

High-Altitude Grassland Management and Improvement of Pastoral Livelihoods in the Hindu Kush Himalayan Region



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ABSTRACT

The Hindu Kush Himalayan (HKH) region is the largest mountain systems in the world, spanning over 4.3 million km² and covering 3500 km long fragile environment. Grasslands in the HKH region are the source of livelihoods for approximately 25 to 30 million pastoralists and agro-pastoralists. High altitude grasslands play a significant role in storage and regulation of water; storage of carbon in soil and peat lands; permafrost storage; and stabilization of climate, soil, and nutrients. They foster a rich biodiversity with endemic species of fauna and flora; provide clean air and open spaces for recreational purposes, and bolster a rich cultural diversity. However, this asset is encountering many challenges, not the least of which are climate change, globalization, land use change, and land degradation. It remains under-recognized in terms of research for development, enactment and government planning and conjecture for sustainable development, which are largely to be the main reason towards grassland degradation. There is an urgent need for managing both the grassland ecosystems and the pastoral livelihoods in the HKH region. International Centre for Integrated Mountain Development (ICIMOD), as the regional center dedicated to sustainable mountain development of the HKH, is promoting the management of grasslands in six countries of the region with a view to identify opportunities for improving strategies for pastoral livelihoods. Co-management approaches and community-based conservation initiatives are the basis for the sustainability of the grassland resource management. These initiatives have led to better regional cooperation and understanding among the HKH countries on the issues of grassland management, particularly on trans-boundary issues. Mountains and high altitude grasslands deserve greater attention and higher investment in future.

Key words: Co-management, ecosystem restoration, grassland services, policy advocacy, renewable energy, sustainable pastoralism,

Introduction

Mountains occupy 24% of the global land surface area and are home to 12% of the world's population (UNEP-WCMC 2002). As mountain areas are repositories of biological and cultural diversity, they provide vital services with a tangible economic value – such as water, hydropower, tourism, minerals, medicinal plants, and fibers – to mountain communities and, even more important to downstream areas. About 12% of the world's population depends directly on mountain resources for their livelihoods and well-being, while an estimated 40% depend on them indirectly for water, hydroelectricity, timber, biodiversity, mineral resources, recreation, and flood management (Schild and Sharma, 2011; Molden and Sharma, 2013). But despite their tremendous contribution, mountains are still marginalized in the development agenda. The importance of ecosystem services coming from mountains is being increasingly recognized, including at global forums like Rio+20. Despite this, benefits to

mountain people for their role in sustaining these services remain negligible. This situation is especially true for the Hindu Kush Himalayan (HKH) region.

The HKH region spans over 4.3 million km², running 3,500 km from Myanmar in the east to Afghanistan in the west. About 18% of the total HKH area (760,000 km²) is covered by snow and 60,400 km² is covered by glaciers (ICIMOD, 2011; Singh et al., 2011). Politically, the region encompasses Afghanistan, Chittagong Hill Tracts of Bangladesh, Bhutan, Western China (China's Xizang Autonomous Region, Tibetan Autonomous Region, Qinghai, Western Sichuan, North West Yunnan and Southern Gansu), 12 States of the Indian Himalayas, the Northern hilly region of Myanmar, Nepal and Northern and Western Pakistan (Figure 1). This tremendous tract of mountain ranges incorporates chains known as the Karakoram, the Hengduan Mountains, the Himalayas, the Hindu Kush, and the Tibetan Plateau. It is endowed with a variety of farming practices and rich natural resources, including

global biodiversity hotspots that form the source of ecosystems directly servicing more than 210 million people living in the HKH and indirectly servicing 1.3 billion people living in the downstream areas.

High altitude grasslands are the climatic climax not suitable for cultivation in light of low and whimsical precipitation, harsh geography, poor seepage, or cool temperatures and which provide forage for free grazing native and domestic animals along with a source of animal products, water and wildlife (Stodar *et al.*, 1975). Grasslands possess more or less 50% of Earth's territory surface (Sidahmed and Rota, 2004) making them the biggest land use of the world. According to Zhaoli (2004), the grasslands make 70% of the world's total area where arid and semiarid grassland ecosystems are approximately 45% of the earth's land surface (Huntsinger and Hopkinson, 1996; Branson *et al.*, 1981; Reid *et al.*, 2008) and represent nearly 80% of the areas grazed by livestock (Asner *et al.*, 2004). More than 38% of the global populations live in grasslands and a great proportion of the world's poorest are settled on the very ecosystem (Nalule, 2010).

Heterogeneous grassland ecosystems, in terms of land area covers about 2 million km², encompass more territory than any other ecosystem in the HKH region (Table 1 and Figure 1). The grassland ecosystem extends from splendid, subtropical savannas in the Siwalik foothills to abundant, alpine meadows in the high altitude alpine areas and stretching on for 1,200 km North across the spacious steppes of Tibet to the cold dry deserts of the Kunlun mountains.

Grassland Ecosystems for Sustainable Development

The Grassland ecosystems and their integrity are very important in terms of environmental services provided, even though this is difficult to enumerate and value. Their functions and services are essential even

beyond the HKH itself. First of all, these vast grazing lands provide forage for millions of grazing livestock. Livestock production systems, a part of the livelihood systems of majority HKH inhabitants, contribute significantly to household economy. Since cultivated agriculture is not quite feasible, grazing by domestic animals enables herding communities to convert otherwise unusable plant biomass into valuable animal products that are either consumed by the pastoralists themselves or sold for income. Conclusively, in vast part of the cold and dry HKH region, pastoralism remains the only livelihood option, where livestock contributes close to 100% of annual household income. Wherever agro-pastoralism is the main livelihood activity, this contribution is 50–70%, and in mixed crop livestock farming systems, it is 10 to 30% (Tulachan and Pratap, 1997).

Secondly, most of the main rivers of Asia, the lifelines, originate here. Grassland ecosystems make up the headwaters' environment for the major river systems, thus, whatever takes place in these upper highland watersheds has far-reaching effects on downstream areas (Miller, 1997). At high altitude grasslands permafrost is conserved which forms substantial water storage in mountains. Eventually, the quality livelihood of not only the mountain communities, but also the people of the plains depend very much on these hydrological functions and that high altitude grasslands are properly managed. The water originating from, storing in and even replenishing from these grasslands will be of increasing importance in future for agriculture based irrigation at lower valleys and plains, for hydropower development in downstream. Role of grasslands will be eventually important for environmental flow and socio-economic sustainability of downstream societies. The importance of grassland ecosystem functions in capturing and regulating water resources is being increasingly acknowledged, while water scarcity becomes more obvious than ever before in changing climate and increased physical vulnerabilities downstream.

Third, Grasslands are strategic wildlife habitats for many endangered and other species which may provide important genetic material for future economic use. Erosion of these endemic species would mean loss of valuable gene bank to becoming extremely vulnerable in case of any extreme events in this region. Therefore, most of the protected areas in the HKH are classic or relic grassland ecosystems are store house of rich biodiversity. Conserving these crucial biodiversity for sustainable development is often the major management concern in mountain protected areas and

Table 1. Extent of Grasslands in the HKH region

Country	Area (km ²)	Per cent of total
China (Tibetan Plateau)	1,250,000	60.80
Pakistan	400,000	19.42
Afghanistan	200,000	9.71
India	180,000	8.71
Nepal	20,000	0.97
Bhutan	7,000	0.34
Myanmar	760	0.04
Bangladesh	290	0.01
Total	2,058,050	100.00

Source: Miller, 1996



often resource access related issues cause local conflicts.

Fourth, grassland ecosystems in the HKH region are becoming increasingly popular as tourist destinations. The HKH grasslands reflect as well a diverse geographical, spiritual, religious and cultural landscape, concurrently shaped by historical and present physical forces and human uses. Tourism in mountain grassland environments has the potential to not only improve the livelihoods of the local people, but it can also contribute to overall economic development. In this context, their climate regulatory function cannot be ignored as these ecosystems are serving as major carbon sinks though not quantified yet. Good example of carbon storage is peat lands, used for grazing in many high altitude areas including Tibetan plateau.

Current Scenarios of Use, Practice and Status

The state of grassland resources is degrading (Ho and Azadi, 2010) and principally because of drought, overgrazing and bush encroachment (Abate et al., 2010; Bhasin, 2011). Han et al. (2008) have also discussed that in the last 10 years, grassland degradation has risen from 55 to 90% in China. Harris (2010) concluded that grassland degradation is one of the serious problem caused by too many livestock numbers. As a livelihood improvement strategy, pastoralists continue to increase their livestock beyond the carrying capacity which consequently increase concern about the vulnerability and present day impacts on grasslands. Heavy grazing pressure cause dramatic change in species composition, reducing the density of palatable species and in permitting invasive species to dominate. These effects reduce the capability of grasslands to provide goods and ecosystem services (Vasquez et al., 2010).

Recently, it has been identified that climate change is one of the major drivers of change in the mountainous region. Although the long-term impacts of climate change are difficult to predict, the most important predictions made are of rising temperatures and changes in precipitation with an increased number of extreme events (Mortimore et al., 2009; Singh et al., 2011). Erratic and unpredictable rainfall along with extreme weather conditions and longer and more frequent droughts would affect the sustainability and efficient use of grassland resources. In the last 10-15 years, longer and more intense drought events in summer, incessant and heavier snowfall in winter and prolonged summers and moderately shorter winters were the perceived changes by herders in Pakistan and the Eastern Himalayas (Joshi et al., 2013, Tsering et al., 2009).

The report by the Intergovernmental Panel on

Climate Change (IPCC, 2007; IPCC, 2014) clearly expresses that climate change is already having discernable impacts on various areas. Numerous overwhelming impacts of climate change, for example, global warming, changes in evaporation and runoff, vegetation composition and diversity, above-ground productivity, decomposition rates, and carbon sequestration effects, increased risk of fire disasters, drying-up of wetlands/peat lands, submergence of pastures close to glacier lakes, and changes in wildlife habitats are already threatening on the vast mountain stretches covered by grasslands.

These climate and eco-crises are breaking down the pastoralism and furthermore perturbing the health of both people (Eriksson *et al.*, 2009) and livestock, soil characteristics and nutrients, and the natural highland-lowland linkages which consecutively are upsetting highly productive agricultural systems in prodigious plains. The pace of climate change makes already harsh grassland environment more vulnerable that threatens pastoralists' resilience and eventually the ecological security of the HKH region. Impact of climate change should be comprehended and systems should be created for tackling livelihoods and ecological issues by making animal husbandry more proficient, finding solutions to the rising energy crisis, and raising pastoralists' liability and adaptive capacity in sustainable management of grassland resources. Much of these issues can be addressed through regional trans-boundary cooperation on rangeland management particularly in high altitude areas of the HKH region (Sharma *et al.*, 2007)

It is likely that no other region in Asia will experience the ill effects of changing atmosphere and approaching energy emergency as most of the HKH grasslands are located in high altitude (3000m above main sea level) and they endure annually a long cold season from November to April, where living conditions are extremely harsh and aggravated by the subsistence capacity (Sharma, 2009). Livelihood opportunities are constrained and demand for energy is high, herders cannot survive the winters without fuel. In the absence of renewable energy alternatives, the grassland resources in the HKH region are increasingly being exploited by local people for cooking and space heating. The challenge is particularly demanding in arid grassland environments that are beyond the limit of timberline where coupled with inherent seasonal and ecological constraints, conventional methods and approaches of finding energy solutions which work well in other circumstances remain ineffective. Renewable energy options that is sustainable, accessible



and affordable by the pastoralists will help grassland conservation (Sharma et al., 2007)

Moreover, the most critical issue in regards to sustainable use of grassland is conflicts in land tenure and access and absence of institutional capacity for managing and understanding grassland ecosystems. Surveys of pastoral communities conducted recently in Bhutan, China, Nepal and Pakistan revealed the significant issues concerning grasslands. Ownership is one of the most important issues concerning grasslands. Proportion of grassland ownership by Government was 50% in Bhutan and 100% in China; on the other hand more than 80% belonged to community in Nepal and Pakistan (Table 2).

Table 2. Legal ownership of grasslands

Country	Percentage		
	Community	Government	Others
Bhutan	0	50	50
China	0	100	0
Nepal	83.3	16.7	0
Pakistan	100	0	0
Total	56.3	37.5	6.2

Different factors such as grazing access, land ownership etc. lead to conflicts over resource use. Besides uncontrolled grazing, inadequate governance, deterioration of grasslands because of limited management and climate change were the major perceived issues of grasslands in the HKH region. All these issues equally affected grasslands in Bhutan. About 26% respondents considered uncontrolled grazing as a major cause of grassland degradation in Nepal. Despite the grasslands being single largest ecosystem of the HKH region, it is as in many other parts of the world, a generally neglected resource in terms of government activity, development policies and programmes for sustainable utilization, legislating and research. Around 16% of the respondents considered lack of management to be the main reasons of grassland degradation in Nepal. Their current institutional negligence, lack of appropriate policies and mismanagement is bound to make the local poor further vulnerable under the progressive change phenomenon of climate and other drivers. Breakdown of tradition, lack of labor, lack of adequate resources and climate change were reported as the major issues of grasslands in China. Degradation of grasslands and climate change were the major issues of Grasslands in Pakistan (Figure 1). Repair and management of the Grassland ecosystems in the HKH should be considered crucial for restoring fragile ecological balance. Poor understanding, based on limited knowledge base, of

grassland ecosystems in HKH provides a research rationale to generate supportive scientific grounds.

Other problems associated are inadequate knowledge of grasslands and their values, degradation, improper management and overconsumption of fuels and frequency of droughts (Readings et al., 2006). Moreover, overexploitation of medicinal plants has also caused serious threat to the survival and re-generation of many valuable medicinal plant species such as *Cordyceps sinensis*. The acute shortage of pasture land is compelling the local community to abandon the traditional systems of livestock based agricultural practices and forcing them to engage in alternative option such as tourism. However, the rapid growth of tourism combined with a lack of planning is causing severe environmental problems in some areas. Therefore, increased support in terms of applied research is critical to the future of the HKH grassland resource management (Dong et al., 2010).

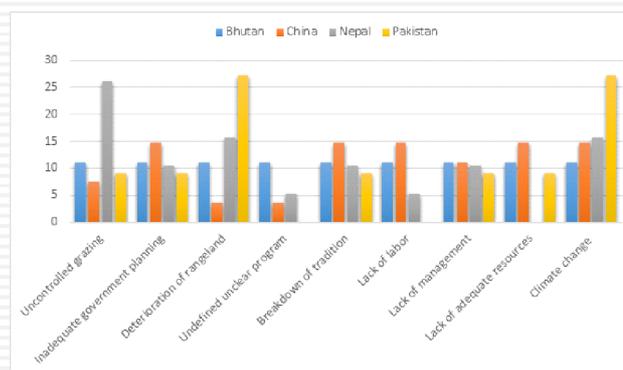


Figure 1. Issues of Rangelands in HKH Countries

ICIMOD Programmes on Grassland Management

Grassland management in the HKH region faces various issues, a large number of which are common across national boundaries and oblige provincially composed endeavors to handle them comprehensively. ICIMOD, as the regional center dedicated to sustainable mountain development of the HKH, therefore started its keen concern and dedicated efforts in promoting appropriate grassland management and the regional exchange and sharing on grasslands from mid 1990s. ICIMOD's main objective was to address regularly prominent HKH grassland issues with an emphasis on supporting and advancing legitimate grassland management and lessening destitution in the high mountains. Programme interventions for the most part concerned with advocating legally supported sustainable grassland management practices and

upgrading institutional ability to enhance grassland management and building the capacity of communities to adapt to their physical, social, and economic vulnerabilities.

Sustainable Pastoralism

For centuries, pastoralists (from purely nomadic to semi-transhumant) are the main users of the grasslands in the HKH and overseeing grassland through migratory pastoral production and pursuit of livelihoods which are perfect with exceedingly variable grassland systems. Customary practices do not appear to be ideal to contemporary drivers, which do not have sufficient comprehension of natural procedures and elements. The lack of efficient communication is the major reason behind conflicts between pastoralists and other stakeholders. One of the significant concerns of ICIMOD is along these lines - how to demonstrate and advance the significance of pastoralism with respect to manageability. From one viewpoint ICIMOD attempted to engage pastoralists, widening their insight base through group based participatory activity research, in this manner adding to their ability to shield them and to enhance their methods for adapting to physical, financial, and social vulnerabilities. Consequently, income of pastoralists was increased through interventions on adding value to locally produced livestock products, such as better packaging method and marketing strategies. Then again, ICIMOD additionally attempted to guarantee that the voices of pastoralists are heard and considered in decision-making.

Example 1: Pastoralists' Livelihood Improvement

In the scantily populated Chiang Tang Plateau in Tibet, local people depend solely or largely on livestock grazing. Shortly after previous communally owned livestock was allocated to individual households, a large number of pastoral families lost their livestock – means of living – and became poor due to lack of livestock managing skills, unsuccessful trade or natural disasters. Adaptive technologies for grassland and livestock management therefore were key to improve local pastoral livelihood. ICIMOD and its partners documented and provided support to local activities to the aggregate management of domestic animals and grasslands in Nima county and neighboring areas, after the domesticated animals and grasslands had been dispensed to individual family units. Through community oriented game plans, nearby herders helped one another to graze domestic animals on the unlimited yet low productive grasslands; they figured out how to

offer their domestic animal products at market several kilometers away and bring back to family the different merchandise at reasonable costs; they sorted out a surplus work power to work in neighborhood off-farm activities; and they assembled routinely to share data and talk about new issues. As a result, these initiatives have improved herders' income through promoting hay harvest, livestock enhancement, processing and marketing of livestock products, and alternative livelihood options. Individuals in all sorted out groups had the capacity to live better. Mainly sorted out groups are additionally in a superior position to converse with, and acquire support from, nearby protection compelling voices in fencing their winter pastures in order to minimize the generally intense livestock-wildlife conflicts.

Ecosystem Restoration

As the number of inhabitants in both individuals and domesticated animals has quadrupled all through the HKH in the last 5 to 6 decades, grassland has definitely gone under uncommon pressure and degradation. This circumstance has been exacerbated by cooperation with environmental change and more visitors and tourists visiting grassland territories, particularly in delicate semi-arid-dry and arid-dry zones. ICIMOD endeavored to screen grassland environment procedures and elements and anthropogenic effects, keeping in mind the end goal to restore grassland land use systems and, all the more critically, management in a cooperative manner. ICIMOD activities in community managed grassland increased primary production which incorporate observing plots, and determination of generally versatile species for re-vegetation techniques, such as top sowing of native grass seeds, selection and plantation of cold and drought tolerant local species, and through rotational grazing management in China (Sichuan), Nepal (Upper Mustang), and Pakistan (Baluchistan).

Example 2: Forage Development in Upper Mustang

Upper Mustang in Nepal belongs generally to the cool desert environmental zone where animals confront extreme winter feedstuff deficiency. ICIMOD introduced 16 outlandish fodder and forage species to Upper Mustang for hay-making, of which a few could deliver seeds and had noteworthy efficiency in irrigated hay meadow. After two years, the local community staff circulated seeds to 48 families upon demand. In the wake of sorting out more agriculturists to visit the hay meadow and to talk about how to overcome winter



feedstuff deficiency, a large number of the proposed gathering and planting seeds of indigenous species was pursued. In the third year, the farmers collected 50 kg seeds of one grass and one leguminous local forage species increasing the seeds stock locally. Likewise, specialists and agriculturists together in Baluchistan Province of Pakistan chose and planted dry season tolerant local fodder scrub species in degraded dry terrains for ecological rebuilding.

Renewable Energy

In cold and dry grassland region where plant growth is moderate, bringing on shortage in biomass, and in the absence of alternative energy sources, people are uprooting shrubs and using animal manures as fuel to meet their energy needs. Such practices are undermining the maintenance of natural conditions, degrading environmental services, and having effects on human wellbeing. Climate change is already impacting on the grasslands, hitting the poor the hardest, with women and children confronting the day to day burden and drudgery of gathering fuel wood and water from a declining natural asset base. With limited options in high altitude areas, grassland resources are progressively being over-abused to meet local energy requirements for cooking and space heating. ICIMOD investigated and tested and then piloted achievable renewable energy supply alternatives (metallic improved cooked stoves, solar cooker and light) for addressing energy service needs for cooking, space heating and lighting by herders in ways that fulfill the criteria of sustainability. The long haul target is to plan and bolster advancement of environmentally friendly, socially equitable, and economically sustainable energy resources and innovations in high altitude grassland areas to improve livelihoods as well as the environment. The renewable grassland energy options added to a daily fuel saving of 12-55% in the project pilot sites, with drastically reduced greenhouse gas (GHG) emission. The transient target is to survey household energy needs and document good practices with sustainable energy sources and

technologies, to implement a pilot demonstration energy framework that is available, accessible, and affordable for the grassland community as demonstrated in Figure 2.

Co-Management Approach

Grasslands furnish an extensive variety of products and services, as a consequence of the variety in water and heat resources in different areas, benefiting many parties in the context of complex traditional and simultaneous landholdings, asset utilization, social richness, recreational beauty, and preservation objectives. For thousands of years, mountain communities or pastoralists, have been sustainably using grasslands in the HKH, who depend fully or partially on livestock production for their livelihoods; however, there are multiple stakeholders who have rights and interests in the use and management of grassland areas. The governments generally have ownership rights of grasslands, assign different ministries or departments to take care of sectorial management. For instance, a livestock department in a ministry of agriculture may have a mandate to maximize livestock production from the grasslands, whereas a ministry of environment (and forest) is likely to be responsible for conserving the grassland ecosystems and biodiversity. Other stakeholders include representatives of industry and entrepreneurs, development workers, travel agencies, tourists, collectors of non-grazing grassland products, and conservationists involved in grassland protection. The

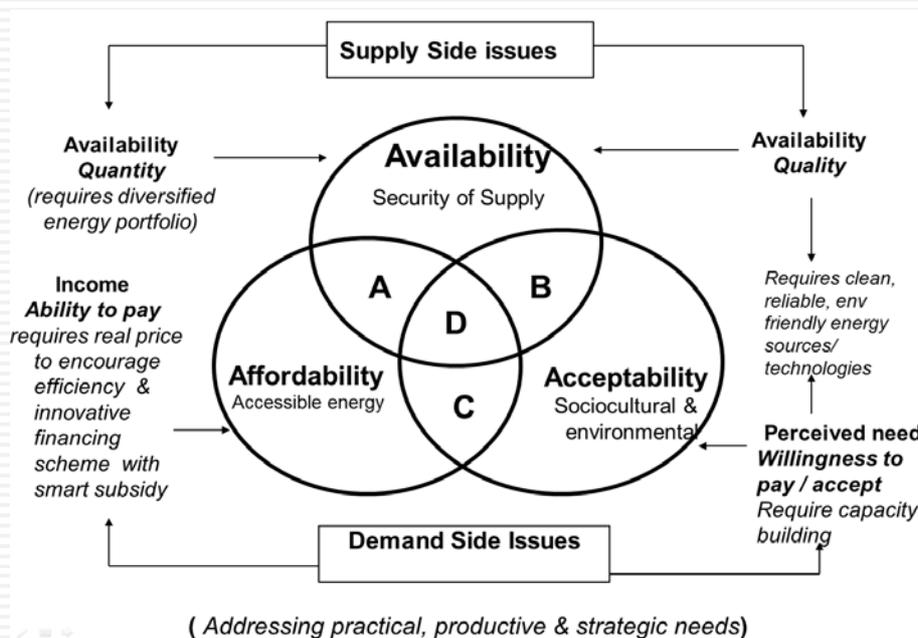


Figure 2. Framework for addressing sustainable energy services

multiple stakeholders include others who are concerned about, have an impact on, or benefit from the grasslands. The major challenge is the way that land tenure over grassland ecosystems, particularly in developing countries, is frequently portrayed by rivalry or clash between customary and statutory frameworks, which exacerbates the issues resulting from the pressure applied by increasing populations and a changing environment.

The benefits, entitlements and responsibilities of each party are unfortunately often unclear, bringing about clashes and the opposing plight from claiming over-exploitation versus under-management of grassland. In light of quite some years of participatory action research, ICIMOD, together with its partners, figured out the need to initiate a process multi-stakeholder community oriented management about grassland to different purposes, however focusing with respect to a common objective. The core of the co-management methodology is negotiation and the principle is 'learning by doing.' Co-management of grassland is occurring at all ICIMOD pilot sites at different regulatory levels. ICIMOD likewise encouraged regulating institutional arrangements in all its pilot project countries by applying a co-management approach, using both formal and casual mechanisms.

China's Grassland proprietorship belongs of the state government, and the national arrangement encourage (Grassland Law 1985 and its revision in 2002) to dispense grassland use rights to individual households or alternately least contract unit for long term lease. Upper and lower villages of Zoige County decided to keep summer pastures on the mountains behind their winter settlements for basic use to dispense a long patch of other three-season pastures to individual households so that every household got equally all types of grasslands stretching from east to west. The effect might have been that one household got just a patch of tens of meters wide (depends on number of family members) yet all the thousands of meters in length (about the same length for all households) pasture. It might have been scarcely conceivable to those villagers to deal with their grassland separately in a long narrow piece of land. Therefore, they consented to oversee grassland in the neighborhood of villages and figured together regulations on how to aide their grazing movements. This instance of grassland co-management within community is to adjust to the transformed legitimate surroundings.

Upper Mustang in Nepal is a place where an

intense shortage of forage prompted to a breakdown in traditional winter-spring and summer-autumn pasture rotation cycles. The disordered utilization of seasonal grasslands exacerbated those shortages, particularly during winter and spring, and increased clashes between families and village development committees (VDCs). ICIMOD and local partners underpinned the formation and functioning of pasture management sub-committees (PMSCs) at the VDC level. These committees built three-dimensional participatory models and brought the villagers together to use the models to mutually define boundaries between VDC areas and seasonal pastures. The villagers assigned the PMSCs to screen and implement these commonly consented regulations. They also started to grow productive fodder and forage species to supplement winter feedstuff for the grazing animals.

The government of Bhutan had promulgated burning ban on grasslands for environmental conservation since late 1960s. After three decades of burning ban, however, farmers were complaining about the invasion by thorny shrubs and loss of palatable species on previous good grazing lands where they used to practice fire management. Together with farmers, researchers collected information on unwanted vegetation change on grasslands and they eventually convinced government authorities to approve setting up prescribed-burning trials. Researchers collected second year vegetation data from fire management trials in autumn 2007 with very encouraging results, which could be used to advocate for policy changes.

Policy Advocacy

Based on community-level experiences, ICIMOD supported the development of grassland policy and set up of institutions for the co-management of grasslands in the region. ICIMOD has been involved in National Grassland Policy Formulation in Nepal and Pakistan. In addition, Northern Mountain Provinces of Pakistan have recently adopted 'Rangeland Specific Policies' with support from the Centre. ICIMOD and its partners supported the establishment of the grassland co-management committee in Sichuan Province of China, consisting of representatives from communities, local government, local industry, entrepreneurs, research institutes and technicians, to regularly coordinate use and management of grassland resources. Co-management as an approach has also been articulated in the Ladakh 2025 Vision Document and the Upper Mustang (Nepal) Biodiversity Conservation Master Plan (2007-2012), through the efforts of ICIMOD and its partners.



Conclusion

The HKH region is the largest mountain system in the world which provides immense ecosystem services for the people living in mountains and downstream. The grasslands in the high altitude region have been supporting pastoral livestock production for centuries. Livestock provide a large part of the livelihoods of the people of the region, especially the poor, including provision of high protein food, and materials for clothing and shelter. It is increasingly recognized that grassland ecosystems also provide significant services and benefits that go far beyond livestock production. Grasslands deliver a wide range of non-grazing grassland products and services for recreational, educational, cultural and socioeconomic uses, fresh air, beautiful scenery, and diverse genetic resources. They play important role in the storage, regulation, and provision of water, sequestration of carbon and stabilization of soil, nutrients, and the climate.

ICIMOD has been promoting appropriate grassland management and the regional exchanges on grasslands for more than two decades. The programme contributed in reducing poverty of grassland based livestock herders and in improving grassland services. The programme has been implementing long-term approach following participatory action research for sustainable development and conservation of grasslands. This programme has been able bring change among regional partners including researchers and governmental officials who started to recognize the worth of community participation and to encourage collaborative actions in managing grassland resources. Meanwhile, the programme has also been contributing to reduce vulnerabilities of pastoral communities from erratic climate settings and varying socio-economic environment, through various innovative practices on adaptation. The programme has been primarily focusing on interventions that are of intangible nature for example a change in attitude and management style among the staff of participating institutions, forming the cadre of “change agents” required to foster a transformation in the way government agencies think and work for grassland resources.

Grassland resources and its beneficiaries make up a complex environmental and institutional context in terms of varying agro-ecological conditions, rampant poverty among pastoralists, high altitude climatic harness, environmental fragility, inaccessibility, conflicts on tenure issues of common pool resources, and accelerated climate change in recent time. These challenges needs to be addressed for which the grasslands and pastoralists in high altitude should

receive special attention both in research and development. The high altitude grasslands and people dependent on them deserve more investments and regional cooperation for continued supply of ecosystem services that have global goods and services value for humankind.

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