5 Resource Dynamics and Promising Livelihood Options: A Study of the Bheta Gad-Garur Ganga Watershed, Indian Central Himalayas

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Abstract

The Himalayas are ecologically fragile and economically underdeveloped with severe limitations on resource productivity. Subsistence agriculture is the main source of livelihood. Rapid population growth has led to extensive land use changes mainly through the extension of agricultural land and widespread deforestation. The People and Resource Dynamics in Mountain Watersheds of the Hindu Kush-Himalayas Project (PARDYP) focuses on building local capacity to better manage the available resources to provide for people's livelihoods. This study reports on project work in the Garur Ganga watershed, northwest India to demonstrate and introduce new farm-based technologies that are mostly low cost. These include polyhouses, improved composting, apiculture, small-scale fish farming, improved seed varieties, and soil and water conservation techniques. The rehabilitation of degraded lands, seedling raising, and improved fodder have also been promoted.

Introduction

The Himalayan region of India occupies about 18% of India's area and is inhabited by 6% of its people. The Himalayan economy is mostly agricultural and farm incomes are generally very low. Key strategies to improve farm incomes include growing higher value commercial crops and processing agricultural produce and natural resources such as minor forest products.

The diverse agro-ecological conditions of this part of the Himalayas form niches for the growing of certain horticultural crops, flowers, spices, tree fruits, medicinal plants and fish. These can be grown in the hills at a comparative advantage as they cannot be produced in the plains areas to the south. Many specific products are only being produced in these hilly areas either due to favourable growing conditions or the availability of traditional skills. Some skills are traditional while others have developed recently in response to market opportunities.

Environmental constraints and ineffective development planning mean that there are few off-farm livelihood opportunities in this area. Most local people rely on the unproductive agricultural economy for their livelihoods. It is very difficult for this subsistence agriculture to provide a decent livelihood to the growing population even if agricultural productivity is greatly increased. Most households in the study watershed have small landholdings of less than half a hectare.

To significantly increase incomes in this area must involve a shift from subsistence to more enterprise oriented production. However, such a shift needs improved infrastructure to give

better access to inputs, markets, and improved institutional support. The strengthening of links to local and national markets would greatly encourage the development of micro-enterprises. This study suggests ways for local people to improve their livelihoods.

The Problem

As in other parts of the Himalayas, the economy of the Bheta Gad-Garur Ganga watershed mainly depends on traditional agriculture. However, on average there is only 0.13 ha of cultivable land per person and the productivity of local agriculture is low. Consequently, the local economy is subsistence dominated with food grains accounting for most production. This leads to a large section of the adult male population having to migrate out of the area in search of better livelihood opportunities (Bisht and Tiwari 1997). About a quarter of local people live and work outside the watershed for at least a part of the year (Topal et al. 1999).

Other problems in this area that are common to the Himalayan region in general are:

- rainfed agriculture largely depends on traditional farmyard manure for improving and maintaining soil fertility in the absence of chemical fertilisers;
- scattered and small land holdings;
- large areas of waste land;
- increasing human and livestock populations with increasing demands for food, fuel and fodder;
- lack of advanced technological inputs, and
- lack of water for drinking and irrigation (Rawat et al. 1997a and 1997b; Bisht et al. 2000 and 2002).

There is an urgent need to improve the area's farming systems and provide alternative sources of income.

Study Area

The Garur Ganga watershed covers 82 km^2 and is administered under the Garur block of Bageshwar district, Uttaranchal, in northwestern India. Bageshwar is the major population centre lying 40 km away from the watershed. The watershed has 63 revenue villages with a 1991 census population of 14,524 giving a density of about 175 person/km^2. About 72% of the population are engaged in agricultural activities.

Population growth in this watershed between 1951 and 1991 was 1.52% with a very high growth rate between 1971 and 1981 of 3.2%. The area has 1025 females to every 1000 males – much higher than the national average figure of 929. The per capita availability of cultivable land is 0.13 ha, slightly higher than that of the entire Indian Central Himalayan region (0.12 ha), but lower than the national average of 0.20 ha. The watershed is centrally located in Uttaranchal and has great physical and cultural diversity.

Land Use and Population Dynamics

Pinus roxburghii (chir pine) forest cover much of the watershed. These forests provide fuelwood, fodder, and non-timber forest products and have significant economic potential. Agricultural and settlement land accounts for 42% of the total area. Table 5.1 shows land use changes in the watershed over the 34 years between 1963 and 1996 from geographical information system and remote sensing information. The area under agriculture and settlements has increased by over 7% due to the large increases in population. The major

agricultural expansion has happened close to settlements. There has been a corresponding 5% decrease in forest area.

Table 5.1: **Land resource pattern and dynamics, 1963-96, in the Garur Ganga watershed**

Land-use type	1963		1996		Changes (%)
	Area (km^2)	Area (%)	Area (km^2)	Area (%)	1963-1996
Agriculture/settlement	28.89	34.97	34.98	42.34	+7.37
Forests	50.11	60.65	45.92	55.58	-5.07
Barren land	3.00	3.63	1.09	1.32	-2.31
Other	0.62	0.75	0.63	0.76	+0.01

Source: B. S. Bisht and B.P. Kothyari, 2001

In the Himalayas, excessive population growth tends to be detrimental to economic development, the sustainable use and management of natural resources, and improvements in the quality of life (Bisht and Tiwari 1996). The watershed registered a 44% growth in population between 1951 and 1991 although 1981-91 saw a decline of 5% in the population. This decline was mainly due to the lack of economic opportunities in the area.

Sustainable Livelihoods

The majority of the area's people rely on agriculture and the surrounding natural resources for their livelihoods. It is therefore crucial that their livelihood strategies are sustainable otherwise these natural resources could disappear. The area's main livelihood resources are described below.

Forests – Forests cover 56% of the watershed's area and play a major role in local livelihoods. Their economic utility depends on their geographic location, slope and altitude. The area's forests include reserved forests, civil forests, and panchayat forests.

Agriculture – Agricultural land covers 42% of the watershed with the largest part falling between 1200 and 1600m altitude. About 80% of the watershed's population is engaged in agriculture but this does not provide enough to feed the local population. Local farming systems produce three crops over each two year period in rainfed conditions and two crops per year on irrigated lands (Table 5.2). Over time local people have adapted their farming practices to a sustainable pattern of mixed cropping with leguminous and minor crops mixed with the main staple crops.

Table 5.2: **Traditional cropping pattern in the Garur Ganga watershed**

Season	Main crop	Other crops
Rabi season winter crops	Wheat (*Triticum aestivum*) and barley (*Hordeum vulgare*)	Sarson (*Brassica campestris*), muter (*Pisum sativum*), and masoor (*Lens esculenta*)
Kharif monsoon season crops on irrigated land	Rice (*Oryza sativa*)	Koni (*Setaria italica*), til (*Sesamum orientale*), and urd (*Phaseolus radiates*)
Kharif monsoon season crops on unirrigated land	Finger millet – mandua (*Eleusine coracana*)	Ramdana (*Amaranthus paniculatus*), jowar (*Sorghum vulgare*), soyabean (*Glycine max*), gahat (*Dolichos uniflorus*), urd (*Phaseolus radiatas*)

Cash crops – The Himalayan region has a vast potential for cash crop cultivation. Such crops substantially contribute to local people's livelihoods. However, there is a tremendous scope for adding more value to increase economic benefits. For example, local people sell potatoes locally. Processing them into potato chips would realise much more profit. Similarly, ginger, chillies, garlic, peas, and other crops are sold unprocessed with no value added.

Alternative potential cash crops include large cardamom. This can be cultivated on sloping, moist wasteland; along water channels, field bunds and terrace risers; and under the shade of nitrogen fixing trees where other crops cannot easily grow.

A major focus of watershed development programmes is to improve local incomes to reverse out-migration. Huge opportunities exist within the watershed for farmers to increase their incomes. The introduction of off-season vegetable cultivation for the local market is one such area. PARDYP began to promote this in 1997 by building a small polyhouse on Girish Tiwari's farm at Talli Nakuri on an area of degraded grazing land.

Table 5.3 shows how Tiwari's income has increased by using polyhouses and polypits. He built two polyhouses and two polypits to raise vegetable seedlings in the early spring to get a several week's advantage in vegetable production. The area under cultivation has been 0.10 ha. In 1999 his total gain from the polyhouse was Indian rupees (IR) 3055 (US$66) increasing to IR 21,557 by 2002 (US$ 469). This was on top of the substantial extra nutritious vegetables consumed by the family. The polyhouses were used to grow seedlings for his own use and to sell on to other farmers.

A variety of horticultural fruits are also produced in the area, but only citrus fruits, pears and walnuts are sold. Improving the market infrastructure and carrying out some primary processing would greatly add value to these products. Improving the local roads is a large task that takes time. Adding value to the primary products and improving marketing can be done relatively quickly. Horticulture has great potential for the development of this area. However, the government has given little attention to horticultural development in this region.

Table 5.3: **Economic analysis of farmer Girish Tiwari's innovations**

Year	1999 (IR)	2000 (IR)	2001 (IR)	2002 (IR)
Inputs				
Farmyard manure (600 kg)	650	650	800	1,000
Seeds	500	750	1,000	1,200
Polyhouses and polypits	650	-	-	-
Labour	Self – no cost	Self – no cost	Self – no cost	Self – no cost
Pesticides	50	50	100	150
Transport to market	350	1,150	1,400	1,600
Total inputs	**2,200**	**2,600**	**3,300**	**3,950**
Outputs				
Vegetable and flowers	5,455	12,393	16,385	18,357
Seedlings	5,650	6,150	6,500	7,150
Total outputs	**11,105**	**18,543**	**22,885**	**25,507**
Total net gain	**8,905**	**15,943**	**19,585**	**21,557**

Water harvesting – Local people suffer from serious water shortages. Paradoxically a huge amount of water is available through rainfall and subsurface flow; but poor management means that only small amounts are available. This mismanagement leads to constant shortages of drinking water in dry seasons and the very limited area of irrigated cropland. The improved availability of water is a prerequisite for the development of this watershed. PARDYP has introduced a simple and cheap water harvesting technology to store rainfall for dry season use. Polythene lined ponds are built to collect and store rainwater, unused spring water, and wastewater for domestic and minor irrigation purposes. PARDYP has successfully mobilised many village communities to adopt this technology.

Fish farming – PARDYP is promoting small scale domestic fish farming to improve farm incomes. Participatory research carried out by PARDYP India in 2001 raised the three species of grass carp, common carp, and silver carp in farm ponds. The promising results led to 40 farmers taking up fish farming in 2003. It is estimated that over three years households with a stock of 1,000 fish have earned a net profit of about IR 30,000 per year (Table 5.4).

Table 5.4: **Economic analysis of small scale fish production in the Garur Ganga watershed**

Farmer	Village	No. Tanks and type	Costs (IR)			Income (RIR)	Profit
			Up-keep	Feed	Medicine & nutrients		
Prakash Singh Khatri	Pingalkot	5 (MPL)	1000	2000	250	18000	14750
Ishwar Singh	Jeona	3 (MPL)	800	500	10	5600	4200
Balwant Singh	Majherchaura	4 (cement)	500	1000	200	5200	4000
Bahadur Singh	Gewar	2 (MPL + cement)	400	500	-	4000	3100
Rajendra Sen	Dumlot	4 (MPL)	400	800	-	4000	2800
DS Bisht	Kausani	1 (MPL)	200	1000	200	4000	2600
Sun Bahadur	Dumlot	3 (MPL)	200	400	-	3200	2600
Ramesh Ram	Jadapani	1 (MPL)	400	500	50	3200	2250
Manohar Singh	Lawbanj	1 (cement)	-	100	-	2000	1900
DS Parihar	Arah	1 (MPL)	200	800	200	2800	1600
Harish Ram	Jadapani	1 (MPL)	200	250	-	2000	1550
Rajendra Singh	Deonai	1 (MPL)	250	300	-	2000	1450
Madhan Singh	Pingalkot	1 (MPL)	400	500	100	2400	1400
Narayan Giri	Pokhari	1 (MPL)	200	200	-	1600	1200

Note: Only farmers making more than IR 1,000 profit included. Cost of tank construction not included in income calculation. MPL = mud polythene lined

Degraded lands – This watershed has many areas of pasture that are moderately to highly degraded. PARDYP has initiated work to improve the condition of these lands and reduce women's workload and improve local economic conditions. Community forestry offers great scope for rehabilitating degraded lands. PARDYP selected a highly degraded 4.5 ha site owned by several Lawbanj families. The locally preferred tree species *Grewia optiva, Quercus*

glauca, Quercus incana, Celtis tetranda, Alnus nepalensis, and *Toona serrata* were planted by local people. They closed the site to grazing. During the first year there was a huge increase in ground vegetation and the villagers collected about 28,000 kg of green grass worth about IR 36,000 (US$ 780). In-line with PARDYP suggestions local people established nutritious grass species such as species of *Thysanoleana, Setaria,* and *Pennisetum* on to empty patches of forest land.

Other Sources of Livelihood

The watershed has immense potential for developing livestock raising, apiculture, poultry and medicinal plants. Economic inputs and new skills are needed to take advantage of these resources.

Livestock farming is a very important source of income and nutrition. Cows and buffaloes produce milk, ghee, and khoya (solid milk), bullocks provide draught power, and goats are kept for their meat.

PARDYP has made considerable efforts to raise awareness among beekeepers about the importance of conserving indigenous honey bees and especially the local species (*Apis indica*). More than 20 farmers have become fully engaged in bee keeping.

A number of farmers in the watershed are taking up poultry farming. It is proving a lucrative enterprise. PARDYP provided advice on the most appropriate technology and management issues. This has significantly uplifted the economic status of many households including that of Ram Prasad Dudila. Ram Prasad is one of the most efficient and experienced poultry farmers in the watershed. In 1999 he built a poultry house costing IR 50,000. The amount he has earned has risen every year and in 2002 he made a profit of IR 49,000 (US$ 1,065). He makes this amount from one lot of chickens but is usually able to raise two lots a year. He sells the birds at the local market at Garur and to local hotels (Table 5.5).

Table 5.5: **Economic analysis of Ram Prasad Dudila's poultry enterprise**

	1999 (R)	2000 (IR)	2001 (IR)	2002 (RF)
Chicks	2,000	3,500	5,000	5,000
Transportation	1,700	2,500	4,500	5,000
Medicines	1,600	1,800	2,000	1,500
Poultry feed	3,000	4,000	5,500	6,000
Electricity	1,800	2,000	3,000	3,000
Water pots	1,000	200	1,500	
Feeders	1,000	-	-	-
Maintenance	700	800	1,000	500
Total cost of inputs	**12,800**	**14,800**	**22,500**	**21,000**
Income after 3 to 4 months	48,000	60,000	70,000	70,000
Net gain	**35,200**	**45,200**	**47,500**	**49,000**

Note: this analysis is on a per lot basis. Normally two lots are produced in a year.

The Indian Himalayan region is home to 1748 species of medicinal plants. Most of these are being harvested from the wild, often in an unsustainable way. This has adversely affected the existence of a number of valuable plants. Local people in the watershed have much knowledge about medicinal plants. Their lack of access to modern medicine means that many people turn to locally available herbal remedies. However, this knowledge is fast disappearing and needs to be preserved. The cultivation of medicinal plants has great potential for improving livelihoods in the watershed

Conclusions

The main conclusions of the action research are:

- the initiatives being tried out in the Garur Ganga watershed have great potential to promote the sustainable and equitable development of marginalised families and communities in the Hindu Kush-Himalayas;
- the study area's farmers are not passive inflexible victims of unsustainable development. They are highly active, adaptive and dynamic actors;
- great progress has been made towards initiating and extending better livelihood strategies for local people in the study watershed; and
- the introduction of fish farming has been one of the most beneficial initiatives.

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References

Bisht, B.S.; Tiwari, P.C. (1996) 'Land-use Planning for Sustainable Resource Development in Kumaun Lesser Himalaya: a Study of the Gomti Watershed.' In *Journal of Sustain. Dev. World. Ecol*, 3: 23-34

Bisht, B.S.; Tiwari, P.C. (1997) 'Occupational Pattern and Trend of Rural Out-migration: a Study of Gomti Watershed in U.P. Himalaya.' *Journal of Rural Development*, 16(2): 329-339

Bisht, B.S.; Kothyari, B.P. (2001) 'Land Cover Change Analysis of Garur Ganga Watershed using GIS and Remote Sensing Technique.' *Photonirvachak, Journal of the Indian Society of Remote Sensing*, 29(3):137-141

Bisht, B.S.; Bhuchar, S.K.; Bisht, S.S.; Kothyari, B.P.; Palni, L.M.S. (2000) 'A Functional Analysis of Women's Participation in Various Activities in Hills: A Case Study from Village Arah in Kumaun Himalaya, India.' *Journal of Human Ecology*, 11(6): 487-489

Bisht, B.S.; Bhuchar, S.K.; Pant, P.; Kothyari, B.P.; Palni, L.M.S. (2000) 'The Pivotal Role of Women in the Hills: Gender Analysis in Arah Village in Uttar Pradesh, Central Himalaya, India'. In *The People and Resource Dynamics Project: The First Three Years (1996-1999) Proceedings of a Workshop Held in Baoshan, Yunnan Province, China* (March 2-5, 1999), pp 35-46. Kathmandu: ICIMOD

Bisht, B.S.; Kothyari, B.P.; Bhuchar, S.K.; Bisht, S.S. (2002) 'Energy Inputs by Women in Various Activities in Kumaun Central Himalaya, India'. Paper presented at the 'National Seminar on Women, Environment and Sustainable Development', D.S.B. Campus, Kumaun University, Nainital (Uttaranchal), April 28-30, 2002

Blaikie, P.; Cannon, T.; Davis, J.; Wisner, B. (1994) *At Risk. Natural Hazards: People's Vulnerability, and Disasters*. Routledge, London and New York

Dahl, S.L. (1993). 'Sustainable Livelihoods Security'. *The Indian Geographical Journal*, 68(1): 21-32

Rawat, D.S.; Joshi, M.; Sharma, S.; Rikhari, H.C.; Palni, L.M.S. (1997a) 'Sustainable Development and Management of Rural Eco-system in the Central Himalaya: a Case Study from Haigad Watershed.' In *Jour. Sustain. Dev. World. Ecol*, 4: 214-225

Rawat, D.S.; Joshi, M.; Sharma, S.; Rikhari, H.C.; Palni, L.M.S. (1996b) 'Land-use Planning for Sustainable Development: A Case Study from the Haigad Watershed in Central Himalaya.' In Kumar, K.; Dhyani, P.P.; Palni, L.M.S. (eds) *Land Utilization in the Central Himalaya*, pp 302-10. New Delhi; Indus Publications

Topal Y.S.; Mishra, A.K.; Kothyari, B.P (1999) 'Causes of Out-migration and its Socio-economic Implications: some Evidences from Bheta Gad-Garur Ganga Watershed in the Indian Central Himalayas.' *IASSI Quarterly*, 18(2): 109-122