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International Centre for Integrated Mountain Development

# SUSTAINABILITY OF THE ENVIRONMENTAL RESOURCE BASE AND DEVELOPMENT PRIORITIES OF A MOUNTAIN COMMUNITY

Bhardeo, Nepal

Kk Panday

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# Sustainability of the Environmental Resource Base and Development Priorities of a Mountain Community: Bhardeo, Nepal

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## Foreword

Mountain Environmental Management constitutes one of the four thematic research and development programmes at ICIMOD. The programme is concerned with sustainable use and management of natural resources and the impact of development activities on the mountain environment. This programme is devoted to the scientific and technical understanding of biophysical aspects of mountain environment vis-a-vis traditional and modern human-use systems through appropriate research, state-of-the-art reviews, and field studies. Proper understanding of the functioning of natural systems and their interrelationships with the development needs of the people provide the basis for the sustainable development of mountain ecosystems.

This study on Bhardeo Village is one that has used a grass roots' approach. It is an attempt to examine the very real paradoxes existing in the rural mountains today; namely the struggle to eke out a subsistence living from the vanishing topsoils of the Himalayas; the wish to improve village living conditions; and the very real need to act on the awareness of the critical issue of decreasing resources.

The author has spent many years working at the grass roots' level in villages like Bhardeo and has used his first-hand knowledge and experience to portray the urgent problems facing the thousands of hill/mountain villages in Nepal today. He conducted the study under the auspices of the Mountain Environmental Management Programme of ICIMOD.

It is hoped that this study will provide useful insights to planners, policy-makers, and field-workers and help to make the implementation of development schemes at grass roots' level more effective than hitherto. The small farmer is the most important client in the context of agricultural plans, off-farm and non-farm income-generating projects, and environmental and resource rehabilitation schemes. This study places the small farmer where she or he belongs, at the very centre of development activities.

E.F. Tacke
Director General

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Kk Panday

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# 1. Introduction

**Development Perspective**

In recent years, local development planners have started to take a keen interest in and have become critical of rural development programmes, the emphasis of investment and aid policies, and project-oriented development approaches. The people of Bhardeo are no less critical of development programmes that concentrate their activities on biophysical management aspects and not on income generation for the local people. Poverty becomes less of an issue to be addressed and becomes very sensitive politically and economically because of the absence of an outspoken national policy.

For too long, Nepal has been obsessed with its perceived problems of deforestation and population growth and has guarded its poverty zealously. Objective assessment of development works and issues directly linked to poverty, apparently the main cause of environmental degradation, has not been undertaken.

There is also the question of whether to alleviate poverty or to alleviate the food deficit. Most integrated rural development projects place a high priority on food production programmes which are relatively cheap and show comparatively impressive results. Manufacturing and job opportunities, which require relatively high investments with slow and undramatic results, receive low priority. In the hills of Nepal, particularly in areas like Bhardeo, opportunities exist for creating off-farm activities. The main purpose of off-farm activities should be to create employment opportunities to generate additional cash income, so that households can meet costs beyond their basic requirements.

With regard to biophysical management through reforestation and checkdams, the limit to their effectiveness is not only due to geophysical conditions but also to the socioeconomic conditions of the population that lives in these mountains.

Traditional land use and cropping patterns also place constraints on the development of the community within given environmental conditions. It is imperative to work out plans and strategies for natural resource base conservation, protection, and long-term rehabilitation and management of the local economy based on the resource base. The identification of local economic and ecological potential is a vital step towards implementing feasible economic development programmes.

**Development feasibility in the context of identifying target households' income enhancement activities that lead to self-reliance and management of development by grass-roots' level institutions is extremely important.** If development is also to be sustainable, then the environment must receive due consideration.

It is often difficult to separate resources (production base) from the environmental setting in the mountain economic-ecological system. At which stage and state of the economy the natural environment becomes a resource or vice versa is relative to the production base and the economic condition of the community in question. The natural environment, in most cases, is an aggregate of sociocultural-economic-ecological elements and becomes an environmental resource when part or whole of it is used for production and enrichment and exists as a community's present and future assets.

The questions of potential and sustainability of the environmental resource are governed by the role of resources being defined, whether they are for basic requirements (employment leading to income generation), or for regular or occasional use; condition of the resource base (in the case of land resources, soil fertility, stability, and productivity), depending upon climatic variations; and the scale of demand placed on the resource.

Given the direct intensive use of natural resources, especially of the farmlands and forests, and the equally intensive indirect use of livestock, as in Bhardeo, should the existing practices of resource use and poverty continue, local resources could become limited. The resources, particularly the tree resources generated by the biophysical management programmes, would not be protected in the long run. The community would also have to use up the newly established tree resources for survival.

Occasionally, development experts tend to assume that farmers, particularly those in the mountains, do not have planned strategies for facing local problems or managing local resources. This does not hold true everywhere. The Bhardeo community shows how indigenous techniques can be used in the management of natural resources, such as livestock, given limitations that are not usually felt, even in this part of the world. The limitations include a high rate of deforestation, a food deficit lasting over six months a year, damaged farming infrastructures (terraces and irrigation systems), and out-migration during the dry period of most adult males in search of incomes. This shows that, even in the most unfavourable conditions, the efforts of the local mountain communities reflect their best options when it comes to the management of scarce and vulnerable resources.

*Poverty and Development Issues*

The major problem in the mountains is not the food deficit, which can be solved by better production techniques, storage technologies, organised marketing, and efficient distribution of food and services, but the lack of **purchasing power**. Cash distribution in the form of wages, which are small, has not helped to improve the production base of individual households in the mountains. A little food security offered over the dry period, based on labour wages in kind, does not make up for the total economic deficit affecting the sustained development of Bhardeo and other areas in these mountains. The wages of a common labourer in Nepal, especially in the rural areas, are too low to make any significant contribution to the household even if all the economically active members of the household could find a place in wage-earning programmes.

There are cases of special programmes, like the food-for-work programme in Nepal, which do not address the issues of the poorest of the poor due to the scale (too low), nature (mostly in food products), mode (through middlemen), and timing (seasonal work opportunities) of the wage payments. In most of the food-for-work programmes, even cash transfers are not felt to be necessary. Cash transfers in small amounts are not a solution to the existing poverty. What is not debated is the fact that food security is a prerequisite to changes in the economic conditions.

A common approach to change is limited by the fact that the production and demand base of individual households differ within a community. Economists and environmentalists should work together towards the "self-reliant development of the poorest of the poor" at the local level to generate sufficient knowledge about the issues involved.

Given the ecological-economical and social constraints and the extremely limited economic fallback potential, the poor seem to lack an elaborate self-help and resource management system. Individuals cannot get far with small amounts of cash and limited labour but, in specialised production groups, they could progress, provided the activities generate income above the level of their basic food needs.

Since, in many cases, environment and resources can be one and the same in the mountain eco-system, for integrated development of mountain communities **the level of environmental poverty should also be considered by the planners as a parameter for investment and development.**

*Planning for Development*

A general concept and planning for development can be based on knowledge of the country, in general, whereas, to implement development policies, it becomes important to know the local field in particular in order to make pertinent decisions. **The environmental reality, e.g., resource management in the mountains, is that ultimately every decision and adjustment counts with regard to a single tree being planted, or a single metre of road being constructed, or a single off-farm employment opportunity being created.**

After all, the mountain community is an important factor in ultimately bringing about a managed environment so that favourable development conditions prevail. For mountain communities, a defined resource boundary of both physical and legal nature and guaranteed ownership of the farmlands and forests are important motivating factors. The political boundaries do not satisfy the resource management needs (as characterised by resource use at present), particularly the use of forests, of mountain communities like Bhardeo, nor have the newer institutions yet proved to be appropriate to guarantee rational management of natural resources, or for that matter the environment.

## Understanding Bhardeo

*Location*

Bhardeo is located almost in the centre of Lalitpur district's north-south transect (Figure 1) - in its mountainous part. It

# THREE DISTRICTS OF KATHMANDU, LALITPUR & BHAKTAPUR

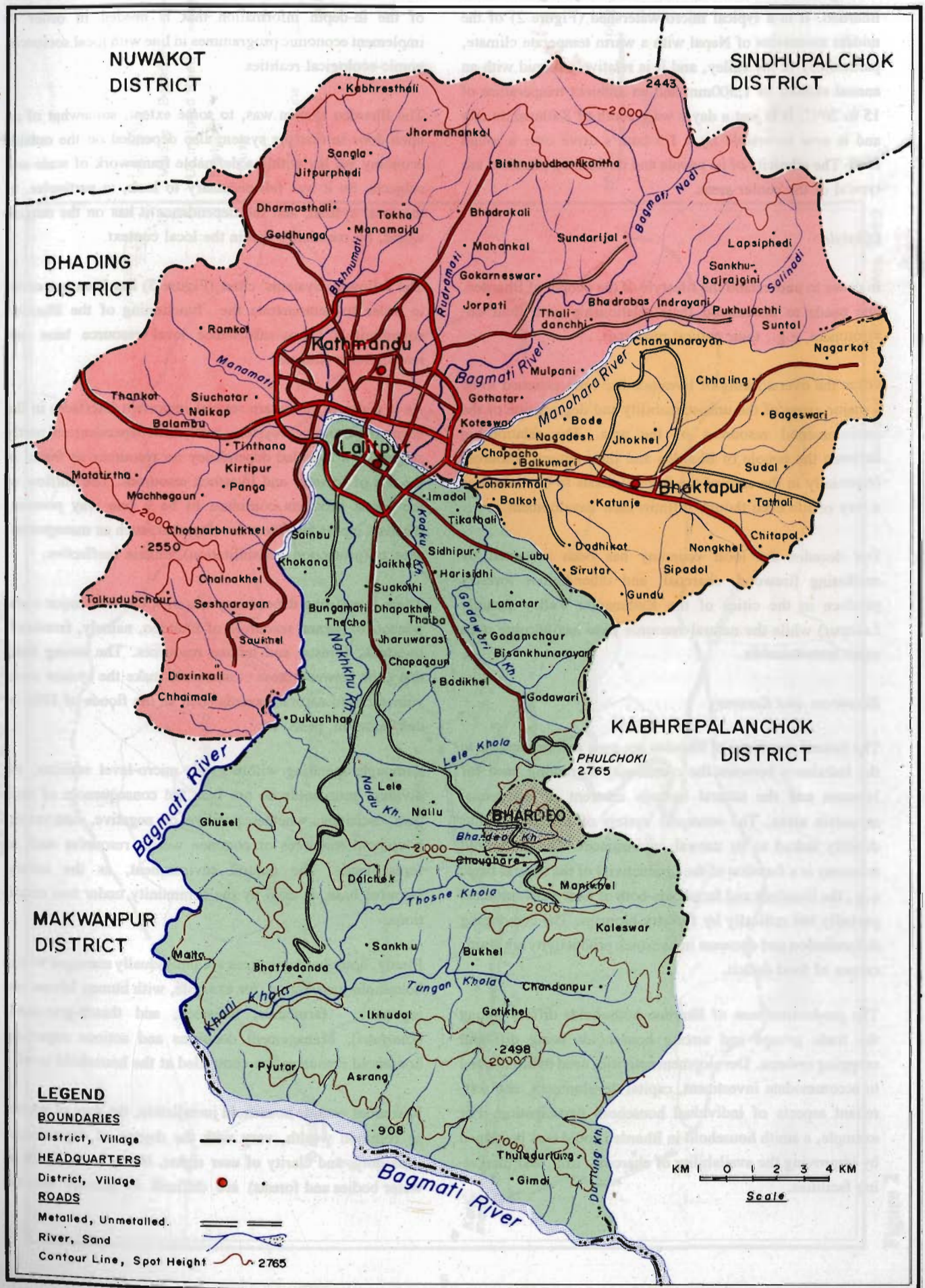



**Figure 1**

Prepared by ICIMOD June, 1989

lies within the Kathmandu Valley watershed. The last stream coming from the south to Kathmandu Valley originates from Bhardeo. It is a typical micro-watershed (Figure 2) of the middle mountains of Nepal with a warm temperate climate, particularly in the valley, and it is relatively humid with an annual rainfall of 1,500mm and an ambient temperature of 15 to 20°C. It is just a day's walk south of Kathmandu city and is now accessible by a 1.5 hour's drive over a rough road. The ethnicity of its people and its farming practices are typical of the cooler areas.

*Lifestyle*

In order to understand the lifestyle of the people of Bhardeo, one needs to understand their relationship with their environment, e.g., their natural resources.

Often the overstocking of livestock has been assumed to be a major cause of the unsustainability and degradation of the environmental resources of the area. The relationship between the people of Bhardeo and their natural resources (especially in the case of the forests) needs to be viewed as a way of life even though it limits their development.

For decades the local economy has been sustained by marketing firewood, charcoal, and other minor forestry produce in the cities of the Kathmandu Valley (mainly Lalitpur) while the natural resource base has become even more unsustainable.

*Resources and Economy*

The natural resources of Bhardeo are poor and susceptible to the imbalance between the community's growing need for biomass and the natural hazards inherent in monsoonal mountain areas. The economic system of Bhardeo is thus directly linked to its natural environment. The household economy is a function of the productivity of the natural base, e.g., the livestock and farmlands-both of which are sustained partially but critically by forestry biomass. The converging deforestation and decrease in livestock productivity are major causes of food deficit.

The production base of Bhardeo households differs among the trade groups and among households using different cropping systems. Development activities need to be adjusted to accommodate investment, capital development, and self-reliant aspects of individual household participation. For example, a smith household in Bhardeo could best be helped by improving the availability of charcoal, iron, and marketing facilities.

The difficulties faced by the local community and government institutions could also be attributed to a common lack of the in-depth information that is needed in order to implement economic programmes in line with local socioeconomic-ecological realities.

The Bhardeo system was, to some extent, somewhat of an open door in that the system also depended on the outside economy yet lay within a definable framework of scale and subjects. So it was felt necessary to look, in particular, at the local system, and the dependence it has on the outside world, by remaining within the local context.

The following systems' chart (Figure 3) has been presented in order to demonstrate the functioning of the Bhardeo community's below-subsistence level resource base and resource use patterns.

As is apparent, there are several important interfaces in the economic-ecological system, partly interdependent and partly subject to a lopsided dependency on resources as found in the use of forestry and livestock resources. The outflow of the forest products continues to be a one way process, whereas inputs for forest development, such as management aspects (protection, rehabilitation), remain ineffective.

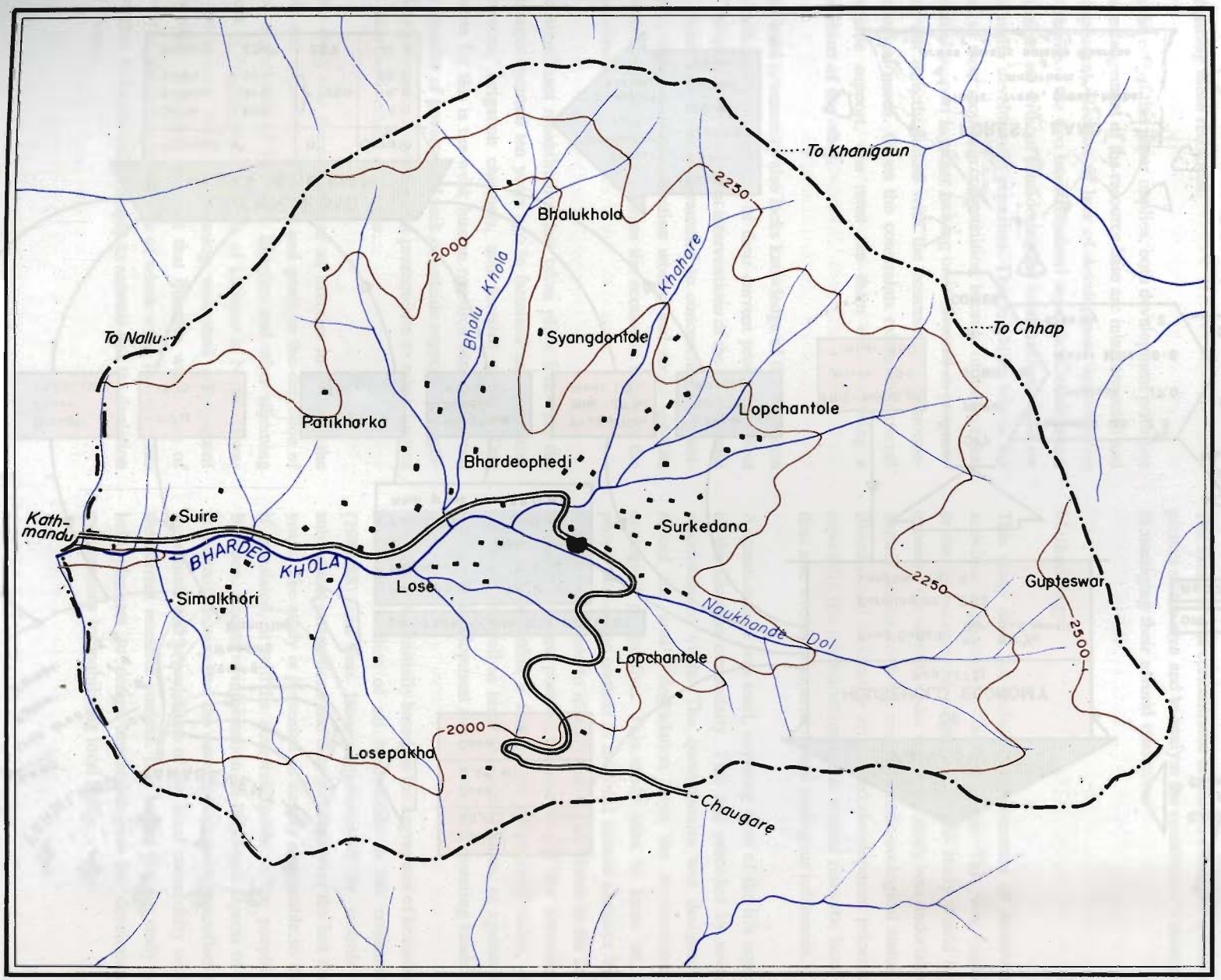
There is a strong dependency amongst the four major components of natural resources of Bhardeo, namely, farmland, livestock, forests, and human resources. The strong links that exist between these components make the system more vulnerable to natural hazards such as the floods of 1981 or deforestation, pests, etc.

Although operating within local, micro-level realities, individual households do not bear the consequences of their own decisions, whether positive or negative, concerning household resources or common wealth resources such as forest lands. The natural environment, as the natural resource base, is used by the community under two conditions.

Firstly, household resources are individually managed within household jurisdiction, for example, with human labour and ingenuity: farmlands, livestock, and thatch-grasslands (*kharbari*). Management decisions and actions regarding household resources are controlled at the household level.

Resources outside household jurisdiction, the uses of which, as common wealth, vary with the degree of dependence, proximity, and clarity of user rights, if any exist, (such as water bodies and forests) are difficult to manage because

# BHARDEO VILLAGE




LEGEND

Village Boundary

Un metalled Road

Footpath

House

River

Contour Line

Spot Height 2626

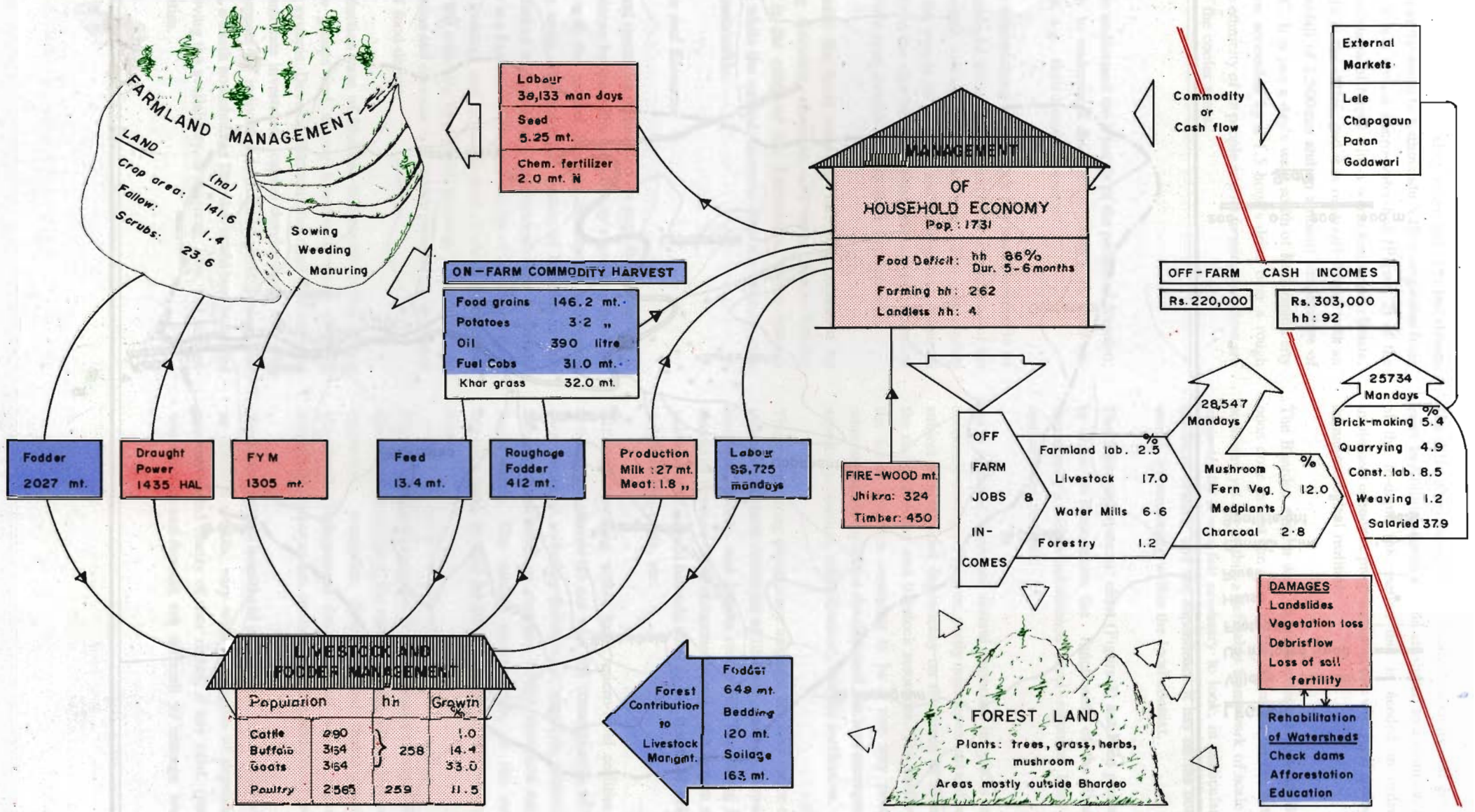
200 0 200 400 m.

Scale

Prepared by- ICIMOD May, 1989

**Figure 2**

# A SIMPLIFIED FLOW CHART OF RESOURCE MANAGEMENT IN BHARDEO VILLAGE 1987 - 88.




hh = house hold

**Figure 3**

community-level management decisions are non-existent in Bhardeo.

To the Bhardeo community, the natural environment (particularly forests, livestock, farmlands, and water) has been their sole asset and an integral part of their farming system. As the whole system of sustenance and development in Bhardeo depends upon the natural resource base, it is only natural to think of development priorities in terms of enhancing these resources.

As the title of this paper implies, both development priorities and management of the resource base are interconnected and independant. Because of lack of development opportunities in Bhardeo, the two have remained separate. Development priorities set without considering the local resource base are not really development priorities. This might be true in the case of most mountain communities, because of the fact that external support is either lacking or is invested in programmes not directly linked with the community's economic-ecological needs. Given the constraints related to external resource support, one must see them each as being a condition of the other.

The local community also lacks knowledge of the long-term impacts and consequences of their current problems. Most of the ongoing development interventions of the Government or donor NGOs are programmed to concentrate on plantation, engineering construction works, and social services which normally do not address the economic issues of the area directly.

No significant rehabilitation has taken place following the damages incurred ten years ago to farmland infrastructures (terraces, irrigation channels, and forested slopes). One reason for this is the weak human resource base; weakened by decades of poverty and lack of outside support. Strengthening of human resources is a prerequisite to rehabilitation of Bhardeo's natural resources.

This study was the outcome of an exercise in defining the role and importance of cattle and goats in the depletion of and degradation of forests in Bhardeo and other adjoining parts of the mountainous areas of Lalitpur in Nepal. It was a preliminary study to planning watershed management activities. It became apparent that Bhardeo was a case of poverty, the causes and effects of which were, however, too complex to be attributed simply to animals and the depletion of forests.

It is unfortunate that livestock, which are a crucial link in the mountain economic system, have often been regarded as a cause for environmental problems in mountain watersheds. Experience shows that low livestock productivity and deforestation cannot be attributed, in any particular area, to fodder exploitation alone. The nature of the problems in Bhardeo, for example, with its diminished forest resources, may be a case in point in which livestock could be assumed wrongly to be a causative factor in the deforestation process. The exercise was concentrated in Bhardeo to make a detailed picture of the area and to analyse the community's strategies in managing their natural resources.

**Methodology**

This study does not include the economics of investment activities suggested in Chapter Seven. This was omitted primarily because the scope of the case study would have exceeded the context under which the study was undertaken; namely, to establish the socioeconomic-ecological status of Bhardeo and to identify articulated development priorities, especially the rehabilitation of the natural resource base. It thus also avoids comparative and analogous references.

A questionnaire was used, covering most of the life aspects of the Bhardeo community. This was preceded by several reconnaisance visits. The questionnaire was designed to record the area's degradation from the socioeconomic-ecological perspective. This study tries to focus on the people within the context of the local natural resource base. Efforts were made to identify individuals down to the level of babies, where possible by name, and the network of relationships within a family, the educational status, and economic, as well as birth and death, status, as against the traditional development study method of counting heads.

This study was initially based on the aggregates of household level case studies of all households in the community (1987/88) and was later complemented by records of subsequent interactions and data gathered over the last three years. The study is presented as simply as possible so that, if translated, it will be comprehensible to the people of Bhardeo. Access to information on important aspects of the community is easy and the development priorities reflect the aspirations and articulations of the local community within the current resource context. It is hoped that the study will help planners to design methodologies for development programmes by mobilising local skills.

## 2. A Socioeconomic Profile of the Bhardeo Community

### Ethnicity and Culture

Bhardeo, located in an ecological 'niche' comprised of one single and clearly-defined watershed, has an ethnically diverse population but lacks the sophistication of a lowland population. Table 1 gives the ethnic breakdown of the Bhardeo population in 1988.

**Table 1: Ethnicity and Population of Bhardeo in April 1988**

| Ethnic Composition | Households # | Population | Family Size |
|---|---|---|---|
| *Tamang** | 212 (79.7%) | 1414 (81.7%) | 6.6 |
| *Newar* | 33 (12.4%) | 177 (10.2%) | 5.4 |
| *Chhetri* ** | 16 ( 6.0%) | 102 ( 5.9%) | 6.4 |
| *Sunwar/Sikari* | 2 ( 0.75%) | 15 ( 0.9%) | 7.5 |
| *Kami* (smith) | 2 ( 0.75%) | 17 ( 1.0%) | 8.5 |
| *Damai/Nagarchi* (tailor) | 1 ( 0.37%) | 6 ( 0.3%) | 6.0 |
| Total | 266 (100%) | 1731 (100%) 1510*** | 6.5 |

* includes a few Ghale households (a *Tamang* speaking non-*Tamang* community).

** Karki, Khadka, Ghimire-Khatri, Silwal-Khatri, Sijapati, K.C.

*** Census 1971

The ethnic diversity is narrow. Representation of functional and trade castes such as shoemakers and *Brahmin* priests (required by *Newar* and *Chhetri* families which account for 18.4% of the population) is interestingly missing. In 1955, a *Brahmin* family from Dhungkharka village in Kabre district migrated to this village and settled near the school house. After three or four years the family departed (Personal Communication 1988).

The *Chhetri* and *Newar* castes are the traditional clientele of the *Brahmin* caste. The traditional priests of these families came from Behbar (Kabre district) or Jyalungtar near Chapagaon in Lalitpur district and were called whenever their services were required. The new priest, therefore, could not build up a clientele.

Bhardeo still has a *Tamang* population of over 79 per cent, and this group does not normally accept the *Brahmin* caste as their priests. Although the *Tamang* generally tend to adhere to the Buddhist religion, in Bhardeo their culture is more Hindu, and *Baisakh Purne*[1], the Birthday of Lord Buddha, is celebrated in honour of Gupteswor (Lord Shiva in a cave), a native deity of Bhardeo. There are many other festivities that have little to do with Buddhism, but the important life cycle ceremonies are conducted according to the Lamaistic traditions of Buddhism.

*Age and Sex Distribution*

The population of Bhardeo was 1,731 at the end of April 1988 and, thus, 8.5 per cent less than in 1987 (New Era 1987). Of this total, women accounted for 47.9 per cent only. Seven per cent of the adult male population (>16 years) were unmarried. For a mountain community like Bhardeo, with its marginal farming conditions, the population was relatively large. Population growth in Bhardeo in 1987/88 was 4.7 per cent. Only three deaths were recorded during the same period.

Females formed a minority. Especially noteworthy was the imbalance in the economically-active population for which even a deficit of 44 women could be considered a serious constraint in terms of Bhardeo's economy. Although there were 364 married couples, including 10 in polygamous relationships, many households lacked working women, and this caused a severe strain on economically active family-members and also on the aged. It was found that, in the age group above 60 years, there was a notable lack of women.

There were 34 widows, mostly elderly, and unable to form a new household within the community. About 22 per cent

1. The New Years' first full moon

of married women had not given birth to a child. About 3.4 per cent of the married women had given birth to their first child before the age of 15 years, 67 per cent of the women had given birth to their first child between the ages of 16 and 30 years, and one half of them (33.5% of the married women) had given birth between the ages of 16 and 20 years. One woman gave birth just after her 45th birthday. Fifty per cent of married women were under 30 years of age. Eleven per cent of married women were older than their husbands.

*Population Density*

The population density per hectare of cultivated land (maize and paddy land) was twelve persons, which averages roughly 820 square metres of cultivated land per person. Population density per hectare of total land (grassland, fallow plots, and cultivated land) utilised by the local population exceeded 10 persons, a figure much higher than the national average (Livestock Strategy Vol.I).

Permanent out-migration was recorded from four households only. Of these, two households had left the area within the decade. Seasonal migration in search of off-farm income was regular and widespread and, according to the local people, tended to be prolonged each year provided opportunities existed.

## Income Opportunities and Economy

The people of neighbouring villages hesitated to let their girls marry Bhardeo boys because of the lack of economic security. The Bhardeo people themselves attribute this to poverty caused by over-dependance on fragile natural resources such as farmlands, livestock, and forests. Poverty challenges normal human relationships. Most meetings with outsiders and the finding of spouses take place during the most important events in the area, or during the two to three days of the *Baisakh Purne* festival. Many men approaching old age still look for a wife in order to carry on a normal farming life.

At the time of the study 86 per cent of the households in Bhardeo were experiencing some sort of food deficit, while over 50 per cent suffered food deficit for at least six months each year. There were several reasons for this: for example, low farm productivity, mainly due to the loss of soil fertility; catastrophic floods (especially in September 1981); and the fact that *de facto* landholdings were too small and that production of adequate amounts of food had become nearly impossible.

Celebration of many cultural festivals was becoming a major factor contributing to poverty. There were five annual cultural festivals, i.e., *Baisakh Purne, Saune Sankranti, Dasain, Tihar*, and *Maghe Sankranti*. Each one of them was celebrated as lavishly as possible. In addition, the *Bratabandha* (initiation ceremony for boys) and marriage of a young son and funeral and mourning ceremonies cost a fortune for a small farmer. Getting married had become an impossible proposition for many a young man. Traditionally, the first marriage, particularly of a young woman, was accompanied with all the due ceremonies, and these were very expensive for both brides and grooms.

The low volume of income accrued from off-farm sources could partly be due to the vulnerability stemming from the poverty of the community which left them open to exploitation by employers.

The farming system of Bhardeo, including off-farm activities within the area, generated only 85 per cent of the total income of the people. The rest had to come from external earnings. Yet, the total income available was roughly 60 per cent of what would be necessary for a subsistence household in Bhardeo. An average Bhardeo household with 6.5 family members required an income equivalent of over Rs 12,000 (US$ 300) for its basic necessities. Even the best of households could hardly meet the requisites of five to seven religious occasions, medicine, school, clothes, house repairs, and maintenance or travel with this income.

Given the prevailing situation, even if farm productivity increased by 100 per cent, it would still fail to provide the basic food requirements. Farmers had been compelled to migrate to urban areas during the winter dry period to supplement their incomes. There was already a noticeable trend of permanent out-migration. The lack of cooperative spirit made the situation worse. For example, after the implementation of the Lele-Chandanpur Road Project, which, according to the farmers, facilitated migration, it had become difficult to operate any usual, cooperative socioeconomic activity. Without cash, simple activities undertaken voluntarily or on a *parma* (labour sharing) basis, for private or community works, were hardly possible.

In Bhardeo, the economic situation had also affected the cultural life of the people. The people had reduced the frequency and changed the *modus operandi* of some cultural

and spiritual ceremonies. Certain ceremonies, e.g., *Satya-narayan Puja*, were held less frequently. These were held during the daytime, as against evening ceremonies, so that neighbours would attend in smaller numbers making the occasion less expensive.

### On-farm Incomes

Incomes from on-farm activities came from cultivating food grains, oil seeds, horticultural commodities, maize, wheat, millet, barley, potato, and mustard. A breakdown of total incomes from farmland is given in Table 2.

**Table 2: Cash Equivalent Incomes from Farm Produce in the Year 1987/88**

| Commodity | Quantity(MT) | Value (Rs) |
|---|---|---|
| Foodgrains | | |
| Maize | 134.832 | 707868 |
| Wheat | 9.769 | 39076 |
| Barley/millet | 0.710 | 2675 |
| Paddy | 0.168 | 810 |
| Soya/peas/beans | 0.732 | 6600 |
| Oilseed/mustard/ | 2.175 | 21750 |
| Potatoes | 3.248 | 16240 |
| Milk and meat | 28.8 | 273000 |
| | 180.434 | 1068019 |

* May 1988

In the case of mountain farming systems, it would be unrealistic to judge the income from farmlands on the basis of grain harvests only. Crop by-products, such as fodder, fuel materials, (maize cobs), and thatching materials (wheat straw), were regarded by the farming community as most valuable and without these by-products the farming community could not function properly. Considering the amount of maize stalks, husks, and cobs (over 400MT) harvested, the net income could be regarded as positive, particularly when calculating the cost and benefit of maize cultivation.

At prevailing market prices, total on-farmland income amounted to Rs 4,000 per household or 48 per cent of the total income. This was insufficient for even the basic food requirements of the community. The collection of firewood for household energy needs was worth over Rs 200,000 in monetary terms and was thus reflected in total incomes (Table 3). Since farming activities did not suffice to meet household requirements, farmers were compelled to look for off-farm opportunities for additional income.

**Table 3: Total Estimated Incomes of the Bhardeo Community**

| Incomes | Amount (Rs) | Ref. |
|---|---|---|
| Remittance sources | 303196 | (Table 5) |
| Off-farm internal sources | 503984 | (Table 4) |
| Farmland foodgrains | 757029 | (Table 2) |
| potatoes/oilseeds | 37990 | " |
| fuel cobs | 13950 | " |
| Forest fuelwood | 225000 | " |
| Milk and meat | 182742 | " |
| Total | 2023891 | |

### Off-farm Incomes

*Incomes within the Bhardeo Area*

The search for off-farm activities (livestock excluded) begins right after the main crop harvest, which is around October, and continues until just before the sowing season in April/ May, particularly during the dry season, when farm activities are minimal. The main objective of off-farm employment is to generate cash income for essential and diverse commodities, including food products. This, if possible, is given priority over wage labour in the Bhardeo area.

Most of the poor households in the mountains find the period from May to October an important time when they most need support. Food reserves from previous harvests finish in May, and the harvesting of new crops is three to five months away. The basic food requirements are unavailable, especially during the monsoon period, when opportunities for alternative employment are rare. It is also the beginning of the monsoon when all food-for-work programmes peter out.

Approximately 841 man months of employment (or 28,547 mandays) were available within the Bhardeo area. The incomes derived were needed for the wet season. Both male and female members of the household, above the age of 10 years, worked as labourers in the construction of local houses, drinking water projects, weaving, carpentry, and as farm and forest labourers.

*Agriculture-Forestry Labour*

Generally, agricultural labour was not treated as an off-farm activity. However, if the work involved fell outside one's own farmland, and if payment was involved, then this too was thought of as an off-farm activity. As far as the mode of payment was concerned, it was on the basis of cash and/ or kind and not on the basis of the labour exchange ratio.

The wages for adult women were about 20 per cent less than those for adult men. The cash wage rates of Rs 15 for adult men and Rs 12 for adult women were common. Youngsters between the age of six to ten years were normally paid in kind at the rate of 3.25kg of maize grain per day. Three households had found work in Bhardeo, more or less on a long-term basis, in the forest nursery. The wage rate for farmland-forestry labour in the Bhardeo area was low compared to wages earned by unskilled adult labourers for similar jobs in the Kathmandu Valley.

*Construction Labour*

Skilled or semi-skilled workers received Rs 50 to 60 as a normal daily wage. Labourers who collected stones for construction work received Rs 12 as daily wages or Rs 40 per cubic metre of stones delivered. The net savings in the area for the same period of time engaged in similar labour activities were higher than outside the area, because extra costs were involved in commuting to and from work.

*Trade and Commerce*

At least seven households were engaged in small retail businesses, and the volume of transactions involved was considered by them to be satisfactory. Commodities dealt in were cigarettes, salt, oil, soap, and kerosene. The incomes generated by the three occupational households (1 tailor and 2 blacksmith) were not considered as it was difficult to solicit information from them directly as written records were not maintained.

The collection of mushrooms, medicinal plants, and fern (*niuro*) provided opportunities for cash income, but these were insignificant considering the effort invested and the volume of monetary transactions involved. Compared to other forms of off-farm employment, this activity was readily available during the summer period. Even the much despised charcoal production and sale provided a respite for farmers. Cash income from this source was the highest.

The charcoal-making season starts in October and lasts throughout the whole dry season. For farmers who cannot find employment in Kathmandu Valley during this season, charcoal-making seems to be an alternative particularly for those with the required skills. Over 700 loads of charcoal, amounting to 35MT, are annually exported to the markets in urban areas of the Kathmandu Valley, primarily to Patan. About 35 per cent of the charcoal is exported just before October to help meet expenses for the *Dasain* celebrations and festivities. Another 30 per cent is exported before the celebration of *Baisakh Purne* in April.

From October/November onwards until May, the price of charcoal increases. This is also a period in which farmers are less motivated to accumulate cash, and they are thus less inclined to make charcoal, although the demand for charcoal is high. The price of charcoal generally goes down to one-third of the *Dasain* price (Oct/Nov)during the *Baisakh Purne* festivals when the season is warm. The farmer is hard pressed to sell charcoal for ready cash to finance the *Baisakh Purne* festival. This creates a small charcoal glut in the markets in nearby Chapagaon and Patan.

According to the local people, at 1988 prices, a load of 40 to 50kg of charcoal netted a profit of over Rs 300 and involved a total of four to five days' work. Up to 15 loads could be produced by one man per year, fetching Rs 150 to 700 per load, depending upon the species of tree. *Q. semecarpifolia, Rhododendron* sp., and *Lyonia* sp. are required by different smiths and artisans.

The marketing function was thus determined by the demand for charcoal (and this was determined mainly by artisans in the traditional markets of Lalitpur district) and also by the pressure to earn money to meet the cost of important cultural occasions. Such price determinants were favourable to buyers only and had a negative impact in the context of both the environment and the economy. The exploitation of common property for individual enrichment was also a negating factor.

Operating Grinding Mills. Income generated through water mills was normally in the form of commodities (4% of the milled commodity) i.e., in grain, valued at Rs 2,300 per annum per mill. The investment needed for a traditional grinding mill was over Rs 10,000, and this is quite high.

Livestock Products. Cash income from livestock and livestock products were considered to be off-farm income. Gross income, in terms of cash and kind from the sale of

animals and their products, was estimated to be Rs 1,365 per household in 1987/88. The total cash income for the community from sales to outside markets, such as Lele, Godavari, and Chapagaon, was over Rs 90,000, equivalent to 11 per cent of off-farm incomes. Ward three, with its 20 households, had no milk and only Rs 600 was earned by selling animals.

However, Bhardeo started selling milk to a collection centre in Lele. Between mid-July and mid-October a total of 3,390 litres was marketed. This was all from old buffalo stock.

The interesting fact is that in the month of *Srawan* (July/Aug) almost 79 per cent of the total milk produced by 19 households (95% of the milk-producing households) was marketed. In the next two months (Aug/Sept and Sept/Oct) the percentage of marketed milk decreased to 41.3 per cent (produced by 50% of the milk-producing households) and 32.3 per cent (produced by 35% of the milk-producing households) of the total milk produced.

The central Dairy Development Corporation failed to attract more farmers to participate in marketing milk. The main reason was the discrepancy between the actual income and the expected income (based on prices offered at the nearest private market), the former being lower by 40 per cent. The price paid per fat unit remained uniform throughout, whereas the checking of fat contents was not carried out properly at the milk collection point and people felt cheated. According to the farmers, the expected price normally correlated with the minimum estimated cost of production in the area and the prevailing prices in the local markets. The collection point was part of the central dairy area and hence lay outside the local pricing system. Table 4 indicates the scale of incomes involved in local off-farm activities.

**Table 4: Gross Off-farm Incomes - Bhardeo**

| Activities | % Households | Mandays | Income (Rs) |
|---|---|---|---|
| Agricultural labour | 3.4 | 1125 | 13050 |
| Forest labour | 1.5 | 562 | 624 |
| Mushrooms, *Niuro, Kafal* | 65.0 | 17885 | 62600 |
| Charcoal-making | 18.8 | 3500 | 297500 * |
| Livestock products | 29.7 | NA | 90088 |
| Water mills | 5.6 | 5475 | 34500 |
| Total | | 28547 | 503984 |

* Data are mostly based on informal talks and discussions with selected persons who volunteered the information. It was possible to solicit information directly from three households only.

Only one household each engaged in agricultural labour and forest labour and 6.4 per cent of the households engaged in livestock products produced sufficient food. The number of households making charcoal was declining, and this was mainly due to heavy penalties of up to Rs 3,500 and one year's imprisonment for the offence.

The three households of trade castes, such as tailors and blacksmiths, together had more than 150 man months of engagements. Two of them were landless. They earned their off-farm incomes at home. One blacksmith household in Ward No. One, for example, gave up two hectares of farmland in order to devote all its time to the traditional family profession. This household served two other villages apart from Bhardeo.

*Incomes Outside the Bhardeo Area*

The incomes generated within Bhardeo, although much below subsistence needs, accounted for about 85 per cent of community incomes. The below subsistence level economy of Bhardeo depended upon outside sources for food security. The farmers of Bhardeo generated cash income outside the area to supplement meagre incomes earned locally.

Any attempt to estimate gross incomes from off-farm activities outside the Bhardeo area was difficult because of the cost of living involvements that fell outside the periphery of the household unit economy. Savings in cash or kind were brought home-normally for the celebration of *Baisakh Purne*. An estimate of net savings was made only to establish the degree of support available from off-farm incomes earned outside the system.

The major source of cash income came from labour opportunities, both from within the country and outside, involving seasonal or permanent employment opportunities for 846 man months (or 25,734 mandays). Seventy-one per cent of these labour opportunities were in regular jobs.

*Seasonal Labour Opportunities*

Brick-making, weaving, carpentry, quarrying, and construction job opportunities were other important activities that played a significant role in the Bhardeo household economy.

Brick-making. Brick industries in the Kathmandu Valley provided opportunities for farmers to work as labourers during the dry season. According to the farmers, an able-bodied person could make up to 650 bricks a day, with a

normal labour wage of Rs 20 to 25 per day. About four per cent of the households in Bhardeo relied on this activity for their incomes, and the average net income saved per household was Rs 3,075 per year.

Weaving. This included handloom and carpet weaving. At least 1.5 per cent of the households, mainly women, had benefitted from this activity. During the period from November to April, people found employment in Patan and Kathmandu. Work was on a contractual basis and fetched a rate of rupees two to six per metre of cotton cloth woven, depending upon the quality of the textile material, pattern, and colour combinations required. Provisions for design, raw materials, and weaving machines were made by the employer. On average, in the year 1987/88, a net income of Rs 3,000 to 4,000 was earned by the households involved.

Quarrying. This was a difficult and risky job. Men mostly took advantage of the labour opportunities in the form of quarrying at Godavari or Lele. This was an important income source for Bhardeo farmers as it was near their homes. About 5.6 per cent of the households were seasonally engaged in this activity. The average net savings made during the dry season amounted to Rs 2,000 to 2,500 per household per man month.

Construction. Carpentry, house construction, and road building were the main construction activities in the area, and wage rates varied from Rs 15 for a young person to Rs 30 for an adult per day (males) in work other than road building. About 1.5 per cent of the households, mainly men, were engaged more or less professionally in this activity. The wage rate for carpenters was Rs 50 to 60 per day. The seasonal net saving varied from Rs 500 to 3,000 per year. Able-bodied people were found working as wage labourers on the Lele-Chandanpur Road project which passed through the area. Payment was normally made in kind, generally in the form of food. This hardly qualified as an off-farm activity, at a time when even local labour sharing was being replaced by cash wages.

The amount of food that each labourer received for the work was found to be insufficient to feed his family. So, apart from households that had more than one person employed at the site, it was virtually impossible to earn enough to support a family. It thus seemed ironical that, despite the relief that this project was to bring to the local population, in reality, it became an untenable process, firstly because of the loss of farmland for road construction and, secondly, because the payment in "kind" was inadequate for basic survival. The monsoons (by bringing the construction work to a halt) further defeated the purpose of this food-for-work programme in a chronic food deficit area.

As the construction sites moved further away from Bhardeo, jobs became more difficult to find for the local people. Labour transport facilities were rare. On-site shelter was not available for overnight stays. The wages received for work in the form of food were far too inadequate to enable even a single labourer to take any home, so work on sites had become less attractive, even in a food deficit area like Bhardeo.

*Regular Employment and Service Opportunities*

Some local people worked in other parts of the country in salaried jobs, some even went to foreign countries in search of employment. These migrations provided more or less regular job opportunities and were an important source of income, higher in scale, and of longer duration. At least 52 men in 15 per cent of the households were engaged in services in the police and army and as gatekeepers. Ninety per cent of these households suffered food deficits. These jobs provided an average net saving of about Rs 3,500 per annum.

Table 5 illustrates the scale and degree of households depending upon remittance incomes.

**Table 5: Net Remittance Incomes - Bhardeo**

| Activities | % Households | Mandays | Income (Rs) |
|---|---|---|---|
| Construction | 10.5 | 3500 | 44.432 |
| Brick-making | 4.1 | 2114 | 28.374 |
| Weaving | 1.5 | 395 | 6.500 |
| Stone quarrying | 5.6 | 1475 | 25.490 |
| Salaried jobs | 15.0 | 18250 | 198.400 |
| Total | | 25734 | 303.196 |

*Importance of Off-farm Incomes for Bhardeo*

Of the total labour, 13.8 per cent travelled outside Bhardeo for work. Total incomes from off-farm sources amounted to an average of about Rs 3,000 per household or 40 per cent of the total income. The income was used to purchase chemical fertiliser, clothes, salt, oil, kerosene, tobacco, and

food for a four to five month lean period, especially during the monsoon. Although only 56 per cent of the total labour available was used productively, a labour constraint was felt during the critical planting season (which starts in February when many menfolk are still out of the area working in off-farm jobs).

Figure 4 illustrates the contribution of different local and external sources to off-farm incomes in Bhardeo. Although milk was not marketed, apart from in a few instances, cash income from livestock and livestock products contributed 40 per cent of the off-farm sources within the local area. The incomes from permanent salaried jobs outside Bhardeo contributed the largest amount (65%) in cash.

**Socioeconomic Conditions**

On-farm and off-farm incomes were major determinants of the socioeconomic status of the community in Bhardeo. Table 3 illustrates the estimated total direct and indirect incomes of the Bhardeo community from their diverse mini-sources.

The income of the Bhardeo community was around Rs 2 million or less than US$ 30 per capita (1988 population: 1,731). From the study, it became clear that the combined incomes from the two sources hardly met the normal requirements of the local community. Even staple food requirements were hard to meet.

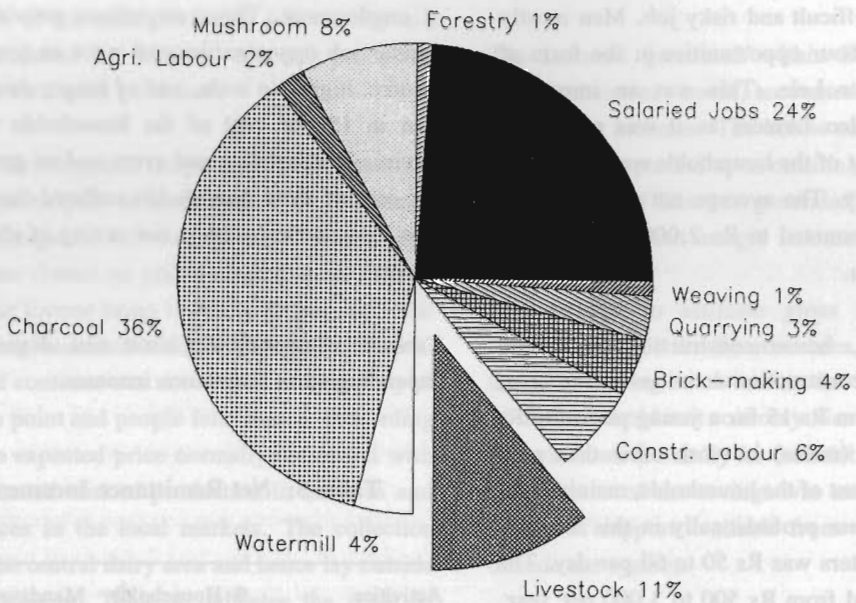



**Figure 4: Cash Incomes from Off-farm Sources Including Livestock Keeping**

*Food Situation*

When one single crop or a single commodity, such as maize, becomes the most important staple food, the production of and demand for the commodity determines the level of poverty or the level of affluence of individual households. The quantity of seed input and the yield of maize seem to have direct implications on the economic status of households. Maize, which is also the most important staple food of the Bhardeo people, was taken as a parameter for measuring household food security from farmlands in Bhardeo. Figure 5 classifies households on the basis of maize harvests.

Only 13.5 per cent of the households could claim to have sufficient income from cultivation. About four per cent of the households had to rely upon minor crops in order to be self-sufficient. Income from maize cultivation was not equally distributed throughout the community as households were of diverse character, differentiated by hierarchial levels of production that reflected household economies.

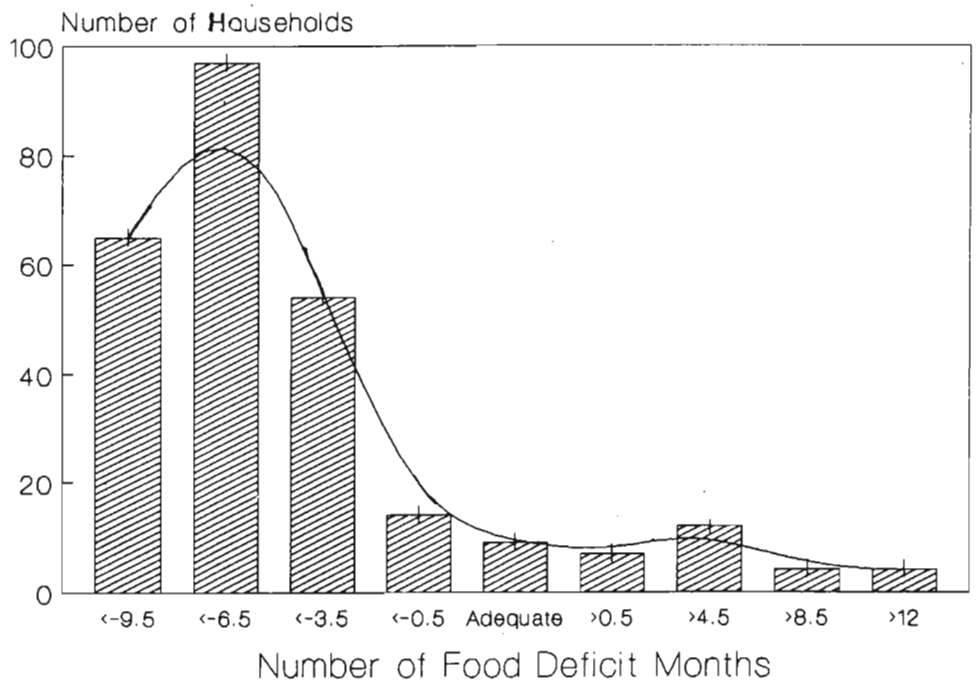



**Figure 5: Household Food Situation Based on Farmland Produce in Bhardeo**

Around ten per cent of the households cultivated less than 0.15 ha, while only 18.3 per cent cultivated more than one hectare of land. Considering the amount of seed inputs required to harvest a minimum amount of maize for a household of 6.5 family members, almost 90 per cent of the households did not have sufficient land to cultivate. Thus they were not able to produce a sufficient quantity of maize to feed the family. The daily requirement of three meals for an adult unit in Bhardeo was approximately 1.5 *mana* or 0.4kg of maize.

On an average, each household produced only about 507kg of maize, equivalent to about 210 grammes of maize per day per person. Consumption needs were estimated to be around 150kg of maize per person, or 975kg per family of 6.5, or 259MT of maize for the community per annum. Roughly 10 per cent of the maize harvested was used as livestock feed. The estimated food deficit might run over half a metric tonne of maize per household per year. The total deficit of staple food was around 130MT per year.

Only a few households managed to grow sufficient food on their land. Such farmers either had a large area of land to cultivate and/or had better lands and/or applied a comparatively higher amount of farmyard manure per unit of land. The surplus food generated by a few households did not seem to improve the food distribution to needy households within the community significantly, although any excess produced was used locally as labour wages and reflected in the off-farm incomes of recipient households from farmland labour, construction, etc within Bhardeo (see Tables 3 and 5).

The per capita maize available in 1988 was only about 78kg. In 1971, it could have been around 110kg. Given the farming conditions (with 140ha of maize land available prior to the devastating rains in September 1981), the 1971 productivity could have been 1.4MT/ha or ca 15 per cent higher than in 1988, an amount of 130kg per capita per year of maize. The deficit of staple food was still over 13 per cent. On average there was a food deficit for over five months a year throughout the community. The Bhardeo community must have been facing food shortages for many years, forcing them, in subsequent years, to use all the resources at their disposal.

# 3. Dynamics of Resource Utilisation

Two basic issues of development in Bhardeo lie both within and outside its system. On the one hand, the deterioration of the local natural resource base and, on the other, the weak national institutional response to the community's needs are both crucial for sustainable development. The resulting constraint is naturally felt by local institutions, hindering development and hindering the expansion of necessary services and economic opportunities. The potential of Bhardeo's human resources has not been fully utilised. Their varied skills, however, are intact.

## Human Resources

*Family Size and Economically Active Members (EAM)*

In 1988, the average household size was 6.5 persons. The family size was not uniform among different ethnic households. The Newar community, which accounted for 12.4 per cent of the total households, had fewer family members (<5.4 members/household), well below the average.

More than eight per cent of the households had three family members and 4.5 per cent had only two members. There was a single person household too. Most households were headed by males, but 11 per cent of the households were headed by females by virtue of age and seniority.

Most Bhardeo households (67%) contained members from two generations and in 29 per cent of the households there were members from three generations. Approximately four per cent of the families had members from a single generation.

Although 11 per cent of boys and girls between the ages of 11 and 15 years were actively contributing to household work, such as fetching water, fodder, dry leaves, or firewood from the forests, or taking care of livestock, the estimation of labour availability was carried out, however, on the basis of adults between 16 to 60 years. This was not quite relevant to Bhardeo's condition because, due to a degraded resource base, the community had to engage every able family member. Over 52 per cent of the population (916 persons) was economically active and, on average, households contained 3.44 EAM, of which at least one EAM had to be totally occupied with the livestock. The balance of 2.44 EAM had to cope with on-farm and off-farm activities. The dependency ratio of children under 10 years of age and older people above 60 years (4% of the population) upon the economically active population was over 55, which means that almost every second man had to feed and clothe another person.

*Education and Skills*

The literacy rate for Bhardeo was 40 per cent. Twenty-nine per cent of the population above the age of five years could generally either read only or read and write Nepali.

The number of persons that attended school, either wholly or partially, or who were still in primary school, was 160. Of these, 55 per cent were at primary school level. Seventy-one persons were in middle and high school while 415 were self taught, barely literate. There was only one local school that ran primary and middle level classes. The local school also catered to the neighbouring villages. Bhardeo shared only 38 per cent of the population of the school. Two boys had completed high school and one of them was attending college.

The local people were skilled and experienced in making charcoal from different kinds of wood. There were masons and carpenters, basket-makers, ghee-makers, and collectors of wild mushrooms, ferns, vegetables, and medicinal plants. Their invaluable skills were yet to be used for development.

*Women's Literacy*

The overall literacy rate for women (including girls above the age of five) was only 15.6 per cent. In both the primary and middle level classes, girls from Bhardeo formed a small minority of 11.7 per cent. The total attendance of girls in school was 22 per cent in the primary and 44 per cent in the middle level. There had been a rise in the enrolment of girls

by 16 per cent during the previous academic year. Only one lady above the age of 60 could read a simple Nepali text and only one girl above the age of 16 had completed lower secondary schooling. This is an important parameter for planning local development support activities, especially those involving women.

About 38 per cent of the households had no family member above the age of 10 years with either formal or informal education. It is significant to note, however, that, in three per cent of mixed households (containing both male and female members), the only literate members were female. These women could read or, in some cases, were able to write simple Nepali.

### Farmland Resource Management

In 1978/79 the Land Resources' Mapping Project (LRMP) estimates (based on aerial photographs) showed that the area of Bhardeo was around 806ha of which 34 per cent (274.3 ha) was privately owned and cultivated, whereas the Cadastral Survey of 2022 (1965/66) recorded that Bhardeo had 265.78ha of private land. However, the District Revenue Office Record of 1991 showed a normal revenue area of only 175.6ha for which a regular revenue of Rs 3007.94 was paid. According to information collected from individual households, in April 1988 the total area of land under private use was less than the 1991 figure (166ha, Table 6, Figure 6). The percentage of households cultivating one or several types of land was 98.5.

**Table 6: Types of Private Land Used in Bhardeo - 1988**

| | Area (ha) | User (#) | HH (7) (%) | Holding Size (ha) | (range) |
|---|---|---|---|---|---|
| Shrubland | 23.64 | 150 | 56.4 | 0.157 | 250sq.m.-1ha* |
| Fallowland | 1.42 | 7 | 2.6 | 0.202 | 250sq.m.-0.55ha |
| Rainfed *Bari* | 140.31 | 262 | 98.5 | 0.535 | 500sq.m.-3ha |
| Flatland | 1.27 | 7 | 2.6 | 0.181 | 375sq.m.-0.1ha |
| Total | 166.64 | | | | |

* (four households < 125sq.m.)

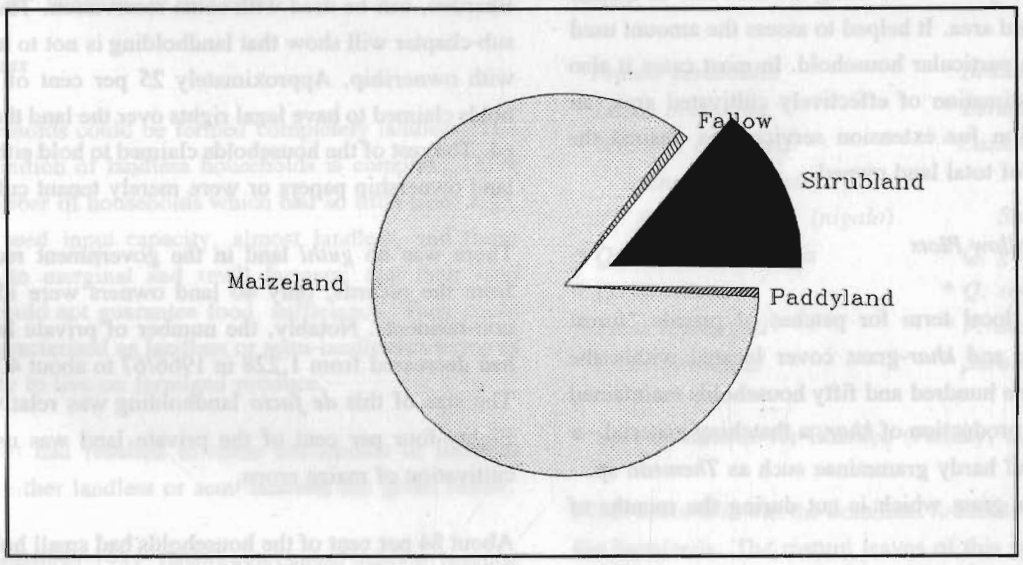



**Figure 6: Types of Landholding in the Year 1987/88**

The people had recorded flat land, used for growing rice, as 1.27ha, whereas the Revenue Office had a record of 1.6ha a loss of 0.33ha. Of the land resources under private use, about 56 per cent of the households maintained larger or smaller plots of *kharbari*[2]. Seven households owned plots of fallow land (normally under grass) which remained untilled for a variety of reasons; either the land was unproductive for cereal growing, or it was too steep for regular use, or it was

2. *Kharbari* is a category of land normally maintained for the production of thatch grass (*khar*). A kind of silvipastoral (more of a shrubland) type of land in local use for diverse resources such as grasses, non-fruit trees, etc.

prone to slides, or there was a need for grassland. The area of land under paddy cultivation was small. Only seven households owned rice cropped land in this mountain valley. The most important type of land in Bhardeo was dry land, especially suitable for the cultivation of maize, millet, unirrigated wheat, and barley crops.

*Rainfed Land (Maize Cropped)*

About 141ha of rainfed land, which accounted for 84.2 per cent of the total land under various uses, or 99 per cent of the land under cultivation, was assumed to be available for the cultivation of maize. In fact an amount of 3.829MT of maize seed was sown in 1988 which would have sufficed, according to local seed rate practices[3], for approximately 118ha only.

The difference of about 22ha (15%) of cultivable land or equivalent area, for 714kg of maize seed inputs, was yet to be reclaimed from the land damaged by the 1981 floods. Initially over 30ha of farmland were estimated to have been damaged.

There were two objectives for using the seed rate as a basis for estimating land area. It helped to assess the amount used for farming by a particular household. In most cases it also facilitated the estimation of effectively cultivated area, an important criterion for extension services, as against the general concept of total land owned.

*Kharbari and Fallow Plots*

*Kharbari* is the local term for patches of private "forest land" under tree and *khar*-grass cover located within the farming area. One hundred and fifty households maintained *kharbari* for the production of *khar*, a thatching material - a mixture of several hardy gramminae such as *Themeda* sp. - and some fodder grass which is cut during the months of July/August.

Land lying fallow (*bajho*) amounted to about one and a half hectares. The private lands which were being used as shrubland had potential for improvement.

*Flat Terraces*

Located in the temperate region, rice farming in Bhardeo was carried out on the valley floor, a narrow ecological area above 1,700masl which is a fairly marginal area for rice. There was a tendency to turn the valley into flat terraces by levelling off the slopes. The productivity of this new land, however, was generally low.

Land areas earmarked as being suitable for rice cultivation were small. Earlier, only 1.27ha of flat land on the valley bottom were used for paddy cultivation. Since the 1981 floods, over 80 per cent of the paddy land still needed to be cleared of debris and boulders. Only about 0.15ha was cultivated by three households. One local variety of rice (*bhaimale*) seemed to have adapted to the harsh conditions of Bhardeo.

Many flat paddy terraces along the valley, and semi-terraced maize fields on the hill slopes, were destroyed in 1981 during the catastrophic floods. The people had made several efforts to convert this damaged land into acceptable gradients and to increase the soil fertility, but with little success.

**Land Tenure**

The ownership of cultivated land was tenuous for the majority of households. The term landholding, in the case of Bhardeo, can be used with some reservation. The following sub-chapter will show that landholding is not to be confused with ownership. Approximately 25 per cent of the households claimed to have legal rights over the land they cultivated. The rest of the households claimed to hold either dubious land ownership papers or were merely tenant cultivators.

There was no *guthi* land in the government records, but, from the records, only 40 land owners were identified as non-residents. Notably, the number of private land owners had decreased from 1,228 in 1966/67 to about 400 in 1991. The size of this *de facto* landholding was relatively small. Eighty-four per cent of the private land was used for the cultivation of maize crops.

About 84 per cent of the households had small holdings with an area below one hectare. Ownership data, therefore, did not give a realistic picture of effectively cultivated lands. This was the major reason for considering the total seed input applied by local farmers to the summer crops of maize and rice as a basis for estimating land area.

Table 7 illustrates the situation in the year 1987/88 and clearly shows that the majority (55%) of the population cultivated less than 0.5ha per farming household.

3. This is around four *mana* of maize seed (equivalent to 1.625kg) per *ropani* or about 32.5kg/ha of maize cropped land.

**Table 7: *De Facto* Landholding Situation in Bhardeo**

| | Size of Land (ha) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | <0.25 | <0.5 | <0.75 | <1.0 | <1.25 | >1.25 | Landless | Total |
| HH | 56 | 88 | 54 | 21 | 14 | 29 | 4 | 266 |
| % | 21 | 33 | 20.3 | 8.0 | 5.2 | 10.9 | 1.5 | 100 |

The size of individual farms was small in Bhardeo with over 80 per cent of tenant households cultivating, on average, an area less than one hectare of land. The size of such holdings ranged from 0.05 to 4.75ha.

Following the floods in 1981, two households had "officially" encroached upon forested slopes for cultivation and had constructed dwelling huts with the tacit agreement of the community and of government officials. One house-hold lost its cultivation rights to the Agricultural Development Bank of Nepal because of bankruptcy. One household, having lost all its cultivable lands during the floods of 1981, was still trying to reclaim them and had successfully reclaimed an area of about one hectare only. These cases have not been registered as "landless" in this study.

*Landlessness*

Four households could be termed completely landless. The whole definition of landless households is complex. There were a number of households which had so little land; e.g., very low seed input capacity, almost landless, and those belonging to marginal and small farmers; that their land earnings could not guarantee food sufficiency. They could also be characterised as landless or semi-landless in terms of their ability to live on farmland produce.

Factors that had resulted in some households in Bhardeo becoming either landless or semi-landless are given below.

i. In September 1981, flashfloods caused many to become landless or semi-landless within hours. Ms. Bisnumaya Rambo and Thuli Maya of Ward Nos. two and five lost all their cultivable land. Ms. Rambo was later allotted a plot of forest land within her ward.

ii. A number of tenant farmers were cultivating land owned by others and were paying a high rent, exploited by so called *de jure* landlords. Not even a receipt for rent paid was given to the tillers. They were not even recognised as tenants and could be evicted any time if the owner so wished.

iii. The construction of the 50km Lele-Chandanpur road under the Food-for-Work Programme, undertaken on the assumption that people would voluntarily contribute their lands for the road, created a new category of partially landless households. One household, for example, had become virtually landless having lost most of its productive land to the road. No compensation had been paid for the land.

*Tree Planting and Cropping System*

Tree Plants in Use. Some farmers had planted fruit trees, but more for ornamental purposes than for fruit production. Most of the trees were yet to bear fruit. One or two households had started small orchards with 20 to 30 fruit trees of oranges, apples, limes, plums, peaches, guavas, pomeloes, walnuts, and pomegranates.

Out of 4,855 or more fodder trees on the farmlands and *kharbari*, approximately 50 per cent yielded fodder materials totalling 120MT of leaves, while the other half were expected to yield in another five years' time. Saplings of certain species were in demand. They have been listed below.

*Prunus cerasoides*
* *Litsea polyantha*
* *Michelia champaka*
*Alnus nepalensis*
*Arundinaria* sp. (*nigalo*)
* *Quercus lanuginosa*
* *Q. lamellosa*
* *Ficus roxburghii*
* *Ficus nemoralis*
* *Brassaiopsis hainla*
* *Betula alnoides*
* *Castanopsis tribuloides*
*Salix babylonica*
* *Q. glauca*
* *Q. semecarpifolia*
* *F. auriculata*
* *Sarauia nepalensis*

* Species suitable for Bhardeo (Panday, 1982 and 1991).

*Ficus nemoralis* was the dominant fodder tree species around the farmlands. The mature leaves of this species can be fed to livestock until mid-June, following the season of forest species such as *Quercus glauca*. The species of *Alnus nepalensis* was planted more for the protection of steep farmlands. Apart from fodder trees there was a local demand for the fodder grasses which were planted on terrace benches. There had been no previous experience of grass planting in Bhardeo, except for local species of *babiyo* (*Pollinidium angustifolia*), etc. Vegetable production, however, was virtually non-existent during the months of April and May. Only one or two households maintained kitchen gardens. Potatoes and radishes were grown by most

farmers. Remarkably, the farmers grew major hill crops in a locally-developed, elaborate cropping pattern.

## Cropping System

The climate of Bhardeo is temperate, starting from the warm temperate area of the valley bottom (1,750m) in the west, to cooler temperate areas (2,600m) in the east. Infrequent snowfall, which occurs during the months of December and January, limits the cropping pattern to some extent.

Bhardeo is agriculturally an upland area where the climate permits only one major crop. Maize is a major summer crop, together with potatoes and beans. The growing period for maize is longer on the upper slopes (by one to two months) than in the valley bottom.

Growing potato crops during winter, as practised in Kathmandu Valley, is out of the question in Bhardeo. Potatoes are grown in summer (May-August) as practised at high altitudes. Maintaining seed potatoes (during the winter for summer crops) is not a common practice here (Table 8), apart from in the case of a few households. Part of the potato harvest (harvest leftovers) is left in the soil to provide seeds for the next season.

Potatoes perform surprisingly well even as an inter-crop. The autumn months are good for mustard crops and, in the winter and spring months, wheat and barley grow on middle slopes and in the valley bottom (Figure 7). Potato productivity was generally low but farmers claimed that, in terms of the low input required, production could be considered to be high.

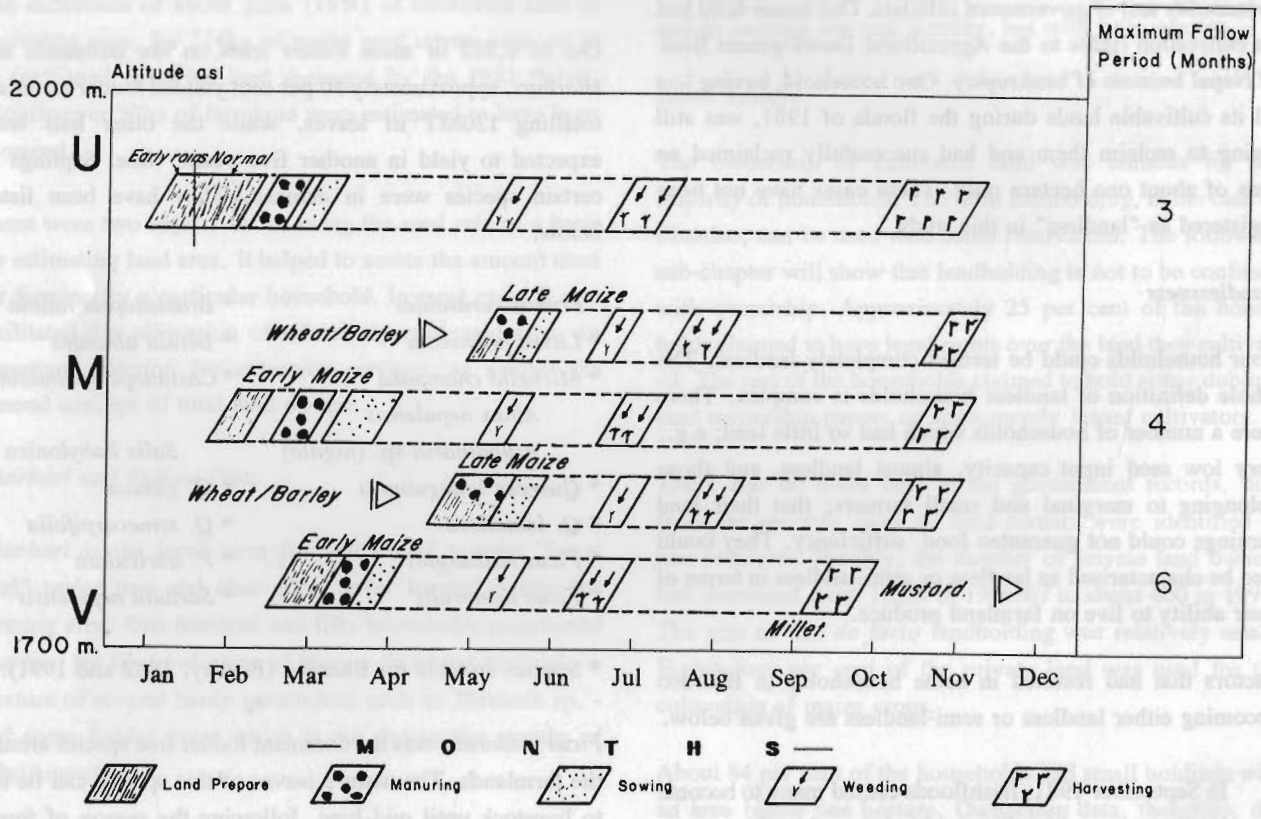



**Figure 7: Cropping Pattern of Bhardeo**

## Farm Inputs

### *Seed Inputs*

Table 8 gives an idea of seed inputs required by households for normal crop yields in the Bhardeo area.

The required quantity of maize seed (a major crop) indirectly reflects the economic conditions of individual households (Figure 8).

A normal household in Bhardeo with 6.5 members in the family requires 30 to 35kg of maize seed inputs to guarantee minimum staple grain production.

**Table 8: Seed Inputs of Crops - 1988**

| Crops | Seed Inputs (kg) | Cost (Rs) | Households (%) |
|---|---|---|---|
| Maize | 3829 | 22974 | 98.5 |
| Wheat | 1047 | 4188 | 40.9 |
| Mustard | 240 | 2400 | 12.4 |
| Barley | 54 | 204 | 4.1 |
| Beans | 22.5 | 130 | 6.4 |
| Soyabeans | 14.5 | 49 | 3.0 |
| Millet | 13 | 41 | 1.5 |
| Paddy | 8.5 | 1.1 | - |
| Potatoes | ? | 11.6 | - |
| Peas | ? | 0.75 | - |

Only 6.7 per cent of the households could afford adequate seed inputs. In an area where there is as chronic a food deficit as in Bhardeo, maintaining even an adequate quantity of seeds becomes a difficult proposition. Many farmers in Bhardeo could not afford to store seeds at home and had therefore to rely on the market for seeds. This influenced seed prices in Bhardeo and the surrounding areas, ultimately affecting grain prices during the late dry season. The price of maize seeds was normally higher than the maize grain used for food. The rise in price was continuous from October (Rs 3.10/kg or Rs 10/*pathi*) through April (Rs 5.50/kg or Rs 18/*pathi*).

*Labour*

Farming in Bhardeo can be considered to be labour efficient. This is due to the fact that there is one major summer crop which forms part of a multi-species, inter-cropping system with potatoes and beans, planted as inter-crops, followed by millet as a relay crop. The major labour force required was for maize cultivation, at the rate of 7.8 mandays per kilogramme of seed input, from the soil preparation (inclusive of 0.6 mandays [bullock driver]) to harvesting.

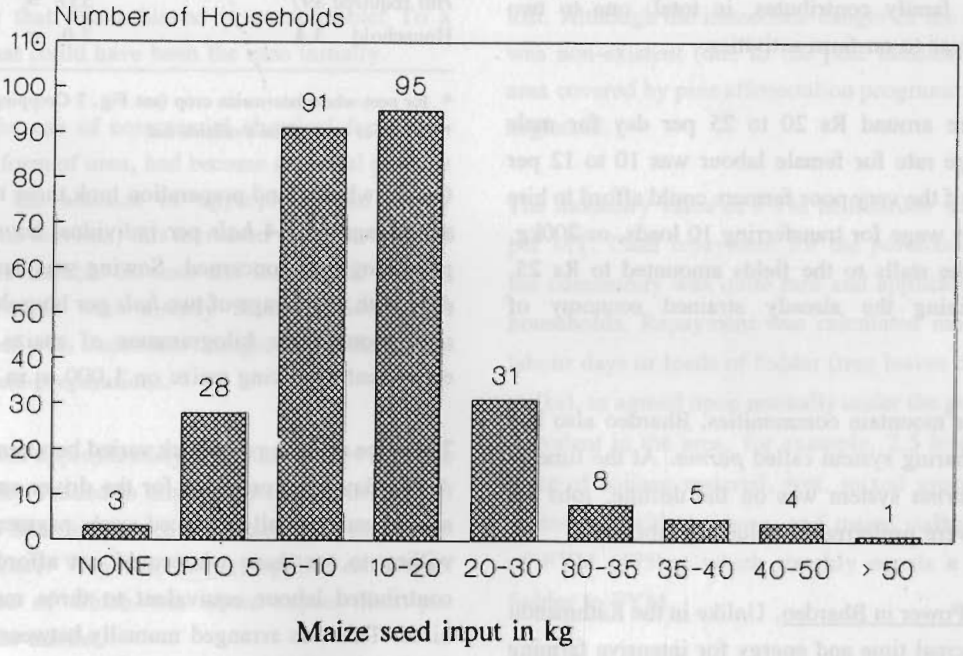



**Figure 8: Classification of Households by Maize Seed Inputs**

About 18 per cent of the labour was required only for the transfer of farmyard manure (FYM) from the stalls to the fields and spreading operations were mostly carried out in the months of February and March. Table 9 illustrates the labour distribution needed for maize crop production.

Similarly, the labour requirements[4] for minor crops such as wheat and barley might be slightly lower than for maize cultivation. Minor crops were normally of a single species. The labour requirement was roughly equivalent to four man months for maize (plus inter/intra crops) cultivation-which

4. Based on the Bhardeo system, a factor of 0.75 is to be multiplied by a kilogramme of seed of minor crops (wheat, barley, mustard, peas) to calculate the labour requirements for minor crops.

**Table 9: Farm Labour Requirements for Cultivation of Major and Minor Crops (mandays)**

| For maize crop only | Mandays/kg seed | Crops | Mandays |
|---|---|---|---|
| Field Preparation 1 | 1.8 | Maize | 29866 |
| Manuring/fertilising 2 | 1.5 | Wheat | 6449 |
| Sowing 3 | 0.9 | Barley | 399 |
| Weeding 1st | 1.5 | Mustard | 1201 |
| Hoeing 2nd | 1.0 | Millet | 85 |
| Harvesting | 1.1 | Peas/beans | 111 |
| Total | 7.8 | | 38111 |

1) 0.4 mandays bullock driver, 2) 0.3 mandays for transportation, 3) 0.2 mandays bullock driver

takes place only during the months of January to early October. The total farm labour requirement was approximately 1,254 man months or 20.5 per cent of the labour used. This would imply that each economically active member of the family contributes, in total, one to two months labour/year to on-farm activities.

Wage rates were around Rs 20 to 25 per day for male labour. The wage rate for female labour was 10 to 12 per cent less. None of the very poor farmers could afford to hire labour. The daily wage for transferring 10 loads, or 200kg, of FYM from the stalls to the fields amounted to Rs 25, further constraining the already strained economy of Bhardeo.

Like many other mountain communities, Bhardeo also had a local labour-sharing system called *parma*. At the time of the study the *parma* system was on the decline, jobs for monetary gain were preferred to voluntary labour.

Use of Draught Power in Bhardeo. Unlike in the Kathmandu Valley, the principal time and energy for intensive farming operations, such as soil preparation and sowing, were conducted through the use of draught power. The demand for draught power was high from the month of December to the beginning of May when most of the able-bodied persons were away in search of job opportunities. Plantation on farmlands located at higher altitudes took place in February, whereas in the lower areas of the valley it was carried out in March.

The draught power requirement per household was more or less positively related to the amount of seed input involved and the land area brought under cultivation. The average use of 0.37 *hal*[5] per kilogramme of maize seed sown was the norm. Altogether such operations last for a total of about 40 days per annum (Table 10). The main draught power requirement was for soil preparation. The use of draught power was not equally intensive in all the wards.

**Table 10: Seasonal Requirement of Draught Power (*Hal*) in Bhardeo**

| Area | Soil preparation | Sowing operations | |
|---|---|---|---|
| Upper | December | February | (2nd half) |
| Middle | January | March | (1st week) |
| Valley | February | March | (2nd half) |
| | April* | May | (1st week)* |
| *Hal* required | 897 | 537 = | 1434** |
| Household | 3.4 | 2.0 = | 5.4 |

* for post-wheat late-maize crop (see Fig. 7 Cropping Pattern)
** 87.5 per cent of the available *hal*

On the whole, land preparation took three to four days with an average of 3.4 *hals* per individual household, as far as ploughing was concerned. Sowing was carried out in two days with an average of two *hals* per household. A *hal* could sow about three kilogrammes of maize seed per day, equivalent to sowing maize on 1,000 sq.m. of land.

The price of hiring a bullock varied between Rs 40 to Rs 70. A mid-day meal provided for the driver and fodder for the animal substantially reduced cash payment. Those either willing to, or those who could not afford cash payment, contributed labour equivalent to three mandays to a *hal* hired. This was arranged mutually between bullock owners and the households hiring the *hal*.

*Soil Nutrients*

The quantity of soil nutrients, particularly N, P, and K, for the level of productivity found in Bhardeo, was agronomically acceptable. Per hectare use of N, P, and K in 1988 was estimated to be around 94, 115, and 325kg, respective-

5. *Hal* = one day's labour from a pair of oxen with a driver = *Hali*.

ly. However, taking into consideration the slope gradients of the cultivated land, nutrient inputs, even at this level, were insufficient to prevent soil erosion and loss of soil nutrients.

Of the total amount of nitrogen fertiliser available, 18.5 per cent (2.08MT N) was available in the form of urea (46% N). People in Bhardeo used commercial chemical fertilisers increasingly, partly due to the heavy loss of soil, on one hand, and partly due to aggressive agricultural information that promoted the use of commercial chemical fertilisers. The local people had only recently become aware of the negative implications of commercial fertilisers, and previously chemical fertilisers had been assumed to have only positive qualities.

Commercial Chemical Fertiliser. In Bhardeo, the use of chemical fertilisers increased following the catastrophic floods of 1981 as an instant response to the sudden and massive loss of farmlands and soils, causing drastic reduction in cultivable land. Since no food aid was supplied from outside Bhardeo, the pressure to increase productivity was strong. Whether that was achieved is questionable! To a certain degree that could have been the case initially.

As elsewhere, the use of commercial chemical fertilisers, especially in the form of urea, had become a normal practice in Bhardeo. In the absence of appropriate and timely technical extension services, this increased use of urea could lead to more unfavourable harvests and loss of soil fertility in the future. People were already facing difficulties in breaking soil clods with traditional draught power during the post-monsoon field preparations.

A sack of urea cost approximately Rs 200 to 215 (4% of the household income). Added to this was the additional cost of transportation to Bhardeo, which amounted to about Rs 40 per sack of fertiliser. Very few farmers applied muriate of potash, the price of which was about rupees four per kilogramme in the market.

In 1987/88, 34 per cent of the farming households in Bhardeo used 90.5 sacks of urea worth Rs 22,000; equivalent to almost three per cent of their cash incomes from the farmlands. Because of dwindling forestry resources the use of chemical fertilisers was expected to rise substantially. For longer term maintenance of soil fertility, organic fertilisers such as FYM play a crucial role.

Farmyard Manure (FYM). The total FYM available for the area was about 1,305MT which is equivalent to 11MT of FYM/ha of effectively cultivated land. The estimated NPK content of the local FYM was estimated to be around 9.1, 13.7, and 38.7MT respectively (LAC 1991).

The amount of FYM in terms of its value in NPK contents should not be the way the importance of FYM is judged. It is the organic nature of FYM that is essential for the soil structure, plant nutrition, and water absorption capacity of the soil. Some households had started collecting pine needles as bedding materials from the degraded pine plantations of Ward numbers one, two, and six, and this would have ultimately ended up as FYM. About 4.9 per cent of the farm households in Bhardeo did not keep any ruminant animals and about 1.9 per cent did not have any animals (including poultry) at all. These households faced the problem of insufficient soil nutrients and organic matter for their farmlands. The amount of FYM available for Bhardeo soils would have been adequate for most households, provided the gradient of cultivated lands had been good and soil erosion at a minimum. However, this had not been the case since the 1981 floods when terraces were damaged and topsoil was lost. Although the immediate danger of the Ph level sinking was non-existent (due to the pine needles), the increasing area covered by pine afforestation programmes should not be neglected.

The monetary value of FYM in Bhardeo was around Rs 70 per MT. Cash repayment for the purchase of FYM within the community was quite rare and applicable to only a few households. Repayment was calculated mostly in terms of labour days or loads of fodder (tree leaves or loads of maize stalks), as agreed upon mutually under the general conditions prevalent in the area, for example, 2.5 loads of fodder (ca 60kg of soilage material, wet, mixed green-cut during the monsoon, fodder grasses, and maize stalks) to seven loads of FYM (175kg) which roughly equals a ratio of 1:3 of fodder to FYM.

Cost of Maize Production. The cost of maize production, which can be relatively high in the mountains, was about Rs 5.45 per kilogramme of maize. But the effective cost to the farmer in terms of cash expenditure for chemical fertilisers and tax payment was less than Rs 0.40, and this covered the cost of seed, chemical fertilisers, and land taxes. Table 11 shows the cost-benefit ratio of maize production in Bhardeo. This is inclusive of the cost for the production of potatoes, beans, and soyabeans, as they form part of the maize cultivation system.

**Table 11: Cost of Maize Cultivation in Bhardeo**

| | Rs | Rate |
|---|---|---|
| Labour | 597324 | Rs 20/day wage |
| Manure | 104385 | Rs 2/bag of 25 kg |
| Land tax | 3330 | Rs 20/ha |
| Urea fertiliser | 21700 | Rs 4.80/kg urea |
| Seed | 22974 | Rs 4/kg |
| Total Cost | 734463 | |

## Major Contributions of Farmland Resources

*Foodgrains*

A major contribution to the local farmland resources came from maize which provided 89 per cent of the foodstuff produced.

More than 60 per cent of the households harvested less than 0.5MT of maize grains (Figure 9). The second important, crop was wheat which accounted for 6.4 per cent of the total crop production, whereas rice was insignificant.

*Fodder and Feed*

As elsewhere in the mountains, the farmlands in Bhardeo were used for producing fodder in numerous ways. The contribution from the local farmland, of fodder and bedding materials for the management of livestock, was substantial. It was estimated to be around 80 per cent of the total fodder from multiple sources.

The maize grain used as feed accounted for approximately 11 per cent (13.4MT) of the total maize production. For ruminant animals it was used as *khole* (salt and flour boiled in water), especially for feeding draught animals.

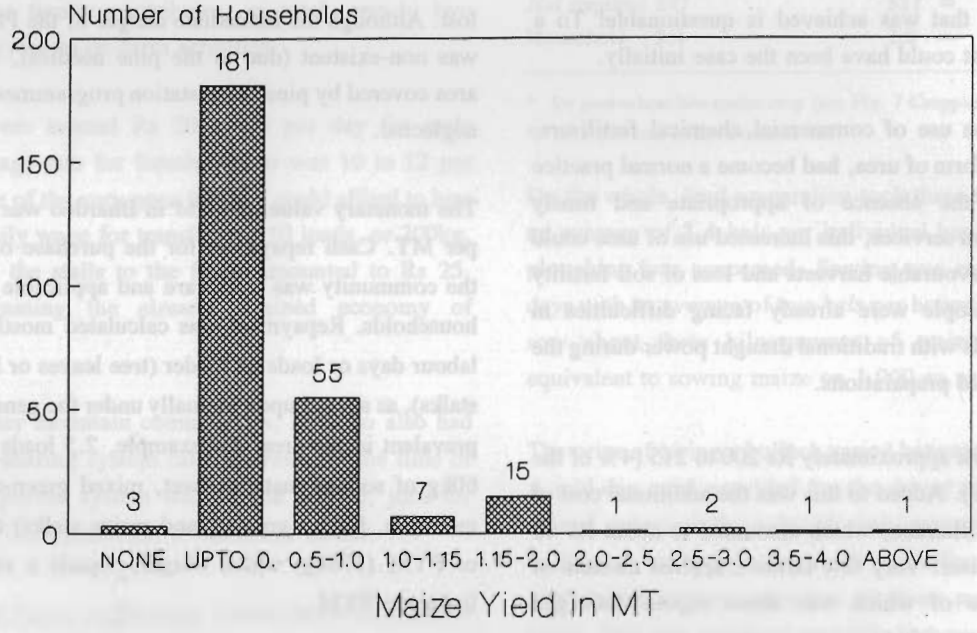



**Figure 9: Classification of Households by Maize Yields**

The crop residues were used as fodder during the dry season. This was an important investment on the part of the community as it still faced a food deficit for six months of the year. Mustard straw (*gatte)*, paddy straw (*paral*), wheat straw (*chhwali*), and millet straw (*nal*) were also fed to ruminants, although the low volume of production was hardly significant. Miscellaneous plants collected as green soilage fodder from the farmlands amounted to about two to three basket-loads per household daily and they were collected mainly during the monsoon season.

*Cooking Fuel and other Materials*

The most important by-products of maize are dry cobs which are used solely for cooking and heating purposes. About 31MT of cobs were available in Bhardeo as fuel. It was estimated that an increase in maize production by 10 per cent could increase the availability of cobs by over three metric tonnes, which was equivalent to the firewood needs of two households in Bhardeo or five households in warmer areas.

The farmlands also produced *babiyo* (*Pollinidium angustifolia*) and *amriso* (*Thysanolaena maxima*) plants which are used for making brooms. About 25 per cent of the households produced their own *amriso* plants whereas *babiyo* was not available in abundance, although the area was suitable for both species. A bush of *amriso* or *babiyo* of average size could be used for making four brooms. They were planted for home use only and were sufficient to meet local household needs.

## Production and Productivity

Maize, which is the principal crop and requires the most inputs, was the staple foodgrain for the local community and had an output rate of 134.8MT with a productivity rate of about 1.2 metric tonnes per hectare. The quantity of foodgrains (including soyabeans, beans, and peas) produced in the area exceeded 146MT. Potato production was about 3.2MT and mustard output amounted to about 2.1MT or equivalent to 390 litres of edible oil. Minor crops, such as wheat, provided only a month's supply of staple food. Winter wheat was becoming the most important crop after maize. Over 40 per cent of the households cultivated wheat.

There was a potential to produce a further 25MT on an estimated area of 22ha of farmland which were still under debris cover. The average yield of maize was much below the national average and even 35 per cent below the district's average yield of 1.836MT/ha (Agricultural Census 1977).

Even if productivity had increased by 10 to 15 per cent (as it had in 1971 according to the farmers), the total production would have been only around 185MT of maize grains from a total of 140ha, giving, on average, a per capita maize availability of about 120kg per year, implying the existence of a serious food deficit even before the catastrophic soil loss and damage to the farmlands in the 1981 floods.

## Livestock Resource Management

Livestock are one of the most important resources of mountain communities. They contribute directly and indirectly to nutrition and rare cash incomes, draught power, and crucial farmland nutrients. Regular investments in terms of fodder and forage materials, building of stalls, and addition of new animals to augment or replace the stock were important elements in the Bhardeo farming system.

*Ruminants*

As of mid-1988, there were 1,892 ruminants in Bhardeo (Table 12)

**Table 12: Ruminant Animals from 253 Households in Bhardeo**

| Ruminant Animals | | # | (%) | Household Owners | Holdings |
|---|---|---|---|---|---|
| Buffaloes | | | | | |
| | male | 70 | (63) | 59 | |
| | female | 294 | (60) | 180 | |
| | | 364 | (44) | | 1.4 |
| Cattle | | | | | |
| | oxen | 21 | (29) | 63 | |
| | cow | 169 | (29) | 91 | |
| | | 190 | (29) | | 1.1 |
| Goats | | | | | |
| | males | 314 | (67) | 155 | |
| | female | 924 | (28) | 220 | |
| | | 1238 | (38) | | 4.7 |
| Total | | 1892 | (38) | 253 | |

(Figures in parenthesis = % very young animals)

What is worth noting from Table 12 is the complete absence of pigs and sheep, an uncommon occurrance in a temperate area like Bhardeo. Pig rearing might not be viable in Bhardeo, where food shortages are chronic, and the absence of sheep might be mainly due to the lack of proper pastures.

The mean size of the ruminant holdings of the community varied between 5.97 to 8.37 head per household. Taking into consideration the special dependence of Bhardeo ruminants on forestry biomass for fodder and bedding materials, particularly over the dry periods, an unconventional basis for the estimation of Livestock Units (LSU) was used. The farmers in Bhardeo had an interesting practice: the amount of fresh leaves of *Quercus* sp. fed to the adult ruminants varied according to the type of adult animal. On this basis, it was found that approximately 10kg were fed to buffaloes, eight to cattle, and three to goats daily during the dry season. Hence, to calculate livestock units for the area, an adult buffalo was considered as one LSU, adult cattle 0.8 LSU, and an adult goat 0.3 LSU. This was applicable only

for Bhardeo. Fifty per cent of the population in any one of the above categories were counted as one-half adult units. The estimated total number of Bhardeo LSU was around 700.

*Poultry*

The importance, especially of male birds, is high due to their sacrificial value in the area where five big religious festivals are held every year. Poultry holdings were rather small: 9.64 birds per household among 266 Bhardeo households (Table 13).

**Table 13: Poultry Population in Bhardeo**

| Population | F | M | Chicks | Total No. of Birds |
|---|---|---|---|---|
| Total | 742 | 608 | 1215 | 2565 |
| Households | 246 | 205 | 173 | 255 |

Most of the birds belonged to the local breed (*sakini*) which is not very productive (in the context of egg laying). However, the quality of the meat (in terms of taste) from this breed is much better than that from new breeds of poultry such as the Leghorn, New Hampshire, Astrolop, or their crossbreeds. In fact, the price of *sakini* meat was higher, even in Bhardeo, than the meat from new breeds.

In Bhardeo, normally, *sakini* hens followed three cycles of egg production per year, laying 10 to 20 days in each cycle. This hardly gave 50 eggs per annum. *Sakini* hens lay eggs for about three years or more.

*Resource Dynamics*

The animal population was quite dynamic, as shown in Table 14.

The mortality of ruminant animals for the year 1987/88 was over 80 LSU, worth at least Rs 200 to 300 thousand at the prevailing market price. Mortality of the poultry, found to be highest amongst young chicks, was registered as incurring a loss of Rs 25 to 30 thousand. These figures imply substantial loss of animal resources for farmers who are compelled to search for off-farm opportunities for half the year. The factors that were responsible for the high mortality rate are given below.

**Table 14: Animal Population Changes in 1987/88**

| Population | Buffalo | Cattle | Goats | Poultry |
|---|---|---|---|---|
| April 1987 | 318 | 288 | 930 | 2299 |
| Mortality | 41 | 33 | 139 | 814 |
| Sales | 17 | 1 | 40 | 56 |
| Consumption | 1 | - | 4 | 770 |
| Purchases | 25 | 8 | 21 | 212 |
| Birth | 80 | 28 | 470 | 1694 |
| Population April 1988 | 364 (44.2%) | 290 (29.6%) | 1238 (37.9%) | 2565 (47.4%) |
| Growth 1987/88 | + 14.4% | + <1% | + 33 % | + 11.5% |

(Figures in parentheses = percentage of young animals)

The lack of adequate veterinary services and absence of breeding and brooding programmes were among these factors in terms of lack of inputs. Other factors included the existence of predators such as wild cats, leopards, and jackals which posed a danger to poultry, goats, and cattle, and sometimes also to young buffaloes. The situation could become acutely self-defeating, as the people protect and promote the forests, thereby providing a sanctuary for the carnivores. At the time of the study the danger lay within the farmlands, especially during the monsoon.

The loss of livestock had an important bearing on the production of soil nutrients and direct cash income. In Bhardeo seventeen per cent of the cash incomes were generated by livestock. Much of the loss could have been avoided with the help of timely veterinary services. Despite these losses affecting consumption or sales, the livestock population growth recorded for the year 1987/8 was 14 per cent for buffaloes, 33 per cent for goats, and 11 per cent for poultry, not only through birth but also through purchases from outside. According to the people, the ruminant holdings were one-third of what they had been two decades previously.

**Resource Productivity**

Although the transformation of crop residues, other roughage, and forestry biomass into FYM by ruminants is a crucial contribution of livestock in maintaining soil fertility, the economic contribution of livestock to the local farming system as a source of milk, meat, manure, and draught power is a very important one also.

*Milk Production*

The total milk produced in 1987/88 was about 27,000 litres (equivalent to Rs 189,830 calculated at 6% fat content) and was used for home consumption with few exceptions.

Eighty-eight per cent of the milk was from buffaloes. Of the total number of female buffaloes and cows only 18 per cent of the female buffaloes and five per cent of the cows were lactating.

The milk yield of the animals rises gradually in the early monsoon and is monitored by local farmers. The early stage of lactation and rising milk yield is known as *laino*, the second stage is known as *thito* phase and it indicates the yield constancy, and the last stage or *tharo* phase indicates the drying up of lactation.

The maximum daily performance of a buffalo was 2.3 litres of milk (1987/88). April to June were lean months and milk production was low. This period is also one of stress for farmers due to the scarcity of fresh, green materials for feed. Figure 10 illustrates the annual milk production in Bhardeo.

In terms of the average percentage of lactating animals and the amount of average daily milk yield per animal, buffaloes performed the best. The minimum percentage of lactating buffaloes for the 1987/88 period was over two per cent, while that of cows was just over 0.5 per cent.

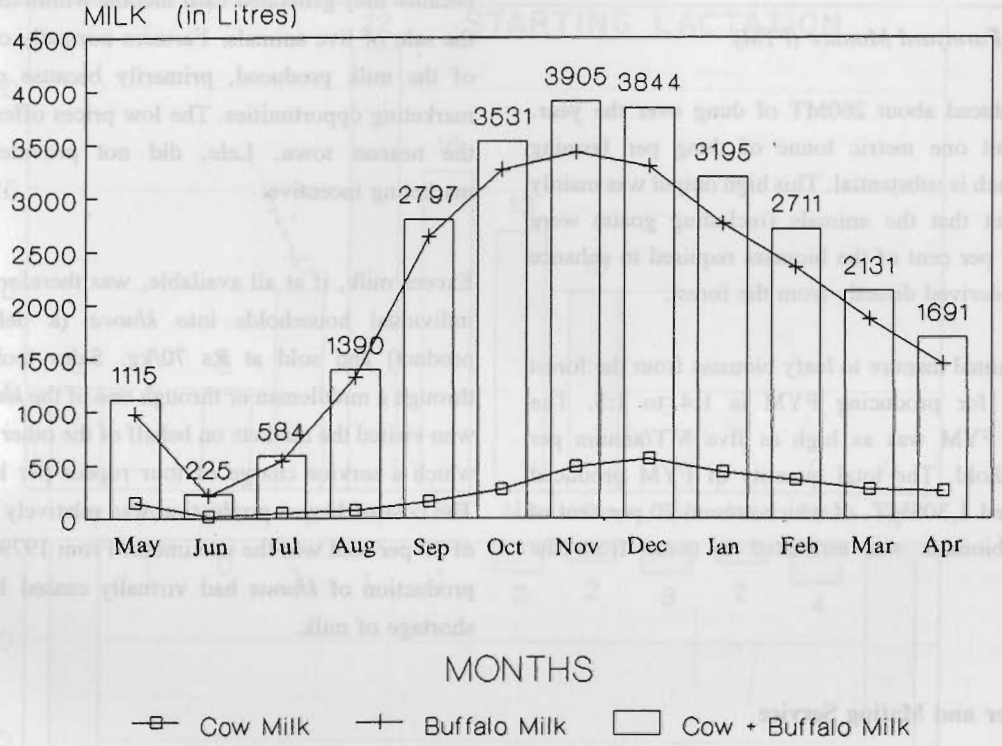



**Figure 10: Monthly Milk Production**

The lactation season begins in May which is normally the hottest and a relatively dry month. A maximum percentage of buffaloes (22%) lactate in *Poush* and *Magh* (December-February) during a relatively dry period and the highest percentage of cows lactating in any one month is eight per cent (Table 15).

*Meat Production*

Only one buffalo and four goats (hardly 1.04 LSU) were slaughtered in 1987/88 for home consumption. This was equivalent to roughly one kilogramme of meat per household per year or Rs 8,000 worth of meat.

**Table 15: Lactation Differences between Cows and Buffaloes**

| Animals | % Animals Lactating | Daily Milk Yield | Fat Content % |
|---|---|---|---|
| Buffaloes : | 15% | 1.5 litre | 6 |
| Cows : | 4-5% | 1.0 litre | NA |

The Bhardeo people are poultry eaters. About 770 birds were killed for home consumption, equivalent to 1,500kg of meat (equivalent to Rs 75,000). On the average 5.6kg of poultry was consumed by each household per annum. The per capita meat consumption was only 11 per cent of the national average (Livestock Strategy Vol.I).

*Production of Farmyard Manure (FYM)*

Livestock produced about 260MT of dung over the year. This was about one metric tonne of dung per farming household, which is substantial. This high output was mainly due to the fact that the animals (including goats) were stalled. Eighty per cent of the biomass required to enhance the FYM was derived directly from the forest.

The ratio of animal manure to leafy biomass from the forest (*patkar/sottar*) for producing FYM is 1:4 to 1:5. The production of FYM was as high as five MT/annum per farming household. The total quantity of FYM produced annually reached 1,305MT, of which around 20 per cent of the required biomass was estimated to come from the farmlands.

**Draught Power and Mating Service**

Oxen were maintained for draught power as well as for normal mating services for which owners charged Rs 10 to 30 per conception. Buffalo bulls cost more than cattle bulls.

The draught power requirement and its generation within the area were very high. It was found that 41 pairs of bullocks were used for draught power within the households of the community, generating about 1,640 *hal* (bullock days) of which 87 per cent were utilised (Table 10). The draught power available was adequate for both types of labour used, namely, soil preparation and sowing operations. Seasonal imports of draught power were not observed.

Soil preparation which takes place in the beginning of the dry period, between November and December, requires approximately double the draught power required for sowing operations. However, during the labour season (November to May), bullock pairs are maintained on a special diet. At the time of the study, fodder shortages were not critical. Animal feed was supplemented with eggs at intervals of seven to 14 days, and about 500 grammes of maize flour were provided daily with salt water. Roughage fodder was provided *ad lib*.

**Livestock as a Source of Direct Incomes**

Livestock were important to the local farming system because they generated cash income within the area through the sale of live animals. Farmers normally consumed most of the milk produced, primarily because of the lack of marketing opportunities. The low prices offered for milk in the nearest town, Lele, did not provide an adequate marketing incentive.

Excess milk, if at all available, was therefore processed in individual households into *khuwa* (a dehydrated milk product) and sold at Rs 70/kg. Sales took place either through a middleman or through one of the *khuwa* producers who visited the markets on behalf of the other producers (for which a service charge of four rupees per kg was made). The cost of *khuwa* production was relatively high. A profit of 20 per cent was the maximum. From 1979, however, the production of *khuwa* had virtually ceased because of the shortage of milk.

**Qualitative Indicators of Livestock Resource Management**

*Visual Condition of Livestock*

The visual condition of the animals indicated a low level of nutrition. The general practices of rearing and maintenance were satisfactory. The animals were normally stall fed. The condition of the stalls was good and the structures protected the animals against rain, cold, heat, and carnivores. The farmers kept almost all animals inside the stalls overnight to avoid the cold. In the coldest period, animals were allowed outside for a maximum of three days.

*Planning for Lactation and Milk Production*

The management strategies for sustaining ruminant livestock resources showed how a small mountain community, without outside intervention, had tried to maximise gain and minimise risks. The farmers were aware of how high temperatures, fodder availability, and labour availability affected the quality and quantity of milk production. Eighty-two per cent of the lactation started during July and lasted until November when the fodder was relatively adequate. Twenty-five per cent of all lactation took place between August and September. The lactation period coincided with seven to eight months of monsoon flush when tree fodder was available for the lactating animals. The highest amount of milk was produced from July (heavy rains) to March (relatively cooler). Fifty-seven per cent of the milk produced in Bhardeo was thus available between July and November.

The three months from April to June were lean months when milk production was at its lowest, when dependence on forest fodder resources increased, and when there were labour shortages. The labour shortage was aggravated by the winter harvesting season, the first hoeing of early maize, and the sowing of late maize which coincided with frequent dry spells.

Servicing and lactation should be timed to avoid lactation during periods of the year when fodder availability is low and milk conservation and the marketing of milk products becomes difficult. Figure 11 illustrates the Bhardeo farmers' planning skills as far as livestock management is concerned.

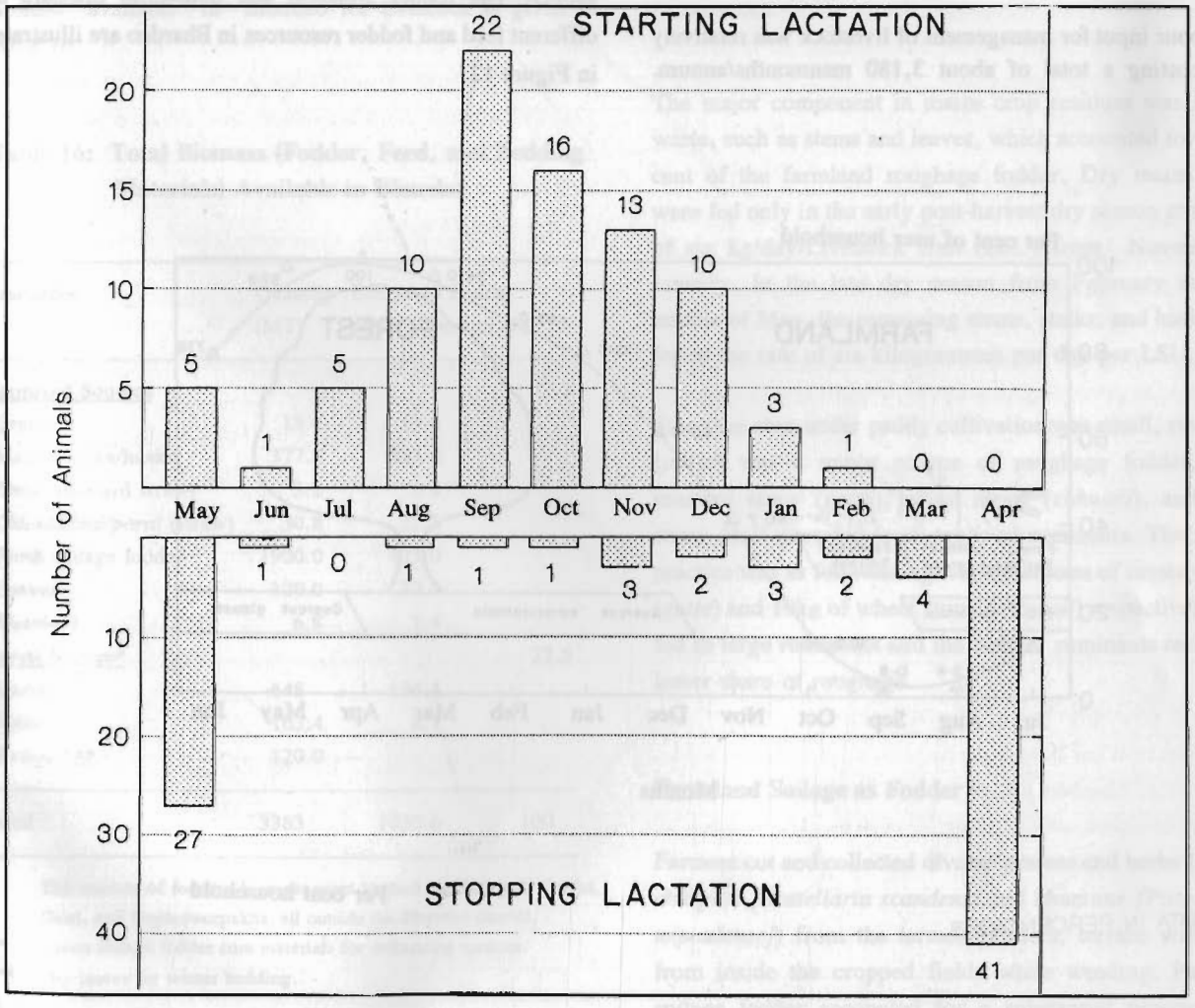



**Figure 11: Number of Animals Commencing and Completing Lactation Periods over a One-year Period**

Coinciding with lactation, 57 per cent of the total amount of milk produced in Bhardeo was available from July to November (five months). The quantity of milk fell during the four months from August to December to over 3,600

litres per month. The increase in total milk production cannot be wholly attributed to the availability of fresh fodder.

It was not surprising to find that 79 per cent of the lactating animals stopped lactating during the three driest months of March, April, and May. The farmers were aware of the implications of fodder shortages and the problems of high temperatures (during the dry period from March to early June) on milk production. Accordingly, the servicing of female animals was arranged in such a way that the lactation period coincided with the flushing season from August to November. This was one of the few good examples of farmers adapting to the prevailing situation. The farmers managed in such a way that they derived maximum benefit from their natural resources.

*Labour Input for Livestock Management*

The labour input for management of livestock was relatively high, costing a total of about 3,180 manmonths/annum. Shifting animals to stalls and farmyards and bringing water to the animals, or even taking the buffaloes for a walk, however, did not require much effort. The ruminants were all stall fed, requiring on an average one extra labourer daily for fodder collection. The time required to collect a load of fodder/forestry biomass had increased by over two hours and the households delegated one member of the family to collect the same each day.

*Fodder Resource Management*

The major sources of feed and fodder/forage for the ruminant livestock in the area were, primarily, farmland and surrounding forests. Even during the monsoon period, the farmlands could not sustain 100 per cent of the fodder supply. The fodder situation and household pressure on different feed and fodder resources in Bhardeo are illustrated in Figure 12.

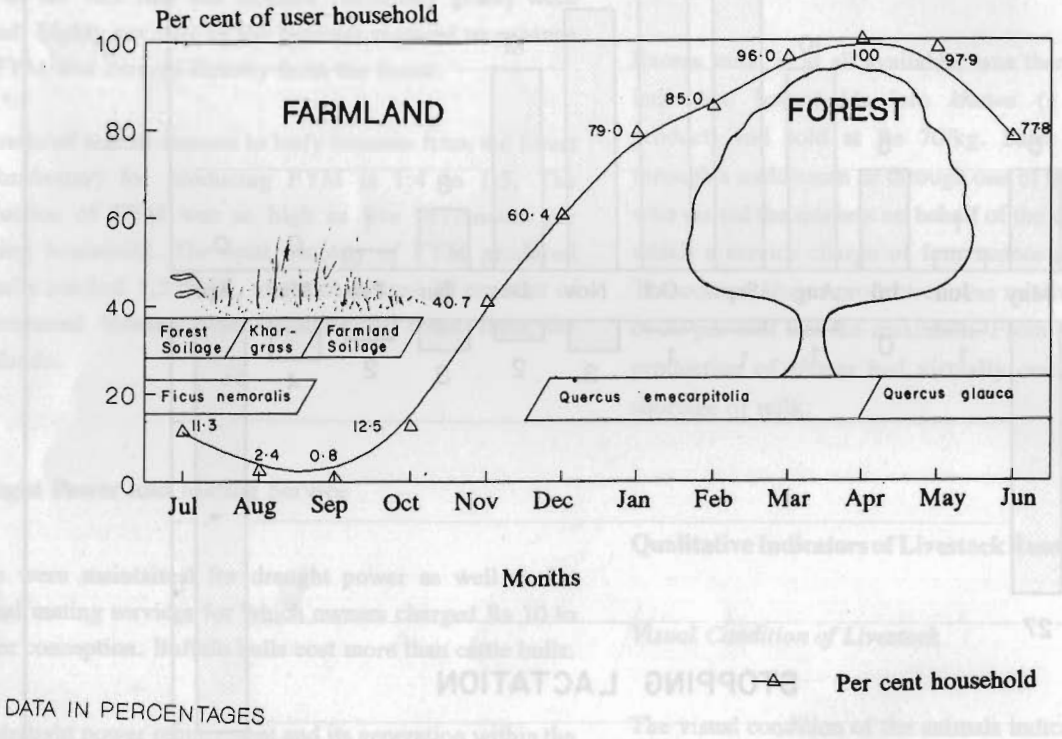



**Figure 12: Dependance of Households on Forests for Fodder Materials during a Normal Year**

There were two distinctive periods when more than 50 per cent of the farm households collected leaf fodder and dry leaves from the forest floors, mostly of the *Quercus* and *Rhododendron* species. During the peak season in the month

of March, 100 per cent of the user households in the area collected forestry resources from the Gairi, Gupteswor, and Phulchoki *Pakha* forests, all of which fall outside Bhardeo.

From June to September, more than 80 per cent of farm households drew livestock fodder requirements from the farmlands. This was estimated to be around 1,900MT of fresh fodder material or approximately 120 harvesting days for each household, amounting to 60kg of fresh fodder material per day. The feeding of fresh farmland soilage fodder was not without problems. The ratio of green fodder to carbon-rich roughage, such as straw, was higher in the monsoon feed. Most households had used up their carbon-rich roughage fodder, such as straw and maize stalks, during the dry period. This led to higher incidences of bloating during the rainy season, causing animal losses. The total biomass available in Bhardeo for livestock is given in Table 16.

**Table 16: Total Biomass (Fodder, Feed, and Bedding Materials) Available in Bhardeo**

| Resources | Quantity (MT) | Estimated Fodder air-dried matter (MT) | % |
|---|---|---|---|
| Farmland Sources | | | 72.5 |
| Grains | 13.4 | 13.4 | |
| Maize (stalks/husks) | 377.8 | 283.4 | |
| *Gatte* (mustard straw) | 3.2 | 2.4 | |
| *Chhwali/nal/paral* (straw) | 30.8 | 22.5 | |
| Fresh soilage fodder | 1900.0 | 475.0 | |
| Leaves | 120.0 | 30.0 | |
| *Kharbari* | 6.8 | 1.4 | |
| Forest Source* | | | 27.5 |
| Leaves | 648 | 194.4 | |
| *Sottar* ** | 163.4 | 8.1 | |
| *Patkar* *** | 120.0 | - | |
| Total | 3383 | 1030.6 | 100 |

* The sources of forestry biomass were located on Phulchoki *Pakha*, Gairi, and Gupteswor*pakha*, all outside the Bhardeo district.

** Green soilage fodder cum materials for enhancing manure.

*** Dry leaves for winter bedding.

## Crop Residues as Fodder

Crop residues, such as maize stalks and maize husks, as roughage fodder were produced on 118 ha of dryland slopes. Table 17 estimates the importance of maize crop residues as a source of roughage fodder for ruminant animals in the area.

**Table 17: Major Roughage Fodder**

| Roughage | | Quantity (MT) |
|---|---|---|
| Maize stalks stems/leaves | : | 306.1 |
| Maize husks | : | 71.7 |
| Mustard straw (*gatte*) | : | 3.2 |
| Wheat/millet straw * | : | 30.8 |
| Total | : | 411.8 |

* *Chhwali/Nal*

The major component in maize crop residues was harvest waste, such as stems and leaves, which accounted for 91 per cent of the farmland roughage fodder. Dry maize leaves were fed only in the early post-harvest dry season at the rate of six kg/day/Livestock Unit (LSU) from November to January. In the late dry season from February until the middle of May, the remaining stems, stalks, and husks were fed at the rate of six kilogrammes per day per LSU.

Since the area under paddy cultivation was small, rice straw (*paral*) was a minor source of roughage fodder, while mustard straw (*gatte*), wheat straw (*chhwali*), and millet straw *(nal)* were fed to all types of ruminants. The feeding practice was as follows: eight kilogrammes of mustard straw (*gatte*) and 10kg of wheat straw (*chhwali*) respectively were fed to large ruminants and the smaller ruminants received a lesser share of roughage.

## Farmland Soilage as Fodder

Farmers cut and collected diverse grasses and herbs (such as *charpate [Scutellaria scandens]* and *khursane [Pittosporum nepaulense]*) from the terrace borders, terrace walls, and from inside the cropped fields while weeding. Farmland soilage fodder accounted for a substantial proportion of monsoon green fodder, supplementing wet soilage fodder collected in the forests. Green soilage fodder collected on the farmlands exceeded 1,900MT annually. With 20 to 25 per cent of air-dried matter this would mean that 400 to 500MT of air-dried fodder was available for ruminants.

**Fodder Trees**

The principal fodder trees found in the area were noted and listed. *Saur (Betula alnoides), chuletro (Brassaiopsis hainla),* and *dudhilo (Ficus nemoralis),* the most ubiquitous, mature into fodder harvest in about 12 years. *Anjir (Ficus auriculata), nemaro (F. roxburghii), kafal (Myrica esculenta),* and *F. nemoralis,* induce increased milk yield. *Painyu (Prunus cerasoides)* was mainly fed to goats apart from during gestation periods. The local people had observed that there was a risk of abortion when this plant was fed to gestating animals. *Banjh (Quercus languinosa)* and *gogan (Sarauia nepalensis)* were some of the other fodder species.

Best in terms of productivity, growth condition, and as a major source of green leaves after the *Quercus glauca* period (about one month prior to the monsoon rains in May/June), was *dudhilo (Ficus nemoralis).* The species of grasses and herbs in the *kharbari* are given below.

| | |
|---|---|
| *Arthunge khar (Themeda* sp.) | *Amriso (Thysanolaena maxima)* |
| *Kansh (Saccharum* sp.) | *Siru (Imperata cylindrica)* |
| *Muse ghans (Capillipedium assimile)* | *Babiyo (Pollinidium angustifolia)* |
| | *Dubo (Cynodon dactylon)* |

Fodder trees on the farmland terrace benches and *kharbari* were used to produce green fodder in critical periods of the dry season. The estimated total of green leaves harvested was 120MT or 30MT of air-dried matter.

*Kharbari (Grass and Shrubs)*

*Kharbari* was the source of about seven metric tonnes of fresh fodder material or 1.4MT of air-dried matter. The first cutting of grass for fodder took place in July/August, although this was not a general practice. Only under conditions of acute fodder shortage do households undertake the first cut. This was one of the reasons why only about 30 per cent or six to seven metric tonnes of the potential fodder material were used for feeding animals in the Bhardeo area.

The experienced (quantitative) estimation in the area was that fully one-third to one-half of the December yield (i.e., 32MT) of thatch could be harvested in July as fresh fodder. This would have yielded 11MT compared to six to seven.

According to the local farmers, the total productivity was about one kilogramme of fresh matter per square metre of *kharbari,* which amounted to a yield of approximately 236MT annually. Not more than six to seven metric tonnes of *khar* grass were harvested as fodder by only 25 households. The fodder potential of the area was not fully utilised. This area could be a vital producer of diverse products such as tree leaf fodder, cut grasses, bedding materials, and also firewood, reducing the existing pressure on forests.

From June to October, the forests are used for wet soilage fodder-cum-bedding materials which are collected mainly for enhancement of FYM. So, even if the quality of the *khar* fodder is not good, it would still be better than the various materials collected from the forest floors as soilage fodder-cum-bedding materials for the same purpose.

People were using *khar* less for fodder production than for thatching material, which was reasonable in the absence of other roofing materials. As more and more people begin to use industrial tiles as roofing materials, the *kharbari* could become much more useful as a source of green fodder. Unless economically viable alternative roofing materials can be found and the grass and tree cover increased, it will be difficult for the community to use more than 20 to 25MT of *khar* grass as fodder.

*Access to Forest Fodder Resources*

Forests were used by local farmers for a number of things, e.g., green leaves for fodder, twigs *(jhikra)* for firewood, dry leaves for bedding and FYM, and wet soilage grass for fodder and for augmenting FYM. Forest products were used throughout the year, e.g., dry leaves *(patkar),* tree fodder, and wet soilage (grasses and herbs).

Lopping of Tree Leaves as Fodder. *Dale ghans,* or mature leaves of *Quercus semecarpifolia,* were used extensively before May before the fruit appeared. The appearance of fruit in this species coincides with the shedding of leaves, beginning in mid-May. By the end of August, the leaves grow back and during this period the leaves are not used.

Fodder collection from *Quercus semecarpifolia* required six to seven hours, compared to the three to four hours needed 15 years previously. On an average, people required two hours more to fetch a load of tree leaf fodder than a decade previously.

The average collection per household amounted to about 25kg of *Quercus* leaves per day throughout the dry season by the user households. Some farmers, who could not afford to go to the forests due to time and labour constraints,

bartered each load of leaves for two kilogrammes of maize flour. Leaves were normally fed with roughage fodder at the ratio of 25kg of green leaves to about 10kg of roughage fodder (Table 17).

Collection of *Patkar* (dry leaves from forest floors used as bedding material). During most of the dry period (November to May), about 10 to 12kg of dry leaves were collected in bundles of about two kilogrammes from the upper *Rhododendron-Quercus* forests. This took place before the start of natural leaf-shedding to avoid the hard and thorny *Quercus* leaves.

Collection of *Sottar* (wet soilage fodder from forest floors). During the wet months from June to September, the forests were used for collecting wet soilage fodder-cum-bedding materials, mainly to enhance the FYM.

The species of plants found in the wet soilage collected from forest floors were mainly herbs and grasses, e.g., *khursane* (*Pittosporum nepaulense*), etc.

Livestock husbandry and farming relied totally on forests in the area. On an average, the people used forest products for 26 weeks per annum. Thirty-two per cent of the households located in Ward numbers one, four, and eight used forest products for 25 weeks, whereas 7.5 per cent of the households located in Ward number three used forest products for 32.5 weeks. The other Wards (Nos. 2, 5, 6, 7, and 9) used forest products for 27 to 29 weeks a year.

The total amount of forestry biomass used for livestock management in Bhardeo is given in Table 18.

**Table 18: Collection of Forestry Biomass - 1987/88**

| | Amount (MT) | Household mean (MT) | # of Households involved |
|---|---|---|---|
| *Quercus* leaves | 972 | 3.9 | 248 (93%) |
| Dry leaves | 120 | 0.74 | 162 (61%) |
| Wet soilage | 163 | 1.8 | 89 (33%) |
| Total | 1255 | 6.44 | |

* 33.3 per cent of this was woody-twigs used as fuelwood

*Pasture and Grazing Practices*

The area under study lacked good pastureland, both in the context of size and in the context of the quality of vegetation.

Grazing was not a general or regular practice, given the difficult terrain conditions in Bhardeo. The cattle and goats were taken to open spaces in the valley. Animals were led to open spaces and watering spots to graze upon the thin vegetation cover near streams and farmland terraces, mostly within Bhardeo. The total value of this source is difficult to quantify. Bullocks were let into the forests during the monsoon for fattening and were brought home just before the ploughing season in November. The absence of sheep and pigs was a positive sign. But it was difficult to judge how far fodder sources had been helpful in alleviating the problems of livestock management in Bhardeo. Was the quantity of fodder and other biomass needed sufficient to maintain the livestock in Bhardeo ?

With the fodder/roughage composition used in Bhardeo, for about 700 LSU, roughly 1,400MT of air-dried matter were required each year for maintenance. (The availability of dry matter in the area is inadequate and the fodder deficit is actually higher than was observed.) The role of the farmland is predominant in producing fodder and bedding materials, but, with the decrease in farmland productivity, more pressure will be brought to bear on forest resources. At the time this study was conducted, 27 per cent of the biomass was required for livestock.

**Use of Common Forests, Private "Woodlots", and Water Resources**

The discussions below on the use of forestry products, such as firewood, fodder, and bedding materials, pertain to forests outside Bhardeo, or even outside Lalitpur district. But forest products such as fern (*niuro* -- *Dryopteris* sp.) and mushrooms were also collected from forest areas within Bhardeo. There were no organised forest slope management groups.

The people of Bhardeo shared the use of the forests located in neighbouring villages such as Gairi, Gupteswor, Phulchokipakha, Khirauli Bhanjyang, and Phulbari, together with farmers from Naldu, Lele, Manikhel, Gotikhel, Chalal, Kaleswor, Chaughare, Dhungkharka, Behbar, Roshi, and Khani villages outside Bhardeo. The percentage of Bhardeo households frequenting Gairi forest was 12.4, Gupteswor 20.6, and Phulchokipakha, 36.4.

*Use of Private Woodlots "Kharbari"*

The area under *khar* (thatching material) production was estimated to be 23.6ha (14% of the total land). Historically, these plots could have been part of the community forests in this area. In subsequent years, the slopes were claimed by individual households and also used for cultivation. This was a primary factor in the loss of forest lands. During the course of the study, observations were made of plant species which indicated the type of forest that could have been in existence before the land was converted into *kharbari: falant (Quercus glauca), banjh (Q. languinosa), khasru (Q. semecarpifolia), punwale (Ilex doniana), chilaune (Schima wallichii), musure katus (Castanopsis tribuloides)*, and *lankuri (Fraxinus floribunda)*.

Other species of trees and bushes normally found were *gurans* (*Rhododendron* sp.), *angeri* (*Lyonia* sp.), and *ghangaru (Pyracantha crenata)*. Only one-half of the 56.4 per cent of households that maintained shrublands as *kharbari* normally harvested thatch *khar* in December, producing 32MT of dry woody grasses of diverse species.

Harvesting *Khar* (thatching material). One *ropani* of *kharbari/kharpakha* (slopy shrubland), generally yielded about 500kg of *khar*, equivalent to 20 loads, each with 40 bundles (*mutha*) of air-dried *khar*. The second cutting of *salimo khar*, which took place in November/December, was considered good thatching material. *Khar* materials were sold at Rs 0.40 to 0.50 per bundle of about one kilogramme in weight. More and more people were using tiles. More than five per cent of the households had used other roofing materials such as terracotta tiles. At the time of the study, the prevailing price of *khar* was Rs 0.50 per kilogramme.

**Use of Forest Resources**

Local farmers used the forests for multiple products such as fodder, firewood, and charcoal all year round.

*Access to Forests, Fodder, and Firewood Sources*

The major use of forests was for collecting leaf fodder, followed by firewood collection. About 972MT of leaf fodder-cum-twigs were collected annually by 265 households[6] and 450MT of firewood were collected annually by all the households. Three species of *Quercus* were used for leaf fodder collection.

The *Quercus semecarpifolia* species of tree can be collected for six to seven months until the end of April and *Quercus glauca* and *Quercus lamellosa* can be collected during the month of May. The twigs and branches (*jhikra*) of the two species are different. *Q. semecarpifolia* is a heavier type of wood and the leaf fodder contains twigs and branches accounting for 35 per cent of the weight of a load as firewood *(jhikra)*, whereas *Q. glauca* and *Q. lamellosa* contain only about 25 per cent of twigs and branches.

It is to be noted that the twigs and branches *(jhikra)* that are collected with tree leaves provide the firewood supply for individual households. People normally need such twigs during the pre-monsoon months. The quantity of such material is over 300MT and it is kept outside the house to dry. Good timber wood would have accounted for a large part of the local firewood consumption had it not been for the use of such twigs (to the extent of about 1.69MT/ household, worth Rs 750 at the prevailing local price of firewood).

Firewood was normally collected during the months of March to May for the rainy season. Bhardeo households needed 1.69MT of firewood/household per year, almost 2.5 times more than the farmers in warmer areas, e.g., the lower parts of Dhading district. Some households hired labourers to collect firewood, and this normally cost about Rs 0.40 per kilogramme of firewood.

Charcoal-making. On average, 200 to 250kg of good quality timber wood were used for each load of 50kg of charcoal, preferably *Q. semecarpifolia*, and at times the *Rhododendron* sp. according to the market demands for charcoal. About 40 to 50 households in Bhardeo were involved in this "illicit" trade.

The major risk involved in transporting charcoal was that of being caught by forestry staff and the police. One very courageous labourer made up to three overnight trips per month carrying his charcoal to Patan market to avoid the police and heavy penalties. Their patience, perseverance, and drive in marketing the charcoal were remarkable.

6. Only one household does not keep a ruminant animal

*Use of Minor Forest Produce*

Mushroom and Edible Fern (*Niuro*) Collection. According to the people of Bhardeo, there were ten different forest locations surrounding Bhardeo where *Quercus* sp. dominated and were hosts to different mushroom species, particularly to *polypores*. *Quercus glauca* is host to the mushroom *Grifolia frondosa* and *Q. semecarpifolia* to *Laetiporus sulphureus Murr*. There were five to six different mushroom varieties available at different times during the summer season of 1987/88 (Table 19).

**Table 19: Collection of Mushrooms**

| Available months | Mushroom Variety (*Chyau*) |
|---|---|
| May/June | *Mirge* (*Lentinus edodes*) |
| June/July | *Kamde* (*Pleurotus ostreatus*) |
| August/September | *Falant* (*Grifola frondosa*) |
| | *Kanne* (*Auriculeria auricula*) |
| August/October | *Rato* (*Laetiporus sulphureus*) |

One labourer generally collected enough to fill between ten to fifteen locally-made, special baskets (*perungo*) of 100 to 200 grammes per day. The number of households engaged in this activity was between 150 to 180 in Bhardeo during the mushroom season. The activity included the collection and packing of roughly six metric tonnes of fresh mushrooms and bringing them to ten different collection points within Bhardeo. There were middlemen who paid some money in advance to the collectors before the onset of the mushroom season.

Fern (*Niuro*). Edible fern was collected by individual families from April/May to June/July from the forests and packed into 30 to 40 shoots per bundle. The local price of *niuro* was Rs 1 to 1.50 per bundle. No packing was done. The processes of collection from the forests and marketing were similar to those used for the mushrooms.

Medicinal Plants (*sano+thulo okhati* and *bhyagute*). Quite a few households made side incomes by collecting and drying medicinal herbs and selling them to markets in Patan (at Rs 2-3 per kg). The price offered by the markets for the *thulo okhati (Astilbe rivularis Buch.Ham.)* was very low, even an easily available cucumber would cost more.

*Nigalo* (*Arundinaria* sp.) The local species preferred was the *dhuti-nigalo*, a thin bamboo variety, used for manufacturing ropes and a variety of baskets used locally. About 60 to 100 culms harvested in a single day were sufficient to produce four large, local all-purpose baskets. The price of the basket (*doko*) locally was Rs 15 to 25. Very few households produced *nigalo* on their farmlands. Forests were the major sources of thin bamboo.

**The Forest Resource Management System**

The people started stall feeding ruminants a long time ago in order to avoid grazing in the forests. Afforestation took place, mainly with pine trees, some 16 years ago in limited areas of Ward Nos. one, two, and six on the south slopes of Naldu Ridge. The other areas had been under afforestation programmes for about four or five years, with a slight emphasis on *Quercus lanuginosa*. There was a tree nursery to cater for the needs of the afforestation programmes of the watershed project. Priority was given to the greening of slopes. About 3,000 saplings were produced annually. The collection of species in the nursery did not reflect the needs of the local community. As the newly afforested areas of Bhardeo will not be productive for another 10 to 20 years and the species planted hardly fulfil the biomass requirements of the community (fodder, timber, etc), these measures can hardly be seen as an investment for the community.

After the 1981 floods, the community became motivated towards finding new methods of protecting the forests. Not that forests were unprotected previously during the Rana Regime. Even prior to 1951, the forests in the area were protected for cattle. When the nationalisation of forests took place in 1956/57, the community began to feel alienated from the forests.

The community wanted to manage plots of forest lands, firstly for the protection of their own lands located below the forests and for the harvest, primarily of fodder grasses, and secondly of dry twigs and branches as firewood. Individual households, at least, had come out openly on the side of private management of forest areas. The water resources were, too, in a very poor condition and this was directly or indirectly linked with the depleted nature of Bhardeo's forested slopes.

## Use of Water Resources

*Operating Water Mills*

Although Bhardeo has large mountain slopes, there are very few natural perennial water sources. The most important water spring is located in Ward No. seven. The stream water in Ward Nos. four and five was inadequate for grinding mills, yet these waters were used as such. The grinding mill was for the Bhardeo people. Maize was milled throughout the year.

The maximum milling capacity of the simple grinding mill in Bhardeo was around 120kg of maize within a 24 hour period. During the rainy season the water available was adequate. Roughly 100MT of maize, 9 to 10MT of wheat, 0.4MT of barley, and 0.32MT of millet needed to be milled throughout the year. The total amount used was allotted among 15 mills, and each mill had to mill more than seven metric tonnes of cereals per annum. This left the mills operating at one-sixth of their capacities. The milling charges were uniform for maize, wheat, millet, and barley. The charges were four per cent of the milled commodity payable either in kind or in cash.

All mills in the area were not operative. Some stopped milling during the high monsoon period from June to September and others operated only in daylight hours. One reason given for this situation was the lack of sufficient milling materials. At the same time, operating mills ran for 24 hours. The operation of mills at night was profitable because, according to mill operators, mills operate up to 60 per cent more efficiently during the night because of the favourable water conditions.

*Irrigation*

Paddy cultivation in the area was not significant enough for a large quantity of water for irrigation to be required. People used one or two places from the nearby stream to irrigate fields located on the valley floor.

*Drinking Water*

Bhardeo is one area where people have used all sorts of methods to tap the natural springs for drinking water purposes. Most households had piped water, albeit too poorly laid to be hygienic. There were hardly any springs left to be tapped. The only promising source of water that was adequate in quantity was located in Ward No. seven at an altitude of 1,900m, limiting its access to households higher up.

*Water Management*

Given the conditions of water sources and streams, water management in Bhardeo was an example of how the local people had tried to make the most of what was available without doing much to protect the stream sources.

# 4. Changes in the Resource Base

All the local resources, such as human, farmlands, livestock, and fodder, as well as forest resources, were equally exploited. The resources had not been used in a sustainable manner. The Bhardeo community experienced serious shortages that had worsened over the years, particularly in the recent past. The poverty found in Bhardeo was due to a combination of serious economic problems and the depleted natural resource base, it was not the outcome of a single event like the floods of September 30, 1981, neither was it an outcome of happenings over a short span of time. The changes that the area had undergone might not have been noticed by outsiders.

The general changes that ultimately affected the local resource base and weakened the capacity of the resource "managers" started, apparently, with increasing urbanisation and population growth in the Kathmandu Valley to which the area was "exposed but not integrated" (Banskota 1989). Bhardeo was exploited for its firewood and timber (*Quercus* sp. and *Pinus* sp.) as well as charcoal, mushrooms, fern vegetable (minor forest products), animals, and animal products.

The lifestyle in Bhardeo might be no different from any other rural village in the Nepalese Himalayas in terms of environmental changes affecting natural resources. So what really changed in Bhardeo? Physical degradation of cultivated and common lands, loss of productivity, and an increase in the number of households, compared to the situation 10 to 15 years previously, had been the distinct changes noted by the community. The indicators of change seemed to be multiple, but the most visible were recorded.

## Loss of Vegetation

*Depletion of Minor Forest Products*

As far as the other "minor" forest products are concerned, such as *niuro* (a fern species), mushrooms, and medicinal plants, e.g., *thulo okhati* (*Astilbe rivularis*), the productivity tended to have remained more or less constant. Outsiders were not as skilled as the locals in collecting these products. However, the lack of marketing skills led to exploitation of the villagers by traders and moneylenders. Because of poverty, a large quantity of the finest products had to be collected for a small income. Collecting mushrooms, etc was a self-defeating activity. In addition, the forest cover essential for the growth of mushrooms and other forest products, especially *Quercus* sp., decreased. Therefore, the sustainability of these products could not be maintained.

*Depletion of Forest Resources*

Historically, the forests of the area were used both extensively and intensively for animals belonging to the ruling families. According to the people of Bhardeo, the cattle farms of the ruling families existed until the early 1950s.

The people recalled that, two decades previously the slopes of Bhardeo had an adequate stock of trees (also of *Quercus semecarpifolia*) supplying sufficient biomass in the forms of fodder and bedding materials, including firewood for marketing. Each household, on the average, used to harvest three to four loads of leaves or about 70 to 100kg of fodder daily.

The use of Bhardeo forests had almost become a part of local history. The same areas, at the time of the study, were covered with very few trees and the *Quercus lanuginosa* species had degenerated into dwarf bushes. This species is hardy and well coppiced. It has withstood heavy lopping, browsing and, at times, forest fires.

Forest resources were under severe pressure because of decades of unregulated exploitation of this resource, e.g., for firewood, charcoal, tree fodder, and timber. Forest resources (for collection of biomass), in the nearby bordering forest areas within Bardeo, were scarce. The marketing of firewood and timber had to be halted as the scarcity had become critical. Wide variations were observed in the use of neighbouring forests by the Bhardeo households, for which accessibility was a major factor.

People had been compelled to go outside their community area boundaries to Gairi, Gupteswor, or Phulchokipakha, to collect forest products. Ninety-three per cent of Bhardeo households were dependent upon these and other outside forests for their daily needs. Table 20 shows the extent to which these forests were being used.

**Table 20: Exploitation of Trees (MT) by the Bhardeo Community in Forest Locations of Gairi, Gupteswor, and Phulchokipakha during 1987/88**

| Forests | Firewood | Leaf fodder | Dry twigs | User hh (%) |
|---|---|---|---|---|
| Gairi | 86.9 | 119.3 | 59.6 | 12.4 |
| Gupteswor | 132.7 | 186.5 | 93.2 | 20.6 |
| Phulchokipakha | 202.3 | 309.6 | 154.7 | 36.4 |
| Other areas* | 28.0 | 32.7 | 16.3 | 23.6 |
| Total | 449.9 | 648.1 | 323.8 | 93.0 |

* Other forest areas also lie beyond Bhardeo's boundaries

Grazing of animals in the forests, especially goats, was rare. Forest resources were selectively collected. For example, leaf fodder was hand lopped and carried home. Despite precautions, there were certain symptoms which the farmers had observed as signs of degradation of forest resources. How long these resources can be sustained at the current rate of exploitation in high pressure areas, such as those mentioned above, is anyone's guess.

*Reduced Capacity of Individual Trees*

The condition of forests in these areas, in general, had undergone many changes within the previous decade in terms of the differences in the time taken to collect fodder or firewood. Farmers either moved to different forest plots for collection or selected a large number of trees for a single load of leaves or firewood. Forest plots visited for the collection of biomass had also changed within a single forest area, and this was true for almost all the forests in the area. The average time needed by the households to collect *Quercus* leaves was six to seven hours as against three to four hours 10 to 15 years previously. Generally, an increase of about two to five hours in the time taken for harvesting was observed. The ability of a farm labourer to traverse a certain distance to fetch biomass was determined mainly by the daylight hours of the season and by the gender of the collector. Collection of biomass was carried out mostly by the womenfolk.

The maximum pressure was on the slow growing *Quercus* species of the cool temperate areas above 1,900m. Pressure decreased slightly only during four to five months of the monsoon. Three species of *Quercus* sp. trees, in particular, were affected by over-exploitation. *Quercus semecarpifolia*, occurring at cool temperate altitudes, was affected the most, followed by *Quercus glauca* and *Q. lamellosa* which blossomed in the months of April/May. Exploitation of these two species for leaf fodder was carried out in spring, during the blossoming season, which deprived the species of the crucial leaf area needed in spring, thereby weakening the trees physiologically. Given that deforestation of this nature will continue, farmers will need to respond differently and develop other strategies to solve their fodder and firewood problems.

**Loss of Farmlands**

According to the local estimate, a total loss of seeding area of 22ha of prime farmland (mostly located on the valley floor) was recorded after the floods of 1981. This was a great loss when we consider the food and fodder values of the yields from 22ha. In a community where 54 per cent of the households owned, on an average, farmland property below 0.5ha, the loss had a profound effect on the economy.

The rains of 1981 also destroyed many terraces. (A precipitation of 86mm of rainfall was recorded at Khumaltar [1,350m] on the 29th of September and 169mm of rainfall at Godavari [1,529m] on the 30th of September 1981 [HMG 1984], both these locations lie slightly outside the north-eastern area of Bhardeo.) The community had still to give final shape to the terraces which they had started to reconstruct immediately after the floods in 1981. In addition, farmland soils were lost from most of the maize terraces.

The loss was twofold: the real loss of farmland property; as such, a physical loss, unless the debris covering the farmlands could be cleared; and the loss of topsoil. There was no external support to help farmers reclaim the farmlands. Reconstruction of terraces remained incomplete while the relatively flat valley bottom was still under debris cover.

*Loss of Soil Fertility and Productivity*

One of the most plausible indicators of the general degradation of the local environment was soil fertility. Soil productivity had been decreased. The low productivity was indicated by low plant density (germination problem), spotty concentration of plants (on low gradients in relatively fertile parts of the field), and the retarded growth of vegetation in general (agronomically very poor). The productivity of the maize terraces, reclaimed after the 1981 disaster, had been low.

**The loss of productivity must have been gradual but the process could have been aggravated by the 1981 floods which damaged terraces and caused widespread soil erosion.** This point was supported by the farmers' observations of noticeable fluctuation in production and even decline in productivity within the previous 12 years. Production declined by about 11 per cent between 1971 and 1975 in the district of Lalitpur. In the case of Bhardeo, productivity had been fluctuating at the lowest point reached in 1975. Three major factors accounted for this decline, and they are given below.

1. Labour shortage: decrease in the number of family members tilling the land or hauling fodder and other organic materials to augment FYM.
2. Decrease in the supply of forestry biomass used for fodder and FYM production leading to a noticeable reduction of available FYM than previously.
3. Damage of farmland terraces by the floods in September 1981, destabilising the precarious soil fertility balance maintained by hard labour.

In the meantime, the cost of production had also effectively increased. It cost farmers an additional capital of five per cent of their cash incomes to purchase chemical fertilisers which contributed greatly to the higher cost-benefit ratio of farmland incomes. Though this might have helped augment nitrogen inputs, it was not known whether the soil in the Bhardeo area was deficient in nitrogen or not. In the absence of any marketable surplus from farmland products, it virtually meant that the meagre income from the rare off-farm sources had to be used to subsidise cultivation and farming.

Although the total macro-nutrients available for the Bhardeo soil was adequate by agronomic standards, at least for maize cultivation, other factors, such as soil erosion and loss of land, played a crucial role in declining productivity. Most of the land used for cultivation was located on steep slopes (reclaimed after the 1981 landslides) where surface erosion was highly visible. This had affected the local economy and slowed down the development process. The farmers were unable to rehabilitate their lands speedily, primarily because of the lack of labour and time. The little time available had to be invested to earn cash income. During the dry period, they migrated in search of off-farm opportunities. During the monsoon, when they faced critical food shortages, they collected minor forest products to sell for cash to buy food.

The practice of using chemical fertilisers in the area was less than a decade old. In fact, the combined use of urea and the usual doses of FYM by 34 per cent of Bhardeo households failed to produce comparatively higher amounts of food grains, as expected in 1987/88, in terms of seed and chemical fertiliser inputs. This explained, to some extent, the soil fertility conditions. This comparison was made with farmers who were unable to afford chemical fertilisers and used only the FYM which was available. There were also other factors such as over-use of chemical fertilisers as against under-use of other fertilisers, agronomically a self-defeating effort.

The loss in productivity was directly related by the villagers to reduced availability of FYM, as a result of deforestation. Productivity loss and its direct bearing on soil fertility was noted by the farmers in the study area. Table 21 schematically shows how the people perceived the loss of soil fertility.

**Table 21: Soil Fertility and Farmland Productivity**

| Geographical Dimension | Soil **Fertility** | Farmland **Productivity** |
|---|---|---|
| Upper slopes > 1900m | **high** | **increased** through chem. fertiliser |
| Middle slopes > 1800m | **medium** | **sustained** with chem. fertiliser |
| Valley bottom > 1700m | **reduced** | **decreased** despite the use of chem. fertiliser |

Source : Personal Communication (1988)

Access to forestry biomass was still relatively easy due to proximity to the forest at higher altitudes. Increased production was observed only on the upper slopes, as a result of the heavy input of forestry biomass combined with chemical fertilisers. Despite the amount of biomass available, and the use of chemical fertilisers in the lower areas, production could not be sustained. Farmers had been convinced that only higher doses of FYM, together with slope corrections, would cause a noticeable increase in productivity and reduce topsoil loss.

The loss of topsoil was most visible on new sloping terraces, built after the 1981 floods. The growth of plants on these terraces indicated that there was a need for better farmland management, taking into consideration the degree of soil loss and productivity.

**Reduction in Livestock Productivity**

Livestock productivity had decreased within a short period because of the scarcity of fodder materials in the forests, whereas, in the past, good quality fodder from *Quercus semecarpifolia* was abundantly available. The reasons for this decline were deforestation, the difficulty in reaching distant areas with better forest cover, and the difficulty of collecting a load of leaves from a larger number of trees. The quantity of leaves brought from distant places was only one third of the amount that used be collected in previous years in Bhardeo itself.

The level of FYM production was approximately one third of the level 15 years previously; thus affecting both food grain and fodder production. If this situation were to continue the livestock sector in Bhardeo would experience even harsher fodder shortages in future. Environmental degradation had become a serious problem. Harnessing adequate fodder resources to meet livestock requirements was becoming increasingly difficult; thus affecting land and livestock resources' productivity. During the previous decade, the farmers had observed a gradual decline in fodder resources from different types of fodder sources ranging from farmlands to forests. More than 20 per cent of the households experienced a fodder deficit during eight months of the year.

**Decreasing Water Resources in Bhardeo**

In the past, the flow of monsoon streams was less damaging to the fields lying in their course flow than at the time of the study. According to the farmers, the quantity of water available in the stream beds and springs during the dry period was less than before and was not sufficient to meet the requirements of the fifteen grinding mills in the area. The milling efficiency of individual mills had decreased by 50 to 70 per cent after the water channels were damaged by the late monsoon rains on September 29 and 30, 1981.

The water and debris flows caused by the floods had destroyed the natural water courses and also the traditional system of using short, narrow irrigation channels diverted into the fields. Most farmlands on the valley floor, especially the paddy fields, were damaged and covered with debris during the initial hours of the floods because of the drainage channels which diverted the floodwaters into the fields; hence causing significant damage. The people attributed these problems to the loss of forest cover on the slopes.

The few examples cited could well indicate that the sustainability of the system was gradually declining. Although unsustainability itself may trigger off rapid degradation, it could well be a problem that has a solution. The situation requires adjustment efforts, yet adjustment also becomes difficult to sustain because of its negative effects on different resources.

The condition of unsustainability could have been the result of the land use practices which remained unaltered and unadjusted over a long period of time. The people's awareness of unsustainability has an important bearing on the future use of local resources. Their means of solving this problem were positive but inadequate, e.g., by reducing their dependence on local resources. These responses could lead to a more prudent resource use system, e.g., minimum use for maximum benefit, ultimately creating a kind of sustainability.

# 5. Responses of the Community

The changes in the surroundings of Bhardeo, such as the pressure on forests as a result of increasing urbanisation in the Kathmandu Valley, serious degradation of the natural resource base (especially farmlands and forestlands), as well as the constant fight against dire poverty, have been affecting and further weakening the local economic-ecological system.

Contrary to popular assumptions, the people of Bhardeo appear to be aware of ecological degradation and are regulating their use of local resources within the limits of economic imperatives. The Bhardeo community had adjusted in every way possible to them. The responses to economic and ecological losses over the years had been at the level of individual households, e.g., awareness of environmental problems, acceptance of the reduction in forestry biomass, lowering of labour inputs, opting for smaller livestock, and reviewing the population pressure on a seasonal basis by migration?

### Awareness of Environmental Problems

The people of Bhardeo are more conscious than ever before of the importance and vulnerability of their natural resources, such as forest vegetation, farmland soils, and water, because of the catastrophic floods that caused loss of life and property in September 1981.

The community has tried to understand the diverse effects of these incidents on the general environment. The farmers were aware of their precarious situation and were as concerned as any expert would be. They tried to relate the catastrophic events of 1981 to the decades of deforestation that had preceded it. They attributed the 1981 incident to factors such as:

a. a holy curse;
b. degradation of the forest and loss of trees in general;
c. increased use of slope areas for farming; and
d. charcoal production and man-induced forest fires to clear forests and lure animals to new open areas for hunting.

The opinion of the community was strongly based upon the problems it had encountered. The negative effects of over-exploitation of forest resources in the area were held to be mainly due to the rampant poverty that had continued over a long period of time.

It was difficult for the people of Bhardeo to separate environmental problems from economic ones. Job opportunities for generating income based upon activities related to nature management were considered to be vitally important. These activities were reclaiming farmlands damaged in the 1981 floods, planting vegetation on the slopes, protecting farmlands and forests, and strengthening the road alignments.

### The Community's Responses

*Adjustments in Quantity and Quality*

In every system of resource management, the local people must notice and respond first to the changing circumstances before outsiders start taking notice of the changed situation. The people of Bhardeo, too, made different adjustments to their system, which, in the given situation, met with varying degrees of success.

However, due to the economic hardships faced by the community, the responses to the changes in the resource base did not lead to enhancement of the resources but rather to subsistence behaviour.

*Less Reliance on Forest Resources*

**More time was required to collect a smaller amount of biomass.** This provided another reason for the Bhardeoli to consciously plan their animal population, i.e., the constraints felt in the supply of fodder and feed resources. Fodder was not available in adequate quantities and at the required time. As resources became less accessible to individual user households, they took a longer time in comparison to the past to collect even a small quantity of biomass. One of the

most conspicuous strategies followed by the farmers to counter the unfavourable situation was to **opt for smaller quantities of forest products such as fodder and firewood.**

One major reason for this shift was that the forests in Bhardeo had undergone many changes over two decades. The time allocated for collecting fodder and firewood had increased by two to five hours per day. Because of the labour constraints over the dry period, and decrease in tree productivity in general, the system tried to rely less on forest resources for fodder. Within one generation, the community seemed to have succeeded in reducing dependence on forest resources by 60 to 75 per cent.

*Low Labour Input*

Earlier, when the abundant resource base was located within easy reach, higher labour inputs over a shorter period could fulfil a day's biomass requirements. Subsequently, farmers had to face constraints in mobilising labour for the same amount of biomass because of the steady depletion of this resource base. Hence, their response to this change was **to allocate, on an average, only one-third of the labour time for the same.** This naturally helped to reduce the volume of biomass collected in a day, which facilitated the first strategy. But even this strategy had to be complemented by other measures, such as controlling and varying the structure of the ruminant population, controlling the frequency, and scheduling lactation, all of which had a direct bearing on milk production.

*Rearing Different Animals*

According to the farmers, rearing large livestock, such as buffaloes, was becoming difficult. In recent years individual households had reduced their livestock holdings and had **replaced large livestock with small ruminants.** Acute food shortages had made it uneconomical to rear pigs because they compete with man in terms of food consumption. Sheep rearing was avoided, apparently because of the negative grazing impacts caused by this animal on steeper slopes.

Cattle population growth was maintained below one per cent. On average only about six per cent of cows lactated compared to 25 per cent of buffaloes. This was directly related to the fact that the disposal of old cattle was a problem that did not occur in the case of buffaloes and goats. So growth in the population of buffaloes and goats was planned to coincide with the peak demand period during the main festivals in October/November, before the onset of winter.

Bull-servicing and mating were arranged in such a way that calving coincided with the harvesting season between August and November. The lactation period covered the seven to eight months when vegetation flourishes, thus providing an adequate supply of fodder.

*Migration and Off-farm Activities*

In Bhardeo, the population was unable to sustain itself for the whole year. One of the consequences had been **seasonal out-migration for off-farm incomes, especially during lean periods in the dry season.** Off-farm incomes from seasonal migration did help the system to some extent. A few households had permanently migrated to other areas.

*Dependence on the Market for Staple Grains*

The nutritional status of the people was poor and food management a serious problem. Over 86 per cent of the population could only grow sufficient food to last them for about six months. For the remaining period, the food deficit had to be met from off-farm incomes. In a normal year Bhardeo purchased up to 50MT of maize before the onset of monsoon. This hardly covered the total deficit and thus under-nourishment was widespread

The environment in Bhardeo was one of extreme poverty, and this situation could continue for years to come. What then should be the kind and quality of development? Had no major constraints and issues of development existed, the economy and ecology of Bhardeo would have been quite different today. Are the issues of development found in Bhardeo unique? To some extent, the problems discussed in the next chapter may be widespread in these mountains.

**Institutional Responses**

A large sum of money was invested for a watershed management programme in the Bhardeo area. According to the local people, the work mostly involved engineering structures and was undertaken by labourers from outside the community. The resources mobilised to carry out plantation in the hope of increasing forest cover seemed to be higher than the resources allocated for the preservation or conservation of the existing natural forests in the area. Resources were wasted during the implementation of

programmes, mostly implemented directly at the central project level, such as checkdams and bridges. This did not contribute towards motivating and enhancing the competence of local leaders and had discouraged the growth of development oriented institutions.

The few joint programmes of government and other agencies in collaboration with local institutions were very recent ones and were concentrated in service sectors. They included family planning, women workers, community health, and mother and child care centres (catering for five former panchayats too) under the Women's Services' Coordination Committee (NGO). It had an annual budget of 11,000 rupees and employed six women with average salaries of Rs 375 per month. The contacts were infrequent and they had not been of the quality to be appreciated by the local community.

The traditional institutions, which looked after water and forest resources, had been weakened while the modern, politically-based ones, such as the village panchayats, were too weak to respond to local demands. Very little work had been carried out on resource base management to increase incomes, without which environmental management in the area would become ineffective. Many of the afforestation programmes had become unresponsive to local needs. More than 90 per cent of the tree saplings grown in the local nursery were *Pinus* sp., *Populus* sp., and *Grewia robusta*.

The management of forest resources would have been better if the local people had been directly involved in the protection of forests. The roles of outside agencies should have been one of catalysts and resource mobilisers for the creation of essential institutional supports to the people (such as agricultural, veterinary services, marketing and watershed management, and other government services).

The question is, what should be the criterion for allocating resources for environmental management? political clout, or economic potential, or ecological priority (such as a watershed); number of voters, economic leverage, geographical dimension, or strategic location? Which of these criteria are important in the case of Bhardeo? **Being a small community, both in terms of its geographical size as a very small mountain watershed and in terms of it having a small and poor voting population, seems to have disqualified it from receiving external inputs.** Resource mobilisation for economic development in the mountains remains a controversial issue.

The high mortality of household animals (Table 14) has direct and indirect implications for farmland productivity and also for farmland fodder production (by-products and green farmland residues), as a result of reduction in the soil nutrients available in FYM - resulting in high economic-ecological loss.

**The problems of animal husbandry in Bhardeo were interlinked with other socioeconomic-ecological problems. Livestock, which is a crucial link between the different natural resources of the mountain farming systems, should not become the scapegoat for environmental problems!**

In August 1988, a veterinary service centre was set up, manned by a Junior Technical Assistant (JTA) and a peon. Because of inadequate supplies of medicine, tools, utensils, and equipment, as well as lack of training, the staff was not in a position to render the services required. The medicine was allotted by the district veterinary centre located at the district headquarters, and the supply was augmented every four months; this only catered for 25 per cent of the cases. The staff member was ill-paid and inadequately trained.

A goat improvement programme was introduced with a single *Jamunapari* he-goat, although this programme had not been requested by the farmers. But the choice of breed and the way it was reared left much to be desired. The problems resulting from the cross-breeding of local, small-sized goats with large *Jamunapari* was very serious. In 1988, several cases of labour complications were reported. A less popular programme was poultry breeding, especially of improved breeds. Yet five households took part in the programme at a high cost. Mortality was high (one of the households had a mortality rate of 40%).

The livestock development programme became a serious credit burden on farmers in rural areas. It had been more a result of the "push of the banks" than of the "pull by the farmers" for the money which would be required by them for many other development activities. Despite these responses, which can be regarded as a great sacrifice on the part of the community, the community had come to realise that the basic issue for them was to address their situation of dire poverty.

# 6. Development Issues in the Bhardeo Community

Despite past attempts by the local community to recognise the linkages between environmental problems and the over-exploitation of natural resources, the inadequacy of forest resources within Bhardeo for the use of the community left them little option but to continue exploitation even outside their own area. But this does not necessarily mean that it will be sustained over time.

The local community's skills and level of motivation for adjustment were inadequate to deal effectively with negative and persistent changes. The problems of Bhardeo have been extrapolated in earlier chapters. Any community's strength is a sum total of the strength of its individual households and that of its local institutions. The strength of any institution lies in its moral, fiscal, and administrative capabilities. The institutions in Bhardeo should also be viewed within this context.

Lack of a mandate and absence of its related tasks destroy any institution. Such a mandate and programme, as well as sufficient resources, keep the morale of the elected body high. The illusion that rural communities can develop without directly participating in the management of fiscal resources and responsibilities is pervasive in Nepal's concept of mountain development.

### The Limited Role of Local Government

No local institution, whether of the government or of the community, can be viable without regular income, fiscal responsibility, accountability, and a clear concept of the role they ought to play. The role of the local political unit was limited in the case of afforestation programmes. In Bhardeo, it had been able to specify only the area and plot of land for afforestation. It, however, could not recommend wage scales and employ poor labourers from the area. Even the choice of tree species was not made at local level.

The income of the community is insufficient to carry out development work. In a very favourable year, the community registers an income of up to Rs 5,000 from local taxes on radio, grinding mills, and application fees and Rs 10,000 to 15,000 as grant-in-aid from the District Fund tied up in construction works such as drinking water programmes, school and coopcrative buildings, bridges, tracks, and temples. The choice given by the district body for expenditure is narrow. If we consider the inflation rate, the value of the grants in real terms decreases considerably over the years. The scale, nature, and purpose of the government grants have not changed over the years. The visible inadequacy of available resources is apparently commensurate to the priority given to development of the hilly areas of the Lalitpur district.

The trend in district level resource allocation plans has been to grant special priority to areas with politically active and loyal workers, not necessarily active development workers.

### Neglected Government Services

The local community considered the location or the concentration of all services at one end of the district as a decisive factor for the absence of services in the hilly areas. The headquarters of Lalitpur district are at the northernmost tip of the district and Bhardeo is located somewhere in the middle of its hinterland. Communication and transportation facilities are concentrated in a small urbanised area. Bhardeo is a typical mountain farming area and needs additional attention and inputs, both technical and biophysical. The district offices are oriented more towards the urbanised area of the district close to Kathmandu. The lack of livestock protection and animal husbandry services and, for that matter, any extension support, has eluded the attention of the concerned offices.

*Credit Scare*

Cash is in acute short supply in Bhardeo for even a cooperative investment. But, at the same time, there is general apprehension regarding bank loans. Firstly, the household economy is affected if any of the animals, for the purchase of which the loan was taken, dies. There are no

livestock insurance schemes in Lalitpur district as yet. Also in areas where insurance schemes were introduced, it was, at best, the insurance of the **bank loans** and not of the animals belonging to the farmers. The insurance was terminated once the bank got its credit back, interest being around 16 per cent plus a punitive interest of six per cent for any delay in repayment. Very few farmers in hinterlands like Bhardeo manage to service their debts. One of the farmers in Bhardeo, who took a bank loan and failed to pay, lost cultivation rights over his land and became landless.

Another critical problem concerning credit facilities in Bhardeo is of an administrative nature. Most farmers claim that they do not possess land ownership certificates to use as collateral. Without these, as individual households they are disqualified from credit facilities.

In 1988, a programme to introduce a new breed of buffaloes from the *Terai* was implemented with the active support of the local veterinary centre set up in 1988. The minimum credit requirement was Rs 8,000 for a female buffalo. Three poor farmers had deposited land-ownership papers and they were persuaded to consider the advantages of the bank loans. The government offices, and particularly the bank, were interested in giving credit without asking for economic collateral. Pawning land deeds for such credit cannot be regarded as conducive to development.

The Small Farmers' Development Programme could be a solution. Does the concept behind the Small Farmers' Development Programme view the groups as a dynamic agent for social and economic changes? The poverty-ridden Bhardeo economy needs individual entrepreneurial initiatives for self-reliant development. Facilities should be introduced for small and rapid turnover credits based on trust and confidence and not based strictly on conditions of collateral.

## Underutilised Local Institutions and Services

### *Jhankris or Traditional Healers*

Major sicknesses were treated locally (fever, minor poisoning cases, wounds, cuts, TB cases, and diseases similar to typhoid). It was the *jhankri* (traditional healers) who provided the services. They also treated animals. Out of 40 practising *jhankri*, five were considered effective by the local people. Some of them had gained experience and acceptance in the community over 15 to 20 years. The success quota was claimed to be around 90 per cent in these cases.

In Bhardeo, the medicines and healing materials were mainly obtained locally from plants and minerals. No commercial medicines were used by traditional healers. No fees were accepted except for some drinks and tips. Such services cannot be expected from the government office which has limited resources and lack of motivation. The traditional healers were eager to add to their skills, particularly the younger ones. No formal or informal contacts were established between the *jhankri* and allopathic circles. The local healers had a store of knowledge of local diseases, social problems, and psychological cases which were underutilised. Local healers should also be given due recognition and commensurate facilities.

### *Labour Sharing (Parma)*

The existing labour-sharing system (*parma*) was being weakened by the pressure of poverty. A kind of dependency syndrome had overtaken it which indicated a declining household economy, on the one hand, and, on the other, the compulsion to buy food from outside for which money was essential. Compared with the earlier *khai garne* system (not dependent on wages for daily food) based on a strong, individual household economy, the local people had to adopt the undesired system of *gari khane*, which meant working first to earn a living outside of one's own farm. This implied a preference for wage labour over reciprocal free labour contributions between neighbours.

### *Retail Businesses*

Local trading and commercial activities were limited to low value consumer goods such as cigarettes, kerosene, maize, mustard, salt, and crude tobacco. Most of the sales were of cigarettes and tobacco. The volume of local trade was limited in value and kind. There were seven private shops with daily turnovers ranging from Rs 100 to 800. The profit margin of these small shops was 15 to 20 per cent. There was one *Sajha* cooperative. The major turnover of the cooperative was in kerosene, maize, rice, and chemical fertilisers on a cash only basis. The cash crunch was felt by all the households. This was one of the reasons why people preferred to buy from private shops, although the goods were more expensive. The major reasons for setting up the *Sajha* cooperative in the area are mentioned below.

- Essential consumer goods (oil, maize, salt, sugar, and rice) could be sold at much cheaper prices than in the local shops if these goods were brought from Kathmandu and not from the wholesalers in Lele, only a few kilo-

metres away to the north. The small local shops could not compete because of technical difficulties (transport, costs, etc).

- Commercial fertilisers and grains could be purchased in bulk and on time as required locally, compared to the practice of individual farmers going to the nearest market in Lele (which was tedious and more expensive).

- The co-op was recognised as a credible institution and as acceptable collateral by banks, eligible for large-scale credit, so that other investments, such as new goats, could be realised. The business was running on an average profit margin of only five per cent. The business was conducted mostly in the mornings and evenings for sale of chemical fertilisers and other essentials.

The number of shareholders was 52, out of which 47 were from Bhardeo with a share value of Rs 100 each. The major shareholder was the *Sajha* Central Cooperative Oganisation with shares of Rs 20,000. There were 20 to 25 interested potential shareholders in Bhardeo, but they lacked the minimum investment capital of Rs 100 per share.

Although the customers were relatively disadvantaged, one of the major comparative advantages of the small shopkeepers over the *Sajha* Co-op was cash-free purchase or barter of scarce commodities such as mustard, maize, eggs, or potatoes, which benefitted the community. More often, however, this had created a liquidity problem for the shopkeepers and there was a cash flow problem in the community at large. The repayment took place up to seven months. People would prefer to buy cheaper goods. Since cash incomes were rare locally, there was a loss of 10 to 20 per cent on every purchase made on a credit basis from small shops.

There was an inherent problem that *Sajha* could jeopardise the survival of smaller commission shops. Both types of business needed to adjust their business practices in order to have adequate specialisations and an adequate volume of transactions within such a small area.

The importance of small commission shops for the local economy was considerable in terms of small cash-free purchases and in terms of maintaining the mutual support, trust, and confidence present in a traditional society. Once local, regular businesses become too dependent upon cash transactions, then many of the local values, such as the self-help system, may disappear. One of the early victims has been the labour-sharing system (*parma*).

The extent to which these small entrepreneurs will be able to respond to developing marketing facilities, deal with the export of local produce, and cater for diverse inputs needs to be studied and monitored.

### Lack of Commercialisation

Marketing facilities, especially for slaughtered animals, are vital for the local economy. At present the traders from Chapagaon and Godavari, which thrived in the past at the cost of their hinterlands like Bhardeo, collect slaughtered animals from the former *Panchayat*, charging a disposal fee of 10 per cent. In most cases, the determination of live weight, judgement of the animal's condition, and pricing are done on an *ad hoc* basis and this is disadvantageous to farmers. The question of marketing fern (*niuro*) vegetable, mushrooms, and medicinal plants on a better economic footing is as yet unaddressed. To change the roles played by the traditional markets will be difficult in the foreseable future.

Mountain farmers without other means of income, unlike the affluent and clever traders who have access to the growing urban centres and markets, are forced to exert exploitative pressure on their environment with an unfavourable impact on the mountains. Organised marketing is a necessary and realisable goal. A cooperative or a local trade system, established by the farmers themselves, could go a long way towards bringing money to those who need it and who have rightfully earned it. In short, a commercialised approach to production is an issue deserving attention.

The necessity of commercialisation, as understood generally, is debatable. But regarding the potential products and the resource base, as well as the economic condition of the mountain farmers in question, it can become a viable alternative to a subsistence economy which otherwise threatens the environment in the mountains.

Mountain areas with a traditional system of agriculture are under constant stress. If the resource base is to be improved, then commercialisation is unavoidable. Commercialisation does not come so easily, unless higher value products are produced. When the production base is in a weak state, as in the case of Bhardeo, the investments too do not come easily. A whole range of linkages and adjustments needs to be established between the producers and the consumers, e.g., from the potential of the rural areas to the demands of the urban settlements.

People talk about accessibility of markets, in terms of the farmers' approach to urban markets. The hardships would apply equally to urban traders and planners trying to reach the production areas, and this means an additional set of questions needs to be answered. Institutional support could go a long way towards identifying potential areas within the farming systems to improve the production base (livestock, farmlands, forests, and *kharbari*). A question of skill improvement arises when the nature of product use has to be changed, e.g., diversifying the production system, for which the existing administrative structures are ill prepared.

## The Question of Commercialisation

Would commercialisation of mountain agriculture lead to expansion of cultivated land, particularly in Bhardeo? First of all, it depends upon whether the land is available, then upon other factors, for example, the product itself, the market culture, the usefulness of the product in question, and price determinants. We need to consider whether the majority of the poor will benefit from commercialisation or only a few more affluent people. In the case of Bhardeo, land resources are limited as is the cropping intensity. The needed commercialisation has to come through better use of the existing farmland and human resources. The nature, practices, and proximity to markets of the farming system (livestock dominant? horticultural dominant? subsistence or affluent systems? incentives, market, inputs, storage, and transportation, etc?) are strong factors that influence the commercialisation process.

## Deteriorating Natural Resource Base

Mountain farmers would manage their natural environment provided they were motivated, and this depends upon whether they draw benefits (major and side benefits such as water) and possess the required skills. There have been no economic improvements during the last few decades, thus pressure on the natural production base has not been discernible. The production base has not been sustainable in terms of fertility, productivity or quality of products; be they biomass, livestock products, crop yields, or *kharbari* biomass.

### *Biomass*

The dependency on areas outside Bhardeo for biomass could be reduced by over 50 per cent within the next 12 years. A positive development could take place on farmlands where crop improvement measures could turn over higher crop residues as winter roughage, thus reducing further pressure on forest sources.

### *Farmlands*

Since the maize deficit prevailing in the area is over 50 per cent, even if the productivity of the farmlands increased by 100 per cent it would not help the people to raise their living standards. It would be a waste of time trying to increase the production of maize under the present land use system, because the continuous loss of soil fertility could hardly sustain productivity even at the current low rate of production. The mixed cropping of maize and potatoes opens up a new base for improvement. The practice, though not unique here, is of great significance for securing an adequate supply of food for the community.

### *Livestock and Fodder for an Increasing Number of Animals*

This is one of the critical areas of livestock management that should be examined. The present population is not large, considering the average number of animals per individual household. However, seen from other resource perspectives, the situation is serious.

The degree and scale of fodder deficit, both in quantity and quality of fodder, could be measured from the milk yield during the same period. It showed a seasonal fluctuation related also to the dry period and to the shortage of green fodder and forage as such.

Although the leaf fodder available during the dry period was that of *Quercus* sp., which is deemed to be nutritive, the quantity available to the ruminant was low (6-12kg DM or 40kg FM for 2.71 LSU per household, equivalant to 2-4kg DM/LSU which is low for production and maintenance). The bulk of the fodder available in the form of maize stalks and husks, mustard straws, etc is not nutritious enough.

The increasing difficulty in getting green fodder from the farmlands, together with the lack of good materials for quick collection in forests that are easily accessible, would make it even harder to sustain the present livestock population, unless efforts are geared towards improvement of the fodder production base. The primary issue concerning livestock management is whether or not unproductive animals can be replaced by better breeds.

*Improvement of Breeds*

Livestock forms the most important link in the economic-ecological chain. Cattle and buffaloes consume large quantities of fodder and forage; risk is concentrated on one or two animals and is very high; and cash returns are relatively low compared to those for small animals such as goats. In view of the rapidly increasing fodder shortage, difficulties in the marketing of milk and milk products (transport, markets, etc), and the problems linked with the disposal of old cattle, the trend is towards partially replacing the buffaloes and cattle (large livestock units) by an improved breed of goats. There is already a tendency among farmers to prefer buffaloes to cattle. The productivity of individual households could be enhanced by introducing a better breed of buffaloes (22% of the households are planning to take this step) and supporting the others' (49% of the farming households) plan for bringing smaller animals (an increase of 37%) to replace 57 head of buffaloes (19%) by a better breed of goats, thus reducing the number of large livestock.

*Conclusion*

Under the existing bi-polar conditions of weak institutional responses and the weakening natural resource base, the terms of Bhardeo's development priorities have to be considered within the context of its own realities. The priority should not be limited to understanding the local bio-physical process. The problems are easy to comprehend and can be solved if the local people participate in decision-making for initial economic development. It is the management of existing local resources and exploitation of their potentials which are crucial for sustainable development.

# 7. Bhardeo's Development Priorities

In fact, no real development efforts have been carried out in Bhardeo. The distribution of drinking water pipes to households; the community health programme; construction of small wooden bridges and afforestation activities; and road construction under the food-for-work programme, carried out in more recent years, have been indicative of social service programmes that have depleted the natural resources, such as forests, needed for survival. Ironically, they have been seen as signs of development.

The community has realised the fact that the traditional way of farming cannot maintained. Any improvement in farmland productivity requires changes in the land use system, and this will take time. Development cannot take place without key modern tools and services such as electri-city (for cottage and light industries), education, and health and marketing facilities. In short, without job opportunities and manufacturing industries, development will not take place.

A small income-generating programme launched at the end of the study was beginning to show signs of the community's will and resilience to improve its economic situation on a self-reliant basis. The community still lacks fiscal resources and a responsive market to complement its efforts. The majority want livestock and apicultural development. However, any increase in livestock population, by even one-seventh of their total LSU stock per annum, as was the case in 1987/88 without the prior requisite of an improved fodder base, would cause severe pressure on the fodder supply and subsequently harm the vegetation and the environment.

### Economic Development with Responsive Market Links

The role of the existing market in the sale and purchase of milk and animal products is not thought to be satisfactory. Firstly, the traditional market is of negligible importance because of the low volume of transactions involved. Secondly, the merchants from Lele and Chapagaon have traditionally played an exploitative role. For the farmers selling milk, especially, there are no markets apart from a few selected client-merchants, and, in most cases, they are selling under compulsion owing to loan/credit problems.

The trend in the Bhardeo community is moving towards producing high value products like honey, special vegetables for which the area has **comparative environmental advantages** over other low-lying areas close to the Kathmandu Valley, and temperate horticultural products of good quality.

Low inputs are invested in low risk, animal husbandry (goats, specialised poultry, and/or even angora breeding). Small animals that require low inputs are preferred while the market demand for meat is rising. It is obvious that most farmers have also understood the link between fodder shortage and deforestation.

Both types of activity could help create employment opportunities within the area and enhance incomes. A crucial element is better marketing facilities that could increase production without being an additional burden on the environment. These facilities could be provided through measures familiar to the farmers, i.e., reduction in the number of unproductive animals, intensive feeding, improvement of fodder resources on the farmlands, and better management of private woodlots *(kharbari)*.

### Basic Issues of Economic Development

The demand for capital is relatively small. A poor community is less likely to take steps to manage natural resources in a sustainable way, despite biomass deficits, as long as subsistence needs are met. In most cases, attempts to enhance biomass resources are made only when the household economy needs higher biomass inputs. Hardly one per cent of the households (two) wanted a development project in their area. The rest only favoured a development project if it guaranteed them employment and enhanced income.

### Self-reliant Development

At national level, time bound and specific goals can be set to achieve self-sufficiency. But is self-sufficiency at the local level necessary? And does it tally with the imperatives of

optimum land use practices and development potential in a given mountain area with environmental conditions such as those prevailing in Bhardeo? Are there alternatives to local self-sufficiency?

**The Bhardeo community at present has no choice but to realise development priorities through their own efforts. Although the pace is slow, their efforts have chances of success.**

**The selected path would have to be self-reliant development.** It should be "*based on the premises that the poor in Nepal want and can have a better life, materially, physically, and spiritually*" (IDS 1989). Whatever the underlying principle, self-reliance should primarily raise the dignity of individuals in their development efforts. The concept of self-reliance should not be mixed up with the concept of self-sufficiency.

Of course, the issue of self-reliance is relatively sensitive. The development plans in the area have not been able to integrate the concept of self-reliant development of individual households, particularly that of the poorest households, because poverty degrades human dignity and suppresses motivation and initiative. Development plans are imposed on individual households, and this means a loss of individual liberty and human dignity.

New planning excercises and schemes need to be tried out in both on-farm and off-farm areas with consideration being given to micro-level feasibility. The feasibility of new programmes must be viewed from different perspectives.

## New Planning Excercises and Institutional Arrangements

The major indicator of Bhardeo's unsustainability is the biophysical aspect of its economic base. Any efforts to improve Bhardeo's environment must consider income-generating activities, primarily in the off-farm area, in order to alleviate poverty and introduce nature management (rehabilitation of damaged farmlands, stabilisation of steeper slopes, and skill improvement for better marketing of the products of forest and farm-based small-scale cottage industries and trades). Some nature management activities could be used for land reclamation and the generation of direct incomes in the form of wages as a short-term plan. Other activities, such as plantation, are a long-term investment.

While some of the nature management programmes could be carried out as individual sector programmes, especially activities for the rehabilitation of common properties such as forest lands, stream beds, etc, others, such as soil improvement and plantation on farmlands, need to be accompanied by employment and income-generating activites.

Off-farm opportunities, whether in nature management or in the production and manufacturing sectors, should be flexible as far as its demand on local labour is concerned. As the timing of farmland operations is more or less rigid, off-farm opportunities, especially part-time ones, must be available during the monsoon period. Even stabilisation works on feeder roads (such as construction of drainage channels to minimise the damage to farmlands, plantations, etc), which are usually undertaken during the rainy season, offer respite to the poorest people.

However, urban pressure, i.e., relatively cheap labour, lack of development services, and heavy pressure on the resources within Bhardeo, have added to the complexities of nature management. Nevertheless, these complexities are manageable. The longer term effects of environmental conservation could bring back positive trends that once sustained a subsistence economy and a cultured lifestyle in Bhardeo.

The new schemes should take into consideration the importance of employment opportunities and enhanced income through a market-oriented production system, adding components that have a positive impact on the overall resource base. The schemes under discussion here are regarded by the Bhardeo community as ones aimed at sustained income generation which could, at long last, be the start of economically and environmentally sustainable development in Bhardeo. Sustainability is a question related to the environment, consumption patterns, and diversity in farming. In all aspects, the Bhardeo community is experiencing the stress of deficit. The overall objective of development planning in Bhardeo should be to restore a measure of sustainability. Of course, whether Bhardeo possesses potential is a pertinent issue that needs to be examined.

Development of a self-help institution, organised and managed by the local people, is vital to the community. The community has been marginalised politically, economically, and socially, and this has led to the fatalistic view that the local people could not and would not be able to establish such institutions. Hence, efforts to motivate them and restore

their self esteem and confidence must receive the highest priority. That will not be possible unless they participate in decision-making and carry out the programmes meant for them. There is a certain scepticism regarding the political and nationally organised government institutions. Real achievement can only be possible through the community's own efforts. The Bhardeo community has the resilience to organise itself and take the necessary steps. With minimum outside support, at the time of the study, there were six self-help groups engaged in income-generating activities. Within one and a half years they had been able to increase the incomes of 30 per cent of the poorest households by over 30 per cent. Any political institution that needs to be developed will operate better, as far as resource mobilisation and development programmes are concerned, through local self-help groups. This would ultimately strengthen the local institutions.

## Resource Potential

The lifestyle in Bhardeo might not be different from any other village in the Nepalese Himalayas in terms of environmental changes related to natural resources. We have noted the changes in the resource base that have profoundly affected the local economy and environment, and the local community itself tried to solve these problems by taking a number of measures. But the condition of the resource base, as well as the morale of the people, indicated that a positive change was possible. The community had yet to discover its comparative advantages and development potential, compared to other areas close to the markets of the Kathmandu Valley.

Although culturally rich, the Bhardeo community is underdeveloped. The community is diligent, but it has become increasingly unable to cope with new problems. Lack of education, social problems, and lack of new skills, as well as the absence of health, credit, and transport services, have hindered progress. With skill improvement and provision of credit, inputs, and transport services the community could rapidly cast off its economic backwardness and break the vicious cycle of poverty-resource depletion-poverty.

We can assume that most of the area's natural resources, including its human resources, can be developed through demonstration and implementation of improved practices, controlled use of natural resources, and changes in the land use system. Table 22, based on interaction with the local community and observation of technical expertise, illustrates that there are sufficient possibilities of improvement in the system. Even though land-based resources are in an advanced state of degradation, the possibility of improvement exists.

It can be assumed that sustainability of resources would change in Bhardeo under different policy guidelines, access to responsive markets, resource enhancement practices, and provision of needed services and inputs. As far as the effectiveness of policy guidelines in resource enhancement and production increase is concerned, Table 22 illustrates that this is limited to forest and animal resources. But changes in resource use practices, such as changes of species and from seasonal to perennial cropping, can make a difference. What effects will they have on the environment and on the basic requirements of the Bhardeo community?

**Table 22: Potential of Resource Enhancement Efforts in Bhardeo**

| Resources | Production Increase | | | Impact of Changes in | | |
|---|---|---|---|---|---|---|
| | Food | Fwd | Fodder | Policy | Mkt | Services |
| Human Resources | h | h | h | ns | h | h |
| Land Resources | | | | | | |
| Farmland | h | l | m | ns | h | h |
| Forests | m | h | h | h | h | m |
| *Kharbari* | ns | m | h | ns | ns | h |
| Stream beds | ns | m | m | h | ns | ns |
| Animal Resources | | | | | | |
| Cattle | ns | | | h | ns | ns |
| Buffaloes | h | | | h | h | h |
| Goats | h | | | ns | h | h |
| Poultry | h | | | ns | h | h |

(h = high, m = medium, l = low, and ns = no significant change is expected)

With improvement in inputs, credit, and transport services, as well as changes in land use practices, farmland resources still have potential for development. Policy guidelines, however, will not significantly affect farmlands and *kharbari* which are privately owned.

The development of forest resources is influenced by policy changes, particularly for timber and fodder resources, while the market can play a key role in promoting minor forest products. The farmers would indirectly benefit if marketing of cattle outside the country was legalised, or even if they culled the unproductive animals. Because of the lack of

grazing grounds in the immediate area, even veterinary services would fail to provide the needed impetus to cattle productivity. Government intervention could help those rearing buffaloes by fixing the price of milk and providing services. It could render help to the farmers and motivate them to produce fodder.

In the following pages, activities to enhance the resource potential of Bhardeo and increase incomes have been considered. Realistic suggestions have been given, taking into account the resource potential of the community.

**Income-generating Nature Management Activities**

*Clearing Debris*

Approximately 22ha of farmlands were damaged by a cover of approximately one to two metres' thick debris (330,000 cubic metres). Fifty per cent of the area is under loose debris cover with boulders of all sizes and aggregates.

The large amount of debris lying on the farmlands and in the gullies can be regarded as a resource with potential economic use. Clearing debris from farmlands is one of the priorities of the community, primarily because of the necessity of reclaiming farmlands and, secondarily, the debris can be marketed.

*Reclaiming Damaged Farmlands*

It is necessary to consider a few important points before taking measures to reclaim the farmlands with government support. There have already been some efforts on the part of the farmers to reclaim the farmlands which were damaged extensively in 1981. Since then only 30 per cent of the lands have been reclaimed by the farmers who invested substantial amounts of personal savings.

Attempts have been made to reclaim land right up to the stream banks for the production of food. Almost all the households were affected in one way or the other by the floods of 1981. The primary objectives and rationale behind the government-supported reclamation of the 1981 flood-damaged lands are given below.

1) To give partial compensation to the affected farmers for the loss of crops.
2) To help generate cash income to help individual households save some cash for economic recovery.

To reduce pressure on the forests and to increase animal productivity, there is a need to produce more fodder and forage within the farmlands. The best areas are those near the streams in the valley. The reclamation efforts would bring more areas under cultivation, thus producing more fodder and forage as agricultural by-products and crop residues or terrace border vegetation.

The boulders and stones should be removed from the fields so that cultivation can take place. This can be done by engaging landowners on a daily wage basis or under the proper supervision of development agencies.

- The collected debris materials should be purchased and used/deposited to protect stream banks or to stabilise roads.
- Protection of stream banks and road stabilisation works should be carried out by employing local labourers after clearing the debris. This would compensate the farmers in two ways and maintain a certain level of off-farm income generation activity for a considerable length of time. The income generated could be used for improving the farming system (specialisation of production, etc). The people of Bhardeo are ready to cooperate with development agencies.

It is estimated that even if only 50 per cent of the debris was mined, it would yield 15,000 truck loads of stone for export, bringing in over Rs 1.5 million net income to the local economy (at Rs 20 per cubic metre and a load of five cubic metres per truck load), provided that the load-bearing capacity of the road to the area is maintained for loads of up to 10MT.

The amount of money earned by the people through wage labour would be around rupees three million. If the rehabilitation work is carried out over a period of 10 years, expected income from wages would be, on an average, over Rs 1,000 per household/year whereas the households who have stones on their fields would earn much more. If only 10 per cent of this income could be taxed to create a fund for local development in areas such as trade, higher schooling, and creation of local jobs, almost half a million rupees would be available to the community for investment by the year 2000. This project has to be handled with caution. The possibility of making profit from debris may attract clever land grabbers and the poor households deprived of their past incomes may lose future benefits also.

## Long-term and Indirect Income-generating Nature Management

*Tree Plantation*

The suffering of man is linked with the suffering of trees and vice versa. This has become a universal truth. A properly managed slope with a forest containing appropriate species of trees and other plants, valued now and in future by the people, is crucial for Bhardeo's future development. As the farming and livestock management system cannot be totally cast aside, the needs of both man and animals must be met and, if not entirely from the incomes within Bhardeo, a substantial portion must come from these slopes which must be conserved for the sake of the environment.

Programmes need to be devised to plant species that are appropriate as a source of fodder and other useful species. In order to cope with the problems of reforestation, priority should be given to private plots. Increased fodder production cannot be attained unless wide ranging rehabilitation of the farmlands *kharbari*, and the forest lands within Bhardeo is undertaken on a priority basis.

To achieve this end, several means can be considered. Firstly, farmlands could be used to produce larger quantities of fodder, provided the farmland use system changes to accomodate diverse and multiple cropping. There is a local demand to plant suitable species as fodder grasses on terraced benches and there is no previous experience of grass planting, apart from local species such as *babiyo (Pollinodium angustifolia)*, etc. Secondly, the depleted forest lands of Bhardeo could also be used. Both areas could be used to plant fodder trees and other multipurpose tree species. The community wishes to use forest lands for activities such as cultivating mushroom species *(Quercus semecarpifolia, Q. languinosa, Q. glauca)*, species suitable for charcoal-making *(Rhododendron* sp. and *Lyonia* sp.), and fodder tree species (*Ficus nemoralis*).

As far as the nature of land and the choice of species are concerned, the current practice of plantation programmes needs to be reappraised. The Bhardeo *Khola* watershed was linked with the people's farming practices. Multipurpose trees, such as *Quercus* sp. and *Schima wallichii*, are an economically justifiable choice. Construction of many costly checkdams could be avoided in favour of planting specific tree species which have better and far-reaching effects.

- Tree plantation on the mountain slopes should be in line with the people's choice of certain species, their uses, and the local management system. The planting of pine species should be discouraged.
- Tree and shrub species preferred by the people should be planted on common land slopes with the cooperation of the people.
- The major focus of tree and grass plantation should be on *kharbari* lands. One hundred and fifty households have private *kharbari* grasslots of about 24ha that should be placed under priority programmes for planting fodder trees, fodder grass, nut trees, and other useful species.
- In addition, the rehabilitation programme for the common land of the Bhardeo watershed should consider planting fodder trees during the new afforestation programme.

The number of fodder trees to be planted on common lands as part of the massive afforestation programme, especially the species *Quercus semecarpifolia, Q. glauca,* and *Ficus nemoralis,* should total about 30,000. These eventually could yield leaves amounting to approximately 100MT from about 20,000 surviving trees by the year 1995 and 300MT by the year 2000. Over 10,000 fodder trees are needed to carry out plantation on farmlands. These could yield over 300MT of tree fodder in 10 years.

The quantity of fodder from trees harvested from farmlands (and from forests outside Bhardeo) could be increased from around 1,100MT of fresh leaves-cum-twigs (in the year 1987/88) to 1,300MT by the year 2000, given appropriate and timely action. The scenario presented in Table 23, however, does not guarantee complete self-sufficiency in fodder production within Bhardeo if the level of plantation is not maintained and the number of animals remains unchanged or decreases. This shows that the problem can be solved, provided serious efforts are made without delay and not on a piecemeal basis.

As a result of labour costs and time loss, Bhardeo could face problems in the future if it continues to use resources located at a distance. It will not be necessary to collect fodder from the major pressure areas of Gairi, Gupteswor, and Phulchokipakha by the year 2000, if the number of fodder trees planted has exceeded 40,000 to 50,000 by 1990/91. This will have far-reaching effects on the management of the forests and on the stability of the slopes in and outside Bhardeo.

**Table 23: Scenario of Fodder Base Improvement within Bhardeo**

| Time Dimension and Quantity of Fodder Available | | | |
|---|---|---|---|
| **Fodder Base** | Year 1990 (MT) | Year 1995 (MT) | Year 2000 (MT) |
| Farmland/*Kharbari* | | | |
| . Existing trees | 120* | 180 (37kg/tree) | 240 |
| . 1989/90 plantation (11,200 trees) ** | - | 112 (10kg/tree) | 336 (30kg/tree) |
| Forests + | | | |
| . Existing source | 972 | 798 (-18%)++ | 439 (-55%)++ |
| . 1989/90 plantation (20'000 trees) ** | - | 100 (5kg/tree) | 300 (15kg/tree) |
| Total | 1092 | 1190 | 1315 |

* at the present yield estimation of 50 kg/tree

** productive trees

\+ existing forest sources are located outside the former Bhardeo *Panchayat*

++ reduction of dependency on existing forests outside Bhardeo

Nature management activities that are feasible in the ensuing years, such as tree plantation and reclamation of flood-damaged farmlands, will be undertaken to bring relief to the farmers.

*Terrace Improvement*

The gradient of the slopes in question, water, temperature, and soil conditions; price of inputs; and the quantity and quality of products should be considered in order to convert the low lying maize lands into better rice terraces.

The people of Bhardeo now require more than this to carry out terrace improvements. Many flat paddy terraces and semi-terraced maize fields were destroyed in 1981 during the catastrophic floods. What the people have tried and are still trying to do is to reclaim their lands to the extent that they are as close as possible to the original condition. But the farmers have made harder efforts on steeper slopes. The loss of potential nutrients, topsoil, and the loss of productivity from such slopes are too high for sustainable production.

Terrace improvement programmes need to consider the overall gradient of the slopes involved as well as the productivity of the terraces in question. Terraces on steeper slopes tend to become narrow if terrace walls are low, which may prove to be effective depending upon the purpose of land use and the terrace foundation.

The construction of wider terraces on steeper slopes for grain production is a pointless excercise because of high velocity runoff. The wider terraces affect terrace stability because of high terrace walls. Relatively flat valley slopes are suitable for terrace improvements. Unless there is a change in the land use system on such slopes, terrace improvements may not lead to sustainable development. The terrace improvement programme could cause more damage than it remedies.

- Steeper slopes should be used for tree plantation: fruit trees, fodder trees, or any other good cash crop tree (nuts, etc) should be planted on narrow and low-walled terraces with good ground covers of fodder quality grasses.
- The question of providing food subsidies until the land becomes commercially productive should be considered.

Serious thought should be given to the chronic food shortage in Bhardeo. It could be tackled by making available soft and long-term interest free loans from the Agricultural Development Bank Collateral could be offered by development agencies.

*Charcoal Plantation on Kharbari*

Charcoal-making could provide an additional source of income to the people of the area and help in the conservation of forests. It is a fact that charcoal-making has had negative effects on the forests. But the problem does not lie exactly therein. Charcoal-making is concentrated on forest lands. It could have a completely different effect if charcoal-making was carried out outside the forests. The traditional dilemma of integrating conservation with economic development is applicable to this trade. Planners should consider integrating charcoal-making and afforestation objectives.

From the study, it cannot be assumed that the weakest of the Bhardeo households, such as landless or semi-landless villagers (with very little land) with access to forests and poor quality land, tend to engage in the charcoal business. It cannot, however, be denied that poverty induces people to enter the charcoal trade.

The policy of forbidding practices that have continued throughout several generations is wrong and will have no effect. The question is linked to the future of the area which has a long history of poverty. The issue of suitable alternative energy for artisans is also relevant. When it is absolutely necessary to stop the practice of charcoal-making,

priority should be given to providing alternatives to charcoal and not to preventing its manufacture. This is a very difficult process. **The problems created by charcoal-makers do not stem from the fact that they use trees, but from the fact that they have not been able to raise trees on their private plots of land to make charcoal.**

The economics and causes of charcoal-making in the area and its effects and implications, particularly on the environment in the case of forest fires and loss of trees, are known facts. Although forest fires caused by charcoal-makers are mostly incidental and unintended, these fires do cause damage when they get out of control. Better use of the available charcoal-making skills by selecting different species for use should be considered.

From a short-term perspective, charcoal-making is the most lucrative use of forests from the users' point of view. It is also a source of high income, bringing quick profits to a hard-pressed community.

Updating Charcoal-making Techniques. Charcoal-making, which is essential for gold, silver, and copper smiths, is a very intensive process and a technically difficult and risky undertaking. Various techniques are applied at different stages.

The community is interested in making minor adjustments to their practices. In addition to other gains, the motivation to check forest fires would also be there. There are some issues that have to be addressed. The administration's view that this trade is illicit has to be reversed. Returns from the business of charcoal plantation take a long time, e.g., 10 to 20 years depending upon the species of tree used. This activity could be one of the "side-businesses" while others with quicker returns could be the backbone of the household economy, relieving the economic imperatives of the charcoal-makers and bringing positive development trends to market mechanisms.

The use of the currently degraded forests and parts of the private *kharbari* lands for the production of charcoal species, such as *Rhododendron, Lyonia*, and *Quercus*, could motivate the people to manage private local woodlots. It would be a good idea to plant up to 800 trees of the charcoal-making species (or 50% of the total trees normally planted per ha of land) per hectare on *kharbari*, with fodder and fuelwood species making up 50 per cent of the trees.

The area of available *kharbari* is around 24 ha, of which around 50 per cent could be used for planting charcoal species at the rate of 1,600 trees/ha. With a 10 year harvesting cycle only 10 per cent of the standing trees, a yield of 2,000 trees (200MT of fuelwood or 80MT of charcoal) worth a net income of Rs 600,000 would be available after 10 years of production management. Thereafter, annual replacement planting could be carried out. Approximately 150 *kharbari* "holder" households would benefit from this activity, providing an additional income of Rs 4,000 per user household per year.

*Reduction of Pressure on Forest-based Resources*

It may not be possible to avoid extensive use of forests, considering the current conditions and the dependence of the local economy on biomass. Farmers should normally avoid forests during the major growth period of the forest floor vegetation. This could perhaps be made possible by improving the *kharbari* and farmlands.

It is recognised that forestry resources, especially for traditional uses such as leaf litter, leaf fodder, fuelwood, and timber, within the former Bhardeo *Panchayat*, were depleted years ago. Until forest use and forest management systems are diversified, the local forest lands need to be protected from further depletion. The production of fodder within accessible areas is of utmost urgency, if the productivity of the ruminant animals directly and that of the farmlands indirectly, even at the present level of animal productivity, are to be sustained. There are two issues which need to be considered. Firstly, reduction of pressure on the most frequented forests such as Phulchokipakha and Gairi. This is not possible with the efforts of the Bhardeo people alone, but, at least, the Bhardeo people could start by reducing the pressure on the forests. Secondly, rehabilitating the Bhardeo slopes and raising productivity to meet the fodder and firewood requirements of Bhardeo could play a vital role in reducing pressure on the forests of Phulchoki. Alternative solutions are required to achieve this.

*Management of Neighbourhood Forests*

There are households that are eager to protect nearby forest areas, provided the households managing the woodlots derive benefits. For example, an inhabitant of Ward No. One wants to protect and develop a currently degraded woodlot so that she can protect her farmland which is located immediately below the forest and use the available grass, dry twigs, and branches for her household.

*Hunting as an Off-farm Activity*

There are still some traditional hunters and some have permanent jobs in Kathmandu. Since the general degradation of the forest has resulted in the loss of wildlife, the hunters find it hard to make a living. Of the 163 persons belonging to the official hunting brigade, which supplies birds, deer, and wildboars, one is from Bhardeo. All of them face the same problem. The problem is twofold, i.e., loss of wildlife pastures and loss of forest vegetation leading to general degradation and the loss of wildlife. They are under pressure to find wildlife regularly in order to retain their jobs. Their beat covers a large area as far as 10 to 15km away from their traditional areas. Hunting should be regulated to preserve the ecosystem.

In other parts of the country, where forests and wildlife have been revived, the people have to face a different kind of problem. The existing wildlife is posing a threat to life and farming property. It may become necessary to gradually set up an organised hunting area, permitting the local people to hunt only in their own allotted area as a control measure to protect the economic activities of the people in the area.

*Management of Forest Products of Economic Importance*

There are a few important forest-based activities that could enhance household incomes, either in a cooperative or individual manner, such as the collection and marketing of medicinal plants (*Thulo Okhati* = *Astilbe rivularis* and *Sano Okhati*), mushrooms (see Table 19), *niuro* (fern), and *bantarul (Diascorea* sp.)

The local price of mushrooms in Bhardeo is Rs 15 per kilogramme for buyers who are able to pay in advance to the collectors. The price is higher for traders who are unable to pay in advance. By the time the mushrooms reach Lele market, the price increases by Rs 10 and, in Kathmandu, they can fetch Rs 45 which is three times the producers' price. The difference of Rs 20 to 30 per kilogramme, after deducting transportation costs, benefits the traders. The price of mushrooms from May/June to July/August is higher than in later months and fresh mushrooms from Bhardeo are very popular in Kathmandu.

Income enhancement during the initial period of self-reliant development is reflected in the savings made from wages and the price rise that is necessary for collection of the products which have been marketed locally. The strategy would be to help local collectors market the materials. This could help them to more than double their incomes to Rs 150,000 per annum without harvesting more forest-based products. The price rise would hardly affect the local community as collection for home consumption is carried out free of cost. The trader/moneylenders can be bypassed by giving small amounts of credit whenever the collectors are in difficulties, which is normally during the early part of the dry season when they are in need of cash to purchase food.

*Maximising On-farm Opportunities*

The objectives of farm-based activities related to nature management are, firstly, to enrich soil and, secondly, to stabilise the lands for sustainable production and income generation.

*Comparative Advantage*

Ecologically, Bhardeo, being a temperate mountain area close to the large markets of Kathmandu, has two important advantages, i.e., as a production 'niche' and as a place where tourism could be developed. The temperate areas around or close to Kathmandu markets have the natural advantage of marketing products in summer which the valley otherwise would only have during the winter, for example, mountain potatoes, cauliflowers, and peas. There is a potential for growing temperate vegetables and fruits. In fact, a few farmers have tried to produce marketable peas. Income and job opportunities from these activities need to be properly assessed in the future.

The markets of Kathmandu Valley are easily accessible to Bhardeo and, in due time, this fact could serve to reduce reliance on cereal or foodgrain production. There is a high demand for fruit and nut trees in at least four wards (1,3,4, and 8). Fruit species such as apples, *naspati (Pyrus* sp., *Persemum*, apricots, peaches, walnuts (*Juglans regia*), bitter limes (*jyamir*), plums, oranges, limes, and *lapsi* (*Choerospondias axillaris*) could be planted. People are willing to try new species of fruit and vegetables. Even the newly cultivated forest lands (about 3 ha) used by landless villagers could be turned into fruit orchards.

- Horticultural extension works should be started by establishing a horticultural nursery (vegetables, fruit, and nut trees) to make sure good quality plants are available on time. Adequate work should be undertaken in the very beginning to create marketing facilities (collection, storage, transport, payment, and sales).

Special consideration should be given to products that earn higher profits and environmental protection should be supported by increasing fodder production and horticultural production. In the case of cereals, the trend will be one of lowered production while not necessarily leading to a decrease of productivity in terms of value. The farmlands will be used for better production management. The rising trend will be in horticutural and high-value animal products.

Considering the economic potential of other opportunities, the households could be motivated to opt for smaller animals or other income-enhancing activities. It would not be advisable to replace the present stock of large cattle because of the fact that the disposal of unproductive animals may be difficult.

## Specialised Economic Programmes

A crucial issue is the establishment of an organised system for production and marketing of local goods. The experience of other villages in Nepal is that the farmers lose the clout they need to market their goods if they are produced and marketed individually in an unorganised manner. In addition, protection of marketable products is beyond the economic reach of individual households.

Strategic focus should be placed on producing and marketing the kind of goods that have comparative advantages in quality and on scheduling the market requirements of other areas. Different and flexible approaches are needed in production and marketing which involve a whole range of specialised organisational and monetary complexities. The system should not be so rigid as to limit the access of individual households to certain commercial or manufacturing enterprises.

The prevailing marketing and credit policies and disbursement facilities have not benefitted the weak economy of the mountain communities. Movement and access to better and bigger markets are controlled by the traders at strategic points on the producers' route to the markets. For example, the markets in Lele and Chapagaon have exploited the people of Bhardeo. The profits derived by the middlemen are very high. The individual farmers as producers lack price protection and a farmers' association is needed for price enhancement, creation of a market 'niche', and collective sales. The same commodities could increase in value if they were hygienically processed (drying, packing, etc) locally and marketed at reasonable prices.

A new programme based on group efforts for production and marketing could be launched for those specialising in dairy products. Despite fodder deficits, some households continue to keep animals. Depending upon the type of livestock, rearing becomes profitable at a certain level while a large number of animals becomes a burden. The animals are needed not only for meat and milk products but also for the production of essential farmyard manure. An organised production and marketing system could operate at different levels depending upon the approach taken by individual households.

The individual households or clusters of households (a flexible cooperative) could participate in programmes of their choice. The households should be organised into groups of producers (raw materials and manufacturing), packers, and marketeers. A coordinated cooperative system is necessary to avoid hardships (exploitation by markets, middlemen, lack of cash, storage, and transportation facilities).

*Specialised Household Level Activities*

Production programmes could be launched at the household level by selecting low-risk and high-value marketable goods as well as goods for local consumption (inter-household exchanges) such as animals, honey, fodder, fruits, vegetables, raw materials for manufacturing bamboo goods, cream, cheese, husk mats, ropes, and brooms which would not negatively affect the environment.

Some of the activities especially linked to production depend upon favourable exchanges of goods among households. Some households would emerge as producers of raw materials and semi-finished goods, while others would be responsible for manufacturing goods, and some would be involved in marketing.

Livestock have been a vital source of cash income (although the total value of the sales is small), but they have the least potential within the traditional management system. The community is aware that they would need to upgrade their buffalo stock in order to set up dairies. The general shortage of fodder is another constraint. As an alternative, a selective kind of approach is required in the case of animal husbandry with households specialising in buffalo or goat cooperatives. Households should be encouraged to exchange larger animals with smaller ones and to market cream and ghee, instead of milk and *khuwa*.

*Specialised Poultry-keeping with Sakini Fowls*

A poultry industry with the *sakini* breed of local fowl is rarely found. The quality and taste of *sakini* fowl make it very popular and it fetches higher prices than hybrids. Entrepreneurs go from door to door to collect fowls from households willing to sell them.

At present, there are 33 households which are ready to start poultry farming. They have over a thousand fowls at 30 to 50 fowls per household. They have not specified the breed. Because of the constraints of inadequate feed supplies and unfavourable market conditions, it would not be advisable to keep hybrids or exotic fowls. Hence, people should rear *sakini* fowls. Interested households could maintain flocks of 12 to 24 *sakini* fowls selling one to two birds per month. This would bring 2,000 to 3,000 rupees per annum (more than 50% of the total income of the households during 1987/88).

Each household could collect at least an egg a day and market eggs in an organised way. It is difficult for them to sell a few eggs in a market that is four to five hours away. On an average, the participation of 200 households and 300 days of egg collection could bring an annual income of at least Rs 120,000.

*Goat Rearing*

Stall-fed goats are more energy efficient. Even a single household can minimise risks if they invest in several animals and the quicker cash returns realised will be relatively high. Therefore, reduction in the number of goats is not desirable. In fact, the population of goats in the former *panchayat* was not large. Goats are the most important animal resource for cash income and they can be raised with relatively little effort. People would acquire more productive goats provided veterinary services were more readily available.

The local demand for improved breeds is for as many as 461 animals. Approximately 128 households (48%) are interested. The total investment would be over half a million rupees. However, the local economy, as well as the environment, could hardly bear the burden. So positive but cautious steps need to be taken in this area.

In the initial stages, a production programme could be undertaken for the local breed of goats without raising the population, organising the households keeping goats (especially goats raised for their meat), by encouraging participation of about 20 per cent of the households involved in farming. The initial capital investment is minimal. It would come to around Rs 100 per animal. The number of animals should be determined by the households involved depending upon the fodder and the services available. Production of 100 animals for slaughter per annum at the rate of one per household is possible.

*Rearing of Wild Boars for Marketing*

There is a complete absence of pigs as a result of the food deficit. However, six households are interested in keeping 14 pigs, mainly for meat production. Wild boars can find a ready market in all seasons, fetching a price of up to 50 per cent more than goat meat. These could be reared instead of pigs.

*Production of Honey*

Bhardeo has an ecological advantage over other areas, particularly over the Kathmandu Valley. The climate is good, flowering plants are abundant round the year on farmlands and on forest slopes. The air is clean and the area is sunny most of the time. So the quality of honey should be far better in terms of taste, consistency, and viscosity.

Some farmers had tried to produce honey earlier, but, as a result of poor management, the profit was minimal. Seventy-six households are willing to set up 132 hives and undergo training in this activity.

Elsewhere in Nepal, profits between Rs 2,000 to Rs 3,000 per hive per year can be made by marketing honey. This has become one of the most lucrative and environmentally favourable activities in the mountains. The local market price of good quality honey is anywhere between Rs 200 to 300 per kilogramme throughout the year. The income from honey alone would be able to double the current household income of about Rs 5,000. However, if technical expertise is available, efforts could be geared towards producing and marketing high value beehive products (such as royal jelly) with high nutritive and medicinal/cosmetic properties as royal jelly has a profitable international market (Verma 1990).

*Production of Materials for Brooms*

Approximately 25 per cent of the households own a few bushes of *amriso (Thysanolaena maxima)*. Each bush of

*amriso* can be used to produce four brooms. The current price of one *amriso* broom is five rupees in Patan.

*Babiyo (Pollinodium angustifolia)* is available on the farmlands but the number of bushes is limited, partly due to its low price in the market. *Babiyo* is a much more versatile material than *amriso*. *Babiyo* can be used to produce ropes, brooms, brushes, mats, etc. The area is climatically and altitudinally suitable for the production of *babiyo*, especially the lower areas. Production of *babiyo* could be increased by engaging farmers and planting more bushes.

## Manufacturing and Marketing Household Clusters

*Marketing Higher Value Milk Products*

The dairy markets of Kathmandu Valley consider fat content the most important criterion for good quality milk. The lower milk fat content in the milk produced by livestock during the warm monsoon period (*Jestha-Srawan*) would normally bring less money to the farmers. Another problem is the transportation of milk which is especially difficult during the monsoons. Ghee is easier to sell but less profitable compared to *khuwa* (evaporated milk). It also needs firewood for its preparation which poses a problem. The marketing of milk is not beneficial to the people.

During the months from *Bhadra* to *Magh* (six months) the people could churn 25 to 50 per cent of the total milk available into cream, and this amounts to from five to 10,000 litres of milk. The milk (with a content of four to five per cent butter and whole protein) which is left over could be a source of nutrition. This could provide the area with an additional income of at least 30,000 to 40,000 rupees, in addition to employment opportunities for two persons. Should this prove less profitable, the people could still sell 25 per cent of 27MT of the available milk annually to dairies and earn about Rs 50,000. Delivery to dairies or sale of cream would provide immediate relief to the farmers. Arrangements should be made to operate a creamery for marketing fresh cream to markets in Kathmandu.

*Manufacturing Households*

Agencies dealing with local economic development are non-existent apart from some services. NGOs could encourage efforts to attain self-reliance in many ways whether through mobilising the concerned government departments or initiating direct action. The local small-scale cottage industries, based on locally available materials such as maize husks, bamboo, mushrooms, and potatoes, could be promoted. There are also skilled carpenters who could be encouraged to produce furniture.

*Bamboo (Nigalo and Bamboo Goods)*

The strands (*choya*) from *dhuti nigalo* for *perungo* (packing for mushroom baskets) can be produced for local consumption as well as for the markets. *Dhuti nigalo* could be planted in and around farmlands in higher and more marginal areas above 1,900m. At present, a single person can harvest 60 to 100 pieces of *nigalo* in one day, or raw material for four baskets (*doko*), from the forests located at cooler altitudes. Assuming that 10 per cent of the households enter this business and produce four baskets a day, it would imply a collection of 80 bushes of *nigalo* in 100 days and a production of 400 baskets worth Rs 10,000 per year. *Choya* utensils, such as large and small baskets, are in demand in the markets of Patan and Kathmandu. The price of a large basket is anywhere between Rs 15 to 25 in the markets depending upon the quality of work involved.

*Brooms, Ropes, and Headbands (Namlo)*

*Pat* (*Yucca* sp.), *allo* (*Gorardinia diversifolia*), *babiyo* (*Pollinidium angustifolia*), and *amriso* (*Thysanolaena maxima*), are used to manufacture ropes which have a permanent market. An estimated production of 400 brooms worth Rs 10,000 would be possible for Bhardeo households.

*Maize Husk Mats*

The demand for maize mats is high and the price offered is acceptable. They can cost anywhere around Rs 100 to 150 for a 1.2 by 1.5m mat. The Bhardeo area produces over 70MT of maize husks. At present most of it is used as roughage fodder for livestock. At least 50MT of husks could be used to manufacture over 1,500 mats (25kg/mat) at the market rate. This would mean an additional income of Rs 150,000 to 200,000 annually.

## Development Scenario

Given the opportunity, the Bhardeo community could increase its income and also preserve its environment within a decade. If the multiple activities based on judicious use of local resources and efforts are encouraged, Bhardeo possesses the potential to be an example of sustainable development in a mountain community.

# 8. Conclusions and Recommendations

## The Basic Issues of Poverty and Unsustainability

The economic poverty within the Bhardeo community is inextricably linked with cumulative environmental poverty which cannot be tackled unless the people are given an opportunity to undertake economic reconstruction and nature management. The kind of development expected to take place in areas surrounding the capital has eluded communities like Bhardeo.

Should one consider the basic development policies and strategies at the national level and the number and nature of the activities within Bhardeo, the situation would not change for the better in Bhardeo in the next decade as far as external interventions for its economic upliftment are concerned. Communities like Bhardeo are outside the mainstream of development. They are too poor to attract the interest of wider responsive markets, too small to voice their needs, and too weak to respond to economic growth indicators.

The poor economic condition, accentuated by poverty, is one of the important causative factors responsible for the depletion of resources, especially of the natural resource base. The natural resource base of the community is under the stress of constant over-exploitation. Reduction in biomass most probably induced decrease in farmland and livestock productivity. As a result of this, as well as population increase and the increasing reliance on imported fertilisers (Table 21), the local farming system has become unsustainable.

Inevitably, the first victim of perpetual poverty has been the environment, especially forests. Ecological balance will not be possible without greater development efforts and investments.

Basic changes in land use and in the income base have the potential for increasing incomes. Hence, the management of resources and environment in Bhardeo is basically linked to poverty and development issues. Although the basic issue in Bhardeo is poverty, the priority of economic-ecological management is possible for the community. The longer-term effects of environmental stabilisation could bring back the positive trends that once sustained a reasonable subsistence economy and a cultured lifestyle. Institutional support services, such as training, extension, input delivery, and marketing, are not in line with local realities. The institutional path to development, however, is difficult in the absence of national fiscal commitment to local economic development (e.g., the annual district grants to local institutions) and lack of extension services.

## Trends and Indicators of Unsustainability

The situation in Bhardeo in 1988 was that of a post-earthquake area. Physical tiredness and under-nourishment affected the health of women and children. The debris cover on the valley floor and the damaged terraces presented a picture of despair. The community and its resources had to be restored to their former state and the buildings had to be reconstructed quickly so that economic recovery could take place. The agrarian economy with a traditional production base and land use system became no longer self-sustaining in terms of productivity and labour management, nor in its ability to respond effectively to changes in the resource base.

Major trends and indicators of the system's unsustainability can be noted in the depletion of natural resources; deficits in the household economy; migration and marginalisation of the households dependent on imported fertiliser even to maintain a meagre rate of production; the landscape scarred by numerous landslides; and failure on the part of the community to reclaim damaged farmlands, either individually or communally.

*Migration*

The people of Bhardeo find their area a beautiful place to live in. Their attachment to Gupteswor Mahadev, the streams and the forests, their rich culture, and their neighbours and friends are irreplaceable. Despite poverty, the overwhelming majority of the households are unwilling

to leave the place. One is obliged to accept the fact that it is not because of the mental hardships that some households have started to out-migrate. Out-migration, seasonal or permanent, is an economic compulsion, induced by an institutional failure to develop the area, depleted land resources, and a weak economy.

In the last decade, the area became a place that a few households found physically difficult to live in. The present trend of out-migration does not contribute to the development of Bhardeo. Prolonged absence of able-bodied males also results in considerable social problems and in local labour shortages, even under the existing resource use system. Displacement of families could also lead to an increased rate of permanent migration over time.

Seasonal migration might further increase. Also the number of people out-migrating, as well as the period of migration, might increase rapidly in the future. People should redress the damages on a massive scale through biophysical and socioeconomic development activities and sustain development through effective management of nature. As the area is culturally rich, it is the community which maintains traditions. The exodus could result in the deterioration of Bhardeo's environment and culture rather than it being preserved for the next generation.

*Marginalisation*

Bhardeo is marginalised politically and institutionally. Because of its location in the hinterland and the small population of voters, it was neglected by the Government. Development support was nil. It was in mid-April 1988 that the first government institution, the Department of Livestock, was established. Even after the catastrophic floods, no help, rehabilitation programmes, or rescue work were carried out by the Government.

The marginalisation process is affecting some of the very small landholders on the upper slopes and on the valley floor of Bhardeo. They have already started selling their farmlands and have either left the area or are in the process of looking for wage-earning jobs outside the area. This is despite increased use of chemical fertilisers which has led to a slightly noticeable increase in productivity. Yet the net income is below investment (in the form of labour, seeds, fertilisers, crop protection against wild animals, etc), and this is supposedly being subsidised by individual households with incomes derived from elsewhere. The investment made in the nature of labour is normally discounted. This is not an unusual phenomenon.

The mountain farming systems are such that unless they are linked with markets, on the basis of their comparative advantages, regarding kind, quality, and rarity of the commodity, they can only produce enough for their own subsistence. This seems to be the case with the Bhardeo community.

Its linkage with outside areas has been one way of surviving and has a negative impact at best, even if we are to consider the few income-generating opportunities that are available. These too have been at the cost of farming. Where did everything go wrong? Are people too submissive, with insufficient motivation and initiative?

Despite the negligence of the Government, politicians, and development planners, Bhardeo could have cashed in on its comparative advantages. Bhardeo has failed until now to do so.

*Economic Marginalisation*

The altitude factor restricts the present land use system. The production of food crops in the upper areas is limited. The land is occupied by a single crop for nine months and it is not rational to try to improve the crop production system. In the absence of cash income, farming the upper slopes is not profitable while the cost of chemical fertilisers increases. The input of organic materials would decrease in due time as the constraint of collecting these materials is also being felt in these areas. This imbalance exerts higher pressure on land which leads people to use forest resources from a wider area and to expand cultivated land.

Animals can no longer be maintained on the old scale at the household level. At first glance it would appear that any additional effort to expand the fodder base would perhaps result in livestock increase in the population. But there are several other factors that could check further increases in household income, area of land for cultivation, markets for animal products, and the number of economically active family members.

The links between livestock, farmlands, and the use of forests are strong and crucial for the subsistence household economy of the Bhardeo community. Yet the farmland potential would not be fully harnessed, especially under the present land use system and the prevalent cropping practices, in an economy below subsistence level.

*Worsening Socioeconomic Conditions*

Over the years, the supply of farmland products in Bhardeo apparently decreased to about 50 per cent of the community's basic food demand and it is impossible to collect biomass from the local forest lands. Consequently, the prevalent farming practices have proved to be inadequate, more so under the existing production system (maize-based and relying on chemical fertilisers) and the deteriorating economic status of the population.

The economic-environmental degradation of the system has affected social relationships in the community. The eligible male adults are finding it difficult to marry within the area, thus there is a household labour shortage. Traditional skills that could help to popularise activities such as charcoal-making from different species of timber, farming in low temperature areas, summer potato cultivation, and intensive use of forests for minor products, such as mushrooms, exist. Building upon the existing potential should not be difficult.

*Limit to Resource Depletion*

The impact of further depletion of resources is determined by factors such as resource location, resource condition, and the time and labour costs involved in harnessing resources. What choice does the Bhardeo community have? The present cost is high both in terms of the time and labour inputs required to fetch a load of biomass. As biomass sources recede further from the homestead, labour allocation becomes difficult.

Since the able-bodied males go outside the area to work during the dry season, the women, who in most cases stay behind at home to look after the household, tend to be hard pressed. The children and the livestock need regular attention. There is every likelihood that, given the advanced condition of exploitation of the forests in the area, the time required for collection of forest products would increase to about eight to nine daylight hours, as against the present average time of about six to seven hours per day. A farmer can afford to go and collect biomass only during the daylight hours. The farmers would not be able to depend on biomass any longer and the possibility of increase in fodder resources, within accessible distances, are very remote. Such a scenario could possibly occur within the next two decades.

*High Economic Dependency Ratio*

The economic profile that has emerged is bleak, as far as Bhardeo's food situation is concerned. People have to look for income-generating opportunities outside the area. The high dependency ratio found in Bhardeo has a negative impact on the local economy. However, in these mountain societies, it is not examined from the perspective of economic satisfaction only. Yet, given the limited land and income opportunities available, the dependency is far too high, further affecting the food situation.

*The Challenges*

The problems of poverty and environmental degradation observed in Bhardeo, although small in scale, pose a challenge because of their very nature and complexity. The development of Bhardeo on a sustainable basis becomes an insurmountable challenge to planners unless the aspirations for development, articulated needs, local skills, and ingenuity are understood.

Taking into consideration the resources, institutional constraints, and development aspirations of the community, several measures could raise the present virtually destitute condition of the community to a level from where steps towards economic development could be taken.

The Bhardeo community has specified its priorities for development. The needs and priorities of the community are simple in nature. It is pertinent to consider the aspirations and development priorities of the community in the context of nature-based resources, human resources, and the location of Bhardeo in the hinterland. A phasewise economic-environmental rehabilitation should precede economic development. Investments have to be judged on the basis of their relative rate of returns. The production environment of the existing resource base would change under different conditions of resource availability enhancement efforts, and given a production impetus to resource use.

**Recommendations**

*The Need for New Development Schemes*

A new awareness should guide the community in managing the given resources within the limits of sustainability. **Conservation and protection measures are vital to the enhancement of land resources and for promoting a level of sustainability that could motivate the farmers to manage their resources judiciously.**

Some adjustments and newer strategies would have to follow. Development priorities need to be in tune with

efforts to manage the environment, e.g., rehabilitation of damaged farmlands and steeper slopes, reforestation, etc. These are also areas that have immediate development potential. However, a general ban on forest exploitation might not be effective at present, neither would such a move be necessary in the long run.

Development efforts need to take into account the nature of development and the speed at which the community can cope with it. The new programmes under consideration must be simple, relatively familiar, and should lead to rapid increase in income and to stabilisation of the environment.

Contrary to generally held opinions regarding the sustainability of mountain agriculture, a change in production base from extensive to a higher degree of plant and animal diversity, development of human skills, and diversification of the income base from that of a primary product base to manufacturing could make the system sustainable within a short period of time.

The whole concept of sustainability is relative. Hence, it could be tested under different conditions of resource use and development support. For example, the sustainability of new land use practices could be assessed under different conditions of resource management and biomass demand.

Institutional Support and Fiscal Resources Over Time. This area has been neglected by national institutions as far as development support is concerned because Bhardeo has no economic or political clout. There is no guarantee that the necessary inputs will be available on a continual basis. Resource improvement efforts should be based on locally available inputs.

Economics of Production and Land Use and Their Linkages with Markets. Production depends upon the commodity's profitability, and this is subject to demand and production cost. The products that are economical today may not be so tomorrow. The question is do we take the unsustainability of a particular product or change products and their uses?

Environmental Impact of Increased Water and Biomass Consumption. Environmental rehabilitation is a pre-condition to bringing about positive changes in the land use system. The area presently lacks water to satisfy the irrigation and drinking water requirements. What will be the demand of the changed land use practice on the water and biomass inputs of the area?

Level of Production and Human Population over a Defined Period of Time. It would be too unrealistic to expect the system to cope with unlimited population growth, both human and animal. The present level of production is far from sufficient, even for the existing population. Hence, the question of sustainability is not particularly relevant as far as sustaining the present nature and level of production is concerned. It has to increase. But how far will a quantitative increase be matched by a qualitative rise in productivity?

Even if the area is commercialised, production of some goods has to be maintained for security. This also depends upon the kind and quality of the production base and the purpose for which the products are used. For example, there is no alternative to local self-sufficiency where fodder and contingency products are concerned. Particularly in food and timber, the local economy cannot be self-sufficient within the next decade. Securing and maintaining adequate emergency supplies for the community for up to half a year is necessary to ensure self-sufficiency.

*Initial Efforts*

Rehabilitation of natural resources may no longer be possible in Bhardeo without addressing the basic issues of economic development. Hence, an initial start to help the Bhardeo community must begin with the rehabilitation of natural resources, such as clearing debris, primarily from the farmlands and water channels, through purchase and sale of the debris, tree plantations and terrace improvements, and generating off-farm income by providing opportunities for local jobs.

The land use pattern should be changed from intensive food crop cultivation to fruit orchard and charcoal plantation on *kharbari* and on common land. This could help to double the income of the community within three to five years with intensive effort. Activities for rational use and for marketing farm and forest-based products, manufactured from local materials, should accompany these efforts. Bhardeo has wasteland, particularly along the stream banks (in the valley), and low quality grazing grounds. Should these lands be made available for productive uses, the economy would receive a boost. Notwithstanding, with or without additional lands, local farmers should opt for high value products to improve the subsistence level economy.

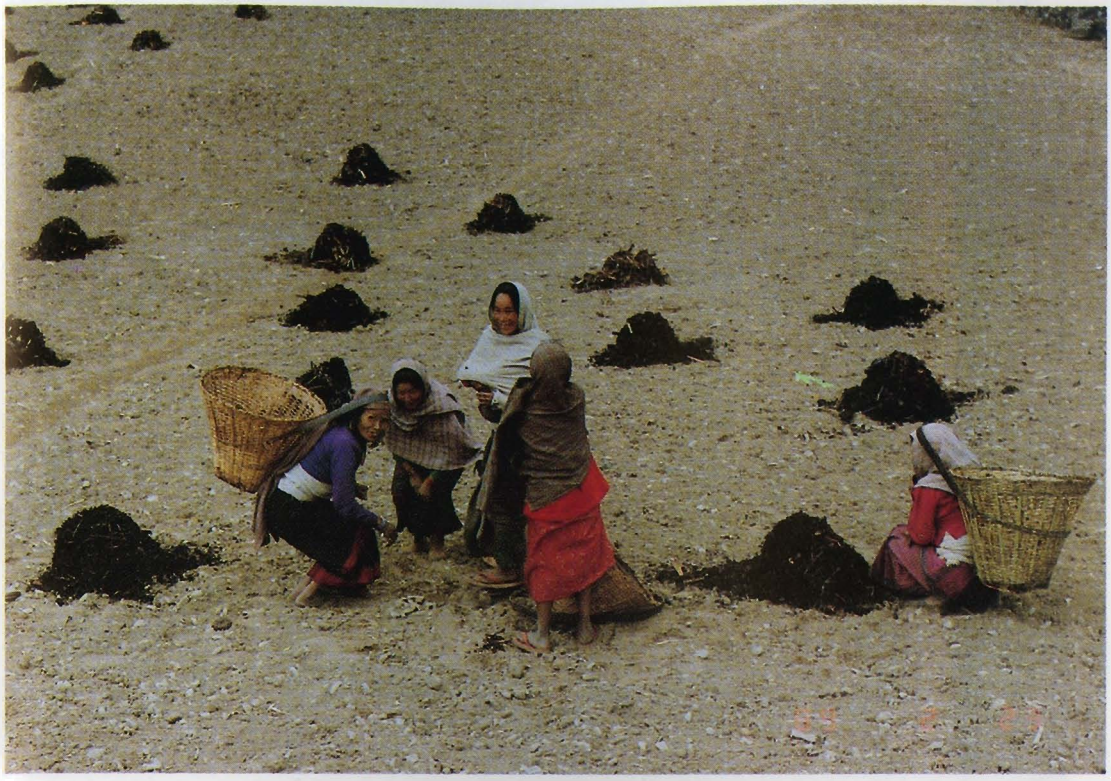
The potential, however, lies in efforts to produce high-value products based on land resources and livestock. Commercialisation has to be seen as a resource

enhancement effort and the necessary human resources should be developed through skill improvement, including in the realm of the basic economics of production. These are the strategies to be considered in the case of Bhardeo within the next few years.

In the past, the attention of researchers was focussed mostly on the climatological effects of soil erosion, loss of productivity, economic surveys, and development studies, based on national plan and policy documents, on areas similar to Bhardeo. **The present need is for an actual development-action study to try out ideas and test knowledge so that the studies can be integrated with investment plans and programmes, and so that changes can be steered on an economically and environmentally compatible course with the "active and gainful participation" of the local community.**

A Panorama of Bhardeo Village Watershed.

Maize Terrace slopes were destroyed in the 1981 rains. The loss of soil fertility being high on steeper slopes the yield is reduced year by year, and soil nutrients shift from upper terraces to lower terraces.



Application of FYM for maize cultivation on the valley terraces.

Buffaloes being fed with dry maize stems during the dry season. It is supplemented with tree fodder leaves from the forests.

A load of Quercus *semecarpifolia* leaves from the forests above 1,900m. The weight carried by an adult varies between 40 to 50 kg.

Dry leaves of rhododendron collected for use as bedding material for the animals during the dry period.

Condition of the maize terraces on the upper slopes. The relation between loss of soil fertility and plant growth is immediately visible.

Once a fertile valley bottom used for rice cultivation, it is covered with debris since the 1981 rains.

The terrace gradient of the elevated parts of the valley lands can hold soil nutrients and the soil is relatively fertile, while the slopes are too steep and without proper terracing.

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## The Author

The author of this paper, Dr. Kk Panday, ing. agr. (ETH) Agronomist, was a member of the Senior Professional Staff of ICIMOD when he wrote this paper.

He has written a definitive book on fodder trees in Nepal which has also been translated into Chinese. Through the proceeds of this he founded the *Jara Juri* Trust from which the annual *Jara Juri* Award is presented to groups or villages that have been successful in using and revitalising their forests. He was actively involved in rural development programmes in the mountains of Nepal in the late 60s and 70s and in the early 80s and he received UNEP's "Global Five-hundred Role of Honour Award - 1988."

Currently, he is a member of the Environmental Protection Council established by the National Planning Commission of His Majesty's Government of Nepal.

## Founding of ICIMOD

ICIMOD is the first International Centre in the field of mountain area development. It was founded out of widespread recognition of the alarming environmental degradation of mountain habitats and the consequent increasing impoverishment of mountain communities. A coordinated and systematic effort on an international scale was deemed essential to design and implement more effective development responses based on an integrated approach to mountain development and mountain environmental management.

The establishment of the Centre is based upon an agreement between His Majesty's Government of Nepal and the United Nations Educational Scientific and Cultural Organisation (UNESCO) signed in 1981. The Centre was inaugurated by the Prime Minister of Nepal in December 1983, and began its professional activities in September 1984, with the support of its founding sponsors:

**HMG Nepal, the Government of Switzerland,**
**the Federal Republic of Germany, and UNESCO**

The Centre, located in Kathmandu, the capital of the Kingdom of Nepal, enjoys the status of an autonomous international organisation.

## Participating Countries of the Hindu Kush-Himalayan Region

- Nepal
- India
- Bhutan
- Bangladesh
- China
- Pakistan
- Myanmar
- Afghanistan

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