FORESTRY - HILL FARMING RELATIONSHIPS

In the past, throughout much of the Hindu Kush-Himalaya Region, government revenue derived mainly from sale of timber in saw log form was the principal consideration in forest management. A direct link exists, however, between the welfare of the local communities and the use of forested land. The forests supply the hill rural population with their essential basic needs: fuelwood, fodder, leaf-litter, poles, timber, etc. These represent the most important contribution of forestry to the generally subsistence types of hill farming economies of the Region. Local people also use forest products for direct domestic consumption and supplementary income generation. All these products of the forests are generally obtained by the local people as free goods.

It is important to understand the contribution forestry can make to the hill farming economies if future forestry and other related development activities are to be geared to fulfil the needs of the local people. This chapter tries to highlight the linkages between the hill farming system and forestry.

The hill farming system can be described in general as being comprised of a complex arrangement of soils, water, crops, livestock, forest and other resources within an environmental setting that the farm family manages in accordance with its preferences, capabilities and available technologies. The farm families are engaged in production of crops, livestock, and non-agricultural commodities such as handicrafts, and other income generating activities off the farm to supplement their income.

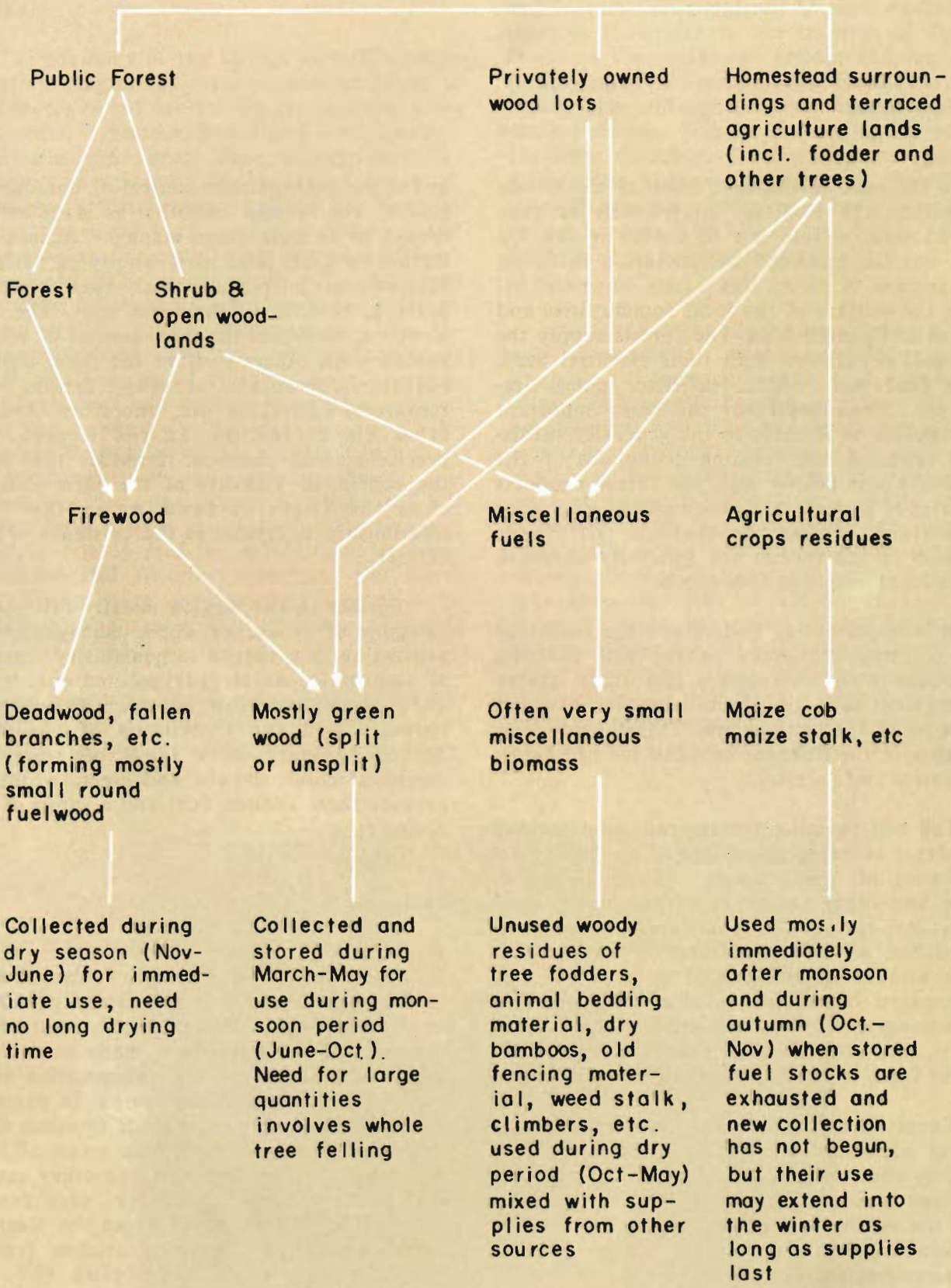
Farms are defined as systems because several activities are closely related to each other by the common use of the farm's labour, land and capital, by risk distribution and by joint use of the farmer's management capacity (Ruthenberg, 1980). Farms are considered both as ecosystems and independent economic units. Any system has a 'boundary' which separates it from the 'environment'. In the case of the farm unit, the system embraces all workers and resources (elements of the system) which are under the management control of one decision-maker - the farmer - whether he is the owner, a tenant, or an authorized manager. According to Ruthenberg, all land used wholly or partly for agricultural purposes, other than communal grazing, belongs to the farm unit. There are, however, resources the management of which is shared with others outside the farm unit (e.g. forests, communal grazing, lands, water resources) and these are, therefore, excluded from his definition. In the Region, it is precisely these common resources that permit the continued viability of the farm units and thus the forestry-farming system interrelationship is crucial to the existence of a hill farmer.

Forests in the Region usually fall into the category of resources where management and utilization is a shared responsibility regardless of ownership. As already pointed out, there is no clear distinction between farming and forestry and the livelihood of the people depends directly on a range of annual and perennial crops, shrubs and trees, which may provide food, fodder, fuel and a range of other products.

Fuelwood

The question of domestic fuelwood supply in developing countries has gained prominence in the past decade. However, only scattered and isolated efforts have been made to assess the quantities and patterns of consumption of fuel biomass by the rural population. In particular, efforts have hardly been made to assess the actual contribution in economic terms of forests and trees for fuel, biomass and other usage by the rural economy. Similarly, very few - if any - efforts are known from the Region of forest biomass productivity studies from the point of view of supplying the local population's fuelwood and other needs. The household energy question in developing countries is, however, very important and plant biomass has the most significant place in it.

Fig. 1: Biomass fuel sources



Source: Adapted from Mahat, 1985.

In the HK-H Region, by far the most important source of energy is the plant biomass, in one form or other, and hardly anything else is of any significance to most farmers. A serious source of confusion lies in the assumption that all fuel biomass is wood or tree product and all are subsumed as 'fuelwood'. Infact, not all fuel is tree or forest product. The fuel biomass supply is obtained from the forest, shrublands, agricultural and other private land (Fig. 1). In the central hill region of Nepal, the biomass from forest, including shrubland, supplies approximately two-thirds of the total annual fuel supplies of the rural population. This supply may come in the form of fuelwood, weeds and other miscellaneous biomass fuels. The rest (one-third or so) comes from private land in the form of agricultural crop residues, tree fodder residues, fuelwood from old or overmature trees and sometimes, purchased or bartered fuelwood. Similarly, the quantities and patterns of fuel consumption may also vary due to change in climate between higher and lower altitudes. Consumption at higher altitude may be almost twice as much as at the lower altitude areas. In the hills dependency on forest is, in general, higher in comparison to lowlands (Mahat, 1985).

Estimates of fuel biomass use show great variability. For Nepal, the estimates vary from 0.1 to 2.57 (or even 6.67) m^3/annum/person although the generally assumed figure for per capita fuelwood consumption is still at 1 m^3 (600 Kg.) per annum (Donovan, 1981; ADB/HMG-N, 1982). Such great uncertainties in data concerning consumption and fuelwood production in average forests and shrublands have led authors to differ in their conclusions regarding the adequacy of forests to meet either demand or actual consumption in the hill region of Nepal and elsewhere in the HK-H Region. It may also be noted that total sustainable fuelwood supply in many areas may exceed total consumption in those areas but the uneven distribution of the forest resource may cause areas of local fuelwood shortage (Bajracharya, 1983; Wiart, 1983).

For India, Singh & Berry (1985), estimate the energy need for cooking to be 1.56 gigacalories per capita which has to be met from fuelwood and agricultural residues. They assume that 1 m^3 of woodfuel produces 2.6 gigacalories and 1 Tonne of dried agricultural residues provides 4.0 gigacalories.

Fodder

Among the forest products derived mostly as free goods and forming the essential basic needs of the rural population in the HK-H Region, livestock fodder for stall feeding, grazing and browsing is perhaps the most important of all.

Farmers maintain large numbers of livestock, largely for manure production and draught power. They also provide milk and meat to supplement food even if crop production is high, as well as many other goods and services and are an additional source of income to hill farmers. It is, therefore, economic compulsion rather than merely religious beliefs that forces the hill farmers in the Region to keep large numbers of livestock. Forests supply the major share of the feed of these animals in the form of fodder. Fodder denotes plant material, fresh or dry, which is consumed by livestock as food and is taken to include material grazed, browsed and gathered. Forest fodder is particularly important for livestock maintenance during the dry season when it is characteristically in short supply. Stall-feeding of livestock is constrained by inadequate fodder supply. Declining availability of fodder from the forest and trees, natural pastures and crop residues is limiting stall-feeding of livestock to night time only for collection of manure, while the animals wander freely by day. Free range grazing and browsing, constituting the other part of the livestock management and production system, also takes place in the forest and shrub areas, grasslands and terraced agricultural land after harvest.

The shortage of fodder, especially in the dry season, greatly limits animal productivity. It is assumed that on an average throughout the year animals obtain only half the desirable ration of optimal productivity (Wyatt-Smith, 1983; Singh & Berry, 1985). Taking 1 ton of total digestible nutrient (TDN) per big livestock unit (BLU) annually, as the absolute minimum, Panday (1982) estimates that the fodder deficit may run over 20% of the present demand for maintenance and very low performance. Panday's estimates also show that over 50% of the total fodder supply comes from forest sources with the forest trees supplying 20%. Singh and Berry (1985) estimate that in the Dehradun region 57% of the annual fodder supply comes from forests, 19% from cultivated areas and the rest from the blank areas. Data collected in Thokarpa region of Nepal show

Plate 3: Fuelwood Collection

Plate 4: Tree leaves and branches for fodder and fuelwood

that one quarter of total gathered fodder is derived from forests (Mahat, 1985). Quantification is, however, not possible in the case of grazing and browsing, but casual observation suggests that the quantity of plant biomass involved in grazing and browsing is huge, and that the effects of uncontrolled browsing, particularly by goats, are serious. Excessive grazing leads to soil erosion besides the degeneration of grasslands and herb fields.

Regarding fodder availability and consumption Wyatt-Smith (1982) has suggested that 2.8 ha of accessible unmanaged forest are required for 1 ha of agricultural land to sustain the existing farming system. It is possible to calculate from Wyatt-Smith's (1982) data that each person requires c. 1.65 ha of accessible unmanaged forest to sustain the existing farming system. Similarly, for timber and fuelwood the requirements are 0.4 ha and 0.3 to 0.6 ha respectively (i.e. a total ratio of 1:3.5 or 3.8 between agricultural land and forest). Shepherd's (1985) estimates for the current mixed farming system in Nepal are in agreement with Wyatt-Smith, and show that 3 ha of forested land are required to support 1 ha of cultivated land. Applegate and Gilmour (1985) put the ratio as high as 1:6.

For most of the hill areas, however, this ratio between agricultural land and available forest land is much lower. In the Phewa Tal and Tinau watersheds in Nepal this ratio is in fact only 0.97, even when forest land is taken to include forest, shrubberies and grasslands. For Sindhu Palchok and Kabhre districts the values are only 1.69 and 0.52 respectively. Similarly, for the eight districts of U.P. Hills forming the entire Central Himalaya in India, this value is only 1.58, well below that required to sustain the hill farming system (Shah, 1982). On the above criteria of Wyatt-Smith and others, in terms of the adequacy of forest land to supply the animal fodder required by the hill farming system, most hill areas in the HK-H Region are grossly deficient in forest area including shrub land.

The problem of heavy pressure on land is compounded by the growing number of an already over-high livestock population that has far exceeded the carrying capacity of forest and other grazing lands. In Nepal, livestock population growth has kept pace with the high rate of growth of human population so that there is approximately 1 large livestock unit per capita in addition to small livestock units. The estimated carrying capacity of the open grassland and forest in the Middle Hills is only 0.54 and 0.31 livestock units per ha respectively whereas present stocking rate is 7 and 2.8 livestock units per ha, or 13 and 9 times greater respectively. (Rajbhandari and Shah, 1981). The situation is hardly any different in other parts of the Himalaya. In Himachal Pradesh in India, up to 80% of all fodder requirements are obtained from the forest (Singh and Swarup, 1980). Consequently, the intensity of grazing and browsing is very high at about 5 livestock units per ha of grazing land (Singh, 1984) that can support only 0.51 to 1.0 livestock unit at the present levels of production (Ashis, 1980; Singh, 1984 a; Singh, 1985a & b).

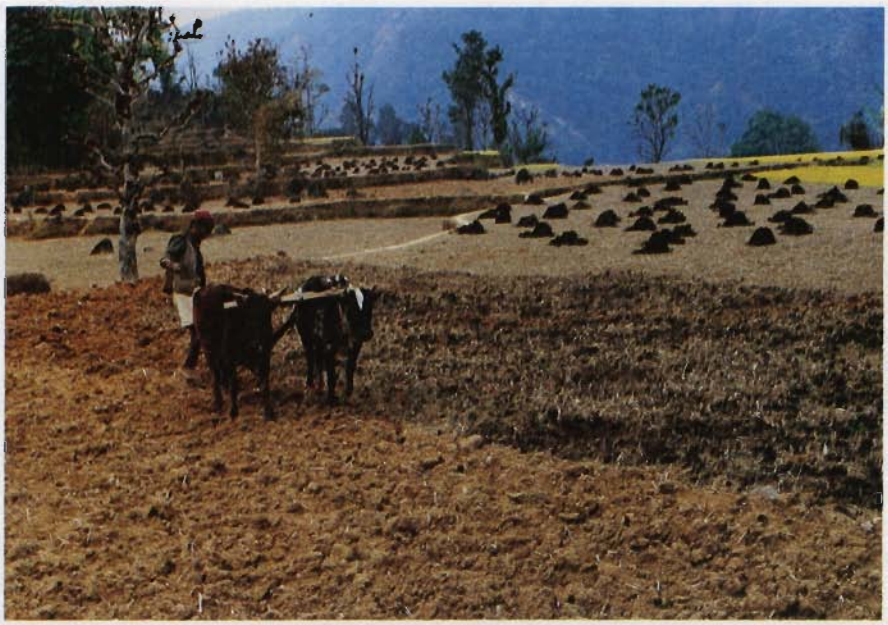


Plate 5: Forest biomass mixed with animal excreta yields organic manure, the principal source of soil nutrient for hill agricultural land

Thus, the increase in the total number of animals, along with the increase in human population, has aggravated the situation of over exploitation of forest for fodder in recent decades. The fodder resource base has contracted as a result and livestock productivity is declining. The hill farmer is forced to maintain more animal units to maintain his farm income, thus further aggravating the situation of over exploitation of forests.

Leaf-litter - organic compost manure

Another very important contribution of forestry to the hill farming system is the use of plant biomass as bedding for stall-fed animals. Forests are the principal source of fallen dry leaf-litter and lopped green foliage of trees and herbaceous species which are used for animal bedding and composting. Forest biomass, when mixed with animal excreta, yields organic compost manure which forms the principal source of soil nutrients for hill agricultural land. In fact, it provides almost the only manurial inputs to crop production in the hills. Hill farmers well know that agricultural yields decrease when fodder and leaf-litter are no longer available in sufficient quantities from the forests. However, this aspect of the forestry-farming system linkage is much less understood by professionals and the contribution of forestry to the hill farming economies is neglected so that there is a paucity of data on the subject. Adequate assessment of the effects of animal manure and litter is wanting but the significance of these to hill agriculture is obvious. Data collected from Sindhu Palchok & Kabhre in the Central Himalaya region of Nepal show some 2.3 metric tonnes of litter and manure are used per ha of cultivated land annually, whereas the use of chemical fertilizers is negligible, mainly because of shortage of cash in the rural economy and lack of irrigation facilities (Mahat, 1985). Khandka et al. (1984) have estimated that 50% of the litter production is removed annually from some forests in the Nepalese Middle hills. This seriously interrupts nutrient cycling within the forest. However, the overwhelming dependence of the crop lands on organic manuring derived from animal dung and forest biomass can not be over emphasized also. Organic manure yield is directly proportional not only to the number of livestock and stall-fed animals but also to the quantities of forest biomass used for the purpose.

Poles and timber for rural construction and farm implements

The forest, in addition, provides timber and poles for housing, livestock sheds, furniture, household and farm implements and tools for the rural population in these mountain areas. Timber, poles and bamboo are the principal construction materials. Thatch grass is the most commonly used roofing material. Conifer shingles at higher altitudes and tree leaves may also be used for roofing for temporary shelters and animal sheds. The forest also supplies the local population with wood for making various farm implements and tools which are renewed regularly to sustain the hill farming practices. All these products of the forest are generally available as free goods. As with other local uses of forest the data on consumption of timber, poles and other forest products for construction and maintenance of houses and for the manufacture of agricultural and household implements and tools is again in short supply. Available estimates vary greatly.

In India timber used for house construction alone is estimated to be only 0.018 m^3/person/annum (Bannerjee, 1978). For Nepalese Hills the estimates of timber for house construction and maintenance vary from 0.027 (Wiart 1983), and 0.05 m^3/person/annum (New Era, 1980) to 0.1 m^3/person/annum (Wyatt-Smith, 1982). Grunenfelder's (1977) estimates based on the experience of Integrated Hill Development Project in Nepal show that a medium sized house for a family of seven people uses, on average, 1.13 cubic metres finished wood or 2.26 m^3 round logs with a 50% conversion waste of timber using saws. Mahat's (1985) survey in the Thokarpa Region gives an annual per capita usage of saw log size round timber of 0.05 m^3 and 0.02 cubic metre of finished products where the axe is usually used in all timber conversion practices.

Besides the use of this timber, many pole sized components are used. Their volume has not been quantified, but the requirements per average household of 6 to 7 people with a medium sized holding for house construction and maintenance, exceeds 260 poles of medium and small size. Local houses in these hills may last 60 - 80 years but major maintenance would be required every 25 - 30 years. This shows high consumption of small poles and hence of the future potential tree crop (Mahat, 1985).

The local population uses the forest to obtain wood for making various farm implements such as plough-shares, poles, handles, levelling tools, hafts, shafts, stet, etc. The quantity of wood used for such implements and tools may vary greatly depending on percentage net utilization rates, design, duration and the site of use of the implements and other such factors. Plough life in India is taken to be 3 years with a timber content of 0.056 cubic metre (Banerjee, 1978). For Salme in Nepal it is 0.019 cubic metres with a life of 18 months (Wiart, 1983). For the Thokarpa region, the requirement (Nos.) of farm implements and tools per household per annum is shown to be much higher i.e. 3-4 plough-shares, 1-2 plough-poles, 2-3 plough-handles, 1-2 yokes of plough, 2-3 levelling tools, and an unquantifiable number of hafts, shafts, handles, etc. Two to three small sized trees may meet the needs of an average household. However, as the farmers use different species for various purposes many trees are involved for different tools and implements (Mahat, 1985).

Besides the use of timber for house construction and farm implements, timber is also used for various local and regional developmental activities such as building bridges, schools, etc., and form the contribution of forestry to the rural economy through economic and social development of the area. Singh and Berry (1985) in their case study of Dehradun, India, illustrate a very substantial contribution of forestry to the household economy of hill farmers. The Chakrata District in U.P. Hills of India has over 60% of its area under forest and 14% is cultivated land. Agriculture and animal husbandry, contributing 33% and 36% respectively of the household income, are of enormous importance to the household economy of the area. The Chakrata Forest Division covers an area of 362 km^2. In 1982 - 83, the Forest Department gave from the government forests 1512 m^3 of timber worth a value of about Indian Rupees 2.3 million to the local villagers free of cost. In the same year 67,058 animals (i.e. 434 buffalos, 22,439 cows, 44,185 sheep and goats) grazed free in these forest areas. In addition, 8,400 m^3 of timber worth the actual value of Indian Rupees 10.5 million and 6,813 quintals of fuelwood worth the actual value of Rs. 272,500.00 were purchased from these forest areas. Such forestry related economic activities generate additional cash income to the rural people in the form of wages often earned through seasonal employment outside the agricultural season and further illustrates the linkage of forestry to the socio-economic life of the hill people.

Forest products for direct domestic consumption

Besides the provision of basic needs as discussed above, the rural population also uses forest products for direct domestic consumption and income generation. Naturally occurring

Plate 6: Farm implements made from wood

foods, including wildlife, make a significant contribution to food supplies. Many wild forest plants provide naturally valuable supplements to diets based on a limited number of staple foods. The local population derives various forest products: plants, fungi, birds, fish, animals and insects, for direct domestic consumption, thus contributing to human nutrition. Tubers, roots and stolon, bamboo and other shoots, stems, whole or part, bark, leaves, flowers, fruits, nuts and berries, seeds, mushrooms, game, fish and honey are all such forest products for human consumption and nutrition. Data on quantification of these is lacking. The rural population in the Region however, is known to use various of these forest products to subsidise their food. These may be available when agricultural food produce is in short supply and thus contribute to the stability of food supplies throughout the year. Forest products play a particularly significant role in nutrient supply in areas of food scarcity and in periods of food shortages. For forest dwelling communities and those living in the vicinity of forests, forest products form a major source of nutritional supply. Some plants are also important sources of income, e.g. bamboo shoots and mushrooms. Honey is another significant source of food and income from the forest.

For both wild life and potential food plants, forests constitute the largest reserve of genetic diversity; the most certain way of conserving this vital pool of genetic material is the conservation of the forest habitats themselves.

Forest products for supplementary income generation

Local people use forest products for supplementary income generation also. Hill farmers augment their cash income and utilize their spare time by engaging in various home based small scale industries and trades dependent upon forest products. These often small forest based local industries and manufacturing processes provide a considerable and diversified source of income to the hill farming population of the Region. Some of these need forest products as raw material, others require fuelwood as the source of energy for primary and secondary processing, while some are forest dependent for both: raw material base and energy supply.

SUMMARY

The forests in the Hindu Kush-Himalaya Region represent one of the most important land uses. The foregoing discussion highlights the important contributions forestry is making to the upland farming economies. It is also clear, however, that forests in the Region do not stand apart as a separate sector but are closely interwoven with other land uses. The analysis of the inter-relationship of forestry with agriculture and livestock husbandry shows the need for an integrated management of resources in the mountain watersheds.

Plate 7: Disabled hill farmer earns a living by bamboo goods manufacturing