Agricultural transformation as a window to rehabilitation of Common Property Resources

R. White*, S.K. Bhuchar, K.M. Sthapit and M. Dhakal

International Centre for Integrated Mountain Development (ICIMOD), Khumaltar, Lalitpur,

GPO Box 3226, Kathmandu, Nepal

Abstract

During the last nine years the ICIMOD-coordinated project (People and Resource Dynamics in Mountain Watersheds of the Hindu Kush Himalayas - PARDYP) has looked at natural resource management dynamics in five watersheds of the ‘middle mountains’ in four countries of the Himalayas. The project identified the centrality of people and the factors influencing their land usage systems, along with the holistic treatment of natural resources, as a key essential step in management of watershed as an integrated pool of resources. Initial baseline surveys of the watersheds helped in understanding major socioeconomic and biophysical constraints to sustainable crop productions and improved livelihoods. Many of the issues thought to be the key issues at the beginning of the project, such as flooding, soil erosion, etc., turned out to be of less importance than other issues such as loss of soil fertility and crop productivity, reduced low season stream flows. The biophysical research allowed some initial opportunities to explore sustainable use of natural resources, including the common property resources (CPRs) as well as private lands. It was recognized that to be able to promote community participation to address the above problems, it was necessary to provide tangible private economic benefits to individual farmers.

The paper presents a number of case studies on rehabilitating degraded community lands in India and Nepal. In both cases understanding the people-dimension proved to be of far greater importance than the biophysical measurements and technical solutions. Examples include community forests in Nepal and degraded village lands that were developed into fodder banks in India. Scarcity of water in the dry season is an increasing problem in the middle mountains as increased demand exceeds the supply.

Case studies from India and Nepal show that communities if made aware of the possibilities and given the confidence to develop their ideas can improve and effectively manage water sources.

Farmers in the study watersheds participated in the conservation and protection of CPRs because of their contributions to improved agricultural production options. They were either introduced or developed with farmers by PARDYP. Significant benefits have been gained by adopting and adapting simple appropriate technologies. Examples from Pakistan in a rural watershed with low productivity show 300% increase in farm income based on a combination of increased productivity and increased cropping intensity. There are options that are well suited to mountain farmers that take advantage of their niche conditions – such as off season vegetables. Biofertilisers can be used in places where transport costs for mineral fertilisers precludes their use and therefore maintain or increase soil fertility, which in turn means that cropping intensities can be increased. Improved methods of water management as well as methods of improving supply are being adopted, particularly when associated with another enterprise like fish farming. As a final consequence, effective management of CPR (non-crop lands) proved an attractive bonus-like option resulting from improved agriculture. This is a unique example of CPR-PPR complementarity.

*Corresponding author: email – rwhite@icimod.org

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INTRODUCTION

The Hindu Kush-Himalayan (HKH) region extends 3500 km from Afghanistan in the west to Myanmar in the east. It sustains approximately 150 million people and affects the lives of more than three times as many people in the plains and river basins below. This region is not only the world's highest mountain region, but also the most populous and fragile. It has an area of 354 million hectares of which 11% is crop land; 17% forest; 41% pasture and rangeland, and 11% in protected areas.

In the HKH, common property resources (CPRs) provide many resources such as water, fodder, fuel wood, medical plants, timber, etc., which are essential for sustaining rural livelihoods. They have a pivotal role in maintaining production capacities of the mountain farming systems. Unfortunately, these vital assets have undergone degradation overtime due to human-induced and natural factors. Some resources have reached a point of no return, and many others require large investments and motivation for reconstructing them.

As else where (Jodha 1986), in the middle Himalayas too it is the smallholder farmers and poor households who suffer most due to degradation of the commons. Not only is their poverty exacerbated, but in the long-term institutions that are traditionally maintaining the commons also degenerate (Rai 2005). Many mountain women are finding it increasingly difficult to meet their daily water and energy needs as a result of deforestation, a scarcity of freshwater resources and population pressure (Sharma and Banskota 2005). Degradation of land and water resource from a watershed management perspective has also been found to undermine the hydrological functions (Merz 2004) thus affecting environmental benefits for upstream and downstream communities. White (2005) reported that five per cent of degraded forest in the mid Himalayas could contribute about 50% of the total river-transported sediment that leaves a watershed. It is therefore crucial for all, and especially the vulnerable mountain communities, to assure sustainable management of the mountain commons.

During the last nine years the ICIMOD-conducted project (People and Resource Dynamics in Mountain Watersheds of the Hindu Kush Himalayas - PARDYP) has looked at processes of natural resource degradation in the ‘middle mountains’ of the Himalayas. The project is funded by the Swiss Agency for Development and Cooperation (SDC), the International Development Research Centre (IDRC) of Canada, and ICIMOD, and it operates in five middle mountain watersheds across the HKH - two in Nepal, and one each in China, India and Pakistan (Figure 1). The basic characteristics of the watersheds are given in Table 1.

Figure 1. Location of PARDYP watersheds in the HKH

PARDYP was launched in response to concerns about the pressures on the resources and people in the HKH middle mountains. Issues of particular concern were 1. the marginalisation of the mountain farmers, 2. the declining availability of water and land, 3. forest degradation, 4. declining soil fertility, 5. declining carrying capacities of the resource base, 6. the lack of natural regeneration, and 7. the challenges provided for the needs of the increasing population. Initial baseline surveys of the watersheds helped in understanding major socioeconomic and biophysical constraints to sustainable crop productions and improved livelihoods. Many of the issues thought to be the key issues at the beginning of the project, such as flooding, soil erosion, etc., turned out to be of less importance than other issues such as loss of soil fertility thus crop productivity, reduced low seasonal flows of moisture thus water scarcity for irrigation and domestic use, etc. The biophysical research carried out by PARDYP allowed some initial opportunities to explore sustainable use of Natural Resources, including the CPRs as well as private resources. It was recognized that to be able to promote community participation to address the above problems, it was necessary to provide tangible economic benefits to individual farmers and families.

This paper presents case studies on rehabilitating degraded community lands in India and Nepal. In both cases understanding the people-dimension proved to be of far greater importance than the biophysical measurements and technical solutions. Examples include community forests in Nepal and degraded village lands that were developed into fodder banks in India. Scarcity of water in the dry season is another increasing problem in the middle mountains as increased demand is exceeding the supply. Case studies from India and Nepal show that communities if made aware of the possibilities and given the confidence to develop their ideas can improve and effectively manage water sources.

Table 1. Characteristics of PARDYP project watersheds

Watershed	**China**	**India**	**Nepal**	**Pakistan**
	Xi Zhuang	**Bhetagad-Garur Ganga**	**Jhikhu Khola**	**Hilkot-Sharkul**
Area (ha)	3,456	8,481	11,141	5,230
Elevation (masl)	1,700-3,075	1,090-2,520	800-2,200	1,450-2,911
Population	4,016 (1997)	14,524 (1998)	48, 728 (1996)	11,322 (1998)
Av. family size	4	7	6	11
Main staple crops	maize, wheat, beans, rice, potato	Maize, rice, wheat	Rice, maize, wheat, millet, potato	Wheat, maize, rice
Main cash crops	tea, tobacco, fruit	Winter vegetables, stone fruit, tea, fodder	Potato, rice, tomato, fruit, vegetables	Stone fruit, fodder

CASE STUDIES

Sustainable rehabilitation of degraded common land and water resources has been an important thrust on soil and water conservation and watershed management in the Himalayas. It has been an important theme in PARDYP and the research teams, along with the land users, have been successful in rehabilitating and reconstructing many degraded common resources in Nepal and India (Bhuchar et al. 2005). Five successful case studies on common resources and the factors, which supported the successes, are presented hereunder.

1. Nepal

1.1 Mandalidevi Community Forest

The participatory management of commons through community forestry has been one of the most acknowledged successes in Nepal. However, there are many community forestry sites in Nepal that remain degraded (Figure 2A); Mandalidevi community forest (MCF; Figure 2B) in the PARDYP Jhikhu Khola watershed was one of them. This forest, situated on relatively dry south facing aspect, has a slope of 30-40% and a total area of 3.6 hectares. The Mandalidevi community forest user group (CFUG) comprises of 110 households.

Figure 2. Forest degradation in the Jhikhu Khola (A); Orthophoto of degraded Mandaladevi community forest in Nepal (B)

In 2003, MCF was in a degraded state, and the villagers did not benefit much from it. The site was being used mainly as a free grazing and quarrying site by some families. An appraisal by PARDYP found that a lack of interest by the forest user group (FUG) members encouraged unsustainable harvesting of resources by a few members, and its degradation overtime. The majority of the villagers however thought that the site needed to be rehabilitated and managed properly.

PARDYP stimulated local leadership and provided ‘missing’ technical know-how for rehabilitating the Mandalidevi community forest. The project, along with a NGO, organized meetings of all the FUG members and prepared an action plan for rehabilitating the MCF. The members collectively agreed to stop grazing and any other free riding activities inside the site. With the help of local administration, they were also successful in stopping mining activities above the forest site. PARDYP, in the first year, provided planting material for the site.

Figure 3. Mandalidevi community forest: A: Degraded state; B. Participatory planning for rehabilitation; C. After rehabilitation

Mandalidevi community forest, after three years of interventions, is now in a good state. Most of the species planted are useful for the villagers, particularly women; and assist in soil and water conservation (Figure 3). The site is being managed well by the Mandalidevi FUG and the villagers have already started harvesting grass from the site. They are confident that the site will provide many more tangible benefits in the near future.

1.2 Dhotra communal land

After observing the Mandalidevi CF success, villagers of Dhotra in Jhikhu Khola felt motivated to undertake rehabilitation of a severely degraded communal site (Figure 4A). According to Dhotra villagers, the main reason for this site’s degradation was uncontrolled grazing and open access problems. The Ekanta Basti Youth Club at Dhotra took up the responsibility of land rehabilitation and in 2004, the club approached PARDYP Nepal team for help and advice in this matter.

PARDYP team made an assessment of physical and chemical status of the site and found that it comprised of ultisoils with high iron and aluminium content and with a plant cover of less than 5%. The site therefore required technical interventions different from those implemented at the Mandalidevi CF. The soil was compacted and stressed in terms of moisture and nutrients. Based on earlier experiences, the project recommended construction of eyebrow pits and trenches along the contours so that surface runoff could be harvested and utilized by the plants. Fast growing and nitrogen fixing species were planted along the trenches and at the lower margins of the pits. Between the eyebrow pits species preferred by the villagers (Box 1) were inter-planted. Simultaneously, work on gully plugging, by using simple vegetative and structural measures (soil filled cement bags; Figure 4C), was also taken up.

The important aspect of this rehabilitation research was that more than 400 villagers were actively involved during planting, protection, grazing control and overall management of the site.

Figure 4. Planting activities at degraded Dhotra community site (A); after one of rehabilitation measures (B); gully plugging (C)

Women's participation was particularly encouraging. PARDYP staff also organized training on eyebrow pits, hedgerow planting and gully plugging. In order to sustain the work, a user committee comprising of five women, which is supported by a village team of five men (both groups nominated by the villagers), was formulated. This committee organizes site related meetings, facilitates discussion, and keeps a record of the contributions for development of the site. It also undertakes further activities such as enrichment planting.

Box 1. Plant species planted at Dhotra

Tree species
Schima wallichii, Michelia champaca, Melia azedarach, Choeropondias axillaries, Bamboo, Phyllanthus emblica

Hedgerow species
Crotalaria juncea, Tephrosia candida, Flemingia microphylla, Tithonia diversifolia

Grasses
Stylosanthes guianensis, Panicum maximum, Pennisetum purpureum, Melinis minutiflora, Brachiaria decumbens, Aeschynomene Americana, Vetiveria lawsoni

A number of people from Nepal and outside have visited the site and have been impressed by the transformation. It is however the Dhotra villagers who feel most satisfied by the achievements. The plants are not yet mature enough to give substantial harvests, but the committee has been able to earn a modest amount of cash for their fund by selling seeds produced from the grass and shrubs species growing at the site.

1.3 Juke irrigation Canal

Juke canal (Figure 5) was constructed about 200 years ago for running a traditional water mill. The water mill is gone but the importance of the canal has grown because it provides water for irrigating 46 hectares of prime agriculture land belonging to 250 households. This canal, which sustains about 1/3rd of the agriculture in Jhikhu Khola's valley bottom, became degraded due to inadequate maintenance. Conflict among the head, middle and tail end users was one of the main reasons for its poor management. In consequence, farmers with land at the canal's tail end suffered due to shortage of water during dry months.

Figure 5. Juke Canal (JC), having a length of nine kilometers, is the second largest irrigation canal in the Jhikhu Khola

In 2001, PARDYP Nepal carried out a situational analysis of the canal by involving all the beneficiary farmers. Based on technical, socio-cultural and institutional information, an action plan for the revival of the canal was prepared, which was then implemented collectively by PARDYP, irrigation related line departments, and water users. The intake was reconstructed (Figure 6A) to increase water availability, and the canal (mostly earthern) was cleaned and repaired (Figure 6B). A water user committee, with members representing all the social groups, was formed and registered with the District Water Resource Committee. The users framed rules and regulations (Box 2) for managing the system and designed monitoring mechanisms, which they continue to follow religiously. The Juke canal system is working well and due to proper maintenance water flow efficiency has increased due to which there is more water available for tail end farmers and therefore much lesser conflicts among farmers.

Box 2

With the intensification of cropping system, demand for irrigation water is ever increasing. Because of limited availability as the water is diverted from the main river canal, due to canal seepage losses and staggered demand for transplanting, the Juki irrigation could not supply enough water simultaneously to all the command area. This problem was more prevailing during winter potato crop when planting needs to be carried out during a limiting time window. Therefore, users of the head end enjoyed irrigating their land first than the users from lower strata. Regular cleaning of the canal was essential for irrigating the land in the lower strata. Therefore, to irrigate the land users from the lower strata have to clean the canal regularly and at the same time they are the one to enjoy the irrigation facilities only at later part. This has been the practice in the past.

To minimize such disparity, the water user group formulates the rules for charging different service fee for the users of the head end and tail end. The service fee for the upper command area is NRs. 30 per ropani (508 m^2) per year, whereas it is only NRs. 20 for lower command area. All the maintenance and cleaning is carried out by the fund raised from the service fee. Basic principle is users enjoying more and easier irrigation facilities pay more service fee. This rule was formulated by the users themselves with encouragement from PARDYP in 2004 and is working smoothly.

Figure 6. Revival of Juke canal through collective action by farmers, line departments and PARDYP

Box 3. Sloping Watershed Environmental Engineering Technology (SWEET)

Main elements:

- Generating a systematic knowledge of the land use history, vegetation, physical and cultural setting and factors leading to land degradation.
- Ensuring community participation through mass awareness, skill improvement.
- Prevention of open grazing and minimizing other biotic interferences.
- Gully plugging using biological and physical means.
- Waste water harvesting and appropriate utilization.
- Establishment of on-site nurseries using improved methods.
- Mixed planting of tree, shrubs and green fodder species selected on the basis of villagers' requirements and ecological realities.
- Improvement of soil fertility through physical and biological treatments.
- Crop diversification and value addition to raw material.

(Source: GBPIHED; India)

2. INDIA

2.1 Rehabilitation of degraded lands in Arah and Khaderiya

Farmers in Khaderiya village in the PARDYP India watershed used to experience fodder scarcity during winter and dry seasons. Most of the cattle owners bought fodder from outside sources to meet the scarcity. To tackle this issue, PARDYP India team initiated a participatory fodder based land rehabilitation programme in this village in 1997. These sites were rehabilitated using SWEET (Sloping Watershed Environmental Engineering Technology; Box 3) – a framework developed by GB Pant Institute of Himalayan Environment and Development (GBPIHED) in Almora, India. Some of the benefits of rehabilitating this site were found to be:

- Improvement in fodder production (Figure 7)
- Reduction of women's workload
- Increase in bio diversity
- Increase in soil fertility
- Increase in environmental awareness among villagers
- Reduction in soil erosion and runoff

- ➢ Increase in local skills of land management, nursery operations, etc. (Figure 8)

Figure 7. Khaderiya (India) site after rehabilitation. The grass production at this site (about 4 hectares) increased from about 1.2 t/yr in 1997 to about 11.6 t/yr in 2004.

Figure 8. Training on the art of nursery-raising for farmers has been one of the key components of land rehabilitation programmes in PARDYP India

2.2 Rehabilitation of land and water resources at Doba

Doba village is one of the remotest villages in the PARDYP India watershed. The village has limited amenities, and the villagers rely mainly on common forest and water resources for meeting their daily energy and water needs. Due to a rise in individual self-interest over collective interest and unsustainable use of the resources, an important common drinking water source or spring (Figure 9A) and a patch of forest right above the spring (Figure 9B) were reduced to open access resources and were highly degraded. Introduction of a Government pipe water supply rendered the traditional spring source obsolete. However Government was unable to maintain the new pipe water supply and it fell into disrepair. But the spring source too had been neglected. The traditional village mechanisms for maintaining the water supply had stopped. Therefore PARDYP helped stimulate rejuvenation of the traditional institution. Villagers were encouraged to adopt social fencing instead of mechanical fencing as a source protection measure. The project team together with the villagers and Doba Gram Sabha rehabilitated these resources in 1999.

These resources are efficiently management by a village committee and provide drinking water to more than 14 households and fodder for many more families. The changes in the spring water quality and quantity are presented in Table 2.

Table 2. Changes in drinking water quality and quantity of Dhotra spring in India

PARAMETERS	SEASONS	YEAR

		1999	2004
Discharge (l/hr)	Winter	32	45
	Summer	25	41
	Monsoon	40	81
Electrical conductivity	Winter	212	196
Dissolved Oxygen	Summer	226	201
	Monsoon	208	190
E. coli (CFU/100 ml)	Winter	8	0
	Summer	14	0
	Monsoon	32	0

Figure 9. The water collected in the tank (A) from the rehabilitated spring in Doba provides drinking water for 14 families. Site B has also been rehabilitated as a catchment protection measure

The Common-Private property resource complementarity

Farmers in the study watersheds participated in the conservation and protection of CPRs because of the contributions from CPRs to improved agricultural production options. They were either introduced or developed with farmers by PARDYP. Some of the PARDYP popular options in the PARDYP watersheds, including Nepal and India, that have made a significant improvements in farmers' livelihoods are:

1. **Biofertilisers**: There has been consistent increase in yields by around 25% for beans and wheat. Also, increases of 40% have happened when legumes have been inoculated with the right strain of rhizobium.
2. **Improved seed**: Good quality seeds have made a big difference. Yields have been atleast doubled by planting improved varieties.
3. **Fodder grasses**: The growing of quality fodder grasses, e.g. Napier, has been spreading through farmer-farmer diffusion (Figure 10).
4. **System of rice intensification**: Rice farmers in Nepal and Pakistan have been able to increase their yields by up to 50% by adopting aspects of the system of rice intensification.
5. **Fish farming**: Another success has been with the fish ponds in the PARDYP India watershed. Smallholder poor farmers have been able to increase their income by at least 20% by adopting fish ponds.
6. **Off-season vegetables**: PARDYP has demonstrated that mountain farmers can take advantage of their niche climatic conditions. Many farmers have increased their incomes by off-season vegetable cultivation using simple polyhouse technology and by growing crops that reach markets at times of relative shortage and therefore high price.
7. **Improved composting**: Significant improvements in quality and rates of composting by covering compost heaps with black plastic sheets have been demonstrated and scaled up in Nepal. By this method compost, which takes 5-6 months for decomposition by traditional method, gets ready in about 45 days.
8. **Drip irrigation**: Farmers in Nepal have been able to raise their income by growing more bitter gourd and other vegetables with less water using drip irrigation.

PARDYP has found that providing the poor farmers alternative options that increase sustainable productions of CPRs, and at the same time raise the productivity of private property resources, is very important. PARDYP success has also been largely due to the way it has built up the credibility of the research teams with local people so that local people have become willing to trust the teams' recommendations and try out new ideas and methods being promoted (White 2005).

Figure 10. Promotion of cultivation of fodder grasses on private land has been one of the PARDYP approaches to reducing pressure on the common resources

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