

# Mountain Biodiversity Conservation and Management

Selected examples of good practices  
and lessons learned from the  
Hindu Kush Himalayan region



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The International Centre for Integrated Mountain Development, ICIMOD, is a regional knowledge development and learning centre serving the eight regional member countries of the Hindu Kush Himalayas – Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan – and based in Kathmandu, Nepal. Globalisation and climate change have an increasing influence on the stability of fragile mountain ecosystems and the livelihoods of mountain people. ICIMOD aims to assist mountain people to understand these changes, adapt to them, and make the most of new opportunities, while addressing upstream-downstream issues. We support regional transboundary programmes through partnership with regional partner institutions, facilitate the exchange of experience, and serve as a regional knowledge hub. We strengthen networking among regional and global centres of excellence. Overall, we are working to develop an economically and environmentally sound mountain ecosystem to improve the living standards of mountain populations and to sustain vital ecosystem services for the billions of people living downstream – now, and for the future.



# Mountain Biodiversity Conservation and Management

Selected examples of good practices and lessons  
learned from the Hindu Kush Himalayan region

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# Foreword

In the International Year of Biodiversity 2010, the International Centre for Integrated Mountain Development (ICIMOD) called for case studies from the Hindu Kush Himalayan region on initiatives dealing with mountain biodiversity with a focus on success stories. Twenty-eight case studies were received from most countries in the region. Based on criteria such as content, relevance, and analysis, a panel of ICIMOD experts consisting of Dr. Rajan Kotru, Dr Giridhar Kinhal, Dr Nakul Chettri, and Ms Bandana Shakya awarded prizes to four case studies:

- 'Enhancing conservation and livelihood security in biodiversity hotspots', by Shristi Kamal, Suman K Rai, and Kamaljit S Bawa
- 'Linkages between the Akas and their forests: An analysis of problems and prospects for sustainable development', by Gibji Nimachow
- 'Afghanistan's Pastoral Engagement, Adaptation, and Capacity Enhancement (PEACE) Project', by Michael J Jacobs
- 'Community-based biodiversity conservation in North East India', by Vincent Darlong

The panel also cited for 'Special Mention' the case study 'Countries, communities, and conservation: Building cooperation in Kangchenjunga', by Molly Clark-Barol and Karma Bhutia.

This publication contains 15 case studies selected by the panel. The case studies provide a glimpse of the kind of mountain biodiversity initiatives implemented in the Hindu Kush Himalayas. While these initiatives may not be representative of the region as a whole, owing to the small sample size, they are broad in scale and scope, ranging from the protection and conservation of endangered species (such as the snow leopard, *Acer pentaphyllum*, and Himalayan golden mahseer) to integrated approaches to conservation, transboundary and otherwise, that link livelihoods with the sustainable use of biodiversity resources. While virtually all mountain biodiversity initiatives documented in this publication emphasise community involvement, a few have also leveraged local institutions and indigenous knowledge systems, blending them with scientific knowledge to find a way forward.

Most case studies capture good practices that can be replicated and scaled up, as well as lessons learned, thereby contributing to the Programme of Work on Mountain Biodiversity adopted by the Conference of the Parties to the Convention on Biological Diversity.

It is hoped that this publication will spark the interest of relevant stakeholders and motivate them to revisit critical and emerging mountain biodiversity issues facing the region in the run up to the 11th Meeting of the Conference of the Parties to the Convention on Biological Diversity in India in 2012.

**Wu Ning**

Programme Manager

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# Acronyms and Abbreviations

ATREE	Ashoka Trust for Research in Ecology and the Environment
CBD	Convention on Biological Diversity
CoP	Conference of the Parties
ICIMOD	International Centre for Integrated Mountain Development
IFAD	International Fund for Agricultural Development
INHERE	Institute of Himalayan Environmental Research and Education
MAP	Medicinal and aromatic plant
NaRMG	Natural resource management group
NERCORMP	North Eastern Region Community Resource Management Project for Upland Areas
NISTADS	National Institute of Science, Technology and Development Studies
PPI	People and Plants Initiative
SLC IT	Snow Leopard Conservancy India Trust
TMI	The Mountain Institute
USAID	United States Agency for International Development
WCS	Wildlife Conservation Society
WWF	World Wildlife Fund for Nature

# Introduction

— Sunita Chaudhary and Nakul Chettri

Mountains occupy 24 per cent of the global land surface and directly support 12 per cent of the world's population who live within mountain regions (GTOS 2008; Sharma et al. 2010). One-fifth of humankind derives a vast array of services from mountains including water, energy, timber, biodiversity maintenance, and opportunities for recreation and spiritual renewal. Mountains fulfil the freshwater needs of more than half of humanity and are regarded as important water storage towers. Their ecological, aesthetic, and socioeconomic significance is not only relevant to the people living in them, but also to those living downstream and beyond. Mountains harbour an extremely high level of biological diversity, which is the result of the compression of climatic zones with altitude and the diversity of small-scale habitats produced by varied topoclimates. Mountains contain half of the world's 34 biodiversity hotspots with a diverse array of species, habitat types, and ecological conditions. At the centre of endemism, genetic diversity, and agro-diversity, mountains are ethno-culturally rich and home to distinct human communities (CBD 2011). However, mountain ecosystems are among the most fragile in the world and are under severe threat from climate change, urbanisation, invasive alien species, and other anthropogenic changes. Species with narrow ecotone ranges and high altitude ecosystems are highly vulnerable. Nonetheless, because of their topographic diversity and bio-cultural richness, mountains have always been a place of survival and provide opportunities for climate change adaptation (Caprez et. al 2010).

Considering the vulnerability of mountain biodiversity and its importance in maintaining the global environment and supporting economic, cultural, and social sectors, the global community recognised the value of mountains at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992 and the World Summit on Sustainable Development (WSSD) in Johannesburg in 2002. In 2004, the 7th Meeting of the Conference of the Parties (COP-7) to the Convention on Biological Diversity (CBD) adopted the Programme of Work on Mountain Biodiversity (PoW-MB) as Decision VII/27 in Kuala Lumpur, Malaysia. The goal of the PoW-MB was to significantly reduce mountain biological diversity loss by 2010 at global, regional, and national levels through the conservation, sustainable use, and fair and equitable sharing of benefits of biological resources. The ecosystem approach is given special emphasis in the PoW-MB to contribute to poverty reduction and benefit indigenous and local mountain communities. The COP-10 held in Nagoya, Japan in October 2010 further strengthened the PoW-MB by setting up the new Strategic Plan for Biodiversity 2011–2020, which addresses the drivers of mountain biodiversity loss and emphasises efforts to safeguard and restore mountain biological diversity and related ecosystem services, given their potential to contribute to climate change mitigation and adaptation.

The Hindu Kush Himalayas, ICIMOD's working area, is one such mountain region that is significantly rich in biodiversity. This region contains highly diverse and important eco-regions and is rich in gene pools, species, and ecosystems of global importance, which are facing threats from environmental and human-induced drivers of change. Unsustainable land use practices and a lack of incentives for local communities to conserve biodiversity and water resources are contributing to species extinction and habitat degradation, leading to unsustainable development in the region (Sharma and Yonzon 2005; Sharma et al. 2010). Because of ecological fragility and economic marginality, the Hindu Kush Himalayas, particularly the eastern Himalayas, are vulnerable to climate change. Biodiversity across all systems (terrestrial and freshwater) and levels (genetic, species, and ecosystem) is undergoing a major transformation, thus altering the condition of biodiversity, flow of ecosystem services downstream, and wellbeing of the people (Tse-ring et al. 2010).

However, the Hindu Kush Himalayan countries – Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan – are parties to the CBD and have been recently showing more commitment to conservation (Chettri et al. 2008). These countries have started taking action for the conservation, sustainable use, and benefit sharing of biological diversity (Desai et al. 2010). In recent years, the focus of such action has been shifting from flagship species to livelihoods-based landscape conservation. Today, conservation efforts are more participatory

with a decentralised governance approach that empowers local communities in biodiversity management. People-oriented conservation and development approaches are currently being practised in many parts of the Hindu Kush Himalayan region (Sharma et al. 2010).

The decision on mountain biodiversity adopted at COP-10 encourages national governments and relevant organisations to share good practices on the conservation and management of biological resources (CBD 2010). In line with this, and to capture the recent conservation efforts in the Hindu Kush Himalayan region, ICIMOD initiated a process of collecting and documenting initiatives, lessons learned, and success stories on mountain biodiversity as a contribution to the International Year of Biodiversity 2010. These case studies highlight the need to enhance conservation and secure livelihoods through the promotion of community-based biodiversity conservation and the sustainable use of natural resources. They also provide a basis for developing a regional approach for effective biodiversity management in the Hindu Kush Himalayan region. Through this publication, ICIMOD aims to share good practices and lessons learned with decision makers and practitioners for uptake in the region and beyond.

The publication is divided into six thematic sections. The first section, 'Protection and conservation of species at risk', highlights threats to different plant and animal species and looks at a number of conservation approaches and initiatives for the protection of endangered species in the region. The next section, 'Integrated approach to biodiversity conservation', focuses on multidisciplinary or integrated approaches to conservation and livelihood security at the community and landscape level through local and regional cooperation. This is followed by 'Agrobiodiversity conservation', which emphasises the promotion of organic farming through value chain development, and the use of local crops, seeds, and cultivars instead of modern high-yielding seeds and chemical fertilisers. 'Capacity building for natural resource management' highlights the importance of building the capacity of local and national bodies for effective natural resource management. 'Conservation based on indigenous knowledge and customary practices' accentuates the value of indigenous knowledge and practices for biodiversity conservation and local livelihoods. The last thematic section on 'Innovation' brings to light some pioneering conservation techniques and their multiple benefits for forest ecosystem preservation and soil conservation. Finally, some take home messages are distilled and presented in the conclusion.

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Theme I  
Protection and  
Conservation of  
Species at Risk

# Save and Protect the Precious and Endangered Plant *Acer pentaphyllum*

— Lu Rongsen

The Chengdu Institute of Biology, Chinese Academy of Sciences, with a grant from the World Wildlife Fund for Nature (WWF), implemented the project 'Save Precious and Endangered Plant *Acer pentaphyllum* and Protect its Population' in the Hengduan Mountains of China from April 2009 to February 2010.



*Acer pentaphyllum* on the steep slopes of the Hengduan Mountains



A training course in Mono village, Kangding, Sichuan

## Problem

*Acer pentaphyllum* is perhaps the rarest maple species in the wild. A perennial deciduous tree, it has serrated five-lobed leaves that turn orange and red in autumn. This maple species was first discovered in 1929 by the Austrian natural historian Joseph Rock in Muli, Sichuan, China and later introduced abroad. It is much sought after as an ornamental plant. There have been many attempts to estimate the total population of *Acer pentaphyllum* growing in the wild in China, but only 100 or so trees were found. Its population has dwindled over the years because of overgrazing and the felling of trees for firewood by local farmers. Furthermore, infrastructure development projects such as roads and hydropower stations continue to pose serious risks to the survival of *Acer pentaphyllum*. According to the criteria set by the International Union for Conservation of Nature (IUCN), *Acer pentaphyllum* is an extremely endangered species on the verge of extinction.

## General approach

*Acer pentaphyllum* is found on the steep slopes of the Hengduan Mountains along a tributary of the Yalongjiang River. A hydropower station is under construction nearby. In order to sensitise local farmers to the importance of *Acer pentaphyllum*, a small training was held. An inventory of *Acer pentaphyllum* trees was then made to convince the local authority to ensure their survival. With the information gathered, and the support of the community, a dialogue was initiated with the hydropower company to convince it of the importance of protecting *Acer*

*pentaphyllum*. A baseline survey is necessary to find out if any other populations exist in the area and to understand why this species has become endangered.

## Outcomes

Working together with the villagers and the local Forestry Bureau of Jiulong county, an inventory of *Acer pentaphyllum* was made. A total of 198 trees were identified and a number was put on each trunk for monitoring purposes. A group of villagers was formed to take responsibility for protecting the trees. A farmer who lives near the site was chosen to set up a small nursery where more than 100 seedlings were raised; these seedlings were planted at the site. The survival rate of the seedlings was about 50 per cent. The Forestry Bureau provided some funds to the nursery (USD 180 per year).

The government of Jiulong went to a lot of effort to convince the hydropower company to modify its plan to build a big hydropower station just under the site where the *Acer pentaphyllum* grows. The company planned to excavate a large cave on the *Acer pentaphyllum* site and all trees within the site were in danger of being destroyed. After a series of consultations, the company agreed to move the excavation site 100 metres, costing the company USD 150,000. Thus, the 198 trees were saved from destruction.

With the help of the Forestry Bureau and township government, a one-day training course was conducted in the village. Fifteen villagers, including 10 Tibetans, were trained in the conservation of *Acer pentaphyllum*. After the training, all of the trainees expressed a desire to protect these rare and precious trees.

A search was conducted to discover new sites of *Acer pentaphyllum* along a tributary of the Yalongjiang River in Kangding county. About 12 adult trees, 80–100 years old, were found, taking the total number of trees found in the area to 210. Despite this, the species is still in a precarious situation.

## Good practice

- Best results are obtained when scientists work together with the local government and forestry authority to implement biodiversity conservation and protection programmes.
- Mobilising local farmers to participate is key to success.

## Lessons learned

- A long-term biodiversity protection plan, with benefits accruing to farmers taking responsibility for the protection of species, is needed otherwise they may not have sufficient incentives to guarantee protection.
- To reverse mountain biodiversity loss owing to natural or anthropogenic factors, it is necessary to establish a mechanism of dialogue among the stakeholders.

## Contact

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## Resources

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# Ex-situ Breeding Performance Using Pond-Reared Broods of Endangered Himalayan Golden Mahseer (*Tor putitora*) in Nepal

— Tek Bahadur Gurung and Arun Prasad Baidya

The Nepal Agricultural Research Council (NARC) has successfully implemented a project on 'Ex-situ breeding performance using pond reared broods of endangered *Pisces Tor putitora*' in various fish farms in Nepal including in Pokhara (Kaski district), Trishuli (Nuwakot district), and Beltari (Syangja district).



Himalayan golden mahseer (*Tor putitora*)



Fish hatchery

## Problem

*Tor putitora*, commonly known as Himalayan golden mahseer, is renowned because of its large size, sparkling golden body colour, and unique sport-fish fighting capabilities. A full-grown fish can weigh hundreds of pounds. The fish is found in large rivers and lakes in the Hindu Kush Himalayas from Afghanistan to Myanmar. However, in the last few decades, the population of golden mahseer has declined alarmingly because of the physical alteration of natural rivers and lakes by dams and barrages; the destruction of breeding grounds; and environmental pollution. Overfishing is another factor in its decline in the natural environment. While several countries declared the golden mahseer to be endangered, its conservation posed a challenge as its ex-situ breeding method was a mystery for a long time.

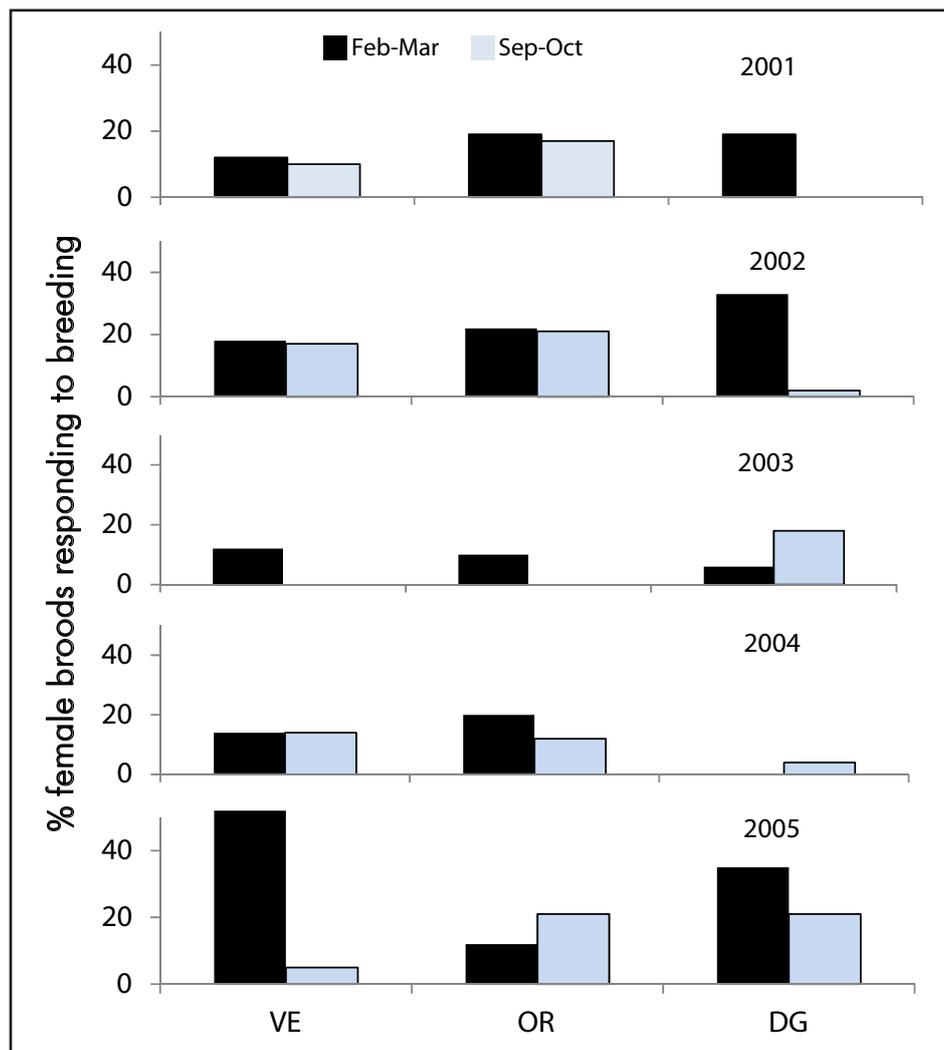
## General approach

The Nepal Agricultural Research Council undertook several initiatives for the conservation of *Tor putitora* including campaigning against non-conventional fishing methods (such as the use of dynamite and electric currents) and awareness raising programmes involving women in the conservation of golden mahseer in their natural habitat. As an experiment, *Tor putitora* were collected from rivers and reared in fish farms until maturity for ex-situ breeding. The study of ex-situ breeding methods in hatcheries using pond reared broods was led by the lead author of this case

study. Prior to this study, it was believed that golden mahseer could not attain sexual maturity in captive ponds, as their natural habitat is large torrential rivers.

## Outcomes

The breeding programme successfully bred *Tor putitora* in ponds for the first time in Nepal. It was discovered that mahseer can attain sexual maturity in captivity in experimental ponds 1 metre deep and 500 square metres in area, such as those established in Begnas lake, Kaski district. Captive fish can also be bred at least twice a year, in February/March and September/October when the water temperature reaches 18–19°C (Figure 1).



**Figure 1: Percentage of female broods reared in pond environment responding to breeding in February/March and September/October**

Note: VE = viable egg; OR = overripe egg; DG = degenerate egg

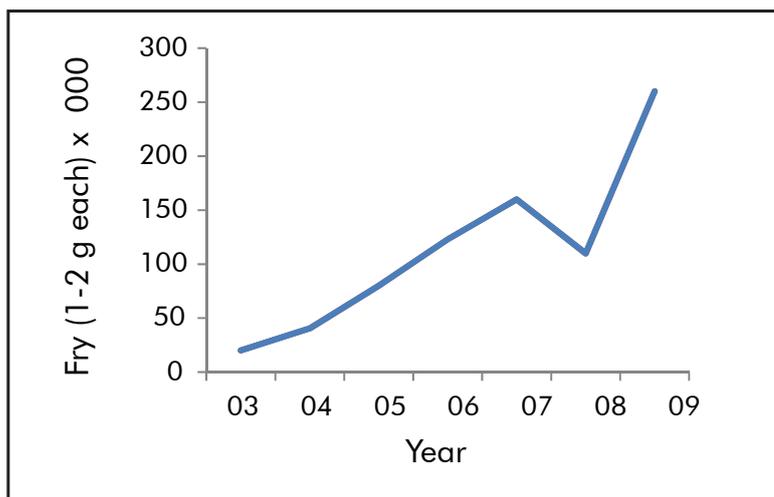
This discovery led to the production of fry in desirable quantities. Using this technology, fish farms can now produce millions of fry annually to restock rivers, lakes, and ponds with declining populations of mahseer.

Today, rearing *Tor putitora* in ponds is a standard practice of the Fisheries Research Stations in Pokhara, and Trishuli, and the Fish Hatchery of the Kali Gandaki Hydropower Station in Syangja. With the scaling up of technology, the Kali Gandaki Fish Hatchery alone produces a million fry every year (Figure 2). This technology has helped restore mahseer populations in the rivers and lakes of the Nepal Himalayas to some extent, thereby enhancing

the livelihoods of the mountain and hill communities dependent on fishing. It has also opened up the opportunity to promote sport fishing of golden mahseer in Himalayan waters, for which anglers are prepared to pay good money, some of which can be used for conservation and community development.

## Good practice

- The ex-situ breeding method developed in Nepal can be replicated in other parts of the Hindu Kush Himalayas to promote the conservation of the mahseer in the Himalayan waters.



**Figure 2: Number of fry produced from pond reared *Tor putitora* broods in Kali Gandaki Fish Hatchery, Nepal**

## Lesson learned

- It was long assumed that the golden mahseer could not breed in captivity, as it preferred torrential river waters. The NARC team proved this assumption wrong. This shows that scientists must be willing to test assumptions as well as experiment.

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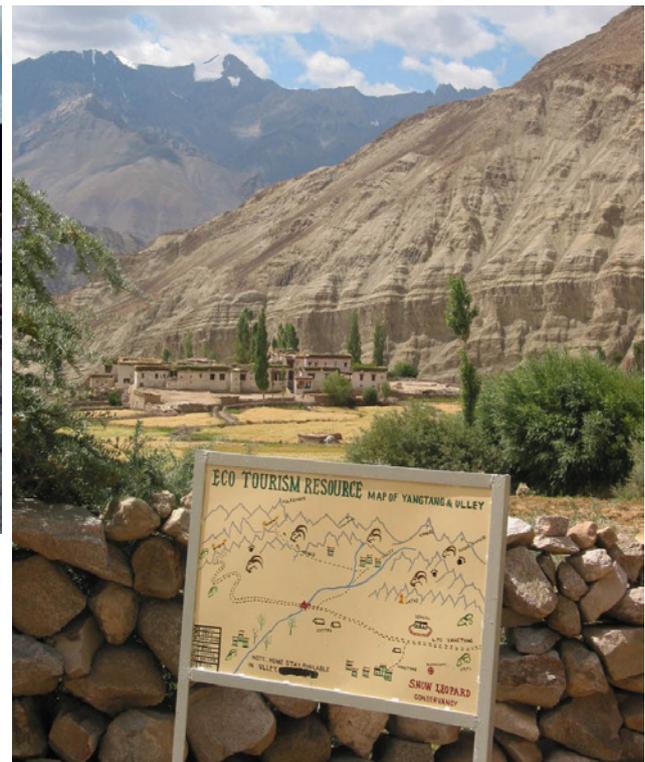
# Snow Leopards and Himalayan Homestays: Catalysts for Community-Based Conservation in Ladakh

— Wendy Brewer Lama, Rodney Jackson and Rinchen Wangchuk

The Snow Leopard Conservancy India Trust (SLC IT) is a pioneer in snow leopard conservation through innovative community-based approaches. Since 2001, with support from the Snow Leopard Conservancy USA, The Mountain Institute (TMI), United Nations Educational, Scientific, and Cultural Organization (UNESCO), the departments of Wildlife Protection and Tourism (Government of Jammu and Kashmir), and Ladakh Ecological Development Group (LEDeG), SLC IT has been promoting Himalayan homestay tourism in Ladakh in the northwestern Indian Himalayas for the conservation of the snow leopard on an ecosystem scale. The involvement of the mountain community is at the heart of this ongoing conservation initiative.



The mystical snow leopard



Homestay ecotourism in Ladakh

## Problem

The endangered snow leopard (*Panthera uncia*) is perhaps the world's most elusive and charismatic large felid, serving as a flagship species for mountain biodiversity. It persists in naturally low numbers, totalling 4,500 to 7,500. Inhabiting mountainous regions at elevations of 3,000 to 5,000 metres and above in the Himalayas and Tibetan Plateau (and as low as 600 metres in Russia and Mongolia), its habitat is among the least productive of the world's rangelands because of low temperatures, high aridity, and harsh climatic conditions. With naturally low numbers of wildlife as prey, snow leopards often kill livestock, thus bringing them into conflict with herders.

## General approach

The Snow Leopard Conservancy used a two-pronged approach in Ladakh to resolve human-wildlife conflict and encourage the protection of snow leopards. The first step, which emerged from planning meetings that involved the majority of village households, centred on predator-proofing the most vulnerable night-time livestock corrals. Villagers contributed materials and labour and the Snow Leopard Conservancy provided technical support and funds for materials. All livestock owners signed an agreement to protect snow leopards and other wildlife, and to keep their livestock numbers within reasonable limits. They were also encouraged to improve daytime guarding practices, and, where possible, to set aside areas for wild ungulates to access forage. However, losses to predators cannot be completely eliminated on the open range.

The second step was aimed at reducing adverse economic impacts flowing from protecting the snow leopard by enhancing the income-generating capacities of households living in prime snow leopard habitats, such as the Hemis National Park, Sham Valley, and Zaskar Valley. Villagers chose homestays and wildlife tourism as activities that would give value to the conservation of snow leopards and generate supplementary household income. Micro-enterprises such as eco-café managed by local women's groups, solar showers, and nature guide training programmes were initiated to complement the homestay programme. The benefits of tourism and external investment were spread widely through the rotation of homestay visitors and tented eco-café duties among participating households.

## Outcomes

- The homestay programme currently benefits over 100 households in 20 communities in Ladakh-Zaskar and 40 households located in prime snow leopard habitat. The average income earned by homestay households in the Sham Valley was approximately USD 752 (Indian rupees 33,862) in 2007, USD 988 (Indian rupees 44,480) in 2008, and USD 1,201 (Indian rupees 54,080) in 2009; and in Hemis National Park, USD 752 (Indian rupees 33,880) in 2007, USD 1,518 (Indian rupees 68,320) in 2008, and USD 1,127 (Indian rupees 50,720) in 2009. Note that household incomes are higher in prime snow leopard habitat areas, providing an important motivation for conservation. Another USD 400 in income from sales was earned from eight tented cafes along trekking routes and shared among four to eight families.
- Tourist visitation has increased from 37 bed-nights in 2001 to over 700 in 2007, 854 in 2008, and 634 in 2009.
- In 2009, approximately 78 per cent of homestay visitors rated the quality of homestays as excellent and another 20 per cent rated it as good; overall satisfaction was up to 88 per cent in 2010.
- Approximately 10–15 per cent of homestay profits are directed into a village fund to support conservation, which initially provided indirect conservation benefits (e.g., garbage management and stupa painting). After four years, the communities became more proactive with the establishment of a village wildlife reserve for the threatened Tibetan argali (*Ovis ammon hodgsonii*).
- One community used the fund to construct predator-proof corrals, another paid a fulltime herder to guard livestock in high summer pastures, and a third insured large-bodied, high-valued livestock such as yak through a national insurance programme.

## Good practice

- Important factors in the success of the project were transparency of key decisions, the support of the government department responsible for wildlife conservation, and broad stakeholder participation from the community, private sector (e.g., local travel agents), and government in the initial planning stages, which built confidence and ownership in the initiative.
- Projects should aim to include as many households as possible in supplementary tourism programmes to share the benefits of tourism and external investment as broadly as possible.
- Women and youth play a leading role as hosts and guides in homestay and wildlife tourism. Their involvement is key in generating supplementary income to support village-based conservation and in helping to build sustainable locally-managed biodiversity conservation.

## Lessons learned

- It is generally only when tangible economic returns are realised that communities are willing (indeed financially able) to assume their role as conservation partners and environmental stewards. Accordingly, community-managed conservation is more successful if linked to opportunities to earn income.
- The existence of a relatively homogeneous, cohesive community helped to equalise competition and encouraged willingness to share the benefits of tourism and external investment.

Conservationist Rinchen Wangchuk, who succumbed to motor neuron disease in March 2011; he will be sorely missed.



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## Resources

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Snow Leopard Conservancy USA website: [www.snowleopardconservancy.org/](http://www.snowleopardconservancy.org/)

Snow Leopard Conservancy India Trust website: [www.snowleopardhimalayas.org](http://www.snowleopardhimalayas.org)

Himalayan Homestays website: [www.himalayan-homestays.com/](http://www.himalayan-homestays.com/)



Theme II  
Integrated Approach  
to Biodiversity  
Conservation

# Community-Based Biodiversity Conservation in North East India

— Vincent Darlong

The first phase of the North Eastern Region Community Resource Management Project (NERCORMP) for Upland Areas, a joint project of the International Fund for Agricultural Development (IFAD) and the Government of India, was implemented in the states of Assam, Manipur, and Meghalaya in North East India in the eastern Himalayas from 1998 to 2008. 'Community-based biodiversity conservation' was but one component of NERCORMP carried out in the first phase. The second phase of NERCORMP (2010-2015) is being funded by IFAD and Government of India to scale up the initiatives commenced in the first phase and strengthen natural resource management governance at the community level.



Landscape view of community conservation area in West Garo Hills, Meghalaya



Signboard for elephant reserve (part of the community conservation area) in West Garo Hills, Meghalaya

## Problem

The development demands posed by population increases, coupled with the unregulated extraction of forest resources, decreasing *jhum* (shifting cultivation) cycles, and the privatisation of community forest for monoculture (teak, horticulture crops, and tea) have seriously impacted on the traditionally rich biodiversity landscape of North East India. These factors have also affected the livelihood base of the rural poor, reinforcing persistent cycles of poverty amid 'plenty' in many pockets of the region. Against this background, the IFAD-supported NERCORMP was implemented from 1999–2008 to:

- assist communities to conserve their unique natural resources and biological diversity by using socially, culturally, and commercially valuable products in an environmentally sustainable manner through the development of an enhanced natural resource-based production and management system; and
- strengthen indigenous institutions and institutionalise new conservation models and practices.

## General approach

NERCORMP's innovative, participatory, and remunerative project worked to reduce dependence on forests for livelihoods by providing livelihood enhancement support systems (such as rural infrastructure and revolving funds for micro-credit) coupled with training on soft-skills for on-farm and off-farm income generating activities. The project worked through natural resource management groups (NaRMGs) and self-help groups to enhance institutional capacity and build on existing social capital. NaRMGs were formed in selected villages, usually with husband and wife as members from each household. Women were organised into self-help groups with 15–20 members in each group. The executive committees of the NaRMGs were trained in preparing the village or community resource management plan under the guidance of participating non-government organisations and NERCORMP and following community sensitisation, mobilisation, and capacity building training using the Participatory Rural Appraisal method. Social agreements were made between traditional village institutions, authorities, and NERCORMP to allow NaRMGs to managing the selected community biodiversity conservation areas in partnership with village authorities. Community-based management rules and regulations for biodiversity conservation were written or verbally agreed in village meetings. These include elements that are preventive, prohibitive, punitive, appreciative, extractive, regenerative, facilitative, and explorative. Equitable access to, and benefit sharing of, biodiversity resources including non-timber forest products was also addressed.

## Outcomes

The outcomes can be grouped into three key success indicators: ecological, economic, and social outcomes.

### Ecological

- Visible forest recovery with the return of small native wildlife and fish resources in local streams and rivers
- Significant improvement in water availability, both for drinking and irrigation purposes, and the re-charge of natural springs
- Improved availability of non-timber forest products including construction materials, firewood, fodder, edible plants, roots and tubers, honey, and medicinal and aromatic plants for household consumption and sale in local markets
- The emergence of inter-connected and inter-village conservation areas

### Economic

- Improved availability and increased collection of saleable forest produce
- Increased income from sale of non-timber forest products
- Increased number of roadside makeshift markets (*haat bazaar*) for the sale of local forest and home garden produce
- Overall increase in the food and nutritional security of households

### Social

- Conservation initiatives are becoming a 'movement' locally; similar initiatives are springing up in non-project villages
- Reduction in conflict over natural resources
- Reduction in the drudgery of women in the collection of firewood, drinking water, and wild edible plants and vegetables
- Increased awareness about, and appreciation of, the tangible and intangible benefits of forest reserves and biodiversity conservation
- Development of new community-based organisations, NaRMGs, capable of protecting the community's own natural resources
- Facilitation of good social agreement between traditional village institutions and NaRMGs

- The emergence of community-based biodiversity management and governance systems that address equity in access to, and benefit sharing of, biodiversity resources
- A halt to the privatisation of community forest areas
- Reduction in the incidence of man-wildlife conflict in pockets along elephant corridor reserves
- The emergence of alliances between project and non-project villages for conservation initiatives

## Good practice

- Management partnerships for natural resources are best built upon existing social capital and respect for traditional community authority over natural resources.
- The programme forged alliances between traditional institutions and community-based organisations (NaRMGs). By empowering and trusting these institutions and building their management capacity, the formal authorities created viable partners in the new biodiversity management system, which relies on networks of villages and community conserved areas. This contributed to meeting the overall objectives of the National Forest Policy, while also enabling communities to develop resource management plans to address forest conservation and livelihood issues.
- Keeping traditional ancestral domains such as forests and natural resources under communal tenure is an effective strategy for maintaining forest cover and protecting biodiversity. The future of forests and biodiversity conservation lie in such strategies, as does the wellbeing of the people of communities dependent on forests.

## Lessons learned

- Community-based biodiversity conservation interventions require less investment and produce greater returns.
- Community mobilisation, education, and institution building for conservation requires mentoring and nurturing in the initial stages; the social and soft skills of the project team made all the difference in this.
- Conservation initiatives must result in tangible social, environmental, and economic benefits to communities.
- Optimal conservation results are achieved by forging practical alliances between traditional village institutions and community-based organisations with the equitable participation of women and youth. Participatory conservation initiatives that build upon existing social capital for improved common ownership and that are guided by equitable access to biodiversity and benefit sharing achieve sustainable results.
- Practical approaches to 'sustainability', compared to 'conventional approaches', can differ greatly, but sustainability is more likely if there is security of tenure over natural resources; a favourable social context and dynamics; a transparent and impartial decision-making process based on prior informed consent; openness to collaboration with agencies having similar objectives; committed local leadership and capacity; and a gender balance and the involvement of youth.
- Projects and organisations that promote community conservation initiatives should be able to provide guidance to the communities they work in on existing legal and policy issues and support linkages with the formal system to give the communities a voice in policy dialogue and initiatives.

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## **Resources**

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NERCORMP website: [www.necorps.org](http://www.necorps.org)

# Enhancing Conservation and Livelihood Security in Biodiversity Hotspots

— Shristi Kamal, Suman K Rai and Kamaljit S Bawa

From September 2004 to April 2011, the Ashoka Trust for Research in Ecology and the Environment (ATREE) implemented the initiative 'Enhancing Conservation and Livelihood Security in Biodiversity Hotspots' in 14 forest villages on the fringes of Senchel Wildlife Sanctuary, Neora Valley National Park, and Singalila National Park in Darjeeling district, India.



Pokhritaar, one of ATREE's target forest communities near Senchel Wildlife Sanctuary



ATREE recognises the importance of empowering women in conservation

## Problem

Darjeeling district is part of the eastern Himalayan biodiversity hotspot, indicating its richness in flora and fauna and high vulnerability to anthropogenic pressures. Over the past few decades there has been a drastic increase in population and development activities, which have increased the pressure on forests and their resources. Protected areas in the district have managed to retain significant diversity, but this has resulted in conflict over resources between the rural poor living within, or on the periphery of, protected areas and the State. The rural poor depend on continuous inputs from local ecosystems, and yet issues in relation to rights over land and bio-resources have not been resolved. Chronic rural poverty and environmental degradation are causally linked and mutually reinforcing. Hence, the challenge in resolving this cycle is to address poverty and biodiversity degradation simultaneously.

## General approach

ATREE believes that a sustainable model of conservation that secures rural livelihoods and conserves biodiversity in the ecologically fragile landscape of Darjeeling requires advancements on environmental, economic, and

social fronts. ATREE's economic initiatives have centred on the development of green micro-enterprises such as apiary, square-metre vegetable gardens, and handicraft products, and the promotion of organic agriculture and eco-tourism. Additionally, ATREE focuses on providing assistance for the marketing of indigenous products by securing markets and building market linkages. To sustain these initiatives and ensure social equity in the flow of benefits, ATREE has created self-help groups in project villages to facilitate micro-credit, build capacity, and raise awareness about the need for gender equity. At the same time, to bring about long-lasting change, ATREE works with local communities to promote the sustainable extraction and co-management of ecosystem resources. On the ecological front, ATREE fosters conservation along with economic and social interventions by promoting an inclusive model of management for biological resources near the three above – mentioned protected areas and by taking a participatory approach to the monitoring of biodiversity in these areas with the help of community members.

## Outcomes

The benefits of ATREE's programme in the Darjeeling hills can be categorised as economic, social, and ecological.

### Economic

The economic benefits include an increase in the annual income of households and self-help groups as a result of skill training and the marketing of their products. ATREE successfully created a community-owned organisation called 'Life and Leaf', which is a fair trade outlet linked to 33 self-help groups to support local livelihoods and market indigenous products. In 2009/10, these groups observed an average annual income increase of USD 275 (or 21 per cent). Besides the income from this fair-trade outlet, beekeeping promoted in the 14 villages resulted in an increase of USD 126 (or 22 per cent) in the total annual income of contributing households, while income from square-metre vegetable gardens led to an increase of USD 62 (or 31 per cent) in annual household income from agriculture.

### Social benefits

The social benefits of the programme include the strengthening of local institutions and the building of linkages, capacity building, and community mobilisation. As part of its community mobilisation, ATREE supported 33 self-help groups, 60 per cent of which are all-women self-help groups, and 20 of which were formed directly under ATREE's guidance. These self-help groups have been successfully linked with local Grameen banks, enabling them to benefit from government loan schemes. ATREE also conducted several workshops and seminars for communities, non-government organisations, and the Forest Department addressing various issues such as transboundary conservation, biodiversity conservation, and the Forest Rights Act. These workshops brought different stakeholders to the table for participatory discussions.

### Environmental and ecological benefits

The environmental and ecological benefits include increased awareness about the importance of maintaining a healthy ecosystem and the sustainable use of resources. These benefits resulted from ATREE-supported endeavours such as ecotourism and environment-dependent livelihood activities such as beekeeping and square-metre vegetable gardens. During a survey conducted in 2009 in the village of Upper Chattakpur near Sanchel Wildlife Sanctuary, the average daily consumption of fuelwood in the village was reported to have decreased from 1,440 kilograms to 160 kilograms. Similarly, square-metre vegetable gardens and organic farming have promoted the revival of local seed banks in Kolakham (near Neora Valley), which have collected up to 47 types of local crop varieties. The communities ATREE is working with are also involved in monitoring the biodiversity of their forests together with ATREE staff to observe trends in resource consumption as a result of ATREE's interventions.

## Good practice

- Compensation or incentives are needed to involve economically poor communities in biodiversity-rich areas in the conservation of ecosystem services. In addition to indirect financial incentives to economically uplift communities through market linkages, livelihood options, and skill building, it is important to acknowledge the local communities' stake in biodiversity conservation.
- By bringing together 33 different community groups across the Darjeeling district, ATREE has created an organisation that represents the voices of this mountain area. Scaling up this outcome by bringing together more local groups is a powerful way to support communities to alleviate poverty and conserve biodiversity.

## Lessons learned

- ATREE's experience in implementing this initiative highlights the need for better understanding, communication, and collaboration among all stakeholders to bring science, policy, and practice together for substantial progress towards conserving the area's biodiversity.
- Ecosystem services are often undervalued by communities because of lack of understanding of their benefits in the absence of direct economic benefits. The development of livelihood options that are dependent on the environment and its quality, combined with harnessing traditional knowledge to open up more market options, can help communities to understand the need to conserve the forests they live in.

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## Resources

ATREE website: [www.atree.org/ccc\\_darjeeling](http://www.atree.org/ccc_darjeeling)

# Countries, Communities, and Conservation: Building Cooperation in Kangchenjunga

— Molly Clark Barol and Karma Bhutia

For over a decade, the Mountain Institute (TMI) has been fostering transboundary cooperation for the protection of the environment and the improvement of local livelihoods at a landscape level in 17 village development committees in Nepal and two watersheds of Sikkim, India, in the Kangchenjunga complex.



Farmer weeding his field of medicinal and aromatic plants    Livestock in the transboundary area

## Problem

The Kangchenjunga complex in the eastern Himalayas is one of the world’s ten most critical centres for biodiversity and endemism, which is ascribed to marked variations in elevation, climate, terrain, and topography occurring within short distances. Unfortunately, the livelihood strategies of local people, including animal husbandry and the collection of wild non-timber forest products, can present a challenge to biodiversity conservation. The transboundary nature of the project zone presents its own unique challenges to conservation work including the cross-border implementation of law and policy, and networking and communication among diverse communities. TMI has taken a community-led approach to protecting the environment while improving local livelihoods.

## General approach

TMI’s approach to biodiversity conservation is multipronged and pairs conservation activities with livelihood generating programmes to incentivise community participation in, and ownership of, conservation efforts. Its three most significant approaches are: conserving key habitats, especially alpine and pasture areas, through improved livestock management and by reducing livestock herds; conserving wild stocks of medicinal and aromatic plants (MAPs) through on farm cultivation; and reducing the negative impacts of tourism and promoting improved eco-tourism management in biodiversity-rich areas. Key to ensuring the sustainability of the programme has been improving the capacities of local organisations to conduct conservation programmes, as well as establishing a network of natural resource user groups across watersheds to create ‘Community Conserved Areas’ outside the established protected area network in Nepal and India.

## Outcomes

TMI has seen significant livelihood and conservation impacts as a result of the process of technical training and support, the formation of community-based organisations, community capacity building, and market access facilitation. Over 5,000 farmers and herders have been trained in the cultivation of high-demand MAPs and in caring for new livestock varieties and rotational grazing. These farmers have been provided with seeds, nursery materials, high-dairy yield stud stock, and construction materials. MAPs and pasture user groups have been formed and registered, and gone on to establish six MAP collection/processing centres and four dairy processing centres. A total of 500 MAP farmers have also been registered with the local District Forest Office, exempting them from certain fees and royalties. In 2009, income of USD 696,477 was generated from MAPs and USD 274,488 from dairy programmes.

TMI has also networked with existing community-based organisations, building on traditional values to create additional conservation agreements with school groups, religious institutions, women's institutions, community forest user groups, and religious forest user groups. Transboundary cross-sectoral working groups facilitate networking and knowledge sharing among stakeholders on conservation issues, 'trouble-shooting', policy, and implementation. Most recently, the Kangchenjunga Singhalila Transboundary Bio-diversity Conservation Working Group (KSTBWG) was formed and registered with 17 members from India and Nepal.

Areas covered by conservation agreements between TMI and local stakeholder groups have created an additional 1,493 square kilometres of Community Conserved Area, in which MAP populations have rebounded by as much as 20 per cent, while at the same time improving livelihoods and creating strong local and regional networks for the expansion and sustainability of the overall programme.

## Good practice

An essential component of TMI's work has been a networked and nested approach to capacity building. Individuals trained with certain skills are networked in user groups encompassing a few villages, the capacities of which are built until functioning user groups can be networked with each other to form cooperatives that operate collection and processing centres for MAPs and dairy products and help monitor conservation efforts. This is a process that takes time and effort to develop, but ensures a strong system capable of distributing benefits and knowledge and absorbing new members.

## Lessons learned

- The Kangchenjunga complex is an open transboundary area characterised on the Indian side by established conservation zones and regulations and on the Nepali side by lack of regulation, limited government presence, and political instability. In this context, it is important to create mechanisms for communication and conservation action between the two sides. For example, TMI established a transboundary governmental working group enabling suddenly appointed Nepali government officials to be quickly apprised of and integrated into project activities. It also allowed policy implementation to be harmonised across borders with minimal bureaucratic hassle.
- During political conflict, local concerns and national politics are tied together and affect one another. TMI found it best to work through local non-government organisations to avoid programme activities being co-opted or obstructed by political actors.
- Where there are strong indigenous movements, it is essential to include these groups in the planning process and to include components in the programme such as TMI's community radio, which disseminates market information and cultivation good practices for MAPs in local languages.

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## Resource

The Mountain Institute's Himalayan Programme website: [www.mountain.org/himalayas](http://www.mountain.org/himalayas)



Theme III  
Agrobiodiversity  
Conservation

# Conserving Traditional Seeds and Agriculture

— Biju Negi

Conserving traditional seeds and agriculture is a priority agenda of the Beej Bachao Andolan (Save Seeds Movement), an ongoing people’s movement that started in the mid-1980s. The movement is particularly active in Uttarakhand, India, with advocacy extending to the national level.



The sustainability of traditional agriculture rests on crop diversity and mixed forests



Agrobiodiversity ensures household food security and nutrition

## Problem

Since the 1960s, the ‘green revolution’ has promoted a new agriculture system through a deeply entrenched nexus between seed-chemical companies and governments, which has systematically downgraded and marginalised small farmers and their holistic farming practices. The green revolution has altered farming communities’ livelihood options and severely threatened people’s food security and nutrition. In reality a market strategy and system, the green revolution has also resulted in the serious loss of once rich traditional agrobiodiversity and natural resources, and caused land and soil degradation, water depletion, and soil and water pollution, as well as other socio-cultural losses.

## General approach

Through the Beej Bachao Andolan, farmers decided to take their own farming decisions and refuse chemicals and high-yielding varieties (HYV) of seeds. Long marches and tours were undertaken to collect and exchange local seeds. Meetings were organised to advocate for community resilience, safe food, health, and livelihoods by returning to local agricultural practices such as mixed cropping, crop rotation, cattle rearing, and community inter-dependence in agriculture. The help and advice of elders was sought to understand, document, and underline traditional knowledge. Traditional cuisine was promoted. Students and researchers were invited to study the various aspects of traditional agriculture now being practised by Beej Bachao Andolan farmers.

## Outcomes

Beej Bachao Andolan's work has addressed forest conservation, while promoting the localisation of food production and consumption, now considered vital to address climate change concerns. Most importantly, Beej Bachao Andolan revived the communal nature of farming, which had been eroded by the green revolution.

Beej Bachao Andolan's approach enabled farmers to have control over their own agriculture, which was being seized by market forces. Diversity in crop production systems strengthened household food security and nutrition, while generating a surplus for exchange or sale. Use of local seeds promoted water conservation, and the rejection of chemical fertilisers and pesticides revived the health and quality of the soil and water.

Today, Beej Bachao Andolan has an in-situ collection of over 350 rice varieties, over 200 bean varieties, 30 wheat varieties, and 27 millet varieties, as well as various other local crops, vegetables, and spices. The movement has helped revive *baranaja*, a traditional mixed cropping system wherein 12 or more different crops are grown simultaneously in a single season.

Beej Bachao Andolan's call for traditional agrobiodiversity conservation in the mid-1980s attracted ridicule, but today, governments, scientists, and organisations are supporting the movement and the ideas it encompasses. Uttarakhand has been declared an organic state, and Beej Bachao Andolan's work contributed towards this.

## Good practice

The in-situ conservation and exchange of local and traditional seeds holds immense promise for replication and up-scaling in the Hindu Kush Himalayan region. Conserving seeds is as much a symbol of life and wellbeing as it is an instrument of protest against new and corporate agriculture that is harmful to the interests of smallholder farmers.

## Lessons learned

It is important not to depend solely on external funding but also to generate local resources and support for seed conservation initiatives. In the meantime, people can be provided with the knowledge and tools that they need to advocate for traditional seeds and agriculture.

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## Resources

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# Agrobiodiversity-Based Initiatives for Enhancing the Livelihood Opportunities of Rural Households in the Mountain Villages of Kumaon and Garhwal in the Indian Himalayas

— Sonali Bisht and Bharat Singh Bisht

The rich biodiversity of the Himalayas is an asset to be taken care of and utilised appropriately for the provision of food, nutrition, and livelihoods for communities. In 2000, the Institute of Himalayan Environmental Research and Education (INHERE), based in Masi, Almora district, Uttarakhand, India, initiated some low-cost activities towards this end. In 2008, the Sir Dorabji Tata Trust, Mumbai, provided funds for a three-year period to expand this initiative into an integrated programme covering 120 mountain villages in Kumaon and Garhwal in the state of Uttarakhand in the Indian Himalayas.



Amaranth



Labelling of organic pickle

## Problem

The state of Uttarakhand in India, part of the Central Himalayas, is blessed with rich agricultural biodiversity, which is now in decline with traditional local crops being dubbed commercially unviable and integrated mountain farming systems considered backward and inefficient. The positive advantages of agricultural biodiversity for environment conservation, community food security, nutrition, livelihoods, soil fertility, agricultural inputs, and livestock need to be harnessed and sustained. Community motivation for the protection and conservation of mountain agrobiodiversity can be achieved by linking it with food, nutrition, and sustainable livelihoods.

## General approach

INHERE is a non-government organisation working to restore interest in, and appreciation of, the agricultural biodiversity of smallholder mountain farmers through organic certification and natural farm produce processing, packaging, branding, and marketing to generate additional income. INHERE has created a model that encourages groups of smallholder farmers to continue traditional agrobiodiversity on their farms, ensuring food and nutrition to local families year round (which is not possible with mono crops), while aggregating small surpluses for value addition and sale as specialised and differentiated products unique to the mountain region.

Activities undertaken towards this include:

- contact and motivational interfacing with communities to create awareness of organic agricultural practices and the value of on-farm agrobiodiversity;
- the formation of farmer groups for the organic cultivation of cereals, pulses, spices, fruits, vegetables, culinary herbs, and medicinal plants using traditional farming systems;
- the provision of exposure to and training on organic farming techniques;
- the setting up and maintaining of an Internal Control System for organic certification;
- the collection of quality local seeds and other planting materials from the Himalayan region in Uttarakhand;
- multiplying and conserving local planting material and the creation of a seed repository;
- the strengthening of allied agriculture activities for support to integrated agriculture; and
- up-scaling and extending value chain systems for a range of produce from smallholder farms.

## Outcomes

The programme generated awareness and interest in organic practices and agrobiodiversity through regular community interfaces in 120 villages, the formation of organic farmer groups, and by demonstrating the usefulness of agrobiodiversity in the maintenance of soil fertility, for pest control, in the preparation of agricultural inputs on farms, as a risk mitigation strategy, as a way to produce sturdy crops in a time of climate change, and for value addition and market opportunities. The revival of agrobiodiversity is being achieved through the collection and storage of local/traditional seeds of now endangered crops; use of improved planting material; multiplication of seeds; dissemination of seeds and planting materials to farmers; and training for capacity building and skill development in activities related to production, value addition, and marketing.

Livelihood opportunities have been upgraded by the conversion of 'organic by default' farming to certified organic farming for 3,328 smallholder farmers in 120 mountain villages covering 1,744 hectares of rainfed area. A total of 144 certified organic crops are being protected and cultivated by farmers with a total annual production of 2,556.7 metric tonnes. Certified organic crops include millet, pulses, spices, oilseed, fruit, vegetables, herbs, and medicinal plants. Four processing units service this range of produce applying world-class standards. Products are sold in local and national markets. Related agriculture activities such as beekeeping, poultry, and vermi and bio composting are generating additional income and contributing to productivity through pollination and by providing soil fertilizer.

## Good practice

Agrobiodiversity can be maintained by creating social and economic value for the diverse agricultural produce of mountain farmers through farmer appreciation; knowledge and input support; the creation of local and accessible markets facilitating on farm or near farm sale of produce by farmers; and local value addition, thereby creating employment and a unique identity for mountain produce.

## Lessons learned

- The interest and motivation of farmers is essential to protect agricultural biodiversity.
- Farmers need to be educated and supported to protect agricultural biodiversity.

- Farmers need their diverse and small surpluses to have economic value through the availability of on or near farm sale opportunities.
- The value of the diversity of agricultural produce can be enhanced through local aggregation, value addition, quality packaging, and branding.
- Local marketing of produce generally ensures the availability of fresh, healthy, and reasonably priced produce to the community; reduces market risk; and strengthens the local economy.

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## Resources

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# Policy Development to Support Biodiversity within Agricultural Systems of Hilly Regions of Uttarakhand, North India

— Mohammad Rais and Gary W. van Loon

The National Institute of Science, Technology and Development Studies (NISTADS) based in India and the Department of Chemistry and School of Environmental Studies of Queen's University, Canada implemented the initiative 'Policy Development to Support Biodiversity within Agricultural Systems of Hilly Regions' in Uttarakhand, North India, from 2003–2005.



Tarikhet block, Almora district, Uttarakhand



Threshing grain

## Problem

In the absence of appropriate policy instruments and proper management, the erosion of agro and silvi-biodiversity is continuing unabated in the hills of Uttarakhand. This has resulted in significant ecological degradation and environmental damage, threatens food security, and aggravates the poverty of poor farmers in the hills. Despite this, the conservation of native agriculture crops and plant species in the Indian Himalayas has not received sufficient attention in national and state policy instruments.

## General approach

NISTADS, in collaboration with Queen's University of Canada, conducted a field study from September 2003 to December 2005 with funding from the Canadian International Development Agency through the Shastri Indo-Canadian Institute, New Delhi. The study examined sustainable land management practices in the hilly region of Uttarakhand and looked at how to build a foundation for the development of policies to strengthen agrobiodiversity. Data regarding average landholding size, crop patterns, and crop rotation were collected by surveying 349

households in 28 villages of Tarikhet block in Almora district and 261 households in 15 villages of Ukhimath block. This initiative analysed the cash income generated and energy status associated with traditional coarse grains, local landraces, and high-yielding crops in the region, using standard agrobiodiversity indicators such as the Shannon diversity index.

## Outcomes

The project team held regular interactions with senior officials of the Uttaranchal Agriculture Department, Watershed Directorate, and Uttaranchal Organic Commodity Board office in Dehradun. One hundred participants attended the NISTADS-Shastri Applied Research Project (SHARP) Dissemination Workshop, which was conducted from 22–23 November 2005 in Ukhimath, Rudraprayag (Uttarakhand), including 53 female farmers and 10 senior government functionaries with influence over policy. This workshop generated a good level of awareness among participants about the importance of traditional crops and varieties. As a result of the SHARP project, the Uttaranchal Organic Commodity Board is now propagating and marketing traditional crops. Other positive impacts included the non-government organisation Appropriate Technology India-Ukhimath showing interest in following up a proposal for traditional grain-based agro-processing industries.

## Good practice

- Environmental education can be promoted at all levels within and beyond the farming communities in Uttarakhand. If the nutritional and medicinal values of traditional crops are made known to the hill people they can then join in the biodiversity conservation campaign through self-help groups and non-government organisations.
- The exploitation of organic potential through composting and vermi-composting on agricultural land is essential to increase farm productivity and for sustainable land use for organic farming. The manufacturing of compost and vermi-compost has the potential to develop into a cottage industry for women in the region, as the women of Uttarakhand are active in agricultural activities. Stringent measures are needed to prevent the degradation of soil quality to protect yield.
- The strengthening of intra-state and inter-state commercial nodes and marketing networks is essential to improve the micro and macro-economy related to the products of traditional agrobiodiversity, which will, in turn, boost the on-farm conservation of traditional varieties and landraces in Uttarakhand. In view of the geographic complexities of the State, this will require the development of a private/public administrative set-up such as a local citizen force or a cooperative system or government structure to mobilise and maintain marketing products.
- The agriculture products and by-products from Uttarakhand can be certified and quality marked or eco-marked for value addition of various refined/processed food, making them more competitive on national and international markets. Food and recipes prepared from different traditional food grains can be incorporated into tourism.
- A special ecological zonation for conserving local/traditional crops and crop varieties can do wonders. Within these zones, incentives for promoting ecologically sustainable practices are promoted. Further, the Government of Uttarakhand can directly purchase food grains from traditional crops produced by farmers. The coarse grains of the hilly region being cheaper than those of plains could be an economical source of food security for weaker segments of society. Such grains could be included in the Public Distribution System of the State, and even the whole country.

## Lessons learned

- The thrust of government policy instruments (credit, subsidies, and the public distribution system) has so far been directed towards promoting high productivity monocultures, to the detriment of local/traditional crop varieties.
- Uttarakhand hill farmers require special incentives and ecological compensation to conserve local/traditional crop varieties.

- As per capita landholding and annual income is very low in Uttarakhand, the conservation of traditional agrobiodiversity may not be effective unless it is sufficiently promoted.
- There is ample scope for the manufacturing of by-products from the agricultural produce of the hill region, (for example, toffee, glucose, and essential oil can be produced from malt; biscuits and noodles from Mandua).
- The unique regional cuisine based on traditional agro-products hasn't been promoted effectively and can be incorporated into the development of tourism in the area.

## Contact

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## Resources

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Theme IV  
Capacity Building  
for Natural Resource  
Management

# Improving Livelihoods and Governance Through Resource Management in Afghanistan

— Peter Zahler and David Lawson

The Wildlife Conservation Society (WCS) and United States Agency for International Development (USAID) have been implementing an ongoing initiative called 'Improving Livelihoods and Governance through Resource Management in Afghanistan', primarily at the landscape level, in the Wakhan region of Badakhshan Province in the Pamirs, as well as in Bamyan Province in the Hindu Kush range.



WCS 'Environmental Education Day' for school children in Wakhan



Members of Band-e-Amir Protected Area Committee meet to discuss plans for Afghanistan's first protected area in Band-e-Amir

## Problem

Afghanistan's resource base has been dramatically eroded over the last quarter century by near-continuous conflict and associated pressures related to the destruction of infrastructure, movement of large numbers of internally displaced people, influx of modern weaponry, extreme poverty, and an almost total lack of enforcement. Coupled with severe drought, the result has been the deterioration of rangelands, felling of forests, and decimation of wildlife.

## General approach

In 2006, WCS, with funding from USAID, embarked on an initiative to develop Afghanistan's capacity for biodiversity conservation by building local and government capacity for natural resource management. The initiative focused at all levels, from support for the drafting of environmental laws and the creation of regulatory bodies, to protected area design, training, data collection, and community assistance.

## Outcomes

WCS has developed community-based governance institutions and technical tools for resource management in over 55 communities in the Wakhan and Bamyan regions of Afghanistan and trained thousands of Afghans at

the national and local levels in sustainable resource management. WCS helped to create Afghanistan's first-ever official protected area, Band-e-Amir National Park, by facilitating the development of the Band-e-Amir Protected Area Committee, consisting of representatives from 14 communities and local government. WCS is also working to develop a transboundary Pamirs conservation initiative with Afghanistan, Pakistan, and Tajikistan for the transnational management of this region.

WCS has promoted resource stewardship at the local level by investing in environmental education and outreach (especially focused on land-use management and sustainability), technical training, natural resource mapping, wildlife-human conflict resolution, the development of alternative livelihoods, and by building local institutions and legal instruments to improve resource management. WCS has also implemented an environmental education programme in all schools in Wakhan, initiated the first community ranger programme in Wakhan, and supported national rangers in Band-e-Amir.

At the same time, WCS has worked intensively to improve the capacity of the central and provincial government to manage the country's critical resources. WCS has created a baseline geographic information system (GIS) database of wildlife, rangelands, and land use patterns across a broad swath of the country in order to monitor trends in recovery or degradation to enable the Afghan Government to pursue adaptive management approaches. WCS has supported the drafting of seven environmental laws and regulations; trained officials in the Ministry of Agriculture, Irrigation and Livestock and the National Environmental Protection Agency; conducted study tours to sites around the world to build understanding of international best practices; and provided mentoring for both the current and next generation of government personnel. Recent events such as the creation of Afghanistan's first national park (Band-e-Amir) and the development of its first Protected Species List have not only improved the country's ability to manage its resources, but also provided concrete examples of Afghanistan's importance and place as a functional member of the international community through the fulfilment of its commitment to international conventions such as CITES (Convention on the International Trade in Endangered Species) and the Convention on Biological Diversity.

## Good practice

It is necessary to work at multiple levels – at the central government level, provincial government level, and community level – to build resource management capacity and to link these groups to improve trust, governance, capacity, and environmental stewardship.

## Lessons learned

- There is a need for continuity of effort – short-term projects (3–5 years) are unlikely to provide lasting benefits.
- All levels must be engaged and linkages between levels facilitated to ensure effective and sustainable resource management in the long term.
- Projects must be able and willing to quickly provide expertise in a variety of fields as needed and requested, rather than providing what outside assessments deem appropriate.

## Contact

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## Resources

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# Afghanistan's Pastoral Engagement, Adaptation, and Capacity Enhancement (PEACE) Project

— Michael J Jacobs

The University of California at Davis and Texas A&M University collaborated with Mercy Corps; the Ministry of Agriculture, Irrigation, and Livestock; Independent Department of Kuchi; Sanayee Development Organisation; President Karzai's Peace Commission; and Kabul University to implement the Pastoral Engagement, Adaptation, and Capacity Enhancement (PEACE) Project. The project ran from August 2006 to April 2011 at both the community and landscape levels in 31 out of 34 provinces, with field work conducted primarily in Afghanistan's central and northern provinces.



Conducting rangeland surveys in Badakhshan province



Kuchi and Hazara leaders discuss ways to address conflict over land tenure

## Problem

Food security has become a chronic issue in Afghanistan as a result of decades of conflict, political instability, population growth, fluctuations in oil prices, and changing land use/tenure policies. It is widely recognised that improving livestock production in Afghanistan is important to stabilise the country's economy and for food security.

One way to improve livestock production is through the better management of rangeland resources. The Ministry of Agriculture lacks the modern tools required for proper management. However, the most important issues facing extensive livestock producers are insecurity, land conversion, and access to public lands. Commanders, other powerful people, criminals, and insurgents continue to be a source of risk for herders. Land conversion has reduced rangelands and eliminated travel corridors, restricting movement.

## General approach

Over the past four years, Afghanistan's PEACE Project has been transferring rangeland management tools to the Ministry of Agriculture to enable it to more efficiently monitor rangelands and prevent resource degradation. The project has established a successful conflict resolution programme, which has gained the support of the government and stakeholders alike. In collaboration with government/non-government organisations and universities, the project has documented and assessed rangeland biodiversity, digitised historical climate data, helped to restore the national herbarium, and trained Afghan scientists and leaders. The project has built trust among partners and developed strong collaborative relationships.

## Outcomes

### Development of livestock rangeland management and marketing technologies

- The project provided regional assessments of forage conditions to the government and other organisations to inform policy and enable them to react.
- The project developed an early warning system to improve marketing options for livestock and livestock products and reduce the likelihood of negative environmental impacts from livestock grazing.
- Nutritional profiling technology introduced by the project has allowed the assessment of forage quality to maintain and improve herd health and condition.
- Market information systems developed as part of the project provide easy access to price and volume data enabling fair market transactions.

### Conflict resolution

- The project developed the skills of Kuchi and village leaders in peacefully resolving land access issues.
- The project developed a way for farmers and herders to re-establish and build relationships to improve security for both.

### Capacity building

- Ministry of Agriculture, Rangeland Department: The project provided long-term field training in survey methods for the Livestock Early Warning System (4.5 months per year; 3,100 person-days of training).
- Ministry of Agriculture, Animal Husbandry Department: A Nutritional Profiling Laboratory was set up and training provided for fecal scanning (1,490 person-days training).
- Independent Department of Kuchi: Multiple conflict resolution training was provided to 169 Kuchi leaders from 31 provinces (3,265 person-days of training).
- Kabul University: Internships were provided to 34 university students during sheep and goat feeding trials, allowing them to receive training on vegetation sampling methods, global positioning system (GPS) technology, and feeding trial research and design.

## Good practice

It is important to include a conflict resolution component in any project that deals with natural resource management. This is absolutely critical for engaging stakeholders in productive dialogue.

Another practice that was extremely important in the project, and is often overlooked, is mentorship. The project spent 4.5 months each year for 4 years working with the same staff from the Ministry of Agriculture conducting fieldwork to support the Livestock Early Warning System. Spending large amounts of face-to-face time is not only important in terms of technology transfer, but can make a huge impact on the transfer of a whole range of cultural and social attributes.

## Lessons learned

- Gaining the trust of stakeholders (government and livestock producers) is paramount and cannot be accomplished quickly. Substantial traction does not occur for a programme until trust is established. It took about a year to gain the trust of pastoralist leaders and about the same for government counterparts.
- Allow sufficient time to transfer technologies to government staff, which can take longer than anticipated.
- It is better to facilitate efforts than to direct efforts when it comes to conflict resolution; provide parties with the skills and let them solve issues their own way.

## Acknowledgement

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Theme V  
Conservation Based  
on Indigenous  
Knowledge and  
Customary Practices

# Linkages Between the Akas and Their Forests: An Analysis of Problems and Prospects for Sustainable Development, Arunachal Pradesh

— Gibji Nimachow

The Department of Geography, Rajiv Gandhi University, Rono Hills, Itanagar, Arunachal Pradesh, India, implemented a study on the 'Linkages between the Akas and their forests: An analysis of problems and prospects for sustainable development' at the landscape level in West and East Kameng districts of Arunachal Pradesh from January 2008 to December 2009.



Akas woman displaying *Colocasia* spp. collected from the forest



Nyezowo, an isolated sacred hill at Jamiri village

## Problem

Since the dawn of human civilisation, man has derived sustenance and shelter from forests. Man has had a symbiotic and mutually reinforcing relationship with forests. In time, through the axe, man became 'lord of the forest'. The degree of man's association with the forest signified the status of his tribe in the rural-urban continuum.

The tribe is an important component of a forest ecosystem and exists in a web of complex relationships with the forest and the organisms it harbours for sustenance and adaptation. Even today, forests occupy a central position in tribal culture and the tribal economy, dictating the very life of the tribe from birth until death. Most of the tribes living in forests, hills, and mountains practise a simple mode of production and have a stratified social-political structure and religious system revolving around their surroundings. Hence, an assessment of the linkages between the tribal way of life and the surrounding ecosystems is key to understanding their prospects of a future together. Tribal areas have not been spared from the forces of globalisation, including development; hence, an analysis of the utilisation of forest resources by the Akas people of Arunachal Pradesh was conducted to understand if their way of living is sustainable in today's changed context.

The objectives of the study were to:

- highlight the impacts of the Akas tribe on their forest resources, and the implications of such impacts;
- evaluate the status of customary and modern judicial laws associated with forests and forest governance; and
- suggest a forest management plan keeping in mind the geo-environmental set up, the needs of the people, and customary and modern laws.

## General approach

Sixty per cent of households in the villages of West and East Kameng districts of Arunachal Pradesh were randomly selected. The total sample size was 517 households out of a total of 862 households, with representatives from either sex.

Topographical maps from Survey of India were used to delineate the study area. Geographic information system software ILWIS (Integrated Land and Water Information System) was also used. Interviews, questionnaires, and observations were made to gather empirical data. Relevant secondary information was collected from books and journals. Audio-visual tools such as a tape recorder and camera were also used. Statistical measures were used to analyse the data including percentages, graphs, and diagrams. Statistical software SPSS 9.05 was used for tabulation.

## Findings

The Akas largely depend on forest resources for their livelihood. Agriculture, hunting, fishing, and food gathering are important for their sustenance. The inherent indigenous knowledge system allows them to interact with the surrounding forests in different ways. Their belief system, including the concept of sacred groves, plays a significant role in the conservation of plants and animals. For example, drinking water sources are believed to be the abode of a deity locally known as Hügeyin Ubrao or Ubram, who maintains the purity of the water. They worship peepal trees (*Ficus religiosa*), believed to be the home of the deity Wiinjigi. Hills worshiped by them have local names such as Vojophu, Liiriiphu, Jyopsinfo, and Nyejowoh. Locals believe that these hills possess magical powers and that misfortune will come to those who desecrate these sacred places. The forests provide vegetables, fruit, bark, edible leaves, wood, bamboo, cane, and thatch to the Akas. Agricultural implements, bows and arrows, handles, cloth, hair oil, musical instruments, ornaments, and ethno-medicines (Table 1) – which are integral to Akas life – are also made from forest resources.

Parts of plants and animals including antelopes, bears, and fish are used by the Akas to make traditional medicine. However, population growth and the percolation of scientific and technological knowledge into their tribal society have impacted on the Akas's linkages with the forest. Some of these impacts include deforestation and the loss of important plant and animal species. The survey revealed that some important plant species are on the verge of extinction and certain wild animals such as *Muntiacus muntjak*, *Selenarctos thibetanus laniger*, *Macaca munzala*, and *Sus scrofa* are endangered. Plants once found within 10 metres of Akas settlements are now 40 kilometres away.

Existing formal laws against illegal exploitation are seldom implemented. The Akas deal with such problems through customary laws known as Nobazio. There is an urgent need to formulate a sustainable forest management plan for the area based on Nobazio.

Community forestry in Nepal, under which community forest user groups are primarily responsible for the forest management plan, has performed well. Such management plans could prove fruitful in the area. Existing customary laws and the Akas's traditional knowledge base in relation to their ecosystem can facilitate a revolution in preserving and protecting forest resources.

**Table 1: Ethno-medicinal plants used by Akas tribe**

Botanical name	Local name	Therapeutic indication	Part used	Preparation
<i>Ageratum conyzoides</i>	Pasong	Cuts	Leaves	The leaves are squeezed by hand to prepare a paste, which is applied to cuts to clot blood and as an anti-microbial agent.
<i>Artemisia nilagirica</i>	Syowum	Coughs and fever	Leaves	Fresh leaves are squeezed and consumed with lukewarm water; for mild conditions the leaves are squeezed and inhaled directly.
<i>Begonia</i> sp.	Pelowo	Boils	Tender leaves	Tender leaves are steamed and taken orally to speed recovery and for pain relief; also used as a blood purifier.
<i>Centella asiatica</i>	Syowbo	Jaundice	Leaves and roots	Raw roots and leaves are taken along with food to stimulate appetite in the treatment of jaundice.
<i>Centella</i> sp.	Sim syowbo	Jaundice and indigestion	Leaves and roots	The whole plant is taken in raw form to stimulate appetite and for roughage in the treatment of jaundice and indigestion.
<i>Clerodendrom colebrookianum</i>	Drolain	Diarrhoea	Leaves	The tender leaves are steamed and consumed to treat diarrhoea and indigestion.
<i>Costus speciosus</i>	Rumo-sana-dugo	Jaundice, gastric, and eye infections	Beat	The juicy beat is chewed just like sugarcane to treat jaundice and gastric. One to two drops of the extracted juice from the stem is applied twice a day for the immediate relief and treatment of eye infections.
<i>Curcuma</i> sp.	Kiistradu	Stomach ache	Rhizome	Five grams of clean rhizome is consumed twice a day for at least three days to treat severe stomach pain.
<i>Dendrocalamus hamiltonii</i>	Si-emnyo	Cuts	Culm	The powdery peel of the culm is directly applied to fresh cuts and wounds to help the blood clot.
<i>Discorea</i> sp.	Nyemumsi	Dysentery	Tuber	Cooked yam (both boiled and roasted) is consumed to cure dysentery. It is also given to domestic animals for the same purpose.
<i>Macaranga denticulata</i>	Liidzin	Fire and hot water burns	Latex	Fresh resin is collected from the plant in a bamboo tube and applied to burns (anti-inflammatory).
<i>Paederia foetida</i>	Adraluhumbe	Fire and hot water burns	Leaves and stems	Ten grams of fresh leaves and stems are crushed with an indigenous mortar and pestle, sieved with a fine cloth, and the juice applied three times a day to treat burns.
<i>Rhus javanica</i>	Subyutro	Dysentery	Fruit	For mild dysentery, the raw fruit is consumed directly, but for severe dysentery the juice is extracted from the fruit by hand squeezing and three to four glasses taken per day.
<i>Ricinus communis</i>	Migyim jyoksu	Orthopaedic problems	Leaves	Ten to twenty grams of fresh leaves are made into a paste and applied to fractured bones and to relieve joint pain. Two to three leaves are slightly heated in a fire and tied with a rope over the fractured part and kept for a week.
<i>Trichosanthes tricuspis</i>	Pampawo	Fire and hot water burns	Fruit and stem juice	The peel of the fruit and stems are ground with an indigenous mortar and pestle and the extracted juice is applied to burns (as an anti-inflammatory and anti-microbial agent).
<i>Zanthoxylum piperatum</i>	Siina	Labour pains	Fruit	The dried fruit is fried and taken with warm fermented local liquor Tsii (rice beer), mostly during labour pain and after delivery.
<i>Zanthoxylum rhetsa</i>	Pyetree	Diarrhoea	Fruit and tender leaves	Tender leaves are taken in raw form. Both fresh and dried fruits are crushed with a small quantity of salt and consumed for instant relief from diarrhoea.
Unidentified	Mechme	Diarrhoea	Leaves	Two to three leaves are consumed directly with water for at least three days to treat diarrhoea.

## Good practice

The immediate formulation of a sustainable forest management plan, an awareness campaign, and the creation of village forest protection committees have emerged as useful ideas from the present initiative. These ideas can be replicated throughout Arunachal Pradesh and other mountainous areas inhabited by tribal communities.

## Lessons learned

- As tribal communities derive their daily requirements from the forest, formulating plans and implementing policies to protect and conserve forests is a challenge.
- Akas villages are located in inaccessible areas and the Akas people, who are mostly illiterate, were reluctant to provide information during the field survey. Hence, the collection of primary data was difficult.
- Community participation in initiatives is the most important factor in the successful protection and conservation of forests.

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## Resources

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The Scheduled Tribes (Recognition of Forest Rights) Bill, 2005: [www.forests.tn.nic.in/Legislations/graphics/01\\_Scheduled%20Tribes%20Bill%202005.pdf](http://www.forests.tn.nic.in/Legislations/graphics/01_Scheduled%20Tribes%20Bill%202005.pdf)

# Promoting Indigenous Knowledge for Biodiversity Conservation in Dolpo, Nepal

— Gautam Paudyal

The World Wide Fund for Nature (WWF) Nepal, within the larger framework of the Northern Mountain Conservation Project (NMCP), implemented the initiative 'Promoting indigenous knowledge for biodiversity conservation in Dolpo, Nepal' between 1997 and 2004.



Ringmo village, Dolpo



Picking medicinal herbs for health, Dolpo

## Problem

The medicinal plants and herbs of Dolpo in the Nepal Himalayas are under threat from overexploitation and habitat destruction. Free grazing continues to threaten valuable plant species such as *Dactylorhiza hatagirea* (hathajadi, panchaunle), *Neopicrorhiza scrophulariflora* (kutki), *Delphinium himalayai* (atis), and *Nardostachys grandiflora* (vulte). Dolpo is a relatively inaccessible area characterised by one of the lowest literacy rates and annual incomes in Nepal. Lack of legal access to forest resources, particularly medicinal plants and herbs, is an issue, although these resources underpin the Amchi tradition of health care. Amchi institutions in Dolpo are currently facing financial hardship. Amchi knowledge and skill training is laborious and expensive. Students no longer see the benefit in enrolling in Amchi schools. Accordingly, the future of the Amchi tradition is uncertain.

## General approach

Amchis rely mainly on medicinal herbs and plants to provide health services, but their supply of raw materials is at risk because of overharvesting and lack of awareness of the value of such medicinal herbs and plants. WWF Nepal, with support from USAID and the People and Plants Initiative (PPI), adopted a multi-pronged approach to address this issue. WWF mobilised local communities to participate in the sustainable management of forests and pasturelands rich in medicinal plants and herbs. WWF constructed a permanent Traditional Health Care Centre to provide local communities with easy access to health services. An endowment fund was established to cover the operational costs of the centre, ensuring its long-term sustainability, and an education programme initiated to

revive this age-old tradition and encourage the younger generation to become Amchis. A system of public hearings and public audits was institutionalised to ensure the good governance of forests by forest users groups and the Traditional Health Care Centre.

## Outcomes

USAID and PPI's support enabled WWF, in collaboration with the Dolpo District Forest Office, to hand over the management of 17 forest areas to local communities. The handover of these forests has helped to foster a sense of ownership among local communities and motivated them to be responsible for the sustainable management of these forests. Local communities now have legal access to forests and are sustainably harvesting forest products according to their forest operational plans. This arrangement has ensured a sustainable supply of raw materials for medicines to the Traditional Health Care Centre.

The Traditional Health Care Centre is providing health care services to the surrounding four villages in this remotest of mountain areas in Nepal. The Amchi education programme has supported 60 students from the area to study Amchi traditions and practices. This programme has been highly effective in transferring knowledge on Buddhist culture and locally available medicinal plants, their value, collection time, and harvesting practices. The programme has played a critical role in safeguarding the traditions of the region through the next generation of Amchis who are providing health services to their communities.

## Good Practices

- The creation of legal access to natural resources for local communities and skill enhancement through capacity building are essential for the sustainability of biodiversity conservation programmes.
- The promotion of traditional knowledge and practices can significantly contribute to biodiversity conservation, while at the same time providing necessary services to local communities.

## Lesson learned

- Project presence in local communities, not just in the district headquarters, can help build trust and ensure the active participation of local communities in project activities.

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## Resources

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WWF Nepal website: [www.wwfnepal.org/](http://www.wwfnepal.org/)



# Theme VI Innovations

# Strengthening Fodder Resources through Fodder Banks to Reduce Drudgery of Rural Women in Upper Kedarnath Valley, Uttarakhand, India

— Shalini Dhyani

The GB Pant Institute of Himalayan Environment and Development, Garhwal Unit, Srinagar Garhwal has been implementing the project 'Strengthening fodder resources and developing a pilot fodder bank model for reducing drudgery of rural women' at the landscape level in Maikhanda village cluster in Upper Kedarnath Valley, Uttarakhand, India, since March 2009.



Local woman harvesting fodder from fodder bank in Upper Kedarnath valley, Uttarakhand



A meeting with local women's forest conservation group (Mahila Mangal Dal) of Maikhanda village, Uttarakhand, regarding fodder

## Problem

Agriculture and animal husbandry are the main sources of livelihood for over 70 per cent of the population in the Indian Himalayan region. Women are the main collectors of forage for livestock feed in the region. Extracting fodder and carrying it long distances on their heads and backs negatively affects women's health and the education and nutrition of their children. It is also a cause of minor and major accidents. Lack of forage for livestock means that women have to go further to extract fodder, adding significantly to their drudgery. It has also led to the illegal harvesting of such resources, putting pressure on forests. The ecological sustainability of biomass extraction is a much-debated issue; many believe that extraction compromises the aims of biodiversity conservation. Information on resource use patterns, particularly fodder extraction, in the Indian Himalayas is insufficient and mainly restricted to inventories.

## General approach

The project addressed various problems associated with fodder extraction in the Garhwal Himalayas and implemented cost-effective solutions to reduce the drudgery of local women, minimise fodder resource extraction pressure on forests, and provide better quality feed for livestock. The project developed a pilot fodder bank model using fast-growing and high biomass-yielding nutritious species (both indigenous and introduced) to reduce the drudgery of women by lowering their fodder collection time and distance travelled. The project also attempted to create awareness among women of better livestock feeding methods and how to improve livestock health, milk, and meat yield, through better quality fodder.

The village cluster selected contained poor, marginalised, and uneducated segments of society living under difficult conditions, including the unavailability of water. The local fodder removal calendar was established using the Participatory Rural Appraisal method and resource removal frequency and quantity were assessed. The screening and propagation of promising fodder species (indigenous and fast growing trees, shrubs, and grasses) was carried out on community lands. Indigenous fodder species used included ringal bamboo such as *Chimnobambusa falcata*, *Thamnocalamus spathiflorus*, and *Arundinaria* spp. and tree species such as *Alnus nepalensis*, *Quercus glauca*, *Quercus leucotricophora*, *Ficus nemoralis*, *Ficus auriculata*, *Debregeasia salicifolia*, and *Ficus subincisa*. Introduced species used included tree species such as *Celtis australis*, *Morus alba*, and *Bauhinia variegata* and various grass species. A small fodder nursery was established near the fodder bank with a polyhouse, nethouse, and rainwater harvesting tanks. The nursery provides seedlings and seeds of fast growing fodder species to locals at a nominal price.

Women of the valley were trained to introduce fast-growing, high-biomass yielding grasses, which can be harvested throughout the year, in their cropland bunds, kitchen gardens, and degraded community wastelands. Hybrid Napier, broom grass, and Guinea grass were some of the fast-growing, high biomass-yielding nutritious grass species used. Livestock owners and farmers were also trained to construct their animal houses along scientific lines with proper ventilation and provided with cost-effective feeding and watering systems, using locally available materials.

The rehabilitation of village commons in Maikhanda, Rudraprayag district was carried out with community participation. Initially, one fodder-based model was developed on an experimental basis on more than four hectares of village wasteland. Trenches were prepared to store rainwater. This model is ready for replication, which has already started in the high altitude village of Triyuginarayan.

The fodder bank is currently governed by the author, Dr Shalini Dhyani, under the project funded by Department of Science and Technology as part of the Science and Society Scheme in the Garhwal Unit of the GB Pant Institute of Himalayan Environment and Development, with active collaboration and support from local women in the project village cluster (Mahila Mangal Dals). The handover of the fodder bank to local women groups is envisaged in 2013, after which it will be fully governed and managed by them. A workable strategy has been developed for the replication of fodder banks and several villages in the valley have shown interest.

## Outcomes

- A fodder bank was established with both indigenous and introduced fodder species to ensure the conservation of biodiversity and provide nutritious fodder to livestock.
- Three hundred and fifty-one women from the village cluster, including women from weaker segments of the community, are directly benefitting from the first phase of this project.
- Fast-growing, high-biomass yielding fodder trees *Morus alba* and *Pennisetum purpureum*, and hybrid Napier 2 varieties were distributed to women following onsite training in planting, harvesting fodder, and multiplication. At the end of the year, 65 women initially reported harvesting eight times per year and stall feeding Napier grass to their mulching animals since May 2010. So, during the first phase of the programme, these 65 women did not need to harvest fodder from the forest for five days in each month and reported better milk yield.
- The project has encouraged locals to grow excess fodder (mainly grass) in their cropland bunds, kitchen gardens, wastelands, and commons to meet the demand for fodder for livestock and pack animals during the tourist season, while also generating additional income.

- Women in the area are using their small land holdings to grow fodder, which saves time and labour, allowing them to pay more attention to other household chores and the health and education of their family.
- Training and capacity building was another key aspect of this integrated programme. Women were trained in the cultivation of fast-growing, high-biomass yielding grasses and livestock owners and farmers were trained in livestock house construction and feeding systems.
- Replication of a similar model by other villages in the upper Kedarnath valley has been a success and highlights the importance of an integrated approach. Plans are underway to extend the project to 250 more women in a neighbouring village.

## Good practice

Fodder bank development in mountain villages with local participation is a novel idea. The introduction of fast growing fodder species (both indigenous and those recommended by the Livestock Board) in cropland bunds and kitchen gardens makes optimal use of small patches of land. Village fodder banks preserve and store surplus fodder, making nutritious fodder available during periods of fodder scarcity and enhancing the nutritive value of crop residue and other cellulosic waste, while minimising waste from conventional and non-conventional fodder. The adoption of such cost-effective and innovative scientific practices can save time and labour spent on harvesting fodder, thereby reducing the drudgery of women and protecting forests.

## Lessons learned

- Decentralisation and community perceptions and participation should be addressed during the implementation phase of the project.
- To lessen the impact of fodder extraction in villages with ample area under forests, a self-regulated, rotational approach to harvesting (every 4-5 years) is suggested based on the carrying capacity of the forest.
- Trees may be protected from damage by restricting the lopping of branches to the lower third of the tree canopy and lopping only trees with a diameter of more than 30 centimetres and branches with a girth of less than 5 centimetres.
- Locals must have a sense of ownership of the project.
- Implementation mechanisms, capacity building, and skills development should be thought of as important factors in the success of any project related to rural development and conservation.
- The regular monitoring of project activities by funding agencies and the implementing agency is also important.

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## Contact

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# Soil Conservation for Settled Agriculture Using *Echo*, a Traditional Soil Conservation Structure, in Wokha District, Nagaland, India

— Laishram Kanta Singh

Krishi Vigyan Kendra, in Wokha district, Nagaland, under the Indian Council of Agricultural Research (ICAR), Research Complex for North Eastern Hill Region based in Meghalaya, India, has been implementing a front line demonstration called the 'Construction of soil conservation structures for settled agriculture using *echo*, a traditional soil conservation structure' since October 2007. A similar trial is being conducted in the adjoining state of Manipur. The project will eventually be expanded to other districts of Nagaland.



*Echo*, the traditional soil conservation system practised by farmers



*Echo* with contour bunding at Longsachung Village, Wokha District of Nagaland

## Problem

Shifting cultivation, locally known as *jhum* or *jhumming*, is the chief means of livelihood for the tribal people in the hilly areas of North East India. The *jhum* land in a village has a uniform period of rotation or '*jhum* cycle'. The period after which cultivation is again taken up on *jhum* land depends on the man/land ratio in the village. As the population in a village increases, the cycle is adjusted accordingly. One of the major problems with *jhum* in North East India is the drastic shortening of the *jhum* cycle from more than 20 years to 4–5 years. As a result, the land is not able to recoup and regenerate and the system has started to break down. The *jhum* cycle plays a critical role in natural regeneration and, consequently, the economy. Soil conservation measures such as bench terraces with assured irrigation have proved effective in attracting villagers to settled agriculture.

## General approach

*Echo* is a traditional soil conservation system practised by the farmers of Wokha district and other districts of Nagaland. *Echo* is the local name used by the Lotha community to describe the placing of bamboos or logs randomly across the slope in *jhum* fields. The logs conserve the soil and are replaced after two or three years, depending on the durability of the logs. This method has been scientifically modified so that logs are now placed across the slope along the contour line at a vertical interval of 3 metres, depending upon the slope. Results reveal that this configuration significantly minimises soil loss.

## Outcomes

Many farmers in Longsachung and nearby villages have already started constructing *echo* using the contour bunding system. As the farmers in these villages are already familiar with *echo*, it was easy to supplement with scientific methods and modern soil conservation techniques. Intensive training was provided on the modified *echo* system to incorporate contour bunding, which has been successful in terms of soil conservation.

### The modified *echo* system with contour bunding

Using the same traditional materials and input, the modified *echo* system is constructed by placing logs along contour lines, which are marked across the slope using an A-frame or water pipe. The modified system diverts runoff during rain to grass-lined waterways, thereby retaining eroded soil. Parabolic channels (0.3 metres top width and 0.2 m deep) are built along contour lines and excavated soil is placed in the form of a bund downstream. Developing terraces through a slow process with contour bunds avoids the exposure of subsoil as in bench terracing; it also avoids the huge expenditure involved in the direct construction of terraces. Usual cultivation is continued between two bunds. With gradual silt deposition, the area between the bunds takes the shape of a terrace in 4–8 years. Bunds require care and maintenance during the first two years. The planting of forage grass strengthens the bund.

## Good practice

- Shifting cultivation can be made more sustainable and environmentally safe with contour bunding. After a few years of cultivation the land transforms into terrace, which minimises soil erosion problems.
- *Echo* with contour bunding and proper land use planning has in some instances led to settle agriculture.

## Lesson learned

- Farmers in the project sites were already familiar with the traditional soil conservation practice of *echo*, hence it was easier to adapt this traditional technique than to adopt a new one, and more practical for the region.

## Contact

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# Conclusion

# Take Home Messages

— Bandana Shakya and Ujol Sherchan

Conservation approaches are as diverse as the biodiversity of the Hindu Kush Himalayan (HKH) region, ranging from the classical approach with emphasis on flagship species to more participatory conservation methods at the landscape and ecosystem levels. The 15 case studies presented in this publication give a glimpse of the varied approaches and initiatives being employed for the conservation and management of mountain biodiversity at community, national, and landscape levels in the HKH region. These case studies give an overview of biodiversity conservation in the region, the services provided by biodiversity resources, and the challenges being faced in their management. They call for the enhancement of conservation and livelihood security through participatory and community-based approaches and regional cooperation.

With a focus on the interdependence between the environment and development for a sustainable future, the case studies on the conservation of species at risk advocate for enterprise-based livelihood support and community development to motivate farmers to participate in conservation. These case studies present innovative conservation technologies that can be replicated elsewhere in the region and highlight the need to involve communities as conservation partners for effective environmental stewardship.

The HKH region is a vast source of traditional ecological knowledge and practices. Some of the case studies promote the idea of biodiversity management through existing traditional practices. They also emphasise the need for equitable access to biodiversity resources and benefit sharing for more sustainable results, thereby directly contributing to one of the fundamental objectives of the Convention on Biological Diversity.

Global issues are also examined in the case studies, such as the role of agrobiodiversity in economic development and agro-based industries for a green economy. Lessons on good governance, local capacity building, and promoting local markets through value addition for effective natural resource management are also contained in some of the case studies.

It is hoped that the messages from these case studies will provide clear insights into the development of appropriate strategies for ecosystem conservation to ensure the continuous flow of ecosystem goods and services for the upliftment of the livelihoods of the people of the region and to facilitate adaptation to climate change in the region and beyond. Together, these case studies provide a framework for biodiversity conservation and management in the region. The following take home messages can be distilled:

- Biodiversity conservation measures should be incentivised to ensure the participation and ownership of stakeholder communities. Conservation measures should enhance local people's livelihoods, technical and management capacities, and decision-making role, otherwise sustainability can prove elusive.
- Conservation should be built on social capital, such as indigenous knowledge and culture, traditional institutions, and customary rights and practices, from the community level up. The best hope for conservation may come from the fusion of traditional/indigenous knowledge and science.
- Good governance and conflict resolution across all levels is essential for the success of conservation efforts.
- Reversing the rate of biodiversity loss in the Hindu Kush Himalayan region – be it the loss of the iconic snow leopard, or the Himalayan golden mahseer – through appropriate protection and conservation measures, as advocated by the Convention on Biological Diversity, calls for regional and sometimes transboundary cooperation.
- Given that communities across the region, with their traditions and cultures, will go on shaping ecosystems, and that various drivers of change, including climate change, will continue to influence biodiversity and ecosystem

services, focusing on a long-term, integrated landscape approach to conservation with long-term monitoring can have lasting impacts.

- Similarly, putting in place mechanisms such as payment for ecosystem services (PES), and appropriate strategies promoting a green economy can further build the resilience of socio-economic and ecological systems in the landscape.



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