People and Resource Dynamics Project (PARDYP) – participatory options for sustainable sloping land management promoted in 5 watersheds in the Himalayas

I. Providoli, S. Bhuchar, R. White, K. M. Sthapit, M. Dhakal
International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal
iprovidoli@icimod.org

Abstract
The Hindu Kush-Himalayan (HKH) mountain range is suffering in recent decades from increasing population pressure, especially in the "Middle Mountains", where the catchments are degrading rapidly due to unsustainable land management practices. In response to this concern the "People and Resource Dynamics Project – PARDYP" (1996-2006) was launched, with a focus on natural resource degradation in the "Middle Mountains" of the Himalayas. PARDYP was a research for development project and the main objectives were (1) to find options and approaches to support sustainable and equitable access to water, land, and forests; (2) to improve productivity of farming systems; (3) to increase productivity of agricultural land; and (4) to test and disseminate improved water management options. The project operated in five middle mountain watersheds across the HKH - two in Nepal, and one each in China, India and Pakistan. The key approach was social empowerment through awareness raising, involvement of local institutions and users, encouraging women involvement, user committee formulation and technical backstopping. In this article we will list the most popular options addressing soil fertility and water scarcity which can lead to significant improvements in farmer's livelihoods. A key learning of the project was that the opinions of land users govern whether new technologies and approaches are accepted. However, a big challenge at the end of every project is to promote knowledge sharing and to encourage cross-fertilization of ideas, with other middle mountain inhabitants and practitioners in the region.

Keywords: water scarcity, soil fertility, Himalaya, middle mountains

1 Introduction

The Hindu Kush-Himalayas (HKH) happens to be one of the most fragile mountain ranges in the world. This mountain range is suffering in recent decades from increasing population pressure, especially in the “Middle Mountains”, where the catchments are degrading rapidly due to unsustainable land management practices (Schreier et al., 2006). Furthermore, the Himalayan mountain range is suffering from water scarcity due to increasing water demand, enforced by annual rainfall extremes - too much water during monsoon and too little during dry seasons (Merz, 2004). Therefore, sustainable management of watershed resources in Himalayan countries has been a high priority over the past decades. Watershed management evolved from an initially water engineering and forestry based discipline to a multidisciplinary approach linked to agriculture, rural development, environmental economics and social sciences. During the 1990s integrated watershed management through people’s participation has become widely accepted as a promising approach for conserving water, land and biodiversity, enhancing local livelihoods, improving the economy of upland inhabitants and people living in downstream areas, and ensuring sound sustainable natural resource management overall (FAO Forestry Paper, 2006). The rehabilitation and sustainable management of these upland catchments is seen as not only important but also challenging for all mountain societies and governments in the region and associated downstream communities.

In response to this concern the “People and Resource Dynamics Project – PARDYP” was launched (1996-2006), with a focus on natural resource degradation in the “Middle Mountains” of the Himalayas (White, 2005). PARDYP was a research for development project addressing in particular marginalization of the mountain farmer, the use and availability of water, issues on land and forest degradation, soil erosion and declining soil fertility, carrying capacities of the resource base, the speed of regeneration, and the ability of the natural environment to support the growing needs of the increasing population. The main objectives were (1) to find options and approaches to support sustainable and equitable access to water, land, and forests; (2) to improve productivity of farming systems; (3) to increase productivity of agricultural land; and (4) to test and disseminate improved water management options. 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, and reduced low season stream flows (Merz et al. 2004). This paper is focusing on the participatory options for sustainable sloping land management promoted by the PARDYP project in 5 watersheds in the Himalayas (Figure 1). It highlights basically options a) for improving soil fertility and crop production and b) to address water scarcity in the dry season.

2 The PARDYP project

The PARDYP project operated in five middle mountain watersheds across the HKH - two in Nepal, and one each in China, India and Pakistan (Figure 1).

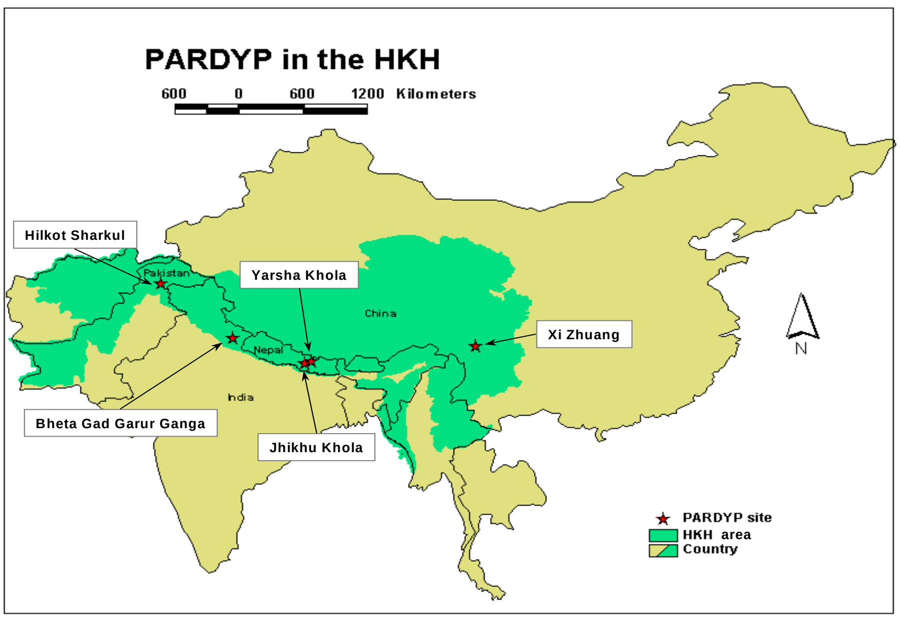

Figure 1: Location of PARDYP watersheds in the HKH

The characteristics of the five watersheds are given in Table 1. In each country a specific PARDYP country team was conducting the research, with regular exchange with the other country teams and with technical backstopping of the universities of Bern, Zürich and British Columbia. The first phase of PARDYP (Oct 1996 - Sept 1999) had a strong biophysical research dimension. The two following phases (Oct 1999 - Dec 2002; Jan 2003 - Jun 2006) shifted to stronger socio-economic and community-based approaches, focusing on development through community based decision making processes and the development of relevant methodologies. These participatory approaches were mainly participatory action research (PAR), participatory technology development (PTD), and community based management of natural resources. PARDYP used participatory rural appraisal and informal meetings with villager and farmer groups to identify the major problems in the watersheds. The PARDYP team then suggested and tested potential interventions. The basic idea was to test, develop and promote simple options, e.g. techniques for sustainable land management, while building on local knowledge and practices involving local people. Each country team had a slightly different focus and did not test exactly the same options. The key approach was social empowerment through awareness raising, involvement of local institutions and users, encouraging women involvement, user committee formulation and technical backstopping.

Table 1: Characteristics of PARDYP project watersheds (adapted after White, 2005)

	China	**India**	**Nepal**	**Nepal**	**Pakistan**
Physiography	**Xi Zhuang**	**Bheta Gad Garur Ganga**	**Jhikhu Khola**	**Yarsha Khola**	**Hilkot-Sharkul**
Total area [ha]	3’456	8’481	11’141	5’338	5’230
Elevation range [masl]	1700-3075	1090-2520	800-2200	1000-3030	1448-2911
Climate	Wet and dry seasonal variations	Sharp wet and dry seasonal variations	Humid sub-tropical to warm temperatures	Humid sub-tropical to warm temperatures	Humid sub-tropical to cool temperatures
Average rainfall [mm/y]	1’413	1’291	1’316	2’276	911
Dominant geology	Limestone and sandstone	Schists and gneiss	Mica schist and limestone	Gneiss and slate+graphitic schist	Micaceous schist, slates,
Population	4016 (1997)	14’524 (1998)	48’728 (1996)	20’620 (1996)	11’322 (1998)
Population density [people/km^2]	116 (128 in 2002)	171	437 (587 in 2001)	386	243
Family size	4	7	6	5	8
Dominant ethnicity	Han Chinese	Brahmin, Rajputs, scheduled castes	Brahmin, Chettri, Tamang, Danuwar	Brahmin, Chettri, Tamang	Gujar, Swati, Syeds
Major cash crops	Tea, tobacco, fruit	Winter vegetables, fruits, tea, fodder	Potatoes, tomato, rice, fruits, vegetables	Seed potato, fruit	Fruit, fodder
Main staple crops	Maize, wheat, beans, potato, rice	Mixed cereal, grains, rice, wheat	Rice, maize, wheat, potatoes, millet	Maize, rice, millet, potatoes, wheat	Wheat, maize, rice

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 deforestation, increasing soil erosion, flooding, etc. turned out to be of less importance. The issues of major concern were ***loss of soil fertility*** thus crop productivity, and reduced low seasonal flow thus ***water scarcity*** for irrigation and domestic use. In the 1990's agricultural intensification in the Himalayas led to significant changes in the traditional farming system with a shift towards cultivation of seasonal cash crops (Schreier and Shah, 2000). In the case of Jhikhu Kola watershed, Nepal, the farmers had moved from two annual staple crop rotations (rice and wheat or maize) to triple annual crop rotations (rice, potatoes, and tomatoes) (Shah, 2005). This intensification led to depletion of soil fertility, created health issues related to the heavy use of agrochemicals, and increased the demand for irrigation water, particularly during the dry season. Continuous crop intensification and heavy use of urea and ammonium based fertilizers increased soil acidity and created an imbalance in soil nutrients. Soils analysis in the study area showed that the soils had in general low pH, low carbon content, lack of available phosphorous, and low base cations (Shah, 2005). Therefore, farmers were dependent on more inputs and applied chemical fertilizers in an unbalanced way. Furthermore, water scarcity in the dry season is an increasing problem across the HKH region as increased water demand exceeds the supply (Merz et al. 2004). For farmers long walks to springs or lining up at taps are the reality. In addition, even in rural areas water quality is deteriorating and environmental health problems lie ahead.

PARDYP tried to identify sustainable farming practices that reduced negative environmental impacts and increased farmers' income without increasing women's workloads. On-farm trials were carried out in Pakistan, India, and Nepal. In this article we will list the most popular options which lead to significant improvements in farmer's livelihood addressing soil fertility and water scarcity.

3 Participatory options promoted by PARDYP

3.1 Participatory options for increasing soil fertility

To increase ***soil fertility*** and to raise farmer's awareness on controlled nutrient input the following technologies and approaches were applied and promoted (Table 2).

Table 2: Promoted options to increase soil fertility

Increasing soil fertility				
Options	Approaches	Positive aspects	Negative aspects	Country
Biofertilizers	On-farm demonstration (India), On-station trial (Nepal)	- can be easily transported to mountain areas - reduces workload on women - environment friendly	- mostly not available in local market	India, Pakistan, Nepal and China
Improved composting		- better compost quality (nutrient rich)		Nepal, India
a) Black plastic composting	On-farm demonstration to individual farmer (Nepal)	- simple and easy to handle durable on-farm technology - compost decomposes quicker - compost has better quality	- durable black plastic is expensive and not available in local market	Nepal
b) Vermi-composting	On-farm demonstration, enterprise demonstration, training	- simple technique - good quality compost - growing worm population, worms can be sold (additional household income)	- needs specific worms which are not available in local market	India

Biofertilizers are microorganisms that can improve the availability of key soil nutrients either by fixing nitrogen or releasing important nutrients. Such biofertilizers as e.g. vesicular arbuscular mycorrhiza (VAM), were promoted by PARDYP. They are cost effective, environmentally friendly, and help to naturally maintain soil fertility. This technology was demonstrated to farmers by on-farm demonstrations. A big advantage of such biofertilizers for mountain areas is that they can be easily transported to remote areas (Bisht et al. 2005). However, a major challenge is still how to provide biofertilizers to local markets, and availability of strains specifically for the upland crops. For addressing the former challenge, the support from the extension services and collaboration between public-private is very important. For example in India, the PARDYP team brought together a local shopkeeper and the biofertiliser production unit for storing and selling the PARDYP tested biofertilisers in the watershed. For the latter, capacities and resources of research institutes working on mountain issues still need to be developed so that they can undertake research programmes for the identification, selection and propagation of appropriate strains of biofertilisers.

Improved compost a) Black plastic composting

Picture 1: Black plastic composting, Jhikhu Khola (Nepal)

PARDYP promoted a simple and cheap on-farm composting technology to improve the quality of traditional farm compost, which is generally a mixture of cattle dung, urine, and plant material. Most of the farmers dump this heap in an open space for decomposition. In the black composting method, the traditional compost heap is covered with a black polythene sheet. The black sheet protects the compost from nutrient leaching during rainy days, and provides a favorable environment for the growth of microbes (increased temperature and decreased evaporation). By using this method compost decomposed within 45-60 days compared to about 4-6 months without the plastic sheet and had a much better quality (higher nutrient content and better decomposed). PARDYP demonstrated this method as on-farm demonstrations. A disadvantage was that for farmer the thick (durable) black plastic is quite expensive and not easily available in the local market.

Improved compost b) Vermi-composting is produced by using earthworms to convert biodegradable wastes into compost. The nutrient composition of vermi-compost is much better compared to compost made in pits or by bacterial decomposition. In PARDYP India, Red-worm or Tiger-worm *(Eisenia fetida*) and local variety were tested for vermin-composting. The *E. fetida* results were much better because the species can tolerate wide ranging environmental conditions. It can also feed on a variety of organic wastes (e.g. cattle dung, sheep dung, poultry dropping, weeds, used flowers, waste paper, waste from fruit, pulp, etc.) and grow and multiply very fast.

This technology was demonstrated to farmers by on-farm demonstrations and trainings by increasing farmer’s capacity. Mainly two user groups could be distinguished, on one hand private farmers who produced the vermi-composting for their own vegetable production and on the other hand women-self help groups which produced the vermi-compost for selling (micro-enterprise). Therefore, this technology had also an important link to the market.

The use of the proposed options showed that by learning and applying black plastic and vermi composting methods, and by using bio-fertilizer the soil quality and the crop production could be increased.

3.2 Participatory options addressing water scarcity

Case studies from India and Nepal showed that communities if made aware of the possibilities and given the confidence to develop their ideas can improve and effectively manage water sources. Effective water management was achieved by strengthening community-based water management. PARDYP promoted options for increasing water availability and improving water use efficiency (Table 3a and 3b).

3.2.1 Increase water availability

Good options to increase water availability were achieved by a) increasing infiltration, b) water harvesting, and c) by improving drinking water supply (Table 3a).

Table 3a: Good options for increasing water availability

INCREASING WATER AVAILABILITY				
Increasing infiltration				
Options	Approaches	Positive aspects	Negative aspects	Country
Eye brow terraces	- community participation (local youth club) - field demonstration - bottom-up approach (demand driven)	- easy way of rainwater harvesting - increases soil moisture status - creating favorable micro-environment for plants to grow	- labour intensive	Nepal
Contour hedgerows	- field demonstration	- stabilises soil - nitrogen-fixing hedgerows improve soil nutrients - provide fodder availability	- nutrient competition with agricultural crop - shading effect on crops if not properly managed	India, Nepal, Pakistan
Improving terraces including vegetative measures (grasses)	- field demonstration	- modifies slopes - reduces direct runoff and soil erosion - improves soil moisture status - increases fodder availability - retains soil nutrients	- labour intensive - structural measures costs high	India, Nepal

Water harvesting				
conservation ponds	- field demonstration	- simple, low cost and durable - stores excess runoff water reducing erosion - improves soil moisture - can be combined with sprinkler and drip irrigation and vegetable and fish farming (enterprise)		India, Nepal
a) conservation ponds (earthen)	- field demonstration	- useful for buffalo bath	- significant seepage loss	India
b) conservation ponds (plastic line)	- field demonstration	- reduces seepage loss	- high cost of plastic - thick plastic not easily available in local market	Nepal
Drinking water supply				
Spring source protection	- field demonstration (with user groups)	- water quality and availability improvement		Nepal, India
Roof water harvesting	- field demonstration (on household basis)	- water use during scarce period - reduce women work load	- costly for farmers - if preventive cleaning measures (of roof) not applied water not safe to drink	India, Nepal

These improved methods of water management as well as methods of improving supply were adopted, particularly when associated with another enterprise. Therefore, the storage ponds were combined with fish farming and presented a lucrative extra income for farmers. Particularly in India, in the Bheta Gad watershed this option was very successful and was adopted by many farmers.

3.2.2 Water use efficiency options

To improve the water use efficiency new irrigation methods such as drip, sprinkler and pitcher irrigation were promoted by PARDYP, as well as and SRI (System of Rice Intensification) (Table 3b).

Table 3b: Good options for increasing water use efficiency

INCREASING WATER USE EFFICIENCY				
Options	Approaches	Positive aspects	Negative aspects	Country
Drip irrigation	- first on station trial, later on on-farm trial - farmer to farmer visits - on-farm demonstration	- saves water - crops matures earlier (advantage for market) - less labour	- not easily available in local market	India, Nepal, Pakistan
Sprinkler irrigation	- on-farm demonstration	- easily available in local market - low cost technology	- head pressure required	Nepal
Pitcher irrigation	- on-farm demonstration	- easily available in local market	- useful only for permanent crops (horticulture)	Pakistan
SRI	- first on station trial, later on on-farm trial - farmer field schools - training - farmer to farmer visits	- increases rice production - requires less seedlings - reduces irrigation frequency	- excessive weed growth (very labour intensive)	India, Nepal, Pakistan

Drip irrigation is a method of watering plants by delivering drops of water in a controlled way to the plant root zones of the crop (Nepal team, 2006). The system is made up of a water tank and a network of pipes with drippers at predetermined intervals. When used on bitter gourd, drip irrigation saves about 60% of water compared to bucket irrigation and it also helps to mature the crop earlier. In PARDYP Nepal this method was tested at the Panchkhal Horticulture Centre to grow bitter gourd (Merz et al. 2005). Only in a second phase the trial was started with farmers on rainfed plots. Later on PARDYP organized interaction programs and farmer to farmer visits to disseminate the new technology.

Sprinkler irrigation is another option for an efficient irrigation method for high value cash crops. Most farmers collect tap water in a traditional pond, which flows through a polythene pipe to run to the sprinkler. This method saves time compared to the bucket irrigation and it provides uniform application of water. Furthermore, it is easy to handle and to transport to the desired location.

In Table 4 the drip and sprinkler irrigation method is compared according to farmer's perception. In Nepal the drip irrigation is intensively applied and is highly appreciated by farmers to get earlier mature crops (about 3 weeks for bitter gourd) and therefore help farmers to get a better price on the local market.

Table 4. Farmer's comparison of drip and sprinkler irrigation. (adapted after Nepal team (2006))

Drip Irrigation	**Sprinkler irrigation**
Useful for the distantly grown crop such as bitter gourd and cauliflower	Useful in closed grown crops such as garlic and onion
Difficult to use in sloping (steep) land	Can be used in sloping land as well
Difficult to transport, it is fixed for one crop and stays the whole growing season	Easy to transport, and possible to use for different crops in rotation
Does not repel insects	Repel insects
Not easily available in local market and expensive	Easily available in local market and cheap
Requires less water and is highly water efficient	Require more water therefore requires perennial water source
Requires low maintenance	Requires frequent maintenance against blockage
Low head pressure is adequate to irrigate with drip	Requires sufficient head pressure therefore not applicable in plain
Difficult to dismantle once crop is grown	Likely to be stolen because of easy dismantling

Pitcher irrigation is a simple method for watering plants in dry areas and is used to establish fruit tree orchards (Figure 2, Box 1). Clay pots are buried in the ground close by the rooting zone of a crop plant. The pots are filled with water and covered with a lid. Water from the pot seeps slowly through the pot walls into the soil and irrigates the plant giving it a steady supply of moisture. The pots should be about 30 cm away from the plant.

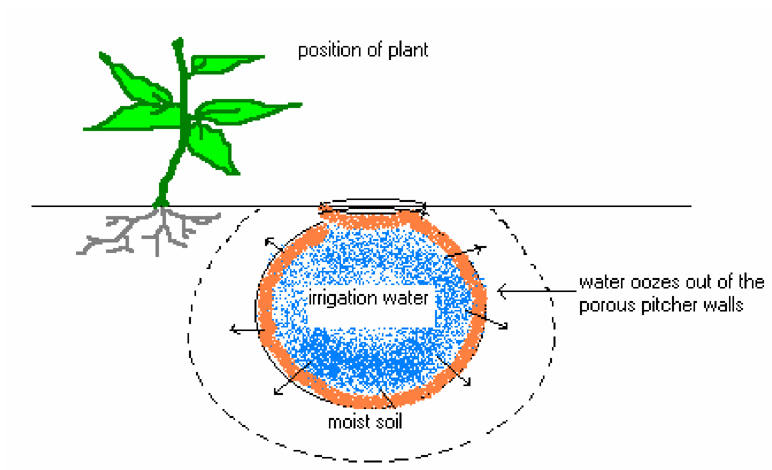

Figure 2: Model of pitcher irrigation (PARDYP Pakistan)

Box 1: Case Study on pitcher irrigation of farmer Akhtar Khan in Hilkot (Pakistan)

I am a farmer and live with my large family in Hilkot. My main problem in growing crops is lack of water. For many years I have been trying to establish an apple orchard. In the past many of the tree seedlings died because of water shortages. Then I heard from PARDYP project about a simple and cheap way of establishing young fruit trees. By using pitcher irrigation I have established an orchard of 60 apple trees. All of the seedlings I planted have survived. The trees are now three years old and are very healthy. In a few years I will be able to harvest apples and sell them in the market.

Once I set it up it hardly takes any work. The pots only need refilling about once a week.

I am amazed how such a simple technique could produce such good results. In my area water is very scarce and vegetables and fruits are expensive and hard to grow.

System of Rice Intensification (SRI) is a methodology for increasing the productivity of rice by changing the management of plants, soil, water and nutrients (Uphoff, 2004). In SRI management practices 8-12 days old rice plants are transplanted at distances of 25x25 cm or wider (only one seedling per hill instead of 3-4 together in the traditional management). Paddies are not kept continuously flooded and plant population density is greatly reduced when adopting the system. Since weeds become a problem in fields that are not kept flooded, weeding is necessary at least once or twice, starting 10-12 days after transplanting, and preferably 3 or 4 times before the canopy closes.

In case of PARDYP Nepal the first SRI trial was carried out at the Panchkhal Horticulture Centre in collaboration with interested farmers. Later on on-farm tests were carried out and farmer-to-farmer interactions helped to promote this new technology. Getting more production with less total costs was considered a clear net benefit with SRI by the farmers (Merz et al, 2005). It is also noted that with reduced frequency of irrigation, there were fewer conflicts among irrigation water users, and terrace 'failures' (collapses) caused by stagnant water, which are both serious problems in hill irrigation systems.

3.3 Participatory options for increasing production and income generation

Among the most popular options to increase production leading to higher income generation were improved poly-pit houses (off-season vegetables), seeds quality, fish farming and drip irrigation (Table 5).

One successful option for farmers was particularly to take advantage of a niche and to produce off-season vegetables using simplified poly house/poly pit and kitchen gardening. Vegetable seedlings were raised in protected structures during winter and then transplanted to the fields as temperature rose in spring. Due to this method the vegetables were ready for harvesting 2-3 weeks earlier than normally. In Pakistan and Nepal, turnip and bitter gourd, respectively, have been raised as off-season vegetables (Bisht et al. 2005).

Improved seeds quality: PARDYP provided seeds of new varieties to farmers which were high yielding crop varieties. These good quality seeds made a large difference. In India wheat yields doubled when improved varieties were planted. In Pakistan the high yielding seeds were promoted in farmer field schools (FFS). However, the use of high yielding seeds may also lead to higher nutrient and water requirements. Another negative effect is that traditional varieties get lost.

Furthermore, the drip irrigation sets were very popular and helped the farmers to get their crop about 3 weeks earlier mature. Therefore, the farmers could sell their vegetables earlier on the market. Also the fish farming in the conservation ponds proved to be very lucrative for farmers.

Table 5: Promoted options to increase production and income generation

Increasing production and income generation				
Options	Approaches	Positive aspects	Negative aspects	Country
Improved seed quality	On-farm demonstrations with lead farmers (India), farmer field schools (Pakistan)	- increasing yields (increasing income)	- additional inputs required (water, nutrients) - high quality seed multiplication is not possible - traditional varieties get lost	India, Nepal, Pakistan
Fish farming (enterprise)	- field demonstration	See Table 3a	See Table 3a	India, Nepal
Drip irrigation	See Table 3b	See Table 3b	See Table 3b	India, Nepal, Pakistan
Poly-pit houses (off-season vegetables)	- field demonstration	- income generation		Nepal, India, Pakistan

4 Participatory approach and adoption of options

Picture 1: Farmers' field observations (Nepal)

Generally, it was recognized that to be able to promote community participation, it was necessary to provide tangible economic benefits to individual farmers and families as for example with off-season vegetables. To improve farming system and agriculture productivity an integrated approach had to be kept in mind and the farming and market systems had to be understood properly. PARDYP followed a participatory action research approach, in which the researchers (facilitators) and villagers jointly diagnosed the problems, tried to find the causes of the problems and possible solutions. 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. PARDYP stimulated local leadership and provided 'missing' technical know-how. PARDYP's overall approach was to implement its activities by fostering dialogue and interaction between farmers and local organizations. Furthermore, PARDYP success has 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. One important way of trust and confidence building was to find a good entry point with the rural community. In the case of Yarsha Khola watershed, Nepal this entry point was the construction of a mule trail, which was on the top of the priority list of the community (Box 2). It was in particular crucial that project staff and extension worker spent time with the communities and were able to understand the local context.

Box 2: Case Study: Mule trail at Kabre village, Yarsha Khola watershed (Nepal)

During the VDC (Village Development Committee) level and DDC (District Development Committee) level meetings DDC and VDC representatives, school teachers, CBO (Community Based Organization) representatives and farmers prepared a list of research and development activities required for their VDC's. PARDYP's main task was to carry out only NRM related research activities.

During the discussion, the VDC Chair person of Kabre proposed the mule trail as most urgent and top priority activity because the villagers and especially school children suffered a lot during high flows. Although it was not a priority and not a planned activity for PARDYP, PARDYP supported this *construction as an entry point activity to build a good rapport with VDC and the villagers, and to engage them in the NRM research. This intervention turned out to be one of the popular and highly appreciated (by villagers) works of PARDYP. Due to this a good rapport was built with the VDC and local residents, which ultimately helped PARDYP to conduct research work with different stakeholders in a collegial participation.*

The major key learning of the project was that the opinions of land users govern whether new technologies and approaches are accepted. Therefore, the approaches were as important as technologies and peoples' perception mattered strongly. This explains why a strong focus had to be on capacity building. Consequently on-site trainings and farmer to farmer visit were organized and the work and collaboration with the farmers was the key. As a result market strategies had to be developed together with the farmers. In addition, local institutions had to be strengthened or if they were not available they had to be created. Decision-makers also had a key role to play in up-scaling good practices and therefore, they had to be invited to participate in relevant networking and knowledge-sharing activities. In Table 6 the key approaches to success are summarized.

Table 6: Key approaches to success

Approaches	• Involving farmers as research partners
	• Community participation and promoting community user groups
	• Social and community empowerment
	  o Awareness raising
	  o Capacity building
	  o Involve local institutions
	  o Involve all users
	  o Encourage women involvement
	  o User committee formulation
	  o Linking groups
	• Addressing needs of community
	• Building on indigenous knowledge and traditional practices
	• Gaining credibility (trust-building through entry point, Box 2)

Knowledge sharing and networking	• Dissemination of findings • Farmer to farmer exchange visits • Farmer field schools (FFS) (e.g. Nepal, Pakistan) • Farmer day (e.g. Pakistan) • On-site training and education • Newsletters, CDs, films, websites, extranets, papers.

5 Conclusions

The participatory action research approach PARDYP followed was very successful and 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.

Furthermore, sharing knowledge and demonstrating socially validated best practices can make a tremendous difference in people's livelihoods. However, transfer of knowledge among countries in the mountains and between communities is still not taking place efficiently. Still, farmers as well as project and government staff are often not aware of many cheap and simple solutions. Therefore, a big challenge at the end of every project is to promote knowledge sharing and to encourage cross-fertilization of ideas, including in the PARDYP case, sharing with other middle mountain inhabitants and professionals in the region

On the bigger scale, one way to promote knowledge sharing is through networks such as the WOCAT database (World Overview of Conservation Approaches and Technologies, www.wocat.net). This database has a subnet called HIMCAT (Himalayan Conservation Approaches and Technologies), including an extranet platform for the Himalayan region (http://extranet.icimod.org.np/himcat/), in which good soil and water conservation practices can be documented and shared. In the case of Nepal, 10 technologies and 5 approaches from the PARDYP project will be shared in the WOCAT database.

Furthermore, ICIMOD is developing training packages on the lessons learned of PARDYP to share the gained knowledge with a bigger audience. A training package on "Low Cost Soil and Water Conservation Techniques and Watershed Management Measures" is under preparation.

However, apart from sharing and disseminating best practices to other mountain communities, the continuation and the sustainability of the project itself has to be kept in mind as well. The central question is "what remains after the termination of a project?" Often this aspect is neglected and should be monitored more closely, even after the closing of the project.

Acknowledgement

This article takes into acknowledgment all the people who have worked in the PARDYP project. Furthermore, we acknowledge also the Swiss Agency for Development and Cooperation (SDC), the International Development Research Centre (IDRC) of Canada, and ICIMOD for funding.

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