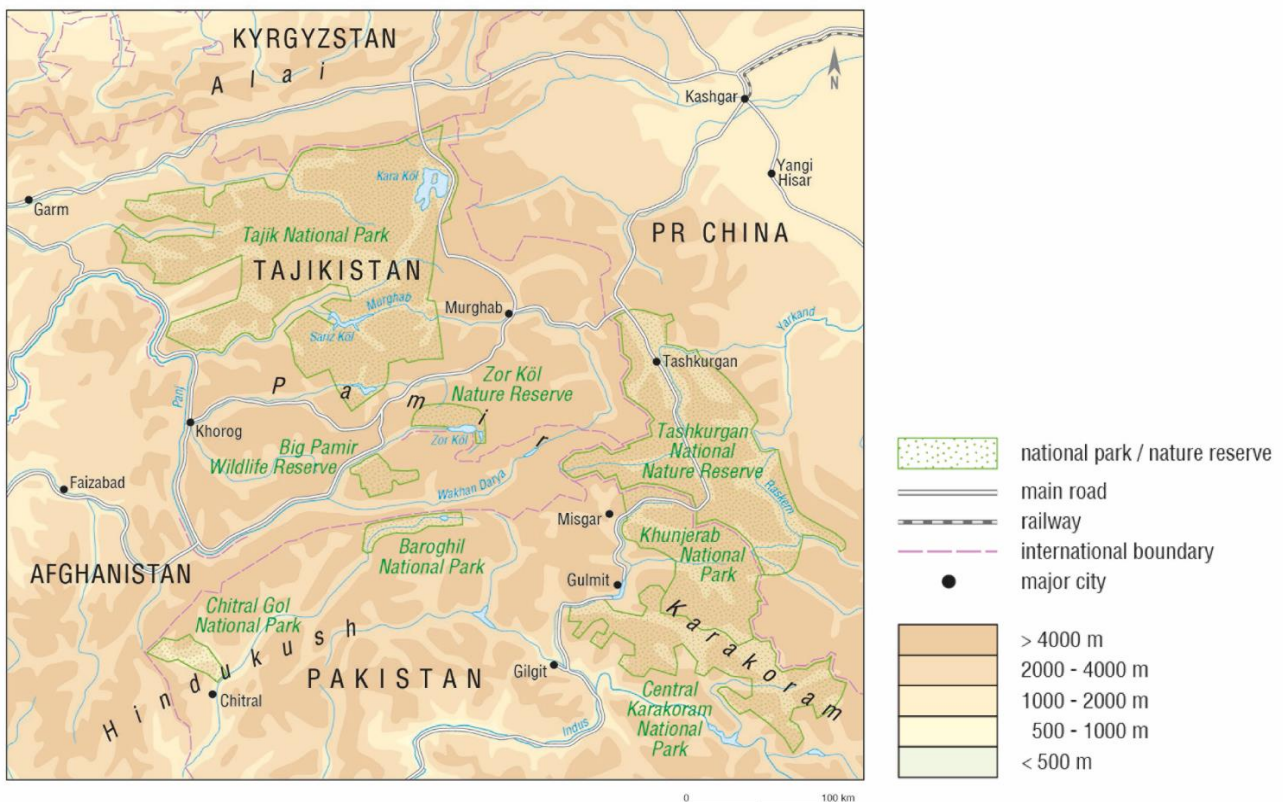


Fig. 4 Existing nature reserves in the borderlands of the Pamirian Crossroads have been identified as a salient network on the way to building a Pamir Peace Park (Kreutzmann, 2016).

Table 2 Protected areas and nature reserves in the Pamirian Crossroads.

Country	Administrative unit	Size (km ²)	Protected area and date of establishment	Size (km ²)	Share of protected area (%)
Afghanistan	Badakhshan	44,059	Wakhan National Park (2014)	8,936	21
Tajikistan	Gorno- Badakhshan	64,200	Tajik National Park (1992)	26,116	43
			Zor Köl Nature Reserve (2000)	1,610	
People's Republic of China (Xinjiang)	Kashgar Prefecture	112,057	Tashkurgan National Nature Reserve (1984)	15,863	14
Pakistan	Gilgit-Baltistan	72,500	Central Karakoram National Park (1993)	10,557	26
			Deosai National Park (2016)	3,580	
			Khunjerab National Park (1975)	2,271	
			Hunderap Shandur National Park (1993)	1,650	
			Karumber National Park (2011)	740	
	Chitral	14,850	Baroghil National Park (2010)	1,347	9
			Chitral Gol National Park (1984)	77	

Source: Data are based on Felmy and Kreutzmann (2004) and Kreutzmann (2015)

trans-boundary professional cooperation (Cunha, 2016; Kreutzmann *et al.*, 2011; Wu Ning *et al.*, 2014). Protected areas have begun to exist on paper only, but are taking shape and being integrated into an international monitoring system and eligible for development funding. The earliest was Khunjerab National Park, established in 1975, and the latest addition was Deosai National Park in 2016. The share of protected areas varies from 14% in Tashkurgan National Nature Reserve to 43% in Gorno-Badakhshan (Table 2). Lack of funds makes proper management difficult and has contributed to rising tensions as mountain farmers have not been adequately compensated for their loss of access to pastures, shrubs and forests. Here a significant difference between European and Asian mountain areas emerges as it seems to be highly difficult to provide mountain dwellers with sufficient local income sources.

4. Common Challenges : Perceived in Different Contexts and Adjusted for Selected Strategies

Most governments in the Pamirian Crossroads are interested in keeping mountain farmers within their settlement areas in order to substantiate their territorial claims of state ownership. Farmers are expected to utilize existing resources, to provide ecosystem services free of cost and to depend less on government subsidies. The cost to maintain this status quo is predominantly borne by mountain dwellers. Different approaches have been used in the Xinjiang Uyghur Autonomous Region within the People's Republic of China where state authorities have implemented strict resettlement policies by concentrating rural populations in new housing schemes and townships that are less scattered than traditional habitations and are meant to provide modern facilities (Kreutzmann *et al.*, 2011; Kreutzmann, 2022). The efforts of the "Great Development of the West" and subsequent policies have brought significant change to rural livelihoods by cutting back their degree of freedom in local decision-making,

and motivating residents to seek employment in urban settings. Mountain dwellers in Xinjiang have undergone a strong incorporation into mainstream Chinese development policies.

In all of the neighbouring countries the negligence of mountain dwellers is more vivid, leading to a different set of responses. Agriculture that was based on providing the basic subsistence for mountain households has lost in importance. Its share in providing food for the villagers is fading, with most foodstuffs having to be imported from nearby lowlands or even further away. Only a few cash crops such as potatoes, fruit (apples, apricots, cherries) and herbs can be grown on the small and further shrinking available plots. Land fragmentation due to heritage division, an ever-expanding infrastructure and housing construction demand valuable village lands and contribute to dwindling household landholdings. In the livestock sector man- and woman-power is increasingly lacking as formal education and non-agrarian jobs do not provide sufficient time for extensive stays in high pastures, which are often far away from the villages. The consequent agricultural labour shortage is the manifestation of a lack of income sources that could enable a living to be made in the mountains. As external support is not expected, there remain basically two options for augmenting mountain households and counteracting the depopulation of mountain areas.

First, off-farm assets have to provide the required funds for basic household expenditures (Fig. 5). In some regions tourism has become a prominent means of generating additional income. In Kyrgyzstan and Tajikistan community-based international and domestic tourism has been marginally developed while in Gilgit-Baltistan, domestic tourism has experienced a major boom since 2015, thus attracting even outside investors from downcountry Pakistan to exploit a potential "goldmine." Other sources of income are provided by wage labour, civil and military services, and entrepreneurial businesses and trade.

Second, a more common strategy is outmigration of household members by creating a multi-local household

structure in which different members generate income within their valleys and outside the mountain areas and even transfer funds as remittances from overseas. The Hunza Valley in the Karakoram is a prominent case in point (Fig. 6).

Its inhabitants look back at a long history of outmigration without giving up a strong bond with the relatives who have remained in their original villages. In a

situation where lacking subsidies and marginal external support do not make up for financial deficits, a community has maintained a sizeable population within the mountains despite being equipped with only meagre agricultural resources. What will be its impact for sustainable mountain development? The unequal access to adequate and sufficient resources for maintaining a combined mountain agriculture composed of interrelated

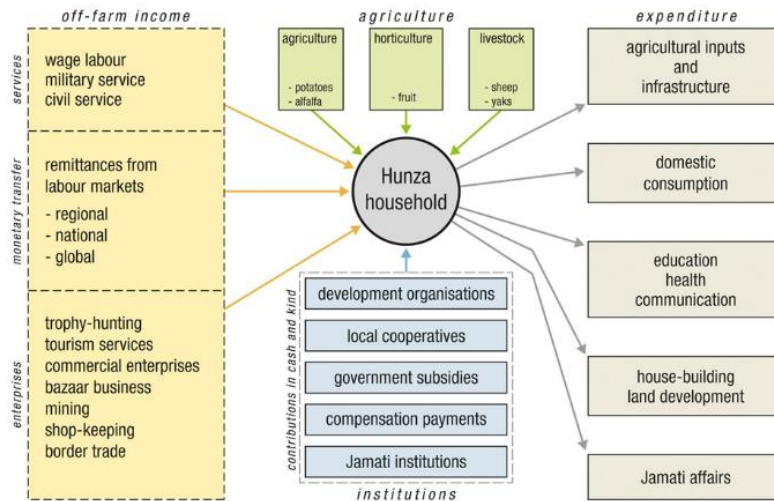


Fig. 5 Varied income sources and multi-faceted expenditure demands of a Hunza household (Kreutzmann, 2020).

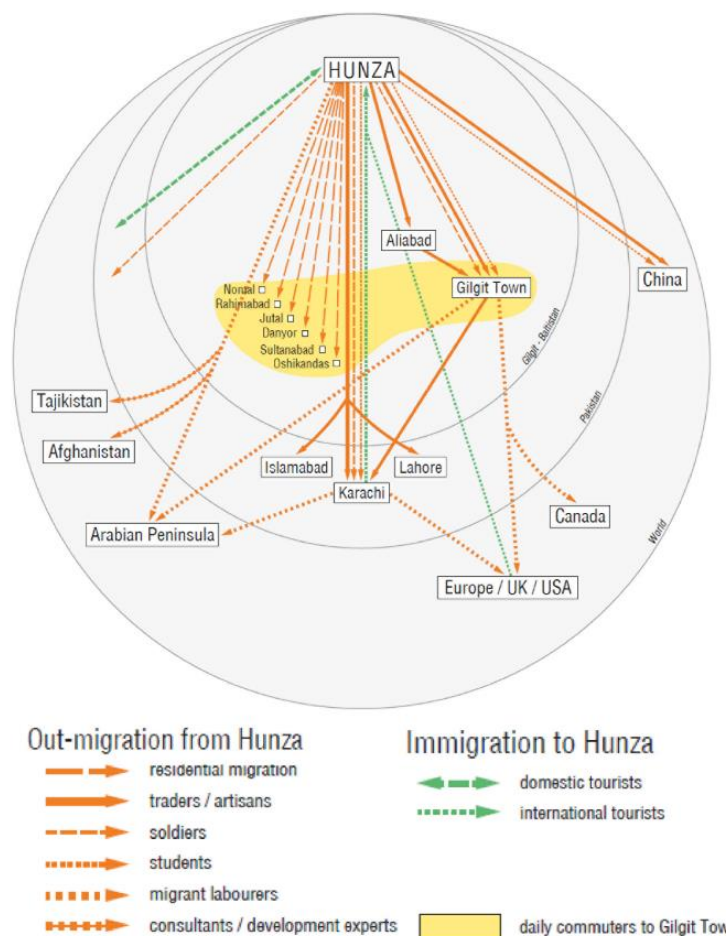


Fig. 6 Migration patterns on different spatial scales by household members originating from the Hunza Valley, Karakoram (Kreutzmann, 2020).

crop-farming and animal husbandry and/or mobile pastoralism might lead to growing abandonment of vast natural pastures, future collapse of weed control and fallowing of village lands. Unless mountain farmers are equipped with a decent set of income sources for a lifestyle comparable with other citizens of their country, they will be unable to perform important duties as landscape and resource managers, ecosystem services providers and preservers of local culture. Sustainable mountain development requires a stronger focus of actors and stakeholders on the vital role of mountain dwellers for the protection of mountainous areas.

5. International Year of Sustainable Mountain Development 2022 : Salient Points Emerging

Previously prime targets for mountain studies were identified as the agricultural practices of crop farming and animal husbandry; in earlier studies these practices were taken to categorize and identify development gaps between Asian and European Mountains. Since regional mountain development has taken various paths, infrastructure development, urbanization and a fast-growing tourism industry have exerted major pressures on mountain environments and resources. Challenges increase when it comes to defining pathways for sustainable mountain development and strategies for coping with climate change effects.

Analytical approaches are meant to precede policy packages. Often this rule and sequence are neglected as general programmes are designed to promote adaptation to climate change that are not specific to singular locations. Evaluating the achievements of half a century of focused human-environmental relations has shown us the desiderata: more empirical evidence and comprehensive and complex approaches to survival conditions for mountain communities are required. The challenge for academics and scientists will be to contribute to sustainable mountain development studies through concise investigations that are embedded in mountain-specific contexts and that take into account wider implications on regional, national and international scales. The few examples presented from High Asia and European mountain areas have illustrated that common challenges and constraints do not necessarily generate the same answers and response mechanisms. Beyond these general remarks on mountain studies, four points might be mentioned:

- (1) Create awareness based upon cooperation between international organizations and civil society, the private sector and academia to highlight the importance of sustainable mountain development and the conservation and sustainable use of mountain ecosystems.
- (2) Contribute to mountain ecosystem regeneration by

selecting nature-positive investments guided by science that take into account the living conditions of mountain residents.

- (3) Boost and improve regional coordination for professional exchange, communication on common themes and challenges in neighbouring mountain areas that would contribute to mutual understanding, conflict reduction and peacebuilding measures.
- (4) Develop and implement adequate policy agendas and connect them with specific action plans for mountains by integrating mountain communities into the decision-making process as expert informers and principal stakeholders.

Decision- and policy-making should be guided by the general consideration that mountain dwellers are locally available ecosystem and landscape managers and proven experts on local and traditional knowledge, who could be brokers for adapting to conditions of climate and social change if sufficient income could be generated to allow them to stay in their mountain abodes (Fig. 7). The International Year of Sustainable Mountain Development could be an initiative to draw proper attention to the need for keeping up mountain systems by enabling the residents to live there. Their services support not only mountain regions but vast areas beyond.

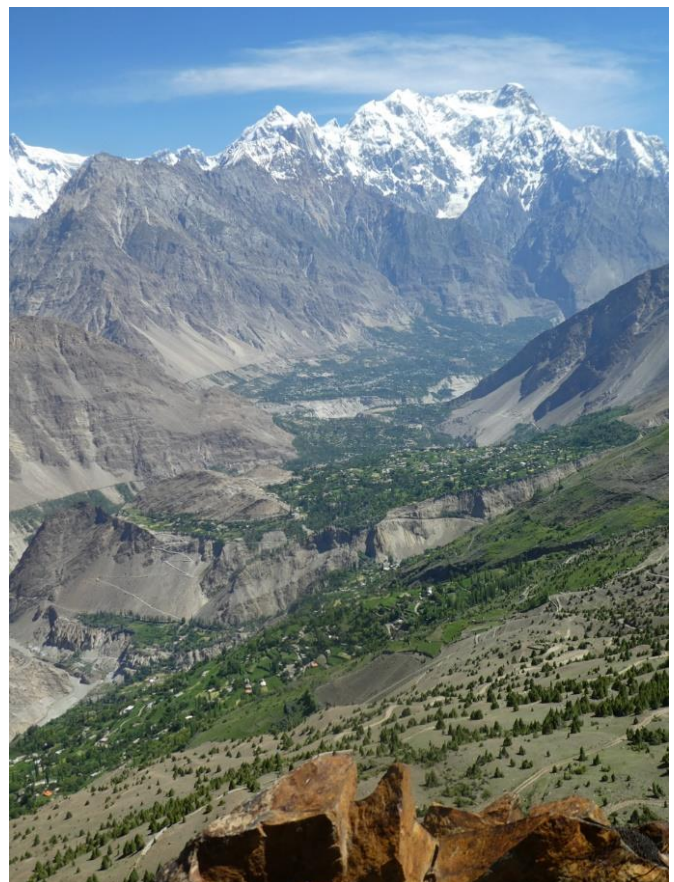


Fig. 7 Mountain oases of Central Hunza and Nagar. Residents have proven able to maintain and manage their lives on steep slopes ranging from 1,800 m to peaks above 7,300 m altitude by tapping glacial water resources and combining crop-farming with pastoralism. Outward relations are facilitated by the Karakoram Highway (Kreutzmann, 25 July 2021).

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