

# **Extensive Bamboo Production-to-Consumption Systems in Eastern Nepal: a Case Study**

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# 1 FOREWORD

Nepal — with its rugged terrain, under-developed infrastructure, burgeoning population, poor communication links, limited human resource base, low literacy, deteriorating forests, etc. — is one of the most resource-poor countries. Agriculture, the mainstay of the domestic economy, is mostly subsistence-oriented. The state of non-timber forest resources, including bamboo, is one of under-development and mismanagement.

Bamboos are endemic to all three major ecological zones of Nepal: the mountains, the mid-hills and the Tarai. However, they are more concentrated in the eastern half of the country — one of the biodiversity “hotspots”. A unique feature of Nepal is that both tropical and temperate bamboo species grow there. Bamboo is a widely planted agro-forestry crop in the country, and bamboo-based enterprises form a traditional though non-formal rural economic activity. Given the highly integrated nature of bamboo cultivation both in private and public lands, the acceptance level of this commodity is quite high. As such, the growth of the bamboo sector holds the potential for being a key to rural socio-economic development.

This report examines an extensive bamboo production-to-consumption system in the three-districts of Siraha, Saptari and Udaypur in the eastern Nepal — an area selected for its relative richness in bamboo resources and for the existence of vibrant bamboo-based rural enterprises. This study, part of INBAR's Working Paper Series on the socio-economics of bamboo and rattan, was carried out by Madhav Karki of the International Development Research Centre, India, Gopal Sherchan of the Forest Research and Survey Centre, Nepal, and Jay Bahadur Karki of the Tribhuvan University Institute of Forestry, Nepal.

The authors have recommended several measures for the development of the bamboo sector as a means for achieving rural socio-economic upliftment in the eastern Nepal. We hope that these would serve to stimulate more in-depth assessments and appropriate actions aimed at using bamboo as a strategic tool for achieving livelihood, food and ecological securities.

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# INTRODUCTION

## Overview

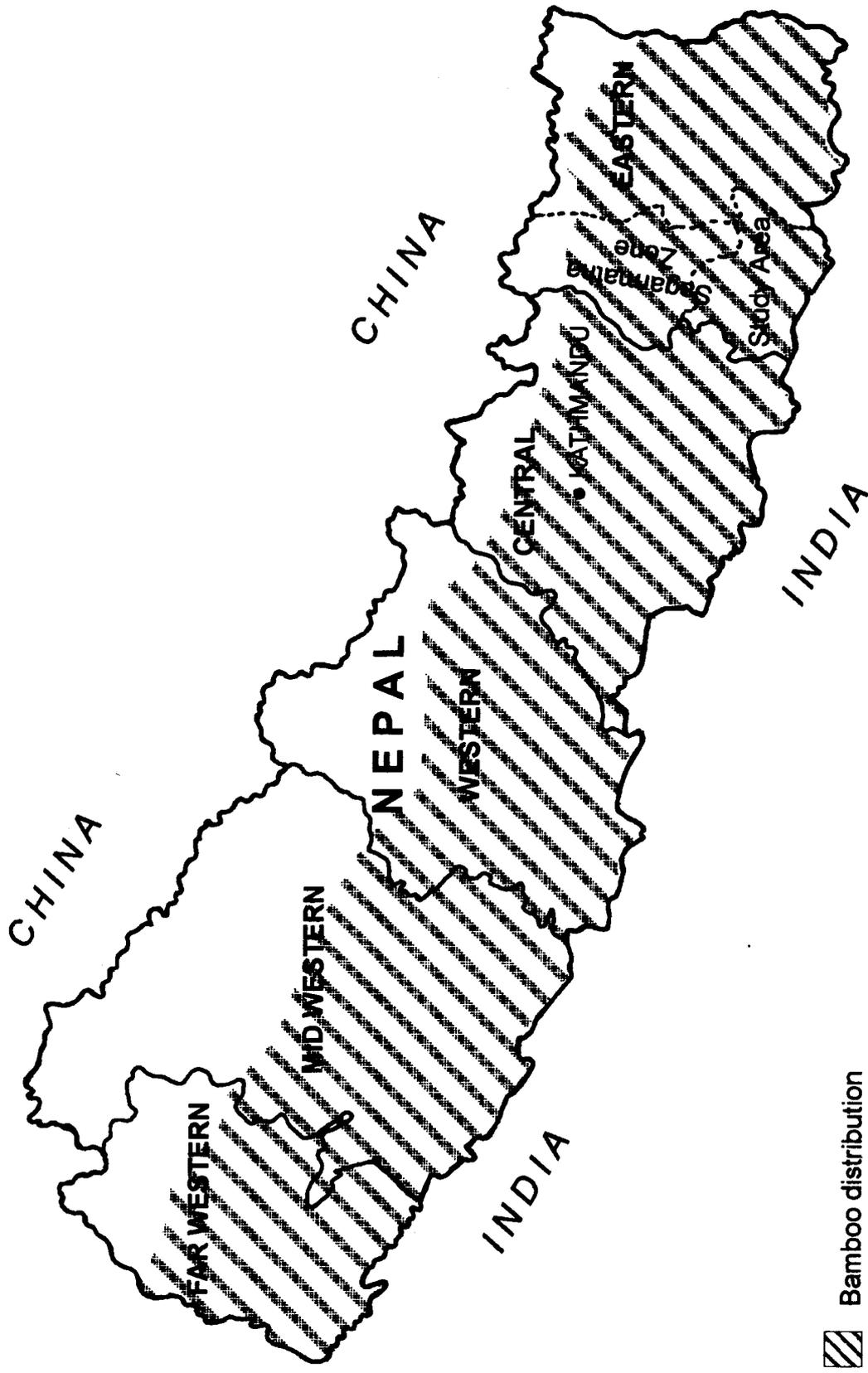
Bamboo-based economic activities are an intrinsic part of both rural and urban life in Nepal. The importance of bamboo in the predominantly agricultural economy, particularly the rural economy, of Nepal is well recognized. Bamboo products are in great demand among farmers, artisans, and rural and urban enterprises for fodder, construction materials and a host of domestic uses. Round culms are widely used as rafters, pillars and fence posts, or they are split into sections, crushed into panels or further split for use in activities such as weaving.

Bamboo-based enterprises are an important source of employment for both the rural and urban work-force. It is estimated that more than 100 000 work-days are accounted for by this sector. Out of the estimated 12% contribution to the national GDP by the forestry sector, the share of bamboo is appraised to be only about 1-2%. This is mainly because of the lack of processing at the production sites and rural areas, where production costs are relatively low and most of the products go to meet subsistence needs. Most bamboo products such as mats, baskets and household items are manufactured by local farmers and artisans and sold in local markets. The national market, though strong, does not receive products from all the regions owing to the lack of a transportation network and a well-established marketing system. The only item that receives significant value addition is furniture, for which national and international markets are now slowly emerging. Considering the abundance of human resources and the richness of indigenous craftsmanship, this is one area where Nepal can gain a comparative advantage, provided the work-force could be trained to improve their skills and enterprises assisted in value-added processing and marketing.

## Resource Distribution

Bamboos are endemic to all the three major ecological zones of Nepal: Tarai, Midhills and Mountains (Fig. 1). However, they are more concentrated and show larger diversity in the eastern half of the country, from the Annapurna to the Kanchenjunga ranges of the 'Himalayan mountains. Species abundance is directly related to the amount and distribution of rainfall, with areas that receive well-distributed and greater rainfall, such as Pokhara and Illam regions, having the largest number of bamboo species. Nepal has both tropical bamboos found in South-East Asia and temperate bamboos found in Tibet and Bhutan.

Natural bamboo resources in Nepal have considerably dwindled during the last three decades. This is primarily owing to the large-scale destruction of the habitat of bamboos resulting from encroachment and release of forest land for agriculture, shifting cultivation, negligence in the management of natural bamboo stands, and the lack of an appropriate policy governing the resources.



 Bamboo distribution

Fig. 1: The administrative zones/regions of Nepal and bamboo distribution

Bamboo cultivation in rural areas is generally restricted to the banks of water-courses, marginal and leftover land, low-productivity land, homesteads, and back and front yards of houses on the hills. However, the situation is quite different in the eastern districts of Siraha, Saptari and Udaypur, where the farmers consider bamboo to be as important as other agricultural crops and grow it in their rice fields.

## **Bamboo as an Economic Crop**

In the eastern region of Nepal, bamboo is extensively found on both farm and non-farm lands. There is a large number of bamboo farms, ranging in area from 1.25 to 2.5 ha, in the eastern Tarai. In the low lands, natural stands are found mixed with deciduous subtropical forest vegetation. Natural stands, however, are suffering from a lack of management, lack of development schemes, unsustainable harvesting and outdated silvicultural technologies. Bamboos used for weaving are the most popular species as 70% of the farmers grow them on their farms and homesteads. About 66% of the bamboos are grown for commercial purposes. An equal percentage of growers are interested in expanding bamboo farming (Shrestha 1994).

## **Production and Consumption**

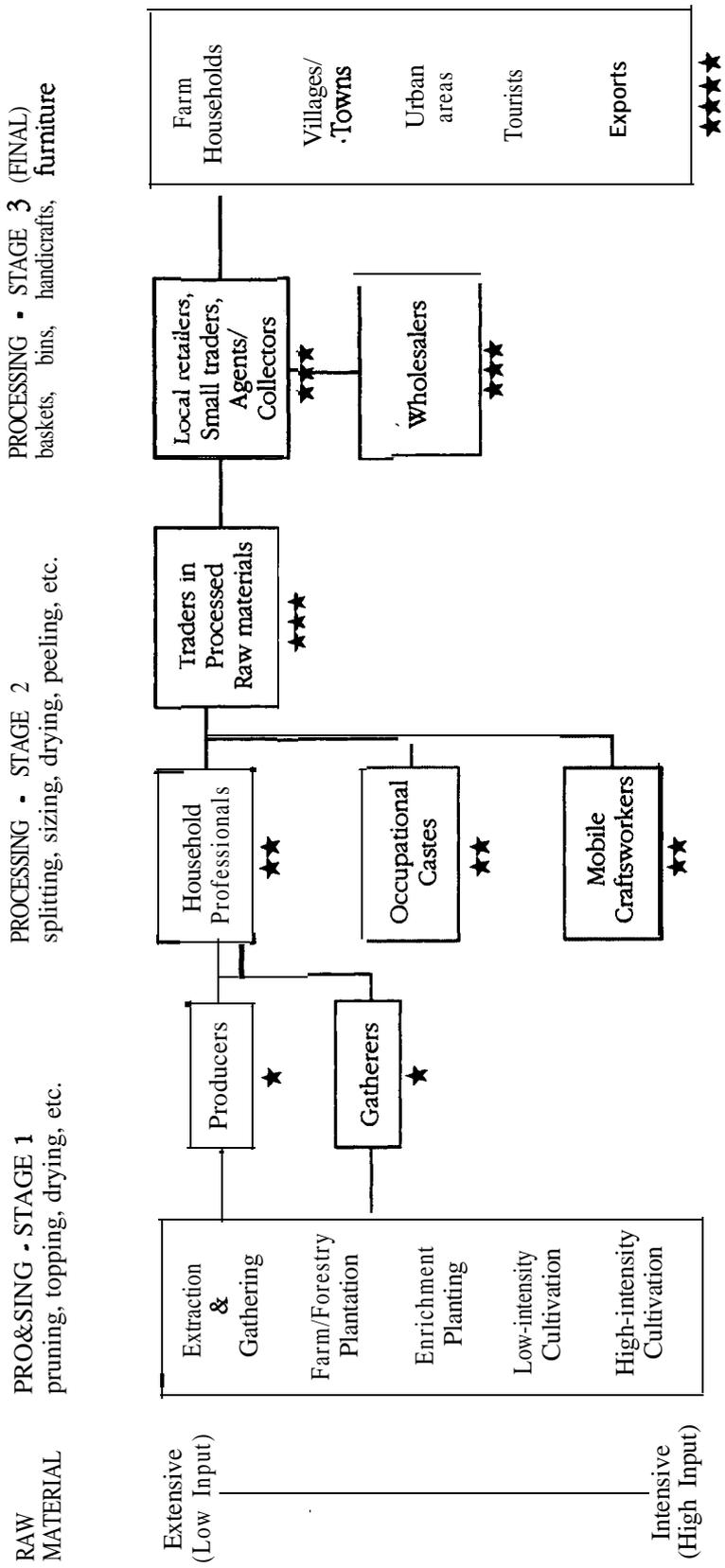
Bamboo is widely cultivated in both rural and urban areas of the country because of its vigorous regeneration, fast growth, high productivity, quick maturity, short rotation and desired form. Although the use pattern is overwhelmingly based on traditional practices, more and more new uses are being popularized with the expanding and more easily accessible infrastructure, information and technology.

In the eastern Nepal, bamboos are cultivated in homesteads for local use as well as for commercial purposes. Such bamboo groves mostly have small areas varying from 0.1 to 0.5 ha. Uses of bamboo in the study sites can be observed in two categories (Fig. 2).

Bamboo used for all commercial purposes (furniture, handicrafts, scaffolding, etc.) other than as raw material for industries can be termed as commercial bamboo. In terms of quality, commercial bamboos are normally superior to those used for subsistence purposes. Commercial bamboo comes to the market through traders, intermediaries and often through farmers themselves. Although the major supply of such bamboo is from the farmlands in the eastern districts of the country, wild bamboo from government forests in Churia augments the supply. The demand-supply situation varies from time to time and place to place; consequently, regional variation in price is common. Price of bamboo in urban areas is usually higher than at farm-gates or areas near forests.

## **Major Uses of Bamboo**

Bamboo plays a vital role in rural socio-economic life for its variety of uses: material for house construction, fencing and enclosure for cattle, agricultural implements, and for making handicrafts and furniture for income generation. In



- Notations**
- ★ Producers
  - ★★ Processors
  - ★★★ Traders/Market participants
  - ★★★★ Consumers

Fig. 2: The extensive bamboo production-to-consumption system in the eastern Nepal

many places, bamboo is used for the protection of farmlands from land slides, and soil and riverbank erosions. Young shoots of bamboo are used as a seasonal vegetable by many people, in both rural and urban areas.

### **Building construction**

In the eastern Tarai, bamboos are traditionally used to construct almost all parts of a house except the fireplace. Bamboo houses are widely prevalent in the rural areas of eastern Nepal, particularly in Siraha, Saptari and Udaypur districts (the study areas). Beams, trusses, frames, walls, partitions, ceilings, doors, windows and floors are made from round or split culms. Long culms are laced together for erecting construction scaffoldings in urban areas.

### **General construction**

Bamboos are commonly used also for a great number of general construction purposes. Round or split culms of suitable size and quality are employed to produce a range of products such as: ladders, musical instruments, sport implements, bows and arrows, fishing rods, tool handles, frames of fishing nets, fishing traps, boating poles, bullock cart railings, mats and sheets, etc.

### **Agricultural articles**

Many articles are made out of bamboo for on-farm and off-farm agricultural uses. Some common ones are: water pipes, hoe handles, aeration mats, sieves, screens, fans, carrying rods, racks, carry baskets (tbuncb and doko), ropes (namlo), trays (nanglo), barns, granaries, cylindrical baskets (dalo), and grain containers (bhakaris), bins and other types of containers.

### **Arts and handicrafts**

Many art objects and items for household use are made from bamboo culms, splits and strips. These include flower pots, model furniture, lamp stands, lamp shades, sun shades, picture frames, mats, blinds, mat ceilings, hand fans, dusters, brushes, walking sticks, cudgels, fruit containers, book and shoe shelves, baskets, ladies' bags, wastepaper baskets, combs, hats, blow pipes, TV antenna posts, flag-poles and pencil holders.

### **Shelters**

Shelters made of bamboo are common in the eastern districts. They are erected for cattle, agricultural and cultural fairs, market stalls and bus stops.

### **Food**

Young bamboo shoots are widely used as a vegetable. They come from natural stands and are sold fresh, mostly for domestic consumption. Dry, pickled or canned shoots are not marketed because of the lack of know-how.

### **Soil erosion control**

Round or split bamboo culms are used for protecting hill sides and riverbanks. Every year, large quantities of bamboo culms are used for the protection of the Koshi River banks. The dam maintenance project buys bamboo culms from the farmers. Farmers in all three districts (Siraha, Saptari and Udaypur) employ bamboo culms for making check dams and spurs to protect their farmlands from torrential rains and soil erosion.

## **Constraints and Potential of the Bamboo Sector**

### **Bamboo plantations**

Despite the importance attached to bamboo products, government attention on and investments in bamboo-based enterprises have been poor. In recent years, farmers have been planting bamboos primarily to meet their subsistence needs. However, the growing demand for bamboo culms in the rapidly expanding urban housing sector has induced many enterprising farmers to embark on more commercially oriented bamboo plantations. This has resulted in several large bamboo holdings in the eastern Nepal and created a major boost in production. Although the prices in the urban markets have been steadily rising, the profit generated goes mostly to intermediaries and retailers; the growers are not getting an attractive rate of return for their investment. This has created dissatisfaction among bamboo growers, thus affecting the future of bamboo cultivation in agro-forestry farms.

### **Bamboo in construction**

Because of its low natural resistance to biological deterioration, the service life of bamboo structures varies from less than one year when in contact with soil to as long as 30 years when employed in more favourable conditions, especially when used as bamboo mats for partition walls plastered with cement-sand mortar.

In many villages, bamboo is infested with diseases that cause, among others, die-back and yellowing of leaves. Damage by powder-post beetles and termites has also been observed in most households in the study area.

The use of mature (four years old) bamboo and soaking the culm in water for about 5-7 days are the major techniques employed by the farmers to prevent insect attacks. Lack of knowledge on bamboo protection combined with a lack of suitable treating facilities and a low demand for treated products are the major factors that restrict the use of bamboo in construction, especially in the housing sector.

## 2 CASE STUDY FRAMEWORK AND METHODS

### **Theoretical Considerations**

A case study is a holistic research method applied when the phenomenon of interest is intertwined with its context and where the boundary between the phenomenon and the context are not evident (Yin 1984). The following conditions suitable for the application of the case study method prevailed in the study area:

1. Variables of interest such as production of raw bamboo, the number of families engaged in bamboo-based cottage industries, and export of products from the study area were not controllable;
2. There was an emphasis on understanding and explaining the relationships between specific variables; and
3. The linkages among the various components of the bamboo sector were too complex for statistical analysis or any other analytical tests, but were relevant for the study.

Therefore, the case study method was chosen based on the following rationale:

1. Involvement of stakeholders in the sector cannot be studied in isolation from the cultural and socio-economic context of the locality;
2. A multiple case study design could be used if a variety of sets of phenomena exist in a small area;
3. Case study research involves a low-constraint research design because many of the variables in the sector cannot be controlled; and
4. The nature of the sector places constraints on the researchers and/or the data collection procedures.

The research focused on the following areas:

1. Key decision-makers in the sector (network of individuals and institutions);
2. Operating features of the sector;
3. Sharing of benefits among the key players;
4. Options available to the stakeholders; and
5. Feasible and appropriate strategies for improvement.

The study area was selected to meet the needs of the research design that aimed at a better understanding of an extensive bamboo production-to-consumption system in a relatively subsistence economic framework. The extent to which the results of the case study can be generalized depends on the study's external validity. This case study uses multiple sources of evidence so that the construct validity is significantly increased.

## **Framework**

This case study is basically aimed at providing two sets of information: (1) factual descriptive information on how bamboo production-to-consumption systems are organized; and (2) the interplay of marketing factors, including the market channels and value added chain. In the area of socio-economic research, the major issues to be addressed are:

1. Employment, income, marketing costs and benefits, and output of bamboo-based activities;
2. Value of bamboos to the rural economy, equity in their uses and benefit sharing;
3. Effect of diminishing supplies of bamboos on rural income;
4. Socio-economic institutions, land and tree tenure rights (usufruct), and marketing and processing rules; and
5. Regulatory functions of the government, and the facilitating role of government and non-government organizations.

## **Objectives**

### **General objectives**

The general objective of this study was to identify opportunities for the development of the bamboo sector in the study area, as well as to analyse the constraints and potential to achieve sustainable development of bamboo in the study area. The micro-level study was expected to contribute to the development of an empirical basis for describing a conceptual framework of an extensive but small-scale bamboo production-to-consumption system.

### **Specific objectives**

The case study attempted to achieve the following specific objectives:

1. Describe an extensive bamboo-based production-to-consumption system specifically aimed at (a) showing the flow of raw material from the production/extraction site to the final consumers, (b) cost pricing, and (c) identification of major stakeholders along with their interests and aspirations;
2. Identify within the extensive system groups that are potential targets for development interventions based on (a) level of poverty, (b) the number of people involved, (c) the role of bamboo in the local economy, (d) gender and disadvantaged group specificity to bamboo, and (e) the scope for expansion of bamboo-based enterprises;
3. Describe the decision-making environment of the study groups of collectors, processors and consumers in terms of (a) indigenous traditional knowledge and skills, (b) the resource base and rate of depletion and regeneration, (c) socio-cultural

constraints and opportunities, and (d) the existence of incentives and disincentives including policy, acts, rules, regulations and circulars related to finance, enterprise development, and tenure;

4. Analyse the current problems and future opportunities associated with the bamboo production system by (a) describing the existing system of collection and transportation, (b) identifying the practical constraints faced by the growers and collectors, and (c) identifying appropriate interventions to overcome such constraints; and
5. Make suitable recommendations for both short and long-term actions specifically to (a) organize and empower (through skill enhancement and group organization) local groups, (b) promote utilization by establishing guidelines for sustainable harvesting, (c) disseminate imported technology and information, and (d) focus the efforts of donor-funded projects on more cost-effective and livelihood improving activities.

## Study Area

The study was conducted in Siraha, Saptari and Udaypur – three districts in the eastern Tarai region of Nepal (Fig. 3) – which have an extensive though small-scale system of bamboo production in both natural forests and farms. The target respondents were chosen from both these production types. The area has a large number of on-farm bamboo stands ranging in area from 1.25 to 2.5 ha. The natural stands are mixed with deciduous subtropical forest vegetation.

Several indigenous Hindu castes – Yadav, Mahato, Tharu, Musahar, Dusad, Paswan and Chamar – and Muslims are found engaged in bamboo collection and sales. Their numbers, according to Shrestha (1994), run into thousands. These are generally landless people who have been in this profession for periods ranging from 10 years to several generations. The major villages selected for this study were (Fig. 4):

1. Kushaha-Laxminia and Brahman Gorchhari in Siraha district;
2. Bhangaha and Bakdhuwa in Saptari district; and
3. Hadiya and Joginath in Udaypur district.

Kushaha-Laxminiya village (denominated as a Village Development Committee - VDC) lies in the south-central part of Siraha district, about 10 km inside the Nepal-India border. The total land area of the village is 483 ha, of which 433 ha is arable. The village is approachable by a gravel road leading from the National Highway and the Indian border. There are 406 households in the VDC with an estimated population of 4 025. The average household size is 9.9, owing to the prevalence of the extended family system with several generations residing under one roof. Nineteen castes and ethnic groups live in the village with the Yadav (26.7%), Baniya (17.2%) and Malaha (10.5%) castes dominating the population. The literacy rate is around 27% (compared with the national average of 37.5%).

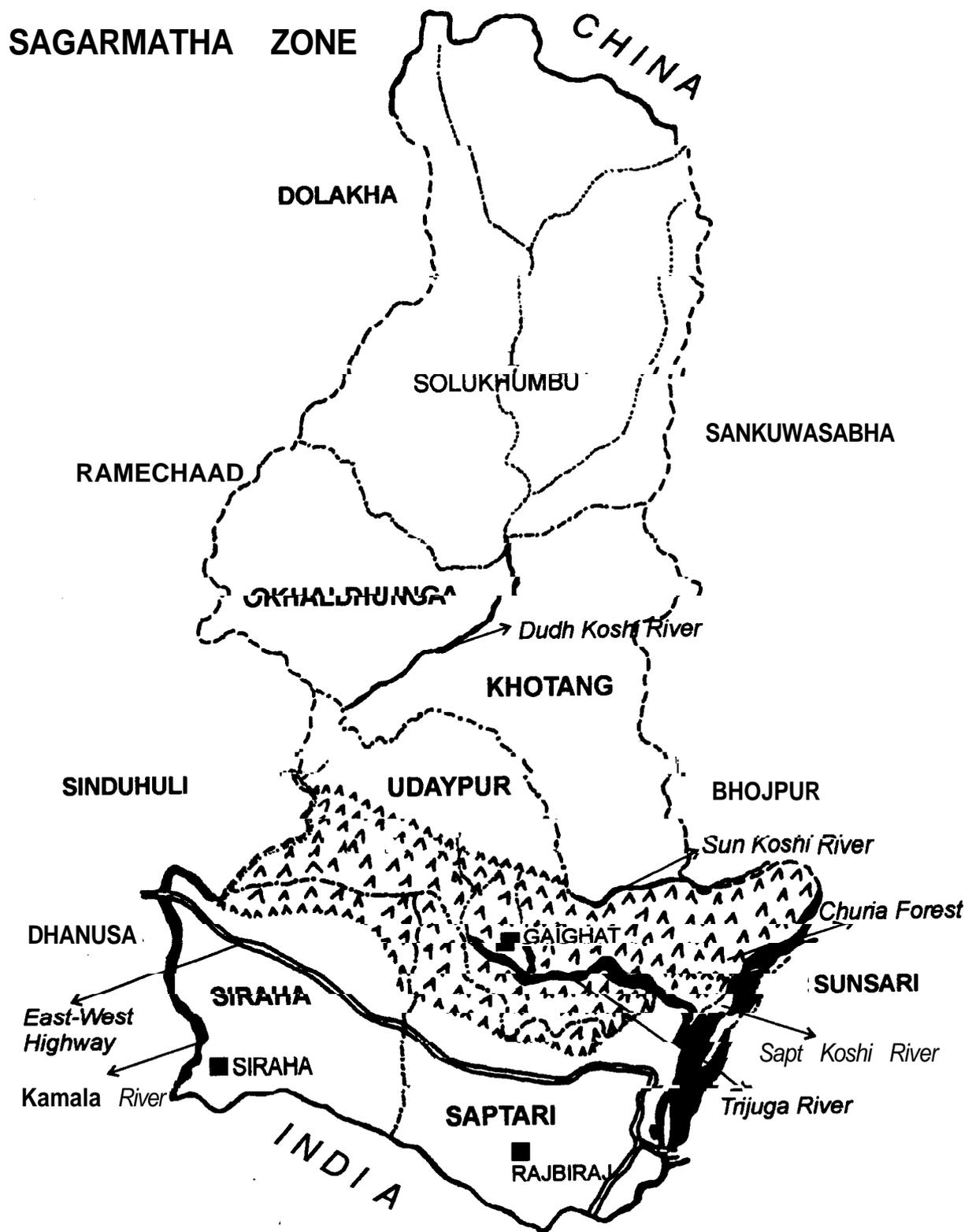


Fig. 3: The Eastern Development Region of Nepal

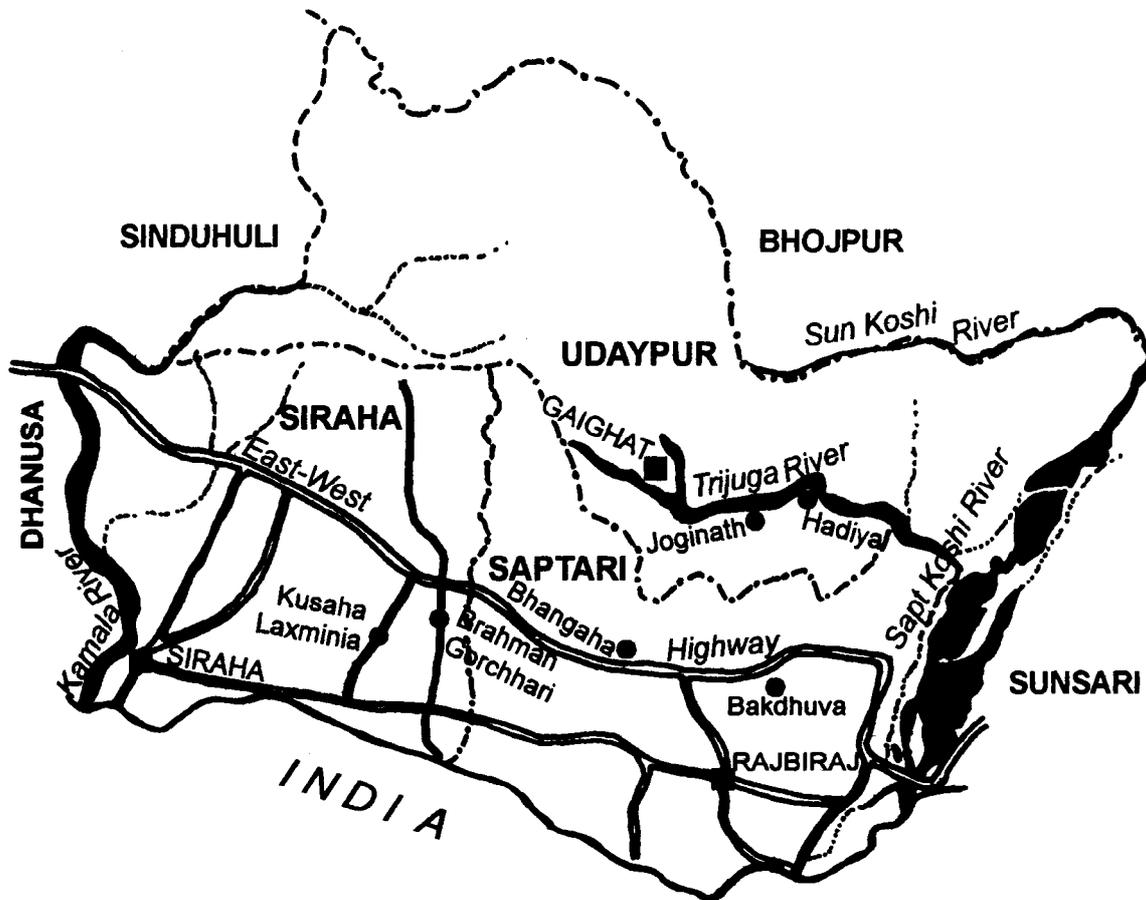


Fig. 4: The study area: Udaypur, Siraha and Saptari districts in eastern Nepal

Although the economy is predominantly agricultural, only about 3% of the households are able to meet their annual food requirements from agriculture. Of the rest, 5% grow enough to last for 9-12 months, 12% for 6-9 months and 15% for up to 6 months. The remaining 65% households are unable to meet their food requirements through agriculture and take on a variety of off-farm activities to supplement their income. Bamboo-based basket-making, rope-making, tile-making and fisheries, and wage labour are some of the activities they engage in to earn extra income.

A number of agro-forestry practices exists in the VDC, primarily because of the increasing scarcity of forest products. Some prominent systems are: multi-purpose tree planting on farmlands; windbreak plantations; block plantations with bamboos; fruit orchards; tree-based home gardens; living fences; silvi-pasture; and aqua-silviculture.

A typical bamboo block is 0.07 to 0.15 ha in area, and is primarily managed for culms for sales in Nepal and India. Most farmers have at least one or two bamboo clumps in their farmland or homestead. About 10% or 41 households were selected for sampling in this village.

Bhangaha VDC lies along the East-West Highway in Saptari district and is connected to the major towns of Rajbiraj and Lahan by all-season roads. This village has a mixed ethnic composition dominated by the Tharu (48.6%), Tatma or weaver (16%) and Bantar/M usahar (15%) castes. The low-lying hills of the Churia forest and shrublands claim about 30% of the VDC area. The forest is highly degraded and therefore, villagers are increasingly becoming dependent on private lands to meet their needs for products that were hitherto available from forests. There are about 650 households in the VDC with a population of around 4 165. The average size of a household is 6.4. About 30% of the people are literate and men outnumber the women by two to one. Ten percent or 65 households were selected for sampling in this village.

Farming, including animal husbandry, is the principal means of livelihood. However, only 4% of the families are self-sufficient in food production and the majority (53%) have enough food for less than six months. About 105 of the households are landless and another 30% owns less than 0.25 ha. Therefore, a large number of households subsist through different kinds of off-farm activities. Animal farming, fruit farming, fisheries, forestry and wage labour are the major economic activities. During off-season, a large number of labourers migrate to cities in India and Nepal to work for wages.

Bhangaha has a large number of traditional occupational castes, particularly the Tharu women who are engaged in weaving baskets and making other agriculture or forest-based products for sale in the local markets. Others in the community (mainly male members) sell bamboo culms to agents during the dry season. Almost all the landowners have trees and bamboo in their homesteads and orchards. Some bamboo grows on reclaimed land along riverbanks as well.

Hadiya VDC is located along the Trijuga River and is connected by a fair-weather road to the market centres in Gaighat and Kanchanpur about 10-15 km away. Seventy percent of the land is hilly and dominated by degraded forest and shrubland. The total population of the VDC is 8 980 from 1 430 households, with an average household size of 6.2. The literacy rate is close to 35%. The native Tharus are the most populous single group (36%) followed by hill migrants Chhetris (29%) and Bahuns (11%). Artisan and other lower castes make up the remaining 24% of the population. Migration from different parts of Nepal, and from India also, to this village is still continuing. Because of the large geographical area and high ethnic homogeneity, 5% or 72 households were sampled in this VDC.

The local economy is largely dependent on agriculture, wage labour (in urban areas) and forest product extraction. Rice, wheat and corn are the major field crops and bamboo is the major forest product. A few other sources – such as trade in precious stones, and employment in a new cement factory and local tile factories – also provide income. Two small roof tile factories have been operating for several years providing employment to the local people. However, since the skills and capital have come from outside the village, locals do not consider this industry to be beneficial with regard to their socio-economic conditions.

Seasonal migration to Kathmandu and India for farm and off-farm work is prevalent, especially among villagers with small or marginal land holdings. In 1994, more than 300 adults left the village looking for seasonal work and, on an average, each labourer brought in Rs 7 000 to 8 500 per year.

Each VDC selected in Siraha district has at least 100 bamboo collectors. In the adjoining districts of Saptari and Udaypur (Hadiya), there are more than 500 bamboo transporters and 100 family-owned bullock carts engaged in bamboo sale and transport, forming a traditionally maintained production-to-consumption chain.

A comparison of different attributes of the three districts in the study area is given in Table 1. The Tarai region is considered as “the last frontier of Nepal” (Carson 1992), although most of the best land has already been brought under intensive farming. While the region is experiencing modest growth in agricultural production, serious constraints exist relating to the sustainability of productivity and livelihood security. The property regime is dominated by traditional landlord-tenant relationships. The increasing difficulties created by a myriad rules and regulations are forcing more and more landowners to turn away from farming to forestry. Despite the ambiguities, complexities and frustrations arising from the enforcement of contradictory policies and regulations on private forestry, the high profitability of agro-forestry activities (including bamboo production) is attractive enough to ensure their continuance.

Table 1: The research area: a comparison

| MAJOR ATTRIBUTES                   | SIRAHA                                      | SAPTARI                                     | UDAYPUR                                     |
|------------------------------------|---|---|---|
| <b>GEOGRAPHY</b>                   |   |   |   |
| Total area (km <sup>2</sup> )      | 1118  | 1 363                                       | 2 272                                       |
| Forest area (km <sup>2</sup> )     | 220   | 164   | 1 630                                       |
| Elevation (m)                      | 76 - 895                                    | 61 - 305                                    | 360 - 2310                                  |
| Hill:plain ratio                   | 28:72                                       | 32:68                                       | 30:70                                       |
| Latitude                           | 26 <sup>0</sup> 33' - 26 <sup>0</sup> 55' N | 26 <sup>0</sup> 25' - 26 <sup>0</sup> 47' N | 26 <sup>0</sup> 39' - 27 <sup>0</sup> 11' N |
| Longitude                          | 86 <sup>0</sup> 6' - 86 <sup>0</sup> 27' E  | 86 <sup>0</sup> 28' - 87 <sup>0</sup> 7' E  | 86 <sup>0</sup> 9' - 87 <sup>0</sup> 10' E  |
| Main rivers                        | Kamala, Gagan                               | Koshi, Trijuga                              | Kamala, Trijuga                             |
| <b>CLIMATE</b>                     |   |   |   |
| Type                               | Tropical to sub-tropical                    | Tropical to sub-tropical                    | Tropical to temperate                       |
| Annual rainfall (mm)               | 1442  | 1718  | 1 669                                       |
| <b>POPULATION</b>                  |   |   |   |
| Total                              | 442 445                                     | 407 723                                     | 171 891                                     |
| Male                               | 230 071                                     | 207 939                                     | 86 805                                      |
| Female                             | 212 374                                     | 199 784                                     | 85 086                                      |
| Density (persons/km <sup>2</sup> ) | 387.6                                       | 330   | 95  |
| Members per household              | 5.5   |   |   |
| Literacy rate (%)                  | 29.0  | 5.4   | 4.7   |
| <b>LAND &amp; AGRICULTURE</b>      |   |   |   |
| Cultivated land (ha)               | 108 551                                     | 95 607                                      | 49 848                                      |

| MAJOR ATTRIBUTES            | SIRAHA  | SAPTARI  | UDAYPUR   |
|-----------------------------|---|--|---|
| Per capita landholding (ha) | 1.4   | 1.27   | 0.74  |
| No. of landowners           | 76 760  | 42 356   | 39 345  |
| No. of landless families*   | 4 625   | 4 760  | 1 076   |
| LAND USE PATTERN (%)        |   |  |   |
| Cultivated                  | 67.0  | 59.7   | 26.7  |
| Pasture                     | 1.1   | 2.0  |   |
| Forest                      | 21.3  | 23.2   | 42.3 <sup>67</sup>  |
| Shrubland                   | 0.3   | 0.9  | 56 .  |
| Wasteland                   | 6.32  | 50 .   | 12.3  |
| Others                      | 4.0   | 93 .   | 64 .  |
| ECONOMIC STRUCTURE          |   |  |   |
| Major occupation            | Farming   | Farming  | Farming   |
| Population engaged in       |   |  |   |
| - agriculture (%)           | 91.2  | 88.5   | 95.0  |
| - commerce (%)              | 3.5   | 45 .   | 1.0   |
| - social services (0/0)     | 2.5   | 2:6 <sup>2</sup>   | 1.5   |
| industries (%)              | 1.5   |  | 0.5   |
| - others (%)                | 1.3   | 1.2  | 30  |
| MAJOR INDUSTRIES            | Cotton textiles,<br>bricks, tiles,<br>bidis/cigarettes,<br>tanning, cement,<br>furniture,<br>distillery | Match factory,<br>bricks, tiles,<br>bidis, sawmill,<br>bakery, textiles,<br>solvents,<br>furniture | Cement, quar-<br>rying, mining,<br>bakery, textiles,<br>furniture, bricks,<br>handicrafts |
| GOVT/PUBLIC SERVICES        |   |  |   |
| District centre             | Siraha  | Rajbiraj   | Gaighat   |
| All-weather roads (km)      | 110   | 126  | 68  |
| Regional markets            | Lahan   | Kanchanpur   | Katari  |
| MAJOR DEV. PROJECTS         | Afforestation,<br>irrigation,<br>flood control  | Afforestation,<br>irrigation,<br>flood control   | Afforestation,<br>irrigation,<br>flood control  |
| LANDLESSNESS (households)*  | 4 403   | 4 531  | 1 023   |

Note:\* = Under the joint family system of the villagers, especially the Tharu tribe, more than one family may stay in one household and therefore, the number of landless families is more than the number of households.

Sources: Census Report, Central Bureau of Statistics, Kathmandu, Nepal, 1991; Karki et al. 1993.

Altogether, 178 households from three districts (two VDCs each in Siraha, Saptari and Udaypur districts) were surveyed using multi-stage sampling methods, ensuring that the sampled households are growing bamboo for both consumption and sale. The study commenced in August 1995 and the fieldwork was completed in February 1996.

## Data Collection

Sample surveys were carried out to collect the basic socio-economic and production related figures in the three VDCs, including bamboo harvested per unit of clump or household. An inventory of bamboo was carried out to assess the current stock situation in the locations with relatively high industrial potential. Although information available was rather scant, an extensive literature survey was conducted to ascertain the state of current knowledge about bamboo in the region. A survey of existing industries that use and process bamboo and rattan was carried out, and the raw material demand and supply and product marketing were studied. Rapid Rural Appraisal (RRA) and participatory techniques were used to appraise the prospects of bamboo extension activities and identify suitable areas for bamboo cultivation. Indigenous knowledge and skills related to bamboo use and harvest were studied through RRA and sample survey techniques. Household surveys were conducted using a semi-structured interview schedule. Besides, interviews with key participants, focus group meetings and discussions, and observation of the area also formed part of the data gathering process.

The decision-making environment was determined by surveying family heads, both male and female, to find out how they decide on the time, volume and location of collection and sale. Investigations were made to find out whether bamboo collection by the collectors was a full-time activity, and whether their dependence on income from bamboo collection was total or partial. The role of intermediaries in both sale of raw materials and purchase of processed goods was investigated to the extent possible. Constraints related to outdated technology and the lack of credit facilities and information were identified. The lack of incentives – such as tenurial security and the “common property” nature of natural stands – for the landless farmers to plant and maintain bamboo was also investigated.

Potential interventions in the production-to-consumption system were viewed as belonging to four broad areas:

1. Technical inputs to bamboo plantation management (trained technicians, pest control measures, training on improved collection methods, and availability of bamboo cuttings and fertilizers at subsidised prices);
2. Resource development and sustainable harvesting (providing common land on lease to a group of landless farmers, allowing user groups to plant bamboo in the community forest, and providing guidelines for sustainable harvesting of bamboos);
3. Products promotion (providing market information on local handicrafts, providing improved designs and tools, short-term training, and linking the urban consumers to local artisans and collectors); and
4. Extension and monitoring (coordinating bamboo sector programs with other development activities, providing training to disadvantaged and gender groups, helping to organize better marketing strategies and institutions, and providing better financing facilities – including venture capital – to bamboo-based entrepreneurs).

## **Research Methods**

The case study method, being a holistic research design, calls for a better understanding and explanation of the relationships between the variables involved (Yin 1984). Bamboo collection, processing and marketing activities form such a complex phenomenon that it was found necessary to use multiple sources of evidence. Moreover, since only a very small fraction of the bamboo produced entered the market, a single source of data would have had narrow validity and weak reliability. Multiple sources of evidence would develop reliability through cross checking and triangulation processes. Since the variables of interest could not be manipulated, it was not possible to directly draw a cause-effect relationship from them. Hence, the investigators used historical, attitudinal, observational and institutional methods to discern multi-pronged interactive relationships.

### **Variables and their measurements**

The bio-physical and socio-economic variables were measured as a part of the case study research. Among the bio-physical variables, data on the extent and location of resources, their availability in terms of required quantity and quality, rate of seasonal and annual extractions, and 'estimated growth and yield were collected. The following methods were adopted to collect the required information:

#### **Relative density and frequency analysis**

Species richness and abundance were analysed by counting the number of bamboo clumps in a 1 ha plot of randomly selected transects. The relative density was calculated by counting the number of bamboos of one species, dividing the figure by the total number of clumps of all species, and multiplying the result by 100. The relative frequency was analysed by counting the number of quadrates in which a species was found out of the total number of quadrates examined overall. The results were analysed to determine the bamboo acreage, stocking and annual production. Production-related information is given in Tables 3-6 in Chapter 3. Socio-economic information was collected based on the results of the household-based sample survey. Tables 7-11 in Chapter 3 and Tables 1-7 in the Annexe provide information on the socio-economic features of the study area and on respondents.

## 3 CASE STUDY FINDINGS

### **General Findings**

#### **Key players of the sector**

The major players in bamboo-based activities are: private growers, forest user groups, local and non-local enterprises, farmers, occupational castes, craft workers, local and foreign (Indian) traders, urban business people, NGOs, and government officials. Among these, the producers who number in thousands are the key players. However, these small producers and gatherers are unable to participate in secondary processing and marketing of bamboo products because of socio-economic factors – low level of education, low social status of bamboo craftspersons and traders, weak financial position, etc. – as well as the lack of necessary knowledge, expertise and organization.

Although bamboo is grown mainly to meet subsistence needs, which include the sale of bamboo products to meet emergency cash needs, the cultivation is not 'done at the cost of food production. Therefore, bamboo producers participating in the market are generally those who have surplus land or who have other sources of income to buy food. Large blocks of bamboo are grown by large-scale (and absentee) farmers and by households with significant off-farm income sources.

A new type of growers has come up in recent years – the user group. Forest lands, which till recently belonged to the government, have now been handed over to these community-based groups with full use rights and privileges. These organized groups have the potential to become a major player in bamboo production since their holding sizes are fairly large.

#### **Key features of the sector**

##### **Production-to-consumption environment**

A typical feature of the bamboo resource in the study areas is that the bulk of it is in the hands of private growers and collectors. Utilization is need-driven, based on traditional practices and to support agriculture. Harvesting is generally carried out by contract labourers, leading to wastage and unsustainability. Processing technology is low level and trading generally involves monopoly by a few wholesalers. End-users have scant idea of the resource situation and their decisions are determined by convenience and price. Tables 2-7 provide more information on the features of the bamboo production-to-consumption chain while Fig. 5 illustrates the basic flow of the resource.

Table 2: Size of bamboo holdings in the case study area

| Farm size (ha) | Households sampled | Av. bamboo holding (ha) | No. of clumps | No. of culms |
|----------------|--------------------|-------------------------|---------------|--------------|
| Below 0.65     | 62                 | 0.07                    | 14            | 486          |
| 0.65 - 2.0     | 57                 | 0.15                    | 32            | 1 280        |
| 2.0 - 4.0      | 47                 | 0.35                    | 69            | 2 898        |
| Over 4.0       | 12                 | 0.75                    | 143           | 5 720        |
| Total/average  | 178                | 0.22                    | 258           | 10 384       |

Table 3: Bamboo production in the study area (1995)

| District      | Private Farms            |                             |   | Government Forests           |                        |
|---------------|--------------------------|-----------------------------|---|------------------------------|------------------------|
|               | Av. size of holding (ha) | Av. no. of clumps/household | Annual culm production/household ('000) | Estm. area under bamboo (ha) | Annual culm production |
| Siraha        | 0.080                    | 6                           | 921                                     | 816                          | 652                    |
| Saptari       | 0.090                    | 7                           | 890                                     | 650                          | 455                    |
| Udaypur       | 0.010                    | 2                           | 126                                     | 1 245                        | 996                    |
| Average/total | 0.065                    | 5                           | 1937                                    | 2 711                        | 2 103                  |

Table 4: Major bamboo types and preferences among users

| District | Bamboo types                                 | Preferred by (%) |
|----------|--|------------------|
| Siraha   | <i>Bambusa tulda</i> (Chab bans)             | 66               |
|          | <i>B. nutans</i> (Mala bans)                 | 12               |
|          | <i>B. balcooa</i> (Haraut bans)              | 14               |
|          | <i>Dendrocalamus hamiltonii</i> (Lathi bans) | 6                |
|          | Others                                       | 2                |
| Saptari  | <i>B. tulda</i>                              | 84               |
|          | <i>B. balcooa</i>                            | 11               |
|          | Others                                       | 5                |
| Udaypur  | <i>B. tulda</i>                              | 51               |
|          | <i>B. nutans</i>                             | 23               |
|          | <i>B. balcooa</i>                            | 24               |
|          | Others                                       | 2                |
| Average  | <i>B. tulda</i>                              | 67               |
|          | <i>B. nutans</i>                             | 15               |
|          | <i>B. balcooa</i>                            | 13               |
|          | Others                                       | 5                |

Table 5: Production and consumption of bamboo culms in the sampled VDCs

| VDC        | Production<br>(No. of culms) | Annual yield<br>(culms/household) | Domestic use<br>(culms/year) | Sale<br>(culms/year) |
|------------|------------------------------|-----------------------------------|------------------------------|----------------------|
| Siraha     | 30 571                       | 510                               | 168                          | 342                  |
| Saptari    | 40 403                       | 673                               | 316                          | 357                  |
| Udaypur    | 18 179                       | 313                               | 131                          | 182                  |
| Study area | 89 153                       | 501                               | 205                          | 296                  |

Note: A total of 178 bamboo growing households were sampled.

Table 6: Number of different ethnic group families engaged in bamboo work in some key bamboo craft villages

| District | Area               | Ethnic groups               | No. of families |
|----------|--------------------|-----------------------------|-----------------|
| Sira ha  | Bathnaha           | Malik Dom                   | 6               |
|          | Lahan Gudi         | Sarki, Dusad, Magar, Gurung | 45              |
|          | Lahan Bhadaiya     | Sarki, Dusad, Magar, Gurung | 32              |
|          | Harouth            | Sahani, Malaha              | 118             |
|          | Khapate Danda      | Sarki, Kami                 | 12              |
|          | Sub-total          |                             | 213             |
| Saptari  | Pansera            | Dom                         | 7               |
|          | Sitapur            | Dom                         | 4               |
|          | Thelia Byangri     | Magar, Sarki                | 20              |
|          | Bakdhuwa Basantpur | Magar, Rai                  | 27              |
|          | Basaha             | Magar                       | 20              |
|          | Sub-total          |                             | 78              |
| Udaypur  | Hadiya             | Tharu, Sarki, Magar         | 8               |
|          | Jogidaha           | Kshetri, Sarki              | 18              |
|          | Gaighat            | Gurung, Rai, Sarki, Magar   | 32              |
|          | Sub-total          |                             | 58              |
| Total    |                    |                             | 349             |

Note: Data only from major craft villages. Households exclusively engaged in bamboo work in the study area is estimated to number about 1000.

Table 7: A profile of bamboo-dependent communities in the study area

| Sahanis  | Musahars   | Koeries   |
|--|--|---|
| <ul style="list-style-type: none"> <li>• Predominate in the area</li> <li>• Inhabit the upland areas of the foot hills</li> <li>• Own small land holdings</li> <li>• Skilled bamboo workers</li> </ul> | <ul style="list-style-type: none"> <li>• Occupy the mountainous portion of the ghats</li> <li>• Skilled, settled agriculturists</li> </ul> | <ul style="list-style-type: none"> <li>• Inhabit river valleys</li> <li>• Work primarily as vegetable farmers, but also as wage labourers</li> <li>• Skilled craft workers and farmers</li> <li>• Do not own any arable land</li> </ul> |

Table 8: Livelihood means of traditional communities in the study area

|               |  |
|---------------|--|
| Agriculture   | Only one rainfed crop of rice in the lowlands and millets on uplands; oil seeds, fibre and vegetables mainly for domestic consumption.     |
| Other sources | Hunting, fishing, bamboo craft, collecting forest products, work as wage labour at farm houses, fields, road construction and brick kilns. |

It has been reported that the collectors have to trek 25-30 km inside the forest to reach bamboo stands, and they often have to travel to India to market the harvested culms. In other words, they have to work three days and three nights continuously to sell a shoulder-load of bamboo that fetches a meagre US\$ 2/load to raise money to buy rice. The price difference between Nepalese and Indian markets was 60% in favour of Indian market (Shrestha 1994).

Bamboo craft is not a full-time activity; it is seasonal, sporadic and need-driven. This allows the craft workers to participate in a diverse range of activities that are sensitive to human and seasonal cycles, providing considerable security in the event of any calamity (failure of monsoon, pest attack, storms, epidemics, etc.)

### **A Bamboo Weaving Community**

Gada village in Gadiya VDC in Siraha has a large community (more than 100 households) engaged in bamboo weaving. The main products are storage bins (bhakari) and baskets (dbaki, daliya, etc.). Each family of seven of the Suri tribe has on an average from four to five members fully engaged in this vocation, thus making a workforce of about 500 people involved in bamboo work. Three types of bamboo are used: *Bambusa tulda* (Chab or Gharaiya bans), *B. nutans* (Mala or Male bans) and *Dendrocalamus* sp. (Pahad bans). Each culm can yield two baskets and each person can make around three baskets/day. The yield/household is 11 units/day for a gross return of Rs. 550. Out of this, the cost of bamboo alone is Rs. 300, thus leaving a wage of Rs. 30/day/person involved.

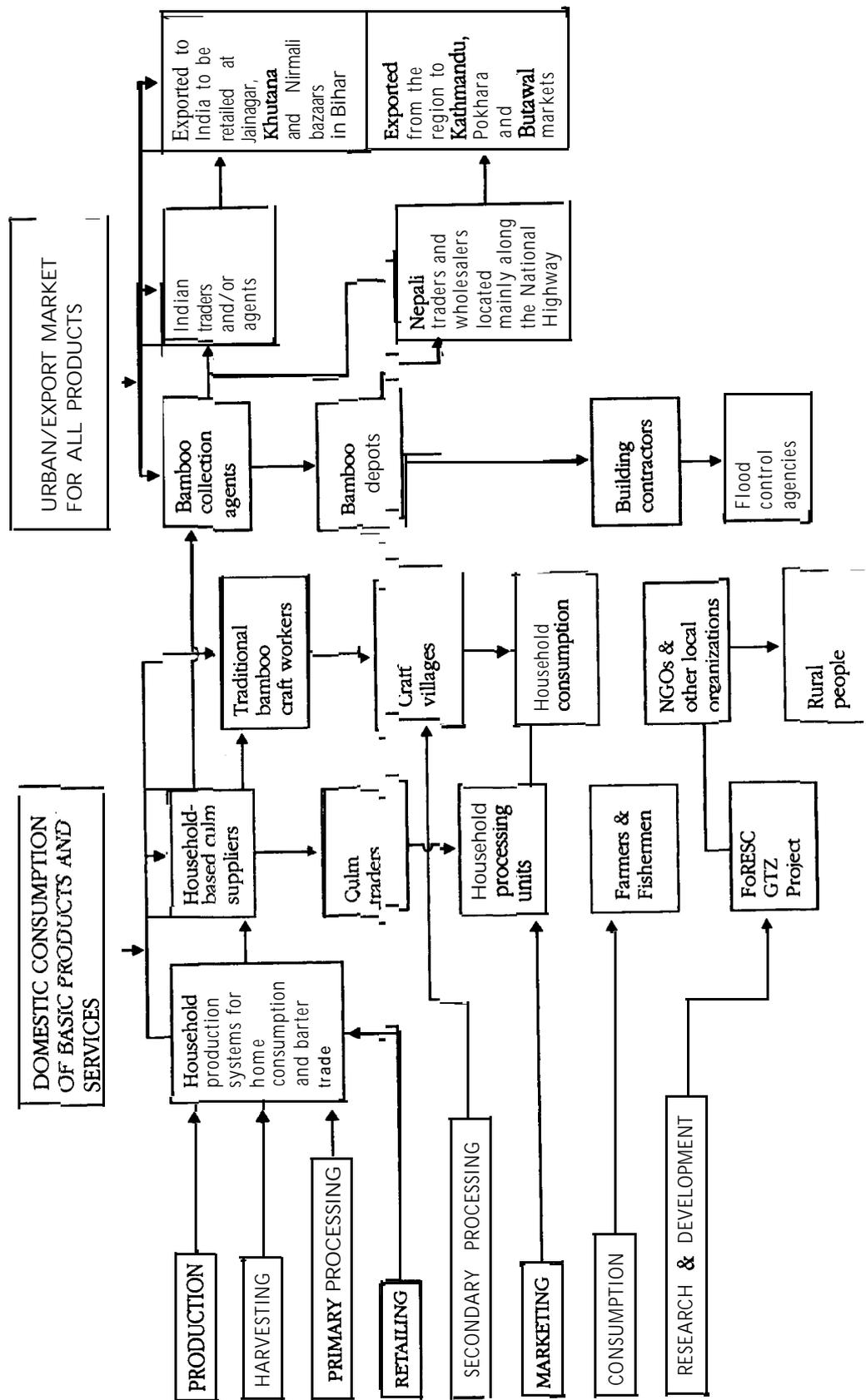


Fig. 5: Basic flow of bamboo resource

Nearly all bamboo craft workers belong to lower occupational castes. The Musahars and Mallahas or Sahanis craft workers mainly produce for themselves, regular clients and relatives. Brahmins and Kshatriyas do not know any bamboo work and depend on Dom, Chamar, Sarkis or Dushad craft workers for their needs. Most craft workers are in the age group of 40-70 years. The most skilled are the oldest, between 60 and 70 years old. Nearly all craft workers are male. The younger generation is increasingly inclined to change to better-paying and less arduous vocations.

### **Bamboo marketing and trade**

The study area is a major bamboo producing area and a transit route for bamboo trade from the hills. Bamboo culms are transported through the Koshi river using bamboo rafts and unloaded at Chatara regional bamboo market. During February-April, 50 000 to 60 000 culms are transported per month by this route to urban destinations in Nepal and India. However, the trade is not transparent and ends up being exploitative, with the agents and the wholesalers taking disproportionate shares of the sales proceeds.

The bamboo market in the neighbouring Indian state of Bihar is highly fluctuant. Major bamboo export occurs from custom points at Bariyarpati, Thadi (Siraha); and Belhi and Kusaha (Saptari). From each point on an average 500 to 1 000 culms of bamboo are exported daily to India during February-April. The total annual export is around one million culms. Prices in India are 40-60% higher (Rs. 80 to

#### **A Typical Bamboo Market**

Lahan Bazar situated on the East-West Highway of Nepal is the major trading centre for bamboo products. The bi-weekly open market trades almost 7 000 culms/week or 500 000 culms/year (price Rs. SO-GO/unit), apart from 100 winnow trays (Rs. 20-25/each), 600 baskets (Rs. 25-30/unit) and 50 bundles of bamboo fuel wood (Rs. 20-25/bundle) per day. Besides, this market is also the major collection centre for transporting bamboo to Kathmandu and other cities in Nepal.

#### **Craft workers on the Move**

Every year around October-November, occupational castes, such as Doms and Dushads, visit their client villages and make various products out of bamboo. These traditional craft workers are paid a daily wage of Rs. 50 plus three meals. They make storage bins (Bhakarīs) for which the charges vary according to the sizes (approx. Rs. 2/kg). Bamboo partitions are priced on the basis of running length. In all cases, the required bamboo culms are provided by the employer or client. These artisans usually stay for 10-15 days in a particular village before shifting operation to the next village. Their work is conveniently scheduled during lean and festive season.

120/culm) than those at the local market. The demand for bamboo is highly influenced by seasonal floods, especially of the Koshi River, that create a huge demand for embankment stabilization.

In the southern part of the study area, dry and fallen leaves of bamboo are gathered for use as fuel. Green leaves are harvested for animal fodder. This has resulted in the degradation of bamboo sites and impoverishment of stands.

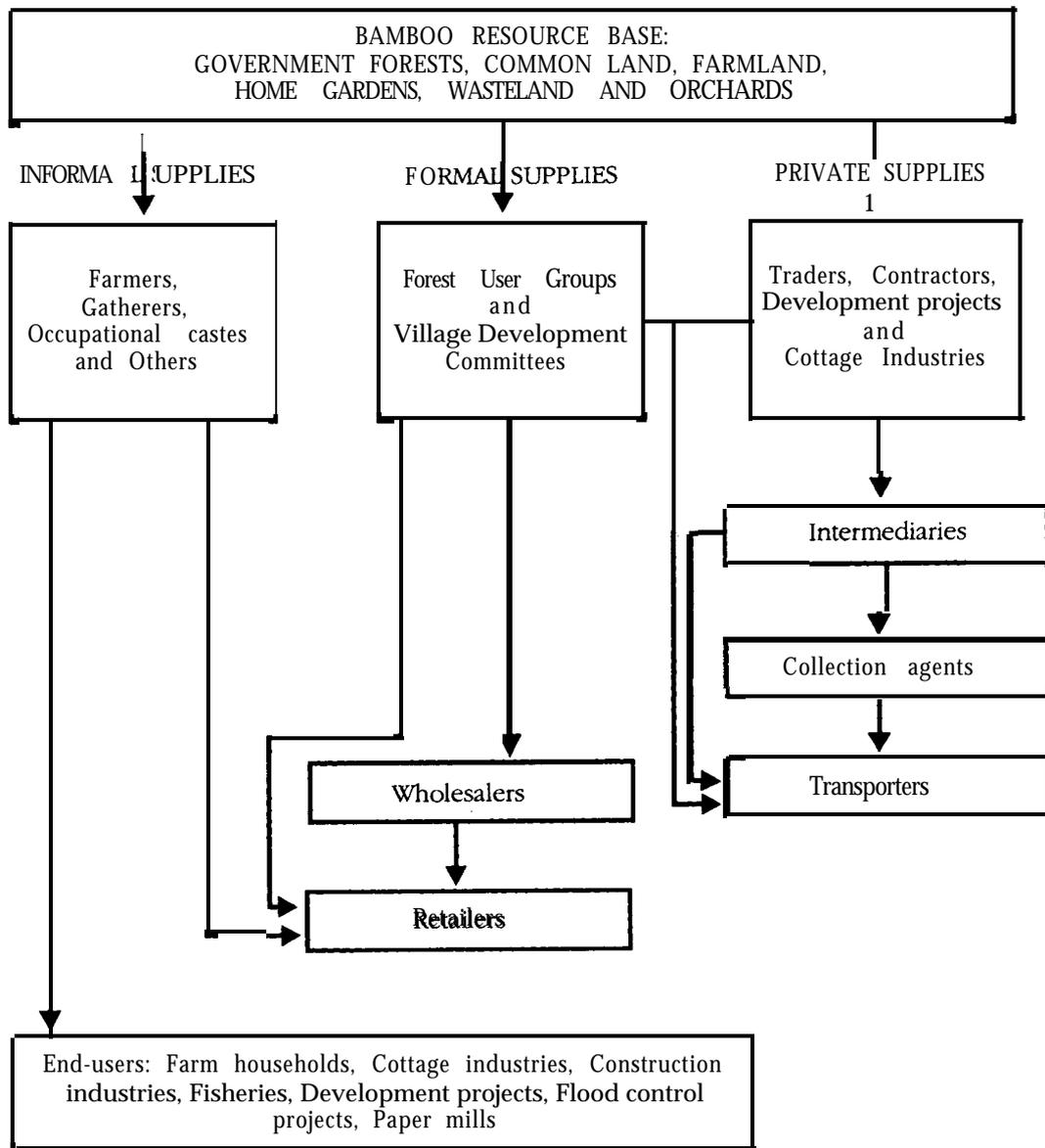


Fig. 6: Flow pattern of bamboo products in the study area

Table 9: Bamboo prices and in the study area

| District | Type of bamboo      | Price (Rs.)<br>Farm-gate | Retail Price (Rs.) |                        |           |
|----------|---------------------|--------------------------|--------------------|------------------------|-----------|
|          |                     |                          | E. Nepal           | Kathmandu <sup>2</sup> | India     |
| Siraha   | Weaving bamboo      | 30 (30.0)                | 60 (60.0)          | 100 (100)              | 96(96.0)  |
|          | Construction bamboo | 25 (27.8)                | 55 (61.1)          | 90 mm                  | 88(98.0)  |
|          | Scaffolding         | 40 (36.4)                | 70 (63.6)          | 110 (100)              | 102(92.7) |
|          | Stick bamboo        | 12 (24.0)                | 30 (60.0)          | 50 (100)               | 48 (96.0) |
| Saptari  | Weaving bamboo      | 35 (31.8)                | 65 (59.1)          | 110 (100)              | 104(94.6) |
|          | Construction bamboo | 28 (29.5)                | 58 (61.1)          | 95 (100)               | 93(97.9)  |
|          | Scaffolding         | 43 (35.8)                | 75 (62.5)          | 120 (100)              | 120 (100) |
|          | Stick bamboo        | 13 (26.0)                | 30 (60.0)          | 50 (100)               | 48 (96.0) |
| Udaypur  | Weaving bamboo      | 25 (27.8)                | 55 (61.1)          | 90 (100)               | 88(97.8)  |
|          | Construction bamboo | 22 (27.5)                | 50 (62.5)          | 80 (100)               | 80 (100)  |
|          | Scaffolding         | 36 (32.7)                | 67 (60.9)          | 110 (100)              | 107(92.3) |
|          | Stick bamboo        | 10 (25.0)                | 23 (57.5)          | 40 (100)               | 37 (92.5) |

Notes:

1 = The bamboos used are:

Weaving - Chab/Gharaiya bans (*Bambusa tulda*)Stick/pole - Ban/Banaiya/Tama bans (*Dendrocalamus hamiltonii*)Construction - Haraut/Bansin bans (*B. balcooa*)Scaffolding - Mala bans (*B. nutans*).

2= Used as 100 percent to calculate price differences.

Table 10: Market types and participants in the study area

| Local markets (Hat Bazar)  | Regional markets (Biratnagar/Janakpur)  |
|--|---|
| <ul style="list-style-type: none"> <li>• The craft worker sells products directly to the consumers.</li> <li>• The users come from nearby villages; if the market is on the highway, travellers also buy things of their interest.</li> <li>• A wide range of products are sold. Each craft worker may bring up to 10 large baskets, 5-10 cylindrical baskets, 20-50 winnowing trays, few grass carry-ons, etc. at one time.</li> <li>• The scale of the transaction is small. If all the products are sold, the craft worker may earn Rs. 300-500/week which has to be shared with close associates.</li> </ul> | <ul style="list-style-type: none"> <li>• The craft worker sells products to agents or traders, who supply to wholesalers.</li> <li>• The agent comes from as far as 100 km away from Kathmandu or across the border from India.</li> <li>• The range of products sold is limited to baskets, some handicraft items, and small tools and implements.</li> <li>• Trade is brisk and items change hands in a couple of hours. Each craft worker sell at least 20 baskets each time, earning about Rs. 1 000/week.</li> </ul> |

Both these types of markets do not reflect the entire volume and dimensions of trade in bamboo articles as there is an informal exchange of bamboo articles at the village level. Whenever the need arises, consumers directly approach craft workers in their own village or in a nearby village to get the products, paying for them in cash or in kind. The volume of such transactions is considerable, more than what is transacted at local markets in small towns.

### **Indigenous systems of management**

The local people follow a strictly enforced set of harvesting rules for bamboo management both on private and public lands. Some of the prescribed guidelines are as follows:

1. One-year-old culms should not be cut;
2. The number of old culms retained should equal the number of new ones subject to a minimum of six old ones;
- 3 No digging is allowed for new shoots that are generally used as a vegetable;
- 4 Culms are to be cut at a height of about 15-30 cm or leaving at least one node stump;
5. Culms on the outer periphery should not be cut; and
6. Harvesting is to be done only during the winter season and only sharp tools are to be used for felling the stems and pruning the branches of the young culms.

While selecting culms for cutting, first priority is given to those stems that are blackish on the outside and orange-yellow on the inside since these are considered to be mature enough. Villagers affectionately refer to mature bamboos as “grand daddy” since these are more than three to four years old. Second priority for harvesting is given to those culms that are green on the outside and white on the inside. These bamboos are locally known as “daddy” bamboos since they are around three years old. The lowest priority is given to bamboos that are less than three years old. Even if these are cut to meet some emergency, they are not used for construction. The most common use for such bamboo is to make fencing.

While harvesting bamboos, the first cut is made on the innermost culm of a clump (beat in a local language). This system helps provide adequate space to the outer and younger culms.

The local farmers have accumulated a rich wealth of knowledge and skill systems in bamboo cultivation and management based on their age-old tradition of growing bamboos. These knowledge systems can be classified as: (a) technical knowledge & skills; and (b) social customs and norms.

Technical knowledge systems are used to address a variety of technical problems such as, for instance, termite control. The villagers identify the onset of termite attack by observing the nesting behaviour of egrets. Accumulation of their excreta attracts termites, and infested bamboo, especially the young shoots, suffer die-back. The villagers prevent termite infestation by adopting the following indigenous methods:

1. Lighting a fire in the clumps during the night (controlled burning during the dry season, using the tall grass *Saccharum spontaneum* as fuel, was also reported); and
2. Inter-cultivating the clump and adopting cultural measures, including the application of salt.

Bamboo leaves are considered a good fodder since, according to the locals, they give energy to draft animals and increase body temperature, especially during the winter season. However, the local people believe that lactating animals should not be fed bamboo leaves as that would dry up the milk yield. *Dendrocalamus* species are generally preferred for fodder.

### **Gaps in community knowledge and skills**

Despite the existence of a wealth of knowledge and skills related to bamboo, there are still some gaps that need to be bridged before bamboo can adequately meet present day demands. According to the local growers, the most important prerequisite for promoting bamboo is to provide them with training on:

1. Planting techniques;
2. Soil fertility status and requirements;
3. Post-plantation care;
4. Pests and diseases control; and
5. Good harvesting practices.

### **Community management of the bamboo resource**

There are three community-based forest user groups (FUGs) that are currently managing bamboo forests: Jhobai Kholsi Churiya, Rajdevi Churiya Danda, and Hario Danda User Groups.

Jhobai Kholsi Churiya FUG was established in 1993-94 and has a membership of about 80 households. Each household has to provide on rotation two members to protect the forest. Although bamboo is the dominant species in the forest, there are a number of commercially important trees that are being managed by the FUG. The total area of the forest is around 350 ha. Extraction of bamboo shoots was a very common off-farm activity till the large-scale destruction of the resource brought on a temporary ban. The sale of bamboo generated about Rs. 14 000 in 1995 and is expected to grow further. The FUG decides the harvesting rules and sets the prices for its members (the prices are doubled for non-members).

Rajdevi Churiya Danda FUG was established in 1994-95 and has about 140 households as its members. The forest is over 450 ha in size and is dominated by hills. There are two types of bamboos found in the forest: Kakas, a large-diameter hollow bamboo; and Porja, a short solid bamboo. The latter is more popular with the weaving community.

Hario Danda FUG in Mirchaiya was registered in 1995. The forest area is about 235 ha, comprising the southern and eastern slopes of the Siwalik hills. Most

bamboo stands belong to a dwarf species, locally called Kath bans or Porja. The management involves mainly protection since the forest is highly degraded. However, the 300 households that are members of the Group are allowed to extract dead and dying bamboos to meet their needs.

## **Development Options**

The economics of different village-based enterprises are shown in Table 11, indicating that the bamboo-based enterprises in the area enjoy a comparative advantage over the more traditional ones. Bamboo-based activities provide various options that the players in the bamboo sector can profitably take up.

The development options in general fall into three categories: the small-scale enterprise option, the raw material supply option and the integrated option.

### **Small-scale enterprise option**

This option is suitable for traditional craft workers and landless householders who can use the traditional skills and abundant labour at their disposal to initiate small enterprises in their courtyards. Units that manufacture simple chairs (stools) or winnowing trays are examples of such small-scale enterprises that families can run. A small amount of capital will be required to buy the necessary equipment and raw materials. As lack of capital and market information are the most serious hurdles to such family-based enterprises, the government's role is critical. Government agencies can offer small loans through group collateral schemes, provide training for skill improvement, and help link these disadvantaged producers to the markets.

### **Raw material supply option**

This option is also attractive in that the capital requirement is quite low. The large and medium farmers and the FUGs will continue practising this option since the market margins are fairly high because of the higher economy of scale. The traditional markets for raw culms in the urban areas of Nepal and India can be tapped to improve the market returns. The government can help these producers by charging lower taxes, and providing improved market infrastructure and information.

### **Integrated option**

Bamboo production — through bamboo-based agro-forestry, block plantations and mixed forest systems — can be developed by integrating it with other enterprises. Alternatively, bamboo products could be combined with other products in micro-enterprises. A typical case is the production of furniture wherein both bamboo and rattan furniture items are produced by the same workers. Another example is the integration of fisheries and bamboo basket making. Flood control and stabilization of embankments are major activities in the region and a number of development agencies are involved in such projects. Bamboo development could be integrated with the activities of these agencies on a long-term basis.

Table 11: Economic options, opportunities and constraints for the residents in the study area

| Opportunities  | Constraints   |
|--|---|
| <b>Bamboo and other NTFP extraction</b>  |   |
| Good opportunities exist. Markets for bamboo and medicinal plants are excellent (especially across the international border in India). There are several traders, intermediaries and small-time agents (as well as networks of smugglers), and access to markets in India is relatively easy. Urban markets within Nepal is also gradually developing. | Government rules, regulations and restrictions are many; the permit system requires some modifications.   |
| <b>Farming, farm ownership</b>   |   |
| The most commonly practised activity. Many market opportunities, good infrastructure (transport), and adequate technical and financial services are available.   | Requires access to land (of sufficient size), infrastructure (irrigation), labour force and capital. Land can be acquired through inheritance or forest land conversion, both of which are difficult options.       |
| <b>Tenant farming</b>  |   |
| A very common option among the small landless farmers with long-standing and some often inherited tenant-owner relationships. Recent legislation provide tenants with the right to acquire some portion of the land they cultivate.  | Needs interested land owners to rent out and land. The tenant needs sufficient land, capital, and foresight to benefit from farming.  |
| <b>Small-scale rural enterprises</b>   |   |
| Recent liberalization of the economy has made it easy to set up small rural enterprises. Good markets exist for most of the products, especially those based on forest products. Some technical and financial assistance is available.   | Requires appropriate property, capital and collateral to invest. Also, technical knowledge and skills are needed which are rather difficult for the poor and less powerful to obtain.                               |
| <b>Employment in the local labour market</b>   |   |
| Employment opportunities are increasing in the local industries, business and development projects. However, labour is in over-supply and a fairly large number of people go outside the region to Kathmandu and India to work as seasonal labourers.  | Opportunities are decreasing in the local agricultural sector. Unskilled industrial jobs entail long hours, low pay, hazardous conditions and high risk. Seasonal migration is highly disruptive to family systems. |
| <b>Government/public services sector</b>   |   |
| Many agencies and offices exist in the area.   | Requires education, training and personal connections.  |

Availability of an improved input delivery system, greater involvement of the private sector, flow of appropriate technology from other countries, and an enabling policy and institutional environment are important prerequisites for the smooth and effective implementation of these options.

Table 12: Economics of bamboo stool production in the study area

| Item                                 | Quantity    | Rate (Rs)   | Amount (Rs) |
|--------------------------------------|-------------|-------------|-------------|
| <b>Inputs'</b>                       |             |             |             |
| Bamboo                               | 55 culms    | 7.00/stem   | 385.00      |
| Jute rope                            | 2.5 kg      | 40.00/kg    | 100.00      |
| Colours (synthetic)                  | 400 packets | 0.50/packet | 200.00      |
| Plastic sheet (Nylon)                | 20 kg       | 100.00/kg   | 2 000.00    |
| Tyre strips                          | 150 pieces  | 3.00/tyre   | 450.00      |
| Labour                               | 25          | 45.00/day   | 1 125.00    |
| Agent's commission                   |             | 5 .00/piece | 500.00      |
| Total input cost                     | -           | -           | 4 760.00    |
| Output value at<br>factory/household | 100         | 60.00/unit  | 6 000.00    |
| Net return*                          | 100         | -           | 1 240.00    |

Notes: 1 = For 100 units; 2 = Each family earns Rs. 1 240/week in the peak season which lasts for 3 months in a year.

The case study examined the economics of a family-based enterprise that manufactures winnowing trays and some handicraft items. The economics of a winnowing tray manufacturing unit work out as given below:

|   |                                  |
|---|----------------------------------|
| Size of operation                                   | : 1 piece/day/person             |
| No. of persons engaged                              | : 3 (part-time)                  |
| No. of bamboo consumed                              | : 60-70 culms/month for 6 months |
| Cost of 1 large culm                                | : Rs. 50                         |
| No. of winnowing trays that can be made from 1 culm | : 7-8 (18 inches radius)         |
| No. of winnowing trays made by the unit per month   | : 180                            |
| Price per tray at the point of production           | Rs. 20-25                        |
| Price per tray in the local markets                 | Rs. 40-55                        |

Sieve tray, locally known as Chalno, is another major item manufactured in the area. Mala bans (*Bambusa nutans*) is the most utilized species. It is generally collected from external sources. Up to 4 sieve trays can be made in a day. They sell for Rs. 15 each at the point of production.

Decorative baskets and storage boxes are used by ethnic communities for carrying materials required for marriages, religious ceremonies, etc. These are in great demand during the season considered auspicious for such ceremonies. From one culm, 7 or 8 baskets and 10-12 boxes can be made. All tasks, including bamboo collection and sectioning, are done by the male members of the family. On an average, each person can make two baskets and two boxes per day. Chab bans (*Bambusa tulda*) is considered the best for this purpose. The Tharu and Magar tribal communities are very much involved in bamboo craft making. It is estimated that up to 40 households are engaged in this business.

## **Policy and Institutional Issues**

The case study has generated a considerable amount of information on how crucial the bamboo resource and products derived from it are to household food security and rural livelihoods in the eastern Nepal. Dependence comes from the multiple use of bamboo in the daily lives of people to meet subsistence, environmental and commercial goals – culms for house construction and articles of everyday use, crafts to generate off-farm income, shoots for food, and whole plants for preventing soil erosion and protecting river embankments. Many aspects of bamboo dependence and use have been illustrated, including the plant's use for meeting cash and food requirements during emergency situations.

One of the major gains of the case study was capacity building – enabling the researchers from the Forest Research & Survey Centre (FoRESC) and the Institute of Forestry (IOF) to practise new data collection techniques, strengthen their analytical capacities, and get training to work in multi-disciplinary teams and directly with communities.

## 4 IMPLICATIONS OF THE STUDY

### **Major Highlights**

The implications of this study need to be viewed in a wider context. First, the food security needs of the poor people must be given a high priority. Second, the various local institutions providing relevant services to the communities need to be strengthened through a series of measures. These will include strategies that can facilitate appropriate support to the communities, lead to the development of training programs that can enhance skills for better utilization of bamboo, and help promote a wider use of bamboo in the communities' livelihood activities.

The case study has raised a number of other related issues. For instance, there is a need to improve the bottom-up link between local communities and formal institutions, between institutions from different sectors, and between researchers and planners so that food security and environmental stability issues that emerge in bamboo-dependent communities are given priority attention in development plans. Table 13 provides a matrix of issues and possible methods of addressing them.

### **Implications of the Findings**

Proper management of bamboo stands had long been ignored in the study area by both government agencies and farmers. Bamboo farmers in this region have accumulated a wealth of experience, but lack the silvicultural knowledge and expertise – such as controlled felling, weeding, thinning, soil conditioning, fertilization and elimination of pests, which are essential for management under resource-scarce conditions – to practise intensive management of bamboo stands.

Clumps are not properly thinned out, thus restricting free movement of cutting implements among the culms. Culms are allowed to touch each other, thus preventing the sprouting of new shoots at the centre of the clumps, despite the existence of fairly detailed traditional harvesting rules.

The results are unscientific management of the resource, weak vertical and horizontal linkages and lack of new technology that have caused virtual stagnation of the sector in the eastern Nepal. Some of these consequences are explained below.

Table 13: An analysis of variables in the bamboo production-to-consumption chain in the study area

| ITEM                   | RESOURCE BASE   | EXTRACTION/HARVESTING   | PRIMARY PROCESSING   | SECONDARY PROCESSING  | WHOLESALE   | RETAIL  | END-USE  |
|------------------------|---|---|--|---|---|---|--|
| Players                | <ul style="list-style-type: none"> <li>Private growers</li> <li>Community/national forests</li> <li>Local/outside enterprises</li> </ul>  | <ul style="list-style-type: none"> <li>Individuals, families</li> <li>Community user groups</li> <li>Professional workers</li> <li>Occupational castes</li> </ul> | <ul style="list-style-type: none"> <li>Occupational castes</li> <li>Professional workers</li> </ul>                    | <ul style="list-style-type: none"> <li>Craft workers</li> <li>Furniture/mat manufacturers</li> </ul>            | <ul style="list-style-type: none"> <li>Community brokers</li> <li>User group members</li> <li>Local traders</li> </ul>  | <ul style="list-style-type: none"> <li>Local bazaars</li> <li>Roadside yards</li> <li>Local businesses</li> </ul>     | <ul style="list-style-type: none"> <li>Individuals</li> <li>Families</li> <li>Retail business</li> <li>Public works</li> </ul> |
| Key features           | <ul style="list-style-type: none"> <li>Individual ownership</li> <li>Community ownership</li> <li>Subsistence use</li> <li>Low marketability</li> </ul>   | <ul style="list-style-type: none"> <li>May or may not own the resource</li> <li>Need-based decision</li> <li>Unskilled workers</li> </ul>                         | <ul style="list-style-type: none"> <li>Rudimentary technology</li> <li>Only occupational castes involved</li> </ul>    | <ul style="list-style-type: none"> <li>Product-based</li> <li>Often depends on tools availability</li> </ul>    | <ul style="list-style-type: none"> <li>More interested in export to India</li> <li>Do not share market info.</li> </ul> | <ul style="list-style-type: none"> <li>Traditional businesses</li> <li>No specialization</li> <li>Seasonal</li> </ul> | <ul style="list-style-type: none"> <li>Price and convenience influence buying decision</li> </ul>                              |
| Different options      | <ul style="list-style-type: none"> <li>Private ownership</li> <li>Community ownership</li> <li>Lease hold</li> </ul>  | <ul style="list-style-type: none"> <li>Will result in better management</li> <li>Marketing will increase value</li> <li>Local enterprises</li> </ul>              | <ul style="list-style-type: none"> <li>Better technology &amp; assembly line organization can improve value</li> </ul> | <ul style="list-style-type: none"> <li>Market-driven technologies</li> <li>Training support</li> </ul>          | <ul style="list-style-type: none"> <li>Education on better marketing techniques can be of help</li> </ul>               | <ul style="list-style-type: none"> <li>More specialized trading may help</li> </ul>                                   | <ul style="list-style-type: none"> <li>Price paid need to include resource costs</li> </ul>                                    |
| Issues                 | <ul style="list-style-type: none"> <li>Lack of inventory</li> <li>Limited genetic base</li> <li>Primacy of socio-economic needs</li> </ul>  | <ul style="list-style-type: none"> <li>Exploitative relation in the resource</li> <li>No vested interest to contract harvest</li> </ul>                           | <ul style="list-style-type: none"> <li>Combined with harvesting</li> </ul>   | <ul style="list-style-type: none"> <li>Price incentives and product designs lacking</li> </ul>                  | <ul style="list-style-type: none"> <li>Exploitative market practices</li> <li>No sharing of market info.</li> </ul>     | <ul style="list-style-type: none"> <li>Lack of market information</li> <li>Lack of marketing skills</li> </ul>        | <ul style="list-style-type: none"> <li>More options on type and quality of products</li> </ul>                                 |
| Consequences           | <ul style="list-style-type: none"> <li>Gross neglect</li> <li>Poor resource quality</li> <li>Poor marketing networks</li> </ul>   | <ul style="list-style-type: none"> <li>Significant wastage</li> <li>Leads to poor standards</li> <li>No knowledge of consumer preferences</li> </ul>              | <ul style="list-style-type: none"> <li>Unorganized sector</li> <li>Lack of knowledge on product markets</li> </ul>     | <ul style="list-style-type: none"> <li>Lack of processing facilities</li> <li>Unclear govt. policies</li> </ul> | <ul style="list-style-type: none"> <li>Does not promote healthy trade</li> </ul>  | <ul style="list-style-type: none"> <li>Promotes sale of products</li> </ul>   | <ul style="list-style-type: none"> <li>Consumer knowledge is poor or distorted</li> </ul>                                      |
| Development strategies | <ul style="list-style-type: none"> <li>Develop marketing infrastructure</li> <li>Technology transfer and training</li> <li>Business promotion organization</li> <li>Credit facilities</li> <li>Integrated approach</li> </ul> | <ul style="list-style-type: none"> <li>Adopt appropriate harvesting systems</li> <li>Training and monitoring</li> <li>Devise incentive mechanisms</li> </ul>      | <ul style="list-style-type: none"> <li>Improve technologies</li> <li>Link to market needs</li> </ul>                   | <ul style="list-style-type: none"> <li>Link to consumer demands</li> </ul>                                      | <ul style="list-style-type: none"> <li>Promote transparency in dealings</li> </ul>                                      | <ul style="list-style-type: none"> <li>Needs to be educated</li> <li>Promote transparency in dealings</li> </ul>      | <ul style="list-style-type: none"> <li>support market research</li> </ul>  |

## **Consequences and Outcome Analyses**

### **Forestry MasterPlan**

Nepal's Master Plan for the Forestry Sector (1988) has stipulated the necessity of promoting the propagation of "minor forest product" species in plantations, managed natural forests and farms. It also emphasizes the need to introduce proper collection methods, an important measure to ensure that the remaining resource base is not overexploited. Processing allows value-added products to be produced and marketed, while practising sustainable utilization of the resource. Although the production and marketing of minor forest products have specific requirements, their common aspects, according to the plan, have been categorized into the following primary program components to facilitate implementation:

- Immediate follow-up measures for the various commodities to solve problems pertaining to collection, marketing and related concerns;
- Cultivation of non-timber forest plants to increase production; and
- Development of industries based on NTFP resources and other products.

The plan has also included botanical surveys, genetic conservation, and research and development as supportive programme components that are essential to backstop the development of the bamboo sector. This policy augers well for proposing an integrated bamboo-based resource development and management project in the eastern Nepal, where bamboo is a traditional resource.

### **Development strategies**

Under the existing forest policy and the recently enacted Forest Regulations (1995) of Nepal, management of a large part of the national forests is being handed over to community-based User Groups. Similarly, degraded land is being leased out to private individuals or enterprises for reforestation and utilization. However, the government is unable to provide the administrative, institutional and technical supports needed for the successful and timely implementation of the recent reforms in policy and institutional mechanisms. The pool of technical personnel is inadequate to effectively implement new, and sometimes radical, programs in forestry. The strategies contained in the new forest policy include: reduction in fuel wood consumption by effective demand management; increasing the supply of fuel wood and fodder by involving user groups, private individuals and enterprises; effective strategies for conservation of ecosystems and genetic resources; public education in conservation; improved pasture and livestock management; provision of livelihood opportunities to the forest-dependent poor and landless people; improvement of the institutional framework; priority ranking of development programs and adherence to priorities; and encouraging active participation of the people and NGOs in forest development and protection.

Under this scenario, the strategies for development need to be planned to maximize the utilization of the non-timber forest resources, such as bamboo, by adopting the following approaches:

- The government should provide a strong leadership and financial support to bamboo-based enterprises;
- The private sector should be encouraged to invest in large-scale bamboo plantation and processing activities;
- Coordination should be enhanced among the different public and private agencies involved in the collection and processing of bamboo products;
- The private sector needs to take full advantage of the current policy provision of leasehold and private forestry to invest in the area of plantation establishment of improved bamboo (and rattan) species;
- Trained personnel and an efficient management system should be developed for improved collection, processing and utilization of bamboo (and rattan) through government initiatives;
- A sound marketing infrastructure and a reliable information system should be developed mainly to address the issue of lack of awareness on the part of consumers of prices and competitiveness of bamboo (and rattan) products;
- Technology transfer from neighbouring countries such as India, through either bilateral cooperation or foreign investment, is vital to develop improved production systems and in-country processing facilities;
- As the primary producers/collectors are forced to operate with limited bargaining power, there is a need to organize them into groups, such as production cooperatives, to be able to participate in the bamboo (and rattan) trade from a position of strength; and
- Skill-oriented training courses should be conducted by the Institute of Forestry and the Department of Forest Training Division on the production, processing, utilization and marketing aspects of bamboo (and rattan).

## 5 RECOMMENDATIONS

### Major Recommendations

1. The government must make a policy decision to accord top priority to the bamboo sector in promoting ecologically sound development in the Tarai region of the eastern Nepal.
2. There is a need to change the tree and land tenure rules to allow a better share of the returns to tenant cultivators. The landowners should also be given tax and land ceiling concessions for at least 25 years if they decide to grow bamboo.
3. There is a need to organize the communities, mostly belonging to the tribal groups of Tharus and Magars, in harvesting and marketing bamboo in the forests managed by Forest User Groups.
4. Training, credit, and simple machinery and tools should be provided to traditional craft workers (including women) to better organize the sector and improve the quality of the products.
5. Studies have to be carried to assess culm yields of the most popular bamboo species — Chab (*Bambusa tulda*) and Haraut (*B. balcooa*) — in the project areas. Felling, shoot protection, weeding, thinning, soil conditioning, fertilization and pest control are the other major areas that need attention. The findings of these studies, together with traditional experiences, will contribute towards integrating systems of silvicultural techniques with bamboo management, Bamboo processing techniques and the use of simple machines have to be studied, and suitable technology transfer effected. Because of the hard and slippery skin and the silica content of culms, special techniques are required to peel the bamboo skin for use in the manufacture of high-quality products. Secondary processing techniques — such as blending, moulding, coating, polishing and dyeing — that are important for furniture, art objects and other fine products should also be included in the research programs.
6. Development of a village bamboo resource program should be adopted as one of the main thrusts of the community forestry plan being implemented by the government.
7. Bamboos in the study sites need to be efficiently and sustainably managed. This will require the development of a long-term management and utilization plan. The Forest Department should work with national and international agencies (such as INBAR) to bring in the latest technology to improve both the stock and the management techniques.
8. Private sector investment should be encouraged by offering wasteland on long-term lease and by introducing feasible technologies, such as the bamboo matboard technology from India.

9. The on-going GTZ-funded Churia Afforestation Project should immediately start working with FORESC, IOF and INBAR to develop viable bamboo-based enterprises in the study area (an indicative list is given on the following page).

## **An Indicative List of Investment Projects**

On the basis of the findings of the case study, it is proposed that the government initiate the development of micro-enterprise projects based on bamboo (and rattan) in the eastern Nepal to alleviate rural poverty and contain ecological degradation of natural resources. Some of the activities that can be designed as investment projects for funding by international financing institutions – such as the World Bank, Asian Development Bank (ADB) and the International Fund for Agricultural Development (IFAD) – are described below.

1. **Bamboo-based micro-enterprise development.** Small enterprise development is a particularly important strategy for reaching women and other disadvantaged groups in Nepal. Although women form a significant percentage of micro-entrepreneurs in the eastern parts of Nepal, conventional credit and service-oriented cottage industry promotion activities do not target them as clients. There is also a need to develop strategies that can more effectively involve poor and marginalized groups. Small enterprises based on bamboo (and rattan) can fit into rural economic development and environment protection activities since the benefits derived from them will be immediate and felt in both enterprises and households.

2. *Bamboo resource improvement and management.* Most bamboo stands existing in the Tarai districts of eastern Nepal are of poor genetic stock. A recently concluded provenance trial conducted by the Forest Research and Survey Centre in Nepal has indicated the suitability of several exotic provenances, mainly from Thailand and India, to the Tarai (plain) ecosystem of Nepal. The project plans to introduce provenances that are known to be suitable for manufacturing handicrafts, furniture, mats and other market-oriented goods. INBAR, as a network of a large number of scientists, has the adequate technical expertise and information needed to help Nepali researchers access suitable bamboo germplasm in the region and to provide guidance.

3. *Establishment of a prototype bamboo matboard factory.* Currently, bamboo producers are facing severe marketing problems in the eastern Nepal. Although the sale of raw culms is not providing them with adequate economic benefits, presently no other better alternative exists. The paper mills do not have machines needed to crush bamboo and are currently using other raw materials, such as grasses and crop residues, available at much cheaper prices. The soaring timber prices have boosted the economic prospects of bamboo-based alternatives such as the matboard. Therefore, it is proposed that a prototype bamboo matboard factory is established in the town of Lahan, the regional market centre for raw bamboo culms. During field visits, the team discussed this idea with the GTZ-funded Churia Afforestation Project being implemented in the study area. The Project has shown interest to fund the establishment cost of this prototype provided the technical coordination is handled by INBAR. The financial viability of a bamboo matboard

unit appears good because raw material and labour costs in Nepal are very low, and the prices of plywood and timber are 10.25% higher than that of bamboo in Kathmandu and other major cities.

4. ***Rehabilitation of flood-affected lands.*** The three Tarai districts of Udaypur, Saptari and Siraha suffer from recurrent flooding owing to the changing course of the Koshi and other rivers. There is a tradition among the local people of utilizing bamboo to control flooding and rehabilitate flood-damaged land. It is proposed that the models developed under the IDRC-funded Farm Forestry (Nepal) Project are applied, along with agro-forestry, community-based mixed forestry and other ecologically and economically sound. land use systems.

5. ***Establishment of private plantations of rattan.*** Rattan has very good commercial prospects in Nepal. Currently, there are more than 40 rattan processors in the country who mostly use imported raw material. Two genera and six species of rattan are available in Nepal and there is an urgent need to. conserve them. One way to conserve this genetic resource is to establish private plantations. It is proposed that demonstration plots be established in private farms by introducing commercially important large diameter rattans from other parts of the region. INBAR will be able to facilitate germplasm supply and provide technical supervision.

6. ***Development of community information resource centres.*** There is a great need to increase awareness among people at all levels regarding the necessity to conserve bamboo and rattan resources as well as to protect the environment. This can be achieved by creating a network of grassroots level community institutions that can network to carry out the following functions:

- Provide training to community members and work with NGOs in refining technologies and disseminating information;
- Sensitize the community to the need and potential of biodiversity conservation and environment protection;
- Ensure regular flow of technical information to the community and act as a repository of outside information;
- Improve the process of participatory learning through awareness generation and gender sensitization
- Create information systems to constantly monitor and evaluate the problems, needs, priorities and aspirations of the communities, and the changes occurring within them;
- Facilitate inter-community exchange and sharing;
- Facilitate different training courses wusing local media and communication network; and
- Assess the gaps in the knowledge and skills of community members and help incorporate indigenous knowledge and skills into new projects and initiatives.

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## ANNEXE

Table 1: Average income and expenditure of households in the study area (in Rs.)

| Item                          | Siraha     | Districts<br>Saptari | Udaypur      |
|-------------------------------|------------|----------------------|--------------|
| Average annual income         | 11.16      | 10.98                | 9.76         |
| Range of <sup>2</sup>         | 10 - 70    | 9 - 63.45            | 8.5 - 57.33  |
| Average expenditure (annual)  | 16.27      | 16.50                | 13.46        |
| Expenditure range (min./max.) | 5.5 - 18.3 | 4.8 - 16.8           | 4.75 - 16.25 |

Notes:

All units in thousands.

1 = Income and expenditure do not include produce that are produced and consumed in homes;

2 = Range of income markedly varies as there is a large and growing gap between the rich and the poor.

Table 2: Trend of bamboo market prices in the eastern Nepal (1991-95)

| Year | Prices (Rs/10-m culm) in different areas |         |         |         |
|------|--|---------|---------|---------|
|      | Siraha                                   | Saptari | Udaypur | Average |
| 1990 | 25                                       | 26      | 20      | 23.7    |
| 1991 | 32                                       | 35      | 23      | 30.0    |
| 1992 | 50                                       | 50      | 28      | 42.7    |
| 1993 | 56                                       | 60      | 35      | 50.3    |
| 1994 | 61                                       | 63      | 50      | 58.0    |
| 1995 | 68                                       | 70      | 56      | 64.7    |

Table 3: Perception of demand and supply of bamboo in the study area

| Item            | Demand-supply perception (%) |         |         |         |
|-----------------|------------------------------|---------|---------|---------|
|                 | Siraha                       | Saptari | Udaypur | Average |
| Demand = supply | 83                           | 76      | 57      | 72.0    |
| Supply > demand | 14                           | 19      | 37      | 23.3    |
| Supply < demand | 3                            | 5       | 6       | 47 .    |

Table 4: Type of uses of bamboo in the study area

| Uses               | Percentage of use |         |         | Average |
|--------------------|-------------------|---------|---------|---------|
|                    | Siraha            | Saptari | Udaypur |         |
| House construction | 79                | 73      | 62      | 71.4    |
| Weaving materials  | 17                | 21      | 26      | 21.3    |
| Fencing            | 2                 | 3       | 8       | 4.3     |
| Others*            | 2                 | 3       | 4       | 3.0     |

Note: \* = Include poles, trusses, agricultural tools and other household goods.

Table 5: Household members/key players of the bamboo sector sampled in the study area

| Key players  | No. of households sampled |         |         | Est. total in the three districts |
|--|---------------------------|---------|---------|-----------------------------------|
|  | Siraha                    | Saptari | Udaypur |                                   |
| Collectors and gatherers from government forests                   | 28                        | 14      | 21      | 6 300                             |
| Farmer producers   | 13                        | 51      | 51      | 200 000                           |
| Intermediaries & brokers   | 8                         | 7       | 5       | N.A.                              |
| Traders or sellers (Raw culms/finished products)                   | 4                         | 4       | 4       | 60                                |
| Small-scale industries and/or processors (furniture & handicrafts) | 2                         | 3       | 2       | 31                                |
| Workers in furniture & handicrafts manufacture                     | 2                         | 3       | 2       | 70                                |
| Community forestry   | 1                         | 1       | 2       | N.A.                              |
| Transporters   | 5                         | 4       | 2       | N.A.                              |
| Total  | 63                        | 87      | 89      | —                                 |

Note: Assumes 5.5 members per household.

Table 6: Trend of farm-gate bamboo prices in the study area (1991-95)

| Year | Collection price (Rs. per culm) |         |         | Selling price (Rs. per culm) |         |         |
|------|---------------------------------|---------|---------|------------------------------|---------|---------|
|      | Minimum                         | Maximum | Average | Minimum                      | Maximum | Average |
| 1991 | 10                              | 15      | 11.25   | 15                           | 20      | 16.25   |
| 1992 | 15                              | 15      | 15.00   | 20                           | 25      | 21.25   |
| 1993 | 15                              | 20      | 18.75   | 20                           | 30      | 25.00   |
| 1994 | 20                              | 25      | 21.25   | 25                           | 35      | 29.75   |
| 1995 | 20                              | 30      | 25.00   | 25                           | 40      | 32.00   |