Mountain Forum Bulletin

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Mountain Agriculture for Better Lives

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Saving for winter - dried fern as fodder. Photo: Bandana Shakya.
Capsicum harvest. Photo: Helvetas.
An Andean farmer sorting freshly harvested potatoes. Photo: Benjamin Ditto.

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Message from the Executive Secretary

Dear Mountain Forum Member,

This is the first Bulletin produced in the new phase of the Mountain Forum. The Strategy and Workplan 2008/2011 have been recently approved by the International Board. It outlines three main thrusts:

1. Sharing information and communication, including on-line and 'off-line' tools and content;
2. Mutual support from over 5,000 members;
3. Support to strategic policies and advocacy processes with key partners.

Overall, four broad thematic areas in sustainable mountain development can be identified namely: natural resource management, climate change, livelihoods and cross-cutting issues such as trans-boundary governance. For each, further areas are defined for which networks of experts or communities of practice can be formed.

You may note the focus in the coming Bulletins on themes linked to key events and strategic areas. Content will benefit from contributions from members as well as key thematic partners.

The central theme of this Bulletin is mountain agriculture, a theme of major importance for sustaining mountain livelihoods and food security. The conservation aspects are addressed especially in this issue in view of the World Conservation Agriculture Congress in Delhi, February 2009. I'm glad to note that interaction on content sharing has started with ILEIA, who produce one of the most widely disseminated magazines on sustainable agricultural development.

A theme that has not been addressed much so far, but will receive increasing attention, is the use of information and communication tools to support access to information and provide a voice for local mountain communities. In order to benefit from knowledge and information about lessons learnt, practices, policy regulations and market opportunities, an effective local infrastructure has to be in place. Mountain communities especially face difficulties due to their remoteness, geography and distance to technical support centres. However in several countries, community centre initiatives have been taking place which can give ideas for other communities. An interview with Mahibir Pun highlights some of the work being done to bring the internet to local communities in Nepal.

I would like to close thanking the members of the Mountain Forum who have contributed to this issue of the Mountain Forum Bulletin. I also would like to welcome all interested members and others to continue contributing their knowledge and sharing information through the Bulletin and by the other means offered by the Mountain Forum.

I wish you happy reading.

Frans Neuman
Executive Secretary
Mountain Forum Secretariat

Your feedback is always welcome. Please send any comments or suggestions by email to bulletin@mtnforum.org or by ordinary mail to the Mountain Forum Secretariat (for the full address see the back of the Bulletin).

Recognising the Amenities of Mountain Agriculture in Europe

Thomas Dax

Spring in the Austrian Alps. Photo: Gerard Hovorka.

For many years, the specific handicaps of mountain areas in Europe have been seen as a major reason for targeted policies, particularly for mountain agriculture. There is a range of differences in the production difficulties due to the climate and topographical variety of geographical situations. Farm abandonment and marginalisation processes are seen as significant threats not just to agricultural production but also to regional development of these areas in general.

From the 1970s, mountain farming support was conceived as one of the main instruments of structural policy aimed at the prevention of land abandonment, to preservation of the farming population in these areas and maintainance of cultural landscapes. It was framed within the Less-Favoured Areas (LFA) policy which also addresses other LFAs outside the mountain areas, including types of production difficulties. In the long term, it can be observed that this was one of the first measures to address environmentally beneficial farming systems and High Nature Value (HNV) farming systems. It was developed both within the EU and rwn - EU European countries.

Objectives of mountain farming support

The dominant objective of this policy is to maintain farm management in less-favoured areas based on environmental principles and provision of other functions beyond food production. The aim is sustainable resource management, which includes particularly preservation of soil, water and air quality, maintenance of the cultural landscape, a high degree of biodiversity and protection from natural hazards. As the EU regulation provided a flexible framework to take account of the specificities of production difficulties, the implementation in the different Member countries and regions focus on various priorities. Usually the following aims are formulated by these programmes:

- Maintenance of agricultural land use and the associated rural community through the development of the rural environment;
- Contribution to the settlement and land use management systems under difficult production conditions; and
- Remuneration of the public goods produced by farms in less-favoured areas.

Delimitation of areas

Due to the high variation in climate and production between different European regions (North/South), thresholds applied vary considerably between the Member States of the European Union (MS) and regions. The demarcation of the mountain areas as defined in EEC Directive 75/268 (Art. 3, para 3-5) and later amended several times, has set the geographical area and can be considered as the best known classification for mountain areas in Europe. By addressing altitude and the gradient of the agricultural areas as main criteria, it provides a measurement for farming difficulties. Mountain areas are understood as areas where altitude and slope reduce the growing season and scope for mechanisation. High latitude regions in Finland have been included in this category. Mountain areas make up about 17 percent of the total Utilised Agricultural Area (UAA) of the EU.

Particularly high proportions of mountain areas can be found in several Member States like Austria, Greece, Slovenia and Finland, whereas Italy, France and Spain show the highest absolute mountain areas. In central and northern European mountain regions, animal husbandry and grassland management are of major significance for land use and decisive for landscape structures. Areas with a particular high nature value are widespread, such as high pastures, steep mountain meadows, dry grassland biotopes and damp meadows in some valleys. Mountain farms are also of great importance for forest protection and the management of Alpine pasture areas, which are extremely sensitive eco-systems.

In comparison to the UAA, the proportion of permanent grassland and wooded area is particularly high. The low production potential is underscored by the low share of the Standard Gross Margin (SGM) in LFA. The additional variables on the situation per holding underpin the small agricultural structure for the mountain areas. It reinforces the need for the differentiation between other LFAs and mountain areas, demonstrating quite clearly that land use, livestock and crop production potential are significantly lower for mountain areas.

Table 1: Contribution of mountain areas and LFA to EU agriculture (2003 in percent of total EU-15)

	Mountain areas	Other LFA (incl.specific handicaps)
UAA	17.8	38.2
Arable land	10.4	33.0
Fallow land	12.5	43.8
Permanent grassland	28.4	48.4
Permanent crops	27.4	33.8
Wooded area	60.0	34.9
Share of SGM	11.8	24.1
SGM per ha (EU-15=100, Index)	66	69

Source: Eurostat, own calculation

[1] *Due to the extension of LFAs and the limited differentiation of the other less-favoured areas, doubts on the effectiveness of the implementation for that part of the scheme have risen and a revision is required by 2010. However, this revision will not apply to the mountain areas for which the delimitation will remain unchanged.*

In many mountain regions, farm holdings are moreover characterised by a small farming structure which is operated primarily by family labour input. The average size of mountain farms in EU-15 is as low as 12.3 ha UAA against an average of 18.7 ha UAA for all farms in EU-15. In terms of Standard Gross Margin (SGM), the difference is even bigger. Whereas the average SGM per holding in mountain areas is 8.1 Economic Size Units (ESU), this figure is up to 18.7 ESU for all the EU-15 farms. These indicators refer to particular production difficulties and region-specific problems that have to be addressed through strategies to strengthen viability of land use in mountain areas.

Support levels

The different priorities identified by Member States and the variety of policy implementation, lead to differences in uptake which are not explained by structural differences alone. Factors of importance include:

- The average payment per beneficiary holding ranges between 600 and 9,000 Euros. The range for the average payments per supported area is similarly high, comprising support levels of 20 to 200 Euro/hectare. In the regions most concerned, LFA support achieves up to 40 percent of farm income (Crabtree et al. 2003);
- The proportion of beneficiaries with regard to all holdings in eligible areas varies considerably. This proportion varies from about 10 percent in Italy and other southern European countries to nearly all farmers in northern Member States;
- Whereas some countries do not modulate the payment according to the size of the holding, in others, provisions exist to differentiate grants according to type of production, number of productive units, stocking rate, maximum payments or revenue of the farmer.

About 470,000 mountain farmers (2004) received Compensatory Allowances payments, which is less than a quarter of eligible mountain farmers.

Diversification and multifunctional tasks

The fact that only for a minority of mountain farms is agriculture the main economic activity, has driven farmers towards the recognition of a wide range of functions, going far beyond food-provision. Some of these are linked directly to farming, but multifunctional mountain farming includes objectives to sustain the management of externalities supplying services and values, reflecting a rising social demand.

Agriculture and forestry in a Swiss Mountan Valley. Photo: Roland Neissi.

It is important that the provision of these tasks is linked to specific requirements of farm management with clear limits for intensification of production. Such production methods are particularly supported by the widely applied agri-environmental measures of CAP. In this regard, the priority of mountain farming strategies on quality development and region specific products represent a major asset and has a positive impact on farm household incomes.

Through the provision of positive externalities, mountain farming contributes to maintaining settlement structure and shaping the cultural landscapes in areas which otherwise would lose significant parts of their development potential. Since by definition public goods are not rewarded in the market, there is an obvious case for transfers from society at large to reward those who maintain such public goods. Thus the support for mountain farms is core for the positive direct and indirect effects in safeguarding the sensitive eco-systems and maintaining multifunctional landscapes in mountain regions. The debate on the socio-economic processes increasingly has to focus on the long-term provision of public environmental amenities to facilitate sustainable regional development and address the threats of land abandonment and marginalisation processes in mountain areas.

Harness development potential of mountain agriculture

With the appreciation of rural amenities as a development asset (e.g. OECD 1998), the discourse on mountain policy has changed from the demand for compensating for production difficulties towards a stronger integration of the specific features and potential as a development asset.

These are linked to products and farming activities where the inter-relationship with other sectors, regions and persons is most strongly developed. Tourism activity, high-quality production, regional products and traditional processing methods, as well as organic production are examples. The important issue is that this development could only be realised because of the rising demand from large parts of society in Europe, including the urban population. The stronger inter-relationship of mountain and non-mountain areas seems therefore one of the main prerequisites for effective diversification. A host of other factors also need to be taken into account for successful development approaches. These include (Fleury et al. 2006):

- Reflection of the diversity of mountain regions and products;
- Long-term support by regional managers to “detect” and nurture development potential;
- Enhanced understanding of processes of change, product development and innovative projects;
- Continued assessment of achievements, securing the lasting effect of the dynamic of the project;
- A professional approach to product development that includes recognition of strengths and weaknesses and takes account of failures in order to overcome them;
- Use of the advantages of cooperative action wherever appropriate.

This is not just about increasing the effectiveness of mountain farming systems and adapting it to the actual demands of society, but also envisages closer cooperation with the non-farming sectors and a new understanding of the specific role of mountain agriculture within the regional economy, environment and society.

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Agricultural Diversity in Coping with Climate Change

Bandana Shakya

Saving for winter - dried fern as fodder. Photo: Bandana Shakya.

Livelihoods of mountain communities in the world revolve around the farming system, where production is mostly subsistence based and the systems are influenced by traditions. In the last few decades, farming systems are gradually changing into the market led businesses. The global food supply shows an increase in both productivity and the production area, mainly the result of industrial and mechanised agriculture that focuses on high yields from a few crops, ignoring the other minor crops. Industrial agriculture, though the basis of the 'green revolution', is often very demanding in terms of resources and energy input compared to traditional agriculture. Besides, a dilemma of industrialised agriculture is that it benefits the wealthier communities who own large farms but relegates the poor and marginalised further into poverty. It further controls the agri-business and enhances monocropping. The diversity of farming systems is fundamental in supporting global food security. In the face of climate change affecting biodiversity, evidence shows that crop diversity plays a significant role in adapting to changing environments (Hajjar et al.2008, Zhu et al.2003). Agro-ecosystems also deliver important regulating services such as soil protection, erosion control, pollination, carbon sequestration and the maintenance of soil and water quality. Another very important aspect of agro-ecosystems is that it gives continuity to human traditions, cultures and customs. The genetic pool of modern day crops and their wild relatives is the outcome of selection processes and practices adopted by humans and nature over centuries. Further, development of molecular biology and genetic engineering, cellular fusion and tissue culture has greatly added to the genetic diversity of crop plants. Today, there are an estimated 7,000 plant species cultivated for consumption; many are yet to be studied. Among all the cultivated crops, cereals are the most important food commodities, providing over 50 percent of the daily calorie

supply and 45 percent of protein (FAO, 1998). A much wider variety of food crops such as pulses, oilseeds, yams, potato, banana and others continue to supply nutrients in diets. A vast array of crop diversity is nurtured by rich tradition and culture that is prominent at the local level. Safeguarding and protecting the rich gene pool of the crop plants is a major challenge in the context of climate change. It is also important to consider the wide range of services provided by agro-ecosystems that safeguard the production system in its entirety. The paper briefly highlights the current discourse on the impacts of climate change on agro-biodiversity and outlines the dynamics of production systems and measures for their sustenance in the backdrop of climate change.

Climate change impacts

Global warming is evident and considered to be a major factor influencing the world's living diversity, including agricultural biodiversity. The rise in temperature, changes in precipitation patterns and extreme weather events influence changes in vegetation structure, productivity and species composition. Although the extent of this influence on the nature and behaviour of agricultural crops is not clear and scientific uncertainty remains, serious implications are predicted. For example by 2080, the 40 poorest countries mainly in tropical Africa and Latin America may lose 10-20 percent of their basic grain growing capacity due to drought and many of the rain-fed crops are already under worse stress (Kotschi, 2007). Crop diversity and production can also be affected by the change in soil quality caused by the changes in soil temperature, accelerated soil-matter decomposition and changes in microfloral and microfaunal metabolism. Drought resistant crop varieties may become prevalent in the tropics while tropical crops may move to the subtropics. Changes in cropping patterns based on climatic zones may also influence the production system by altering the connection between the soil and associated biodiversity such as pollinators and decomposers. In the temperate belts, mountain agriculture may experience expansion of agriculture into the transitional zones, converting other ecosystems such as open-meadows and pastureland into agriculture fields. Complete loss of crops resulting from extreme and unpredictable weather events such as prolonged rainfall and torrential rain are also possible, although research into this area is scanty. The pressing threat to agro-ecosystems posed by climate change however, is the fluctuations in the production system making the farming system less desirable and undependable (Morton, 2007). This means reduced gross productivity from agriculture, fluctuations in world market prices of crops, a decrease in food security and reduction in the well-being of rural communities. While there are growing concerns over the depletion and degradation of agro-ecosystems, there is also an increased understanding about their potential in coping with climate change. The key for adaptation is the wide genetic base of the crop plants and their wild relatives that can support and sustain mountain agriculture for years to come.

Dynamics of the agro-biodiversity

Agro-biodiversity is the result of evolutionary changes involving constant selection of species by farmers' in their field over time. The evolutionary events of 'major gene mutation' and 'gene doubling' are significant in bringing out the desirable morphological and adaptive traits in crop plants that are advantageous in terms of increasing productivity, as well as adapting to diseases and pest infestations and harsh climatic conditions. The useful genetic variations that have developed thereby give the crop plants an advantage to grow and prosper over large geographical areas distributed at different elevation zones. Doubling of genetic entities through polyploidy has greatly expanded the yield of many important crops such as rice and wheat. The various millets grown in different parts of Africa, Asia and Eurasia present an excellent example of genetic variability accrued over the years due to their cultivation under extremely harsh conditions (Bala Ravi, 2004). Similarly, housegram and buckwheat which grow in poor edaphic and environmental conditions can have advantageous genetic composition for adaptation. It is therefore crucial to maintain the genetic pool of crop plants along with their wild relatives, since the adaptation capacity of agro-ecosystems relies on genetic diversity. Landraces are an important genetic resource base of crop plants that are subject to selection pressure and are manipulated by farmers for their various adaptive properties with moderate productivity. However, some landraces can still out-yield selected cultivars under adverse conditions (Weltzien and Fischbeck 1990). Advanced cultivars are a homogenous population of crop plants that are selected by plant breeders and are the basis of modern agriculture mainly meant for increased productivity. Wild progenitors and other close relatives of crop species are known as the 'secondary gene pool' (Harlan and de Wet 1971), and together with the pollinators and other elements of the agro-ecosystem play an important role in crop diversification and their sustenance. Dispersals by human and migratory animals have also significantly contributed to the diversification of the crop gene pool creating a 'secondary centre of diversity' or areas of favourable genetic diversification. In recent years, gene transfer in crop plants through genetic engineering has given tertiary pools for further crop enhancement and sustainability, broadening the scope for adaptation.

Conservation and management

With climate change becoming a reality and adaptation measures receiving global attention, conservation and management of natural ecosystems such as forests, wetlands and rangelands have received great attention. The agrarian ecosystem with its entire diversity of species and genes is yet to receive full attention in terms of recognition of their potential for complementing other ecosystem services and balancing food production with conservation of biodiversity. As witnessed in many mountain areas, there are issues of food security, shifts in traditional agriculture practices and loss of agro-biodiversity. Some of the minor food crops grown by mountain farmers such buckwheat *(Fagopyrum sp)*, foxtail millet *(Setaria)*, amaranth *(Amaranthus sp)*, horse gram *(Macrotyloma uniflorum)* and sesame *(Sesamum indicum)* should receive priority in conservation. To conserve crop genetic resources, the Food and Agriculture Organisation (FAO) emphasises building up an inventory of the genetic diversity of plants used for food, medicine and other purposes in traditional agricultural systems in marginalised areas such as in the mountains. There are many national and global conservation mechanisms for biodiversity such as the International Treaty on Plant Genetic Resources for Food and Agriculture, the Convention on Biological Diversity

(CBD) and National Biodiversity Strategies and Plans, that propose the protection of indigenous knowledge associated with farming systems and use of genetic resources. For the conservation and management of agro-biodiversity resources in the face of climate change, a multi-sectoral approach is needed. An appropriate conservation strategy for agro-biodiversity would be the promotion of in-situ mechanisms that involves the constant exposure of crop plants to environmental pressure, complemented by ex-situ gene banks and a horticultural garden development approach. While the protection of community knowledge and recognizing women's role in safeguarding agro-biodiversity must be a priority, it is equally important to have an incentive mechanism established for farmers to create and sustain the community gene bank, to enhance customary legal instruments to protect farmers' rights and to improve their social capital. Large-scale awareness on the relationship between climate change and food security is crucial and should be raised at local, national and regional levels.

Agricultural biodiversity thus provides many benefits to humans including food security, nutrition and livelihoods. In addition, the genetic diversity of agro-biodiversity gives species the ability to adapt to the changing environment, as well as increase their resistance against certain diseases and pests. Maintenance of crop genetic resources, domesticated and in the wild is therefore essential to ensure sustainable production of food and other agricultural products, to enhance ecosystem services and to allow adaptation to the change, including climate change.

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Livelihoods at Risk: Agricultural Viability and Converging Climatic and Economic Change in the Central Andes

Adam French and Jeffrey Bury

An Andean farmer sorting freshly harvested potatoes. Photo: Benjamin Ditto.

In the world's highest tropical mountain range, the Cordillera Blanca of Peru, impacts linked to climatic change, increasing pressures on water resources, rapidly rising petroleum costs and shifting market conditions are threatening the viability of agricultural systems. Currently, these distinct processes of change are converging in ways that significantly enhance and reinforce their negative effects on the livelihood security of rural populations in this region. Based on new case study research comprised of extensive surveys and interviews with a broad range of regional stakeholders, the authors illustrate the ways in which highland farmers and their agricultural pursuits in the Cordillera Blanca are increasingly vulnerable to these intersecting changes.

Recent impacts of climate change on Andean agriculture

Historically, agricultural production in the central Andes has been characterized by a high degree of endemic risk due to the region's extreme topography, poor soil quality, climatic variability, crop pests and diseases and limited water resources (Brush and Guillet 1985). Many of these challenges are likely to be intensified by changes associated with a shifting climate regime such as increasing temperature extremes, less-predictable precipitation patterns, decreasing freshwater resources and greater prevalence of crop pests and diseases (Slingo et al. 2007). Recent research in Peru's Cordillera Blanca indicates that this intensification of threats to agricultural production is currently occurring in the region and many local residents perceive a clear link between climatic change and shifting agro-pastoral productivity (Young and Lipton 2006).

In the final decades of the twentieth century, temperatures rose markedly throughout the tropical Andes, contributing to a rapid and ongoing decline in the glaciers of the region (Bradley, Vuille et al. 2006). As tropical glaciers provide a critical source

of drinking and irrigation water for large numbers of mountain residents and downstream users, their recession has the potential to lead to significant crises over water availability. Growing water scarcity is already fomenting new social and economic conflicts over access to and use of hydrologic resources in the central Andes and will have significant impacts on agricultural productivity in the region. On the western slopes of Peru, melt water from the Cordillera Blanca is particularly important as a buffer against low precipitation and runoff levels during the tropical dry season and drought years (Mark and McKenzie 2007). Additionally, modeling of future climatic conditions in the Cordillera Blanca predicts enhanced seasonal variability by the middle of this century, with significantly less runoff occurring during the dry season (Juen et al. 2007).

People throughout the Cordillera Blanca are keenly aware of the rapid glacier recession occurring there and many case-study respondents noted decreasing water levels in the lakes, rivers and streams of the range. In relation to these changes, many of those surveyed expressed serious concern about both current and future water availability for agricultural and grazing uses. Respondents also noted that recently there have been significant shifts in water management practices such as canal improvements and extensions, irrigation rationing and a return to rain-fed agriculture in fields that have lost irrigation access due to changing water flows.

Although water scarcity is a serious concern for people of the region, our respondents were even more alarmed by recent and very marked short-term shifts in temperature extremes (colder nights and more frequent killing frosts as well as more intense solar radiation and heat) and the timing and distribution of precipitation as well as by a perceived decrease in annual rainfall. While these changes are generating a broad range of health and livelihood impacts, more frequent and severe frosts have significantly diminished high-elevation tuber crop productivity and unseasonal rainfall has damaged cereal crops close to harvest. These changes are leading to growing uncertainty about the traditional agricultural calendar, as planting and harvesting dates are shifting unpredictably in response to both unseasonal rainfall and temperature extremes.

New political economy complications

Increasingly, scholars investigating human vulnerability to global change recognise that the impacts of biophysical and socio-economic conditions and changes must be considered together to understand the ways in which their convergences increase or reduce risks and opportunities for those affected (O'Brien and Leichenko 2000). In the Cordillera Blanca, convergences of this sort are increasingly critical, as the negative impacts of climate change on highland agriculture are being significantly intensified by growing demand for water resources by downstream users, rapidly increasing petroleum prices and unfavorable market conditions for traditional Andean products.

The Rio Santa, the river with the second largest and least variable annual discharge on Peru's Pacific slope, collects the majority of the runoff from the Cordillera Blanca and supplies vital water to highland farmers. The Santa, however, also drives several hydroelectric power generating facilities along its middle reaches, provides a significant portion of the potable water used by more than a million coastal inhabitants and supplies two massive and rapidly developing coastal irrigation projects that support the growth of an estimated 100 million dollars worth of commercial agricultural products annually, most of which are exported (Painter 2007). As a significant portion of the Rio Santa's dry-season flow is made up of glacial melt water, it is likely that as glaciers recede further and discharges diminish, conflicts between these various users will ensue with more financially and politically powerful stakeholders best positioned to maintain their resource access. In addition, an important indirect effect of the recent sharp rise in global petroleum prices on Andean farmers has been a rapid increase in the costs of synthetic fertilizers and insecticides. Over the last several decades, those able to afford synthetic inputs have used them liberally to compensate for poor soil conditions and crop pests. During late 2007 and early 2008, however, farmers watched the prices for synthetic fertilisers triple and many respondents reported that they will no longer be able to afford these inputs in the quantities to which they have become accustomed, which will likely lead to significant reductions in crop yields. Prices for insecticides have also risen dramatically and demand for them has intensified due to increasing problems with both crop pests and diseases. A surprising number of respondents indicated that, given the prohibitive prices of agricultural inputs and the fact that their crops would not produce without them, planting traditional tuber and cereal crops is no longer a viable activity. Similarly, a number of respondents indicated that if input prices remained at such high levels, they would be forced to seek work in urban areas or in the region's tourism sector to support themselves.

Further exacerbating the challenges confronting Andean agricultural production are extremely low market prices for a variety of tuber crops, which provide the primary source of agricultural income for many residents of the Cordillera Blanca. Most respondents stated that they currently grow crops solely for personal consumption as market prices no longer cover even the costs of production. Research conducted several years ago in this region found similar results, reporting that many residents felt livelihoods devoted solely to agriculture were no longer sufficiently profitable to justify their pursuit (Young and Lipton 2006).

Curtailing the convergence - what can be done?

Most agricultural livelihoods in the central Andes are characterised by a high degree of risk linked to the difficult conditions of their production. Recent climate shifts, however, combined with important changes in the regional and global political economy are intensifying elements of this risk to such an extent that the viability of agricultural systems is being challenged. While an ingrained resilience born from adapting to harsh and unpredictable circumstances will undoubtedly enhance Andean agriculturalists' abilities to respond to the mounting challenges they face, the research indicates that many farmers in the Cordillera Blanca are confronting processes and impacts that they do not feel confident addressing without assistance.

This situation creates important opportunities for critical intervention from the scientific community, the Peruvian state and foreign governments and the international philanthropic and development sectors. Helping local people understand the nature and scale of the diverse changes taking place in the region and providing crucial tools to help them respond effectively to the challenges they face are key components of promoting successful adaptation (Tschakert 2007). Increasingly, it is recognised that these kinds of efforts will require new

theoretical innovations and modeling frameworks, intensive fieldwork and applied research, effective dissemination of research results, and widespread distribution of both information and material resources. To achieve these ends, Andean farmers, scientists, politicians and development practitioners will need to identify and work towards common goals through broad collaboration and a willingness to bridge significant cultural, disciplinary, and professional divides. In light of the converging threats to agricultural livelihoods in the Cordillera Blanca and the central Andes in general, this difficult work should be pursued with urgency.

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Traditional Irrigation System: A Case of Apatani Tribe in Arunachal Himalaya, North East India

Mihin Dollo

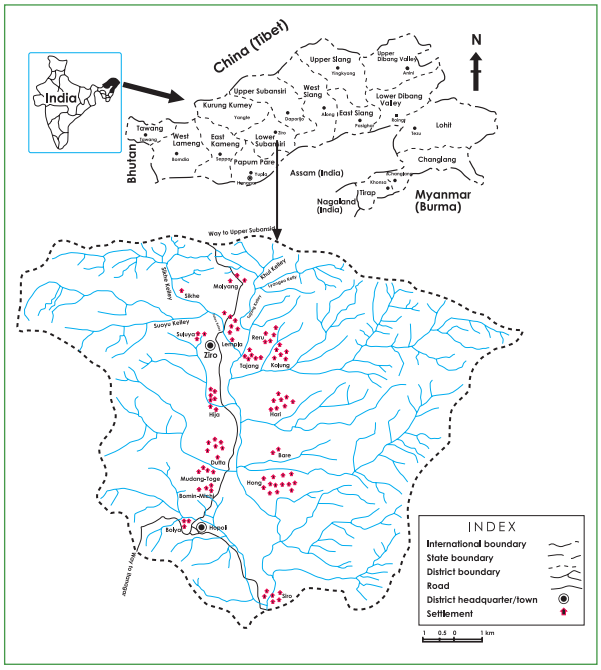

Figure 1: Map of Apatani plateau watershed.

The post-World War II era has witnessed a drastic increase in irrigation activities that have contributed substantially to the massive growth in agricultural production that enables humanity to feed its doubling population. Worldwide, irrigated land has increased from 50 mha (million hectares) in 1900 to 466 mha today. Much of this increase has been in developing countries. For example, in 1950 India had an irrigation potential of 22.6 mha which today has risen to 105 mha. However, in many cases, water resources have been overdeveloped. There has been overspending on capital and significant cost in terms of loss of ecosystems, extinction of fish species and contamination of water sources. This has happened due to underestimated or neglect of economical and ecologically viable traditional irrigation technologies which are time-tested and location specific. Documentation and validation as well as valuing of traditional irrigation practices may have a pivotal role particularly in fragile mountain ecosystems.

Arunachal Pradesh, a state in the extreme north-east of India (bordering Bhutan to the west, Tibet to the north and Myanmar to the east), has great ethno-cultural diversity, with 26 major and 110 minor sub-tribes. The region is well-known for its rich eco-cultural heritage, as well as the wealth of traditional ecological knowledge amongst farmers. As agriculture is the main livelihood activity in the region, it is vital that the production systems are managed efficiently. The Apatani tribe in the Apatani plateau situated in the central western part of Arunachal Himalaya, through traditional irrigation systems locally called as Bogo, has been successfully managing their agro-ecosystem for many years

Plate 1: Landscape view of Apatani plateau. Plate 2: Paddy-cum-fish culture by the Apatani tribe. Plate 3: Traditional erosion control system in irrigation canal by using locally available resources. Plate 4: Modern erosion control in irrigation canal by using concrete. Plate 5: Traditional check dam for irrigation. Plate 6: Modern check dam for irrigation. Photos: Mihin Dolla.

(Figure 1 and Plate 1). However, in recent times, with the youth migrating in search of jobs and other labourers coming in, many of these traditions, practices and knowledge are in danger of being diluted or lost.

When traditional knowledge and practices developed over centuries are shared within the tribe who work on the land together, it clearly supports sustainable agro-ecosystem management in this region. The Apatani are known for their system of rice and fish cultivation (Aji-ngyii) in the valley, which produces enough rice to export from the region after meeting local needs (Plate 2). This is a highly evolved indigenous farming system, the energy and economic efficiency of which is very high partly due to effective irrigation practices.

As part of a wider research effort into this little studied region, the G.B. Pant Institute of Himalayan Environment and Development set out to document traditional knowledge in relation to sustainable agriculture across the Arunachal Himalaya. The main objectives of the study carried out between March 2006 and February 2008, were to examine the traditional irrigation practices used by the farmers in the Apatani plateau, the nature of community participation and the changes they are facing. Group discussions among different age groups of the Apatani were held, involving both men and women. Special attention was paid to older farmers in order to understand the exact nature of traditional irrigation system and its transition.

Traditional system

The Apatani system of irrigation is more than a century old. The practice has been worked on and perfected through community involvement and equitable sharing of water resources. In this system, water is tapped near the forest in the foothills of the valley and is channelled through to major canals on either side of the valley to supply the agricultural land. The water is distributed via numerous small canals so that every plot of land is well supplied with irrigated water for rice cultivation and fish culture. This also ensures that any surplus water is drained back to the main canal without the loss of any organic matter or soil.

Terraces made along the gradient are connected using bamboo pipes of small circumference (10–15 cm) at the higher elevations where water intake is lower. In the lower valley where the volume of water is greater, pine pipes of larger circumference (15-25 cm) are used. These pipes are made from pine trunks split vertically, hollowed out and then the two parts put back together. Water from the bamboo and pine pipes is not allowed to cascade from one plot to another; bamboo barriers are fixed on the upper elevations where the volume of water is smaller, with pine blocks at lower elevations where the volume of water is greater. Further, to contain losses of organic matter or fish from the plots, bamboo traps or straw bedding have been introduced into all plots. In addition, the outflow pipes are placed five to eight inches above the surface of the lower plots so that water from lower plots cannot flow back to the upper plots. The dimensions of the dykes or bunds change from higher elevations towards the valley floor. At higher elevations, the plots are wider, whereas at lower levels the bunds are narrower.

To curtail soil erosion from the main canal, bio-fencing measures such as planting with *Phragmites sp.*, *Ligustrum sp.*, etc. have been carried out and wooden barriers of *Pinus wallichiana A. B. Jacks*, *Castanopsis spp.* or bamboo species have been installed to limit the flow of water (Plate 3). Weeding of *Houttuynia cordata Thunb.* is not done, as it is considered good for soil binding and stabilization of the bunds. Bamboo is also used to support the wider bunds. The bunds are repaired every year before rice planting. Ploughing is not done in the rice plots so as to avoid soil loss, but spades may be used to till the land before irrigation.

Equitable sharing

The Apatani traditional community has evolved using diverse management tactics. For example, they have set a group called Bogo, which is seen as the most important group as

there are limited water sources for irrigation in the Apatani valley and good water management is essential for efficient production in the rice-fish system. These irrigation systems are managed by the traditional farmers' group led by Bogo Ahtoh. The Bogo Ahtoh is mainly headed by a male member as it requires heavy work. The group manager leads all the activities, although in some cases the financial transactions are made by the Finance Secretary or Passer Binee. The Bogo Ahtoh post can be held for one to three years and is selected from within the group. Organisation size normally ranges between as low as three and a high of nearly 600 households depending on village size and irrigation canal length. The main task of the organisation is construction and maintenance of the water supply system and regulation of the efficient sharing of water among the group. The vision of this group is reflected in the management and sharing of water in the community, which recognises that water is the common concern which binds the group. The farmers know that traditional practices are very important for maintaining sustainable production systems and that farmers' associations are the foundations of these practices. Most farmers recognise that without farmers' organisations, agro-ecosystem management will easily weaken and the technical ecological knowledge which supports it will quickly erode.

Since water is most important for rice cultivation, the entire community has a stake in it and its equal distribution ensures collective survival and social cohesiveness within the community. The proper distribution of water is regulated by a few nominated members of the community who ensure its equitable distribution and are empowered to resolve any conflicts that arise. Each year, repairing of the canal is carried out by collective participation, whereby one person from each household provides their labour. Some villages within the community have a small grant for the upkeep and maintenance of the canals. Each plot owner is bound to provide equal supplies of water to the neighbouring plots and violation of such regulations is dealt with by the community institution called Buliyang. The division of labour is such that men repair the bunds and canals, whilst women manage the plantations and weeding through to harvest. Harvesting is done jointly by both, with women cutting the spikes and men doing the threshing.

Irrigation and soil fertility

The canal draining the village wastewater, which carries organic material, particularly the biodegradable waste from the homesteads that comprises of vegetable waste, poultry and piggery manure, is a good source of fertiliser and is also connected to the irrigation canal, which is further draining into the agricultural fields. In addition, the organic material (decomposed leave litter) leaching from the forest floor is collected in separate pipes connected to the main canal so that whenever the additional forest run-off reaches the canal, it goes on to the plots. Plots not connected to the main canal collect any organic material from the forest through the normal bamboo pipe connected to the plots above them. The extra organic material accumulating near the inlet pipe is spread by hand on other parts of the plot. The traditional perception is that the run-off from forest with trees such as *Ficus spp.* are more fertile compared to forest with *Quercus spp.*, *Castanopsis spp.* etc. This traditional perception may be correlated with the decomposition of leaf litters as the litter of Ficus spp. decomposes faster that of *Quercus spp.* and *Castanopsis spp.*

Transition and future options

Traditional irrigation systems are now in a transitional phase, mainly due to outside intervention. It has been quite evident that the traditional check dam and irrigation canal are slowly and steadily transformed by the use of concrete and iron materials from outside sources (Plate 4). This transition not only endangers Apatani's ecological knowledge but also risks the future survival of the fish population, as the concrete reduces the movement of fishes from down to upstream and it also lacks a breeding centre. In the traditional system there is enough space for breeding as the channels are made of wood and bamboo, which is not common in concrete construction. Though the Apatani are believed to be a very conservative community, now some of the traditional irrigation management systems are on the verge of extinction due to the integration of outside technologies. It is common for the youth to leave the communities in search of jobs, which creates shortages of traditional labour. In addition, outside labour forces are increasingly coming to the area for timber sawing, stone mining and the harvesting of non-timber forest products. Due to sociocultural, climatic and physiographic differences, these people have different management techniques which often dilute the Apatani traditional practices. The Apatani will still need labour from outside, but now they are trying to cope with the emerging situation by being aware that their system is very efficient yet delicate, and realising the need to preserve their time-tested knowledge by documenting it for future generations.

Except for financial support, particularly for erosion control, fencing and drainage maintenance, the farmers do not receive or seek any technological interventions or other help from any outside agencies. Outside experts have highlighted the Apatani rice-fish culture system as one of the most efficient crop production systems, encouraging the Apatani farmers to continue their traditional practices. The ingenuity of the Apatani community is well reflected in its traditional water management systems and in the sharing of resources for optimum utilization. The traditional system of wet-rice cultivation, which is a purely organic farming system, is functional even today and is modified by the community as and when required. There is optimum utilization of available natural resources such as bamboo, cane, pine, *Phragmites sp.*, *Ligustrum sp.* and *Castanopsis sp.* in order to check soil erosion, conserve soil fertility and raise fish in an integrated manner along with the cultivation of the many available rice varieties. The Apatani irrigation system offers environmental implications in sustainable resource management and may be replicated in similar micro-ecological conditions.

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Medicinal Plants in Valais: A Success Story

Charly Darbellay

Edelweiss field. Specie domesticated by Agroscope and cultivated by Valplantes' producers. Orsières - Canton Valais. Background: Catogne Mountain 2598 m. Photo: Charly Rey.

Project genesis

During the 1980's, the mountain regions of Switzerland (including Valais) were facing serious difficulties. The farmers abandoned their fields and the population was weakened by a rural exodus. The future of mountain regions seemed uncertain.

However, the mountain people did not give up. They looked for new solutions to look after their life in mountain regions. It was necessary to innovate, to find new solutions. Among these, the cultivation of medicinal plants, new to the Valais, captured the attention of some pioneers. A group of farmers founded the cooperative Valplantes to launch the cultivation of medicinal and aromatic plants, organise the production and trade, and enhance final products.

The following goals mentioned at the time of the founding of Valplantes are still pertinent today:

- maintain a type of agriculture respectful of the mountain environment;
- encourage diversity in agricultural production;
- foster additional income for mountain people;
- fight against the exodus from villages;
- enhance the beauty of landscapes.

Results

After some difficulties in the beginning, the producers rapidly found solutions for the new problems they were confronted with. The cooperative organisation proved to be efficient. Today, Valplantes counts around 100 producers. The quantity of plants produced in Valais and conditioned in the cooperative's dryers is about 150 tons. These plants achieve a high standard of quality; their production follows the rules of organic agriculture and the concentration of essential oils and their presentation are closely monitored. Since the standards are very high, these plants generate a substantial income. In 2007 Valplantes distributed three million Swiss francs to its producers (approximately two million Euros). The cooperative's fields cover 40 ha. More than 50 different species figure on Valplantes' assortment of plants: the main species are sage, thyme, mint and melissa. New mountain plants have been domesticated and cultivated, in particular the famous edelweiss and the precious genepi.

The market is mainly comprised of food, cosmetic or phytopharmaceutical industries. The candy factory Ricola® (Laufen, Switzerland) remains the principal buyer. The medicinal and aromatic plants sector is very dynamic; every year new products appear on the market. The cooperative itself created and put on the market a mountain herbal drink, BioAlpTea, which is highly successful. During the same period, Swiss agricultural research achieved an international reputation concerning medicinal plants. The Agroscope and Médiplant centres accomplished remarkable work regarding ecology, selection, domestication, cultivation techniques, protection of plants and drying techniques. The University of Applied Sciences Valais (HES-SO Valais) at Sion has become a centre of competence for the analysis and purification of active matter and for the development of new products coming from these plants.

In harmony with sustainable development

The innovation brought by the cultivation of these plants is perfectly in line with sustainable development, answering to its three principles: economic efficiency, respect of the environment and social solidarity.

Economic impact

The growing of medicinal plants generates additional income for approximately a hundred farming families. In addition to this production, it involves new economic activities: seedling production by horticultural companies, seed production, invention of special machines, buying of supplies and auxiliary products (bio fertiliser). The running of the cooperative itself created five jobs; each year investments of around 100,000 CHF (65,000 Euros) are injected into the local economy for the development and the promotion of these products. Downstream, bringing high quality plants on the market stimulates the creation of new products which increases global growth of the sector.

Environmental impact

In Valais, the producers of medicinal plants became involved with organic production, which banishes chemical fertilisers and pesticides as well as herbicides. The aim of this kind of

Harvesting hyssop. Photo: Fournier Valplantes.

production is to maintain soil fertility and to protect nature. Medicinal plants also bring welcomed variations in agricultural production; they enhance crop rotation and enrich biodiversity. They add a creative note to the panoply of cultivated plants: embellishing the landscape by adding new colors.

Social impact

Through the project's success, the actors of local development gained confidence in their business skills. Becoming the artisans of a success story, they rediscovered the pride of being farmers. They now possess the know-how to face new challenges.

Women show a particular interest in this well appreciated activity. In several micro businesses, the medicinal plants' workshop is run by a woman. Finally, the project contributes to diminish the rural exodus and is seen as a model for other initiatives in mountain regions.

Reasons for success

There are three keys to this success:

- a solid organisation: the cooperative Valplantes;
- a dynamic sector;
- effective research.

The cooperative Valplantes proved its capacity to manage the production and marketing of plants. Further, Valplantes created an asset of machines shared by the producers to rationalise and reduce costs.

The branch has an excellent collaboration between agriculture and the industries. In this context, the firm Ricola® played a major role by supporting research, by demanding high quality and particularly by proposing contracts to the producers which assure prices clearly superior to the world market.

Public agronomic research (Federal Station Agroscope) as well as private research (Médiplant, Conthey, Switzerland) added their contribution to the development of these activities. Since the beginning, they have backed the farmers' efforts. They provided advice on the ideal environment for the culture of the different species; they selected quality seeds; they developed high-performance production techniques which are compatible with the rules of organic agriculture.

Perspectives

The producers of Valais can face the future with solid advantages: professional know-how, strong organisation and solid support from scientific research. Nevertheless, competition is fierce. To maintain their competitive edge, the farmers will have to reduce their production costs even more, diversify their markets and aim for an even higher quality level.

Dr Charly Darbellay *(charly.darbellay@mycable.ch)* grew up in a mountain village; his parents were farmers. Agronomist, his career was first oriented towards local rural development and then research. He has led projects related to medicinal plants. For 16 years, he was member of the Parliament of Canton Valais and in 2004, was elected as Chairman of the Foundation for Sustainable Development in Mountain Regions (FDDM). FDDM was created in 1999 with the aim to promote, support and develop projects for sustainable development in mountain regions in Switzerland and in the rest of the world.

No Land Left for Women: Property Rights in Baltistan (Central Karakoram)

Nadine Guenther, Tine Maikowski and Matthias Schmidt

Women weeding the fields in Shigar, Baltistan. Photo: Nadine Guenther.

Land ownership is an important protection against poverty in rural areas all over the world. It defines both social status and political power in a village and it structures relationships within and outside the household. Land ownership can thus be of crucial importance in promoting the empowerment of women. However, command over property in general and land in particular between men and women is extremely unequal in most parts of the world. The academic discourse concerning gender and land rights distinguishes four broad categories and interconnected arguments explaining why women need independent rights to arable land: welfare, efficiency, equality and empowerment (Agarwal, 1994; Mehdi, 2001; SDP, 2006; Mumtaz and Noshirwani, 2006).

This paper aims to examine property distribution, the formal concept of property rights and its customary practice within the context of gender-related differences in Baltistan, a region located in the high mountains of the Central Karakoram and politically part of the Northern Areas of Pakistan. Baltistan's population speaks an archaic Tibetan dialect and most people belong to the Twelver Shia sect. The question primarily addressed is to what degree property distribution and decision-making power are related to gender roles.

Results are based on research on property rights in the Shigar Valley of Baltistan with extensive fieldwork in 1998 (Schmidt, 2004 a and b) and a shorter visit in April 2008. Quantitative and qualitative research methods included semi-structured questionnaires and expert interviews with members of the governmental administration, village elders, religious leaders and others. A sample of several interviews with women and men from various households with different socio-economic backgrounds provided in-depth case study information on

property distribution, subjective perceptions concerning property rights and the conditions under which women are able to obtain their own property.

Ownership of property

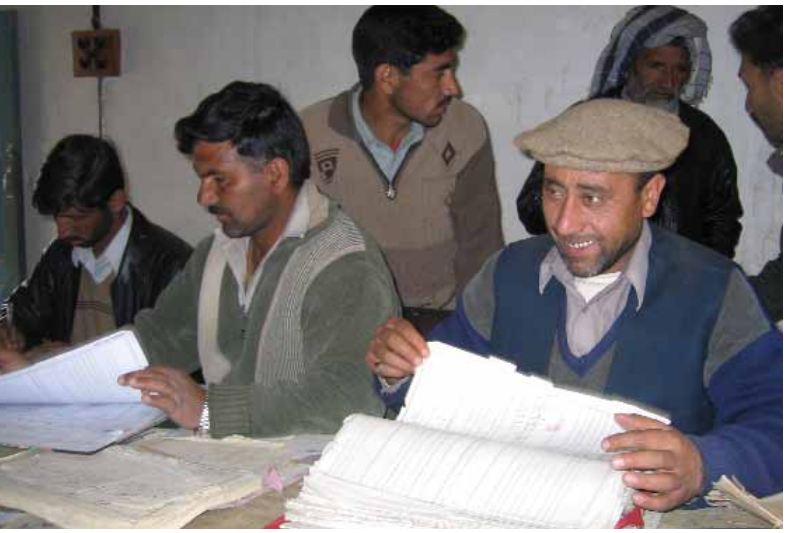
Most households in Baltistan own land and sustain their livelihood basically through a form of combined mountain agriculture (Ehlers and Kreutzmann 2000), the combination of irrigated arable farming and animal husbandry. The mean amount of irrigated land per household (around 0.5 hectares) is nowadays too small to sustain the household's livelihood, so that additional off-farm incomes are generated through business activities, labour work, portering, teaching, army or police service, pensions or remittances from labour migrants abroad. However, land property is still fundamental. Officially, all land property is registered in the settlement records (jamabandi), according to which less than five percent is registered in the names of women, particularly widows. But even in such cases, the specific land is actually often held by their brothers or other male relatives. Hence, the women's property right is de facto exercised by their kinsman (Mehdi, 2001).

The survey also addresses inequalities with respect to economic status, age, level of education and marital status. The findings show that there is no correlation between women's property, their education status or the economic situation of the household. Only widows possess land or other property. In rare cases, men gift small parts of their property to women.

Legal situation and customary practices

In general, property changes hands mainly through inheritance, and only rarely through gift transfers or selling. According to all interviewees, the regulation of inheritance follows Islamic law (sharia). The sharia exactly defines all possible forms of family constellations and the specific shares that are entitled for each case. Under the sharia, both sons and daughters, as well as widows, have the right to a defined share; a son receives as much as two daughters.

Although all interviewees referred to the sharia, according to which daughters are authorised to inherit, in most cases the women "voluntarily" renounce their share and gift it to their brothers. The females are under strong social pressure by their own family not to claim their inheritance. Due to their dependence on their male family members (father, brothers), particularly in times of need (divorce, illness), the women do not risk putting kinship relations at stake and "therefore forgo their share in property as insurance for the future" (Mumtaz and Noshirwani, 2006). The antagonism between Islamic law and the local custom that forces women to renounce their inheritance is obvious.



Patwaris consulting settlement records in Shigar, Baltistan. Photo: Matthias Schmidt.

In the case of gifting property, mostly two cases apply in Baltistan: father gifts land (hiba) to one or more sons mostly to avoid land fragmentation or, as mentioned above, sisters abdicate their claim and gift their contingent to their brothers. Purchasing and selling land as another form of ownership change is mainly a man's business because of women's lack of income and their low amount of land property in general.

Conflicts and conflict solutions

Conflicts concerning the division of land property are not uncommon, in particular when land is gifted. This mostly occurs within the family, e.g. when a father gifts land to his son(s) and thus disadvantages the other children, mainly the daughters, to avoid fragmentation of his land. In this case the disadvantaged children cannot claim their share and may feel cheated, which can lead to long-lasting rivalries between relatives.

Several ways to solve property-related conflicts are prevalent: on the local level it is possible to consult a village elder (tsharma), who tries to mediate between the parties by referring to indigenous law (resm-e-revaj) – rules that had developed before colonial rule under the Dogras of the Princely State of Jammu and Kashmir that started in 1842. The next higher institutional level is reached by consulting the tehsildar (head of a rural district) or the patwari (land assessor) who can solve conflicts by verifying the mutation and actual status of the property in the settlement records. They refer to customary law, which means the indigenous law that was written down under Dogra rule (Lentz 2000).

If the results are not accepted or the conflict parties prefer a more institutional authority, there is also the chance to consult the Assistant Commissioner (AC) as a subdivisional magistrate. A judgment based on constitutional law (qanun) can be achieved if both parties appear in court and produce a witness to verify their claim. If one or both parties refuse to accept the final judgment, the case can be transferred to the district court.

Another way of solving the conflict is through a religious leader (alim), who decides according to Islamic law (sharia) and is said to be faster and cheaper than the court. The precondition is that both parties appear in front of the alim.

These legal categories compete and interact with each other as the individual uses them, a situation that Lentz (2000) terms "dynamic legal pluralism". However, women in Baltistan generally face more difficulties and obstacles in claiming their property than men. Due to the low literacy rate and limited education, most women are neither aware of their rights nor able to read the documents. They are more reluctant to go to a civil court than men because according to purdah and local customs, a woman should not go to public institutions at all, and if she does so, she needs a chaperon (mahram) to accompany her. If the mahram is the person she accuses or if he refuses to support her, it is nearly impossible for women to

Irrigated farmland of village Tisar, Baltistan. Photo: Matthias Schmidt.

take legal action anyway. Since conflicts occur mostly on the inner-family level, women who claim their share risk losing not only the case but also the support of the family. Furthermore, women's access to courts is limited by their overall lack of financial resources to pay for a lawyer or even for transport.

Women's mobility

Mobility means not only spatial access to land not directly situated near the house, but also access to new property, e.g. buying land. And mobility influences the feasibility to generate income and thus to have the resources for accessing new property at all.

In Baltistan, women's mobility is limited and strictly defined. Generally, they are not hindered from accessing the fields alone. Even if fields are located further away, women are allowed to go there either alone or as part of a female group. The same applies to occupational situations, namely a job or school. However women are not allowed to take employment in the next town. To visit relatives or friends, women can go alone only within their own hamlet, while for visits in a neighbouring hamlet women need the company of other females or of a mahram. Bazaar areas where many men are usually present are generally taboo for women, even in their own hamlet.

The fact that women can access fields in nearby hamlets alone without any restrictions "highlights the contradiction in the rules governing women's movement in the family unit and underscores women's role as a service provider being perceived as acceptable while that with the potential of autonomy as not" (Mumtaz and Noshirwani 2006). Women are allowed to travel further and with less company if the reason to travel is clearly defined in the female gender role, such as field work or nowadays employment in the health or teaching sectors, generating income for the family.

These facts obviously indicate that women's and men's spatial radius of activity and their appropriation of space are highly unequal. Whereas women's mobility is restricted and dependent on the reason to travel, the distance and the company, there are no restrictions for men at all, neither in the manner of travelling, nor the reason, nor the distance.

Conclusion

The results presented indicate basic trends concerning gender-related inequalities in the distribution of property (rights), conflict situations and mobility. Generally, women and men have an unequal scale of possibilities in regard to property access. It is only partly the legal system but much more the socio-culturally defined role that privileges men to own, secure and decide over property. Women's access to property in particular is restricted by customs and taboos; it is almost impossible for them to realise their legal claims to landed property.

However, females in Baltistan do not necessarily understand the existing gender inequalities as discrimination or disadvantage. They see land as a joint family belonging and they feel secure in their father's or later their husband's house. Women are highly dependent on the goodwill and economic possibilities of male kinship, husband and in-laws. If a woman decides to realise her right to the defined contingent assured by the Islamic law or is involved in conflict based on property issues, as well as in times of need (e.g. poor in-law family, widowed and without brothers), the inequality becomes relevant. Women generally encounter more difficulties in claiming their share than men.

Command over property is one of the most severe forms of inequality between men and women today and it is relevant for defining social status and political power within society. The genders' different possibilities of getting access to property

need to be considered in future developing activities. It is desirable to promote a debate not only about women's rights but also about their de facto restrictions and chances, especially within a changing society where women will have to take over more responsibility and contribute to the family's livelihood.

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From Subsistence to Cash Generating Crops: A Case Study of Changing Cropping Pattern in the Garhwal Himalaya, India

Vishwambhar Prasad Sati

Introduction

The changes in the cropping pattern from subsistence to paddy and wheat crops gained momentum in the 1970s when the green revolution first took place in India. A vast area of agricultural land was devoted to wheat, paddy, pulses and oilseeds crops with excessive use of chemical fertilisers and experimental seeds. This national trend of intensive cultivation was also adopted in the Garhwal Himalaya, though not to the same degree. The farming community largely transformed their cropping land mainly in the valley regions and mid-slopes. The cropping pattern, which was characterised by the dominance of millets with high crop diversity, changed into the cultivation of paddy and wheat which dominated the valley regions and mid-slopes. Subsistence crops still grow in the highland areas. Fruits are abundantly cultivated in the temperate belt between 1,200 m and 2,200 m. The main fruits grown are apples, citrus, stone and nut fruits. Cultivation of off-season vegetables is a recent trend. While potato is largely grown in the highlands, onions, tomatoes, beans and other vegetables are grown in the valley regions and mid-slopes. These practices of cultivating various crops have been based on trial and error for centuries, as there is no stable farming system prevalent in the region. The present study discusses the changing cropping pattern in the Garhwal Himalaya.

Major trends in changing cropping pattern

- *Cultivating subsistence crops (barahnaza):* Subsistence cereal farming is a centuries old practice in the Garhwal Himalaya, characterised by the dominance of barahnazas (twelve grains). Among them, the major grains are mandua (finger millet), cholai (amaranthus), urd (black gram), moong (green gram), chana (red gram), masoor (lentils), jau (barley), rajama (beans) and bhatt (soyabeen). The method of cultivating these crops is traditional, carried out mainly on the narrow patches of terraced fields. These crops are ecologically strong and can be grown in adverse climatic conditions such as drought, high rainfall etc. and can feed a sizeable proportion of the population. Cereal crops are grown in the highland regions.
- *Cultivating wheat and paddy:* Along with the increase in population, the grain needed has increased in the entire Garhwal Himalaya region and subsistence cereal crops cannot meet this need. Keeping scarcity of grains in view, farmers initiated the cultivation of wheat and paddy in lieu of the traditionally cultivated subsistence crops, applying chemical fertilisers and improved seeds. This trend of cultivating paddy and wheat transformed the lifestyle of the farmers in a positive way and they became self-reliant in food grains. In the vast terraced fields of valley regions and mid-slopes, paddy and wheat are grown extensively in two seasons, kharif and ravi respectively.
- *Fruit cultivation:* During the 1970s, the Government of Uttar Pradesh launched a scheme of establishing fruit belts. The first step in 1976, was to demarcate the land otherwise not fit for cultivation of cereals as 'fruit belts' (Sati, 2002). The land used for this purpose was either unmeasured or measured forestland or community land. This scheme as a whole was not successful and many of the demarcated 'fruit belts' could not be established, while some 'fruit belts' still exist. However, it was widely followed by cultivators as they transformed their agricultural land from subsistence into cultivation of fruit crops. This practice was higher in the highlands than in the valley regions. Over the decades, these enthusiastic cultivators have changed and have started cultivating off-season vegetables, prominently potatoes in the highland areas.
- *Cultivation of off-season vegetables:* During the 1980s and 90s, large-scale cultivation of off-season vegetables was carried out. The production of potatoes in the highlands and onions in the valley regions gained a tremendous momentum. Currently, the trend of cultivating off-season vegetables: potato, onion, tomato, beans, capsicum, spinach, ginger, turmeric, garlic, chili, egg-plant, carrot etc. - dominates the cropping pattern both in the highlands and lowlands. Mainly Nepali immigrants are engaged in cultivating cash generating crops in the valley regions of the entire Garhwal Himalaya. The proportion of native

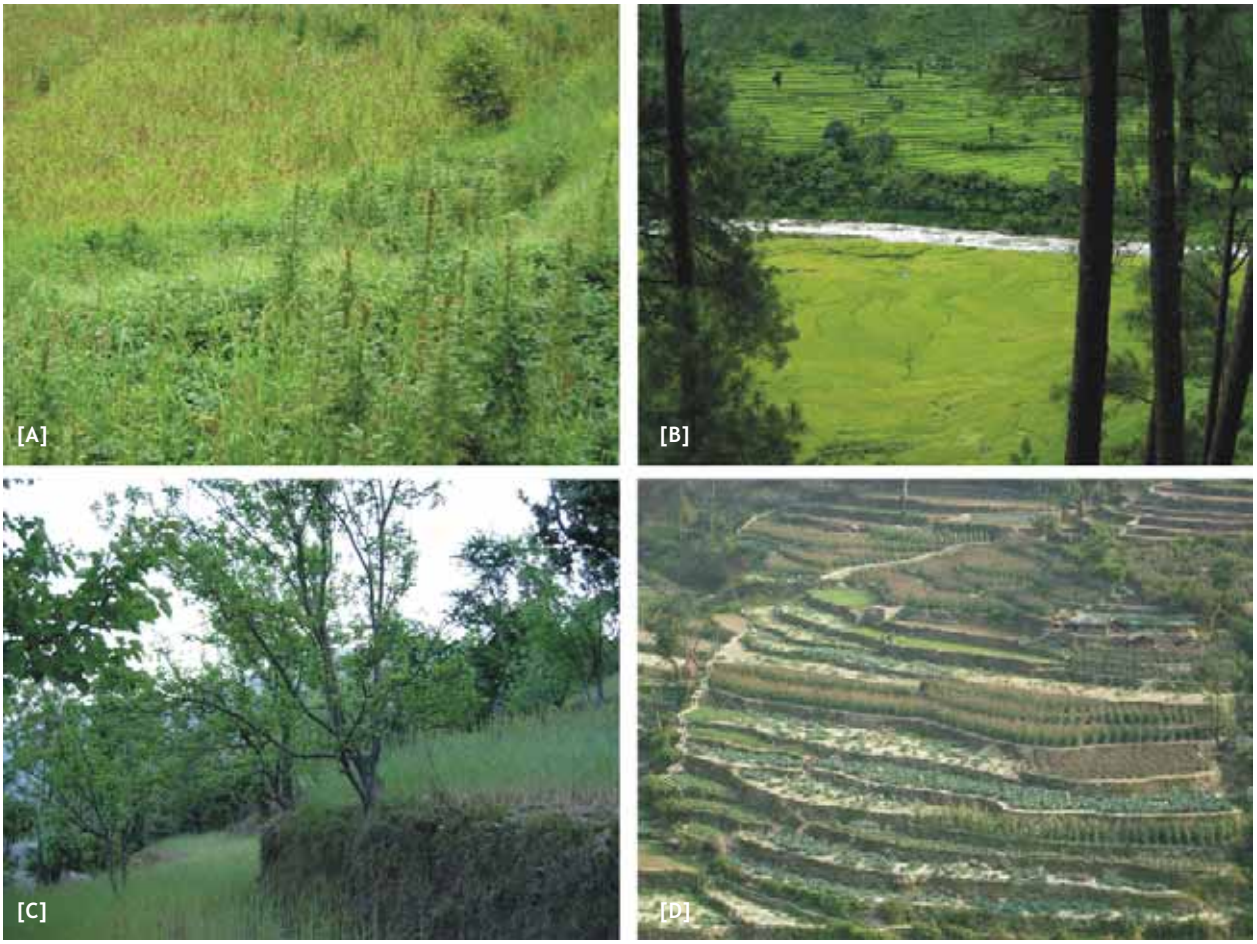

Figure 1 [A] Cultivation of barahnazas (twelve grains) in Kandi Khal area, Tehri district, [B] paddy is grown largely in the Laster Gad sub - watershed of the Mandakini river in Rudraprayag district, [c] apple cultivation on the wheat crop fields in Janglechatti village, Chamoli district, [D] cultivation of off-season vegetables in Khanda Gad sub watershed of the Alaknanda river in Pauri district. Photos: Dr. Vishwambhar Prasad Sati.

people involved is considerably less, although local people initiated potato cultivation in the highland areas.

- *Cultivating medicinal plants:* Recently the Government of Uttarakhand initiated cultivating medicinal plants in the highland areas. Training has been given to local farmers and poly houses were given to them to grow medicinal plants. About 25 farmers of Ghais village of Chamoli district have earned IRs. 87,000 after growing kutki and kut. This was achieved by assistance given by scientists of the High Altitude Plant Physiology Centre, HNB Garhwal University, Srinagar Garhwal, Uttarakhand, India. Similarly, the high altitude areas of Mandakini, Nandakini and Pindar river basins are growing medicinal plants in poly houses. The state government has provided them with subsidies for this purpose.

Land abandonment

Land has been abandoned in many locations. This is generally found in villages which are located in the lower elevations or along the roads. One of the most important reasons for abandonment of land along the road is caused by commercial uses . The study area is best known for tourism, especially for highland sacred pilgrimage tourism. Farmland alongside roads is being developed to provide board and lodging. Along the valley of the Alaknanda River from Deveprayag to Karanprayag, around 80 percent of cultivable land is abandoned and mushrooming hotels, motels, lodges and dhawas can be seen there. In the villages of higher elevations, land abandonment is due to a large-scale emigration of the populace to the urban centres of India. They are permanent emigrants. It was noticed that the households who are earning money through remittances, also leave their agriculture land abandoned in almost all the cases. There are the cases in the villages, where about 60 percent of the people have emigrated. There is a trend for households who are fully dependent on output from agricultural crops for their livelihood to cultivate cereals and they are even cultivating the farmlands of the emigrants which has reduced the growth of land abandonment.

Conclusion

Transformation of crops from subsistence to cultivation of paddy, wheat, fruits and off-season vegetables has been experienced for last three decades or so. Subsistence agriculture in a variety of crops that was the main occupation of most farmers did not continue for long because of low production and productivity. This resulted in a transformation of cereals particularly millets, into cultivating paddy and wheat, which sustained food security in the region. Earlier, marginal farmers struggled to get two meals a day, but are now able to have enough food grains for the whole year. Fruits, medicinal plants and off-season vegetables have the potential to enhance livelihoods as agro-ecological conditions are suitable for growing these crops in all altitudinal

zones. However, this practice requires a considerable level of infrastructure facilities e.g. sizeable cold storages and proper marketing network. The people's perception towards the cultivation of medicinal plants is quite different. Discussion with many farmers of the region showed a unanimous conclusion. The farmer questions: "Why do we grow medicinal plants? We have to wait for two years or so before getting returns from medicinal plants and sometimes the return is not sufficient, while from wheat and paddy crops, at least we have livelihood for a season." "We want to cultivate medicinal plants as the natural environment is favourable for their production, but due to a lack of market facilities, their cultivation is not feasible", a small shopkeeper of Janglechatti village stated. There is a similar case argued for the cultivation of fruits and off-season vegetables. In the highlands, where transportation facilities are poor and cold storage unavailable, farmers are facing acute problems for cultivating cash generating crops. There is an urgent need for the development of infrastructural facilities. The State Government's role in this regard is crucial. If a sizeable proportion of cultivable land is to be devoted to cultivating cash crops, proper marketing has to be provided, community participation and a strong government role has to be ensured. Then the entire Garhwal Himalaya can attain food security.

Sati, V P (2002) *Development of fruit Cultivation in Hills: A Case of the Alaknanda Basin. Kohli, Kothari, and Choudhary (ed)*. Management of Environmental Pollution. Book Enclave, Jaipur, India

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Experiences in Sustainable Agriculture and Natural Resource Management in the Mid-hills of Nepal: Out-scaling the Lessons

Isabelle Providoli

This article largely relates to innovative approaches and technologies deriving from two projects:

- the SDC-IDRC funded People and Resource Dynamics Project (PARDYP), implemented by the International Centre for Integrated Mountain Development (ICIMOD) and partners in five watersheds in the Himalayan Hindu Kush;
- the work of the SDC-funded Sustainable Soil Management Programme (SSMP, implemented by Helvetas-Intercooperation), which focuses on improving soil fertility and farm management for promotion of food security and better livelihoods in the mid-hills of Nepal.

In 2007, inspired by the above two successful programmes spanning the mid-hills of the Hindu Kush Himalayas, ICIMOD and SSMP collaborated in preparing 30 NEPCAT (Nepal Conservation Approaches and Technologies) fact sheets describing some of the most promising and relevant approaches and technologies arising from their work with mountain farmers. These fact sheets have been prepared in both hardcopy, the sheets being enclosed in a folder and as software on a CD-rom.

Each four sided sheet is prepared on the basis of the format used by WOCAT – the World Overview of Conservation Approaches and Technologies, which is a global network of soil and water conservation specialists that facilitates the sharing of knowledge on soil and water management. Regional offshoots of WOCAT include HIMCAT (Himalayan Conservation Approaches and Technologies) for the Himalayas and now NEPCAT for Nepal.

The aim of these fact sheets is to enlarge the range of options for natural resource management and encourage growth of an open network of institutions and organisations in Nepal and the region to share information on their experiences with different technologies and related approaches.

The fact sheets are designed to support the efforts of rural development, especially in the Himalayan mid-hills, and provide impetus and ideas for decision makers and development actors at the planning and extension level. To be directly appropriate to the land user and farming households, the fact sheets need to be adapted and then translated into the appropriate local language – and this is being undertaken in the near future in Nepal by SSMP, the Sustainable Soil Management Programme.

To enlarge the audience for the HIMCAT and NEPCAT approach, ICIMOD has recently provided training in Bhutan on the compiling of land resource and conservation information in the WOCAT format and is undertaking an introductory workshop in December 2008 in Kathmandu, Nepal, as a precursor to a similar training in Nepal.

The Fact Sheets

The first batch of fact sheets prepared by ICIMOD and SSMP number 30, covering both technologies and approaches.

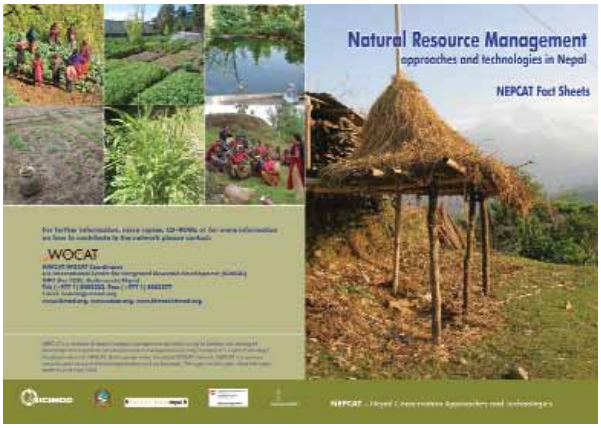
Table 1: NEPCAT technology and approach fact sheets.

Subject area / fact sheets	Lead agency	Technology(T) /Approach(A)
Agroforestry		
Polypit nursery	ICIMOD	T
Conservation agriculture		
Legume integration	SSMP	T
Grazing land management		
Rehabilitation of degraded communal grazing land	ICIMOD	T
Local initiatives for rehabilitating degraded communal grazing land	ICIMOD	A
Gully Rehabilitation		
Gully plugging using check dams	ICIMOD	T
Landslip and stream bank stabilisation	ICIMOD	T
Integrated watershed management for landslip and stream bank stabilisation	ICIMOD	A
Manuring / composting		
Improved cattleshed for urine collection	SSMP	T
Improved compost preparation	SSMP	T
Better quality farmyard manure through improved decomposition	SSMP	T

Improved farmyard manure through sunlight, rain and runoff protection	SSMP	T
Black plastic covered farmyard manure	ICIMOD	T
Urine application through drip irrigation for bitter gourd production	SSMP	T
Pest management		
Organic pest management	SSMP	T
Terraces		
Improved terraces	ICIMOD	T
Improving terraces with farmers	ICIMOD	A
Traditional irrigated rice terraces	ICIMOD	T
Vegetative strips/cover		
Cultivation of fodder and grasses	SSMP	T
Water harvesting/management		
Drinking water quality improvement through conservation measures	ICIMOD	T
Community efforts for improving drinking water quality	ICIMOD	A
Low cost drip irrigation	ICIMOD	T
Participatory action research on drip irrigation	ICIMOD	A
Low cost micro-sprinkler irrigation	ICIMOD	T
Plastic-lined conservation pond to store irrigation water	ICIMOD	T
Rooftop rainwater harvesting system	ICIMOD	T
System of rice intensification(SRI)	ICIMOD	T
Evaluation of the system of rice intensification (SRI) through participatory research and development	ICIMOD	A
Other		
Farmer to farmer diffusion	SSMP	A
Farmer-led experimentation	SSMP	A
Farmer field school on integrated plant nutrient systems	SSMP	A

Two examples of the front covers for one approach and one technology fact sheet are provided below.

An Approach fact sheet *A Technology fact sheet*



For further details or information on the fact sheets and the projects from which they derived, please visit the following websites:

ICIMOD	*http://www.icimod.org* - from where the fact sheets can be downloaded
Helvetas Nepal	*http://www.helvetasnepal.org.np*
Intercooperation	*http://www.intercooperation.ch*
SDC	*http://www.sdc.org.np*
WOCAT	*http://www.wocat.org*

For hard or soft copies of the fact sheets, please contact one of the following:

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Download the fact sheets from: *http://dev.icimod.org/elibrary/index.php/search/publication/518*

Dzo: The Mule of the Himalayas in a Changing Climate

Nakul Chettri

Dzos carrying loads, Nepal. Photo: Celine Curi.

With a large number of ethnic societies having their own social, economic and cultural attributes living in a highly heterogeneous mountain environment, any developmental initiative in the Himalayas has to be based upon a value system that they understand, practice and is sustainable.

The Himalayas are characterised by highly complex socio-ecological systems, with rich cultural diversity linked with equally rich biological diversity. However, it is a paradox that the majority of people living in this biologically rich region are among the poorest in the world. Agriculture, being the most dependable livelihood option available to these people has evolved significantly over the centuries to cater to their subsistence needs. Based on the agro-climatic zones and farming practices, the Himalayas can be broadly categorised into five major systems. Each of these systems can be characterised by i) specialised pastoralism (purely livestock based, a high altitude transhuman subsistence livelihood); ii) mixed mountain agro-pastoralism (livestock, agriculture and agroforestry livelihoods based in the mid hills); iii) cereal based hill farming systems (agriculture based livelihoods in the low and mid hill areas); iv) shifting cultivation (livelihoods based on rotational agroforestry with slash and burn practices) and v) specialised commercial systems (livelihoods based on monoculture and other commercial crops). In each of these specialised systems, there is a variation in crops and cropping patterns which supports a wide range of agro-biodiversity that is the sources of food, nutrients and economic prosperity for the region.

Among these broad farming systems, specialised pastoralism is one of the oldest systems in the world. The people living in one of the harsh ecological zones in higher and trans-Himalayan region have been practicing this system for a hundred years providing vital nutrients to the majority of the mountain people. This practice is widely found in the Hindu Kush Himalayan (HKH) region starting from Afghanistan in the west to the Himalayan and trans-Himalayan regions of Pakistan, China, Nepal, Bhutan and India. These people's age-old dependency on the high pastures and livestock products are embedded in their culture and practices, governed by traditional knowledge and natural resources governance mechanisms. This article shows how they are sustaining their hard life with practically little or no change in their lifestyle in spite of prevailing climate change threats. Examination of the climate change scenario in the HKH shows the link to age old traditional practices used by the mountain people to survive.

Climate change as a global threat to humanity

The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) predicted that climate change would impose significant stress on natural resources throughout the planet. The Himalayan region is home to more than 15 percent of the world's population. However, in the Himalayas, climatic factors depend on various bio-physical parameters including a wide range of altitudinal zones and microclimatic conditions. These range from tropical to arctic, creating highly diverse ecosystems with high biodiversity. The people living in the area are highly depended on natural resources such as agriculture, forest, grassland and snow capped mountains and glaciers for various goods and services. However, the natural resources are already under stress due to an ever rising population, modernisation and erosion of age old traditional practices. As a result, the resilience capacities of most of the fragile ecosystems found in the Himalayas are vulnerable to new and emerging threats such as climate change.

The eastern Himalayas are characterised by very low to high temperatures, heavy rainfall, often excessive humidity and marked seasonal variations. Rainfall in the Himalayas, especially in the eastern Himalayas, is concentrated in the monsoon season with 60 to 90 percent of total rainfall occurring during this period. Agriculture and agricultural products contribute the greatest share of GDP in the region. In addition, agriculture also provides a livelihood for nearly three quarters of the labour force. A heavy reliance on agriculture, as well as on other climate-sensitive sectors such as hydropower and tourism, make the economies of the region a highly vulnerable to climate variability.

The eastern Himalayas are facing enormous pressures from various drivers of global change including climate change. However, the prevailing climate change knowledge from the mountains is somewhat incomplete and scattered. Anecdotal evidence from the HKH are raising alarm signals on the fate of Himalayan biodiversity. It is predicted that a temperature increase of two degrees Celsius would shift the crop cultivation zone 10 metres north into the higher elevation areas. This may seem a positive spinoff, as this situation might increase the temperature leading to higher carbon dioxide levels that may have positive impacts on crop yields. However this would happen only where moisture is not a constraint. Due to steep slopes and limited arable land, such a spinoff would not have any promising advantages for agriculture in high land areas.

Traditional knowledge and adaptation

Human communities living in the Himalayas have always generated, refined and passed on knowledge from generation to generation. Such 'traditional knowledge' is often an important part of their cultural identities playing a vital role in the daily lives of a vast majority of people, especially on food security and health. Pastoralist communities living in the high Himalayas and trans-Himalayan region of the HKH have been practicing numerous indigenous practices to cope up with climatic variability since time immemorial. One such practice

has been the rearing of yaks in the high mountain regions and supplementing it with dzo (a male hybrid of yak and local cow) during the unfavorable seasons.

Sikkim is located in the north-eastern part of India in the eastern Himalayas. The yak rearing history of Sikkim dates back to the Chogyal (King) period when it was a kingdom in itself, before 1975 when Sikkim was formally merged as the 25th state of India. During the Cultural Revolution in the Tibetan Autonomous Region of China many Tibetan people flew to Sikkim seeking asylum. Among them, about 10 families were given a plot of land in the high altitude area of west Sikkim, the present Khangchendzonga (Kanchenjunga) Biosphere Reserve. These 10 families formally started their livelihoods in Tshoka (3,000 metres) along the present Yuksam-Dzongri trekking trail from 1969. Historically, from 1954 onwards, the Himalayan Mountaineering Institute (HMI) in Darjeeling, started their mountaineering courses in the Mount Khangchendzonga area, providing livelihood options for these new settlers. With this new opportunity, the people living in this isolated forested area with limited livelihood options, brought a few dzo from Holung of Nepal in 1971 to cater to the needs of the HMI for carrying goods and training equipment. Soon after that, people started hybridising their local cows with yaks and started to produce this mysterious beast.

Although sheep, horses and goats are pastoral wealth for other communities, dzo and dzomo (female) are choice animals for Tibetans, due to their adaptability to the harsh physiographic features of the region. Yak or 'ya', as pronounced by the Tibetans, are called ‘nor’ which means 'jewel' or 'wealth'. This term only applies to males, the female being called 'dri '. In Sikkim, yak/cow hybrids are bred using yaks and domestic cows or, less often, domestic bulls on dri to produce dzo (male offspring) and dzomo (female offspring). As they are a product of the hybrid genetic phenomenon of heterosis, they are larger and stronger than cattle or yaks. The female hybrids are fertile but the males are sterile. A dzomo crossed with either a domestic or yak bull results in an ortoom (second generation) and an ortoom crossed with a domestic or yak bull results in a usanguzee (third generation). Normally, the males of ortoom and usanguzee are known as tolu and are immediately killed after their birth as these animals are sterile and useless. Females, however, are more productive in terms of milk compared to the dri. This hybridisation (see Table 1) is practiced all over the Himalayas and trans-Himalayan areas and normally the dzos are used as draught animals.

Table 1. Matrix showing the hybridisation between yaks and domestic breeds practiced in Tshoka, Sikkim.

Breeds	Domestic cow	Domestic bull	Yak
Yak	Dzo+Dzomo-		
Dri		Dzo+Dzomo-	
Dzomo		Tolu+Ortoom -	Tolu+Ortoom-
Ortoom		Tolu+Usanguzee-	Tolu+Usanguzee-

Dzo - utility value in the context of climate change

In Sikkim, dzo are normally used as pack animals for tourism purposes. This has provided a strong rationale for their hybridisation and use in economic development for people living in Tshoka. Yuksam-Dzongri is a trekking trail located in the western part of the state of Sikkim in India. It is 26 kilometres long and covers a range of elevation from 1,780 metres to 4,000 metres. The trail passes through Sachen, Bakhim and Tshoka in

Timber to Tibet on dzo, Nepal. Photo: Ujol Sherchan.

the south-western part of the Khangchendzonga Biosphere Reserve in Sikkim. Yuksam is a trailhead for this corridor and leads to the base camp of Mount Khangchendzonga through Dzongri, Thangsing and Gocha La in West Sikkim. Yuksam (1,780 metres) has 11 settlements with 274 households comprising a population of 1,573. Tshoka with 10 households is situated inside the reserve at Tshoka (3,000 metres) and is along the trekking trail. People in Tshoka have very limited options for making a living but can take advantage of the economic benefits tourism can bring.

The people of Tshoka started using dzo as pack animals. During each training course organised by the HMI, they would bring the required number of dzo to Yuksam. The rationale for using dzo is that as a hybrid of a yak and cow, it can withstand with the high temperatures of Yuksam (30-32 degrees Celsius) which yaks normally cannot stand. In addition, a dzo can carry more weight than a domestic cow or bull and can walk through any terrain with a load up to 6,000 metres, withstanding -15 degrees Celsius without difficulties. Thus, this hybrid has become the most promising source of income for Tshoka people. Similarly, the dzomo, ortoom and usanguzee are more productive in milk and can survive at a wide range of altitudinal zones during seasonal migration compared to yaks, which are normally known for less milk and being limited to alpine zones above 3,500 metres. This new avenue is earning more money for people compared to yak or dri rearing. In 1990, almost 200 yaks and dri died due to unprecedented and continuous snowfall in the high altitude area of Dzongri and above but the people did not starve as they had quite a number of dzo, dzomo, ortoom and usanguzee to compensate for the loss.

Genetically, the hybrid does not show any advantages over yaks or even domestic cows. They simply follow Mendelian inheritance. About half the hybrids resemble cows (as seen in dzomo), presumably having received the ‘cow’ alleles in duplicate; while the other half resemble yaks (as seen on dzo), having presumably received one ‘cow’ and one (dominant) ‘yak’ allele. In addition, it is also observed that the pulmonary arterial pressure and resistance necessary for high altitude environment were significantly higher in indigenous Himalayan cattle than in the yaks. However, the pulmonary arterial resistance, an adaptive mutation in the arterial wall that enhances the capacity of animals to withstand a low oxygen

supply, was slightly higher in the dzo and yak than in domestic cattle. This is the reason why people prefer to cross a yak with a cow rather than a domestic bull with a dri. The indigenous knowledge practiced by Tibetans as well as high altitude pastoralist communities has a strong rationale base: Mendelian inheritance which has been used for centuries.

Many families from Yuksam and the surrounding area now also rear dzo to meet the increasing demand for pack animals due to the increasing tourism in this area. The Government of Sikkim also encourages having dzo and dzomo that have greater flexibility in using lower as well as higher pastures seasonally. Such practice minimises the degradation of high alpine pastures due to higher numbers of unproductive yaks.

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Women in the Forefront: Conservation of Traditional Crop Biodiversity: A Study of Uttarakhand State in Indian Himalaya

Rajendra Prasad Juyal and Mahesh Chandra Sati

The Uttarakhand State spreading over 53,485 km^2 accommodates 8.48 million people, accounting for about 0.83 percent of the population of India and 21.4 percent of the Indian Himalayas region respectively. The region is primarily an agrarian economy, operating at a very low level of production, unable to provide income and employment round the year to the dependent population and consequently pushes large numbers of young males to go outside the region in search of a livelihood. This trend is reflected in the sex ratio of the region. As per the census of 2001 among the thirteen districts of the state, in the eight exclusively mountainous districts, there are more than one thousand women per thousand men. This was first visible in the last decade of nineteenth century and continues. Agriculture coupled with animal husbandry is the mainstay of the people here but because of the heavy migration of males, these districts have very high participation rate of women in the work force. Except to plough, which is symbolic of male domination, all other activities in agriculture are the exclusive domain of women. Thus their contribution to total work in agriculture is more than 85 percent.

A finger millet plant conserved for seed in the study area. Photo: M. C. Sati.

To examine the gender role in conservation of traditional crop biodiversity, a sample of twelve villages located within an altitudinal variation of 1,400–2,200 metres, in the Nagaun and Purola block of Uttarkashi district and Pokhari and Joshimath block of Chamoli in Uttrakhand State were selected. Approximately 200 women respondents associated in different self-help groups (SHG) participated in the study by sharing their perceptions. Traditional crop diversity of survey villages is as high as about forty crop species comprising cereals, pseudo cereals, millets, pulses and oilseeds of various varieties. The best agricultural practices of the region involve turning environmental constraints into resources to preserve bio-diversity and making it a basis of food security. The farmers have learnt that a simple two crop rotation is not possible in the region, because winters are too harsh for seeds to germinate. Therefore the crops to be harvested in spring have to be sown well before the onset of winter. Moreover to ensure food security, fullest utilisation of rainwater is also necessary. Paddy locally known as sati *(Oryza sativa)* and finger millet, locally known as mandua or koda *(Eleusine coracana)*, which have better yields in the region vis-à-vis other crops and require more water and a hot humid climate are cultivated simultaneously during the monsoon. These factors necessitated the evolution of a unique pattern of rotating crops. Farmers divide the entire arable land of the village in two segments locally known as *sari*. Habitation or any other prominent geographical feature like a rivulet separates these two segments. The crop rotation is followed in such a way that paddy occupies one sari, and koda is cultivated on another half. Paddy is sown in one sari in April and after harvesting it in September-October, wheat locally known as gehun *(Triticum aestivum)* is sown on the same land. Reaping wheat by mid May, the sari is used to cultivate koda. After harvesting the crop in October, the land is left fallow for about four months till April, when paddy is sown in it.

The other half or sari occupied by koda is left fallow and after the crop is over in October till April when paddy is sown and reaped the following October. Subsequently wheat is sown which is harvested in April when the land goes under cultivation of koda. In this way every crop is repeated on the same plot after one and a half years; cultivators get three crops in two years.

This division of land into two parts where a block of land is left fallow instead of where there are scattered fields has its advantage when cattle are turned loose to graze on the remnants of straw and grass that can be found on the terrace walls. Animal husbandry provides support as the principal source of manure and power to mountain agriculture. Many crops are produced in addition to those mentioned above, like potato, amaranth, kidney beans, millets and pseudo cereals. The richness of crop diversity in the region is apparent from the fact that women traditionally harvest more than twelve grains and pulses (locally known as Bara naza) in the monsoon and have evolved a very effective mechanism to avert total crop failure to ensure food security.

The recent experiences

Since the reorganisation of the 13 northern districts of the state of Uttar Pradesh into Uttrakhand State, state patronage has extended to agriculture bio-diversity and women are in the forefront to manage diversity though indigenous knowledge, linking this with marketing channels. To tap the market potentials of organic produce, women farmers have formed voluntary organisations to cultivate and market traditional organic crops. Himalayan Action Research Centre (HARC) has played a seminal role by providing institutional support through the creation of Self Help Groups (SHGs), in the formation of a women farmers' cooperative federation, the Rawain Women Cooperative Federation (RWCF), organising training programmes for the SHGs and federation members and arranging visits of women farmers to interact with other mountain states. In the surveyed villages, women farmers and SHGs are cultivating many traditional crops viz. buckwheat, horse gram, ammranths, foxtail millet etc. on a commercial scale, which were earlier on the verge of extinction.

These women farmers have realised that their crops have unique selling properties (USP) of bio-products and they have created a marketing network through HARC. HARC arranges stalls for the women's cooperative federation's products at national level fairs and exhibitions such as Agriculture Expo, International Trade fair Delhi, and National Women Farmers' Fair in Ahmedabad, Uttarakhand and Mahotsav in Dehradun. It is estimated the ex-farm value of traditional crops is about IRs.30 million along with an annual turnover of IRs.45 million per annum. The average annual return of each SHG is estimated at IRs. 1.0-1.5 million. A typical SHG has 10-12 members, thus the average turnover per member is more than IRs. 100,000, since almost all inputs – labour, seeds and manure are supplied by the household themselves. Thus, this turnover is a substantial contribution to the income of these households that have an average size of five to six members, in majority of cases, possessing less than one hectare of land.

These women cultivators, more importantly than just getting a modest income, have learnt an important lesson in marketing that that proper processing and selling through organised channels can enhance the market value of their product by 50 to 100 percent.

Prospects

It is unlikely that migrated male labour that has been absorbed in the non-farm sector will return to agriculture. Moreover with the sustained campaign to control the rising population, population growth in the mountain districts of the state has slowed down significantly. For example, in Pauri district in Garhwal, according to the census of 2001, the population is growing at a rate of less than one percent per annum. By and large this is the story in the other districts as well. These factors are gradually reducing the pressure of population on agricultural land and are creating an opportunity to focus agriculture to meet the growing demand for bio-products.

The above illustrations show that women by their ingenuity have successfully managed changes and turned adversities into fortune. These efforts need institutional support lest they gradually lose momentum. However, the possibilities of utilising bio-farming traditions of the region to commercial advantage could be emulated elsewhere that has similar agro-climatic and social settings in the Himalayan region. The cultivators, especially Himalayan women, have the necessary skill, indigenous knowledge and acumen to utilise opportunities, with the only necessity being to evolve a community-based institutional mechanism to utilise this in policy-making.

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Table 1. Traditional commercial crops cultivated in survey villages

English name	Vernacular name	English name	Vernacular name
Amaranth	Chaulai	Soybean	Bhatt
Amaranth	Chuwa/Marcha/Ramdana	Soybean	Kala Bhatt
Pigeon pea	Tor	Soybean	Soybean
Pig-weed	Bethu	Naked barley	O-wa-jau
Taro	Pindalu/Kuchain	Horesgram	Gahat
Buckwheat	Oggal	Potato	Alu
Buckwheat	Phaphar	Mat bean	Bhirnga
Maize	Mungri	Adjuki bean	Rains
Rice bean	Bhotia	Black gram	Urd
Zinger	Adrak	Cow pea	Sonta
Poppy	Post	Hog-millet	Cheena
			Jakhiya

Source: Data collected from survey villages

Nepal's Declining Agriculture Production in Changing Climate

Mohan Prasad Devkota and Ashok Kumar Koirala

In recent years, the changing climate and its impact on human lives has been a hot issue of debate worldwide. Whatever the temporal and spatial impacts of climate change on earth, there has been a consensus that poor countries will suffer more than developed countries. It is also assumed that the agricultural production of poor countries, which depend on traditional agricultural practices, will have more food shortages due to the impact of climate change. The development activities of developed countries can be seen to be responsible for the current rate of global warming and it is believed that a significant reduction in the amount of green house gases may help to reduce the impact in the future. The aim of this article is to discuss the impact of climate change on agriculture worldwide, especially in poor countries. This article has also tried to suggest some adaptive measures to reduce the loss in Nepalese agriculture.

Climate change and agriculture in Nepal

Nepal is a country of great diversity which is also reflected in its agriculture sector. Many local varieties of crops and fruit trees grow within the short span of 200 kilometres from the south to the north of the country.

Climate related changes are observed throughout the country. These changes include a rise in temperature, drying of water resources, amount and changes in rainfall pattern and loss in agricultural production. As in the past, the country's economy is still dependent on agriculture with a large percentage of the poor population depending on traditional agriculture practices. It has been estimated that nearly 65 percent of the population is employed in the agricultural sector contributing approximately 38 percent of the total GDP. The ever-increasing population of Nepal and the growing demands for food, inadequately contributed by 27 percent of the total land, has created pressures on natural resources, forcing people towards various non-farm activities. In recent years, a large percentage of the fertile land of the Terai has been converted into urban areas causing more pressure on the remote hilly and mountain areas for food production. Rice production, the most important crop of Nepal, is still dependent on the monsoon rain and unfortunately the recent changes seen in the monsoon has further deteriorated the rice production.

Disappearing glaciers. Photo: Mohan Devkota

The traditional farming practices, with indigenous knowledge that has been inherited through the generations, cannot be ignored in the Nepalese context especially in the mountains. If the indigenous knowledge of farming with local varieties of crops is adopted and incorporated with modern farming practices, then it may help to reduce food shortages to some extent, in Nepal in the future.

The Global scenario

The Intergovernmental Panel on Climate Change (IPCC) has suggested that there will be a rise in the earth's temperature by 1.0 to 3.5 degrees Celsius by 2100. Average precipitation will also rise as much 10 to 15 percent because a warmer atmosphere holds more water (Crosson, 1997). The IPCC report estimates climate change impacts on grain production at the global level both in the developed countries (DCs) of North America and Europe, as well as in the least developed countries (LDCs) of Asia, Africa and Latin America. There are two main factors identified for the loss in grain production. The first factor is "physical" that will warm the higher latitudes more than the tropics, benefiting most of the DCs situated in the northern latitudes, as their agriculture would benefit from the longer growing seasons that the warmer climate would bring. On the other hand, most LDCs occupy terrain in the tropics where the negative effects of a warmer climate would not be significantly beneficial. The second factor is "eco-structural" which is also more in favour of DCs as they have greater economic resources than LDCs, which can be used in helping farmers to adjust to the changing climate.

How agriculture is going to be affected worldwide?

Following are some of the major impacts of climate change that are expected to occur in agriculture:

- The life cycle of grain and oilseed crops will likely progress more rapidly, with increased CO2 and temperatures but later may fail. Especially horticultural crops will be significantly affected;
- Northward migration of many current crops along with weed species, especially C3 invasive weeds, is most likely to occur as they respond more positively to increased CO2 concentration. "Glyphosate", the most commonly used herbicide worldwide, is likely to lose its efficiency in future;
- Crops and animals will be more prone to various diseases due to earlier springs and warmer winters. Warming will also favour the survival rate of pathogens and parasites.
- The productivity of livestock is most likely to be negatively affected with increased temperatures;
- Ruminants are more likely to be adversely affected, as the current management system will be inefficient against temperature rises, whereas non-ruminants might benefit.

Predicted effects of climate change on agriculture over the next 50 years

Climatic element	Expected changes by 2050's	Confidence in prediction	Effects on agriculture
CO2	Increase from 360 ppm to 450 - 600 ppm (2005 levels now at 379 ppm)	Very high	Good for crops: increased photosynthesis; reduced water use
Sea level rise	Rise by 10 -15 cm increase in south and offset in north by natural subsistence/rebound	Very high	Loss of land, coastal erosion, flooding, salinisation of groundwater
Temperature	Rise by 1-2oC. Winters warming more than summers. Increased frequency of heat waves	High	Faster, shorter, earlier growing seasons, range moving north and to higher altitudes, heat stress risk, increased evapo-transpiration
Precipitation	Seasonal changes by ± 10 percent	Low	Impacts on drought risk, soil workability, water-logging, irrigation supply, transpiration
Storminess	Increased wind speeds, especially in north. More intense rainfall events.	Very low	Lodging, soil erosion, reduced infiltration of rainfall
Variability	Increases across most climatic variables. Predictions uncertain	Very low	Changing risk of damaging events (heat waves, frost, droughts and floods) which affect crops and timing of farm operations

Source: Climate change and Agriculture, MAFF (2000)

- There will be a significant impact in livestock operations due to a longer forage production season and reduced need for winter season forage. Livestock will also benefit by shifting of rangeland and pasturelands;
- There will be an increasing demand on irrigation as there will be a greater soil water deficit, but it may provide better working conditions in wetter regions and may lead to reduced erosion;
- Wetland ecosystems are more likely to be affected by changed rainfall patterns.

Adaptive measures to cope with climate change impacts on Nepal's agriculture

Nepal's current agricultural practice depends on traditional agricultural methods and is entirely monsoon dependent. If developments achieved in the past in its agriculture sector are evaluated, the results are very discouraging. The main reasons for the decline in agricultural production include conversion of agriculture land into urban areas, loss of farmers' interest in traditional agriculture methods, unsatisfactory support from the government, poor irrigation facilities and temporary migration of younger generation to foreign countries. It is very hard to predict how much Nepal's agriculture sector will be affected by global climate change in future and how the country will feed the hungry mouths of its people. Following are some suggested adaptive measures that can help to reduce the negative impacts on agriculture and provide food security in Nepal in the future:

- Develop mountain irrigation facilities by encouraging local communities to construct irrigation ponds and collect monsoon water to irrigate winter crops. Improve irrigation efficiency and conserve soil moisture through appropriate tillage methods.
- Develop/import new crop varieties that are heat and drought resistant and are better adapted to new atmospheric and climatic conditions. Local varieties of crops that have been cultivated for many years in the diverse topographical and climatic conditions of Nepal should not be neglected in this regard.
- Import of genetically manipulated crop varieties with higher yields.
- Choose crop varieties with a higher harvest-index (the fraction of total plant matter that is marketable).
- Encourage farmers to cultivate Phaseolus beans, onions and sweet corn which are most likely to grow well in higher temperatures and provide benefit commercially.
- Introduce late-maturing crop varieties or species that are more suited to high temperatures.
- Switch cropping sequences: sowing and harvesting earlier.
- Provide access to new pasture and rangelands at higher elevations to expand livestock farming but also replace animals with improved breeds.
- Import new technologies of improved methods of agriculture and livestock farming to mountain people.

Only carefully considered changes in agricultural policies and import of suitable technologies can help the country to fight climate change and reduce its negative impacts on agriculture in future.

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Mountain Farming Support in Austria

Gerhard Hovorka and Thomas Dax

Autumn in Waidhofen in lower Austria. Photo: Gerhard Hovorka.

Introduction

In Austria, a predominantly mountainous country in the middle of Europe, in general high nature value farming, clean environment and rich cultural and natural heritage prevail. The landscape is characterised by the high proportion of less-favoured areas (LFA), most of which is classified as mountain area. The mountain area comprises 70 percent of Austrian territory and 58 percent of the Utilized Agricultural Area (UAA). The area of permanent settlement in the mountain area is very limited (BMLFUW 2007).

Since a long time, agricultural policy in Austria has aimed to preserve multifunctional agriculture and family farming, maintain the cultural landscape and provide targeted support to farmers in less-favoured areas, in particular to mountain farmers. In pursuing these objectives, Austria has gained considerable experience of mountain farming subsidies, as well as with regional programmes specific to the mountain area and agri-environmental programmes over recent decades. These payments are particularly important in Austria because mountain farming has a key role in safeguarding the sensitive eco-system through the preservation of the multifunctional landscape and the general living and working space (Hovorka 2004 and 2006).

Country profile: Austria

Size: 83,858 km^2 (70 percent mountain area)
Population: 8.0 million; 78 percent live in rural areas
Capital: Vienna (1.6 million inhabitants)
Highest point: Grossglockner 3,797 meters and lowest point: Lake Neusiedl 115 meters
Farming: 189,000 agricultural holdings manage 3,3 million hectares agricultural land (of which 1.8 million hectares is grass land) and 3.3 million forestry land
Farm management: 56 percent of all farms are managed on part-time basis and 10 percent are organic farms
Main components of the food sector: meat, dairy products, cereals, wine, fruit and vegetables

Delimitation of mountain area and mountain farm classification system

The Austrian mountain area forms part of two of Europe's mountain massifs, the Alps and the Bohemian massif. The criteria established for Austria by the EU Commission for the delimitation of mountain areas were (Hovorka and Dax 2007):

- An altitude of at least 700m above sea-level or
- A mean gradient (slope) of at least 20 percent or
- A combination of at least 500m above sea-level and a mean gradient (slope) of at least 15 percent.

Beyond delimitation of mountain areas, Austria has a long experience in assessing the degree of handicap faced by mountain farms. Taking into consideration that farming handicaps in the mountain area are different, the Austrian system uses a classification of site-specific farming handicaps experienced through the particular situation of each individual mountain farm. Since the early 1970s, a differentiated classification system of 4 groups has been the basis for defining support levels for mountain farms. The change to a more differentiated payment structure was planned during the 1990s and a revised classification system has been applied since 2001. This "mountain farmer registry point system" (BHK - points system) addresses the positive externalities of mountain farming more clearly. A detailed system of attributing points is used. The elements used in the calculation are grouped into three categories: "farm situation (internal situation)", "farm situation (external situation)" and "soil and climate". Out of these, the internal situation, indicating the proportion of the agricultural area with production handicaps (slopes), receives the highest weight. Points for each of the indicators are aggregated. In addition, the system allows for annual changes by taking account of the actual land use of mountain farms (Hovorka 2006). In 2005, according to the agricultural census, there were 72,095 mountain farms in Austria. As a proportion of all farms with UAA, mountain farms make up 41 percent (BMFLUW 2008).

Evaluation of compensatory allowances in Austria

The dominant objective for LFA policy is to maintain an agricultural and forestry sector based on environmental principles and small family farms. The aim is sustainable resource management e.g. through preservation of soil, water and air, maintenance of the agricultural and recreational landscape and protection from natural hazards.

Since the beginning of the 1970s, support for mountain farming has been improved through a specific support programme. As a national concern, the "Mountain Farmers' Special Programme" has not just focused on site-specific farming handicaps but has also attached importance to the social situation of farm households and their insertion in the rural economy, aimed at the preservation of mountain landscapes. This has taken account of the necessity of developing concepts oriented at multifunctional aspects in mountain farming and land use. Since then, the total amount of aid has been significantly increased and its circle of recipients has been extended. The adoption of EU policy brought about drastic alterations for direct payments to farms in less-favoured areas (OECD 1998).

According to the Rural Development Programme of Austria (2000 - 2006) mountain farms received annually LFA payments.

Autumn sun on an Alpine pasture in Styria. Photo: Gerhard Hovorka

In 2006, in all 70,957 mountain farms received €243.6 million compensatory allowances, an average of €3,430 per farm each year. The average support sum per farm rises sharply with increasing levels of handicap, up to €5,270 for mountain farms with extreme farming handicaps (MF category 4). The new Rural Development Programme 2007 – 2013 includes again a high priority for LFA compensatory allowances. The budget is €276 million per year of which 88 percent is for farms in mountain areas (BMLFUW 2007).

The importance of LFA and agri-environmental payments on farm income

There are substantial income differences between mountain farms and non-mountain farms – although income includes public support, as well as income from farm tourism and other sources of farm pluriactivity.

LFA payments (CA) narrow this income gap. CA as a proportion of agricultural income achieves 23 percent for all mountain farms (average). LFA payments become more important as the production handicaps increases: with category 4 farms, the LFA support is 47 percent of agricultural income. For these mountain farms, two subsidies, the LFA payment (CA) and the agri-environmental payments together make up 87 percent of the income from agriculture. But CA and agri-environmental payments also make up 56 percent of the agricultural income on average for all mountain farms.

Table 1. Agricultural income situation and public support per farm category (average 2005/2006)

Categories of MF farms	CA as % of farm income	EP as % of farm income	TP as % of farm income
MF Category 1	15.3	29.2	81.0
MF Category 2	21.7	34.2	88.9
MF Category 3	29.4	32.2	85.5
MF Category 4	46.7	39.9	112.2
All mountain farms (average)	23.3	32.8	87.9

Source: Hovorka 2007; own calculations
Note: MF = mountain farms; CA = compensatory allowances is defined as LFA payment from EU reg. 1257/99; EP = agri-environmental payments; TP = total public support is regarded as income; it includes all support measures from public sources.

Conclusions

In Austria the situation of multifunctional mountain farming in terms of local food production, environmental impacts, and threat of land abandonment, natural hazards, rural development and agricultural policies has been discussed as a subject of major national concern for a long time. Multifunctional mountain farming is also an important basis for tourism. Many regions in the Alps are well known for intensive winter tourism (skiing).

The CA is an important part of the agricultural income in mountain areas and its relevance is increasing with higher level of farming handicaps. Thus CA and agri-environmental payments together have an important impact on mountain farming income, ensuring continued agricultural land use and maintaining multifunctional farming in the mountain areas of Austria.

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Himalayan Mountain Pastoralism

Naomi H. Bishop

Cow yak hybrid zomo (left) and yak (right). Photo: John Bishop.

In addressing the challenges facing mountain agricultural communities today, it is important to remember that mountain agriculture has developed hand in hand with pastoralism. Both large and small livestock sustain mountain communities, providing resources that complement those provided through agriculture. Pastoralism is not a strategy of last resort for agriculturalists pushed into marginal habitats. In fact, on the southern slopes of the Great Himalaya in Nepal, pastoralism has permitted agricultural communities to thrive and, in some cases, to extend their use of upper elevations into areas where agriculture is either marginal or impossible. A vertical look at lower, middle and upper altitude agropastoral practices provides insight into some different ways in which livestock management and cultivation interact within the larger context of mountain ecology.

Himalayan pastoralists herd one or more of the following species: sheep, goats, cattle, water buffalo, yak and yak-cattle hybrids. Livestock provide one or more of the following benefits to humans - transportation, agricultural labor, food (milk, meat, and/or blood), raw materials (wool, hair, horn), and/or manure. Livestock and their products are key elements of the diet in mountain communities. Through their labor and their manure, livestock make agricultural intensification possible in mountain environments where arable land is limited and of poor quality and growing seasons constrained. Livestock are also sources of income – their hair or wool becomes commodities that are both used by mountain residents and sold by them.

The various ways in which mountain communities combine agriculture and pastoralism is dependent, to a large extent, on ecological factors. Both livestock and crops are adapted to specific conditions that are differentially distributed. Altitude and climate interact to create zones that support different species.

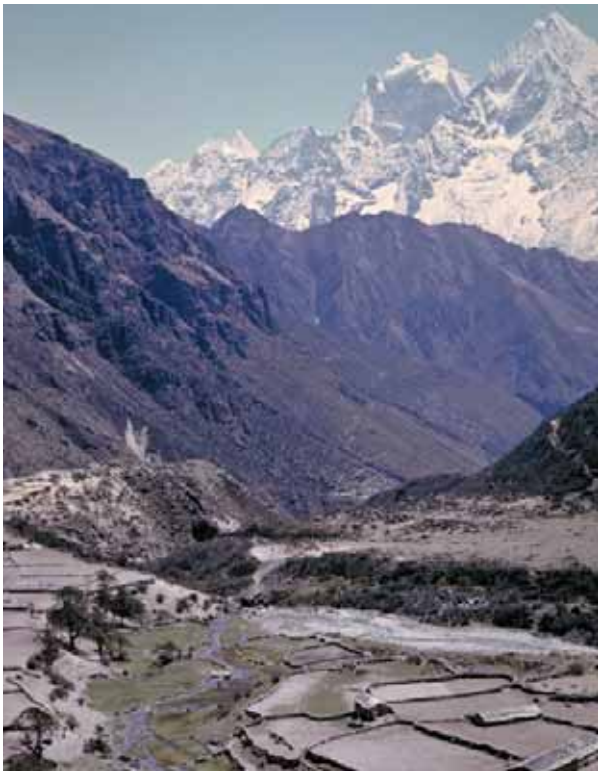
The village of Melemchigaon at 2600 metres in east-central Nepal provides an example of the gode system, in which family-owned herds of cow-yak hybrids, called zomo (Nep: chaunri), are moved through a series of pastures over the year (Bishop 1998).[1] Zomo are in the village for only one week on their way down to the low pastures around 2,010 metres where they spend the winter. In March, they begin moving up the slopes and spend the summer in pastures as high as 3,660 metres. Wheat, barley and potatoes are grown within the village while corn and potatoes are grown just below the village. All of these crops are rain-fed. This is a middle altitude strategy, found in the vertical zones between 2,010 and 3,660 metres, where these particular crops and animals can do well. Agriculture goes no higher than 2,620 metres, but herds thrive on the sub-alpine pastures on the upper slopes.

The gode system in Melemchigaon is a dairy herding system; agriculture has traditionally been secondary or alternative to managing a herd of zomo. Zomo are biologically limited to the middle altitude zone where they produce more milk and richer milk than either cows or yak. Herds are maintained to produce butter, which is used extensively for food and ritual, and sold or traded for grain. A typical zomo herd consists of 10-15 zomo and a bull, too many large animals to be pastured within the confines of the village. Dairying is a household production system; families own their own herds and their own pastures, and the family moves together with the animals. Butter production is labour-intensive requiring two adults on a daily basis. Once there are children to help out, a family might invest in a house in the village and cultivate fields there, while keeping their herd. At this altitude, fields are sown once per year and lie fallow for more than 6 months. Fertiliser comes from night soil or from pasturing village household animals (cows, water buffalo) out on the fields prior to planting. Herding families arrange their routes to be nearer to their fields when work needs to be done. It takes complex coordination to manage both agriculture and pastoralism and families opt out of one or the other periodically. Large family size insures plenty of children to help manage the crops and the animals. Moreover, marriage rules in which you select your mate from a fairly limited pool of families also results in many relatives who can be called upon to assist.

People living on the lower slopes have developed a different system that combines pastoralism and agriculture called the goth system. Described by several researchers[2], the goth system is a village-wide system that coordinates the movement of livestock to produce manure for agricultural fields. It is a form of agricultural intensification that permits greater productivity from poor mountain soils, by permitting use of fields at different altitudes, all of which are intensively fertilised by herds. At lower altitudes, intensification is possible. John Metz (Metz 1994) studied the village of Chimkhola, where they have a three-year crop rotation cycle with two crops per year on each field. Fields can be as far as several hours walk away from the village in different directions. Herds of cattle and water buffalo (with sheep and goats) are housed directly on the fields for a number of weeks prior to planting and contribute nutrients through manure and urine to improve the soil fertility. In this system, large bovids are kept in support of agriculture.

Herding requires only one member of each household to live with the herd in the portable goth structures of bamboo mats built over poles, constructed either directly on the field to be planted or adjacent to forest where the animals can graze. Metz points out that this is a tremendous year-round drain on forest resources; the wood for constructing the shelter, the fodder for maintaining the animals and the fuel wood for a duplicate household are all taken from the forests adjacent to the fields and/or village. In contrast to the middle altitude strategy of independent families moving between their own pastures, here it is necessary for the community to maintain control over the management of agriculture and livestock.

[1] *The gode system is the traditional subsistence system in this village; over the past 25 years it has been superseded by circular migration outside Nepal for wage labour, although today there are still six families who maintain herds and most village fields are planted and harvested every year.*
[2] *The Tamang of Salme in the Trisuli valley just west of Yolmo (Panter-Brick 1986) and the Pun Magar of western Nepal (Metz 1994).*



Walled fields near Thami village in 1972, Khumbu, Nepal. Photo: John Bishop.

Village leaders coordinate the movement of herds and the agricultural cycle, so that families can farm widely dispersed fields in different ecological zones. Ironically, large animal husbandry both makes the goth system possible and ultimately threatens its viability. A successful goth system uses forest resources around the fields to support the livestock, and as population pressure increases, those resources are becoming depleted.

In Khumbu, the high-elevation valley which abuts Mount Everest, Sherpa people also farm and herd bovines. Here the partial rain shadow provided by the Great Himalaya limits summer rain, permitting agriculture at higher altitudes than in Melemchi or farther west. Agriculture is limited, however, to barley, buckwheat and potatoes, at scattered fields ranging from 3,050 to 4,880 metres altitude. The growing season is short and agricultural land poor and in short supply. It is impossible to subsist on agricultural products grown locally; trade has been the major source of income in this region located along trade routes between India and Tibet. At these altitudes, pastoralism exists in support of trade and cattle breeding, not agriculture. While dung may be occasionally used in fields, at these altitudes, it is also an important source of cooking fuel since forests (and fuelwood) are in short supply. Here, female yak are maintained to produce hybrids for sale, while male yak carry loads. Herds are moved in an irregular pattern, up and down throughout the year rather than the transhumant route of the zomo, high in summer, low in winter (Brower 1991). Although female yak may be milked, they are not primarily a dairy animal. Most of the milk goes to the calves, which are raised for sale; the rest is made into butter for the family. In this most marginal habitat, fodder is grown in privately owned hayfields and stored, to supplement the natural forage.

These three patterns represent three different forms of agropastoralism found among Tibetan-derived peoples living above 1,800 metres in the Himalaya. Each meets the dual requirements of pastoralism (need for mobility and adequate resources to support large herds of animals) and agriculture (lack of mobility and intensive human labor), along with the special limitations of the particular environment. Pastoralism is a crucial component of the subsistence strategy in each locale, even as its function varies between them. In each of the three, people combine herding livestock groups with fixed agriculture, but differences in environment, culture and history result in different systems of management.

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Promoting Food Self-Sufficiency in the Mid-hills of Nepal: Fertilisers or Farmyard Manure?

SDC - Helvetas

Baitadi, Nepal. Photo: Helvetas.

This article concerns the work of the SDC-funded Sustainable Soil Management Programme (SSMP, implemented by Helvetas-Intercooperation). The programme focuses on improving soil fertility for promotion of food security and a better livelihood in the mid-hills of Nepal.

Capsicum harvest. Photo: Helvetas.

Situation Assessment

Environmental issues

The households of the mid-hills of Nepal are traditionally poor. With increasing population over the past decades, the problems of productivity decline in the bari (dryland, unirrigated) areas have accelerated. The major causes for this are:

- population pressure, decreasing land holdings, and environmental degradation;
- soil erosion, nutrient mining and a limited understanding of sustainable soil management (SSM) practices;
- a limited number of SSM practices validated under farm conditions;
- a limited knowledge, and networking, of appropriate and existing SSM practices amongst development institutions;
- a decreasing on-farm workforce due to significant male out-migration, thus increasing the workload on women, the very young and the elderly;
- insufficient awareness of gender issues related to sustainable soil management (SSM).

The consequences of the productivity decline, if unabated, will lead to further degradation of the production capacity on bari soils, increased nutritional deficiencies and poverty, and accelerated migration toward urban centres.

Poverty and economic issues

Nepal is one of the poorest countries in the world. Some 31 percent of Nepalese live below the national poverty line and nearly 70 percent below US$ 2 per day (UNDP Human Development Report 2007-2008) with these people being very largely concentrated in the rural areas. The problem of rural poverty remains widespread and most indicators suggest that it is on the increase. Some 80 percent of the working population live in rural areas and depend on subsistence farming.

The causes of poverty in the mid-hills of Nepal are many, but include:

- land ownership in the hands of a few,
- small land holdings - some 70 percent of households have less than one hectare, and many plots are too small to meet subsistence requirements,
- low productivity levels,
- a growing population, and
- illiteracy: the national adult literacy rate in 2005 was 49 percent (UNDP Human Development Report), less in the rural areas and significantly less for women and other disadvantaged groups.

Caste and gender discrimination issues

The most vulnerable groups are the lowest social castes, indigenous people and women. Social discrimination plays an important role in keeping the most disadvantaged people in rural Nepal poor and marginalised. Discrimination on the grounds of caste is officially illegal in Nepal but it remains widespread especially in the rural areas.

The recent conflict was caused by poverty, lack of development and economic growth, especially in the rural areas, and

increasing marginalisation. The conflict caused widespread disruption to development programmes, and to agriculture in particular. Many working household members left their homes, the infrastructure and social cohesion in many rural areas were wrecked, and agricultural production severely declined.

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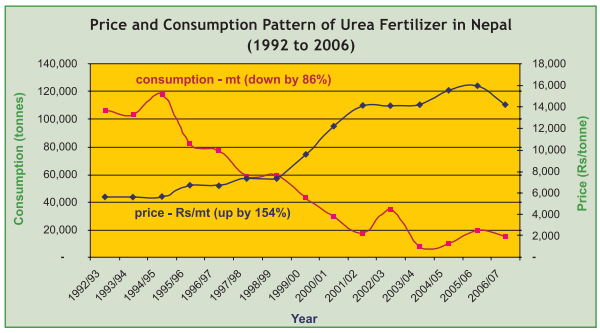
There are both positives and negatives in the current situation - the traditional social order, based on discrimination and feudal power structures, has been partially broken by 12 years of insurgency, but this has simultaneously led to instability in social, political and economic activity.

The Maoist rebellion begun in 1996 has recently ended with the appointment of the Maoist leader as Prime Minister. Hopes are high that political and social unity will prevail, and Nepal can now follow a peaceful development path focused on poverty alleviation and development in the rural areas.

Fertiliser use in the mid-hills

Data on fertiliser sales and consumption from the website of the Ministry of Agriculture and Cooperatives (Government of Nepal) records two very important facts:

- sales of urea have fallen 86 percent in the past 15 years;
- the price of urea has increased 306 percent in the past 22 years.



Similarly, sales of phosphorus fertiliser (DAP) have decreased in the last 14 years by 82 percent, and of an N:P fertiliser ("complex") by 69 percent. Like urea, prices of DAP have also soared, over 300 percent in the past 18 years.

SSMP works in 10 of the 78 districts of Nepal - in only one of these 10 districts is fertiliser use recorded in the MoAC data. This data must be viewed in general terms, as information from the SSMP cluster offices record many fertiliser outlets, and quite general use of fertiliser, especially by market-orientated farming households near the roads and main motorable tracks.

What is clear, however, are the trends - rapidly increasing prices and falling consumption. With the recent hike in energy prices affecting all manufacturing and transportation costs, and mid-2008 inflation rates of over 12 percent in South Asia, prices will continue to rise far beyond what is affordable by the vast majority of mid-hill farmers in Nepal.

Nepal has additional problems which may have affected the distribution, sales and use of fertiliser in the past decade - the civil war and associated unrest affecting many supply chains and accessibility, the deteriorating infrastructure especially in rural Nepal and the current poor availability and supply conditions of fuel.

Other observations on fertiliser use in Nepal include the following:

- the availability of different types of fertiliser in the local market places is poor;
- the quality of fertiliser has in the past been extremely variable; urea should have a 45 to 46 percent nitrogen content – some samples of locally available urea have been recorded as having five percent N content, zero percent K has recently been measured in samples of Muriate of Potash, and mixed fertiliser ratios are particularly variable;
- most mid-hill farmers know very little about either fertilisers or the nutrient status of their soil and often purchase whatever is available locally whether it is needed or not - besides the obvious fact that this is a waste of money, this may often be damaging to both soil and plants;
- adding to this lack of knowledge amongst the farming communities, the traders of fertiliser in Nepal are not experts in fertiliser types or modes of usage and are thus not able to provide advice - what they are interested in, however, is selling more fertiliser. In addition, the poor coverage of the government extension services in Nepal leaves a vacuum in the provision of assistance to the farmers;
- techniques of fertiliser application also leave much to be desired - broadcasting urea without incorporation into the soil is common;
- the use of urea, by far the most commonly used fertiliser in Nepal, is commonly reported to be detrimental to soil structure and workability. In addition, it promotes further acidity in already acid soil conditions within the mid-hills.

The Sustainable Soil Management Project (SSMP)

The SDC-funded SSMP, implemented by a Helvetas-Intercooperation consortium, commenced in 1999 and the 3rd phase of the programme began in January 2008.

Fertilliser for the plants. Photo: Helvetas.

Planting seedlings. Photo: Helvetas.

What does SSMP do?

With the aim of improving livelihoods, SSMP promotes proven and appropriate soil management technologies to the farming households of the mid-hills of Nepal through a pluralistic approach in agricultural extension.

What does SSMP offer to the farmers?

The main promoted technologies, all of which must be economic, and socially and environmentally friendly, are listed below.

- Improvement in the quality of farm yard manure (fym) in a five step programme:
  - maintenance of a well managed heap or pit properly protected from the sun using a protective cover, usually plastic or bamboo-foliage roof;
  - protection from the rain, run-in and run-on water;
  - proper drainage, collection, and storage of cattle urine through simple redesign of the cattle shed;
  - regular turning of the fym, and maintenance of the material in a moist condition before carrying it to the field;
  - no exposure to the sun of the small fym heaps in the field prior to application - again covering is crucial.
- The use of the cattle urine as a fertiliser, plant tonic and bio-pesticide.
- The combining of the above practices with inclusion of legumes, fodder and forage plants into the rotation.
- The incorporation of vegetables and other cash crops into the cropping systems.

Adoption rates of up to 60 percent are recorded for farmers now using the basic fym improvement technologies (a above). Nearly all farmers interviewed at different times during the past five years are convinced that these practices result in higher yields, better quality produce, improved soil conditions (workability), in lower expenditures on chemical fertiliser, and in higher household incomes.

How does SSMP operate?

SSMP works through local NGOs and CBOs who compete for programme funds via a competitive grant system (CGS); proposals from these local organisations are evaluated by an independent technical committee, and contracts awarded on the basis of technical quality, gender and caste inclusion, and poverty and geographical remoteness of the target communities. SSMP has established a system of lead farmers and experienced lead farmers to support the farmer-to-farmer approach (FtF), a key vehicle for further dissemination, and a crucial element of a decentralised extension system, responsive to the farmers needs and in reaching isolated communities who have no access to the government extension structures.

SSMP is committed in all its endeavors to an inclusive work ethic, a focus on the poor and discriminated, and strives for equal access of men and women in its activities.

SSMP in the current mid-hills situation

As reported earlier, fertiliser prices have soared in the past two decades, high oil prices are seriously affecting the cost of transportation and life in Nepal has been severely impacted by unrest, lack of fuel, high inflation and damaged infrastructure. These factors provide further economic and environmental justification for the promotion of SSM practices:

- the raw materials for fym and compost are available locally free of charge - there are no transportation or purchase costs;
- nitrogen is available free of cost in the urine of farm animals;
- urine can be used as an additional input to the fym and compost, as a plant nutrient tonic, and as a plant bio-pesticide, further reducing the need for expensive agro-chemical inputs;
- SSM practices improve the quality of compost and fym that is applied to the farm and thus makes best use of the available resources.

SSMP and the SSM practices that are promoted are thus increasingly relevant and important in the struggle for mid-hill food availability and livelihood sustainability.

The impacts of SSMP

Eight impact studies were undertaken in 2007 after eight years of SSMP implementation. A brief summary of the highlights is presented below.

- SSM technologies developed and extended to over 25,000 hill farmers per annum during Phase 2 have increased the soil nutrient reserve, have had a positive influence on agricultural productivity and have enhanced household incomes;
- the three technologies which have been most adopted in the past three years are improved farmyard manure preparation and management, legume integration in the cropping cycle, and organic pest management;
- the competitive grant system (CGS) and farmer to farmer diffusion (FtF) are cost effective extension mechanisms;
- operating the FtF system through lead farmers and experienced leader farmers leads to demand-led agricultural development in the rural areas, and is far more effective in reaching remote areas which otherwise remain untouched by the government extension service;
- SSMP has had a significant impact on policy development in relation to greater use of locally available natural

resources and improved fym production. The Agricultural Perspective Plan, reviewed in 2006, and the revised National Fertiliser Policy have both taken note of SSMP's achievements, the CGS has been adopted by other government and non-government projects and institutions, and the FtF extension system has been fully endorsed in the 10th Five Year Plan and the national extension strategy.

At the on-farm level, there is a notable beneficial impact of SSM practices on soil fertility. Over 2000 soil analysis benchmark sites have been established over the past eight years. Not all these benchmark sites are now, over time, comparable, but an interim review of soil and fym analysis results from the most reliable sites (n = between 35 and 132) record the following strong trends:

- improved fym production, storage and application practices, including additions of cattle urine, resulted in a significant improvement in the nitrogen content in the prepared fym: a potential increase of 10percent per annum in the N content of the fym can be expected;
- over a 2 to 3 year period, improved practices also increase soil organic matter by between 10 and 15 percent, and soil nitrogen content by around 10 percent;
- SSM practices also result in an increased soil P level, and a potential increase in the on-farm soil P content, somewhere in the region of 10 percent per annum, can be expected in the first few years.

In a separate study, the impact of SSM practices at the global scale has been illustrated in terms of carbon capture in the soil.

In four locations that had completed six years of SSMP operation, soil organic carbon density (quantity of carbon per unit area) increased from 36 ton/ha in year 0 to between 65 and 83 ton/ha in the 6th year. Annual accumulation of soil organic carbon was estimated to be 4.8 and 7.8 t/ha/annum for the low and the high scenario. If it were possible to value soil carbon on the world market, even at conservative rates, this 6 year storage of carbon would be worth between US $ 4 to 7 million. Or put another way, each mid-hill farming household in Nepal, adopting sustainable soil management practices, could trade soil carbon worth around US$10 per year - if given access to the carbon trade market.

Where SSMP operates best, the programme also empowers civil society actors, especially women and disadvantaged groups, and transparently provides sound technical solutions that impact on soil fertility and livelihoods, thereby assisting to alleviate long-term food shortages and poverty.

Future Challenges for SSMP

As it is felt that sufficient local capacity does not yet exist to expand the technologies and practices to wider areas, future challenges include:

- institutionalising key technical and process aspects of the programme into both government and non-government sectors,
- inclusion of key technical and approach elements of the programme into the curricula of educational institutes at different levels;
- outscaling of the key lessons through both the private and public sector to a much wider audience in Nepal and other mountain communities in the developing world,
- entrenching the FtF and CGS system at local level in the districts;
- as more and more males are leaving their home villages, and even the country, to find paid employment, women are increasingly taking the lead role on the farm, and some of the technologies developed and extended may not take this fact sufficiently into account. What must be avoided is increasing the already heavy workload of women.

Success Stories

"Shyam Maya, hard work and dedication, and now a leader farmer"

Shyam Maya and her father. Photo: Helvetas.

"I had to stop my schooling when I lost my mum 15 years ago. Then my father lost his vision from motiyabindu (night blindness) in BS 2058 (2001). After that I had to bear all the responsibility of caring for my father and the farm. We have 11 ropani of land and we only used to produce enough millet and maize for three months", says Ms. Shyam Maya Rai, Baruneshor-8, Okhaldunga.

Since 2058 BS, she has been a member of a group formed by the Local Development Fund and her group received support from the District Road Support Programme (DRSP). For five years with her group members, she found work on the Rampur-Okhaldhunga road for 30-45 days per year. In her own words: "I got the opportunity to participate in training on various SSM practices, after SSMP started to work with our group since 2062 BS. I was also selected as a leader farmer of my group, which inspired me to start vegetable production. I then received support for a plastic tunnel where I produced off-season tomato and earned NRs 13,000 in one season. In three years, I have now earned NRs 35,000 from tomato production and will continue. I am also producing other vegetables like cabbage, cauliflower, radish, cucumber, okra, beans, and peas, and sell these at the weekly haat baazar in Okhaldhunga. Vegetables grown from one ropani has now become the major income source for our family".

She then improved her cattle shed so that she could collect urine and upgrade the quality of the fym she prepares; she also prepares gitimal (bio-pesticides) and uses it on her vegetables. Now she is the manager of Kamladip Misrit Samudaik Sanstha, a women's cooperative and has received training as an IPM facilitator. Subsequently, she facilitated an IPM farmer field school supported by APPSP (DFiD), and a polyhouse vegetable production training, supported by the DADO at Bigutar.

She concludes: "In the beginning, my father, who is 85 now, was not happy with me being away from home attending group meetings and trainings, but nowadays he is convinced by my work and proud of me. My neighbors are also getting courage and ideas from my work". And her future plans? "I was selected as an Experienced Leader Farmer (ELF) and very recently received 4 days capacity building training. These have greatly encouraged my interest in providing support to other farmers in remote villages and in sharing my agricultural experiences through the farmer to farmer (FtF) extension programme. I am so interested in starting this new challenge".

"SSM and vegetable production helped me pay back a big loan and send the kids to school"

Sanu Sharma with her daughters. Photo: Helvetas.

"Five years ago, I was nearly ruined when my husband died leaving a Rs 300,000 debt, and three small children to care for" says Sanu Sharma, 39, from Piple-3 of Myagdi. She got a job earning NRs 1,500 a month but this ended after two years - then, cultivating a small piece of land (1.5 Ropani) became the only alternative..

This piece of land became the basis for feeding the family and also to fulfill all other living requirements, including her children's education and to pay back the loan. These were great challenges for her. She searched for assistance with her small piece of land and found the Hilly Resource Development Centre (HRDC) one of SSMP's partners, and Sanu and her daughters bravely started to grow vegetables with SSM practices.

"I have already sold potato, cabbage, cauliflower and fermented cabbage (gundruk) and earned NRs 16,000, and still have some vegetables to sell this season". She describes how she linked SSM with vegetable production: "After I got training, I started to improve the way I prepared and managed the fym, to practice organic pest management and grow vegetables. I produced improved fym, protecting it from direct sunlight and avoiding run-on, and making best use of cattle urine. The improved fym is light and easy to apply, takes less labour to carry it to the field, and it increases my crop production. I now realise we were losing thousands of rupees especially through the loss of urine. I use the urine on my vegetables not only for nutrients but also it works as a pesticide against vegetable pests. I also use it to make gitimal (organic pesticides), mixing plant parts, including buds and leaves, from banamara, asuro, titepati, timur, sisno, khirro, ketuki, simali with cattle urine and then leaving to ferment for 25-35 days. I feel these fym, cattle urine and gitimal are like a melodious song for plants where they feel they are in a relaxing environment and grow well. I am also growing beans once a year which is also improving my land through nitrogen fixing, I believe".

Sanu Sharma concludes by saying that after three years of effort on vegetable production with SSM practices and saving with Dhukuti (a saving credit scheme), she has finally paid off her inherited loan, and all her children are doing well in school.

"Now I have realised the value of cattle urine", says Kamala

Healthy rice seedlings due to the use of cattle urine 10 days before seed sowing. Photo: Helvetas.

"See my rice seedlings on this two anna (62 m^2).... it is taller, healthier and has grown faster and this is due to cattle urine. I applied 42 litres of fresh urine to this land 10 days before seed sowing." says Kamala Kharal from Dagatumdanda-7, in Kharbang, Baglung District.

She added: "In previous years when I was not using cattle urine, the rice seedlings used to be shorter, pale yellow with dried tips and margins, and were often attacked by several insect pests".

After she became involved in the CYC group, a local SSMP partner, she learnt about SSM practices, and she improved her cattle shed so that she could regularly collect cattle urine. She uses the collected cattle urine as fertiliser and for bio-pesticide (gitimal) to protect her vegetable crops. Kamala has now adopted other SSM practices, including fym improvement, and the integration of legumes in her fields.

She concludes: "After I started to adopt SSM practices on my cereals and vegetables, the yields increased considerably. Before my three ropani of land was not enough to produce food for six months; now.....this land feeds us for the whole year. I have sold vegetables and earned NRs 16,000 in a season from one ropani. Local collectors now come to my home to collect my vegetables, saying Kamala produces organic vegetables!"

Dev Singh Thagunna - now back home and doing well.

Four years ago, Mr. Dev Singh Thagunna, aged 27, was searching for work in various Indian cities and earning about NRs 10,000 per year, far from sufficient to care for his five person family. Back home in Baitadi (Basantapur VDC, Ward No.4), his spouse and children were living in miserable conditions, and the five ropani which they own remained under-utilised due to his absence. The family only grew cereals and the produce was not enough to feed the family.

In 2062 BS (2005), Mr. Thagunna participated in one of the trainings provided by SADA, one of SSMP's partners working in Baitadi District. He says "I had no idea how to grow vegetables or spice crops before. However, after the training, I was inspired to carry out some experiments on small plots on my farm, and SADA really helped me. After a year's experience growing vegetables and spice crops, I was convinced that I could improve my family's condition considerably from these crops".

What did he do then? He continued: "With SSM practices, I started to produce cabbage, cauliflower, tomato, rayo, radish, onion, legumes like French beans, and spices like chilli, garlic and ginger on my five ropani of land. I am now earning NRs 50,000 per year, and of this I am saving NRs 20,000 every year".

He added that, at the beginning, his father and other brothers were not happy with his practice of growing vegetables and spices instead of growing cereals on the land he had inherited. However, they also now realise that it is more profitable to grow these crops than the traditional crops. These days Mr. Thagunna is recognised as a leading farmer in the district and is attracting neighbours towards vegetable and spice crop production.

He concludes: "Now I don't have to leave my family and go abroad any more searching for work. I can earn more and live a better life from my land - here at home with my family".

"An impossible dream just a few years ago."

Chandra Kumari, preparing land for polyhouse tomato planting. Photo: Helvetas.

"Days were very difficult and challenging for me. I only had 1 ropani of land where I used to grow cereal crops - this was all we had to feed and support our family of five. We were so poor", says Chandra Kumari Bishwakarma of Marvu VDC in Dolakha District. "Before 2006, we got no support from the outside and I had no idea of improved agricultural practices".

Since 2006, ECARDS-Dolakha, another of SSMP's local partners begun introducing SSM practices in Chandra Kumari's area; she became actively involved in the programme, receiving training and technical support for vegetable production.

She began collecting urine from her two buffaloes, took serious steps to improve the way she prepared, managed and applied the fym, and started to grow vegetables like cauliflower, potato, onion and tomato.

"Now I grow enough good quality vegetables to sell at the Singati bazaar, and on average I am earning NRs 10,000 per year. My vegetable production is increasing due to improved fym and urine application as a plant tonic - I collect about seven litres a day in a drum. With my increased income, I have purchased two more buffalo and another half ropani of land. Now I am also managing my childrens' education expenses - an impossible dream just a few years ago."

Chandra Kumari has now become a lead farmer in her group and helps to further extend the use of SSM practices in her area.

For further details or information on SSMP and SSM practices, please contact the following:

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Food Security in Mountains – High Time for Action

11 December
International
MOUNTAIN DAY

The problem of hunger in mountains is getting worse. Harsh climates and the difficult, often inaccessible terrain combined with political and social marginality make mountain people vulnerable to food shortages. Indigenous knowledge about local foods and traditional agricultural practices in mountain areas is eroding and agricultural diversity as well as productivity are declining, further increasing the vulnerability of mountain people.

Recent studies indicate that mountain populations suffer from high rates of micronutrient deficiencies, which is one of the contributing factors to the significantly higher infant mortality rates in mountain regions.

Northern Gorkha, Nepal. Photo: Ujol Sherchan.

Now food prices are soaring worldwide and increased transportation costs to remote mountain areas mean mountain communities are paying that much more for their food.

International Mountain Day 2008 (IMD2008), with its theme of Food Security in Mountains, was an apt occasion to reflect on how hard it is for mountain people to consistently get adequate and nutritious food to lead healthy and active lives. Priorities for improving food security in mountains include promoting and expanding traditional mountain crops; safeguarding indigenous land use practices; improving breeding programmes of mountain-adapted livestock; better market access; and mountain-specific public policy, developed with the participation of mountain people.

Source: IMD 2008 public service announcement, FAO.

ICT for Rural Community Development - Interview with Mahabir Pun

Tek Jung Mahat

Mahabir Pun, 52, is a Nepali citizen. After receiving his Master's degree in Education at the University of Nebraska at Kearney, he returned to his native village, Nangi, and founded the Himanchal Education Foundation. Mr. Pun is currently at work establishing wireless networks in rural Nepal and is associated with several organisations working in ICT for rural development. Mr. Pun has won the Magsaysay Award 2007 for his community leadership and innovative application of wireless computer technology that has connected his village Nangi to the global village. Mr. Tek Jung Mahat from APMN discussed with Mr. Pun ICT for rural development in the Nepal Himalayas and his ongoing projects.

Q. Can you please tell us something about your ongoing projects? What is your future plan re: wireless technology in Nepal?

Pun: There are many projects in progress where we are expanding our services upon request from communities, government and other agencies. Now we are connecting the internet to some villages in the Makanwanpur district and planning to provide tele-medicine and tele-education services. Rato Bangla School has planned to conduct training for teachers and also tele-education to schools in rural areas of Makanwanpur. We are working with Kathmandu Model Hospital in expanding a tele-medicine service to Dolkha district. Upon request from Winrock International, we are currently linking rural southern villages of Palpa district to the internet. We are expanding our earlier work in Myagdi to 6-7 more villages which will be provided with tele-education and tele-medicine services. Moreover we are connecting the service to four districts in between Kathmandu and Pokhara. Apart from this, we are working on the introduction of Nepali Windows and Nepalinux with Madan Puruskar Pustakalaya (MPP), with development and organisation of contents through the Open Learning Exchange (OLE). Contents in mathematics are being developed for grade six and eight in consultation with the Ministry of Education. We are also working in the development of video-conferencing applications with the Kathmandu Engineering College and on some other applications with the Gandaki Engineering College.

Q. What are some of the major challenges you encountered during the implementation of your projects?

Pun: When we go to many rural villages it can be seen that there are very few qualified teachers. Not only trained and qualified teachers, many schools lack teachers. In such context, it's a big challenge how we can use ICT to promote education in those areas. My interest is to expand the use of the internet as a means of education promotion and internet expansion itself has no meaning until and unless we enable people to use the services that can be made available through the internet. When they don't understand English they can't make good use of the Internet and then it simply becomes a "show piece."

We have faced a few technical problems in tele-medicine and tele-education and our technical team is responsible for fixing problems. Currently we have only four paid staff and the rest all are working on a voluntary basis. Financial capability is another challenge in order to upscale and expand services. Since we have a very poor literacy rate in the mountainous and hilly areas, development of capacity to use the ICT services among the rural community is another challenge, which can't be solved overnight. It's a gradual process and needs to be integrated with the overall education system of the country.

Lack of coordination among the similar organisations is another problem.

Q. Do you see the possibility of replicating/upscaling your work in Nepal to other remote mountainous regions of Asia and the Pacific?

Pun: Yes, however, our current activities are in Nepal only. Currently we are doing homework to start a relatively big project in three remote districts in far-western Nepal with support from National Panning Commission (NPC), most probably in Bajhang, Bajura and Jumla. Projects in Makanwanpur, Dolkha etc. are a few of the examples of replication and upscaling. However, as we move from hilly areas to the plains areas we may have some problem of line-off sites. In the plains, we cannot see farther like in hilly areas and we have to spend more resources in setting up of line-off sites but in the hilly areas we can easily see peaks from very far-away and that makes the wireless system easier to connect and also cheaper as we don't need to invest much in setting-up many towers. Very recently a team of Television Programmes has arrived from India who is willing to develop some video clips of our work in Nepal and plan to broadcast them in India. We are receiving similar requests from other media also.

Q. What are some of the challenges faced by the mountain community of Nangi? In addition, how has wireless technology helped address them?

Pun: The case of Nangi is not much different form other parts of Nepal. I don't know the situation of far-western hilly districts where people are facing problems of famine most of the time. In general, most of the mountainous communities have traditional agricultural systems and somehow they are able to produce minimum grains to eat and they are able to sustain subsistence livelihood. Not only in mountains but also in other parts of Nepal, the major problem is people don't have jobs or other alternatives of cash income, for which they migrate seasonally (and in some cases for many years) to neighboring countries. It has become an unavoidable option, as people don't have the opportunity to generate income to cover the expenses of basic necessities such as salt and oil. Similarly in the villages, they don't have hospitals, schools and communication facilities, adding more pressure for the overall development of the region. However these problems are not limited to Nepal or the Nepalese mountainous areas.

The contribution of technology in improving livelihoods of rural people is not as easy to measure as it seems. In relatively developed areas or the areas which are closer to markets, the technology can make people aware about market related information of their range of products so they can sell their products for better prices. Take a case of herbs and other high value low volume products that are common in our mountain regions. Presently the collectors, the local people are selling their products for very cheap prices to the middlemen who are mainly from the cities or at least don't belong to those areas and they resell the products for better prices. It's because the local communities are not aware of the market system and the further processes after they sell it to these middlemen. If we manage to

develop a system to inform them about their products, markets, market rates and so on through the application of ICT tools, the local communities will benefit more than they are benefiting now and we can see a remarkable improvement in income generation of local communities. But this is not equally beneficial for all the products and areas. Application of ICT should be supported side-by-side with road and other means of transportation to market the rural goods more effectively. For example Jumla and Humla grow very good quality apples and the people are aware of their market; however, they are still not able to sell their products because of the large investment required and lack of transportation facilities.

Q. How do you see the role of ICT in transformation of rural communities in next five years or so?

Pun: Five years is a very long time when talking about technology and its advancement. In the next five years definitely the technology will be cheaper and will be easily available to poor people. Today's sophisticated technology will be common in practice and more improved technology will be available for our use and can be used for rural communities. When the cost of ICT falls and affordability of local people increases, it will be easier to expand the services and the poorest of the poor can also have access to the technology and benefit from it. However, ICT is not magic in itself and can't transform rural communities drastically. ICT should be promoted side-by-side with other literacy-related programmes and income generating activities, after which some remarkable changes will occur. One tragedy in our country is that many short-term projects are working in the areas of ICT. They do a pilot project in some particular areas and then they just disappear within a couple of years. As a result neither the communities can benefit, nor the technology can be tested in a more exhaustive way. In such cases, no transformation can be expected. But in their reports, they claim big achievements. This should be discouraged for better implementation of ICT projects.

Thank you Mr. Pun for the great work you have accomplished and for taking the time to answer our questions. We wish you all the best in your future endeavors.

Local Access, ICT and Sustainable Mountain Development

Frans Neuman

Technology in rural areas. Photo: Bibhusan Bista, SAP International.

Sustainable mountain development is a matter of local communities managing and implementing activities that sustain the natural resource base whilst ensuring their livelihoods in terms of income and health. Information and communication are key factors in this process. Traditionally this has been by storytelling, newspapers, magazines, radio and television. Internet is one of the more recent channels by which local communities can access information and communicate with others.

There are many examples where ICT can help rescue people from poverty and improve livelihoods:

- *Health:* Telemedicine allow medical staff in villages to link with doctors in hospitals to diagnosis diseases and provide second opinions. Local people can access information to prevent diseases;
- *Agriculture:* Market prices, help with marketing, advice on crop diseases, treatments or measures to improve soil; information on innovations and contact made with agricultural experts;
- *Education:* E-learning for students; access to higher level specialist courses;
- *Commerce and business development:* Information on loans, technical innovations and business developments such as mobile banking useful for small-scale enterprises; tourism is a major source of income for many, so advertising and payment systems are useful;
- *Governance:* Information on government policies such as road-building;
- *Reducing the digital divide:* People in mountain communities can use the internet to communicate with family or business partners in the 'outside world' by email or making cheap calls via voice-over IP (VOIP). Access to news from across the globe help to reduce the digital divide.

The potential of ICT to enhance livelihoods is high, but the reality of making it work is tough:

- Content is available in billions of websites, but finding relevant and validated information is a challenge;
- Accessing the internet requires new technologies: laptops and computers, connection via telephone lines, cable or more costly satellite. Power is needed and links to the grid may not be possible. Solar, wind or hydropower needs to be used. Mountain communities are usually remote, so economics are against them;
- Sustainability is a major challenge as often the initial set-up is sponsored by donors but operations stop when no income is generated to repair equipment and pay internet fees or due to a lack of technical knowledge.

Media such as radio can reach further but has limitations, being a one-way medium of communication. Mobile telephones have gained rapidly in importance. A recent study by APC underlined the need for local telecentres. These play a key role serving the needs of individuals, as well as having a community role in supporting local organisations such as women groups, small entrepreneurs, farmers etc. with information, support and training.

For the Asia Pacific region, the UN Economic and Social Commission for Asia and the Pacific (UNESCAP) set up a Regional Network of Telecentres Asia-Pacific. In Latin America, the Inter-American Development Bank (IDB) and national governments are investing in developing rural telecentres. The Latin American Mountain Forum network, InfoAndina supports rural telecentres by providing content to serve local communities.

It is important for the Mountain Forum community to link up with these initiatives in mountain areas. The importance of ICT for mountain communities is clear. Enhancing access to information is a priority in the Mountain Forum Strategic Plan.

Selected telecentres information resources

- Global information on telecentres: Telecentre.org *http://www.telecentre.org;*
- I4D magazine by CSDMS *http://www.i4donline.net;*
- Regional Network of Telecentres Asia-Pacific: UNESCAP Consultative Meeting 27-29 Sept 2007 *http://www.telecentresap.org/index.php?option=com_content&task=view&id=22&Itemid=30;*
- Telecentre network in Africa: CTA workshop 17-19 June 2008, *http://www.share4dev.info/telecentres;*
- Rural Access: Options and Challenges for Connectivity and Energy in Tanzania, IICD, 2007 *http://www.infobridge.org/asp/documents/3782.pdf;*
- APC study: *(http://www.apc.org/en/news/wireless/all/rural-communication-there-still-need-telecentres-n).*

Asia Pacific Mountain Network

Mr Mahat making a presentation at the HHF launch meet in New Delhi-India. Photo: Min Bahadur Shahi.

Joint work plan for 2009

APMN, maintaining its important linkages with the Decentralized Hub of the Mountain Partnership Secretariat for the Asia-pacific region, the Mountain Forum Secretariat and the Integrated Knowledge Management Programme of ICIMOD has recently prepared a list of joint activities to be implemented in 2009. From 2009 onwards, APMN's activities will be more focused on communication, networking and information and knowledge sharing on sustainable mountain development in the region.

Recommendations for a strategic direction (Framework) 2008 – 2012 (January-June 2008)

With the development of ICIMOD's new Medium Term Action Plan (2008-2012), which has recognized APMN as its 'communication arm', and establishment of a Decentralized Hub of the Mountain Partnership Secretariat at ICIMOD, APMN is entering an exciting new phase as an integral component of a concerted approach to bring the mountain agenda to the forefront of international discussions and policy. With the continued support of Swiss Development Corporation (SDC), APMN is strengthening its relationship with the worldwide Mountain Forum and the Mountain Partnership through dialogue and harmonisation of activities. In the coming year APMN will look at different ways of broadening and extending the network, as well as providing support to entail discussions with more focused content groups. The 'Recommendations for a Strategic Direction (Framework) 2008 – 2012' has been drafted, which is prepared in harmony with the plans, strategies and approaches of the Mountain Forum, the Mountain Partnership Secretariat decentralized hub for Asia-Pacific and ICIMOD. For the ongoing phase (2008-2012) APMN presents itself as the communication, networking and knowledge sharing platform.

Below are key highlights of APMN during this period.

Completion of the projects to support the Mountain Partnership Secretariat (MPS) as of (June 2008):

- Communication needs assessment in Central Asian region;
- Support to MP Biodiversity Conservation Initiative. More information: http://apmn.icimod.org /bdinitiative;
- Who=Who organisation mapping in Sustainable Mountain Development(SMD). More information: *http://www.mtnforum.org*

Co-organisation of meetings, e-conferences, e-discussions:

- E-conference on Culture and Risk: Understanding the Socio-Cultural Settings that Influence Risk from Natural Hazards from 22 September to 05 October 2008, together with ICIMOD, MFS, Stockholm Environment Institute (SEI) and Sida. More information: *http://www.mountainforum.org/rs/ec/index.cfm?econfid=16;*
- E-discussion on 'How disasters help to improve country's economy' from 7-28 July on its [mf-asiapacific] discussion list;
- Global Knowledge Partnership (GKP) South Asia Meeting from 18-19 June 2008, together with ICIMOD, MFS, Panos South Asia, Forum for Information Technology (FIT) Nepal, High Level Commission for Information Technology (HLCIT), National Information Technology Centre Nepal (NITC) and Bellanet and One World South Asia;
- E-discussion on 'Slashing mountaineering charge for climbers' (May 2-6 2008).

Outreach and network activities and growing recognition of APMN:

- Tek Jung Mahat, APMN Node Manager attended the 3rd International Conference on e-Content and Sustainability (ICONECS) and Manthan Award South Asia 2008 in New Delhi, India from 16-18 October 2008.
- Tek Mahat also attended the Himalayan Environment Trust's First Sir Edmund Hillary Himalayan Environment Award 2008 ceremony in New Delhi India on 14 October 2008. This year's award was given to Dr. Andreas Schild, Director General of ICIMOD and Chair of the Mountain Forum Board
- Tek Mahat and Sani Karami of MFS made a brief presentation on 'Endeavours and achievements of the Mountain Forum/APMN' at the launch meet of the High Himalaya Forum, accepting the invitation from organiser of the event, PRAGYA, a development organisation based in India. They attended partnership meetings with One World South Asia (OWSA)/GKP members and the Centre for Environmental Education (CEE) in New Delhi, India from 12-15 October 2008.
- Tek Mahat made a presentation on the role of knowledge networks in addressing climate change issues in the mountain areas: Lessons learnt – APMN at the Climate Talk programme on 19 September 2008, accepting an invitation from the Nepal Youth for Climate Action and other organisers at the ENPHO Resource Centre, Kathmandu, Nepal.

IPROMO participants from Asia-Pacific. Photo: Tek Mahat.

- Tek Mahat was nominated as an Associate Member (expert member) of the Nepal Forum of Environmental Journalists (NEFEJ) on 13 August 2008. NEFEJ is an APMN/MF member from Nepal.
- Tek Mahat attended a partnership meeting with the Mountain Research Initiative (MRI) at its central office in Berne Switzerland from 7-8 August 2008 and discussed potential collaboration between APMN/Mountain Forum and MRI.
- Tek Mahat together with APMN/MF members Dr. Gulzat Kokoeva (Kyrgyzstan), Dr. Pankaj Thapa (Bhutan), Dr. P. S. Negi (India), Mr. K.M. Jakeer Hussein (Bangladesh), Ms. Pratima Shrestha (Nepal), Ms. Saima Siddiqui (Pakistan) and Ms. Shideh Atri (Iran) attended the International Programme for Education and Training on Sustainable Management of Mountain Areas (IPROMO) training course on 'Mountain Environment and Global Change' from 21 July - 06 August 2008 in Torino, Italy. The programme was facilitated by ICIMOD/APMN and discussion on further collaboration is in progress.
- APMN/ICIMOD celebrated World Environment Day 2008 with the theme 'Kick the Habit! Towards a Low Carbon Economy'. Publications were shared at the event in Kathmandu, organised by the Government of Nepal and at the main event in Willington, New Zealand, with support from UNEP Bangkok and ICIMOD.
- Tek Mahat and Daan Boom, APMN coordinator, attended the Mountain Forum's Annual Board and Node Managers' meetings in Chambery, France from 27-31 May 2008. The meeting was also attended by representatives from other sustainable mountain development players from around the world, including Mountain Forum's partner organisations, The Mountain Institute (TMI), Banff, CIP-CONDESAN, African Highlands Initiative (AHI), ICIMOD, Mountain Research Initiative (MRI), Mountain Research and Development (MRD)/Food and Agriculture Organisation (FAO)/Mountain Partnership Secretariat (MPS), Global Mountain Programme (GMP), United Nations Environment Programme (UNEP) and SDC. The meeting provided directions to Mountain Forum for next four years and updated activities of the regional nodes.
- Tek Mahat attended the log-frame exercise of the MPS organised in Chambery, France from 25-26 May 2008. APMN provided inputs to the exercise and assured to be an implementing partner of the newly established MPS decentralised hub for Asia pacific region.

Publications:

- APMN Bulletin Winter issue (November 2008);
- APMN Bulletin Summer issue (May 2008);
- Synthesis of the e-discussion on Building Resilience of Mountain Communities to Climate Change (May 2008).

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InfoAndina – Latin American Mountain Forum

On-line conference "Food Crisis: Challenges and Opportunities in the Andes", 18th-30th August 2008

InfoAndina's online conference services supported CONDESAN in the organization of the e-conference regarding the food crisis and the Andean region. With the co-sponsorship of the General Secretary of the Andean Community, the Andean Initiative of the Mountain Partnership, the FAO and the Swiss Cooperation (COSUDE), CONDESAN organized this electronic conference with the objective to analyse in depth the food crisis in the Andean region and to evaluate the measures that are being taken in these countries to make the necessary recommendations.

This conference provided the opportunity for reflection across the region on the impact, challenges and opportunities that exist concerning the food crisis in the Andes and the possibilities of Andean crops that can help promote food security.

The theme was tackled in three areas:

- Theme 1: Food crisis - principal factors that affect the Andean countries and their impacts;
- Theme 2: Policy measures in the Andean countries to take advantage of the opportunities and limit the threat resulting from the food crisis;
- Theme 3: Policy measures to take advantage of Andean crops' potentials. See: *http://www. infoandina.org/crisisalimentaria.*

InfoAndina and Rural Telecom

InfoAndina signed a collaborative agreement with Rural Telecom to disseminate information across the Peru

Rural Telecom is a Peruvian company that since five years ago, is providing telecommunication services in the Andean rural zones of Peru. They operate the "Rural Broadband at a National Level" (BAN) project supported by Funds of Investment in Telecommunications (FITEL) to install 1,096 public telephones in rural localities, residential telephones in 148 villages and broadband internet access through internet carbines in 1,654 localities.

Robert Hofstede and Patricio Mena in the Paramos of Venezuela. Photo: InfoAndina.

In the framework of this BAN project, Rural Telecom came to InfoAndina to establish a collaborative agreement to show and disseminate relevant information at a national level. This information should help rural enterprises to find appropriate information-related news, contributions, events, opportunities, courses and other relevant information. See: *http://www.ruraltelecom.com.pe/*

New website related the urban harvest development by InfoAndina

Website. Photo: Info Andina.

The Urban Harvest Program (UH) of the Consultative Group on International Agricultural Research (CGIAR) and InfoAndina established a Cooperation Agreement to development and implement the new Urban Harvest Portal as a dynamic and decentralized on-line system and a standard template to implement websites for their similar projects.

Urban Harvest is a CGIAR global initiative that has the objective to contribute to helping the food security of urban poor families and increase the value of agricultural production in urban and peri-urban zones, ensuring at the same time the sustainable management of the urban environment. It has the goals of: (a) contributing to enhanced food security, improved nutrition and higher incomes for poor urban and peri-urban families, (b) reducing the negative impact of UPA and enhancing its positive potential, and (c) establishing the perception of UPA as a productive, essential component of sustainable cities.

Urban agriculture broadly describes agricultural activities and livelihoods in an urban setting. Peri-urban agriculture similarly takes place in those areas immediately adjoining an urban setting, often the area between the suburbs and the countryside. See: *http://www.uharvest.org/*

New MF Board member for Latin America elected

After a transparent election process organised by InfoAndina, the new Board Member representative of Latin America was elected by more than 50 percent of the total votes in favour of Dr. Robert Hofstede.

He has a Ph.D. and Master of Science degree in Biology from Amsterdam University and for more than a decade, has been a Mountain Forum member. He was one of the most active members and organisers of electronic conferences related to the conservation and sustainable management of the Andean paramo ecosystem.

As part of the International Union for the Nature Conservation (UICN), he is in permanent contact with the principal actors and themes related to nature resource management and the sustainable development in Latin America.

He has been living in the high mountains of South America since 1988 and for this reason has an Andean perspective that works in favour of the Latin America interest. See: *http://www.infoandina.org/site.shtml?x=23145*

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North America Mountain Forum (NAMF)

Bow Valley Mountain Forum

The Bow Valley Mountain Forum is now more than two years old and interest continues to grow with over 200 local members and 90 subscribers to the Bow Valley Update bi-weekly newsletter. In fact, interest has been steadily growing enough that we are now looking for grant money to update the site to make it more user friendly. This local website publicizes opportunities for nearby residents and visitors to get more involved in Bow Valley communities. The site focuses on community events and activities that affect economic, social and environmental sustainability in the region. The local calendar and homepage on the Bow Valley Mountain Forum are updated on an ongoing basis. It is hoped the idea will be replicated in other mountain communities.

To this end, Amy Krause (now of the Mountain Partnership) is working on completing a guide describing the experience of setting up the community web portal. The guide will include the step by step process undertaken to set up the portal and what we learned along the way. Accompanying the guide will be information about the specific web technology used. Content Management software was chosen because this allows the users to post information and directly participate in contributing content to the site. A content management system is designed to simplify the publication of content to web sites, allowing users to submit content without requiring technical knowledge of HTML or the uploading of files. Amy has also included definitions of the technical jargon associated with Content Management software. Hopefully this guide will help others learn from these experiences.

Mountain Partnership decentralized hub

The Mountain Partnership Secretariat has recently become decentralized, in an effort to more effectively provide service and support to Mountain Partnership members at local and regional levels. Three separate hubs have been created and

Iceberg Lake below the Continental Divide, United States. Photo: Lisa McKeon.

the North American Decentralized Hub is being hosted here at Mountain Culture at the Banff Centre. Amy Krause shifted positions to become the new Programme Officer for the Hub after being the Node Manager for the North American Mountain Forum for the past five years. The new Decentralized Hub at The Banff Centre will be the main point of contact for Mountain Partnership members in North America for both ongoing and new regional initiatives.

The revised structure will enhance the collection and dissemination of regional information as well as increase local support for networking, organisation and resource mobilisation. Mountain Partnership members will continue to be part of a global alliance that connects mountain communities throughout the world. It is anticipated that there will be an increased collaboration between The Mountain Partnership and The Mountain Forum in North America due to the close ties at Mountain Culture.

On the web

A "Toolbox" of Guidelines for Responsible Growth in North Carolina's Mountains *http://www.mountainlandscapesnc.org/index.html*

The Mountain Landscapes Initiative (MLI) is a program of The Community Foundation of Western North Carolina. After two years of research into mountain communities' needs, The Community Foundation discovered that many issues were connected to land use planning. The purpose of creating the "toolbox" is to take a first big step towards community-determined standards for planning and development in North Carolina's mountain region. The development of the guide included a lot of local, community involvement. To review the Mountain Landscapes Initiative "Toolbox" or learn more about the Initiative, please visit the website.

CPAWS – The Big Wild Campaign

http://www.thebigwild.org

The Big Wild refers to the part of Canada that is still in its natural state. This wilderness area amounts to 20 percent of all that is left on the planet. The vision of the Big Wild Campaign is to keep at least half of Canada's public land and water wild forever. They are realizing their vision by supporting wilderness conservation campaigns across Canada. The Big Wild helps these campaigns by, educating people about the dire need to protect Canada's last remaining wilderness areas, raising funds for wilderness protection and enabling people to show decision-makers they support wilderness protection. The Big Wild has many initiatives up and running that people can choose to support including a campaign to protect Canada's Southern Rockies. To learn more about the 'Big Wild' Campaign, please visit the website.

Upcoming events

74th North American Wildlife and Natural Resources Conference
Arlington, VA, USA. March 16-21, 2009
Contact: *cindy@delaneymeetingevent.com*
More information: *http:/ /www.fishwildlife.org/nawnrc.html*

Climate Change in South Asia: Governance, Equity and Social Justice
New Jersey, USA. April 16 - 17, 2009
Deadline for abstract: September 15, 2008
Contact: *magrconf@rci.rutgers.edu*
More information: *http://magrann-conference.rutgers.edu*

2009 Western Snow Conference
Canmore, AB, Canada. April 20 – 23, 2009
Contact: *BMcGurk@sfwater.org*
More information: *http://www.westernsnowconference.org/*

American Water Resources Association (AWRA) Spring Specialty Conference "Managing Water Resources and Development in a Changing Climate"
Anchorage, Alaska, USA. May 4 - 6, 2009
Contact: *mlilly@gwscientific.com*
More information: *http://www.awra.org/meetings/Anchorage2009/index.html*

New River Symposium 2009
Boone, NC, USA. May 21-23, 2009
Deadline for abstract: December 12, 2008
Contact: *as77619@appstate.edu*
More information: *http://thenewriversymposium.org/*

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Mountain Forum Secretariat

The main activities of the Mountain Forum Secretariat (MFS) in this period June to December 2008 were the following:

The development of the Mountain Forum strategy and work program 2008-2011

In addition to the information and communication services and the mutual support to and by members, attention will be placed on supporting policy and advocacy processes for sustainable mountain development at a global and regional level. A proposal for core-support was successfully submitted to the Swiss Development Corporation and proposals for thematic initiatives are being prepared.

Thematic partnerships

The Board identified mountain biodiversity as one of the priority areas for policy and advocacy support. Together with the Secretariat of the Convention of Biodiversity (CBD) and key research and development partners as the Global Mountain Biodiversity Assessment (GMBA), Mountain Research Initiative (MRI) and World Commission on Protected Areas (WCPA), a program is being developed to support the COP/CBD 2009-2010 process. This should have a strong basis in the regional networks. Mountain Forum Board members Martin Price, Robert Hofstede and ICIMOD expert Eklabya Sharma presented areas for interaction on mountain biodiversity at the IUCN-2008 World congress. The July 2009 Bulletin will focus on mountain biodiversity and be produced jointly with MRI and GMBA.

Partnerships are being explored for sharing and disseminating information on mountain agriculture with ILEIA and the Technical Centre for Agricultural and Rural Cooperation ACP-EUCTA (CTA), the European agricultural information service.

Presentations on climate change and agriculture adaptation were made at events of the Global Knowledge Partnership (GKP) and One World South Asia by the Mountain Partnership Secretariat together with the Asia-Pacific Mountain Network. Partnerships are being explored to provide a mechanism and portal for systematic information sharing.

Contacts have been made with CTA and IDRC/telecentre.org for information sharing on local access to information via telecentres (also called community information centers).

Assist Mountain Partnership activities

The Mountain Partnership aims to foster national policies that favour sustainable mountain development (SMD) and catalyse projects that have impact on the ground. The MFS and regional networks support this with information and communication tasks. The MFS ensures availability of the Mountain Forum on-line library, a calendar of events as well as the set-up of the Who=Who database with information on over 800 organisations which will be made accessible on-line. In addition the regional networks were supported with regionally focused activities. This includes stocktaking of African organisations involved in SMD, assessment of central Asian ICT needs and identification of key European research organisations.

Mountain Forum systems and tools review

Shared and smart tools that serve global, regional and thematic users were identified as a priority by the regional networks. They also placed an emphasis on sharing multimedia material. Partners interested to participate and use such tools include the Mountain Research Initiative (MRI), Mountain Research and Development (MRD), the Institute de Montagne (IM), ILEIA, the Global Mountain Biodiversity Assessment (GMBA) and the Mountain Partnership. A step-by-step approach will be followed that includes a review of the Mountain Forum information

Mountain Forum Board Members, Chambery, France, 2008. Photo: MFS.

functions (on-line library, Who=Who, calendar etc.). There will be a survey of user-needs and assessment of new tools available, followed by a workshop early in 2009 to outline the way forward.

African Mountain Forum revitalization

The need to revitalize AMF and widen the stakeholder base was identified by the Board. Identification of potential partners and members has started with partners that already have programmes there such as MRI, FAO and MRD/CDE. This will be followed by an e-conference and workshop early 2009. Pilots for enhancing local access to information via telecentres are being explored in mountainous areas together with partners.

Presentations

MFS staff presented the Mountain Forum work and attended the following events: ICT and Climate Change (GKP/S.Asia, June 2008) together with ICIMOD, APMN and MP; ICT and Climate Change in Agriculture, E-India (July 2008); IUCN World Forum (Barcelona Oct 2008), High Himalaya Forum (India, October 2008); Mountain Partnership Advisory Committee (October 2008).

Information on new partners:

- *ILEIA (Centre for Low External Input and Sustainable Agriculture) http://www.leisa.info*

  ILEIA is a network of magazines on low external input and sustainable agriculture. It produces global and regional magazines that reach over 50.000 subscribers. The stories and case studies are provided by various stakeholders such as international research centres, NGOs, networks and local practitioners. The information is accessible on-line and subscription to the hardcopy magazine can be made on-line (free for developing countries).

- *Technical Centre for Agricultural and Rural Cooperation ACP-EUCTA (CTA) http://www.cta.int*

  CTA is the arm of the European Union for enhancing access to agricultural information in ACP countries (Africa Caribbean pacific). Whereas increasingly information becomes available on-line, access at local level is crucial in which telecentres or community information centres play a crucial role. In order to support ongoing and future initiatives CTA organized a workshop together with InfoBridge, IDRC and International Institute for Communication and Development (IICD) to bring together African experiences with setting up and sustaining telecentres. http://www.share4dev.info/telecentres. Participants included civil society organisations, national and regional networks such as telecentres.org and Ugabytes. A telecentre manual will be developed in 2009 taking account of experiences from other regions. Pilots in several countries accompany the initiative.

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European Mountain Forum (EMF)

Traces of global changes: Alibek glacier retreat, Teberda biosphere reserve, N. Caucasus, Russia. Photo: Irina Merzlyakova.

The European network is hosted by the European Association of Elected Representatives from Mountain Areas (AEM) in Chambéry, France. Together with the Institute de Montagne (IM), EMF carried out an inventory of key European research organisations relevant for sustainable mountain development and analysed their focus in terms of mountain ranges and thematic areas. This information will support an international conference of European and other research institutes.

Contacts have been made with Commission Internationale pour la Protection des Alpes (CIPRA) to share their methodologies and strategies for collecting information on good practices from Alpine countries, ensuring accessibility and use by civil society organisations and local governments.

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ICIMOD: 17 to 23 August: 'Himalaya - Changing Landscapes' goes international

Nira Gurung, Communications Officer, ICIMOD

The photo exhibition 'Himalaya – Changing Landscapes' is one of the series of events being held by ICIMOD to celebrate its 25 years of working for mountains and people. This exhibition, a small part of which was displayed at Everest Base Camp in Nepal as part of the Eco Everest Expedition 2008, has gone 'international', a first for ICIMOD. The exhibition was developed to raise awareness of the impact of global warming and climate change in the Himalayan region, and was displayed as part of the Stockholm World Water Week at the Stockholm International Fairs and Congress Center from 17 to 23 August 2008.

The exhibition displayed panoramas of mountains, valleys, and glaciers in the Khumbu region of Nepal in the 1950s and in 2007, together with photos of scientific teams conducting research in the 1950s; and portraits of mountain people. The photos provided a striking illustration of the impacts of climate change and glacial retreat in the Himalayas over the last half century. A sound installation portrayed this symbolically - melting water from three tubes of ice caused a small hammer to hit Tibetan singing bowls every couple of minutes attracting much attention. Visitors' comments included 'dramatic', 'impressive', and 'spoke more than 100 pages in a book'. ICIMOD's publications were also appreciated, especially the Atlas of the Himalaya. This exhibition complemented the joint seminar 'Himalayan Water Towers: Resources Under Threat?' held on 21 August by ICIMOD and the World Agroforestry Centre, China (ICRAF-China). More on the photo exhibition can be read at *http://www.changing-landscapes.com/*

For ICIMOD, the exhibition provided a good opportunity to increase the visibility of the Hindu Kush-Himalaya Region and ICIMOD; to network among our target audience; and to be recognised by others as a potential partner for future collaboration. The event has prompted discussion within ICIMOD as to whether or not we should take part in more such strategically placed events to create greater awareness of this fragile region, and to highlight ICIMOD's role and unique position in the region and role as a 'mountain knowledge and learning centre'.

Himalaya - Changing Landscapes photo exihibition. Photo: ICIMOD.

World Premiere of a High-realist Portrait of the Cross River Gorilla

African Conservation Foundation

Painting of Cross River gorilla. Photo: Daniel Taylor.

In Buea, Cameroon, the first ever painting of a Cross River gorilla, Africa's most endangered primate, was unveiled to the public on 19 October 2008, at the Mountain View Conservation and Breeding Centre in Langley, BC, Canada.

The painter of this unique portrait is Canadian artist Daniel Taylor, who travelled along with his wife Ginette to the jungle of south-western Cameroon's Lebialem Highlands to help this critically endangered species – with only 250 to 300 individuals left in the wild.

In 2007, an Artists for Conservation Flag Expedition was organized through a partnership with the African Conservation Foundation (ACF), whose overall goal is to change the use of natural resources to one in which the needs of human development in the region are reconciled with biodiversity conservation.

Besides the unveiling of the painting the event at the Mountain View Conservation and Breeding Centre a short film was featured about this unique expedition, which also included awareness raising activities with local communities, including art workshops with local artists and children.

A multifaceted conservation project

The funds raised with the prints sales will be used to create protected areas for the Cross River gorilla and help the local communities set up alternative income generating activities by providing microcredit to villagers.

Hunters and former poachers will be paid to use their thorough knowledge of the area to become field workers, eco-tourism guides and rangers. The community will be encouraged to breed cane rats and porcupines for food, thus reducing the demand for bush meat.

"Tree planting, ecotourism and cultivating plants for medicine, nutrition and fuel are also part of the strategy to reconcile

local community needs and great apes conservation", said Arend de Haas, Conservation Director of the African Conservation Foundation.

Environmental education is a pivotal aspect of the whole project and it is directed both towards children – who will be part of the solution in the immediate future – and towards other community members. As a result, local fons (kings), chiefs and government officials show a great interest in making a positive change.

Arend de Haas *(info@africanconservation.org)* director of the African Conservation Foundation (ACF) that works for protection and conservation of Africa's endangered wildlife and their habitats. *http://www.africanconservation.org*

More information can be found at the following websites: *http://www.art-for-africa.net/galleryview.htm?crossriver gorilla*

Foundation for Sustainable Development in Mountain Regions (FDDM)

Eric Nanchen

History

The Foundation for Sustainable Development in Mountain Regions (FDDM) was created in 1999 with the aim to promote, support and develop projects for sustainable development in mountain regions in Switzerland and in the rest of the world. The founders were the Government of Canton Valais, the city of Sion and the Association for the Olympic Games-" Sion 2006". With the non-attribution of the games to Sion, the association was dissolved. It has nevertheless been decided to go on with the FDDM. During the last ten years, the foundation became member of various organisations working in mountain regions, collaborating with Swiss and international partners and implementing its own projects.

The board is elected by the Government of Canton Valais. Its members represent the French and German parts of the canton, as well as Swiss academic and politic institutions.

One Foundation, four issues

The FDDM is active on four main issues:

- *Sustainable Development and Agendas 21:* Mandated by the Government of Canton Valais, the FDDM coordinates and coaches the administration in the implementation of a local Agenda 21. Local authorities also benefit from this project and have the possibility to be supported in their first steps toward an action plan in sustainable development. The foundation leads, for example, participatory processes with the inhabitants.
- *Education:* The formal, non formal and informal education plays a key role in the awareness of the population toward sustainability issues. It's a condition for behavior changes. For this reason, the FDDM has close contacts with the Department of Education and is an active stakeholder this field in Canton Valais.
- *Events:* Sustainable development is a broad concept. It becomes reality when seen through examples and issues. The FDDM organizes events which give the opportunity to promote specific aspects of sustainability. During the past year, a workshop has been proposed with private partners, on participatory processes; another one on Swiss mountain laws and the opportunities for mountain territories; and recently, a reflection on mountain products and their marketing has been proposed in the frame of Brigue - Alpine Town of the Year. The main event is a day organized every year respecting the criteria of sustainable development. In 2007, 20,000 participants on bicycles, rollers, wheelchairs and other devices functioning with «human power mobility» had the opportunity to discover the region on roads closed to traffic. The management of the event is based on a holistic approach including economical, environmental and social impacts.
- *Cooperation:* The FDDM strongly defends the idea that sustainable development necessarily includes cooperation with transition or developing countries. For that reason, at least one project is focused on technical cooperation. Since 2006, the Foundation is active in Georgia and implements a project funded by the Swiss Agency for Development and Cooperation.

Eric Nanchen *(eric.nanchen@fddm.vs.ch)* studied human geography in Geneva and sustainable development in Lausanne. He began is career as a teacher and in 1997 founded a company specialised in project management and sustainable development. Since 2004, he is the Executive Director of the FDDM where he seeks to develop a network between the Swiss Alps and other mountain ranges. Currently he is also involved in the implementation of the Agenda 21 for the Canton Valais and in a local development project in Georgia/Causasus for the SDC.

Film Screenings - An Effective Tool for Conservation Education

Nimesh Ved

Children at film screening. Photo: Nimesh Ved.

Samrakshan is an organisation mandated to promote participatory and sustainable biodiversity conservation in a socially just manner. Samrakshan's Mizoram field base is located in the Saiha district at the southern most tip of the state and is acknowledged by experts to harbour some of the best remaining

Films Screened	Institutions		Schools		Total	
	Screenings	Participants	Screenings	Participants	Screenings	Participants
Point Calimere - Little Kingdom by the coast.	6	62	9	506	15	568
Nagarahole – Tales from an Indian jungle.	3	30	7	430	10	460
Total	9	92	16	936	25	1028

rainforests in north eastern India. The focus of our efforts, at this juncture, is entirely on conservation education and awareness. Activities are undertaken in a structured fashion with school children and their teachers (from classes 5, 6 and 7) and members of institutions like youth associations and village council members (institutions that exert influence in village level decision making). As a part of this programme we have put to use various tools towards facilitating interactions on wildlife conservation issues. These range from seeking space in existing newsletters (brought out by other institutions), screening films, organizing discussion sessions with youth associations and village council members to organizing painting and sketching events for school going children.

During the recent months we have screened two films by Sekhar Dattatri. 'Nagarahole – Tales from an Indian jungle' as part of our discussions on wildlife occurring in Saiha as select species occur in both these forests and film provides a platform for discussion on these species; and 'Point Calimere – Little kingdom by the coast' covering our talk on Palak Lake (a lake in Saiha). Nagarahole and Point Calimere are two Protected Areas (PAs) situated in Karnataka and Tamilnadu states in southern India.

Selection of the films to be screened depends on the subject being discussed with the participants. Prior to screening a film for the participants, two to five screenings, depending on the need, are held at our field base. During these, the film is discussed in detail. A list of the species (primarily mammals and birds) depicted in the film is then prepared. This list is divided into species occurring in the region and others. For the species occurring in the region, their local names are found. These could be in Mizo, Mara or Lai; three languages that people in Saiha use. Elementary information on these species is looked up in field guides and other books. The relevant pages in the field guides are book marked to be shared with participants in the course of the screening. During the screenings participants are encouraged to share local names of selected species and are also shown the relevant pages in the field guides. These films usually have a commentary in English or Hindi with English sub-titles and their duration ranges from 30 to 60 minutes. At times, however, we cut down on the length of the film by screening only the portion that is relevant to the subject under discussion. Also at select points within the screenings we pause to allow deliberations; these pauses could be at our or participant's initiative.

Film screening . Photo: Nimesh Ved.

Screenings for members of village councils and youth associations are often organised to be viewed on television sets at a member's residence. This is useful since the screening venue can be made suitable to the time is fixed by the participants. However, at most of the schools at each of the locations of Saiha, Phura and Tuipang where our programme operates, we organize these screenings on our laptop computers. Laptops are of great value in these schools that are without electricity. Since the size of a class varies from ten to twenty five the screen size is satisfactory; the volume however is a concern at times. During screenings at Donbosco School at the district headquarters, as there is electricity, we have put to use a projector, which enhanced the visual impact. Basic details on screenings organized by us between February and June 2008 are given below.

During these screenings, participants have asked if Palak Lake (a wetland like Point Calimere and recognized as Important Bird Area (IBA)) has water fowl in large numbers, as depicted in the film on Point Calimere. When we discussed the concept of Wildlife Sanctuary in context of Point Calimere, the participants have asked us about the Wildlife Sanctuaries in Mizoram. On seeing Spotted dove *(Streplopelia chinensis)* and Wild pigs *(Sus scrofa)*, expression of familiarity dawned on their faces and they told us of the species occurring in the region. Primates with their swinging and scratching generated maximum vocal responses followed by the dung beetle at work. Asian elephants *(Elephas maximus)* bathing and trumpeting too were followed by lot of chattering amongst the participants. They told us that Saiha, where we work, literally means "ivory" in Mizo language.

The hesitation we had in the initial stages on the success of films as a tool disappeared when we observed the body language of the participants during the screenings. Wide eyed and open mouthed students and institution members - who did not even get up to smoke after the film was over brought home the fact that films were loved by participants. At Donbosco School while the students requested us to show another film the next time we visit them, one of their teachers came up after the screening and requested for a copy of the film so that he could screen the film for his own children! We realized that despite the commentary in the films being in a language that

many participants are not comfortable with, the film screenings can make the participants feel that they are not being imposed on.

Screening of the films that focus on wildlife conservation has been of great value to stimulate the understanding of the participants on these issues. This is coterminous to the educative value these films bring. Two reactions we recall with fondness. They bring out the connection these films, despite depicting places far away from the region, made with the participants. During the Point Calimere film, a boy sitting in the corner of the first row, was taking aim at the water fowl on the screen with an imaginary catapult in his hand! During the Nagarahole film a girl covered her face with her notebook when the Wild dogs *(Cuon alpinus)* bit into the then alive Spotted deer *(Axis axis)*.

Acknowledgements

Samrakshan thanks all programme participants for giving an opportunity to screen these films and also Sekhar Dattatri for sharing his films.

Nimesh Ved *(Nimesh.ved@gmail.com)* has worked for Samrakshan for six years and is based in Saihay Mizorari, India.

Samrakshan (*http://mizoram-samrakshan.blogspot.com/*) works in biodiversisty - rich areas on community-based conservation.

First edition of the Mountain Research Initiative Newsletter!

The Mountain Research Initiative (MRI) promotes and coordinates research on global change in mountain regions around the world. In its seven years of existence it has actively participated in the design of the international research agenda and it strives to support the design of integrated programs that further our understanding of the impacts of Global Change in mountain areas that lead to tangible results for stakeholders and policy-makers.

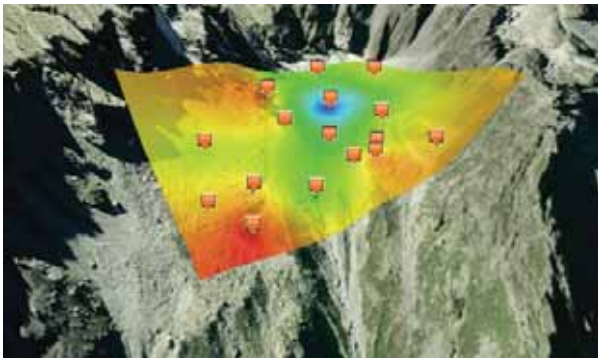
View from Jungfraujoch showing an important part of the cryosphere of the European Alps. Photo: R. Ottersberg-Remote Sensing Group, University of Bern 2003.

The MRI team coordinates regional networks of researchers and acts as an information clearing-house. We link people, projects and funding, and inform about results, events and publications. As the MRI community is growing rapidly, a lot of information on global change research in mountains is passing through our hands. This information is channeled as short news items through the regional Newsflashes of MRI Europe, MRI Africa, MRI American Cordillera, and S4C, the "Science for the Carpathians" network *(see http://mri.scnatweb.ch/index.php?option=com_docman&Itemid=43)*.

With the Mountain Research Initiative Newsletter "MRI News" It is possible to share in more detail some exciting global change science from mountain regions around the world.

Contents of the first edition:

- Inside MRI/MRI's Principal Investigators;
- Science Peaks: Global change research in the Biosphere Reserve Val Müstair and the Swiss National Park (BVM-SNP);
- Science Peaks: The Consortium for Integrated Climate Research in Western Mountains - a progress report;
- Science Peaks: The Mountain Invasion Research Network (MIREN);
- Science Peaks: Swiss Experiment: an e-science platform for interdisciplinary collaboration in environmental research
- Science Peaks: The contribution of satellite remote sensing to the monitoring of cryosphere in mountains;
- Science Peaks: High Elevations working group: a new element of the Coordinated Energy and water cycle Observation Project;
- News from MRI's regional networks;
- Meeting Report;
- MRI Notes.



Sensor map. Photo: Nick Dawes, SWISS Federal Institute for Snow and Avalanche Research, Switzerland.

The MRI Newsletter appears twice a year. The next edition is planned for spring 2009 (deadline 1 February). If you want anyone to contribute a "Science Peak", a meeting report or a short note, please send an email to *drexler@giub.unibe.ch*.

To access the Newsletter:
http://mri.scnatweb.ch/dmdocuments/mri_news_no1-2008.pdf

Mountain Research Initiative (MRI) can be contacted at *mri@giub.unibe.ch*

Maintaining Agricultural Biodiversity in the European Mountain Region: Alps, Carpathians and Balkans

Elli Broxham and Waltraud Kugler, SAVE Monitoring Institute

Cereal Diversity. Photo: SAVE.

Due to the vast richness in climate, soil type, ecosystems and the difference in elevation, mountainous regions provide a unique environment for the development of variation within a species. This is true of wild biodiversity as well as for domesticated animals and plants. The Alps, Carpathians and Balkans have many physical similarities but history has treated each region differently. The origin of agriculture in all three regions lies circa 9,000 years ago. The thousands of years that have followed have seen animals and plants being bred and developed to cope well with the harsh conditions found in the mountains – for example: rough grazing, high altitude and intense sunlight. More recent history has left the regions in very different states of development but with surprisingly similar conservation needs.

Agro-biodiversity

Before considering the main problems and challenges facing these mountainous regions of Europe it is necessary to consider what is meant by "agro-biodiversity". Contrary to what is often mistakenly thought, agro-biodiversity or agricultural biodiversity is not the wildlife found on-farm. Conservation of agro-biodiversity or agricultural biodiversity is, thus, not about environmental management or ecosystem conservation. It is, rather, the conservation and maintenance of a wide genetic diversity within the animals and plants that we humans need for our survival – for food, for clothing, for fuel and for environmental services. The Convention on Biological Diversity (CBD) places agro-biodiversity firmly within the remit of the CBD and defines it thus: *Agricultural biodiversity is a broad term that includes all components of biological diversity of relevance to food and agriculture, and all components of biological diversity that constitute the agricultural ecosystems, also named agro-ecosystems: the variety and variability of animals, plants and micro-organisms, at the genetic, species and ecosystem levels, which are necessary to sustain key functions of the agro-ecosystem, its structure and processes (COP decision V/5, appendix).*

Agro-biodiversity is endangered because many old breeds have been replaced by high performance breeds, which produce more meat and milk. Old species of plants are replaced by high yielding crops. Even though many of the old breeds and varieties are not as productive as their modern counterparts, they possess qualities such high fertility and hardiness as well as resistance against harsh weather conditions and disease, all of which could become increasingly important in a changing economic and climatic situation. Conserving these breeds and varieties along with the traditional knowledge that tells us how to care for the animals and plants is essential.

Mountain agriculture

Due to socio-economic factors, the drive towards industrialisation in agriculture came late to mountainous regions. This means that many breeds and varieties were not irredeemably lost as in other areas of Europe. However, the encroaching industrialisation brought high-yield hybrid crops and cross-breeds of high performance animals. These crops and animals were intended for the intensive farming of the lowlands and are not best suited to the mountain environment they found themselves in.

Traditional animals and plants are important in the mountain regions both ecologically and economically. The importance of semi-natural habitats, such as the Alps, cannot be overemphasised. Vast areas of Europe are now either intensively farmed or are part of the urban sprawl and the infrastructure needed to support it. Encouraging the upkeep of traditional agro-eco-systems in the mountain regions creates a large area of semi-natural habitat, which can be utilised by birds and other, larger animals such as wolves. Space is also provided for wild plants to propagate. Traditional farming systems help to prevent soil erosion and loss of soil fertility, through the use of methods adapted over centuries. In order to promote sustainable development of agriculture in the mountain regions and provide economic security for marginal areas, traditional agricultural methods rather than industrial methods need to be encouraged.

Alps

The Alpine Convention can be seen as a model convention for promoting cooperation in international mountain regions. Both the Carpathian Convention and the Balkan Convention that is currently in development are based on the Alpine Convention. In the context of agro-biodiversity, the Protocol on Mountain Agriculture associated with the Alpine Convention is of great interest. This Protocol actively encourages the promotion of traditional agricultural systems in the Alps, which includes promotion of ecologically sustainable farming methods, cooperation between stakeholders, production of traditional, regionally relevant produce and the promotion of the Alpine region as an area offering a unique experience to tourists.

The Alpine region, as a part of Central Europe, has the best infrastructure of the three areas under consideration. This has disadvantages: modernisation has occurred faster – but it also has advantages: it is easier to monitor the whole region. SAVE Monitoring Institute has undertaken monitoring of the state of agro-biodiversity in the Alpine region since 1995. Working together with the Alpine Convention permanent secretary in Innsbruck, a conference was held in Bozano, May 2008 to discuss issues and ideas for the conservation of agro-biodiversity in the region. This conference lead to the identification of the following needs:

- International cooperation and coordination
- Data standardisation and harmonisation
- Long-term monitoring of conservation trends
- Need for genetic research
- Involvement of the wider public in conservation activities
- Analysis of the role of tourism
- Shared responsibility between producer and consumer
- Lastly, the call for subsidies for certain mechanisms to support traditional plant varieties and animal breeds

SAVE Monitoring Institute will continue working together with the Alpine Convention to implement the above ideas, along with a continued and regular monitoring of the area. Thus, it can confidently be expected that agro-biodiversity in the Alps can be conserved for future benefit and use. For more detailed information see links below.

Carpathians

The Carpathians are the longest European mountain chain after the Alps. The region is home to around 18 million people in seven countries. It is also a refuge for endangered species such as the bear and contains about 4,000 endemic plant species, some of which are highly endangered. The Carpathians are protected by the Carpathian Convention, signed by all seven states. Article 11 of the Convention and Article 23 of the (draft) Protocol on Conservation and Sustainable Use of Biological and Landscape Diversity both directly addresses the issue of agro-biodiversity

Migration away from mountainous areas has occurred since the change in political structure in the countries of the Carpathian region. This leads to de-population of whole villages and a loss of the traditions and knowledge that are essential to keep agro-biodiversity alive. The change in structure and the subsequent migration has led to ecological problems, mainly natural succession, on previously farmed land. In situ conservation of agro-biodiversity can offer a chance for regional development:

- Subsidies for traditional agricultural systems can be an alternative to migration
- Sustainable tourism provides additional income in remote areas
- Regionally typical products can be promoted

Huzul, Bodo. Photo:SAVE.

SAVE Foundation

In many countries in Europe, there are organisations supporting and promoting the conservation of agro-biodiversity. The SAVE Foundation, founded in 1993, acts as a European umbrella organisation for these organisations. It promotes and coordinates activities to conserve endangered breeds of domestic animals and cultivated plant varieties. The SAVE Foundation does not work with a romantic ideal of how it once was, rather the SAVE Foundation undertakes practical work to ensure a sustainable future for the diverse genetic material stored within the traditional breeds and species of Europe. The SAVE Foundation supports, plans and realises on-farm conservation projects alongside collecting and disseminating information about the traditional and endangered European Agro-biodiversity. This work is undertaken in conjunction with the SAVE Partner Organisations. The European Monitoring Institute for Rare Breeds and Seeds is the scientific research unit of the SAVE Foundation.

http://www.save-foundation.net
http://www.monitoring.eu.net
http://www.agro-biodiversity.net

SAVE Monitoring identified these needs in a workshop in 1999 (see links). This kind of development and conservation programme leads to the countries involved fulfilling their obligations under the Carpathian Convention as well as the CBD.

Balkans

Similar to the Carpathian region, the Balkan mountain region is experiencing migration away from the rural areas. The region still has a strong culture of small farms using traditional agricultural practice. The use of traditional breeds in the area is still predominant, which makes rapid action in the area a necessity. Agriculture is still the main form of land-use in the area and is, thus, a source of livelihood for many people in the area. This livelihood needs to be secured for the future development of the area. To this end, the Balkan Foundation for Sustainable Development proposes a list of recommendations for the agricultural development in this region. Together with a general emphasis on promoting sustainable, organic agriculture, the following points can be highlighted as essential:

- Conservation of Agro-biodiversity
- Marketing and promotion of products
- Development of national strategies and guidelines
- Stakeholder networking and motivation
- Stimulation of new ideas for income generation in rural areas
- Cross-border cooperation – especially for conservation of Agro-biodiversity. SAVE Monitoring has been active in both vertical and horizontal networking of key stakeholders within the region (see links).

The similarities in needs in each mountain region, as outlined above, show that the use of the Alps as a model region for maintaining agricultural biodiversity in the European mountain regions is valuable. Through a combination of knowledge transfer and endogenous development, the future of the three regions can be secured – along with the future of the

traditional, domesticated breeds and plants that form an essential part of the local cultures.

Links and References

Agro-biodiversity.net Balkan Network
http://www.agro-biodiversity.net/balkan/index.htm

Balkan Foundation for Sustainable Development
http://www.balkanfoundation.org/eng/index.htm

Conference on Agro-biodiversity in the Alps, Bozano, May 2008
http://www.alpenkonvention.org/page7_de.htm

Convention on Biological Diversity
http://www.cbd.int

SAVE Carpathian Workshop, Suceava, May 1999
http://www.save-foundation.net/english/publications/Carpathians.htm

Andonovski, V; Pop-Stojanov, D (2006) *Assessment on the current situation and needs of cooperation on the protection and sustainable development of mountain regions/areas in South-Eastern Europe (Balkans)*. Balkan Foundation for Sustainable Development

Egger, T; Parvex, F (2007) *Bericht zur Motion der Kommission für Umwelt, Raumplanung und Energie des Ständerates vom 25. Mai 2004 Alpenkonvention und Berggebiet (04.3260)*, SEREC/SAB, September 2007

FAO (2007) *State of the World's Animal Genetic Resources for Food and Agriculture*. Rome.

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BEES is Up and Flying

BEES

BEES facilitates an information exchange system and establishes communication links between various participants

I climb stiff legged out of the car, the snow squeaking pleasingly under my boots as I walk to the edge of the highway pullout. Stretching my arms skyward I inhale the crisp -20C air and take in the view. The dark bulk of a wall of 10,000 peaks dominates the western horizon. It's still too early to pick out any detail, but slowly a delicate violet hue silhouettes the crenelated ridges, and even as I watch, the rising sun picks out limestone ramparts in a splendid golden alpine glow. Another 30 minutes, and in the words of the Great Bard "jocund day stands tiptoe on the misty mountain tops" and its time for my workday to begin as a volunteer with the Alpine Club of Canada's (ACC) waste management team. A distant buzzing jolts me from my reverie, developing into a loud clatter as the helicopter turns in a wide arc, two 40 gallon barrels swinging on a line beneath. I don my work gloves and ear protectors, get ready to unhitch the first of many loads and soon the air is redolent with the stomach churning mixture of jet fuel and sewage. Ah wilderness!

Today we are servicing a chain of four mountain huts on the Wapta and Waptuik Icefields, located just to the west of the Icefields Parkway connecting Lake Louise and Jasper in the Canadian Rockies. Propane and firewood is flown in, sewage is flown out. Between unloading and loading flights, silence and sanity returns, and I conjecture, not for the first time: there has to be a better way. Surely there has to be an alternative to using a million dollar piece of machinery burning gasoline at a prodigious rate, and creating enough noise to panic wildlife for miles just to remove bowel movements of back country enthusiasts and keep them warm. It was these musings, nurtured during many subsequent discussions with mountaineers and land managers that provided the genesis for Backcountry Energy Environmental Solutions (BEES).

BEES is a non-profit web-based collaborative dedicated to the procuring and sharing of information on the best technology and practices available for energy, including wood, diesel, propane, micro-hydro, solar and wind, as well as technological solutions for managing potable, grey and black water in remote mountain locations. Potential benefits of the BEES initiative include environmental protection, human health protection, reduction of fossil fuel use and economic savings through reducing duplication and pooling resources and expertise. BEES is supported by the Alpine Club of Canada, Parks Canada, BC Parks and Protected Areas, Backcountry Lodges of British Columbia, WorleyParsons, and the Improved Processes and Parameterisation for Prediction in Cold Regions (IP3) Research Network.

BEES has launched its new website at www.beeshive.org. The website enables BEES to collect and share information about energy, water and wastewater management at recreational facilities in off-grid, mountainous regions. It provides an opportunity for operators of backcountry facilities to communicate and build upon each other's experiences. The website also offers a repository of technological information and provides references to continuously updated research links. The technologies that BEES identifies or develops will have application in mountainous regions around the world.

Providing energy and potable water, and treating grey water and sewage is exceptionally challenging in mountainous backcountry regions. Technologies used at lower elevations don't necessarily work at higher elevations. Alpine and sub-alpine regions are colder, receive heavier snowfall and have shorter hours of sunlight. While making use of technologies such as composting toilets and photovoltaics is challenging, the current practices of flying in propane, flying out sewage, and using diesel generators present their own unique set of challenges and can be hard on delicate alpine environments. There has been little expertise and technological support for operators of remote facilities in the mountains. They have had to rely on ingenuity and trial and error. Mistakes are usually costly, time consuming and potentially damaging for the environment. BEES provides a vehicle to share technological knowledge, identify information gaps and facilitate research where required.

The real strength of BEES will be in its members. By bringing the stakeholders (technology experts, experienced operators of backcountry facilities, funders) together, by pooling resources and expertise, and by engaging in research when necessary, we will be able to identify or develop functional, economical and environmentally appropriate solutions.

Do you have suggestions, ideas or technical knowledge that you can contribute to BEES? The BEES website includes a forum which members can use to share their own experiences and guide others. Backcountry lodge operators, land managers and energy and waste management experts are encouraged to participate in the forum or contact BEES at *beeshive@telus.net*

Karen Rollins *(beeshive@telus.net)* is the Project Director for Backcountry Energy Environmental Solutions (BEES) *http://www.beeshive.org*

World Overview of Conservation Approaches and Technologies – WOCAT

Hanspeter Liniger, Gudrun Schwilch, Christine Hauert and Rima Mekdaschi Studer

Sustainable land management (SLM) on such steep slopes in Cape Verde requires investment and expertise. Concerted efforts to document, evaluate and disseminate SLM are needed and justified. Photo: Hanspeter Liniger CDE.

Judicious management of natural resources is a prerequisite for sustainable development and it is essential for successful adaptation to a rapidly changing human and natural environment. Many win-win solutions in SLM exist, and this is true for those traditional as well as innovative practices that are technically, ecologically, economically and socially sound. They bring local as well as global benefits. The experiences that have produced these solutions need to be further tapped, promoted and used in decision making for local, regional and global investments.

Over the last 15 years WOCAT (World Overview of Conservation Approaches and Technologies) has built up a network of SLM specialists from over 50 partner institutions worldwide. Many national and regional programs have been initiated to document, evaluate and spread SLM Technologies and Approaches.

WOCAT is organised as an international consortium, coordinated by a global management and supported by the secretariat which is located at the Centre for Development and Environment (CDE), in Berne, Switzerland.

WOCAT tools provide a unique, widely accepted and standardised method of application. They include three comprehensive questionnaires and a database system that cover all relevant aspects of SLM technologies and approaches (as case studies), as well as an assessment of area coverage of degradation and conservation. WOCAT's database currently comprises datasets on 440 technologies and 280 approaches from around 50 countries, of which a subset of 250 technologies and 140 approaches are quality assured. Many of these have not been reported comprehensively elsewhere. A selection of 42 technologies and 28 approaches are documented in the global overview book 'where the land is greener' together with an analysis, conclusions and policy points. An interactive and scale-independent mapping methodology has been developed and used in pilot countries. The WOCAT knowledge base is in the public domain.

WOCAT's vision and mission

WOCAT's vision is that land and livelihoods are improved through sharing and enhancing knowledge about sustainable land management.

WOCAT's mission is to support innovation and decision-making processes in sustainable land management, particularly in connection with soil and water conservation (SWC).

This is done by:

- connecting stakeholders;
- analysing and synthesising experiences and setting direction;
- enhancing capacity and knowledge;
- developing and applying standardized tools for documenting, monitoring, evaluating, sharing and using knowledge.

WOCAT's target group is SLM specialists:

- at the field level (including agricultural advisors, project implementers, and land users);
- at the (sub-)national level (including planners, project designers, decision makers, researchers);
- at the regional and global levels (including international programme planners, donors).

Hanspeter Liniger *(Hanspeter.Liniger@cde.unibe.ch)*, Gudrun Schwilch *(Gudrun.Schwilch@cde.unibe.ch)*, Christine Hauert and Rima Mekdaschi Studer works at the Centre for Development and Environment (CDE) at the University of Berne, Switzerland.

WOCAT's *(http://wwww.wocat.net)* mission is to provide tools that enable specialists in soil and water conservation to share knowledge on a global level.

Mountain Calendar 2009

January

8-12 January 2009
4th International Biogeography Meeting
Merida, Yucatan, Mexico
Contact: *dhafner@comcast.net*
Web: *http://www.biogeography.org/html/Meetings/2009/index .html*

12-16 January 2009
7th International Symposium on Ecohydraulics and the 8th International Conference on Hydroinformatics Concepcin, Chile.
Contact: *hic2009@inmeet.com.sg*
Web: *http://www.heic2009.org/*

12-19 January 2009
Fifth EGU Alexander von Humboldt International Conference Iphakade Cape Town, South Africa.
Contact: humboldt@globalconf.co.za
Web: *http://www.humboldt5.uct.ac.za/*

February

4-7 February 2009
4th World Congress on Conservation Agriculture
New Delhi, India.
Contact: *wccagri@gmail.com*
Web: *http://www.icar.org.in/wccagri/index.html*

14-15 February 2009
Himalaya Film festival
Netherlands.
Contact: *himalaya@pagina.nl*
Web: *http://www.himalayafilmfestival.nl/*

26-28 February 2009
Cities at Risk: Developing Adaptive Capacity for Climate Change in Asia's Coastal Megacities Bangkok, Thailand.
Contact: *fuchsr@EastWestCenter.org*
Web: *http://www.start.org/Program/cities_at_risk.html*

27-28 February 2009
The 3rd Annual Fernie Mountain Film Festival
Alberta, Canada.
Web: *http://www.ferniefilmfestival.com/about*

March

2-6 March 2009
George Wright Society Conference
Oregon, USA
Web: *http://www.georgewright.org/*

16-22 March 2009
5th World Water Forum: Bridging Divides for Water
Istanbul, Turkey
Contact: *info@worldwaterforum5.org*
Web: *http://www.worldwaterforum5.org/index.php?id= 1870&L=0*

22-27 March 2009
2009 Annual Meeting of the Association of American Geographers Las Vegas, USA
Contact: *meeting@aag.org*
Web: *http://www.aag.org/annualmeetings/2009/index. html*

23-26 March 2009
GREENHOUSE 2009: Climate Change and Resources Perth, Australia
Contact: *info@greenhouse2009.com*
More information: *http://www.greenhouse2009.com/*

April

16-17 April 2009
Climate Change in South Asia: Governance, Equity and Social Justice New Jersey, USA.
Contact: *magrconf@rci.rutgers.edu*
Web: *http://magrann-conference.rutgers.edu*

20-23 April 2009
2009 Western Snow Conference
Canada.
Contact: *BMcGurk@sfwater.org*
Web: *http://www.westernsnowconference.org/*

20-23 April 2009
HydroEco 2009: 2nd International Multidisciplinary Conference on Hydrology and Ecology
Vienna, Austria.
Contact: *karel.kovar@mnp.nl*
Web: *http://www.unesco.org/water/water_events/Detailed/1683.shtml*

26-30 April 2009
7th International Science Conference on the Human Dimensions of Global Environmental Change
Bonn, Germany.
Contact: *openmeeting@ihdp.unu.edu*
Web: *http://www.openmeeting2009.org/registration.html*

May

4-6 May 2009
American Water Resources Association (AWRA) Spring Specialty Conference "Managing Water Resources and Development in a Changing Climate"
Alaska, USA.
Contact: *mlilly@gwscientific.com*
Web:*http://www.awra.org/meetings/Anchorage2009/index. html*

21-23 May 2009
New River Symposium 2009
Boone, NC, USA.
Contact: *as77619@appstate.edu*
Web: *http://thenewriversymposium.org/*

4-10 May 2009
Wings Over the Rockies Bird Festival Invermere
Canada.
Contact: *wingsovertherockies@gmail.com*
More information: *http://www.adventurevalley.com/ wings*

4-15 May 2009
17th Session of the UN Commission on Sustainable Development
New York, USA.
More information: *http://www.un.org/esa/sustdev/csd/policy.htm*

26-29 May 2009
Conference on Asia Pacific Climate Risk and Adaptation
Beijing, China.
Contact: *chanp@imsg.com*
More information: *http://asiapacificclimate.org/index.html*

June

28-30 June 2009
International Conference on Water, Environment, Energy and Society
Agra, India.
Deadline for abstract: 31-5-2009
Contact: *wees09@yahoo.com*
More information: *http://www.environment-societyisa.org*

Supporting Institutions

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Agency for Development and Cooperation

Food and Agriculture Organization of the United Nations

Terrace Farming, Nepal. Photo: Ujwol Sherchan.

Host Institutions and Partners

African Highlands Initiative

Bellanet

Consorcio para el Desarrollo Sostenible de la Ecorregión Andina

Association Européenne des Elus de Montagne

Fundació Territori i Paisatge

International Centre for Integrated Mountain Development

International Potato Center

Mountain Research and Development

Mountain Research Initiative

The Banff Centre

The Mountain Institute

World Agroforestry Centre

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