

Land Use Change in the Middle Hills of the HKH: Insights from the Five PARDYP Watersheds

R. White

International Centre for Integrated Mountain Development, Kathmandu, Nepal

Introduction

The People and Resource Dynamics in Mountain Watersheds of the Hindu Kush Himalayas Project (PARDYP) is a research for development project funded by SDC (Swiss Agency for Development and Cooperation), IDRC (Canadian International Development Research Center), and ICIMOD. PARDYP is working with national institutions in China, India, Nepal, and Pakistan¹ to improve understanding of natural resource management in the middle hills of the HKH. Further technical inputs are provided by the University of British Columbia, Canada and the University of Bern, Switzerland. The study areas are watersheds of between 30 and 120 sq.km in each participating country, with the exception of Nepal where two watersheds are included. PARDYP's activities seek to achieve the following:

- understand community institutions and develop community-based methods for solving natural resource management problems faced by the communities;
- understand the basic causes of inequity, and empowering and building the capacities and voices of women and marginalised people and to mainstream gender into the PARDYP programme of activities;
- generate and exchange information on water as a resource, its role in land degradation, and identify and test options to enhance water management decisions;
- improve the productivity and sustainable management of common property resources – forests, pastures, degraded areas, water, and other common resources;
- use participatory on-farm research methods to generate, test, and disseminate innovative practices and technologies based on indigenous practices and scientific knowledge to improve soil, crop, livestock, and farming systems; and
- identify and capitalise on the livelihood potentials associated with the use and management of natural resources in the PARDYP watersheds.

This paper presents a qualitative review of agricultural activities in the five watersheds from west to east. Farmers' perceptions of the problems and issues they face and a review of the research for development activities carried out through PARDYP are included.

The Watersheds

Pakistan: Hilkot watershed, Mansehra district

Maize is grown in the uplands and rice on irrigated land during the summer. Other annual crops are limited to some wheat for fodder and mustard/canola in the winter, but most fields have only one crop per year. There is a high level of off-farm employment and out-migration. Tenants farm most land, and many pay rent by providing the landowners with a share of the crop. The crop varieties grown are low yielding. In practice, there is no

¹Teams from: Kunming Institute of Botany, Chinese Academy of Sciences; GB Pant Institute for Himalayan Environment and Development, Almora; ICIMOD, Kathmandu; and Pakistan Forestry Institute.

agricultural extension service. There is good potential for stone fruits. Government policy is to increase tea production in this region, but the elevation is marginal and soil pH is also on the high side. There will be a limited growing season. Hybrid poplars do very well.

Farmers' perceptions of natural resource issues, in rank order, are: low quality seed, soil erosion, soil fertility, lack of extension services, water shortages (irrigation and domestic), and pests and diseases.

PARDYP has introduced improved varieties of maize and rice to the region, trained farmers to graft fruit trees and walnuts, introduced off-season vegetables, and increased on-farm forestry. By improving farmers' access to some basic inputs, PARDYP has been able to make significant contributions to farm incomes. Surveys of medicinal plants found in the watershed have been undertaken, and further work on non-timber forest products (NTFPs) and medicinal plants will be undertaken in 2002.

India: Bhetagad watershed, Kauseni, Uttaranchal

Maize is grown in uplands and rice on irrigated land during the summer. Mustard and wheat are grown in winter. Other annual crops including winter season vegetables are becoming increasingly important. Nearby markets and the increasing buying power of residents are dramatically changing the crops grown, with an increase in floriculture and an intensification of land use and production via 'market garden' development, polythene tunnels, and so on. Tea is grown at the higher elevations, with strong financial and technical support. Apples, pears, and other fruit trees do very well.

Farmers' perceptions of natural resource issues (not rank ordered) include: out-migration; intensification of production (increasingly large amounts of chemical fertilisers are being used); income generation (the market economy is strong); the quality and quantity of drinking water.

PARDYP has demonstrated the use of VAM and rhizobium as biofertilisers to substitute for high levels of chemical fertiliser. The use of polythene lined pits ('polypits') for raising vegetable seedlings, and poly tunnels for growing off-season vegetables early in the year, has been embraced by many of the progressive farmers. Some demonstration fish ponds have been constructed, with interested farmers raising carp to sell to visiting tourists. Methods of rehabilitating degraded lands have been investigated, with a wide range of species tested under hostile conditions. The approach adopted by the PARDYP partner in India is more one of scientific research and applied research backed up with solid data.

Nepal: Jhikhu Khola watershed, Kavre Palanchowk district

Maize is grown on uplands and rice on irrigated land during summer. Mustard and wheat are grown in winter, but with intensive irrigation, vegetables, including potatoes, are produced in the valley bottom in winter. Intensification of land use has been particularly pronounced in this watershed, and now three crops are grown per year in many places. Further intensification is seen as polythene tunnels are starting to appear. Fruit trees are less important than in Hilkot or Bhetagad. The watershed provides excellent opportunities to monitor and understand the impact of rapidly changing land use as intensification proceeds.

The quality and quantity of water as well as changing soil fertility are very significant issues. Parts of this watershed show the extreme hazards of intensification of land use.

Farmers' perceptions of natural resource issues (not rank ordered) include: pests and diseases; the quality and quantity of water for irrigation; the quality and quantity of drinking water; market access; fodder shortages; workload of women; soil fertility; soil erosion; fuelwood shortages.

PARDYP has tested and continues to monitor a number of options for rehabilitating degraded land. The results of these long-term trials will be published in 2002. On-farm issues include management of organic matter, which is considered to be a crucial factor as intensification proceeds. This is a particularly complex issue in Nepal, as the interaction between forest lands as a source of grazing material and the recycling of farmyard manure is very important, and thus the management of forest land has a significant impact on arable land fertility levels. Other important activities investigated include alternative pest management, rainwater harvesting, and improving water use efficiency through drip irrigation systems. Improving fodder availability is a crucial activity that will be a major research topic in the coming seasons. Trials of bag silage and urea treatment of maize stover are planned for 2002.

Nepal: Yarsha Khola watershed, Dolokha district

Maize and millet are grown on uplands and rice on irrigated land during summer, but rice is restricted by temperature at higher elevations. Mustard and wheat are grown in winter. Some significant changes have taken place such as intensification of land use along the new road, but the area is still remote and farmers complain about lack of market opportunities. The construction of the new road gives an opportunity to monitor the impact of improved access to markets on farming systems.

Farmers' perceptions of natural resource issues (not rank ordered) include: market access; improving incomes (from a very low base); water for irrigation; quantity of drinking water; poor agricultural extension services; fodder shortages; soil fertility.

PARDYP has investigated the possibilities of managing the sustainable extraction and where possible the cultivation of NTFPs and medicinal plants, taking advantage of the important biodiversity in this agro-ecological zone. Improving livelihoods for these poor communities is a priority. Trials for cultivating local medicinal plants on farmers' fields show promising results.

China: Xi Zhuang watershed, Baoshan, Yunnan province

Maize is grown on the uplands and rice on irrigated land during summer. Mustard and wheat are grown extensively in winter. Other annual crops, including winter vegetables, are becoming increasingly important. Nearby markets are expanding, with some urbanisation taking place in the main watershed. Intensification of land use is noticeable, with maize now grown in poly-pots and later transplanted at the start of the monsoon. Tea is grown throughout the watershed, often intercropped with maize. Stone fruit trees and walnuts do well.

Farmers' perceptions of natural resource issues, in rank order, are: irrigation water; soil fertility; forest management and access to forest products; tea processing; pests and diseases.

PARDYP has helped design and construct small water tanks on farmer's fields to irrigate the early maize as well as for drinking water. Numerous fruit trees including improved persimmon, peach, apricot, and plum have been distributed. Training in grafting has been carried out and farmer nurseries for tea, walnuts, and stone fruits have been encouraged. Developing a greater understanding of participatory technology development has been at the centre of the activities carried out in this watershed.

Discussion

Agricultural development activities undertaken in mountain watersheds need to reflect the comparative advantages of that agroecology compared with plains agriculture. The cooler temperatures make cultivation of a wide range of crops, often of high value, possible. Agricultural extension and research should reflect these advantages rather than promoting plains crops in hill areas.

Intensification of crop production will bring with it increased environmental stresses, but there are options to increase agricultural production in sustainable ways if holistic and integrated approaches are adopted. Taking advantage of new biological methods, particularly adoption of bio-fertilisers, effective micro-organisms, and rhizobium, can result in significant yield increases without compromising the environment.

There is increasing demand for numerous medicinal plant species from inside and outside the region. Many medicinal plants thrive in the middle hills and some of these can be grown effectively on farmer's fields. Potentially, the cultivation of medicinal plants is a useful source of income and a sustainable alternative to collecting increasingly rare plants from the wild. It is possible that some of these species can also be grown on terrace risers or in hedgerows so that soil erosion can be reduced.

Consumers throughout the world are becoming increasingly aware of food adulteration. There is a growing, world-wide demand for organic products. While it is still a limited market at present, it is likely to grow significantly and may become a viable alternative to traditional practices if a large urban market and associated consumers are willing to pay extra for unadulterated quality produce. There is clear evidence from India and Nepal that this market is significant. Already many farmers grow vegetable crops in one plot for their own consumption and in another with different amounts and types of pesticides for the market. Linking consumers with growers for this niche market is a challenge.

The baseline data already collected from the five PARDYP watersheds, together with the planned long-term monitoring, should allow the PARDYP partner research institutes to quantify changes in soil and soil fertility in these mountain watersheds as land use changes under increasing human pressure.