

ICIMOD

RANGELAND AND WETLAND
MANAGEMENT IN THE HINDU KUSH HIMALAYA

Compendium of best practices



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Published by

International Centre for Integrated Mountain
Development GPO Box 3226, Kathmandu, Nepal

Citation

ICIMOD. (2026). *Rangeland and wetland
management in the Hindu Kush Himalaya:
Compendium of best practices*. International
Centre for Integrated Mountain Development.
<https://doi.org/10.53055/ICIMOD.1112>

ISBN 92-9115-799-6 (Online)

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Cover photo: ICIMOD archive
Jitendra R Bajracharya/ICIMOD: page 8, 12

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Compendium of best practices

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ABBREVIATIONS AND ACRONYMS

ACAP	Annapurna Conservation Area Project
BMCs	Biodiversity Management Committees
CBTHP	Community Based Trophy Hunting Programme
CGNP	Chitral Gol National Park
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CFOPs	Community Forest Operational Plans
CFUGs	Community Forest Users Groups
EbA	Ecosystem-based Adaptation
GVC	Gewog Verification Committee
FAO	Food and Agriculture Organization
HKH	Hindu Kush Himalaya
IKS	Indigenous Knowledge Systems
JFMCs	Joint Forest Management Committees
LTDC	Lachen Tourism Development Committee
MAPs	Medicinal and Aromatic Plants
NbS	Nature-based Solutions
NCF	Nature Conservation Foundation
NLCS	National Land Commission Secretariat
NTFPs	Non-timber forest products
RTK	Real-Time Kinematic
VR	Virtual Reality
WWF	World Wide Fund for Nature



SUMMARY

This compendium presents a rich collection of 20 best practices in rangeland and wetland management from the Hindu Kush Himalaya (HKH), highlighting innovations rooted in local knowledge, ecological wisdom, and practical application. The cases are thematically organised around technological innovation, restoration and biodiversity conservation, water management, multiple rangeland benefits, sustainable use, and local governance and indigenous systems.

Technological innovations, such as the use of digital applications for pasture mapping, Jersey-yak crossbreeding, and augmented reality for landslide risk mitigation, are enabling data-driven and climate-resilient rangeland management. Restoration and biodiversity efforts include the restoration of alpine grassland using native seed mixes, chicken grazing for pest control, and community-based bugyal restoration, showcasing effective Nature-based Solutions (NbS). Water management initiatives have revived traditional and localised practices like restoring ponds in Solukhumbu, resurrecting the Tarai water harvesting system in Pakistan, and introducing water-lifting for agriculture and highland pasture development in Gilgit Baltistan.

The compendium also demonstrates the multiple values of rangelands: wild honey hunting, eco-friendly bamboo innovations, and community-based trophy hunting for conservation, demonstrating the diverse livelihood opportunities linked with ecological stewardship. Practices promoting sustainable plant harvesting in Jumla and Mugu District illustrate how community-led actions can ensure conservation and income generation. Traditional governance systems like the Saaq and Dane systems in Chitral, co-governance models in Nanmula Wetland, and insurance schemes for yak herders in Mustang reinforce the significance of Indigenous Knowledge Systems (IKS) and traditional institutions in resource management. Lastly, the empowerment of youth in yak farming in Darchula offers a forward looking model for sustaining mountain livelihoods and knowledge transfer. These 20 cases offer scalable and replicable insights for building resilience through rangeland and wetland management in the HKH.

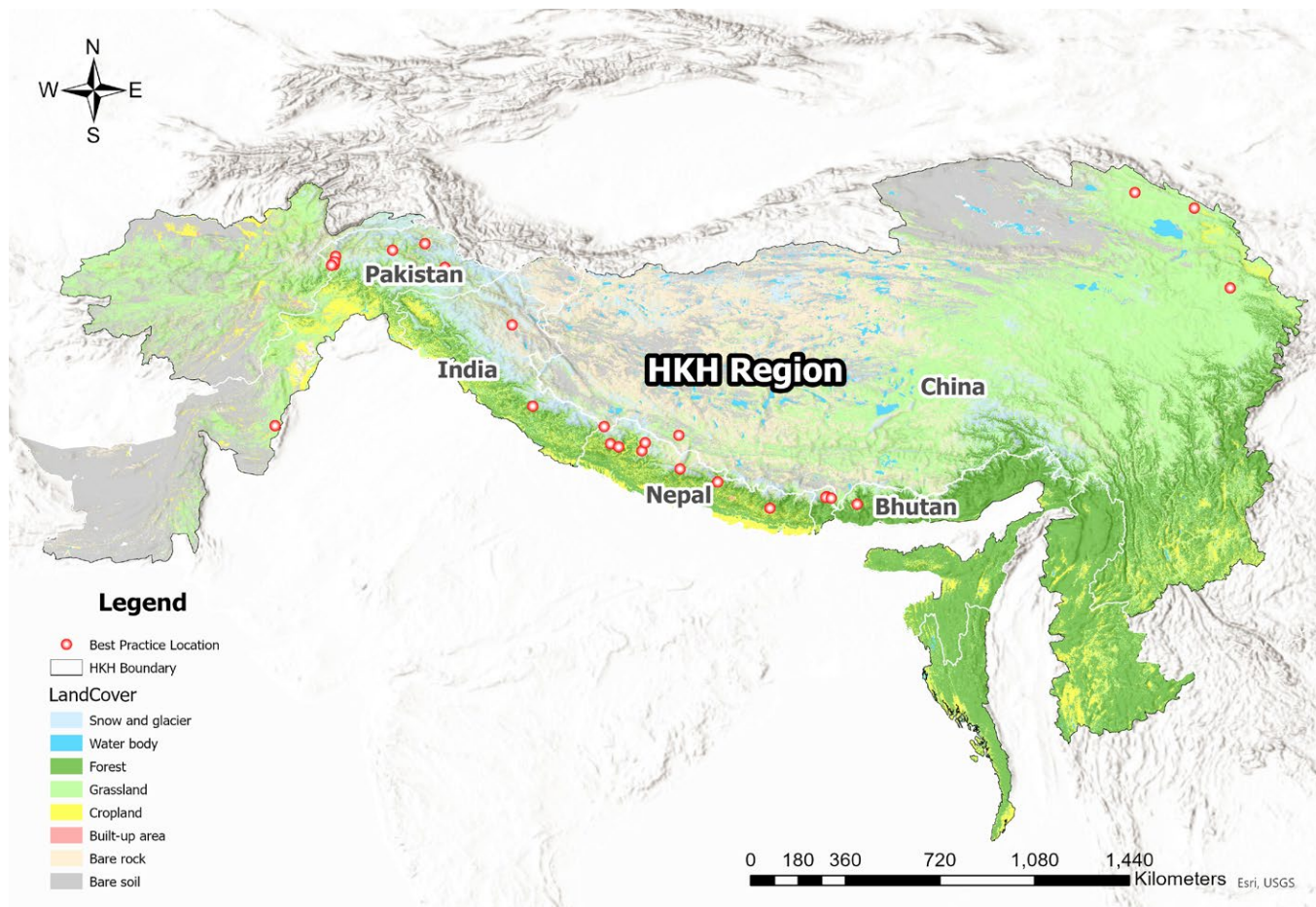
INTRODUCTION

Rangelands account for about 60 percent of the land area in the Hindu Kush Himalaya (HKH). They are the primary spaces and resources for 25–30 million Indigenous and culturally diverse people who inhabit and depend directly on their extensive use, that is, pastoralists, for livelihoods and subsistence. Rangelands also provide enormous ecosystem services and vital ecological assets to downstream areas and communities beyond the region.

In the past, rangelands were mainly regarded as sources of fodder for livestock production. Their management primarily focused on increasing the quality and quantity of fodder for livestock raising. With growing recognition of their multiple functions and the diverse ecosystem services they provide – forage or fodder production (livestock production), habitat for wildlife (biodiversity conservation), carbon sequestration (climate change mitigation), ecological processes (soil and water), and cultural and aesthetic values (recreation and spiritual sites) – the stakeholders involved and the goals for managing the same rangeland areas have become more complex and diverse.

However, climate change and habitat loss, landuse change, over-exploitation, pollution, and the spread of invasive species have caused rapid and widespread degradation of rangeland ecosystems and weakened the resilience and capability of rangelands to contribute to conservation goals and the welfare and sustainable development of human societies. Meanwhile, environmental, health, socioeconomic, technological, and geopolitical drivers are deeply impacting the sustainability of livestock production and pastoralism in the rangeland areas of the HKH.

On the other hand, improved accessibility and social services, emergence of new opportunities arising from the multiple benefits of rangelands, and the rapid dissemination and adoption of new technologies have catalysed socio-economic changes in rangeland areas and provided opportunities for better adaptive capacities and transformation of pastoral communities. Sustainable rangeland management, therefore, is essential for maintaining the health of ecosystems, supporting biodiversity, and ensuring the livelihoods of people dependent on them. It involves finding a suitable balance between ecological, social, and economic goals while recognising the dynamic nature of rangeland ecosystems.



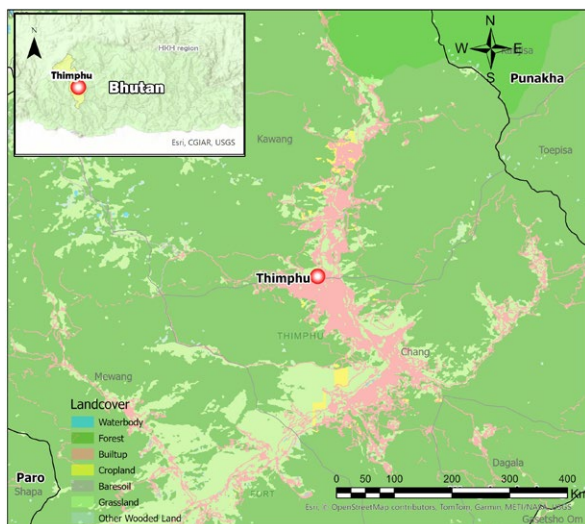


Yaks at the annual festival in Phalelung, Eastern Nepal

TECHNOLOGICAL INNOVATION

1

The use of digital applications for pasture surveys and mapping in Bhutan



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Case contributes to



Background

Pastoralism is an essential part of Bhutan's agricultural system, with nearly 70 percent of the population relying on livestock and crops for their livelihoods. In the highland areas, over 1100 households are involved in yak herding, contributing 4 percent to the nation's livestock products. Highlanders' livelihoods are intrinsically linked to yaks and pasturelands: the yaks provide essential products such as milk, meat, and wool, while the pasturelands offer the necessary grazing grounds for the livestock. This symbiotic relationship between highland communities and their environment, based on traditional knowledge and practices, has been sustained over centuries, and the highlanders' way of life forms an integral part of Bhutanese culture and traditions.

In an effort to protect the grazing rights of highlanders and ensure the sustainable use of pasturelands, the government enacted the Land Act of 2007. This legislation led to the nationalisation of pasturelands, known locally as Tsamdro. As part of this process, Tsamdro rights, most of which were held by non-domicile elites and religious institutions, were deleted from land records, and the title holders were provided with cash compensation. This was intended to balance the need for environmental conservation with the rights and livelihoods of highlanders.

In 2017, the highland communities appealed to His Majesty King Jigme Khesar Namgyel Wangchuck to maintain their Tsamdro rights. Recognising the importance of highland communities from traditional, sociocultural, and biodiversity standpoints, he supported their appeal. His endorsement emphasised the necessity of integrating the highlanders' interests with national development goals.



Subsequently, the National Land Commission Secretariat (NLCS) curated the Tsamdro Implementation Framework, which prioritises a collaborative approach centered on community engagement and participation to ensure the effective representation of highlanders' needs and perspectives. The incorporation of local knowledge and expertise from highlanders was pivotal to the framework's successful implementation. An important part of this framework was the need to carry out a detailed surveying and mapping of Tsamdro areas across the highlands. The endeavour faced significant challenges in terms of time, human resources, and costs and it was unimaginable to take up the task with traditional methods by using Total Stations or Real-Time Kinematic (RTK) surveys.

To enhance efficiency of the surveying process, the NLCS introduced the 'Tsamdro app', an innovative mobile application designed to empower herders by enabling them to directly participate in surveying and mapping of their pasturelands. This user-friendly app integrates image, text, and voice features, allowing herders to conduct surveys independently by using smartphones. Prior to the actual survey, the NLCS provided comprehensive one-day training sessions to the herders

70%

of the population rely on livestock and crops for their livelihoods.

in all local governments in all local government units. Additional smartphones were also provided to facilitate the app's adoption. Owing to the app's simple design, the highlanders were able to quickly grasp its functionalities. To address connectivity challenges in remote areas, the Tsamdro app was designed to function offline, allowing seamless data capture even without network access.

Gewog Verification Committees (GVCs) were established in each local government to ensure the accuracy of information and solicit consensus of surveyed boundaries, before the data is uploaded to the NLCS database for issuing title certificates. The GVCs include local government representatives, land record officials, and surveyors, who provide crucial assistance in interpreting maps and land records. Persistent conflicts among the herding communities have been effectively resolved through this participatory mapping exercise.

Highlanders with shared Tsamdro boundaries collaborate by using the Tsamdro app on their smartphones, resolving boundary disputes collectively. They were advised against surveying cliffs and rocky areas, were unsuitable for pasture, ensuring accurate mapping and sustainable land use practices. All these elements were covered in the Tsamdro guidelines.

The deployment of the Tsamdro app accelerated the surveying process, reduced costs, and enhanced local community empowerment by fostering a sense of ownership and responsibility towards their pasturelands. By leveraging indigenous knowledge and cutting-edge, yet simple, technology, the NLCS effectively managed logistical complexities while strengthening trust and collaboration between highlanders and governmental authorities in the sustainable management of Tsamdro lands. The collaborative approach underscores the crucial role of community engagement in advancing national development objectives.

Just over a span of two years, about 5130 parcels of land, covering about 381,530 acres, were surveyed and mapped using the Tsamdro app. The project's success highlights the effectiveness of combining traditional knowledge with modern technology for sustainable land administration and management. Integrating pastoralism into Bhutan's agricultural system remains pivotal for the livelihoods of many, particularly in highland areas.

Impacts



ECONOMIC

The Tsamdro app has revolutionised surveying and mapping, reducing costs and time by about 90%. What once took a year now takes just about a month. This optimisation conserves resources and eases financial burdens associated with land management. Enhanced management of Tsamdro lands through



About

381,530

acres were surveyed and mapped
using the Tsamdro App

precise mapping and secure tenure has also boosted economic prospects for highland communities. Clearer land rights and improved resource management empower these communities to maximise pastoral activities, potentially increasing income sustainably. By integrating indigenous knowledge with modern technology, the initiative ensures efficient resource use, supports pastoral livelihoods and reinforces sustainable practices vital for the long-term well-being of highland communities.



ECOLOGICAL

The Tsamdro app utilises precise mapping to designate grazing areas. The implementation of the Tsamdro Guideline helps minimise soil erosion and maintain water quality, thereby improving ecosystem health. Moreover, it supports sustainable land management practices that prevent overgrazing and soil degradation, leading to reduced pollution runoff into water bodies and the preservation of natural habitats.



SOCIAL

The approach is participatory and inclusive, involving and empowering local communities, regardless of gender, in the conservation and sustainable management of their pasturelands. This cultivates a strong sense of ownership



and responsibility among community members, fostering collaboration and mutual support in various land-related activities, including conflict resolution. Moreover, the initiative contributed to maintaining a healthy ecosystem that directly enhanced community health and overall quality of life.



CLIMATE CHANGE

The pasture data generated by the Tsamdro App enables evidence-based decision-making and the formulation of mitigation and adaptation strategies across sectors. This supports broader climate mitigation efforts by reducing land degradation and associated emissions. Additionally, the app's accurate mapping helps identify resilient grazing areas, enhancing highlanders' adaptive capacity to climate impacts like extreme weather

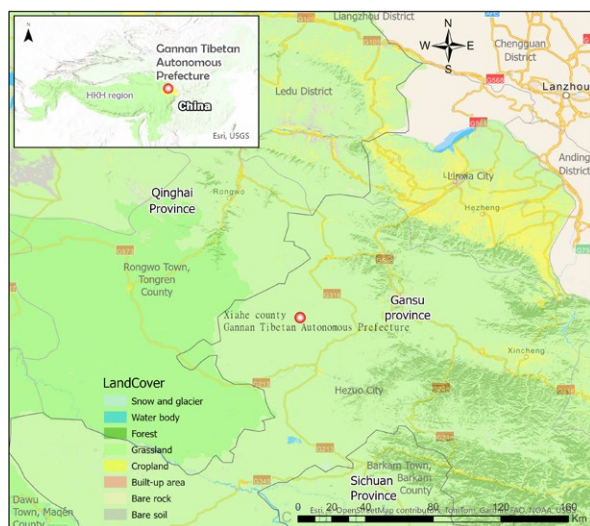
and changing precipitation patterns. This proactive approach strengthens community resilience while sustaining their livelihoods.

Key challenges

Initially, the NLCS was worried about the acceptance of new technology, but it was embraced by all stakeholders. The project's implementation coincided with the onset of the COVID-19 pandemic in Bhutan in 2022, causing delays, but it resumed smoothly post-pandemic. Apart from a few, conflicts regarding legal boundaries no major challenges were encountered during the implementation of the Tsamdro framework. The lack of in-house expertise, however, necessitated outsourcing the development of the Tsamdro app, raising concerns about future upgrades and accuracy, highlighting the need for internal capacity development.

2

Breeding Jersey-yak hybrids to enhance the resilience of yak farmers in Gansu Province, China



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Case contributes to



Background

There are approximately 16 million yaks worldwide, mostly in the Asian highlands, supporting over 40 ethnic groups who rely on yak milk for nutrition and livelihood. However, climate change-related grassland degradation, yak genetic degradation, and the migration of young people to cities have led to a decline in yak milk production. This decline reflected in the reduced number of milking yaks, shorter milking periods, less frequent milking, and lower individual milk yields - has forced herders to reduce their consumption of yak milk and sometimes turn to lower-quality packaged milk, threatening their nutritional and livelihood security.

For these reasons, the demand for alternative milk sources increased in Xiahe County. The Dzo, a hybrid between a male cattle and a female yak, offers higher milk yields (2.5-4.0 kg/day) than yaks (0.5-1.5 kg/day) but with lower fat and protein content. The Jersey-yak, a hybrid between a male Jersey bull and a female yak, yields even more milk (6.5-9.5 kg/day, with a maximum of up to 14 kg/day), with a composition similar to yak milk.

Over the past decade, Xiahe County in the Gannan Tibetan Autonomous Prefecture, Gansu Province has promoted the breeding and raising of Jersey-yak females. The breeding, conducted through artificial insemination using frozen Jersey bull semen, has achieved a pregnancy success rate of over 85 percent. In 18 months, the calves reach an average weight of 193.7 kg and they give birth to their first calves at around 2.5 years old. This programme produces over 2800 Jersey-yaks annually, with more than 9000 now in the county.

Impacts



ECONOMIC

Raising Jersey-yaks is cost- and resource-effective, generates higher incomes for herders, and allows them to access new markets. Yak herders traditionally earned about 1500 Chinese Yen (CNY) per female yak from fresh milk sales. With Jersey-yaks, their income has increased six to seven times. A Jersey-yak female produces approximately 1200 kg of milk over a milking period of five months in a year, generating a net profit of CNY 8000-12,000 from an annual investment of around 1000 CNY per Jersey-yak. Yet, Jersey-yaks use the same resources as other yaks while producing more milk with higher nutritional quality. Additionally, the growing demand for fresh milk and commercial dairy products has boosted local sales and led to the expansion of dairy processing industries.



ECOLOGICAL

Jersey-yak farming benefits biodiversity, soil, and water conservation efforts. For example, reducing the number of grazing livestock has supported pasture restoration. Healthy vegetation prevents soil erosion and aids water retention and filtration through the root network. The vegetation also helps mitigate air pollution by reducing rangeland sandstorms.



SOCIAL

There have been a number of positive impacts in terms of gender inclusion, community engagement, health and well-being, and cultural preservation. For instance, milk and yogurt workstations have attracted more women than men, building new social networks. Collaboration among herder



This programme produces over

2,800
Jersey-yaks annually

The breeding programme has a pregnancy success rate of over

85%

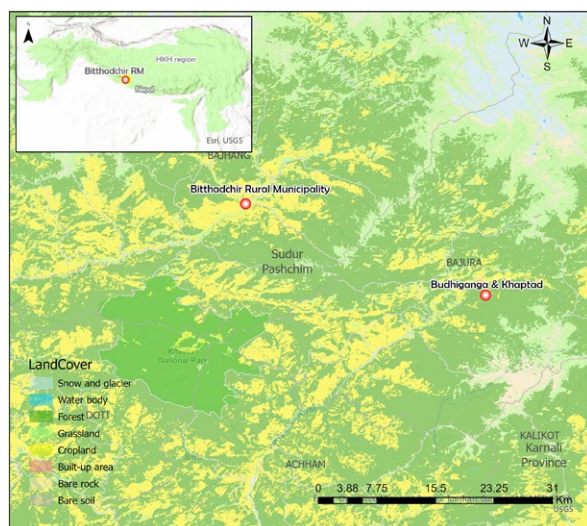
households, cooperatives, enterprises, and the government has benefited all those involved. Jersey-yak milk, which is as nutritious as yak milk, has improved human health and animal welfare by reducing the over-milking of yaks. Increased fresh milk production from milk farms has encouraged locals to preserve and expand traditional animal husbandry practices. Further, the establishment of milk stations supports hand-milking practices, maintaining the traditional connection between humans and animals.

Key challenges

To ensure sufficient milk production, each cow requires additional management and care including more food, shelter, time, and labour which also increases operational costs. Additionally, the migration of young people to cities has reduced the availability of skilled workers, particularly for artificial insemination.

3

Using augmented reality for sustainable rangeland and landslide risk management in Nepal



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Background

This initiative used Virtual Reality (VR) technology to create an interactive and immersive learning experience to raise awareness about environmental risks such as landslides in Nepal's mountain region. Partnering with communities and schools of Bajhang and Bajura in the far-west of Nepal, the initiative helped locals understand risks and prepare risk reduction measures. Through awareness-raising initiatives and targeted mitigation strategies, delivered via a virtual platform, the project has contributed to sustainable land management and rangeland conservation efforts.

360-degree cameras and drones were used to capture detailed images of landslides and land use practices. After analysing the data to identify risk areas and mitigation strategies, we created an interactive virtual environment using the 360-degree images. A user-friendly platform was developed, allowing users to explore the virtual environment and access educational content via mobile devices and web browsers.

Virtual digital boards were developed on landslide types, the impact of rainfall and human activities on land degradation, and potential mitigation measures. This content was integrated into the virtual environment, highlighting risk zones and showcasing sustainable land management practices. This ensures that users are not only immersed in the virtual landscape but are also actively learning about environmental challenges and potential solutions.

Case contributes to





The content and platform were deployed into VR headsets, specifically the Meta Oculus Quest 2, with rigorous testing to ensure a seamless VR experience. The VR experience was then introduced as a pilot project in two schools, providing at least 500 students and teachers with a virtual tour of their locality. The VR headsets were given to the school labs for daily use, allowing more students to benefit from this tool every day. Students could now explore their environment from a new perspective, using joysticks and pointers. Teachers and students were given the responsibility to look after and operate the sets to educate new students.

The project also extended beyond schools offering virtual tours and interactive sessions to the wider community, deepening their understanding of local environmental risks.

To ensure sustainability, schools and communities were provided VR sets loaded with offline content, crucial for areas with limited internet connectivity. Local focal points were trained to operate the VR devices and facilitate virtual tours, ensuring effective use of the technology by the communities. The project team is now exploring opportunities to scale up the initiative to other regions and integrate it into the regular school curriculum.

This technology has the potential to be scaled up and leveraged to sensitise herders and locals about pasture conditions, improve livestock management, and help them better understand the changing landscape. The approach is especially useful for the virtual assessment of remote areas, providing realistic scenarios for improved rangeland management. Additionally, it helps communities better understand vegetation distribution and land steepness. This technology thus bridges the gap between scientific data and community practice through simple, interactive, visual platforms.

Impacts



ECONOMIC

While the initial investment in VR equipment and content development may be high, the long-term benefits – such as risk reduction and improved resource management – can outweigh the costs. By promoting sustainable land management, this initiative can lead to more efficient use of natural resources in the region.



ECOLOGICAL

The VR experience educates users about sustainable land management practices, which can indirectly contribute to soil and water conservation efforts.



SOCIAL

The introduction of VR technology has sparked curiosity and discussion within the community, increasing engagement and interest in environmental risks. By raising awareness about potential hazards like landslides, thereby improving risk reduction and preparedness measures, the initiative contributes to better community health and well-being.



CLIMATE CHANGE

By highlighting the impacts of climate change on the local environment, the VR experience helps communities adapt to changing conditions and make informed decisions about resource management. The awareness and knowledge gained through the VR experience can empower communities to build resilience against climate-related risks and develop strategies to mitigate their impact.

Key challenges

This VR initiative encountered challenges due to the evolving nature of the technology and limited technological awareness, especially in rural areas. Unreliable internet hindered content updates, risking user disengagement. The high costs of VR equipment and ongoing technical support are also significant, particularly in settings with resource constraints. Additionally, covering large spatial areas is resource-intensive requiring manual image capture and visualisation.

Human interest story

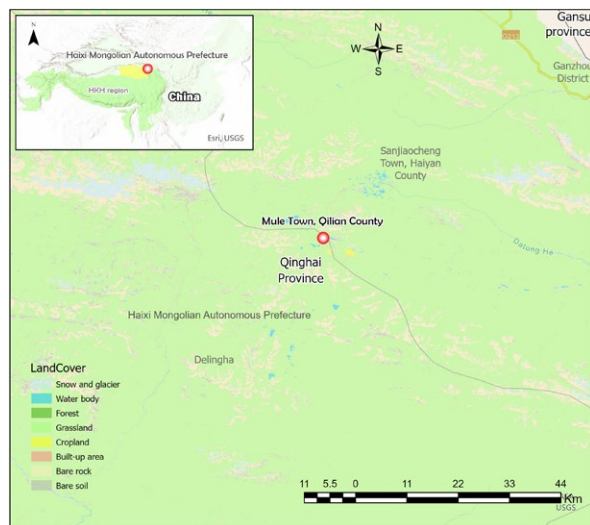
Deepak Biswakarma, a ninth-grader from Sunkuda Secondary School in Bajhang, grew up in a village vulnerable to landslides. The nearby Sunkuda landslide, close to his school, expands every year. Despite witnessing the destruction, Deepak had little knowledge of risk mitigation – until he experienced exploring his village's landslide through immersion in virtual reality (VR). "This is amazing!" Deepak exclaimed, eyes wide with wonder. "How much would it cost? I'll ask my dad to buy one when we can afford it." His reaction highlights the potential of such technology to drive change and build resilience through interactive learning.

RESTORATION AND BIODIVERSITY CONSERVATION, NATURE - BASED SOLUTIONS

CASE

4

Restoring alpine grasslands in China by assembling native seed packages



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Case contributes to



Background

The purpose of reseeding alpine grasslands is to restore biodiversity, productivity, coverage, and carbon content of degraded alpine grasslands such as alpine meadows and alpine steppes located in the Hindu Kush Himalaya (HKH) region at altitudes above 3000 masl.

Identifying grasslands in need of restoration involves assessing level of degradation. Moderately, severely, and extremely degraded grasslands require intervention by sowing native seed mixtures. The dominant species in these areas are *Kobresia* sp in alpine meadows and *Stipa* in alpine steppes. Moderately degraded grasslands have 30-60 percent native vegetation coverage, more than 30-4 percent bare land, and 20-40 percent coverage by poisonous and unpalatable plants. Severely to extremely degraded grasslands have less than 30% native vegetation coverage, more than 40 percent bare land, and over 40% poisonous plant coverage. The practice of reseeding with native seed mixtures can be applied when the bare land exceeds 30%.

Selecting the appropriate native plant species for seed mixtures is crucial. They should be commonly found in productive grasslands of the region, with high germination rates and seed production, such as Poaceae and Compositae species. Typically, a mixture of 4-10 native species is recommended, depending on the dominant plant species in the surrounding grassland. Generally, a seed mixture assembled from 4-6 dominant species is effective. Recommended species for alpine



areas include *Elymus nutans*, *Elymus sibiricus*, *Festuca sinensis*, *Poa pratensis*, *Puccinellia distans*, *Aster alpinus*, *Agropyron cristatum*, and *Stipa purpurea*.

The collection of native seeds typically occurs during September to October in the alpine region of the HKH. Large plastic bags should be prepared in advance for storing seed heads, which are cut off with scissors. After collection, the seeds are removed, placed in a labelled bag, and set aside. Some seeds of native plants can be purchased, but others must be collected directly from the grassland. Once collected, the selected seeds are mixed, packaged, and labelled according to the weight required for sowing the target area. The seed mixture is prepared based on the principle of equal opportunity, ensuring that the number of seedlings germinated and planted is generally equal for each species. The amount of seed sown depends on the level of grassland degradation, typically ranging from two to five grams per square metre, but it can reach up to five grams per square metre in very severely degraded areas.

Hand sowing is carried out in small areas, while a seeder is recommended for larger areas. Seeds are placed directly on the ground surface, but in windy

The practice can generate income as harvested seeds can be sold for

USD 3-5 per kg

areas, they are mixed with soil to prevent them from being blown away. Reciprocating cross-seeding ensures uniform distribution. A very shallow cover of less than 2 cm is required after sowing, usually achieved by lightly raking the topsoil to allow the seeds to enter the soil. The area is then pressed; for small areas, walking on the soil is sufficient, while mechanical equipment is needed for larger areas. In very dry and very cold conditions, the area should be covered with non-woven material to retain heat and moisture, promoting seed germination and colonisation.

Post-seeding management is critical, with particular attention to two issues. First, grazing should be strictly prohibited for a year, especially in alpine areas where plant growth is slow and grazing can damage young

plants. Second, after the first year, grazing should be limited to no more than 50 percent, with winter being the best season for grazing.

The effectiveness of the seed mixture should be assessed in the first year by determining the coverage, community height, biomass, and species richness of the sown area. Coverage is estimated visually, plant species are identified, community height is measured with a ruler, and biomass is measured by weighing plants above ground level. The success of grassland restoration is determined by assessing the condition of the grassland for five consecutive years and comparing the treated area with surrounding non-treated grassland areas.

Impacts



ECONOMIC

This grassland restoration practice is cost-effective, with labour costs of around USD 20 per person per day, though local herders can collect seeds at no cost. The practice can generate income as harvested seeds can be sold for USD 3-5 per kg. The demand for ecological restoration in Qinghai and Tibet Autonomous region, China, is substantial, with a need for around 300 million kg of seeds, worth about USD 1 billion, to restore a total of 10 million hectares.



ECOLOGICAL

The practice also aids biodiversity conservation by mitigating grassland degradation and enhancing soil and water conservation, reducing soil erosion by over 50 percent.



SOCIAL

The practice promotes women empowerment by providing income opportunities for women herders through seed collection and sale, and opportunities for paid work. The practice also fosters community engagement and well-being, and preserves Indigenous knowledge and practices as herders integrate traditional knowledge to identify, collect and sow native seeds.



CLIMATE CHANGE

The practice enhances carbon sequestration in both plant and soil, increasing soil carbon storage by over 50 percent and improving grassland resilience against climate change.

Key challenges

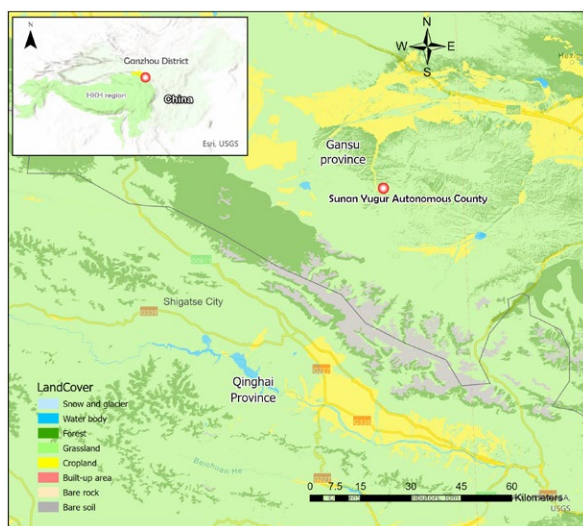
Challenges include determining appropriate grasslands and seed types for sowing, ensuring proper grazing management, especially during the first year and after sowing of seeds, and providing herders with necessary training.

Human interest story

Twenty years ago, a young researcher, Yushou Ma, identified the *Poa pratensis* species at an altitude of 4100 masl. He collected seeds and propagated the plant which now plays a crucial role in grassland restoration on the Qinghai-Tibetan Plateau. “Seeing the grass flourish reminds me how small actions can lead to great change,” said Ma Yushou.

5

Chicken grazing for pest control and food security in alpine pastures in the Qilian Mountains, China



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Case contributes to



Background

The rangelands of the Asian highlands are crucial ecosystems that provide food, nutrition, and livelihood security for over 1.5 billion people. However, these rangelands face frequent pest outbreaks due to global warming and unsustainable management practices. In China's rangelands alone, there are 200 species of grasshoppers, with 20 of them capable of causing severe economic damage by destroying grazing land. In Northwest China, grasshoppers have already caused the loss of around 1.6 billion kg of dry biomass, which is enough forage to sustain 30 million sheep per year. Despite the implementation of chemical control measures costing over USD 16.3 million annually, these grasshopper invasions have not been effectively managed. This has led to a global focus on finding environmentally friendly and sustainable strategies to control grasshopper populations.

According to the Food and Agriculture Organization (FAO) of the United Nations, locusts can be used as food for humans and feed for poultry. Building on these findings, chicken were introduced into the alpine pastures of the Qilian Mountains of Sunan Yugur Autonomous County, Gansu Province, China, to control grasshopper populations. During the warm season, from late June to late September, 5-6 weeks old chicks were introduced into the pastures at a density of 15-20 chickens per hectare. These pastures were previously used for winter grazing.

The free-range chickens primarily fed on pests, plant seeds, and tender leaves, with corn supplement provided only on rainy days. Over five years, the densities of grasshoppers



and other insects were monitored during the warm season. The meat quality of grazing chickens was then compared with chickens of the same breed raised in intensive production systems, with analyses including physiochemical parameters, fatty acid profiles, and lipid oxidation. Additionally, plant biomass yield and diversity were measured in pastures with and without chickens. Finally, the costs and economic benefit were calculated. This approach not only offers a sustainable solution for grasshopper control but also provides economic and ecological benefits to the rangelands.

Impacts



ECONOMIC

The practice effectively controls pests for up to five years with a one-time investment of approximately USD 51 per hectare per year, covering costs like chicken purchases, veterinary care, supplements, and employment. The sale of chickens generates a 50 percent profit. The practice also helps diversify the income of herders, reducing their sole reliance on livestock sales, and

One-time
investment of approximately
USD 51
per hectare

Sale of chickens
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50%
profit

providing an annual increase in income of at least 30 percent through the sale of chicken. Free-range chickens offer organic meat rich in functional nutrients, which is likely to be preferred by consumers over intensively farmed poultry. Additionally, using chickens for pest control eliminates the need for chemicals, promoting eco-friendly foraging, and reducing labour costs.



ECOLOGICAL

Chickens help conserve biodiversity by spreading pasture seeds through their manure, leading to higher germination rates, increased yield, and greater plant diversity. Chemical-free vegetation also safeguards insects and pollinators essential to healthy pastures.

Improved pastures enhance the water-holding capacity of soil through a stronger root system, thereby preventing soil erosion and improving groundwater quality. Additionally, by eliminating the need for chemicals, using chickens for locust control reduces soil and vegetation pollution.



CLIMATE CHANGE

Rich vegetation supports natural carbon cycles, aiding in the sequestration and mitigation of greenhouse gases. The introduction of chickens improves ecosystem balance, helping it adapt to adverse climate impacts. Healthy pastures also improve climate resilience, allowing them to withstand droughts and heatwaves.

Key challenges

The chicken grazing practice for grasshopper control faced four major challenges. Firstly, predicting the timing and location of locust outbreaks is difficult, creating challenges for the timely implementation of management measures. Secondly, the area of influx is very large as grasshopper swarms can be massive and can quickly

attack vast rangeland areas. Thirdly, grasshoppers reproduce rapidly with female grasshoppers laying over 100 eggs at a time, causing sudden population explosions. Finally, warmer climatic conditions, create an ideal environment for locust outbreaks.

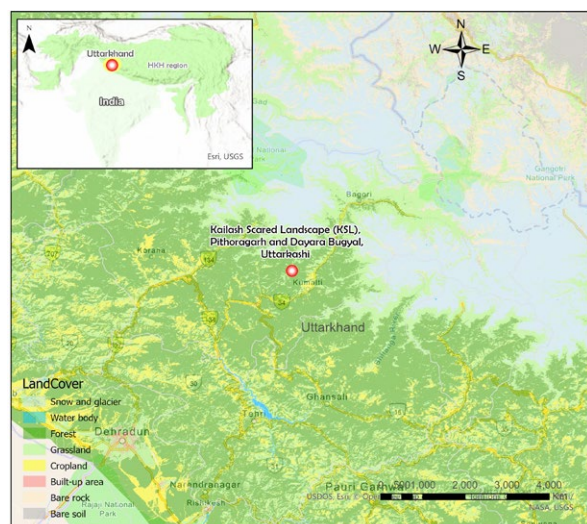
Human interest story

“I’ve witnessed how chicken grazing has transformed our way of life,” said An Weidong, a herdsman at Huangcheng Township of Sunan County. Chicken grazing not only effectively controlled grasshoppers, reduced costs, avoided use of pesticides, but also yielded high-value chicken meat for high-end markets, improving herders’ livelihoods. Furthermore, it attracted enterprises to invest and cooperate with herdsman to expand the grazing scale and benefits. The government promotes this eco-friendly approach for broader implementation across other areas. The project generated significant media attention and encouraged enterprises to invest in the practice, highlighting its potential for additional profits and partnerships with herders. It also attracted interest from local governments and China’s Ministry of Agriculture, promoting the eco-friendly approach for broader implementation in other areas.

CASE

6

Community-based participatory approach for Bugyal restoration in Uttarakhand, India



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Case contributes to



Background

Alpine pasture lands, known as *bugyal* in Uttarakhand, India, are remarkable and unique ecosystems found between the tree line (3000 masl) and the snow line (4500 masl). Uttarakhand has 82 major bugyals covering approximately 8524 sq km, which constitutes about 24% of the state's geographical area. Bugyals serve as rich reservoirs of biodiversity and are home to several rare, endemic, and threatened (RET) plant species, the caterpillar fungus locally called yartsa gumba, as well as important wildlife like the snow leopard, blue sheep, and Himalayan tahr. For pastoral communities, these lands provide areas for livestock grazing and a variety of high-value medicinal plants.

In recent decades, these rangelands face significant threats from anthropogenic activities such as overgrazing, resource extraction, and habitat degradation, compounded by climate change. These pressures endanger both biodiversity and the traditional pastoral lifestyles that have sustained these lands for centuries.

To tackle these challenges, two successful community-based bugyal conservation initiatives were implemented in the Kailash Sacred Landscape of Pithoragarh district and the Dayara-Bugyal landscape of Uttarkashi District. These community-based participatory approaches to restoring Bugyals integrate local traditional knowledge, sustainable resource management, and effective monitoring and regulatory mechanisms, supported by collaborative governance. They effectively address both ecological and socio-economic challenges and are well-suited for replication in other regions with similar



ecosystems and challenges across the HKH region. By adopting the outlined steps, other areas can replicate and benefit from these best practices, ensuring the preservation and sustainable use of alpine rangelands throughout the Himalayas.

1) CONSERVATION AND SUSTAINABLE UTILISATION OF RESOURCES IN THE BUGYALS OF THE KAILASH SACRED LANDSCAPE

The Kailash Sacred Landscape (KSL) covers 31,175 sq. km across China, India, and Nepal, with the Indian portion of 7120 sq. km primarily in Pithoragarh and Bageshwar districts. This area includes 13 percent grazing areas supporting over 40,500 sheep and goats, and 1400 cattle and horses, highlighting the economic importance of these rangelands. Pastoral communities have traditionally managed resources sustainably. However, in recent years, overgrazing and population growth have caused grassland degradation and biodiversity loss.

13% of the KSL in India consists of grazing areas that support over 40,500 sheep and goats, and 1,400 cattle and horses

To address rangeland degradation and management, pastoral communities, the forest department and other stakeholders consulted each other and the wider community to establish Joint Forest Management Committees (JFMCs). These committees educate local communities and involve them in sustainable restoration efforts, including planting native species and monitoring ecological health, which aid in conserving rare species and reversing pressures on and damage to the Buggyals. They also implement rotational grazing to prevent overgrazing and promote alternative livelihoods via the cultivation of medicinal plants and ecotourism together with NGOs. Local festivals like Hill Jatra, Kandali, or Nanda Astami also support conservation by preserving traditional ecological knowledge and sustainable practices.



2) ECO-RESTORATION, CONSERVATION, AND MANAGEMENT OF THE DAYARA-BUGYAL LANDSCAPE:

Dayara Bugyal, an alpine pasture at about 3500 masl in Uttarkashi District, is renowned for its natural beauty and biodiversity. Spanning 3.38 sq. km, it hosts endangered plant species like *Picrorhiza kurroa* (kutki), *Nardostachys jatamansi* (spikenard), and *Aconitum heterophyllum* (Atis) and serves as a habitat for musk deer, brown bear, Himalayan tahr, and monal pheasant. However, growing tourism, overgrazing, and climate change have led to significant ecological degradation, including headwater erosion and gully formation. Over the past five years, tourist numbers in Dayara Bugyal surged by 186 percent, exacerbating soil erosion and habitat loss. Livestock from local villages and nomadic groups put further pressures on the ecosystem.

In response, the Uttarakhand Forest Department, with local communities, launched an eco-restoration project. Villagers from nearby areas, like Barsu and Raithal, were engaged through the formation of the Dayara Bugyal Conservation Committee, comprising members

of Biodiversity Management Committees (BMCs). The committee promotes sustainable practices in both the meadows and villages.

The restoration efforts included using eco-friendly materials such as biodegradable coir-geotextile mats, pine needles, and bamboo to combat soil erosion and aid vegetation regeneration across 6600 sq. m of the Bugyal. Native species like *Iris kumaonensis* and *Rosa sericea* were planted for land rejuvenation and biodiversity conservation. Overgrazing was addressed by shifting livestock grazing areas from Dayara to Lambidhar and regulating livestock numbers, allowing the meadow to recover.

Tourism management was also a key focus. The Forest Department implemented measures to control visitor numbers, in line with the Uttarakhand High Court's 2014 and 2018 orders limiting tourists in Bugyal to 200 per day. Night camping was banned in the Dayara Bugyal and relocated to nearby villages like Ghuyin and Barnala, preserving the meadow's integrity while promoting sustainable eco-tourism. Villagers were trained as tour guides, and homestays were encouraged, offering tourists an authentic experience while ensuring sustainable practices.



The eco-restoration project has transformed the Dayara Bugyal, restoring the meadow's vegetation and stabilising its soil, bringing renewed pride and purpose to local communities, who now see the benefits of their conservation efforts. The project has not only restored ecological balance but also provided alternative livelihoods and economic benefits to the community. The success of Dayara Bugyal's restoration demonstrates the power of community participation and innovative approaches in sustainable conservation, offering hope for other high-altitude pastures in the Indian Himalaya and mountain ecosystems elsewhere facing similar challenges.

Impacts



ECONOMIC

Engaging local communities and using low-cost, locally available materials like pine needles, bamboo, and coir net minimise labour and material costs. Restoration projects in the Bugyals have also diversified livelihoods by promoting the cultivation of high-value medicinal plants and responsible

ecotourism, reducing reliance on overgrazing. Additionally, some 40-50 local villagers earned income through their participation in the Dayara Bugyal restoration activities. The cultivation of high-value medicinal plants and the development of ecotourism have provided local communities with access to niche markets. Implementing rotational grazing systems and eco-friendly soil erosion control measures, such as biodegradable coir-geotextile mats and pine needle check dams, has improved resource efficiency by optimising pasture use and preventing land degradation.



ECOLOGICAL

Community involvement in planting native and medicinal species and the regulation of grazing and tourism have supported the conservation of endangered flora and promoted the regeneration of native vegetation, enhancing biodiversity in the Bugyals. Eco-friendly techniques like coir mats and pine needle check dams, along with planting native species, have stabilised the soil,

reduced runoff, and improved water retention and quality. Managing tourism by controlling visitor numbers and shifting night camping to nearby villages has significantly reduced solid waste and pollution.



SOCIAL

The initiatives actively involved local communities, particularly women and marginalised groups, ensuring equitable participation in decision-making and benefit-sharing. The formation of committees like the JFMCs and the Dayara Bugyal Conservation Committee fostered strong community engagement. Training programmes empowered villagers with skills in restoration techniques, medicinal plant cultivation, and eco-tourism. Improved Bugyal conditions and sustainable livelihood options have positively impacted the health and well-being of local populations. Reduced soil erosion and cleaner water supplies have also contributed to better public health. Finally, the promotion of local festivals and lifestyles has highlighted the cultural significance of Bugyals and supported the preservation of traditional pastoral practices.



CLIMATE CHANGE

Restoration of vegetation and soil stabilisation efforts contribute to carbon sequestration, helping to mitigate climate change. Adaptive management practices, such as rotational grazing and alternative livelihoods, have increased the resilience of local communities. Overall, these initiatives have enhanced the climate resilience of the Bugyals by promoting biodiversity conservation, livelihood generation, and sustainable land management—crucial for maintaining the ecological functions of these high-altitude rangelands in a changing climate.

Key challenges

Despite the success of community-based conservation efforts in the Bugyals of Uttarakhand, it faced several challenges. Bugyals continue to be affected by overgrazing and habitat degradation due to population pressures and insufficient regulation. The rise in mass tourism in the Himalayan region puts further pressures on the ecological integrity of the bugyals. Limited financial resources and institutional support hinder large-scale implementation and long-term sustainability of alpine pasture conservation and management efforts. Additionally, active engagement and synergy building among line departments and various other stakeholders remain difficult, particularly when integrating traditional knowledge with modern conservation techniques. And finally, the effects of climate change, including unpredictable weather patterns, are exacerbating challenges in these high-altitude rangelands, disrupting traditional pastoral practices.

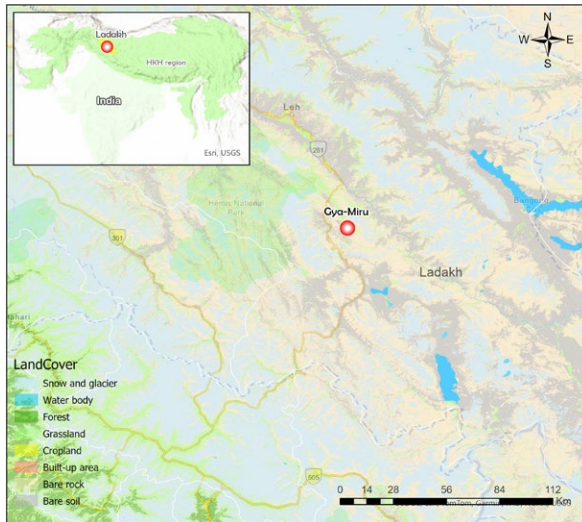
Human interest story

Prithvi Raj, a resident of Raithal village, was thrilled with the success of the Dayara Bugyal restoration programme. After participating in the initiative, he started a successful homestay in his village. "The Bugyal's revival has rejuvenated the biodiversity of the landscape and also brought tourists and income to our doorstep," he said, advocating for replicating this model across the Himalayas.

Similarly, Laxman Singh from Darma Valley in the KSL highlighted that the programme allowed him to begin cultivating medicinal plants and contributing to Bugyal management. He observed that medicinal plant cultivation alleviates pressure on the Bugyals, showcasing the positive impact of biodiversity conservation and sustainable practices on local ecosystems.

7

Floating reserves: Balancing wildlife conservation and community needs in Tsaba Valley, Ladakh, India



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Case contributes to



Background

The Tsaba Valley serves as the winter grazing ground for the Gya-Miru herders. Each year, about 12 herders, each with 200-300 livestock, use the 250 sq. km valley from December to April. The herders rotate between six locations: Manikeri, Nyayul, Kotsa, Paksey, Neylung, and Mitpagunpu. Although they graze their sheep and goats separately, they meet up to stay together in these locations.

The life of these herders is extremely challenging. In addition to daily grazing, they must cook their meals and manage other chores all by themselves. They live in *rebos*, traditional yak wool tents, at least a day's walk from their villages, with winter temperatures dropping to below -25°C. They bring provisions to their camps every fortnight.

The valley is home to elusive wildlife species such as snow leopard, Tibetan wolf, Eurasian lynx, and the rare Tibetan argali. With fewer than 500 argalis left in the wild across Ladakh, the valley is a critical habitat.

Previous research from Ladakh has shown that livestock grazing can negatively impact wild ungulates like argali. However, given the importance of the Tsaba grazing lands for herders, especially in the harsh and resource-limited winter, restricting livestock access to grazing areas was neither possible nor ethical. After extensive community meetings with herders and the village committee, led by Karma Sonam who has led conservation projects across Ladakh, it was decided to create 'floating reserves'. If herders spotted argali they would reroute their livestock to avoid disturbing them. Unlike fixed grazing-free areas, they practiced micro-scale



over the last decade , argali
numbers increased from

**80 individuals
to over 100**

pasture avoidance by shifting grazing grounds daily based on the presence of argali to reduce competition. This has allowed for the co-existence of argali and livestock within the Tsaba.

Additionally, herders were engaged in monitoring the argali, facilitating knowledge transfer to researchers from the Nature Conservation Foundation. Over the last decade, argali numbers have seen a slight increase, rising from fewer than 80 estimated individuals to over 100, with stable male-to-female and young-to-old ratios.

To ensure the floating reserve functions well, an agreement is signed each year with the herders, outlining the terms of the intervention. In return, basic services and supplies, such as newly stitched rebos, are provided to the herders to support their herding practices.

Impacts



ECONOMIC

The floating reserve helps prevent overgrazing in the Tsaba Valley, resulting in healthier livestock, including pashmina goats. The wool from these goats is combed and sold, providing a crucial source of income for the herders.



ECOLOGICAL

This practice has contributed to biodiversity conservation by successfully protecting the rare Tibetan argali population while safeguarding the livelihoods of Indigenous herding communities.



SOCIAL

Women herders actively participate in livestock grazing and monitor the argali, blending their traditional roles as herders with citizen science. Herders make decisions collectively within the traditional Goba system, which governs decision-making in Ladakh, especially for natural resource use such as access to grazing land. The floating reserves are managed through this system, strengthening local governance systems in the region.

Key challenges

Herding in Ladakh faces significant challenges due to the harsh and unpredictable climate. Community support for herders has waned as tourism and other job opportunities have become more prominent. Additionally, the region's potential as a hub for green development and conservation projects threatens traditional herding lands. The key challenges this particular intervention faced included maintaining herder motivation and ensuring compliance with agreements. Adherence relied on a system of trust, making it difficult to assess.

Human interest story

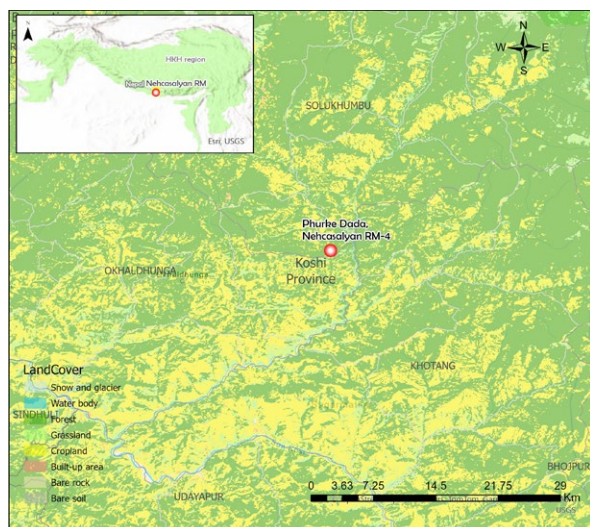
In pastoral herding communities, male narratives often dominate. However, in Tsaba, one female herder, Ache Tsering, was integral to the intervention from the start. Each year, she eagerly anticipates February when the argali surveys are conducted, not only to share insights about the argalis but also to enjoy the companionship of the visiting team. Tsering, said “I eagerly wait for February to come as I know this is when NCF team visits. I love when they come to my rebo (tent) and we chat for hours. They are like family to me.” These personal connections add significant value beyond the immediate outcomes of the intervention.





WATER MANAGEMENT

Reviving arid ponds in Solukhumbu, Nepal



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Case contributes to



Background

Phurke pond, located in Nechasalyan village of Nepal's Solukumbhu district, always had water but dried in 2015 due to earthquake and climate change impacts. Initial restoration efforts by the local government and community, done without technical assistance, failed due to inadequate soling of the pond's bottom layer, insufficient efforts to locate the leakages in the pond, and the fact that they did not use fine soil to seal the pond's base layers. The Association for Rural Development (ARD) in Kavre then attempted a new restoration approach using appropriate techniques.

The nearby spring in Pani Chaur, around 1000 meters uphill, was insufficient for daily household needs during the dry season, which made it crucial to restore the pond for livestock and irrigation needs from spring through summer.

The project aimed to combat soil drought and conserve the wetland ecosystem. For this purpose, an experienced engineer was hired in association with the technical department of the rural municipality and a cost estimate was made. An intake tank was built to collect rainwater and spring water, channeling it to Phurke pond. Following this, excavation and pipeline installation were carried out to locate leaks and direct water to the pond. Two major voids were discovered and filled. The voids were sealed with concrete and grouting, and the rest of the pond was filled with sieved mud, maintaining a 15% slope to direct water toward the centre of the pond. The soil was compacted with a monkey jumper. A canal and sedimentation pond were constructed to collect and filter rain water and spring water before it flowed into Phurke pond. Finally, a small pond was



added below Phurke pond to manage and direct overflow into the animal pond that supports feeding, preserving traditional practices.

This restoration method has been replicated to restore four other dried ponds in Nechasalyan Rural Municipality, demonstrating its effectiveness. Achievements include:

- **Local government support:** Ongoing supervision and management commitment.
- **Water availability:** Reliable water for irrigation and livestock during dry months.
- **Increased tourism:** A rise in visitors to the area after the restoration of the pond.
- **Ecosystem revitalisation:** Greater wildlife activity around the pond observed by local people, enhancing biodiversity in the area.

This model has been replicated to restore four other dried ponds in Nechasalyan Rural Municipality.

Impacts



ECONOMIC

The intervention has helped improve livelihoods and boost economic activity. The restoration of Phurke pond has rejuvenated the area, attracting visitors keen to see the revived water source. Local farmers are using the water for their vegetable farms during the dry season and are considering fish farming in the pond. As the first naturally dried pond to be successfully revived in the area, it has sparked interest in replicating this method elsewhere.



ECOLOGICAL

The area, previously dry land used as football ground, has seen a resurgence of flora and fauna following the pond's restoration. Aquatic plants are reappearing and amphibians like toads and snakes have returned, though their exact species are unidentified.



SOCIAL

Phurke pond was traditionally the site of the Janai Purnima Jatra, a Hindu festival. The pond's restoration has revived its cultural significance, with local youth showing renewed interest in preserving their traditions and cultural practices.



CLIMATE CHANGE

The community is now moving towards greater water resilience, enhancing their ability to cope with the effects of climate change.

Key challenges

The construction faced significant challenges, including a shortage of skilled labour, as workers had to be brought in from other villages. This issue, coupled with workers being engaged in multiple projects, led to delays. Additionally, the scarcity of water during the autumn season, when construction was at its peak, made water management difficult during this phase of construction. The COVID-19 pandemic also disrupted the work.

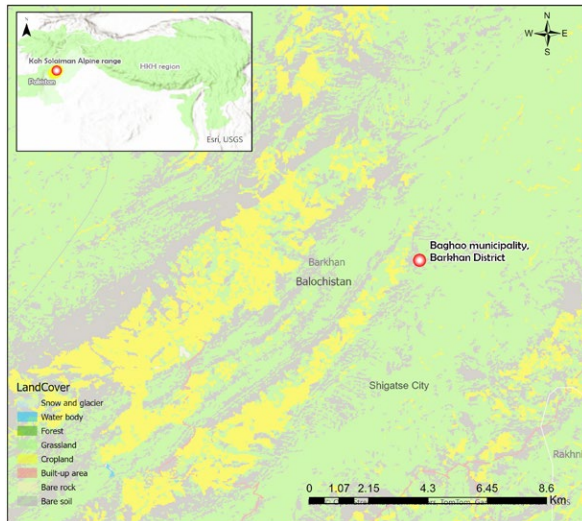
Human interest story

Harka Raj Rai, a priest at the nearby temple, played a crucial role in the restoration of the Phurke pond, being involved from start to finish. He shared his observations of the pond's transformation, explaining that once a resting spot for travellers walking from the village to Okhaldhunga, the site lost its significance after the construction of roads in the area. With the pond's restoration, the area has seen a resurgence of visitors but many now arrive by vehicle rather than on foot.

CASE

9

Reviving the Tarai indigenous ponds in the Koh Solaiman alpine range of the Indus Valley, Pakistan



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Case contributes to



Background

For centuries, the indigenous communities of the Koh Solaiman alpine range, the southernmost extension of the Hindu Kush mountains, have mastered the art of harvesting rain and hill torrent waters. They have done so using half-moon-shaped loose rock dams called Tarai, an ancient water harvesting technique passed down through generations. These structures slow down water flow, allowing it to seep into the soil, and be stored for months or even years. The word Tarai is derived from the Balochi/Persian word Tar which means 'moist'.

The Tarai system is older and simpler than the Qanat or Karez systems of water distribution in dry terrains like the South Iranian plateau. Unlike Karez, Tarais require minimal maintenance and were historically the primary water sources for drinking and agriculture until handpumps were introduced in the region in the 1980s.

Ancient semi-nomadic pastoralists of Koh Solaiman were adept at hydrology, constructing hundreds of Tarais wherever water storage was possible. The process involved i) locating low-lying areas along creeks or near foothills that can serve as natural basins; and ii) building a half-moon-shaped dam or enclosure made of loose rocks on the side of the river to harvest and store water.

This ancient practice is not just a tradition but a testament to the community's deep understanding of their environment, practice now being revived to address current environmental challenges such as droughts, floods, aquifer depletion, biodiversity and habitat loss, and soil erosion.



- **Drought and flood mitigation:** Tarais help manage the oscillation between droughts and floods by retaining moisture during dry periods and slowing down floodwaters during heavy rains, reducing downstream impacts.
- **Aquifer replenishment:** During floods, an intricate network of hundreds of Tarai structures can slow down flash flood water. When Tarais are full, the water percolates into the soil, replenishing underground aquifers and sustaining groundwater levels.
- **Biodiversity conservation:** Tarais and the surrounding protected land reserved for eternal forests serving as wildlife sanctuaries, providing habitats for regional and migratory species.
- **Soil erosion prevention:** By slowing water flows, Tarais prevent topsoil erosion, preserving the land's fertility.

Preserving and revitalising the Tarai system is not just a local concern but of regional significance. Monsoon rainwater flows from the south-eastern Hindu Kush range

through the Koh Solaiman range, shaping the destinies of people as far as Southern Punjab, Northern Sindh, and Eastern Balochistan in Pakistan. Balochistan has already experienced severe climate change impacts with two cycles of year-long droughts followed by heavy rainfall and flooding. Since Tarais in Koh Solaiman act as a natural barrier against flooding in lower regions, their construction is crucial for sustaining both local ecosystems and broader environmental stability.

Impacts



ECONOMIC

Tarais are inexpensive to build and require minimal maintenance. They strengthen over time and are constructed from locally sourced rocks. Without the need for concrete, they act as a natural filtration system, providing clean water to communities. The mineral-rich water from Tarais supports both domestic use and permaculture. Crops like olives, moringa, grapes, and jujube grown around the Tarai can generate significant income for local

communities. Tarais capture floodwaters and recharge aquifers during droughts, offering a sustainable water supply for communities and the ecosystem without the need for energy supply, unlike tubewells.



ECOLOGICAL

Tarais provide critical habitats for diverse species, serving as sanctuaries for migratory and native birds. Tarais also prevent soil erosion by slowing down hill torrents and play a key role in water conservation.



SOCIAL

Tarais foster communal unity, as they are built and maintained by the entire community, with shared benefits. They provide pure, mineral-rich drinking water and support permaculture, leading to healthier food and improved economic conditions. Unlike borewells and tubewells, which are individually owned, Tarais restore the culture of communal ownerships, reconnect communities with traditional values which has led to preserves this heritage and benefits communities once more.



CLIMATE CHANGE

Tarais effectively mitigate hill torrent flooding and reduce soil erosion, helping to manage the impacts of monsoon rains far beyond the Koh Solaiman region. Restoring Tarais promotes environmentally friendly practices and helps communities adapt to changing conditions. Tarais replenish aquifers, rewild lands, and enhance biodiversity, contributing to greater environmental resilience against climate change.



Key challenges

The unregulated extraction of groundwater through borewells in Koh Solaiman has led to the decline of the indigenous Tarai system, disrupting water absorption and flows, which affects both the alpine ecosystem and downstream areas. Additionally, the indiscriminate use of groundwater poses severe health risks, including exposure to natural radioactivity in the water. Government funding prioritises tubewell projects over traditional water-harvesting structures like Tarais, which has led to a decline in Tarai construction over the past three decades.

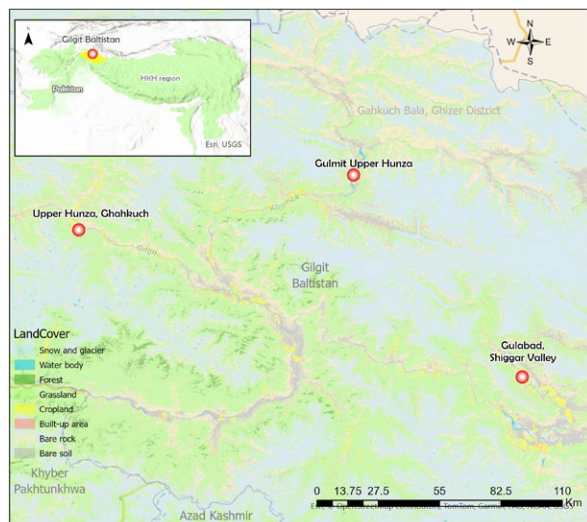
Human interest story

Yogi Kamran, a highly ecoliterate person from the region, stated that “by reviving the Tarai system, we hope to be the first generation in decades to benefit from this ancient practice, inspiring others to restore Tarais and regenerate our ecosystems, tapping into the abundance of our rich land.”

CASE

10

Hydro ram pumps for agriculture and highland pasture development in Gilgit Baltistan, Pakistan



Background

ICIMOD introduced hydro ram pumps in Upper Hunza, Khyber Gojal, in 2017, as part of a larger initiative to irrigate the barren lands along the Hunza River to create green pastures and agricultural opportunities for local communities. The initiative was implemented in partnership with the World Wide Fund for Nature (WWF) in Gilgit Baltistan (GB) under the project “Improvement of Central Karakoram National Park Management System as Model for Mountain Ecosystems in Northern Pakistan”, funded by the United Nations Development Programme (UNDP). With high literacy rates and active participation from both men and women in Hunza, this pilot project was an immediate success. WWF later expanded the technology across several other GB districts. However, the COVID-19 pandemic significantly hindered activities, and the project now faces new challenges posed by climate change.

Hydro ram pumps are specifically designed for hilly areas, where large barren lands along rivers and streams can be irrigated using water from these sources. They are eco-friendly, requiring no electricity or fuel, unlike conventional pumps. These pumps harness the power of flowing water, utilising the ‘water hammer’ effect to convert kinetic energy into high pressure within a pressure cylinder. This pressure lifts small amounts of water to higher elevations. The pump has only two moving parts - an escape valve and a check valve - while the rest of the system remains static. The escape valve regulates water flow, creating momentary pressure that forces water into the pressure cylinder through the check valve. This cycle repeats, enabling continuous water lifting. Hydro ram pumps can be easily integrated with irrigation systems like sprinklers and drip systems.

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Case contributes to





The robust, simple, modular design of the system makes their transportation, installation, and maintenance straightforward, requiring only basic tools and minimal parts, such as nuts, bolts, and rubber washers. Community members are trained on-site to assemble and maintain the pumps. Components can be replaced separately, allowing for upgrades of different parts without compromising the whole structure. The pump's main components are: a pressure cylinder, the main body, a stand with clamps, an escape valve, a check valve, seals, and a splash guard with clamp. Several other components are required for installation, such as pipes, pipe sockets, and a foundation for the pump.

In Gilgit Baltistan, the hydro ram pump, integrated with drip and sprinkler systems, successfully turned steep slopes into green pastures. Encouraged by this, WWF aims to also implement this technology in the Chitral District of Khyber Pakhtunkhwa Province, where similar terrain exists. The barren slopes, prone to erosion and landslides, require stabilisation through vegetation, which can be achieved using hydro ram pumps. Traditional terracing and flood irrigation is costly and unsustainable as it disturbs the natural structure of the slopes. The hydro ram pump with a sprinkler system, on the other hand, offers a cost-effective, sustainable, and easy-to-maintain solution for irrigating slopes with water from nearby streams or springs.

Impacts



ECONOMIC

Ram pumps have a low initial cost compared to traditional electric or diesel pumps, with minimal operating costs due to their simple design and few moving parts. When combined with sprinklers, they distribute water efficiently, reducing waste compared to flood irrigation. This reliable water supply can significantly boost crop yields, creating jobs in farming, processing, and distribution.



ECOLOGICAL

Ram pumps provide consistent water supply, promoting vegetation and tree growth, preserving natural habitats, and supporting local biodiversity. The efficient use of water with sprinklers increases vegetation cover, preventing degradation and soil erosion on slopes. By eliminating the need for fuel, these pumps also reduce environmental pollution. Ultimately, enhanced biodiversity, supported by water and vegetation, positively impacts fragile ecosystems.



SOCIAL

Ram pumps reduce the physical labour required to fetch water, a task often borne by women and children, freeing up time for economic, educational, and other activities. They also foster shared responsibility for sustainable water management and environmental conservation within the community. Additionally, reliable water supply improves nutrition through efficient irrigation and reduces waterborne diseases, like cholera, from stagnant water. These pumps also support indigenous farming techniques and cultural practices that help preserve local flora.



CLIMATE CHANGE

Ram pumps contribute to climate change mitigation, adaptation, and resilience by reducing carbon emissions, stabilising slopes in hilly regions, and promoting sustainable water management. As these pumps do not require external fuel or electricity, they are among the most environmentally friendly and easy-to-maintain systems globally. The focus on developing local skills for installation, operation and maintenance ensures long-term efficacy and sustainability and allows communities to expand these systems to other areas.

Key challenges

Site identification and engaging with local communities is crucial for the successful implementation and sustainability of the project. Working in hilly areas without paved roads presents logistical challenges and the different parts of the system are not always available in these remote areas. The robust, modular design of the system, however, addresses this as it simplifies transport and assembly.



Human interest story

In 2019, Raja Mohammad Aziz from Gahkuch Bala, GB, faced the challenge of stabilising a steep, dry slope near his hilltop home. Rocks and debris frequently slid down the slope, endangering pedestrians on the mountain trail below. Traditional methods of terracing and flood irrigation to grow vegetation on the slope were impossible due to the slope's steepness and lack of nearby water sources.

The solution came with the installation of a hydro ram pump, which lifted water from a stream on the other side of the hill to the top. A sprinkler attached to the pump effectively irrigated the slope, making it possible to grow vegetation. Alfalfa, a perennial fodder for animals, was planted first, quickly transforming the slope into lush greenery within months. Walnut, apricot, and other trees were also planted with minimal effort. The plantation area has since expanded to over 5 acres, successfully stabilising the slope and improving the local environment.

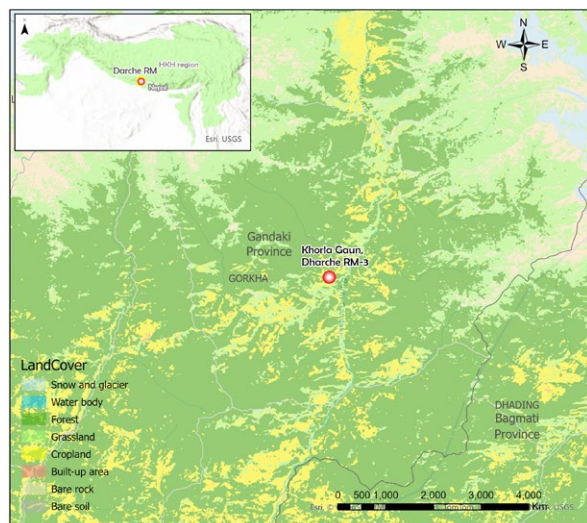
THEME

MULTIPLE BENEFITS OF RANGELANDS

CASE

11

Reviving traditional wild honey hunting methods in Kaski District, Nepal



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Case contributes to



Background

In the Hindu Kush Himalaya (HKH) region, Indigenous Peoples and local communities have long harvested honey from the wild Himalayan cliff bees (*Apis laboriosa*) the world's largest honeybee species, known for building hives on steep, southwest-facing cliffs. The ancient tradition of honey-harvesting, mainly preserved by the Gurung and other ethnic groups, faced significant challenges by the 1990s. Increased tourism and global demand for 'mad honey' had led to a decline in bee populations, threatening traditional honey-hunting practices.

To address the dwindling population of wild cliff bees, ICIMOD, supported by USAID and the Austrian Ministry of Foreign Affairs, launched the, 'Indigenous Honeybees of the Himalayas', programme in 1991. The initiative aimed to develop apiculture and conserve indigenous bee species, empowering hunters to address threats to wild bees, and laying the groundwork for a scientific campaign to conserve *Apis laboriosa*.

The project conducted an in-depth study of wild cliff bees, regional floral resources, and traditional honey-hunting practices in Kaski, Nepal. In Taprang village, where overharvesting had drastically reduced bee numbers, the project focused on preserving the remaining hives through capacity-building exercises for local honey hunters. These efforts raised awareness and developed sustainable conservation strategies, ensuring the continuation of traditional honey hunting in the village. Taprang is one of the few villages in Nepal that continued traditional honey hunting, benefiting both the bees and the local ecosystem. However, the practice is now gradually disappearing due to the declining village population.



Apis laboriosa migrates seasonally, nesting on lower-altitude cliffs in winter and higher altitudes in summer. Traditionally, honey hunting is timed with the bees' seasonal migration. In Seti Valley, Kaski, bees migrate in September, prompting a December harvest before moving to higher altitudes. In Sikles, near Taprang, hunting occurs from May to September, aligned with the bees' arrival and departure cycles.

Honey is usually harvested twice a year, with dates chosen by priests and elders. The indigenous communities only harvest hives after broods have partially or fully emerged and the colony is ready to migrate along the river valleys. The hunters conduct preliminary surveys to choose an optimal harvest time based on the condition of the hives. Colonies lacking crucial nutrients may cease brood

production and face survival challenges. Therefore, it is crucial for honey hunters to allow the bee offspring to mature before harvesting the hives, ensuring the colony's survival and a sustainable honey yield. Certain dates and days of the week are considered auspicious for honey hunting while others are to be avoided.

Honey hunting is rooted in deep-seated beliefs and practices reflecting reverence for nature and local deities. Hunts begin with rituals to appease the cliff gods and a vow to respect and preserve nature's resources. The cliffs used for the hunt are inherited from ancestors. The hunt, lasting 2-3 hours per colony, involves a few experienced hunters descending bamboo ladders without any modern protective gear. They gently wipe the bees away with their hands and cut off portions of the hive with a sharp stick.



Smoke from a fire below calms the bees, allowing the hunters to harvest the honey. They always leave a portion of each comb for the bees to regenerate throughout the year. The harvest is shared among the hunters, with the main climber receiving a double portion.

Apis laboriosa bees forage up to 4100 masl, visiting about 100 different plants for nectar, pollen, and resin. They migrate seasonally, often returning to the same sites, and contribute significantly to the region's ecosystem by pollinating aromatic and medicinal plants. The bees require abundant nectar, water, and pollen to survive – hence their presence indicates a healthy ecosystem.

The red honey they produce is prized for its intoxicating properties. Nepal is the sole exporter of this honey, which is sent to Japan, Korea, and the USA.

Impacts

Reviving traditional honey-hunting practices, particularly those involving *Apis laboriosa* in the Himalayan region, has multifaceted benefits. The approach not only supports the livelihood of honey hunters but also contributes to broader environmental and social goals, making it a sustainable practice with wide-reaching benefits.



ECONOMIC

The revival of traditional honey-hunting methods requires minimal technological input, focusing instead on training and community organisation. This approach is cost-effective and sustainable, allowing communities to reap long-term benefits with relatively low initial investment. By preserving and promoting these traditional methods, communities can secure a sustainable source of income, ensuring financial stability for honey hunters and their families. The unique honey produced is often highly valued, providing an additional economic incentive.



ECOLOGICAL

Apis laboriosa plays a crucial role in the pollination of over 100 plant species across various altitudes. Traditional honey-hunting methods help sustain bee populations, thereby maintaining biodiversity and supporting ecological balance in high-altitude ecosystems such as rangelands and wetlands. Pollination services from healthy bee populations contribute to better plant growth and soil stability. This leads to improved water conservation and reduced soil erosion, benefitting the overall health of the ecosystem.



SOCIAL

Traditional honey hunting is a communal activity that strengthens social ties. Further, reviving traditional honey hunting is a way of preserving indigenous knowledge. Ancient wisdom and techniques continue to be passed down to future generations, helping to maintain the cultural identity of the community. The approach not only preserves but also celebrates indigenous wisdom, ensuring that traditional ecological knowledge is recognised and valued. Additionally, honey from these bees is renowned for its nutritional and medicinal properties, contributing to the health and well-being of the community.



CLIMATE CHANGE

The sustainability of bee populations and their pollination services strengthens the resilience of high-altitude ecosystems. These resilient systems are better able to withstand and adapt to climate change, ensuring the long-term viability of both the environment and the communities that depend on it. Healthy bee populations and robust ecosystems contribute to carbon sequestration, as the diverse plant species they pollinate support vegetation growth. This helps absorb CO₂ from the atmosphere, mitigating the impacts of climate change. Communities practising traditional honey hunting develop adaptive capacities to environmental changes. By maintaining biodiversity and ecosystem health, they create resilient landscapes better equipped to cope with the effects of climate fluctuations.

Key challenges

The rising global demand for honey has led to unsustainable harvesting practices. Indigenous ownership of cliff honey-hunting sites has increasingly shifted to contractors and the government, disrupting traditional management systems and causing overexploitation. Changing temperatures, altered precipitation patterns, and shifts in water availability directly impact the floral resources essential for bee population. Changes in floral phenology (the timing of flowering) affect the availability of nectar and pollen, leading to declines in bee populations. The bees also face threats from parasites and pathogens that can devastate colonies. The introduction of non-native species of bees like *Apis mellifera* (Western honeybee) increases competition for resources, further stressing native bee populations. Additionally, human activities such as tourism, inappropriate harvesting methods and timings, overharvesting, and the use of synthetic materials for lighting fires, which are toxic to bees and the ecosystem, exacerbate the problem. Further, traditional honey-hunting methods are at risk of dying out as younger generations are reluctant to engage in the practice. This threatens both the cultural heritage associated with honey hunting and the long-term sustainability of bee populations.

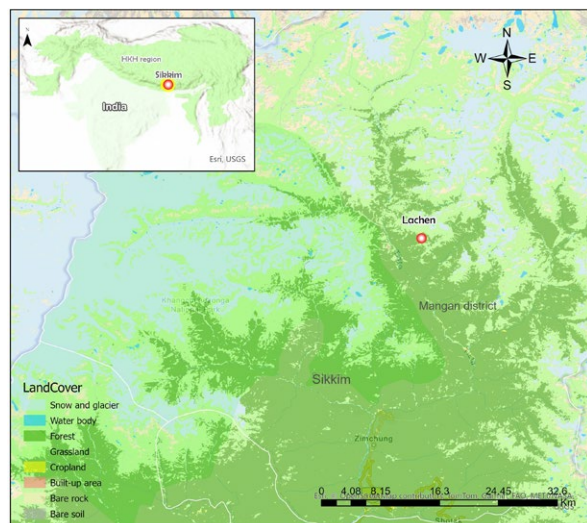
Human interest story

Keshan Gurung from Khorlagaun, Gorkha, Nepal, continues the honey-hunting practices of his ancestors, harvesting honey from cliffs in his remote village. Living in an area with limited job opportunities, Keshan works in construction and hunts honey once or twice a year to supplement his income. However he points out that the earnings from honey hunting are too low considering the high risks of harvesting from cliffs. He also emphasized that the commercialisation of honey hunting, driven by economic needs, is altering the traditional methods that have been passed down through generations. This reality raises concerns about the future of the practice, as economic pressures and the lure of safer, more reliable income sources may drive younger generations away from honey hunting. Keshan's story highlights the delicate balance between preserving cultural heritage and adapting to modern economic realities. It underscores the need for sustainable practices that honour traditional knowledge while ensuring the long-term viability of both the practice and the community.

CASE

12

Lachen's bamboo bottles: Pioneering sustainable tourism in Sikkim, India



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Case contributes to



Background

Lachen, an old heritage town situated at an altitude of 2750 masl in the Eastern Himalayan state of Sikkim, India, is a gateway to the Gurudongmar Lake, the Chopta Valley rangeland, and the Khangchendzonga National Park, a UNESCO World Heritage Site. Lachen has become a sought-after destination, attracting over 200,000 visitors annually, including tourists, trekkers, wildlife enthusiasts and pilgrims. However, this influx of tourists has threatened the area's natural beauty and ecosystem.

Plastic ban

Lachen's popularity brought a surge in plastic waste, especially from packaged water bottles, which accounted for 60 percent of the town's litter. Residents watched helplessly as litter collected in streams and rivers, contaminating drinking water sources, and was spread across the rangeland by grazing yaks.

Despite Sikkim's early ban on plastic use in 1998, plastic pollution remained a significant issue due to poor implementation of the ban. In 2011, Lachen's local authority decided to crack down on plastic waste, leading to a strictly enforced ban on plastic bottles in 2016, followed by restrictions on plastic bags and food wrappers in 2018. The city administration initiated random checks on tourists, taxi drivers, and hotel owners, and introduced fines ranging from Rs. 500-2000 for anyone found carrying plastic bottles. This initiative marked Lachen as potentially the first town in India to ban plastic bottles, and reflects



Lachen receives around

200,000 visitors
annually

the community's commitment to preserving mountain waterbodies, rangeland ecosystems, and sustainable tourism practices.

The initiative has significantly reduced plastic waste in Lachen, protecting the environment and raising awareness among tourists about the harms of plastic. It has also boosted local businesses that manufacture and sell eco-friendly bottles and generate revenue from nature-based sustainable mountain tourism. Overall, the community was satisfied with the successful plastic ban on plastic. The initiative aligns with Sikkim's commitment to sustainability, creating employment opportunities for locals, empowering the mountain communities and fostering the return of migrant youth. Following Lachen's success, neighbouring towns like Lachung and Chungthang have also banned packaged drinking water.

Bamboo bottles

The Lachen Tourism Development Committee (LTDC) and the Dzumsa (local tribal panchayat), driven by the town's youth, collaborated with the World Wide Fund for Nature (WWF) and the Sikkim government to introduce bamboo water bottles as an eco-friendly alternative to plastic bottles. They ordered around 1000 bamboo water bottles from the neighbouring state of Assam to be distributed to tourists as a gesture of hospitality and to promote eco-awareness. The bamboo bottles, sourced locally and featuring the logo of the local yak, were introduced during the Losar festival, a significant cultural event.

Bamboo is a 100 percent biodegradable and eco-friendly material with antibacterial and antifungal properties. It decomposes within three years when buried in soil and is rapidly renewable, making it an ideal sustainable resource. The use of bamboo also supports local economies by promoting cottage industries and generating income for local businesses.



Through its bamboo bottle initiative, Lachen emerged as a pioneer in community-driven sustainable tourism. The initiative exemplifies the power of youth-driven community action in promoting sustainable tourism and environmental stewardship. It serves as a model for other Himalayan destinations and emphasises the importance of eco-friendly practices in preserving natural and cultural heritage. This initiative aligns with the broader goals of creating a cleaner, greener, and more sustainable high-altitude wetlands and rangelands.

Impacts



ECONOMIC

The low-cost, locally made, and eco-friendly bamboo bottles are cost-effective as they replace the significant long-term costs associated with managing plastic waste. The initiative also supports income generation by boosting small local businesses and cottage industries that manufacture bamboo bottles, fostering collaboration with neighbouring states. Market access expands as the unique bamboo bottles attract eco-conscious tourists, opening new opportunities for Lachen's

sustainable tourism market. Furthermore, using renewable and biodegradable materials for the bamboo bottles ensures efficient resource use compared to plastic.



ECOLOGICAL

The initiative contributes to biodiversity conservation by restricting plastic waste, which helps protect the diverse flora and fauna in North Sikkim's unique high-altitude rangelands and lake ecosystems. The elimination of plastic waste also aids soil and water conservation by preventing contamination of soil and water bodies, preserving their quality.



SOCIAL

The bamboo bottle initiative has enhanced community engagement through local participation and ownership. Health and well-being are improved through the use of lab-tested, healthier spring water over packaged water, benefiting both residents and tourists. The bamboo bottles, featuring local symbols, promote and preserve Lachen's cultural and natural heritage, raising

awareness of traditions and the area's rich biodiversity. Additionally, the use of bamboo aligns with indigenous practices and local knowledge, reinforcing cultural identity and sustainable living.



CLIMATE CHANGE

The initiative supports mitigation by reducing plastic waste use, which decreases carbon emissions from plastic production. It also aids in adaptation and resilience, as the community adopts sustainable practices, contributing to a more sustainable and adaptive local economy and ecosystem, ensuring long-term environmental health.

Key challenges

Many tourists and local businesses were initially reluctant to adopt the bamboo bottles, being accustomed to the convenience of plastic bottles. Educating tourists on the importance of eco-friendly alternatives proved to be difficult. Further, Lachen's growing popularity as a tourist destination increases the demand for water bottles, and maintaining a consistent supply of bamboo bottles has been a challenge in the face of rising visitor numbers. Making sure that the bamboo bottles meet quality standards while keeping up with demand requires careful coordination with suppliers and manufacturers. Additionally, shifting to eco-friendly alternatives posed a financial burden on some local businesses, as they had to

invest in bamboo bottles and phase out profitable plastic ones. Finally, effectively enforcing the ban on plastic bottles has required consistent monitoring. This involves frequent checks on tourist vehicles and penalties, which can be difficult to maintain over time.

Sustaining long-term community motivation, especially among the younger generations and non-native business owners, remains critical. Educating tourists and locals alike about the environmental impact of plastic and the cultural significance of the bamboo bottles is an ongoing effort.

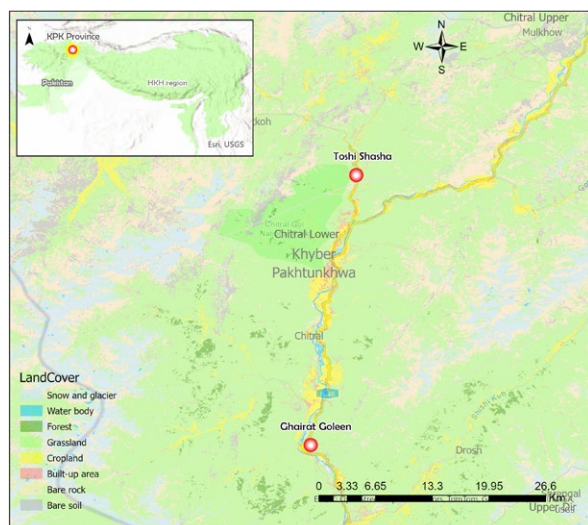
Human interest story

A group of young locals from LTDC shared insights into their journey in managing the bamboo bottle initiative: "We are responsible for preserving both our cultural and natural heritage. Initially, we struggled with waste management and discovered that most of it was packaged drinking water bottles dumped in our rivers and forests. Now, if we find tourists carrying these plastic bottles, the local driver with them gets fined, and we provide the tourists with locally sourced bamboo bottles. Tourists are happy to have one with a picture of a yak. It holds a special cultural significance." Their story exemplifies how community-driven action can preserve local heritage and protect the environment while ensuring that sustainability is integrated into tourism.

CASE

13

Community-based trophy hunting of Kashmir markhor as a sustainable conservation model in Chitral, Pakistan



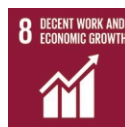
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Case contributes to



Background

This case study presents a community-based trophy hunting programme established to protect the near-threatened Kashmir markhor (*Capra falconeri cashemiriensis*), Pakistan's national animal, in and around Chitral Gol National Park (CGNP). This national park and its buffer zones are a vital habitat for the Markhor, along with other wildlife such as snow leopards, lynx, and Himalayan ibex.

Before the programme's launch, the markhor population in Chitral had drastically declined due to uncontrolled poaching and illegal hunting, with the wildlife department lacking the resources to protect the species effectively. In 1983, the Khyber Pakhtunkhwa Wildlife Department initiated the Chitral Conservation Hunting Programme but it was halted due to a ban on trophy exports. In 1998, the programme was revived, leading to the establishment of the Community Based Trophy Hunting Programme (CBTHP), supported by conservation organisations like WWF-Pakistan and the International Union for Conservation of Nature (IUCN).

The CBTHP established two community-managed conservancies - Toshi Shasha and Ghairat Goleen — adjacent to the Chitral Gol National Park, expanding the protected area and serving as a buffer zone. The structured conservancy management practices have resulted in improved monitoring and anti-poaching measures, significantly reducing illegal activities that once threatened wildlife in the area.



The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) granted Pakistan an annual hunting quota for 12 markhor, with 80 percent of the hunting fees allocated to support local village development and 20 percent going to the government treasury.

A key feature of the CBTHP is community stewardship. The initiative has successfully engaged communities in the management of a protected area, involving them in wildlife monitoring and protection through the establishment of community-managed conservancies. This has helped improve both wildlife habitat conservation and livelihoods in the area. Further, by allocating the majority of hunting fees for community development, the programme introduced an incentive-based system. The revenue from trophy hunting is

From 1998 to 2021, 65 hunts generated

US\$ 4.5 million

with US\$ 3.6 million directed to village conservation committees

reinvested in community development projects like schools and healthcare facilities, uplifting the region socio-economically.

As a result of these efforts, the markhor population in Chitral has shown significant recovery, with reports indicating an increase from a few hundred to several thousand individuals in recent years.

Through community integration, a social development component, and the inclusion of trophy hunting, the CBTHP has addressed challenges such as human-wildlife conflict, financial insecurity, and a lack of trust between the community and rangers. The programme demonstrates that protecting wildlife can lead to both ecological and socio-economic benefits—a win-win for everyone involved. Its success has been globally recognised, providing a model for balancing sustainable wildlife conservation with community wellbeing.

Impacts



ECONOMIC

The CBTHP is highly cost-effective, as it utilises local community involvement to minimise the need for extensive government resources. By training and employing local rangers and community members, who are familiar with the terrain and wildlife, the programme operates with minimal overheads. The programme is also highly resource-efficient, leveraging local knowledge and minimal infrastructure to achieve conservation goals. Between 1998 and 2021, the programme facilitated 65 trophy hunts, generating USD 4.5 million in revenue, with USD 3.64 million allocated directly to community development projects. These funds have created sustainable income streams for local communities, reducing reliance on illegal hunting. However, the revenue generated not only supports local communities but also sustains conservation efforts by providing necessary resources for wildlife departments. A well-structured bidding and outsourcing process, managed by the wildlife department, ensures consistent market access. Both the government and

local people benefit from annual bids for trophy hunting from the international hunting community.



ECOLOGICAL

The CBTHP has greatly contributed to biodiversity conservation by significantly increasing the markhor population, which has grown from a few hundred to several thousand. By protecting key habitats, it has also safeguarded other species such as natural predators like the snow leopard, Eurasian lynx, and grey wolf, helping to preserve the region's overall biodiversity. The programme also plays a crucial role in soil and water conservation through grazing management, rangeland preservation, seed dispersal, and habitat conservation. Further, it helps reduce environmental degradation and pollution by encouraging sustainable land use practices. By engaging communities in conservation efforts, locals are more invested in maintaining the health of their ecosystems. This has led to a shift away from destructive activities such as deforestation and unregulated hunting, positively impacting local air and water quality.



SOCIAL

The programme promotes gender and social inclusion by involving women and marginalised groups in conservation, including in key roles such as rangers. Community development initiatives are designed to benefit women specifically, ensuring equitable distribution of resources. Community engagement is key, with local communities receiving 80% of hunting fees, encouraging active involvement in decision-making, wildlife monitoring, and anti-poaching, fostering a sense of ownership. The programme also improves health and

well-being through projects funded by trophy hunting revenues, such as healthcare facilities and clean water infrastructure, reducing waterborne diseases and enhancing overall health. Finally, markhor conservation, a cultural symbol in Chitral, adds value to local traditions. The programme integrates local cultural practices, involving indigenous communities in conservation management, ensuring efforts are culturally relevant and supported.



CLIMATE CHANGE

The revenue from the trophy hunting programme has allowed mountain communities to make investments in drinking water and irrigation infrastructure, roads, bridges, check dams, healthcare, education facilities, and job creation. These developments strengthen the community's resilience by improving access to essential resources and services.

Key challenges

With shifting norms and a declining interest in trophy hunting, which has been the main revenue source, the long-term sustainability of the programme could be at risk. Alternative models like biodiversity credits, wildlife credits, and wildlife-based tourism integrated with nature-based solutions will be vital for the future.

It is also important to assess how trophy hunting affects markhor population dynamics and structure to ensure there are no negative impacts. Continuous research and monitoring are crucial for the programme's sustainability and its role in conserving the markhor and their habitat. While the economic benefits and their impacts on communities are evident, a closer examination of the social and cultural gains, as well as how funds are allocated for community development is necessary.

Investigating the level of community empowerment and meaningful decision-making power within the conservancies will help clarify the programme's social impact. Finally, exploring alternative livelihood options beyond trophy hunting is essential to diversify income streams and reduce reliance on wildlife revenues.

Human interest story

Muhammad Altaf Ali Shah is a committed conservationist and Manager of the Chitral Gol National Park. Born into the indigenous Roshthey tribe, Altaf has lived in deep connection to the region's pristine habitats. He says he knows every corner of the park and the wildlife in the area, including snow leopards. "Working for wildlife conservation and managing this area is more than just a job, it is a religious service for me – the conservation of nature and the creations of the Almighty," he explained. His deep traditional knowledge and dedication make him an ideal leader for this special wildlife habitat.

Altaf was part of the first research team to confirm the presence of snow leopards in this area, reshaping its conservation strategy. His family was also the first to stop livestock grazing in the park, setting an example for others. As a senior figure respected within the community for his conservation values, he was able to enforce laws and foster collaboration to protect the park and its wildlife. He was instrumental in getting the community to adopt community-based trophy hunting models, which has curbed poaching and the illegal trade of rare species, thereby supporting wildlife conservation. He remains active in annual wildlife censuses and has established 11 nature clubs in local schools to educate children about conservation. He often says, "I am preparing the next generation – those who will inherit this area and set an example of co-existence with nature."

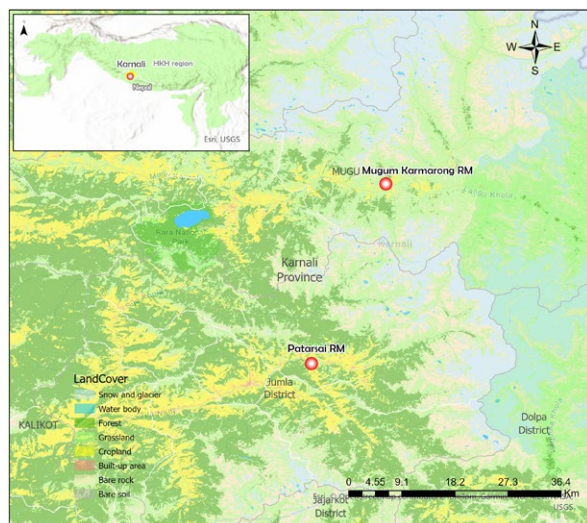


SUSTAINABLE USE OF NATURAL RESOURCES

CASE

14

Supporting local communities to sustainably manage Himalayan wild plants in the alpine meadows of Jumla and Mugu Districts, Nepal



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Case contributes to



Background

Nepal's Himalayan forests and rangelands are rich biodiversity hotspots, home to over 40 key non-timber forest products (NTFPs) like jatamansi (*Nardostachys jatamansi*) and kutki (*Picrorhiza kurroa*), which are vital for the income of rural communities and are traded as medicinal and aromatic plants (MAPs). If conserved and managed well, these wild plants can support both rural incomes and biodiversity. However, overharvesting, forest fires, and uncontrolled grazing threaten forest and rangeland landscapes and their biodiversity. This is largely due to rising international demand for MAPs and poor management. To address this, interventions support local communities in sustainable wild plants management using FairWild certification standards, ensuring responsible harvesting and fair compensation for communities. Through trainings, capacity building, community engagement, and participatory decision-making processes, local stakeholders are empowered in resource management to promote community-based enterprises.

Efforts included training local communities in the sustainable practices of managing Himalayan wild plants, integrating traditional knowledge, and revising Community Forest Operational Plans (CFOPs) in Jumla and Mugu districts. Key gaps, such as the lack of resource inventories and sustainable harvesting methods, were addressed, and MAPs harvesters were registered under a traceable system. The training also covered sustainable forest management, fair pricing, and traceability.

Seventeen CFOPs of Jumla and Mugu were revised, benefitting 5000 harvesters from 950 households. The revised plans incorporated maps of harvesting sites as



well as science-based inventories of MAPs, their total stock, and maximum annual harvest quantity. They also specify good harvesting practices, including instructions on when and how to harvest, dry, and transport MAPs. Certification is a marketing tool to access international markets but it is costly for communities. A bundling approach for certification, combining multiple Community Forest Users Groups (CFUGs), lowers the costs. Local CFUGs now engage MAP harvesters in decision-making, ensuring sustainable harvesting techniques, local ownership of resource management, and equitable access to resources.

Educational campaigns and training session that targets school children, harvesters, leaders, and local communities have been implemented to promote understanding of environmental issues and sustainable practices. They focus on the ecological and economic benefits of sustainable practices and explain sustainable harvesting techniques. Local resource persons (LRPs) have regularly provided such trainings.

Agroforestry and sustainable agricultural practices, such as MAPs cultivation, organic farming, and crop rotation, are reducing pressure on wild plant populations

and rangelands. This approach not only conserves wild plants but also improves food security and income for local farmers. Developing alternative livelihoods, including agroforestry, beekeeping, and MAPs cultivation, has reduced overdependence on rangelands by providing alternative incomes and promoted long-term conservation.

The sustainable management of Himalayan wild plants and rangelands in Jumla and Mugu is a model for balancing conservation with community well-being, setting a strong example for similar initiatives in other regions.

Impacts



ECONOMIC

Implementing sustainable resource management, including FairWild standards, has improved the quality and marketability of MAPs, securing fair prices and economic stability for local communities. Enhanced post-harvest processing has increased product value, while sustainable agricultural

practices like agroforestry and crop rotation have boosted soil fertility and food security. Agroforestry also diversifies livelihoods by providing timber and non-timber forest products, reducing economic vulnerability of forest-dependent communities. In Jumla, MAP harvesters received a FairPrice of NPR 1,650/kg for kutki (compared to the average price of NPR 1,200-1,350/kg), boosting household incomes through sustainable harvesting and FairWild certification. Trade in certified products has increased demand for high-value MAPs.



ECOLOGICAL

Sustainable MAP harvesting and regulated grazing have conserved the biodiversity of alpine meadows by preventing overexploitation and promoting natural regeneration. This helps maintain ecological balance and supports endangered species. Good collection practices and rotational harvesting have improved the health of forests and rangelands by preventing overgrazing, reducing soil erosion, and enhancing water retention.

Local harvesters have adopted organised grazing practices, rotating grazing areas and fully controlling MAP collection zones.



SOCIAL

Community-based resource management has empowered 17 CFUGs and 950 households in fostering social cohesion and equity. MAP sub-groups under the community forest ensure inclusive management practices, benefiting marginalised and vulnerable groups and women. Equitable access to resources and income has strengthened community bonds and reduced disparities. Training and awareness programmes have

built local capacity in sustainable harvesting of MAPs and resource management, fostering a sense of ownership and responsibility for natural resource conservation. Diversified income sources, including MAP cultivation, beekeeping, and eco-tourism have reduced poverty and contributed to improved living standards in Jumla and Mugu districts.



CLIMATE CHANGE

Sustainable practices contribute to climate change mitigation by enhancing carbon sequestration through agroforestry and improved vegetation cover. These practices build resilience in agricultural systems, reducing vulnerability to extreme weather. Sustainable land use has curbed deforestation, soil erosion, and water source depletion, maintaining ecological integrity and securing resources for future generations.

Key challenges

Despite the successes, several challenges persist. Forests and meadows continue to face disturbances from fire, uncontrolled grazing, premature harvesting, and invasive species. Climate change further threatens these ecosystems and the health of livestock. Additionally, limited action research, financial resources, and inadequate infrastructure hinder the full implementation of sustainable practices.

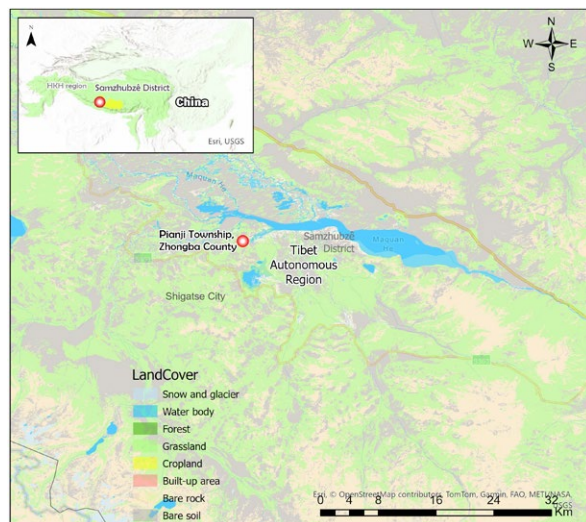
Human interest story

Birkha Bahadur Buda, a 52-year-old harvester and the treasurer of Lamteli CFUG, noted, “FairWild certification increased the value of harvested MAPs and made it easier to find buyers purchasing MAPs at a higher price in the locality.” This helps ensure sustainable resource management in the long run, preserving rangelands and dependent ecosystems.

LOCAL GOVERNANCE, TRADITIONAL AND INDIGENOUS SYSTEMS

15

Co-governance models for Nanmula Wetland restoration and conservation, Tibet Autonomous Region, China



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Case contributes to



Background

The Nanmula Wetland conservation project in Pianji Township, Zhongba County, Tibet Autonomous Region, exemplifies a successful co-governance model that harmonises ecological preservation with community needs. Managed by the People's Procuratorate of Zhongba County, this initiative effectively addresses the environmental damage caused by an artificial canal while engaging local stakeholders in the process.

Facing severe flooding during the monsoon season, the communities near Nanmula Wetland requested the Zhongba County Water Conservancy Bureau in 2019 to construct a dam on Yula Zangbu River with a canal to divert excess water in order to protect their properties and livestock. The county government approved the project, allocating RMB 400,000 from water project funds and an additional RMB 200,000 raised by the village collective. In 2020, a 7,962-metre-long artificial canal was constructed in Pianji Township. This canal successfully diverted water from the Yula Zangbu River to the Maquan River, but inadvertently deprived the Nanmula Wetland in Nanmula Village of its crucial water source.

The Nanmula Wetland spans 7.48 sq. km and is a vital part of the Maquan River Wetland Nature Reserve in the upper reaches of the Yarlung Zangbo River. The wetland supports rich biodiversity, including tens of thousands of birds such as the black-necked crane, bar-headed goose, brown-headed gull, and various wild ducks and waders. The picturesque scenery also attracts many tourists interested in nature. Yet, in 2022, the People's Procuratorate of Zhongba County observed that the construction of the artificial canal had



caused the Nanmula Wetland to dry up. The wetland's water area decreased from 7.48 sq. km to 3.57 sq. km resulting in the destruction of the wetland's natural landscape, drying of surface vegetation, and severe ecological imbalance. The native birds lost their natural habitat for breeding and nesting.

In response, the Procuratorate launched a public interest litigation to address the ecological damage, restore the wetland, and balance the needs of the local community with environmental protection. This effort highlights the importance of effective inter-agency collaboration and community engagement in achieving sustainable conservation outcomes.

The Procuratorate implemented innovative and collaborative strategies to restore the wetland, focusing on data collection, community engagement, and multi-agency cooperation. The restoration process began with a detailed assessment of the damage to the wetland. Using advanced technologies such as drone photography and remote sensing from the Aerospace Information Research Institute of the Chinese Academy of Sciences, the Procuratorate accurately assessed the extent of ecological damage. These high-tech methods ensured precise data collection, essential for devising effective restoration strategies.

Public hearings were held to involve local residents in the conservation process, gathering community input and educating them about wetland conservation and relevant environmental law. Representatives from the local People's Congress, the Chinese People's Political Consultative Conference, village committees, and community members participated. This transparent approach fostered trust and cooperation between the authorities and the community.

Local authorities as well as various experts were involved in developing a comprehensive restoration plan. The Procuratorate worked closely with local authorities, including the Zhongba County Water Conservancy Bureau. The Bureau invited experts to develop solutions to address flood risks after restoring the wetland's water flow. Following field investigation, the experts proposed constructing flood control embankments between Baxiong Village and Nanmula Village. Expert guidance was sought from the Tibet Autonomous Region Procuratorate and the Aerospace Information Research Institute to ensure effective handling of the case. A public interest litigation team was also formed to provide guidance on data methods and other relevant issues.

The restoration activities focused on dismantling the artificial canal to restore the wetland's natural water flow. This process involved extensive engineering work to ensure the wetland received adequate water without causing flooding in nearby areas. Flood embankments were built in strategic locations to mitigate flood risks while allowing the wetland to recover its natural water level. Continuous monitoring was carried out using satellite imagery and ground surveys to track the progress of the restoration efforts. Periodic evaluations were conducted involving community members to ensure the restoration activities align with both ecological goals and community safety. The community was further engaged through workshops, seminars, and volunteer programmes to educate, foster engagement and share updates on the progress made.

By October 2022, the artificial canal was largely dismantled, restoring the wetland to 7.14 sq. km – close to its original size. With increased water levels, the wetland's ecological functions began to recover, supporting the return of native flora and fauna. The project also preserved traditional grazing rights, providing safety and sustainable livelihoods for Tibetan herders.

The Nanmula Wetland conservation project serves as a model for addressing complex environmental challenges through co-governance. By balancing ecological restoration with community needs, this project provides a sustainable blueprint for wetland management that can be adapted to other high-altitude regions with similar ecological and socio-economic conditions. Key elements for successful replication to effectively restore and manage ecological sites include a strong legal framework, integration of advanced technology, community engagement through transparent communication, and inter-agency collaboration.

Impacts



ECONOMIC

The project achieved cost-effectiveness by utilising advanced technologies such as drone photography and remote sensing from the Chinese Academy of Sciences. This reduced labour costs and increased the precision of restoration efforts.



ECOLOGICAL

The project also played a critical role in biodiversity conservation, facilitating the resurgence of native species like the black-necked crane, golden eagle, and Tibetan wild ass. It also helped revive the ecological functions of the wetland, benefiting the Maquan River Wetland Nature Reserve. Additionally, restoring natural water flow improved soil moisture and reduced erosion.



The dismantling of the artificial canal also restored the wetland's filtration process. The wetland now acts as a natural water filter, enhancing water quality and soil health.



SOCIAL

The project promoted gender and social inclusion by ensuring that voices from all segments of the community, including women and marginalised groups, were heard during public hearings. This approach fostered a sense of ownership and responsibility among the community members. Community engagement was further strengthened through workshops and hearings that educated locals on wetland conservation. The restored wetland also contributes to improved public health and well-being by reducing flood risks and enhancing water quality. Moreover, the project respected indigenous practices, preserving the traditional livelihoods of Tibetan herders and embracing culturally appropriate conservation efforts.



CLIMATE CHANGE

The restored wetland acts as a carbon sink, sequestering CO₂ and contributing to climate change mitigation. The increase in vegetation and improved soil health have enhanced carbon absorption and storage. Additionally, the project bolstered community resilience to climate impacts by reducing flood risks and improving water management. The construction of flood embankments and the restored wetland functions now protect the area from extreme weather events, helping regulate water flows and maintain ecological balance. This restoration is vital for sustaining both the ecosystem and the livelihoods of the local community in the face of climate variability.

Key challenges

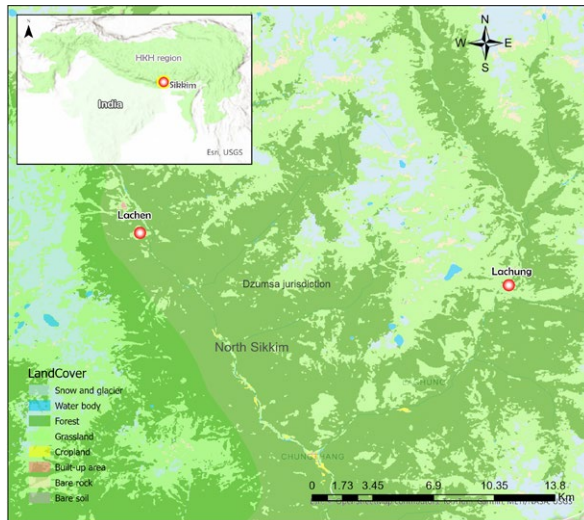
Accurately assessing and monitoring the extent of ecological damage required advanced technology, which was not readily available at the outset of the project. Additionally, effective coordination among various governmental and scientific bodies presented a significant challenge, as successful collaboration was essential but difficult to manage. Another challenge was ensuring active and meaningful community involvement. Addressing the immediate needs and concerns of local residents took considerable effort, as did securing their participation in the restoration process. Resource allocation also posed difficulties, with funding and resources for both the restoration activities and long-term maintenance being limited. Finally, as the first wetland protection case in Shigatse City, there was no legal precedent to follow, requiring innovative legal and procedural approaches to navigate the complexity of the restoration process.

Human interest story

Gesang Wangmu, Deputy Procurator General of the Tibet Autonomous Region Procuratorate, reflected on the challenges and successes of the Namnula Wetland restoration. “As Shigatse City’s first wetland protection case, we faced significant difficulties gathering evidence and applying the law effectively,” she explained. “Coordinating with the Chinese Academy of Sciences for satellite remote sensing technology was crucial. Public hearings with local representatives and villagers were instrumental in securing community support. We also established a unified public interest litigation command system, with coordination across regional, city, and county levels.” Wangmu highlighted the immense satisfaction in seeing the wetland restored and knowing that the case has established a strong precedent for future conservation efforts.

16

The role of Dzumsa, an indigenous governance system, in rangeland management in northern Sikkim, India



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Case contributes to



Background

The high-altitude region of northern Sikkim is an eco-sensitive rangeland, home to glacial lakes and pastures that provide vital ecosystem services. The region is crucial for regulating water and climate patterns and provides habitat for diverse species through carefully managed pastoral practices. The traditional Bhutia herders of Lachen and Lachung, known as the Lachenpa and Lachungpa, practice an indigenous form of self-governance called Dzumsa, which translates to 'village council'. This unique institution enjoys autonomous status as per special provisions in the Indian Constitution and plays a significant role in political, fiscal, cultural, and environmental governance at the local level.

Historically, Dzumsa has regulated community behaviour and ecological and cultural practices in the high-altitude rangelands of northern Sikkim – in particular, the movement of traders and nomads. Its long-established customary conventions have guided decision-making and enforced rules through fines and penalties, regulating environmental governance in northern Sikkim.

Today, Dzumsa continues to exercise control over resource use, fiscal management, and the distribution of government-sponsored schemes. By identifying beneficiaries for employment programmes such as the 'One Family One Job Scheme' and the 'Mahtam Gandhi National Rural Employment Guarantee Act', Dzumsa reduces the community's dependence on limited natural resources, ensuring that at least one family member has a guaranteed income. Fiscal decentralisation has allowed Dzumsa to generate funds by levying fees on



government contracts and commercial activities. During the annual general meeting, audits are conducted and the fiscal surplus is presented to the community. Surplus funds are distributed equally among households within the Dzumsa's jurisdiction. This prevents overexploitation of bioresources like cordyceps, medicinal plants, and juniper as households do not exclusively rely on these resources to generate incomes.

Since the 1962 Sino-Indian border war, rangeland management practices have evolved, with Dzumsa scaling down agro-pastoralism while maintaining a strong sense of ownership over the region's rangeland. Dzumsa now manages the judicious use of limited arable and grazing land at high altitudes, ensuring that families raising cattle or yak or growing food crops follow the rules. It supervises the demarcation of boundaries for grazing activities, the distribution of community land, and sacred groves, and manages the movement of livestock, ensuring that cattle and yaks are grazed in designated pastures at appropriate times. It sets seasonal calendars for both the movement of livestock and the sowing and harvesting crops. The community's knowledge enables herders to identify

the best pastures for grazing and prohibit grazing on degraded pastures, allowing the latter to recover. This system reduces pressures on the land and allows for the rejuvenation of pastures, reflecting the community's historical experience in balancing land use with environmental conservation.

The management of yak herding is important to rangeland sustainability. The region's traditional yak herding community known as the Dokpa, – a small community of around one hundred people – look after the yaks of the Lachenpa people. Unlike in other Himalayan regions, they spend the summer season at lower elevations and move the yaks to high-altitude pastures at the onset of winter. A lower level of snow deposition due to high-velocity winds in high-altitude pastures ensures an abundant supply of dry forage for yaks even during the winter. Designated spring and autumn pastures facilitate the transit from winter to summer grazing lands. Dzumsa determines when yaks can be moved and imposes fines on those moving their livestock earlier or later than the set schedule. Confining yak rearing to the Dokpa community allows the Dzumsa to reduce human pressure on the rangeland. It also



ensures the collective participation of the community in the regulated seasonal movement of yaks. The clear designation of grazing pastures, determined by an indigenous institution of governance, allows the herding community to save livestock from the harsh winter while ensuring the environmental restoration and sustainable management of high-altitude rangelands.

Although Dzumsa is often seen as a traditional institution, its role in managing rangelands is increasingly important, especially in the context of climate change in the Himalayas. This indigenous governance system ensures that rangelands remain productive, even in harsh climates, and supports the broader ecological balance. The institution's stewardship plays a vital role in sustaining the rangeland's ecosystem services. By contributing to carbon storage, biodiversity conservation, water services, and climate adaptation, it ensure the long-term health of both the environment and the community.

Impacts



ECONOMIC

Dzumsa operates as a customary institution with fiscal autonomy, generating funds through fines and fees for development and commercial activities within its jurisdiction. Its role in auditing and distributing surplus funds equally among households fosters resource efficiency. Furthermore, the community can access alternative livelihoods, taking advantage of the region's growing tourism industry, under Dzumsa's guidance.



ECOLOGICAL

Dzumsa has over a century of experience in resource management. Both the declaration of the Khangchendzonga Biosphere Reserve as a UNESCO Biosphere Reserve in 2018 and the recognition of the Khangchendzonga National

Park as a mixed UNESCO World Heritage Site in 2022 acknowledge the natural and cultural significance of Dzumsa for the biosphere reserve. Further, Dzumsa plays a critical role in soil and water conservation, particularly the maintenance of high-altitude wetlands that provide ecosystem services to communities. It also carries out the terracing of steep slopes to prevent soil erosion. Its strict oversight of bioresources, restricting harvesting and polluting activities, protects the environment and its biodiversity.



SOCIAL

While the Dzumsa's traditional structure limits women's roles in leadership, preventing them from assuming the role of the Pipon (a herder elected to lead the community), their participation in resource management and in council meetings reflects an evolving system. The Pিপনs interact with governmental and non-governmental organisations and present the audit of public expenditure to the community. The community is highly engaged, with compulsory attendance at meetings even for high-ranking government officials, ensuring transparency and accountability in governance. Agro-pastoralism within the Dzumsa system promotes self-sufficiency, leading to better health outcomes due to practising organic subsistence farming. Culturally, Dzumsa protects sacred sites and has opposed large-scale dam projects to preserve the spiritual significance of the rangelands. As an indigenous institution, Dzumsa's customary mandate, authority, and responsibility regulate the community's behaviour and influences attitudes and opinions.



CLIMATE CHANGE

Dzumsa has actively pursued mitigation strategies through sustainable pasture management and oversight of bioresources, as well as afforestation and zero-waste initiatives. These efforts have reduced environmental degradation caused by human activities inside the Dzumsa's jurisdiction and contributed to carbon sequestration. The community has adapted to climate change by reducing sheep rearing in favour of yak herding, a more resilient practice. To ensure the preservation of sheep, Dzumsa has regulated their price and slaughter and allowed sheep rearing in smaller numbers. Moreover, the institution plays a vital role in disaster preparedness, as demonstrated by its response to the glacial lake outburst flood in 2023 played a crucial role in restoring connectivity and supporting recovery efforts in Lachen and facilitated the movement of tourists and livestock cut off by the flood on behalf of state institutions.

Key challenges

Increased military presence in the region due to the ongoing India-China border conflict since the 1962 border war has placed Dzumsa under surveillance as its jurisdiction clashes with the military's demarcation of camps which limits the movement of civilians in the borderlands. Many sites considered sacred by Dzumsa became inaccessible for the community. This has sparked conflicts between the military and the Dzumsa over the ownership of rangelands. Additionally, linguistic shifts are gradually altering Dzumsa's customary practices, eroding traditional governance. Environmental changes, such as GLOF have resulted in the loss of pastures, compounding the challenges faced by the community.

The dwindling Dokpa population, traditionally responsible for yak herding, has weakened community reliance on rangeland conservation. Meanwhile, the surge in mass tourism has intensified pressures on the fragile rangeland ecosystem. Additionally, the centralising tendencies of the state have begun to challenge the Dzumsa's autonomy, threatening its ability to manage resources and maintain its unique governance system.

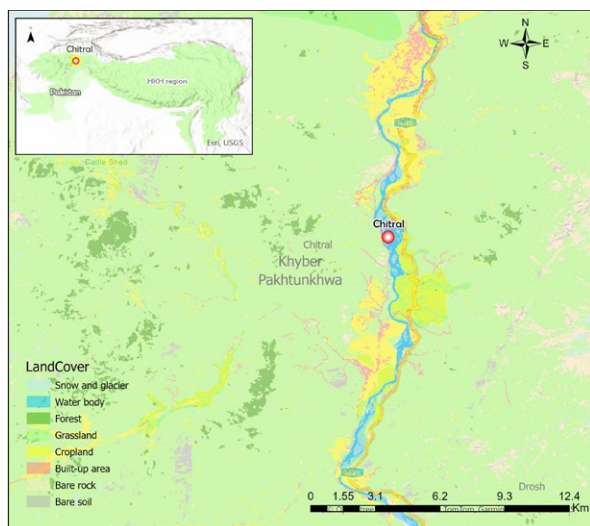
Human interest story

Sangay Lachenpa noted that since October 2023, Lachen and much of northern Sikkim have remained cut off from the rest of the country due to the GLOF at Lhonak Lake, which falls under Dzumsa jurisdiction. He criticised the apathy and lack of response from government agencies tasked with rebuilding and restoring connectivity. In contrast, he highlighted how “Dzumsa has been at the forefront of restoring connectivity to neighbouring areas”.

Lachenpa explained that the flood swept away prime pastures which will affect livestock rearing. He feared that “livestock may migrate on their own in search of fodder, thereby inviting penalties from Dzumsa.” He emphasised the inherent “disaster preparedness of Dzumsa” which allowed the community to host stranded tourists and build temporary bridges using local materials to facilitate their passage out of the area.

17

The Saaq system: The role of local institutions for sustainable grazing and fuelwood collection in Chitral, Pakistan



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Background

Chitral is a remote region in the Hindu Kush and Karakoram mountains, covering about 14,850 km². Around 62% of this area consist of sparsely vegetated rangelands. Upper and Lower Chitral together include 373,600 hectares (ha) of grazing lands, primarily alpine and sub-alpine scrub (269,400 ha), alpine pastures (57,600 ha), and low-yield subtropical and temperate grazing land. About 70,045 ha of forested area is also used for grazing. These lands provide vital ecosystem services to communities in Chitral and beyond.

The local community has long relied on rangeland resources, rooted in strong traditional systems for rangeland management. Historical accounts reveal that, for centuries, communities managed rangelands through systems that regulated communal grazing rights through rotational grazing and the equitable distribution of grazing areas among communities or clans, preventing over-exploitation. However, after the autonomous princely state of Chitral merged with Pakistan in 1969, these practices declined as national laws took precedence. In the 1980s, communities in northern Pakistan, particularly in Chitral, were encouraged to revive their traditional systems by NGOs that recognised their value for communal and sustainable rangeland management.

Case contributes to



Local communities in Chitral had faced numerous challenges in managing rangeland resources, particularly fuelwood collection and overgrazing. In response, they developed a unique system called Saaq, which restricts fuelwood collection through customary rules. This system was strengthened by participatory NGO initiatives in the 1980s as well as by the establishment of village-level



institutions such as Village Development Societies during the same period. It combines traditional practices with modern conservation principles and has enhanced community participation in, and awareness of, sustainable management practices. The Saaq system operates under village-level institutions. Establishing and strengthening formal village-level institutions, along with raising awareness, gave local communities a strong voice in recognising the importance of traditional practices and deepened their support for the Saaq system in their areas.

The Saaq system has been instrumental in regulating rangeland resource management to help address disagreements about resource use. For instance, local communities raised concerns about the unsustainable use of rangelands by nomadic Gujjur herders, who graze both local and non-local livestock on community-owned grazing lands, exacerbating resource depletion. Additionally, the fact that certain community members were using rangeland resources more extensively than others also caused some tensions. This compelled the local community to implement a community-

managed grazing system (Sosiri) where a community representative serves as shepherd on a rotational basis. In some areas, the number of livestock Gujjars can bring for grazing was also fixed. The Saaq system, alongside the community-managed grazing model (Sosiri system), allows for better control of livestock numbers and grazing practices. By integrating traditional practices with modern conservation principles, these systems ensure that local needs are met without disturbing the ecological balance of the rangelands.

In the Saaq system, an assessment of the rangelands is conducted by a local community expert at the start of the grazing season. The rangelands are categorised by available resources – for instance whether the area has dense grasses, locally called gabaroonk, or fewer grasses. Villagers are then advised to use specific rangelands for predetermined periods and to rotate grazing on the remaining lands. Through extensive awareness programmes and engagement, communities are sensitised to the prevailing threats to the rangeland and to proper management practices. Realising the

impacts of unsustainable practices, adherence to the Saaq system's restrictions for fuelwood collection has improved significantly in most rangelands in Chitral. In villages prone to climate-induced disasters, the assessment advises the community to remain vigilant during the monsoon season, sharing information about potential flood risks.

Local institutions are active in enforcing the Saaq system, under the leadership of community elders. The system actively monitors and enforces rangeland management rules, resolving disputes and applying penalties for violations. This approach promotes shared responsibility, a sense of ownership, and loyalty to nature, showcasing the strength of traditional governance in managing natural resources effectively.

Impacts



ECONOMIC

The community-led inclusive Saaq system has provided numerous benefits to communities in upland and lowland Chitral and beyond. It efficiently supplies communities with sustainable resources and is cost-effective, as its management relies on voluntary contributions from the community. By promoting sustainable rangeland use, the system reduces the need to relocate livestock to other areas and ensures the steady local supply of fodder. It supports income generation through the collection of medicinal plants, livestock production, and improved market access for local goods.



ECOLOGICAL

The Saaq system helps conserve the region's unique biodiversity, enhances soil health and carbon sequestration, improves water infiltration, and mitigates

pollution in watersheds. These services contribute to the well-being of downstream communities and beyond.



SOCIAL

Inclusivity is a key feature of the Saaq system, with women actively engaged in its implementation. As such, it helps alleviate some of the burdens face by women-headed households in Chitral. Ongoing discussions within the community help maintain and strengthen the system, fostering greater community engagement. The Saaq system preserves the long-standing tradition of communal land management, regulating and preserving local resources through a community-led mechanism. While the practice is traditional and based on indigenous governance systems, it also embraces new scientific knowledge and innovations to conserve rangelands and their resources.



CLIMATE CHANGE

In the context of climate change, the Saaq system promotes ecosystem-based adaptation (EbA), strengthening the resilience of rangeland ecosystems to cope with unpredictable climate events. It improves the overall resilience of rangelands to continue to meet the needs of the local community.

Key challenges

The Saaq system faces several challenges, including climate change-induced extreme events, which are a major concern. In a changing world where livelihood needs are evolving, local communities are less focused on managing and conserving rangeland resources than before. Households without livestock or those less reliant on rangeland are often less likely to engage with the Saaq



system and follow its protocols. Additionally, younger generations are increasingly using rangelands for picnics and recreational activities, which may negatively impact these ecosystems.

Human interest story

There are several compelling stories associated with the Saaq system, which has been practiced in marginalised communities that historically struggled to meet their basic needs. For example, the Gujjar nomadic herdsmen initially operated under agreed-upon rules. They took livestock for grazing and households provided wheat bread (aunar) to them on a rotational basis. However, in some villages, the Gujjars began making additional demands, including for cash and non-food items. This led villagers to switch to the locally-managed Sosiri system where households rotate to provide shepherds that take the livestock to the rangelands for grazing.

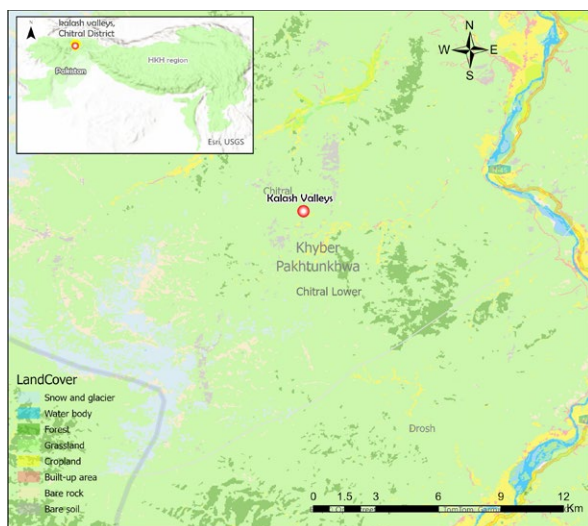
The Saaq system is strictly enforced when someone violates the rules. In cases where individuals do not follow the rules and regulations that the community had agreed on, village elders order that an animal

belonging to the violator, often an ox, be slaughtered, and the meat distributed among the community. Such actions reinforce compliance and significantly improve rangeland management, strengthening the authority of local institutions. “Using rangeland for youth picnics, sports events, and exhibitions must be discouraged, and violators should be dealt accordingly. Community ownership of the Saaq system ensures sustainable availability of rangeland resources throughout the year. The government needs to encourage local communities to sustain the Saaq system and must arrange some incentives by providing cheap energy sources like subsidised natural gas” said Ghazi Khan of Parwak, Upper Chitral.

“The Saaq system should be strengthened with rigorous information, and scientific knowledge and technology should be integrated to address climate change issues. A weather and climate advisory system or early warning system for climatic events should be made accessible to local communities to reduce damages to their livestock and property,” added Ghulam of Reshun from Upper Chitral.

18

The Dane system: A traditional approach to sustainable rangeland management in Chitral, Pakistan



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Case contributes to



Background

The Dane System for rangeland management is a community-based approach practised by the Kalash people in the Kalash Valleys of Pakistan. It revolves around the identification and protection of specific rangeland areas to allow for natural regeneration, ensuring the sustainability of crucial resources. The process begins with the identification of rangeland areas to be designated as Dane areas, based on a decision made by the local Dane committee. These areas are typically chosen based on assessment of overgrazing, deforestation, and degeneration, among other factors. The selection process involves consultations within the community to ensure consensus.

Once identified, these Dane areas are protected for a specified period, usually ranging from five to ten years. During this time, strict rules are enforced to prevent grazing and utilisation, allowing for the natural regeneration of plant species. The enforcement of Dane rules is overseen by the Aouray committee, which consists of 11-15 members nominated by individual villages and hamlets. The Aouray committee plays a crucial role in the management and enforcement of the Dane system. Members are selected based on their knowledge of the local environment and their commitment to preserving Kalash culture. They are responsible for setting fines and penalties for offenders, which may include fines per goat, and for the enforcement of strict prohibitions on fuelwood and fodder use and grazing in Dane areas.



Community participation is essential for the success of the Dane system. Villagers actively monitor the designated Dane areas to ensure compliance with the rules and regulations. Regular patrols are conducted to deter violators, and any infractions are reported to the Aouray committee for appropriate action.

The fines imposed by the Aouray committee serve as a deterrent against future violations and contribute to the maintenance of the system. In cases of repeated violations or egregious offences, the local community may resort to social sanctions against the offender, involving widespread disapproval from community members, leading to non-acceptance and isolation of the violator within the community.

The Dane system demonstrates adaptability to local conditions and needs. While the basic principles remain consistent, the implementation may vary from one valley to another based on ecological factors, cultural

norms, and community preferences. This flexibility allows for necessary adjustments, ensuring the continued effectiveness of the system over time.

Over the years, the Dane system has proven successful in achieving its objectives. Rangeland regeneration has led to increased availability of forage for livestock, reduced incidences of flash floods, and improved overall ecosystem stability. The system has also contributed to the conservation of biodiversity, positively impacting bird species and hare populations. The sustainability of the Dane system lies in its community-led approach, which fosters a sense of ownership and responsibility among the Kalash people for managing their natural resources.

The Dane system offers a replicable model for sustainable rangeland management in similar contexts worldwide. Key components, such as community involvement, clear rules and enforcement mechanisms, and adaptation to local conditions, can be adapted and implemented

in other communities facing similar challenges. By empowering local communities to take ownership of their natural resources, the Dane system demonstrates the potential for scalable solutions to environmental conservation and cultural preservation.

Usually, the area covered by a Dane system spans between 60-100 hectares. Since this is a community-based practice, there is no need for physical fences to demarcate the area. Instead, social fencing is employed, relying on the mutual agreement and cooperation of community members to enforce boundaries and ensure that animals do not enter protected or restricted areas. To keep track of and manage the animals within a Dane system, the community establishes a set of rules and guidelines, with the community collectively responsible for monitoring and maintaining order. This collaborative approach helps ensure that the animals are properly managed and that the designated area is protected from further degradation and deforestation.

Impacts



ECONOMIC

The Dane System for rangeland management is a low-cost, high-return approach, leveraging community structures and indigenous knowledge to restore rangelands. Its main investment is in the cost-effective volunteer-based Aouray committee. Improved rangelands lead to increased livestock productivity, higher milk yields, and healthier and heavier animals due to access to better-quality grazing lands. This in turn, raises incomes for local communities. Additionally, the system supports the increased production of NTFPs like herbs, fruits, and nuts. By increasing the quality and quantity of livestock and NTFPs, community members are given

opportunities to access new markets and demand higher prices, boosting household incomes and economic well-being.

The Dane system promotes efficient resources use, ensuring sustained benefits for the community by preserving the ecological integrity of the area. By protecting specific rangeland areas from overgrazing and exploitation, the system allows vegetation to regenerate naturally, leading to improved soil health, water retention, and overall ecosystem resilience. This efficient utilisation of resources not only supports the economic activities of the Kalash people but also protects their ecosystems, contributing to long-term sustainability.



ECOLOGICAL

The Dane system plays a significant role in conserving biodiversity within the Kalash Valleys. By protecting specific rangeland areas, the system has allowed vegetation to regenerate naturally, creating diverse habitats for various plant and animal species. The regenerating rangelands have supported a wide array of plant species, including native grasses, shrubs, and trees, which in turn attract diverse fauna, including birds, insects, and small mammals. This conservation of biodiversity helps maintain the ecological balance of the region, safeguarding the Kalash people's cultural and natural heritage.

The system also promotes soil and water conservation. Increased vegetation stabilises the soil, preventing erosion caused by wind and water, reducing the risk of flash floods during heavy rainfall, and improving water retention in the soil. Additionally, the regenerating rangelands enhance soil fertility by trapping and cycling nutrients, leading



to improved soil structure and productivity. These soil conservation measures not only enhance agricultural productivity but also contribute to the overall health of the ecosystem by protecting water sources and reducing sedimentation in streams and rivers.

Additionally, the system lowers pollution by reducing human-induced disturbances. Overall, it has supported a cleaner and healthier environment. Reduced grazing pressure and regeneration of vegetation contribute to improved air quality by sequestering carbon dioxide and filtering airborne pollutants. Protection of water sources from contamination and sedimentation has helped to maintain water quality, ensuring access to clean and safe drinking water for both humans and livestock.



SOCIAL

The Dane system fosters gender equality and social inclusion by involving both men and women in decision-making processes and actively engaging them in monitoring and enforcing rules. Women, who traditionally play a significant role in livestock management, gain a voice in rangeland resource use, contributing to their empowerment and agency within the community.

Community engagement is key, with members given plenty of opportunities to voice their opinions, share knowledge, and contribute to decisions, fostering a sense of ownership and responsibility for the management of natural resources. This collaborative approach strengthens social bonds and cohesion. The system also improves community health by ensuring nutritious forage for livestock and

protecting clean water sources, contributing to household food security and reducing the risk of disease. The sense of pride and connection to the land fostered by the Dane system also contributes to the mental and emotional well-being of community members.

Finally, it plays a crucial role in cultural preservation, safeguarding traditional Kalash practices and knowledge tied to rangeland management. The system values and incorporates indigenous approaches to resource stewardship, rooted in centuries-old customs and beliefs, ensuring that these cultural traditions are passed down to future generations. By protecting the natural environment and the resources essential for traditional rituals and festivals, the Dane system helps maintain the unique cultural identity of the Kalash community in the face of external pressures and modernisation. Moreover, the system serves as a model for integrating indigenous knowledge into modern conservation strategies, demonstrating the effectiveness of community-led approaches to environmental stewardship.



CLIMATE CHANGE

The Dane System aids both mitigation and adaptation efforts. It promotes climate resilience by addressing both ecological and social dimensions of vulnerability of Kalash communities. By restoring rangelands, it sequesters carbon and reduces methane emissions from livestock. Regenerated ecosystems provide critical ecosystem services, including soil stabilisation and water retention, helping the community adapt to climatic changes like erratic rainfall and extreme weather events. They also allow communities to maintain their livelihoods

in the face of environmental challenges. The enhanced resilience of both the ecosystem and the community translates into increased food security, water availability, and economic stability for the Kalash people, reducing their vulnerability to climate-induced shocks and fostering long-term sustainability through adaptive capacity and social cohesion.

Key challenges

The key challenges and issues faced by the Dane system include resistance to change, enforcement difficulties, and external pressures on resources. Some community members may resist implementing new practices due to cultural inertia or scepticism. Enforcement of Dane rules can be challenging, requiring continuous monitoring and social pressure. External factors such as population growth, tourism, and climate change also pose threats to rangeland sustainability. Overcoming these challenges requires ongoing community engagement, capacity building, and adaptation of the system to changing environmental and social dynamics.

Human interest story

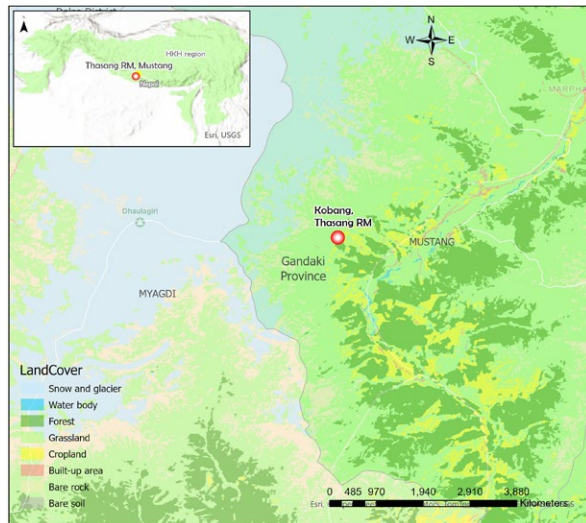
Community members appreciate the positive impacts of the Dane system on their rangelands and daily lives. "I used to oppose the Dane system because I had livestock to graze on the nearby hillside," said Irfan Kalash. "But after three years, viewing the Dane results, I am very much pleased and am sorry for my past attitude. The Dane has done a marvellous job."

"Today the oak forests in the valley are quite stable, and flash floods have reduced to almost zero," Irfan continued. "Thanks to Dane, we are again having pigeons, doves, chakoor (chukar partridge), and hares back in our forest. I was dying to listen to their merry songs."

CASE

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Community-based insurance schemes for yak herders in Mustang, Nepal



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Case contributes to



Background

Mustang, situated in Gandaki Province in northern Nepal, spans the Himalayas and extends into the Tibetan plateau. As one of Nepal's most remote districts, it has a sparse population. Agriculture and animal husbandry are the main sources of livelihoods in this district. Yaks play a crucial role in Mustang's economy and ecosystem. According to government records for the Nepali fiscal year 2077/78 (2020/2021) (Livestock Statistics of Nepal, Ministry of Agriculture and Livestock Development), Mustang's yak population was 3,873 then. More recent data gathered by the District Veterinary and Livestock Service Office in June 2024, indicate a total of 4,500 yak, nak, and chauri (yak-cattle hybrids) in Mustang.

Yak husbandry is a significant part of life in Mustang, providing the local community with income through the sale of milk and various yak products, including hides, hair, fur, bones, and ornamental items. Yak herders in the district have organised collectively to foster sustainable farming practices and address challenges related to their livelihoods. A major development in Mustang has been the creation of a unique insurance mechanism for yak herders, which emerged through local efforts and government policies.

In line with the federal government's initiative to offer insurance services to all communities, Neco Insurance Company began implementing an insurance programme in 2021 specifically for yak and chauri herders. This programme insured each yak without requiring premium payments, with coverage amounts ranging from NPR 40,000 to NPR 120,000. The insurance cost was primarily covered by the federal government (80%), with contributions

from the Annapurna Conservation Area Project (ACAP) (12%), and the insurance company (5% as a service charge). Consequently, herders benefitted from this scheme at no cost. One local, Sojan Hirachan, insured 39 yak and chauri for a total amount of NPR 2.68 million under this programme.

In the following year, the scheme continued with similar financial arrangements, with the federal government covering 80 percent and ACAP increasing its share to 12.5 percent. The full insured amount was paid to herders regardless of the cause of loss, ensuring ease and effectiveness of the insurance scheme. Following the local election, the coverage arrangement was again modified. The federal government continued to provide 80 percent, while the remaining 20 percent was covered by the local municipality, replacing ACAP's contribution. This arrangement remains in effect until today. The total funding allocated to the insurance schemes between 2021 and 2022 ranged from NPR 45 to 50 million.

The claim process is straightforward and community-driven. Documentation is handled by the local (Himalayan Chauri Palan and Samrachhyan Committee), which collects evidence, such as photos and videos, of any incidents. The case is then reported to the insurance company with an application and supporting documents. Verification begins with recommendations from the ward office and the municipal livestock service department, requiring confirmation from five local witnesses. Once the documents, including the animal's tag number and photographic evidence, are submitted, the insurance company assesses the claim and pays 96 percent of the insured amount within one or two months.

While ACAP no longer contributes to general insurance, it still provides compensation of up to NPR 65,000 if wild animals kill a yak or chauri. This additional support ensures that herders receive fair compensation, even in cases of wild animal attacks, safeguarding their livelihoods and promoting the continued sustainability of yak herding in Mustang.



Impacts



ECOLOGICAL

The community-based insurance scheme for yak herders in Mustang has significant positive impacts on biodiversity conservation. One key aspect is the financial incentive it creates for wildlife protection.

With ACAP compensating herders for livestock losses caused by attacks by wild animals there is a reduced likelihood of retaliatory actions against predators like snow leopards. This helps minimise human-wildlife conflicts, ensuring predators are not harmed as herders do not feel the need to protect their animals by killing wildlife. The scheme also enhances community awareness about biodiversity. Through collaboration with conservation projects like ACAP, herders gain a deeper understanding of the

importance of biodiversity and preserving ecosystems. The scheme also contributes to soil and water conservation. By offering financial security, herders can manage their herds more sustainably, reducing overgrazing, which in turn helps prevent soil erosion and land degradation. The protection of water resources is another benefit of the scheme. Sustainable grazing practices contribute to the preservation of water catchment areas, allowing vegetation cover to enhance water infiltration and reduce surface runoff.



SOCIAL

The community-based insurance scheme promotes gender and social inclusion by empowering women and marginalised groups. By reducing the economic risks of yak husbandry, women can take on more active roles, engage in decision-making, and even assume leadership positions in this traditionally male-dominated sector. The scheme also ensures equitable access to insurance benefits for all yak herders, including those from marginalised communities, thus fostering inclusion and reducing disparities. Local committees, like the Himalayan Chauri Palan and Samrachhyan Committee, encourage collaboration among yak herders and fosters a shared sense responsibility, strengthening community bonds. This participatory approach ensures that the voices of all community members are heard in decision-making processes and their needs are addressed. This promotes transparency and trust within the community.

In terms of health and well-being, the insurance scheme promotes economic stability, reducing stress and anxiety for yak herders. The financial security allows families to improve

their nutrition and health by investing in better food and healthcare. The enhanced income also enables greater access to medical services.

Culturally, the scheme plays a vital role in preserving traditional livelihoods and indigenous knowledge. By safeguarding yak husbandry, a key part of Mustang's cultural heritage, it helps maintain traditional practices and ensures these skills are passed down through generations. Economic stability allows families to continue participating in cultural and religious activities linked to yak herding, thereby preserving the cultural fabric of the community.



CLIMATE CHANGE

The community-based insurance scheme for yak herders in Mustang contributes to climate change mitigation by encouraging sustainable grazing practices, which maintain healthy grasslands that act as carbon sinks, sequestering carbon dioxide from the atmosphere. It also helps reduce deforestation by providing herders with economic stability, thus reducing the need for additional grazing land. Moreover, the scheme supports environmentally-friendly practices like composting and the use of organic feed, which lower the carbon footprint of yak farming.

The insurance scheme enhances the herders' resilience by offering financial protection against livestock loss which enables herders to diversify their livelihoods. The scheme also promotes better resource management, allowing herders to adopt water conservation techniques and other adaptive measures in response to changing climatic conditions. Additionally, by fostering collaboration and providing training, the scheme equips herders with the tools, knowledge, and systems needed to monitor and respond to climate challenges.

Key Challenges

The community-based insurance scheme has faced several challenges, primarily financial sustainability and administrative efficiency. The scheme relies heavily on government funding, making it vulnerable to policy changes or budget constraints. To ensure long-term viability, the financial model may need diversification through private sector involvement or international aid. Additionally, the verification of claims requires efficient coordination between different local committees, government offices and insurance companies, which can be logistically challenging. The claim process can also be complex and burdensome, particularly for herders with limited literacy or access to administrative resources, often leading to delays and frustration.

Geographical barriers and social inclusion also pose significant challenges. Remote herders may struggle to access the scheme, while marginalised groups, including women, may not fully benefit due to social norms and biases. Low levels of awareness and education further hinder the scheme's effectiveness, with some herders misunderstanding the processes or mistrusting the system. Climate variability, environmental degradation, and technological barriers also threaten the scheme's sustainability. The limited technological infrastructure in remote areas hinders the efficient processing of claims and insurance pay-outs, reducing the overall efficiency of the scheme. Herders may also not be familiar with new technology and reluctant to adopt it. Effective coordination between stakeholders and consistent policies across government levels are crucial for addressing these challenges and ensuring the scheme's success.

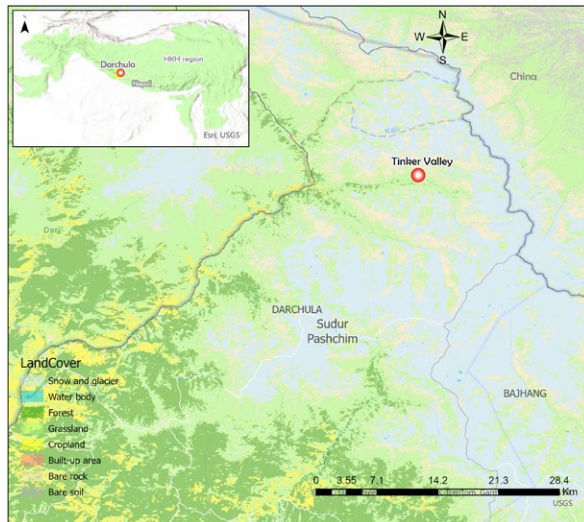
Human interest story

In the remote Thasang Rural Municipality of Mustang, the livelihood of families like Sushila Gauchan's depends on yak and chauri husbandry. A year ago, Sushila faced a devastating avalanche that killed 17 of her chauri, dealing a severe emotional and financial blow. These animals provided essential resources like milk and meat, crucial for her family's survival. After the tragedy, only seven of the affected animals could be found, making it difficult to document the full extent of the loss. With the support of the local Himalayan Chauri Palan and Samrachhyan Committee, Sushila gathered the necessary documentation, including recommendations from the ward office and livestock officer, as well as witness confirmations, to submit a claim to the insurance company.

Despite challenges, Sushila's persisted and the insurance company eventually provided a payout of NPR 396,000, helping her family recover from the disaster. Her success inspired many in her community to adopt the policy because they now recognised the value of insurance as a vital safety net for herders. Sushila's story highlights the importance of insurance in safeguarding livelihoods in remote and vulnerable regions.

Today, the community in Thasang Rural Municipality is more resilient and prepared for future uncertainties. The adoption of the insurance scheme has increased significantly, providing a safety net for many families. In a region where the harsh environment often dictates the terms of life, stories like Sushila Gauchan's offer hope and a model for resilience, demonstrating that with the right support and resources, communities can overcome many challenges.

Empowering youth for sustainable rangeland management: Yak farming in Darchula, Nepal



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Case contributes to



Background

Yak farming is vital for the livelihoods of high mountain residents in Nepal, with around 69,000 yaks and chauri (yak-cattle hybrids) across high-altitude areas of 28 districts where transhumant pastoralism is practised. Generally, yaks thrive in the high Himalayas, providing milk, meat, and wool, and serving as pack animals. However, herdsman, especially young people, are increasingly reluctant to keep these animals due to limited pastures, grazing restrictions, and low incentives, instead shifting towards tourism and porter work. Improved rangeland management is needed to support this traditional livelihood, especially by engaging younger community members.

To ensure that yak farming in the Tinker Valley of Darchula continues, the ‘Tata Yak Tatha Chauri Paalak Krishak Samuha’ was officially registered as an organisation in mid-2023. This organisation now plays a crucial role in maintaining indigenous and transhumance knowledge. It comprises 25 members, including 13 women, complying with the government’s requirement of at least 33 percent female representation in such committees. It aims to increase yak numbers and researches better market opportunities to move beyond the informal local pricing. While traditional methods and materials are still in use, there is potential for upgrading without drastic changes to herders’ practices.

Tata Yak Tatha Chauri Paalak Krishak Samuha was established by Jaspal Budhathoki whose family is one of the last in the area to still practice yak farming.

Despite being well educated and with opportunities to pursue a life abroad, Budhathoki chose to remain in his community, dedicated to preserve his heritage and continuing the practice of sustainable yak farming. This commitment reflects his passion for preserving local traditions and contributing to the local economy, ecological sustainability, and cultural heritage.

Several key steps are needed to continue and further implement sustainable yak farming practices. First, improving transportation infrastructure is crucial, starting with road access that facilitates the seasonal migration to and from Tinker Valley. This enhancement will ease the transportation of yak products to markets. Secondly, organising training programmes on modern husbandry techniques, veterinary care, and sustainable land management will equip herders with necessary skills. There should also be a focus on developing high-value products like yak milk, wool, and meat, along with establishing strong marketing channels for ethical yak products. Forming partnerships with public agencies, non-profit organisations, and private investors can provide valuable resources and support. Finally, promoting yak farming through various media platforms will raise awareness of its importance.

To proceed with these implementations, effective coordination with authorities responsible for navigating rough terrains is needed to facilitate road connections. Additionally, product development should emphasise quality and sustainability in the production of high-value yak products. Building marketing channels through partnerships will help establish market connections and secure funding. Sustainable land management practices, such as rotating grazing areas, will ensure the ecological sustainability of rangelands by increasing vegetation cover and preventing soil erosion. Promoting yak products as sustainable, ethically sourced goods will attract environmentally conscious consumers, while media engagement will showcase the cultural heritage and unique qualities of Darchula's yak products to broader audiences.



The practice of yak herding in Darchula, Nepal, showcases significant potential for replicability and scalability. Budhathoki's commitment to sustaining indigenous yak herding knowledge and practices serves as a strong foundation and example for expansion. By leveraging community engagement and local expertise, this initiative can be replicated in similar high-altitude regions across the Himalayas, highlighting youth leadership in the region. Scalability can further be achieved through improved rangeland management, support for fellow herders, and the promotion of sustainable grazing practices. With adequate investment and policy support, yak herding can preserve cultural heritage while enhancing economic stability and environmental sustainability in high mountain areas.

Impacts



ECONOMIC

By creating high-value products such as yak milk, and wool, the practice generates significant income for local communities. The yak milk produced is consumed within the community, while the wool is sold and distributed, allowing the practice of knitting to continue in the community. Developing strong marketing channels and partnerships facilitates market access for yak products, ensuring that they reach environmentally conscious consumers willing to pay a premium for sustainable goods.



ECOLOGICAL

Yak manure is rich in nutrients and replenishes soil health. The manure excreted before, during, and after the migration adds vital nutrition to the soil. Implementing rotational grazing and maintaining vegetation cover aids in soil and water conservation, preventing erosion and preserving water sources. Sustainable yak farming practices help maintain the natural biodiversity of rangelands by preventing overgrazing and promoting the growth of native vegetation. Additionally, ethical and sustainable farming practices minimise the use of chemical inputs, thereby reducing pollution and maintaining the ecological balance of the rangelands.



SOCIAL

The project encourages the involvement of all community members, including women and youth, promoting social inclusion and gender equity. Approximately 80 percent of members are youth, and around 50 percent are women. As the practice of yak herding is nearly dying, extensive training and engagement

from the government institution ensure that local knowledge and skills are preserved and utilised, engaging the community and fostering a sense of ownership and participation among members. By promoting traditional yak farming practices, the project helps preserve the cultural heritage of the Byansi indigenous community, maintaining their identity and customs. Additionally, it supports the indigenous practice of seasonal migration.



CLIMATE CHANGE

Sustainable yak farming practices contribute to climate change mitigation by maintaining healthy ecosystems that act as carbon sinks, reducing greenhouse gas emissions. The practice of yak herding enhances the climate resilience of the community by diversifying income sources and promoting sustainable land management, which reduces vulnerability to climate-related shocks.

Key challenges

The lack of transportation and accessible roads for yak herds poses significant challenges for seasonal migration. Previously, there was good road access to and from Tinker Valley, which made the transport of yaks much easier and safer. However, over the past decade, the road conditions have deteriorated, increasing the risk of accidents and losses for herders. A local respondent noted, “The Panchayat time was better for us. We were prioritised by the government and had better roads and other services.”

There has also been a change in the composition of rangeland grasses, with new invasive species emerging that are outcompeting native species and negatively impacting grazing practices as yaks favour native species. Inadequate training programmes on climate-related issues exacerbate the situation, as yak farming



faces challenges such as slow reproduction rates and susceptibility to various cattle diseases. Rising temperatures and unpredictable precipitation patterns have heightened these threats, leading many villagers to reconsider their involvement in yak farming.

Moreover, there is a lack of proper markets with fair value for yak products. While items like milk, manure, and wool are considered high-value, the meat is not consumed in Darchula, unlike in other regions like Manang and Mustang. There is a pressing need to reassess and appropriately price these products to reflect their true worth, ensuring that herders receive fair compensation for their efforts.

Human interest story

“I do not want our ancestral practice to become obsolete. I want to make my parents proud. I understand its significance and aim to demonstrate its profitability to convince others to engage in this business,” said Jaspal Budhathoki who envisions a successful yak farming practice for the Byansi community in Darchula.

Krishna Singh Budhathoki, who owns a local wool shop, stressed the possibilities of creating job opportunities through animal husbandry, especially yak husbandry, as it provides the widest range of products. He is hopeful that it would provide more materials for the wool trade. Yak husbandry has a wide range of beneficiaries with the potential for multiplier effects in society. The whole community benefits directly or indirectly, in the form of food or increased incomes..

ICIMOD and its Regional Member Countries gratefully acknowledge the generous support of Austria, Norway, Sweden and Switzerland for core and programme funding, and the Adaptation Fund, Aerospace Information Research Institute of the Chinese Academy of Sciences, Asian Development Bank, Australia, Canada's International Development Research Centre, Carleton University, Finland, Germany, Global Affairs Canada, Global Biodiversity Information Facility, Japan's Sasakawa Peace Foundation, Oxfam Novib, the United Kingdom, United Nations Environment Programme, United Nations Development Programme, and the World Bank Group for project funding. ICIMOD and its Regional Member Countries gratefully acknowledge the generous support of Austria, Norway, Sweden and Switzerland for core and programme funding, and the Adaptation Fund, Aerospace Information Research Institute of the Chinese Academy of Sciences, Asian Development Bank, Australia, Canada's International Development Research Centre, Carleton University, Finland, Germany, Global Affairs Canada, Global Biodiversity Information Facility, Japan's Sasakawa Peace Foundation, Oxfam Novib, the United Kingdom, United Nations Environment Programme, United Nations Development Programme, and the World Bank Group for project funding.