CASE STUDIES

In many developing countries there has been a continuing trend towards capital-intensive technological modernization and large-scale industrialization. This kind of economic policy seems to stem from the view that dependence on industrialized countries can only be prevented through industrial development. However, this type of industrialization, based on patterns derived mainly from the 'developed' countries of Europe and North America, leads to new forms of dependence on external skilled manpower and technologies. More often than not, technological modernization produces more problems than it solves through the implementation of over-ambitious development programmes unsuited to the country's socio-economic situation.

More recently, attempts have been made to provide intermediate or appropriate technology solutions to problems faced by developing countries. However, many of these solutions are generated externally and as such, are often inappropriate.

A different approach to problem solving is needed which should be based on local involvement and aimed at developing existing indigenous technologies. Firstly, the wealth of existing local knowledge of the system and of traditional rural technologies should be documented and evaluated. Secondly, ways of encouraging, up-grading and re-instating them should be explored. These factors are also important in re-establishing a local natural resource base for meeting the local people's basic needs and generating additional off-farm income.

Given the fact that the problems faced by hill farmers are less related to a lack of technology or technical expertise and more to a dwindling resource base, it is high time that professionals adopted a broader, multi-sectoral integrated approach to solving problems that are not merely environmental. In the past, foresters, agriculturists, agronomists and horticulturists have made little effort to co-operate in an inter-disciplinary manner. For instance, until recently forestry development activities were largely focused on the commercial exploitation of natural forests and the establishment of fast growing mono-culture plantations to meet industrial requirements. As a result, the daily basic needs of the rural population and the economic contribution the small cottage/rural industries can make to the hill rural economies have been neglected and the importance of 'minor forest products' undervalued. Thus increased emphasis should be given to re-establish the local forest resource base and to developing small-scale, forest-based industries in rural areas for enhancing the hill farmer's income through off-farm employment generation.

The following case studies of relevant projects selected from the Region attempt to illustrate this approach and to justify investments in forestry for rural income generation in the hills.

- Projects for reforestation and improved management of existing forests and trees:
  - a. The Nepal-Australia Forestry Project, Stage-2, (NAFP-2).
- Projects for the development of small scale cottage industries:
  - a. Bast paper making industry.
  - b. Bamboo and allied industries.
  - c. Cloth production from the fibres of the Himalayan Nettle: Allo.
- Fruits and other cash crops production projects:
  - a. Fruit growing.
  - b. Medicinal plants development.
  - c. Mushroom farming.

REFORESTATION AND IMPROVED MANAGEMENT OF EXISTING FORESTS AND TREES

The case study is aimed at showing the benefits derived by rural people from reforestation projects. Such programmes, in addition to the conservation of forests and the reforestation of denuded areas, also generate employment and income in the hills. The following case study of NAFP-2 tries to illustrate these points.

The Nepal-Australia Forestry Project, Stage-2, (NAFP-2) (Mahat et al., 1986)

The Nepal-Australia Forestry Project, stage-2 (NAFP-2), under review is a joint effort between the local people, His Majesty's Government of Nepal and the Australian Government.

Australian involvement in forestry in Nepal started in 1963. At first, attached to the Bagmati Zone Afforestation Section and based at Kathmandu, it was run on a rather ad hoc basis and its main activity focused on the practice of technical forestry: mainly species trials, nursery work and establishment of small scale trial plantations, mostly of exotic species. All this phase until 1978 in retrospect is considered as phase 1 of the Nepal-Australia Forestry Project (NAFP-1). The old project (NAFP-1) was discontinued in 1978-79 and the new project was launched in an entirely new area of endeavour (Shepherd, 1981). The new phase of the project, now called the Nepal-Australia Forestry Project, Stage-2 (NAFP-2), was developed on the foundations provided by the Community Forestry Programme initiated and successfully developed in the Chautara Forestry Division (Sindhu Palchok & Kabhre Palanchok districts) area since 1973 as an exercise in productive partnership in forestry between the local people and HMG Forest Department. NAFP-2 also chose the Chautara Forestry Division area as its own geographic area of activity. (Campbell and Mahat, 1977 a & b, 1978; Griffin 1978; Midgley and Mahat, 1978; Shepherd, 1981; Gilmour, 1984; Gilmour and Applegate, 1984; Mahat, 1985a & b). Through the NAFP-2, the Australian side thus joined the partnership of the local people and HMG Forest Department in the Chautara Community Forestry Programme. The project has since channelled much greater flow of resources in the form of funds, technical manpower and research inputs for the promotion of community forestry in Sindhu Palchok and Kabhre districts of the erstwhile Chautara Forestry Division. An extended phase-2 of the Nepal-Australia Forestry Project (NAFP-2) was completed in 1985 with a very creditable level of successful performance. The next phase of it (NAFP-3) commenced in early 1986 on similar lines as the NAFP-2 and it is hoped will continue to provide increasing and tangible benefits to the rural population of the two districts. The focus of this study is, however, limited to the NAFP-2.

Table 3: Plantation Established by NAFP (1979-1983)

Planting Season	HMG Fiscal Year	Area of plantation Established (ha) HMG Yearly Total	HMG Cumulative Total	PF Yearly Total	PF Cumulative Total
1979	1978/79	100	100	-	
1980	1979/80	100	200	280	280
1981	1980/81	219	419	233	513
1982	1981/82	479	898	220	733
1983	1982/83	200		400	

Source: NAFP-2. Report of the Evaluation Team, 1983.

Objectives

The NAFP-2 had three main objectives:

- To provide assistance to implement the National Forestry Plan in the Chautara Forest Division.
- To make contributions to training and education in forestry in Nepal.
- To help in the construction of an adequate seed storage and testing unit in Kathmandu.

Activities

The activities of NAFP-2 include nursery establishment and seedling production, plantations on panchayat and government land, encouraging private planting and training. These activities are briefly described below:

Nursery establishment and seedling production have been important activities of the project. Besides supporting HMG nurseries the project has assisted in establishing community and school nurseries. Community nurseries involve the rural communities while the school nurseries involve school teachers and students. Nurseries, seedling production and seedling distribution for private planting have accordingly increased over the years since the beginnings were made by the Chautara Community Forestry Programme.

Plantation

Although the data on earlier planting (between 1973 - 1978) in the project area are not provided, Table-3 below shows that the planting rate in terms of area has been increasing over the years. The increase in annual planting rate in HM Government land has resulted from the accumulation of experience and know-how on the part of forestry staff and greater flow of resources from the NAFP-2. The increase in Panchayat Forest (PF) planting is directly proportional to greater participation by the local communities due to increasing awareness in more and newer areas, as well as the increasing flow of resources from the NAFP-2.

Fodder is one of the most important products from community forestry. The project has realized the need for growing more fodder trees and has planted several fodder species, of which some had satisfactory growth. Fodder species need more careful site selection and handling insofar as site availability for growing fodder is low compared to other species such as the Chir pine (*Pinus roxburghii*) and Pate sallo (*P. patula*) which can survive even in poor sites.

No fencing

Also continuing from the earlier Chautara Community Forestry Programme, establishment of plantation without the use of fencing was perhaps the most unique and outstanding achievement of the project.

Private planting

Although the project has not initiated specific private planting programmes, it has been encouraging private planting in an informal way by distributing free seedlings and technical advice. There is a high potential for expanding private planting.

A very important contribution of the project has been to train people on forestry programmes at various levels.

Another contribution of the project is the Tree Seed Unit (TSU) at Kathmandu. The TSU coordinates and arranges collection of tree seed within Nepal. For use in achieving reforestation objectives within the country:

- It aims to collect, import, export, and distribute seeds according to the requirement.
- It also aims to carry out research regarding seed collection, cleaning, storage and distribution.

Considered a 'model pilot project' for hill forest management, the Chautara Community Forestry Project - subsequently the NAFP-2 has made a very impressive impact at the village level. Its main features can be summarized as:

- Establishment and running of panchayat nurseries to provide seedlings for PF and PPF and private planting.
- The regeneration of PF and PPF through planting programmes.
- Large scale and scattered plantations without fencing.
- Provision of seedlings free of cost for PF and PPF and private planting.
- Employment and training of local people in nursery and planting techniques and forest protection.
- Maximum use of land technology, materials and skills.
- Encouragement of local participation in nursery and planting programmes.

Socio-economic effect of NAFP-2

The general socio-economic effect of NAFP-2 can be seen by the employment generated in the area. A significant amount of skilled and unskilled employment has been generated by the extension and construction of

several buildings and roads. Similarly, several people of the rural community have had the opportunity of being employed as forest workers, porters and workers on other forestry activities. It is estimated that the cash input of the project is Rs. 1100 per planted ha for 200 ha of panchayat forest. Much of this cash input would go to the local people and stay in the area.

The economic analysis of the project is not available. Only preliminary information on the cost-benefit analysis of the project based on many assumptions is available because of lack of data. In this cost-benefit analysis three planting strategies were developed, each of which would occupy 59,000 ha when completed. The annual yield from this total area would be 325,000 cubic metres. The three strategies were:

1000 ha per annum for 62 years,

1500 ha per annum for 45 years,

2000 ha per annum for 36 years.

This analysis considers the benefit of fuelwood only. IRR for different strategies is shown in Table 4. However, due to limited data, this is a very tentative analysis and has not included other benefits. It can be expected that IRR would have been high if other benefits could be included in the analysis.

Table 4: Internal Rate of Return of Various Planting Strategies

PLANTING RATE (ha/annum)	YEARS	YEARS OF NEGATIVE CASH FLOW	IRR
1000	62	16	7.00
1500	45	14	8.78
2000	36	13	10.35

Source: NAFP-2. Report of the Evaluation Team.

THE DEVELOPMENT OF SMALL SCALE INDUSTRIES

Bast paper making industry in Nepal
(Jeanrenaud, 1984; Mahat et al., 1986)

Paper making has been traditionally practised as a cottage industry in Nepal. Locally made paper was extensively used in old Buddhist and Hindu literature and government records. Use of hand made paper is still popular in Nepal today, despite the increasing imports of industrially manufactured paper from India and abroad.

Throughout the Middle Hills region of Nepal hand made paper is commonly made from the inner bark (inner bast) of Lokta or *Daphne* species - *D. bholua* and *D. papyracea*. In some places a third species - *Edgeworthia gardeneri* is also used for the purpose. Both the commonly used *Daphne* spp. grow wild as understorey shrubs in the moist coniferous and broad-leaved forests of temperate zones in the Nepalese Himalaya, with the highest densities growing between the elevations of 2100 - 2700 m above mean sea level, generally on northern aspects.

Lokta harvesting

Lokta harvesting takes place in the agricultural slack season and begins by mid-October and often continues into late spring in May. Usually harvesting is suspended in the two coldest months between mid-December and mid-February. During Lokta harvesting the whole plant is cut and removed to strip off the bark from the stem and the operation greatly limits the natural regeneration of the species. Moreover, observations show that one third of the usual inner bark (inner bast) still sticks to the discarded outer bark after the cleaning or separation process is complete. This is a wasteful method of harvesting.

Wood Requirements

The bast paper making process requires relatively large quantities of wood per production unit for wood ash and fuel. Wood is used for the following purposes:

- **To provide wood ash**: Wood ash is used for making the lye (alkaline liquor) used in the cooking/digestion process. *Quereus semecarpifolia* is often the preferred species for the purpose. Wood ash is also obtained as a by-product from cooking/digesting and drying fires once the production process is in full swing.
- **For cooking/digestion**: The current method of pulp preparation usually

requires two periods of cooking/digestion lasting up to four hours which is traditionally done over open fires and requires large quantities of fuelwood.

- **For paper drying**: Large quantities of wood are required for the purpose. Often at higher altitudes large size logs are used to fuel the big drying fires. In some areas studied, so great was the consumption of wood for the drying fires that the paper-makers had to move to another site every 3 or 4 months (Trier, 1972). In some areas a ratio of 1 kg of Lokta to 10 kg of fuelwood is standard, particularly if wood ash rather than caustic soda is used in the digestion process. The use of caustic soda can reduce fuelwood consumption to as little as one- third (Forestry Services, 1984).

- Wood is also required for construction of the temporary workshops, living quarters for labour and basic manufacturing equipment used in the paper making process.

Economic potential

Recent increased demand for Lokta paper suggests a high economic potential for this local industry. Increased demand has induced Lokta cutters and paper makers to set a higher price for raw Lokta and the finished paper sheets. This means higher income opportunities for those involved. For example, Lokta cutters in Kalinchok forest, Dolkha District, are receiving Rs.10/- per dharni (2.4 kg) of Lokta harvested. They harvest up to 3 dharni (dry weight) per day, thus earning a daily wage of Rs.30/- which is higher than the average wage of labour, which rarely exceeds Rs. 20/-.

Similarly, Acharya (1984) examined the HMG/UNICEF 'Community Development through Production of Greeting Cards Project' in order to analyse the economic benefits of Lokta harvesting and paper making.

The project commenced in 1981 among the paper making communities of Pang and Naglibang panchayats of Parbat District, Lokta collection areas of Tara and Hatiya Panchayats in Baglung District, and the paper finishing community in Bhaktapur. The Agricultural Development Bank undertook the management of the project under its Small Farmers' Development Programme.

The main objectives of the project were to improve the quality of life of the paper making families by supporting hand made paper production and improving community based services.

Scattered paper makers and cutters were organized into groups to facilitate collection, production and marketing. In total, 15 cutters' groups in 6 panchayats were organized to supply the paper makers; 143 members out of a total of 170 were exclusively engaged in Lokta collection.

At 1984 production levels, 60-65 metric tonnes (dry weight) of Lokta were required. Collection involved 140 farm households for an average of 60 days per annum totalling 8,400 man days. The gross income of these households at 1984 market prices was Rs. 250,000 with an average of Rs. 1,800 per household. Other employment totalling 6,000 man days was generated through transportation of raw material to the paper makers. The employment and income derived from Lokta collection are given in Table 5.

In addition to the collectors, 370 farmers from the two panchayats were organized into 33 paper-making groups, of these 316 farmers and their families were exclusively paper producers. Table 6 gives income, employment and investment figures for paper production. It is seen that an investment of Rs. 2,466 for production can generate 300 man days of employment and a gross cash income of Rs. 5,699 for each participating family.

Acharya (1984) concludes that the collection of Lokta and the production of paper are valuable sources of rural employment and income.

Environmental considerations of bast paper making process

The increasing demand for Lokta paper is also resulting in inevitable pressure on the resources and a growing concern for its conservation and management on a sustained basis. Therefore, despite the increase in demand for the *Daphne* bast paper and its economic potential, its promotion and development should not be considered in isolation but in the wider context of the forest ecosystem.

Increased demand for Lokta paper exerts greater pressure on the forest ecosystem due to increased use of *Daphne* bark and fuelwood on the one hand, and on the other, Lokta cutters may be encouraged to resort to wasteful practices in order to gain quicker and higher returns. The bast paper making process requiring very high quantities of fuelwood, in some areas a ratio of 1 kg of Lokta to 10 kg of fuelwood, often results in serious degradation of surrounding forest areas. There is a two-fold threat to the future conservation of the natural stands of *Daphne:* 1) over-exploitation of the resource itself, and ii) the destruction of the forest types constituting its habitat. Moreover, increased demand for Lokta paper induces Lokta cutters and paper makers to seek higher remuneration which in turn may encourage wasteful practices. Field observations suggest that up to 1/3 of the usable bark (inner bast) still adheres to the discarded outer bark after the completion of separation/cleaning process.

Table 5: Lokta Collection: Employment and Income (Acharya 1984)

PARTICULARS	1980/81	1981/82	1982/83	1983/84
No. of Lokta cutters	21	51	86	140
Duration/day	60	60	86	60
Total man/days employed	1,264	3,050	5,150	8,333
Lokta cutting per day in dharni	3	3	3	3
Total prodn. in dharni	3,792	9,149	15,400	25,000
in kg.	9,102	2,195	36,959	60,000
Price / dharni in Rupees	7.50	7.50	8.	10.
Lokta cutters' total income in Rupees	28,440	68,617	123,000	250,000
Wage per day in Rupees	22.50	22.50	24.	30.
No. of man/days employed in transportation of Lokta	1,000	2,300	3,850	6,000
Investment in Rupees*	Nominal	Nominal	Nominal	Nominal

* A small advance on labour cost was extended by SFDP to the cutters

Table 6: Paper Production: Employment and Income (Acharya 1984)

PARTICULARS	1980/81	1981/82	1982/83	1983/84
No. of farm families engaged in paper making	100	180	220	316
Paper prodn. in kories (20 sheets)				
#1 paper	2,356	5,518	8,759	13,500
#2 paper	1,392	2,792	2,905	3,500
#3 paper	1,018	3,540	9,408	18,000
Total kories	4,766	11,850	21,072	35,000
Total price in Rupees	234,540	562,900	938,500	1,901,000
Avg. family income Rs.	2,345	3,130	4,266	5,699
Employment prodn. unit equals 3 persons/f'mly.	-	540	660	948
Loan investment Total				
Paper making	-	180,000	348,000	773,000
Agriculture	-	22,000	179,500	129,000
Loan investment per family				
Paper making	-	1,000	1,581	2,446

Therefore, the resources should not be over-exploited for short term economic gains. Moreover, domestic fuelwood requirements should take priority over those for industry. It is unrealistic also to expect any local rural community, already suffering from fuelwood and other forest products deficit, to support the expansion of such an energy demanding industry whose product does not bring direct benefits to the local community as a whole. Hence, any planned expansion of the bast paper manufacturing industry through either the improved management of natural stands of *Daphne* or an introduction of fibre producing species should address the problem of present and future fuelwood shortages. Prior to the approval of any plans for increased production, therefore, the government authorities have a responsibility to the local community, and thus to the nation as a whole, to ensure that the expansion will not promote and increase destructive and exploitative forestry and allied practices, and bring further hardship on the local people in mountain communities by placing unreasonable demands on already scarce local resources.

Bamboo and allied industries
(Mahat et al., 1986)

Bamboo is of great importance to the people of the HK-H Region. The hill farmers make practically everything they need from bamboo except the ploughshare. Because of its fast growth, versatile nature, light weight, strength and straightness, bamboo finds a variety of uses. Bamboo technology is widespread and processing skills have been traditionally practised and mastered by large sections of hill rural communities among whom a high level of traditional skill still exists. Bamboo and bamboo products, besides providing the local people with their various needs, also provide them with additional cash income. Development and encouragement of cottage industries based on bamboo have, thus, a very high potential of providing the hill farmers with much needed cash income and making a very important contribution to hill farming economy. However, lack of sound management and over-exploitation of the species has resulted in the dwindling of the resource base. This in many areas of the Region has greatly reduced the benefits the hill farmers have been deriving from bamboo and bamboo products. In some areas where bamboo is still available and reasonably well managed, the local people derive considerable amount of benefits, including cash income from them.

Bamboo Utilization

Bamboo is utilized in many ways, e.g., for:

- Handicrafts: Bamboo finds its widest use in the form of handicrafts. Hand-peeled veneered strips of bamboo, of varying widths upto 25 mm and about 1.0 - 1.5 mm thick, are woven into trays, baskets and mats of various shapes and sizes, hats, cradles, beds, various pieces of furniture, blinds, etc.

- Household utensils and general utilization: Segments of larger diameter bamboo cut below each node form cylindrical vessels which are used as household and farm utensils for keeping water, milk and milk products, tea, etc., as well as to measure out many liquid and solid food stuffs. Bamboo is also used for making brooms, brushes, combs, fish traps and fishing rods, toys, kites, bows and arrows, sports goods, nails, shoes, pens, flutes, masks, coffins, etc. Various farm implements are also made out of bamboo.

- Building construction: Bamboo finds use in house and other rural construction particularly in areas of wood shortage. Bamboo is used in building material, particularly for roofing and ceilings, mats, scaffolding, ladders, shutters, bridges, boats, fences, etc.

- Food, fodder and fuel: Very young and delicate shoots of some of the bamboo are eaten as a vegetable or made into pickles. Bamboo has many uses in medicine. Bamboo foliage is commonly used as livestock fodder, especially in areas and periods of fodder scarcity. Similarly, bamboo easily substitutes for fuelwood in domestic energy requirements. Charcoal from bamboo is generally used for gold and silversmithing and is considered superior to the charcoal obtained from conventional sources.

- Cordage: Bamboo is commonly used for cordage such as ropes, twine, hammocks, strings, bags, brushes and slippers.

- Pulp and paper: Bamboo is also the principal raw material for paper production in India and Bangladesh. Large scale bamboo plantations have been established in these countries to supply pulp.

As a result of technological developments new uses of bamboo and bamboo products have also been developed.

Ecological characteristics

In the Hindu Kush-Himalaya Region, Bhutan and India still grow relatively abundant varieties of bamboo. In India, a rich belt of bamboo, both in density and variety, occurs in Assam, West Bengal, Arunachal Pradeh, Manipur, Meghalaya, Tripura, Western Ghats and Andamans. Estimated area of forest under bamboo in India extends over 10 million ha. The principal economic genera include *Dendrocalamus*, *Arundinaria* and *Bambusa*. Most bamboo in the Region grows between the temperatures of 8°C and 36°C and a minimum annual rainfall of 1000 mm. They form an important component of many evergreen and deciduous forests and are widely dispersed from the flat alluvial plains of the tropics to the temperate high mountains upto 3000 mm. Generally speaking, the *Dendrocalamus* and *Bambusa* genera are found under tropical conditions, whereas *Arundinaria* occurs in temperate regions and is most common at high elevations in the western and eastern Himalaya. A majority of the species are light demanders: growth is poorer when they occur as understorey. Silviculturally, bamboo is easy to maintain once established. Clumps renew themselves after cutting and it is generally adequate to ensure regeneration even though the seeding is infrequent.

Productivity

Seedlings generally form clumps in 3-4 years in plantations of 5m x 5m spacing, if soil and precipitation patterns are favourable. Utilizable culms are produced by about the sixth year. On average, five new culms are produced per clump per year. One hectare of land can be stocked with up to 300 productive clumps. A good plantation, when harvested on a three year cycle, may yield 3 to 4 tonnes of bamboo per ha at the first cut, 5 to 6 tonnes at the second cut and 8 tonnes from the third cut. Assuming a 32 year life cycle, in all 8 cuts can be made with an expected final clear-felling yield of 15-16 tonnes per ha. Thus, the total projected yield is 70-74 tonnes per ha (Suri and Chauhan, 1984).

Economic potential of bamboo development

With a multitude of uses for bamboo, a large number of cottage industries have been developed in the HK-H Region. Particularly in China and Bhutan the refinement of bamboo skills and industries has led to the production of highly valued handicraft goods. In Nepal, common knowledge indicates that farmers have a consistent interest in bamboo, centred on its multiple uses as poles, handicraft goods, farm and household utensils and containers, and for fodder, fuelwood and cordage. Due to its not too difficult establishment, fast growth, high regenerative capacity, potential for high density culm production per unit area and other multiple uses, bamboo development has very great potential to provide needed goods and raise cash income through the promotion of cottage industries.

However, as in the case of other small scale local industries, any proposal to expand bamboo based cottage industries must primarily consider the availability of raw material. In this context, re-establishment of the resource base becomes the prime consideration for which improved management of existing natural bamboo stands and establishment of new bamboo plantations is very important. Investment by government agencies in bamboo plantation and development is thus well justified. Community forestry programmes have the potential to greatly promote cultivation and development of bamboo plantations on private as well as community managed lands. Providing credit and other necessary inputs to the hill farmers for smaller scale bamboo cultivation on their otherwise unproductive and vacant private land can prove to be a useful investment for rural development. Leasing land to private individuals, households, communities and organisations and providing them with necessary credit facilities and other inputs for bamboo plantation and development in larger denuded areas in the hills, presently under state control and lying unproductive as wasteland, could go a long way towards re-establishing the resource base. Re-establishment of the resource base would provide the hill farming populations with their basic needs and additional cash income, necessary raw material for home based

small scale cottage industries and even for bigger industries and in addition, reduce soil erosion by providing necessary cover to the bare soil on denuded hill and mountain slopes of the Region.

Cloth production from the fibres of the Himalayan Nettle: Allo (Source: Dunsmore, 1985)

In the Koshi hills of Eastern Nepal the principal emphasis of the Government development programme is on agriculture, forestry and roads but support has also been given to a number of cottage industries including basketry, weaving and the development of the traditional uses of the fibre of the indigenous nettle *Girardinia diversifolia*, known locally as 'Allo'.

Allo grows at altitudes from 1200 - 3000 metres on land which is unsuitable for cultivating food crops. It thrives in the moist temperate broadleaf and conifer forests of the Region with a distribution range extending from Pakistan through India, Nepal, Bhutan, and Burma to China. It tends to favour shady conditions but is also occasionally found in shrubberies, on wasteland and at the edges of cultivation. It is a robust herbaceous, nettle- like perennial growing to heights of 4 metres. The plant seeds freely and also regenerates by means of root-suckers and basal stem shoots. The bark of the stem contains fibres that possess unique qualities: strength, smoothness, and, if appropriately treated, a silk-like lustre and lightness. An individual fibre can be up to 60 cm long and is amongst the longest in the plant kingdom.

Local economy and Allo

In Sankhuwasabha District of the Koshi Hills the local economy is characterized by small scale subsistence farming; most land holdings are between 0.25 and 0.5 ha in size and only a small number of families own rice land at lower altitudes. The main food crops grown are maize, millet, potatoes, with some beans and other vegetables. Roots and fern shoots gathered from the forest supplement the diet, as do young Allo leaves and shoots which are boiled and eaten as a green vegetable or used to make soup. For centuries the Rai people in the Koshi hills have extracted and spun Allo fibres to weave strong, hard-wearing bags, sacks, mats, jackets, porters' headbands and fishing nets. As land holdings are too small to support the family for the whole year, off-farm employment such as portering, selling Allo products, wool or livestock, is even more crucial today to generate some form of supplementary income.

Allo harvesting

This begins at the end of the monsoon season in August and continues until December when the plants begin to flower. Most villages have traditional harvesting areas either on communal or government land.

A person can harvest about one maund (37.5 kg), equivalent to a porter's basket load, in a day. The fresh bark of a mature stem can weigh up to 100 gm with the average stem yielding 5 to 6 gm of dry weight, utilizable fibre. Only mature stems are harvested, the smaller ones being left to seed. When harvesting, hands are protected from the stinging spines on leaves and stem by wrapping them in a bundle of cloth which is also used for rubbing off the leaves and spines. The bark is then stripped from the stems and either dried and stored in bundles or processed while still fresh by boiling for three hours in a lye (alkaline) solution and being left to simmer overnight. This aids in separating the fibres which are then beaten, washed and while still wet, rubbed with clay so as to make final separation and spinning easier. The fibre strands are then sun dried.

Spinning and weaving

Prior to spinning, the dry clay rubbed fibres are opened up and, under tension, the fibres are gently pulled apart. Fibres are traditionally spun using a hand spindle. Weaving is done by women on backstrap looms, mainly during the winter months when agricultural labour demands are low.

Economic analysis

In the past, returns for labour in fibre extraction, spinning and weaving were very low, about NRS 2 to 3 per day (US $ 0.10). However, several important steps have been taken towards assisting weavers to produce higher quality, more marketable products and higher returns for labour.

The Koshi Hill Area Rural Development Project (KHARDEP), jointly sponsored by HM

Government of Nepal and The United Kingdom, conducted field research at Bala and Sisuwa in 1984. The people of Sisuwa and Bala are amongst the poorest in the Koshi hills because of the topography and very limited scope for increased agricultural production; therefore, the expansion of cottage industries to remote areas is particularly relevant to the needs of these communities. The research was undertaken to study and record methods of Allo processing and to ascertain whether the weavers were interested in producing a wider variety of Allo items on adapted loom equipment. The response to these enquiries was enthusiastic and after further trials a workshop was held for 13 weavers at Bala in April 1984. The most remarkable feature of this workshop was the skill with which the weavers adapted their traditional cotton and wool weaving patterns to Allo, which previously had only been woven in a plain warp-faced weave on backstrap looms which restrict production to narrow lengths of cloth. Although the traditional bamboo looms were adequate for weaving Allo, with the new designs and textiles (wool + allo; cotton + allo), frame looms (particularly the Sherpa loom) were found to be more suitable for weaving longer (6m+) and wider (50 cm) cloth.

Following the workshop trials the weavers created many new designs, some cloth lengths were made up into coats, jackets, waistcoats and topis (traditional Nepalese cap) and others were used for upholstery. Allo yarn has also been used to produce knitwear and crochet items. At a recent craft exhibition held in Kathmandu a range of Allo products were displayed - sweaters, jackets, waistcoats, hats, handbags, coats and upholstered furniture. These evoked an enthusiastic response from both local and overseas buyers; all the samples on display were sold and a number of firm orders were placed with the manufacturers.

Table 7: Allo Cloth Production: Cost Breakdown

ITEM	DAYS*	COST Rs.
Warp and weft production (harvesting, processing, spinning	3-4	60
Firewood	1	
Chemicals (bleach)	3	
Warping and weaving		75
Washing, rolling, beating	1/3	5
Soap	1	
Porters' wages @ Rs. 15/- Man/day	2	2
Transport and handling		5
TOTAL:	152($7.50)	

* Daily wages calculated at Rs. 15/-

Marketing presents major problems as Kathmandu is a five or six day journey on foot and then by bus from Sankhuwasabha. However, even with the added cost of transportation (portering and bus or plane) the sale of Allo products would still be profitable, especially given the attractive new range of cloth and manufactured garments which have a high market value. The turnover time for products, from the weaver to the Kathmandu buyer, is estimated to be six weeks.

Table 7 provides an estimated breakdown of costs per 6m x 0.5m length of patterned Allo cloth (equivalent to 1 coat length).

The estimated cost price of all patterned Allo cloth would be Rs 25 per metre (US$ 1.25). This represents a considerably greater return to the weaver than that derived from the production of traditional Allo cloth at Rs 10 per metre (US $ 0.5). The wool-Allo tweed-type cloth works out to be more expensive, at Rs.35 per metre, due to the high cost of wool in the district and the longer processing time required.

Investment potential and priorities

Recent workshop trials have shown that with improved processing methods, a high quality yarn can be spun from Allo and that the sophisticated techniques used by the local weavers can be adapted to produce a wide range of value added goods and thus increase local employment opportunities and incomes. A preliminary assessment of export possibilities has indicated a promising potential.

Small scale cottage craft and large scale production could develop simultaneously, with the cottage weavers catering for individual orders for unique, high value products and those in the centre dealing with larger orders that can easily be repeated using larger looms (weaving cloth widths of up to 1 metre). Retail outlets could be developed through private, government or non-government charitable or-

ganisations e.g. the Oxfam supported Mahaguti shop already selling Allo products, or the Project of Nepal Leprosy Trust. Private entrepreneurs, such as boutique owners, have expressed interest in obtaining Allo cloth jumpers and other products.

Several agencies in Nepal are already working on different aspects of Allo fibres and cloth production. These agencies include: The Panchayat Development Training Centre at Jhapa (Allo processing and spinning), The Research Centre for Applied Science and Technology (RECAST) of Tribhuvan University (dyes and paper- making from Allo stems and oil extraction from seeds), The Integrated Hill Development Project (IHDP), (Allo carpet and rug manufacturing) and the Department of Cottage and Village Industries (DCVI),Dhankuta, (flyshuttle loom weaving trials with cotton and Allo).

Investment priorities

Among investment priorities the establishment of a pilot programme should take the lead in order to:

- examine the feasibility of increasing production based on a survey of the existing resource, and to examine ways of improving product quality.
- examine the potential for growing Allo commercially.
- identify the best methods of fibre extraction and processing.
- determine the indigenous and international demand for the range of Allo products.
- identify marketing constraints and solutions.
- assess environmental impact of Allo exploitation.

Environmental considerations

Increasing exploitation of Allo fibre from the forest will have direct environmental implications. Its economic potential alone should not, therefore, overwhelm the wider context of the forest ecosystem and the larger interests of the mountain communities themselves.

FRUITS AND OTHER CASH CROPS PRODUCTION PROJECTS

Fruit growing (Mahat et al., 1986)

Farmers in the hills and mountain regions grow some trees on their farms. They grow mainly fodder, fuelwood and fruit trees. Besides fodder and fuelwood trees, fruit trees are considered very important by the farmers. The fruits are consumed domestically as well as sold in the market for cash income. For this reason there is a high potential for fruit tree growing in the hills and mountain regions.

This case study concentrates mainly on apple and some other temperate fruits growing in Mustang District of Nepal and is based on the studies conducted by the Tropical Products Institute, London (Thomson et al. 1978), and Vinding (1984). The former presents an overview of the fruit growing industry in the whole of Mustang District, while the latter analyses how fruit growing in the Thak Khola Valley assists the local farmers to make their living by providing them with substantial additional cash income.

The policy of His Majesty's Government of Nepal is to encourage fruit production in the higher Himalaya Region. Apple, peach, apricot, almond, pear and walnut have recently been introduced to the Mustang area. The quality of apples grown in Mustang is high compared to that of the imported Indian apples. The yields are also satisfactory. There is enough market for fresh fruits as well as the processed products such as dried fruit, jam, jelly, juice and alcoholic drinks. Four market locations can be identified for Mustang fruit and fruit products, namely: 1) Local market in Mustang, 2) Pokhara, the nearest city and other town centres in the vicinity, 3) Kathmandu, the capital and other cities in the country, and 4) export market. However, no motorable roads to the area exist at present. Most of the goods are carried by mules or porters. An alternate but very expensive and unreliable way of transporting goods is by aeroplane.

Fruit and vegetable growing in the Thak Khola Valley

The Thak Khola valley is located in the southern part of the Mustang District. Situated between the Dhaulagiri and the Annapurna Mountain Ranges, The Thak Khola valley runs

north-south 30 km in length along the Kali Gandaki River and inclines between 2700m and 1900m. Villages are nuclear settlements situated near the bottom of the valley, which for administrative purposes is divided into 6 village panchayats: Thimi-Jomsom, Marpha, Tukche, Kobang, Lete and Kunjo. More than two-thirds of the population are Thakalis. In 1964 the government established a small agricultural farm in Marpha. The farm, now covering an area of 8.5 ha, has been a great success and fruit and vegetables are now a major source of income for many Thakali people.

Apple growing is well suited to the ecological conditions in upper Thak Khola valley (Panchgaun) and the apples are of excellent quality. Conditions are, however, not as favourable in the southern part of lower Thak Khola valley (Thak-satsai or Thaksai). Apples being the most important fruit grown in the district, there are about 30,000 trees in the Mustang District and 75 percent are grown in Thak Khola. In addition, there are an estimated 3,000 peach trees, and 2,000 apricot trees, and almond, pear and walnut are also grown in the district.

Seedlings are available from the government farm and a private nursery. Farmers continue to grow grain in between the newly planted trees for the first two years or so, and then shift to vegetables. The apple trees yield fruit after the third or the fourth year with an initial harvest of 20 kg. The yield increases to 70 kg after eight years. In 1983 the total apple production in Mustang District was estimated to be 250 mt, with government farms producing 32 mt and the remainder by private farmers. In Thak Khola there were 546 orchards with a total of 22,947 apple trees in 1983 (Table 8). As apple cultivation was introduced to the area only two decades ago, this represents a major achievement, indicating the success of the entire enterprise. More than half of the total number of households in Thak Khola have adopted fruit cultivation. More than three-fourths of the orchards have less than 50 trees. Small orchards located near the farmers' houses average 14 trees and the biggest has 2,000 trees. Many of the bigger orchards are to be found in forest fields.

Income to the local people

Currently, small orchard owners derive some additional income from apple cultivation, whereas substantial income accrues to the owners of big orchards. In 1983 a dozen farmers produced more than five mt each and had an income of Rs. 40,000. Apple production has yet to reach its maximum. Presently only an estimated 25 per cent of the trees are producing

Table 8: Orchards and Apple Trees In Thak Khola (Vinding,1984)

	THINI		MARPHA		TUKCHE		KOBANG		LETE		KUNJO		TOTAL	
No. of trees per orchard	No. of orchards	No. of trees	No. of orchards	No. of trees	No. of orchards	No. of trees	No. of orchards	No. of trees	No. of orchards	No. of trees	No. of orchards	No.of trees	No. of orchards	No. of trees
1-49	103	1,575	87	1,459	36	722	55	969	83	928	50	296	414	5,949
50-99	14	943	21	1,437	19	1,378	18	1,086	6	449	3	217	81	5,510
100-149	5	468	9	1,073	4	478	4	523	2	240	3	319	27	3,101
150-199	-	-	2	305	-	-	2	370	-	-	-	-	4	675
200-249	3	647	1	217	2	433	3	678	-	-	-	-	9	1,973
250-299	-	-	1	277	3	790	-	-	-	-	-	-	4	1,067
300-349	-	-	2	627	-	-	-	-	-	-	-	2	627	
350-399	-	-	-	-	-	-	-	-	-	-	-	-	-	-
400-449	-	-	-	-	-	-	-	-	-	-	-	-	-	-
450-499	-	-	-	-	1	450	-	-	-	-	-	-	1	450
500-	1	2,000	2	1,015	1	600	-	-	-	-	-	-	4	3,615
TOTAL	126	5,633	125	6,410	66	4,849	82	3,626	91	1,617	56	832	546	22,967

fruit. Within the next 10 years the production is expected to increase from its present level of 250 mt to 3,000, when the income will also rise.

Marketing

Farmers sell their apples to the tourists (trekkers), the Government farm, Government employees, local people, a private distillery in Syang, a small fruit processing plant in Tukche and to traders. Apples cost Rs. 4/- to Rs. 7/- per kg in autumn and up to Rs. 12/- by spring. The Government farm distillery uses 25 - 30 mt of fruit for liquor production and the private distillery in Syang uses 20 mt. Private traders buy apples in Thak Khola to sell them in Pokhara and Kathmandu. The Government farm may also buy apples for resale. In 1982, the farm sold from its shop 25-30 mt of fresh fruit, selling up to 1.2 mt in a single day.

Rapid growth in production is, however, posing problems for the farmers regarding the sale of their products. The situation improved with the construction of cold storage facilities in 1983-84. In order to accommodate a further increase in production a small fruit processing plant has been started in Tukche by the newly established Fruit Growers' Association of Thak Khola with UNDP assistance.

Marketing problems

Fruit growers in the area are facing some problems due to high winds which cause damage to fruit-bearing trees. Maintenance of soil fertility is another problem because of the poorly decomposed compost manure used. But the most dominant problem from the fruit grower's point of view is the problem of marketing. The seasonal nature of tourism in Mustang limits the local demand for fruits to some seasonability also. The 8 month period from September to April is the trekking season. During these months 92 per cent of the total trekking occurs. The peak months are October to November and the leanest is the monsoon season. The high demand during September to April coincides with the harvest season for apples and nuts. The annual rate of tourist increase is estimated to be 20 per cent. Therefore, the main monetary earning is obtained from sales to trekkers which is done either at the farm gates or at hotels, lodges, restaurants and shops. For the processed products also the main consumers in local areas are trekkers. Estimates show that after the mid 1980s the surplus will grow. The minimum surplus is estimated to be 1,000 tonnes. It is also estimated that the disposal of 1,000 tonnes could represent 11,000 mule journeys or nearly 700 flights in an aircraft.

Pokhara and Kathmandu have big markets for these products both for local consumption and consumption by the tourist. The standard of living in these cities is higher and tourist inflow is also very high. There are several big hotels with increasing demands. At present large amounts of fruit are imported from India. If local produce could be marketed in these cities, in the other cities of Nepal and in the export market, it will help not only to substitute the import, but also increase foreign exchange earnings, thereby giving higher income returns to the fruit farmer.

- **Short term marketing and transportation problems**: As already mentioned, once the planted apple trees bear fruit the production will exceed the local demand. There is a good prospect of selling these products in Mustang, Pokhara and Kathmandu valley. The market for apples in Kathmandu valley was estimated at 250 - 325 tonnes in 1978 and the national market is between 460 and 575 tonnes (Thompson et al., 1978). The present market would certainly be higher than this. The price of Mustang apples is considerably lower than the prevailing price of imported Indian apples for which the demand is unlikely to increase.

  Due to immediate transportation problems only limited quantities can be transported by air. This is the easiest, but very expensive and highly unreliable, means of transportation. There is also the problem of packing associated with transportation, particularly mule transportation. Traditional type of packing in sacks damages the fruit greatly, rendering them unfit for market. Wooden boxes and paper cartons are in limited use. Packing and storage facilities are undeveloped and inadequate. Much needs to be done to develop and facilitate storage, packing, transportation and marketing of apples and other fruit grown in the Mustang region. The Mustang Horticultural Association aims to better organise packaging and marketing.

- **Long-term marketing problems**: Improvement of transportation facilities is a prerequisite for the marketing of fruit in the long run. Aircraft facility for fruit transportation could also be improved; only then could the fruit be brought to the market soon after harvest. Unless there are good transportation facilities, prices will not be reduced. Demand for these products will increase with the reduction in their price. Reduction in price and stringent control will make the product competitive in export markets. To strengthen the market for processed products like juices, jams and alcohol, canning and bottling facilities have to be developed. As the production is expected to exceed the demand in future,export markets should be explored.

Environmental considerations of fruit growing

Even with much improved transportation facilities, motorable roads, ropeways, etc., the question of suitable packing facilities for transporting apples and other fruit to the market remains important. Paper cartons will continue to remain relatively expensive in so far as the paper/cardboard material is not manufactured locally. Both the material and the technology to be used will have to be imported from outside, thus rendering their use economically less feasible for the local fruit grower. The use of locally made wooden boxes would perhaps become a popular choice for fruit packing. This, however, will not be the best choice, especially from the point of view of the further damage that can be done to the local environment by much greater competition for already scarce resources. Vinding (1984) describes the already existing competition for scarce forest resources in the area thus:

"In Thak Khola villagers use pine, juniper and cyprus for fuelwood and timber. In Thaksai.... forests are found close to the village while in Panchgau forests are situated up to 1,000 m above the village. Forest resources are being over-utilized due to an increased demand for fuelwood from the local population, outside labourers, civil servants, military personnel and tourists. There is also an increased demand for timber for construction; for example,the administrative building complex under construction in Jomsom (under RCUP) requires 12,000 cubic feet of timber. In addition to an increased demand for forest products, the forests are being depleted due to poor management and failure to replant."

Therefore, if wooden boxes become the choice for packing cases, adequate steps will have to be taken well in advance for the development and improved management of forest resources which are already chronically in short supply in the Mustang Region. The requirements of wood for fruit packing cases and the associated environmental problems could easily be visualised from the experience in Himachal Pradesh in India wher more than 50% of tree volume is wasted in the manufacture of packing boxes and each ha of apple growing area needs 3 ha of silver fir and spruce forest for supplying wood for fruit packing cases (and as much as 10 ha of Chir pine forest to support each ha of tomato cultivation), (Singh,1984, 1985a & b).

Keeping such environmental considerations and the marketing problem in view, it is important to concentrate on small, portable, high value processed fruit products rather than on heavy raw fruits.

Conclusion

Mustang area is very suitable for apples and other temperate fruit cultivation. The fruits of this area are also considered to be of good quality. Most of the supply of apples and other fruit are imported because domestic production has not been able to supply at the national level. However, domestic production will soon be greater than the present demand. Due to increase in population and standards of living, there will be some increase in demand within Nepal, but exploration of export markets is essential for surplus supply and foreign exchange earning.

Various inputs should be provided to develop fruit farming and the industry. Financial, technical and research inputs are essential. The most important requirement, however, remains the development of a transportation network to supply the national and international market. Fruit packing for undamaged delivery to the market and the environmental considerations associated with fruit development have to be kept in mind. Fruit development will help to substitute the amount of import and will bring additional foreign exchange to the country. Most importantly, the development of fruits and processed fruit products will increase the level of earnings of the local

people and thus help to sustain the hill farming economy. It is, however, essential to ensure the improved management and development of the local forest resources upon which not only the development of the local fruit industry depends but also the farmers.

Medicinal plant development in Nepal
(Mahat et al., 1986)

Medicinal plants are important products of the forest. These provide important means of income for rural people in these mountains. They also generate a significant amount of revenue and foreign exchange earnings for the government. Medicinal plants are very popular in traditional medicines and are extensively used in Ayurvedic, Unani and herbal medicine in the rural areas of Nepal as also in other parts of the HK-H Region.

The problem

These plants have, however, a very limited market in western countries even though a considerable amount is exported to India from Nepal. Some of the plants exported to India are re-imported in the form of processed medicines. The overall export of medicinal plants from Nepal is declining now.

As with the other forest products, there is a depletion of medicinal plants associated with the declining forest resource base. Moreover, as roots and other vital parts of the plant are harvested, the whole plant is destroyed during harvesting. Replanting or growing of these plants in the forest is almost non-existent.

Production and trade

Collection and trade of medicinal plants is a useful source of income for rural people and tradesmen in Nepal. Most of the medicinal plants grow wild in hill forests, and some in the Terai (Plains) forests. Domestic consumption compared to the exports of these plants, mainly to India, is very low. They are mainly used for Ayurvedic and herbal medicines. More than 90 per cent of the plants are sold to India. Export of these plants is in a crude and dried form. There is a lack of cleaning and quality grading for the export to India and the overseas market is also minimal.

Overseas export of Nepalese medicinal herbs for 1978 - 79 was recorded to be 118.767 tons, worth Rs.4.14 million (Burbag, 1984). Hong Kong, Japan, Malaysia, Singapore, U.S.A., the Federal Republic of Germany, Belgium and Canada are the main overseas importers of Nepalese medicinal plant products. The medicinal plants exported to India are almost nine times greater in volume than the quantity involved in the overseas trade.

Though a significant amount of processed Ayurvedic and herbal medicines are imported from India, there are several private manufacturers in Kathmandu. Many rural families also prepare their own herbal medicines. There are government sponsored manufacturers like the Singh Durbar Vaidya-khana and the Unani Aushadhalaya. Government Herbal Farms, Royal Drugs Limited and Royal Drug Research Laboratory are the important institutional bodies involved in the development of medicinal and herbal plants in Nepal. The cultivation of medicinal herbs started following the establishment of the Department of Medicinal Plants in 1960-61. This department has been actively promoting development of medicinal plants in Nepal and has established seven experimental herbal farms in various zones of the country.

Economic significance and benefits of medicinal plants development

In the rural areas, people have more faith in traditional Ayurvedic and herbal medicines and know-how. The main reasons for the popularity of these traditional medicines are availability in the rural areas and their traditional usage. Collection and trade of herbal plants is also an important source of income for subsistence hill farmers.

Medicines are imported from India and other foreign countries. Private and institutional manufacturers of herbal medicines would help to substitute the imports of these medicines. From the export of processed medicinal herbs the country can earn foreign exchange. Even if Nepal cannot take a bigger share of the export market, it can certainly benefit by meeting domestic demand with domestic production and by substituting the import by local production. This would increase the opportunity for employment and utilization of local skills in the rural areas. Promotion of medicinal plants production and development, combined with improved marketing facilities, has a particularly high potential of income

generation for hill farmers and represents a good case of diversified employment and income through forestry activities.

Data regarding employment and income generated by medicinal plants collection from the forest is hardly available. Nor can the quantum of collected material be ascertained. According to Sheikh (1985), however, an estimated 50,000-55,000 man-days of secondary employment is generated annually in Pakistan for those engaged in medicinal herbs processing, manufacturing, distribution and medicinal practitioners. Malla (1982) has provided a cost-benefit analysis of Belladonna cultivation by farmers in the hill and mountain areas of Nepal. According to him :

Cost of cultivation of Belladonna:	Rs.8,000/ha
Returns per ha:	Rs.20,000/ha
Profit:	Rs.12,000/ha

The costs and benefits of cultivation of the main cereal crops like rice and wheat are as follows:

Cost of rice/wheat cultivation:	Rs.4,000/ha
Returns from rice/ wheat:	Rs.10,400/ha
Profit:	Rs.6,400/ha

Although profit from paddy growing is lower, people prefer not to switch from paddy cultivation to other crops in so far as rice is a staple food. However, farmers could be encouraged to plant Belladonna instead of wheat.

Development potential

Without affecting paddy cultivation farmers can earn extra income by setting apart a portion of their land for the cultivation of medicinal plants like Belladonna in the hills and Rauwalfia and Solanum species in the Terai. Replacing one winter crop by medicinal plants and setting aside a small portion of land for medicinal plants is one way of introducing medicinal plant cultivation.

Another way of encouraging the cultivation of medicinal herbs is by way of agro-forestry. In Nepal, the Community Forestry Development Programme is being implemented throughout the country. This programme can greatly help to promote the cultivation of medicinal plants at minimal additional cost by intercropping with medicinal herbs, fodder, fuelwood and fruit trees. These could be introduced in community controlled panchayat forests and panchayat protected forest areas which are managed by panchayat communities with the help of local people. At the same time the Community Forestry Programme could also motivate and encourage local farmers to take up such agro- forestry practices on their private lands. As the gestation period in tree plantation is long, inter-cropping with medicinal herbs and other agro-forestry practices would look more attractive to the farmers from the point of view of quicker returns and additional income opportunities.

As most of the farmers in the rural areas are at subsistence level, hardly any of them have a marketable surplus to earn the needed cash income. Introduction of medicinal herbs as a cash crop would provide them with direct tangible benefits. Medicinal plant cultivation could help to solve, to some extent at least, the problem of disguised rural unemployment and provide farmers with additional income.

Mushroom farming

A variety of edible mushrooms grow wild in the forests of the HK-H Mountain Region. However, not all species are collected.

Mushrooms are a food item of the local people and are considered nutritive like fruits and vegetables. Mushrooms are, moreover, marketable forest products with high potential for additional cash income generation for rural people. There is high demand for mushrooms in the urban areas and prices are going up. As in the case of other forest products, rapid depletion of the forest has, however, affected the supply of mushrooms.

Collection and processing

Collection from the forest and all further processing of mushrooms including drying, destalking (removal of stalk) and packing for transportation, is all done manually. The whole operation is highly labour intensive.

Mushroom development potential

Although detailed data are not available on mushroom growing, it could be a paying cottage industry for the rural people in these mountains. Instead of depending solely on the forest for mushroom yields, increasing production through artificial methods seems to be desirable. There is a demonstrably high potential of cash income generation through mushroom growing in India, Nepal, Pakistan, Bhutan and the other countries of the HK-H Region.

Economic significance

In the hills and mountains where a majority of the farmers depend on traditional agriculture, mushroom farming can be an alternative food crop which can also be grown as a cash crop. As the potential for increasing cash income through mushroom growing is high in these mountain areas, the farmers should be encouraged to grow mushrooms. The mushroom industry is highly suited for developing countries such as those of the HK-H Region because of its labour intensive nature. Mushrooms of high quality are exportable items and have the potential of earning foreign exchange. Rural people in the mountains can benefit directly from good quality mushroom collection. Most edible mushrooms are, however, highly perishable goods and marketing facilities are essential prerequisites for their development on a commercial scale.

In Pakistan, collectors get as much as 5-6 US dollars for one kilogram of mushrooms (Sheikh, 1985). Similarly, in India mushrooms, particularly the artificially grown ones, are very expensive. China is already a major producer of mushrooms and supplies 10% of the world market. The Federal Republic of Germany, Canada and the Middle East countries are the principal importers of mushrooms in the world, with hardly any production of their own.

Economics of mushroom growing for a small grower

This is illustrated by the following example from a mushroom development project in Kashmir (India).

The Kashmir Project has envisaged establishing 1000 small farms for mushroom cultivation, each having a capacity of 200 trays per crop, taking 3 crops a year. Another lot of 1000 small farms as mixed farms would take only 2 crops a year. There are also provisions for establishing medium and large size farms. The medium size farms (with a capacity of 1000 trays per crop) can take three crops a year while the large size farms accommodate 5000 trays per crop and can take 4 crops a year.

Economics of a small mushrom farm: 3 crops of 200 trays in a year

The farmer shall provide land for the construction of the room and compost yard and shall prepare compost at site.

A. **Fixed investment**

	Rs.
Crop room	10,800.00
Carpenting yard	2,000.00
Wooden trays	3,000.00
Spraypump, Thermometer, Spawn Bottles etc.	2,200.00
Total	18,000.00
Margin money to be provided by the farmer	2,000.00
Term loan component from institute	16,000.00
Total	18,000.00

B. **Working capacity ingredients for one crop**

	Rs.
Paddy straw	--
Labour	3,000.00
Fuel, Spawn etc.	
Margin provided by the farmer	500.00
Crop loan from institute	3,500.00

C. **Returns**

	Rs.
1. The expected yield is @ 3.25 kg. per tray to be valued at average price of Rs. 7.50 per kg. i.e. for 650kg mushroom	4,875.00
2. Value of compost for 200 trays.	70.00
Total returns per crop	4,945.00

D. **Income analysis for 3 crops a year**

	Rs.
Returns from mushroom cultivation @ 12% for 3 months = Rs. 9,000 / + Rs. 270/	9,270.00
Net Returns	5,565.00
Income retained by the farmers	1,000.00
Amount available (balance)	4,565.00
Forecast reliability factor @ 20%	915.00
Amount available to repay loan	3,650.00

Source: Agricultural Finance Corporation Ltd. 1977. "Integrated Horticulture Produce Marketing and Processing Project", Bombay.