SOCIAL FORESTRY NETWORK

FORESTS, TREES AND HOUSEHOLD FOOD SECURITY

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1.0 INTRODUCTION

Forestry and food security? For the forester deciding on the timing of the next timber sale or worrying about the regeneration losses incurred by browsing livestock and wild animals, the issue of food security may seem as though it belongs in another realm ... of agricultural production, grain prices, droughts and population explosion. And yet, in many rural areas forests and farm trees provide critical support to agricultural production, they provide food, fodder and fuel, and they provide a means of earning cash income.

The subject of food security for rural households in developing countries encompasses all factors affecting a household's access to an adequate year round supply of food. Thus it is likely to involve not just the household's production of food crops, but availability of income with which to purchase other food, seasonal variations in food supply and income, the nutritional quality of the food available, shifts from subsistence to the cash economy, and the incidence of other cash needs such as school fees.

The focus of this paper is on the socio-economic aspects of forestry's role in household food security. It synthesizes findings from a longer study conducted for the FAO Forestry Department (see note on inside cover) which draws together information on household food and income which are derived from activities dependent on tree and forest products. It examines the changing uses of these resources, focussing particularly on the impact on the poor and women. It also addresses the consequences of decreasing forest resources and considers the implications for management of forests as well as trees outside the forests.

It is clear that forests and farm trees contribute to a great variety of household needs which often makes it difficult to distinguish between their contribution to household food security and other benefits they provide. Nonetheless, from the information reviewed for this study, it is evident that

their contribution to household food security is often crucial. Figure 1,

FIGURE 1 FORESTRY AND FOOD SECURITY: LINKAGES

highlights some important linkages between forestry and food security and suggests some of the ways forest products, environmental benefits, as well as forestry activities can have an impact on household food security and individual nutritional well-being. The boxes on the far left represent forest products and benefits on which forestry projects often focus (e.g. fuelwood production and shelterbelts). Moving to the right, the linkages between forestry outputs, household food and nutrition status are highlighted. It emphasizes the links between household income, women's work loads and the household availability of food (all of which are factors on which forestry activities can have an impact).

In terms of household food security, forest and farm tree resources serve to supplement existing food resources and income, fill in seasonal shortfalls of food and income as well as provide seasonally crucial agricultural inputs, and help reduce risk and lessen the impact of droughts and other emergencies. In addition, forests and farm trees appear to be especially important for the rural poor (many of whom are women), as frequently they must rely on off-farm employment opportunities and available forest resources to help meet their household needs.

1.1 Supplementary role of forest products

For the majority of rural people, forest food adds variety to diets, improves palatability, and provides essential vitamins, minerals, protein and calories. The quantities consumed may not be great in comparison to the main food staples, but they often form an essential part of otherwise bland and nutritionally poor diets. Diet diversity is an extremely important element of nutritional well-being, in part because more vitamins and minerals are consumed, and also because it improves the taste of staple food. Some species are noteworthy as particularly rich sources of vitamins, minerals, proteins and fats.

There are many different kinds of food gathered from forests, ranging from termite larvae to leaves and mushrooms. Forests also provide the habitat for many commonly consumed wild animals and fish. Forest food may also be smoked, dried or fermented, making it available over extended periods of time. For example, the fermented and dried seeds of Parkia sp. are rich

sources of protein and are widely used as a condiment throughout Sahelian Africa (Campbell-Platt, 1980).

The most common supplementary food are leaves and wild animals, both of which are generally added to sauces and soups which accompany staple food. For example, the leaves of Boscia senegalensis are consumed year-round by the Peuhls in Senegal, where they are added to sauces which accompany their grain staple (Becker, 1983). This combination is important because, in addition to increasing nutritional value, these wild leafy vegetables add flavour to bland staple food, thereby encouraging greater food consumption. Little attention has been paid to the importance of improved palatability provided by wild food, yet it may have significant nutritional implications.

Trees are often left or planted on farms for the food and fodder they provide. For example, home gardens (intensively managed farm systems combining tree and herbaceous crops) supplement food production from other sectors of the farm. The few studies which have examined their nutritional impact show that home gardens increase the total quantities of food consumed by households (Soemarwoto 1985, Immink, 1981). In addition, trees may be maintained or planted to provide wildlife habitat. In Thailand, for example, trees are left in paddy fields and on dikes, in part to provide a habitat for commonly consumed wild animals such as lizards, birds and tree ants (Grandstaff, 1985).

Forest and farm tree products are also valued throughout the year as snack food. Forest fruits and nuts are the most common snack food, especially for children. They are commonly eaten on the job: while working in fields, while herding and while gathering fuelwood. There is little information on the consumption of snack food and its nutritional significance, as most nutrition studies focus on meals or food markets. However, some authors suggest the role is important: a study in Swaziland, for example, estimates that wild fruits are a major source of vitamin C (Ogle and Grivetti, 1985). Forest fruits can be used to combat nutrient related health problems. For example, many forest fruits and leaves are good sources of vitamin A, shortage of which is a common cause of blindness in many developing countries. Table 1, illustrates some of the ways in which forest and tree food might by used to combat specific nutritional problems.

TABLE 1 SOME COMMON NUTRITION PROBLEMS AND THE POTENTIAL ROLE OF FOREST FOOD

Nutrient-related problems	Forest food with potential for combatting deficiencies.
Protein-Energy malnutrition: due to inadequate food consumption causing reduced growth, susceptibility to infection, changes in skin hair and mental facility.	Energy rich food which is available during seasonal or emergency food shortages, especially, nuts, seeds, oil-rich fruit and tubers; e.g. the seeds of Geoffroea decorticans, Ricinodendron rautanenii, and Parkia sp.; oil of Elaeus guineensis, babassu, palmyra and coconut palms; protein-rich leaves such as baobab (Adansonia digitata); as well as wild animals (e.g. snails) incl. insects and larvae.
Vitamin A deficiency: in extreme cases causes blindness and death; responsible for blindness of 250,000 children/yr.	Forest leaves and fruit are often good sources of Vitamin A; e.g. leaves of Pterocarpus sp., Moringa oleifera, Adansonia digitata, the gum of Sterculia sp., palm oil of Elaeus guineensis, bee larvae and other animal food; in addition fats and oils are needed for the synthesis of Vitamin A.
Iron deficiency: in severe cases causes anaemia, weakness and susceptibility to disease; especially women and children.	Wild animals including insects such as tree ants, mushrooms (often consumed as meat substitutes), as well as forest leaves such as Leptadenia hastata, Adansonia digitata.
Niacin deficiency: common in areas with a maize staple diet; can cause dementia, diarrhoea, and dermatitis.	Forest fruit and leaves rich in niacin such as Adansonia digitata, fruit of Boscia senegalensis and Momordica balsamina, seeds of Parkia sp., Irvingia gabonensis and Acacia albida.
Riboflavin deficiency: common throughout southeast Asia; among those with rice diets causes skin problems.	Forest leaves are especially high in riboflavin, notably Anacardium sp., Sesbania grandiflora, and Cassia obtusifolia, as well as wild animals, especially insects.
Vitamin C deficiency: common to those consuming monotonous diets; increases susceptibility to disease, weakness.	Forest fruit and leaves often supply the bulk of Vitamin C consumed, especially good sources include fruit of Ziziphus mauritiana, Adansonia digitata and Sclerocarya caffra, leaves such as Cassia obtusifolia, and the gum of Sterculia sp., are also good sources of this vitamin.

Forests also contribute to the food supply indirectly providing fodder for livestock, thereby helping maintain a supply of milk and meat. In addition, where available, trees are the main source of energy used for cooking and food processing. In some cases this function is essential, as food such as beans cannot be consumed without cooking. Fuelwood is also used to process food such as fish, seeds, and oil, which are generally smoked, dried or cooked. Processing serves to extend food supply, and in some instances provides a source of cash income.

In many rural communities where poor farmers cannot raise enough to be self-sufficient in food, and are forced to earn cash for food purchases, income from forest-based activities may supplement the household budget. In a village in the Philippines, for example, poor farmers rely on year-round rattan gathering as a major source of supplementary income (Siebert, 1985). In many cases forests provide one of the few income earning options for those limited by scarce resources. The burgeoning fuelwood trade demonstrates both the growing demand for fuelwood and farmers' ever-growing need to supplement their farm income (e.g. Kamara, 1986). In many regions, trapped and hunted wild animals also provide supplementary income.

Money earned in forest-based activities may be spent directly on food purchases or may be invested in agricultural assets such as livestock, land, farm implements, or seeds. In this sense, forest-earned income contributes indirectly to a household's food situation, by helping them invest in future production.

1.2 Seasonal importance of forest and farm trees

Forest and farm trees are most extensively used to help meet dietary shortfalls and to supplement household income during particular seasons in the year. Many agricultural communities suffer from seasonal food shortages generally known as 'hunger periods'. They commonly occur at the time of year when stored food supplies have dwindled and new crops are only just beginning. During this period the consumption of forest and tree food increases. In many areas the consumption of wild animals and fish is also highly seasonal. Forest and farm tree produce are also valued during the peak agricultural labour period, when less time is available for cooking and people consume more snack food.

On the other hand, some favoured forest food, such as snails, mushrooms and honey, has particular harvest seasons that do not necessarily correspond to food short periods. In these cases, food is gathered for as long as it is available. For example, in Upper Shaba, Zimbabwe, women are reported to spend several hours a day collecting mushrooms during the early rainy season (Parent, 1977).

In many arid regions, trees provide an important source of dry season fodder, ranging from nil to 100% of the livestock diet. In the Sahelian region browse represents an estimated 30-40% of the dry season feed (Le Houerou, 1986).

Home gardens are widely designed to make use of variations in the timing of the harvest of different component tree crops, in order to supply food and saleable produce during the period between harvests of staple crops. Another important feature of such gardens, and other systems incorporating trees, is that work on the latter can often be undertaken during the slack season, thus helping to even out the peaks and troughs in the demand for farm labour.

A great many forest-based employment opportunities are seasonal. The seasonality of some activities is dictated by the availability of the product or raw material, while in other instances it is determined by the demands of other activities such as agriculture. For example, in Northern Brazil, babassu palm kernels are gathered and processed during the agricultural slack period. During this period the income earned from these activities represents more than a third of the family's overall budget (May et al., 1985). In Sierra Leone, the collection of fuelwood for the market closely mirrors the work requirements for agriculture; during the slack months, fuelwood collection increases (Kamara, 1986). In other cases, the activities may be dictated by seasonally induced cash needs such as loan payments or school fees. As the markets for many locally processed forest products are dependent on rural people's purchasing power, they too are tied to the cyclic nature of agricultural incomes.

Several authors have remarked that income earned in forest-based activities is often used to purchase inputs, such as seeds, needed for the following agricultural season (Engel, 1984; May

et al., 1985). In these cases, forest-based income is quite closely linked to the agricultural production cycle.

1.3 Forests and risk reduction

Many studies indicate that forests have provided essential resources during emergency periods such as floods, droughts, famines, and wars (Becker 1983, Campbell 1986, Irvine 1952, Turton 1977). In times of crop failure they may provide emergency food as well as products which van be gathered for sale. There is a wide range of forest resources used as emergency food. Often they differ from resources exploited in other periods. In famine periods, roots, tubers, rhizomes and nuts are most sought after. They are characteristically energy rich, but often require lengthy processing. For example, in Zimbabwe the stems of Encephalartos poggei are soaked in running water for three days, sun-dried and crushed into a fine powder before being consumed (Malaisse, 1985). Some studies indicate that, with increasing commercialisation of rural markets these emergency uses of forest resources are dwindling as people rely to a greater extent on food purchasing (Turton, 1977). Nonetheless, for the rural poor with good access to forest areas, these resources may still provide a buffer in food-scarce periods.

The sale of gathered and processed forest products tends to increase as agricultural production fails. A study in the Philippines revealed that a greater proportion of villagers became involved in rattan collection and trade as agricultural conditions worsened. In addition, villagers also turned to this activity when income was needed for emergencies - to cover expenses of funerals, medical treatment or weddings (Siebert, 1985).

Trees are also valued by farmers as insurance. They are planted where drought threatens; or to help diversify farm production, increasing the variety of crops available in order to guard against the risk that a crop may fail. Trees may also be viewed as a form of savings which can be drawn upon when needed, or to provide more flexibility in planning expenditures. For poor farmers who have access to few resources, trees may provide one of the few assets they can liquidate in emergency periods (Chambers and Leach, 1987).

TABLE 2 ESTIMATES OF INVOLVEMENT IN FOREST BASED ACTIVITIES

Van Buren, 1982 (India)	25% of the fuelwood used is sold in commerce, and as many as 15 million people (full-time) are involved with market trade.
Agarwal, 1983 (India)	2 to 3 million people are dependent on the fuelwood trade, earning an average Rs. 5,50 /day/20 kg headload of fuelwood.
Surin, 1980 (Chotanagpur, India)	Fuelwood sales are an important source of income for 70% of forest-dweller households.
Hunter, 1981 (Madhya Pradesh)	The collection of Tendu (Diospyros melanoxylon) leaves for bidi cigarette wrappings employs ten million people part-time in the off-peak agricultural season, and earns the state some $40 million in revenue.
Tewari, 1982 (India)	Tendu leaf collection provides about 90 days employment to 7.5 million people; a further 3 million people are employed in bidi processing industry; and 3 million people are involved in lac (resin) production; 735,000 people earn income from sericulture; 550,000 people are employed in bamboo-based craft enterprises. 126,000 households are involved in Tassar silk cultivation (of those 100,000 are from Bihar). More than 300,000 people are involved in mat production from reeds.
Jha, 1985 (India)	More than 3,000 families are involved in sericulture (raising silkworms), and over 3 million rupees is generated from the sale of the cocoon crop (the majority is purchased by the Forest Department).
Blair, 1984 (Kerala, India)	25,000 are involved in the fuelwood trade. There are more than 52,000 forest-based small-scale processing enterprises, who employ 137,000 people;
Jalal-ud-Din, 1984 (NW Pakistan)	18,000 people are employed in FB-SSEs; 10,200 people are employed in FB-SSEs.
Fisseha, 1987 (Zambia)	48,000 people are employed in charcoal production (36,000 of them are part-time charcoal producers and traders); 11,500 people are involved with bee-keeping; 96,000 households earn income from handicraft production.
(Sierra Leone) (Jamaica)	
Marks, 1984 (Zambia)	

Johnson, 1985 (NE Brazil)	Gathering forest products is a component of the agriculture cycle. In 1980, 18,300 tonnes of cashew nuts were gathered and 18,000 tonnes of wax were collected from carnauba palm leaves.
Saadallah, 1978 (Tunisia)	The minor forest product trade provides 270,000 days employment a year.
Chetty, 1985 (India)	Gum collection uses 300,000 man/days. There are an estimated 50,000 small-scale forest product processing enterprises.
Jambulingam, 1986 (Tamil Nadu, India)	The collection, processing and trade in palmyra products (sugar, wine and handicrafts) involves 28,000 households and generates Rs. 120 million annually.
Kulkarni, 1983 (India)	Estimates that 30 million people derive part of their livelihood from forest products.
Rao, 1978 (India)	More than 80,000 tonnes of myrobalan fruit (tannin production) are collected annually by agriculturalists and tribals, 150,000 tonnes of other tannins are also collected. Workers earn between Rs. 0.25-0.50/kg for myrobalan fruit and 0.25-0.4/kg for tannin bark.
Chetty, 1985 (Kolar, India)	20,000 people are involved in bamboo collection for local FB-SSEs.
Moby-Etia, 1982 (Cameroon)	Palm wine production provides income for an estimated 20,000 people from region (an estimated 6,000 tonnes/month enter commerce.
	Estimates that 700,000 litres of palm wine enter commerce a year.
	60% of the farm households in the region process palm fruit and kernels for sale.
Forest Service, 1982 (Senegal)	Estimates 65,000 people are involved in rattan/ cane basketry part-time, while 1,500 are involved full-time.
Engel, 1984 (Bo, Sierra Leone)	3,600 people are involved in raphia and rattan processing in the region.
Kaye, 1987 (Cote d'Ivoire)	
Shiembo, 1986 (SW Cameroon)	

2.0 THE IMPORTANCE OF FOREST RESOURCES FOR THE POOR

In many developing countries, people have historically had relatively unrestricted access to forests. Poorer people have thus been able to exploit the forests for food, fuel and marketable products. While forest gathering activities are not restricted to the poor, they depend on these activities to a greater extent. The poor, and especially poorer women, often dominate forest product gathering and processing activities, both for household products and income. In some circumstances, the integration of trees into farming systems may be particularly attractive to poor farmers because of the low inputs required for their establishment and management.

2.1 Forest food

Forest food is often particularly important for poorer groups of rural people. It provides an available and accessible source of a diverse range of food. Where it is prevalent, it is widely consumed. Especially important are wild animals and fish as well as seasonally available fruit, leaves, nuts and mushrooms. In some cases the availability of forest food may allow farmers to market a greater share of their agricultural produce.

In some societies, food gathered from the forest is believed to be poor man's food. In these cases few people like to discuss the forest food they might consume and purchased food is substituted whenever possible. Thus, in some regions the consumption of forest food appears to be declining.

2.2 Income earned from forest resources

Forest-based activities provide substantial employment opportunities in many rural regions, as is shown from the examples reproduced in Table 2. Many forest-based activities often require low establishment costs, and are characterized by easy entry and open market access. Many are undertaken as part-time activities to provide supplemental income. These activities are especially

important for the poor as they may have access to fewer alternatives. The collection and processing of babassu palm fruit in Northeastern Brazil, for example, provides a major source of income to millions of tenant farmers who have few opportunities for earning cash income (May et al. 1985). Similarly, in the Philippines one study revealed that the poorer farmers were most dependent on income earned from rattan collection and forestry labour (Table 3); for these households it provides a major source of year-round income (Siebert and Belsky, 1985).

Income earned from forest-based activities is sometimes invested in agricultural assets such as livestock for land. In this sense these forest resources offer the poor a means for investment in their future; thus providing an opportunity to escape from the cycle of poverty.

TABLE 3 FOREST PRODUCT USE BY HOUSEHOLD RICE SELF-SUFFICIENCY* (in %)

Use by household rice self -sufficiency status +

Forest Product Activity **	**Low (n-14)**	**Middle (n-27)**	**High (n-22)**	**Total (n-63)**
Rattan Gathering	57	37	9	32
Employment as timber labourer	43	33	36	37
Either rattan or timber	79	48	41	52

* Household rice self-sufficiency refers to the ability of a household to meet its rice consumption demands through rice farming (whether irrigated or rainfed, or as owner-cultivators and sharecroppers).

** At least one adult household member (15 years and older) gathers rattan on a weekly basis or accepts work as a timber wage labourer, whenever work is available.

\+ Low: no rice production
Middle: up to 50% self-sufficiency
High: more than 50% self-sufficiency
Rice self-sufficiency is used as a measure of a households economic situation.

Source: Siebert and Belsky 1985. Economic Botany 39(4) 530.

While forest-based activities provide numerous opportunities for the rural poor, information from studies suggests that the earnings vary substantially from one activity to another. For example, a Tanzanian study revealed that returns to labour varied from well below the minimum rural wage rate for mat-making to two or three times the standard wage for carpentry (Havnevick, 1983). The returns to labour from many forest-based activities are marginal. In addition, markets for products may be quite vulnerable to introduced substitutes. Thus, while forest activities provide some means of income earning for a large number of rural poor, activities which are dominated by the poor and women often provide the lowest returns. Therefore, these enterprises may not be sustainable in the sense that they will be abandoned if other income earning possibilities arise or if substitutes cause a market collapse.

While it is sometimes assumed that women are mainly involved in subsistence activities, in fact they are extensively involved in many forest-based gathering and processing enterprises - as is shown from the situations reported on in Table 4. Women often have little access to land and capital resources. Thus forests provide women with a source of raw materials and products for sale. In addition, women often combine cash earning activities with forest-based subsistence activities such as food and medicine collection. In addition, many forest-based activities can be undertaken near the homestead, thus allowing women to combine these activities with domestic chores.

2.3 Tree cultivation by poorer farmers

It has often been argued that cultivation of trees is something that is possible only for wealthy farmers. This assumption is based on the premise that the poor farmers' main objective is the production of staple food. However, the evidence suggests that in many cases poor farmers' resources are too limited for them to meet their basic food needs, so that income generation becomes increasingly important.

In these circumstances trees may prove to be appropriate cash crops, or intercrops with agricultural cash crops. In situations where land rather than labour is the limiting factor, joint tree/crop/livestock systems may give better returns than monocrops. Where availability of labour has become the constraint, because of the need to find work away from the farm, low input tree crops may provide the best way of keeping land in productive use. Although, overall returns from the latter would be greater under agricultural crops than trees, poor farmers often raise trees because they

TABLE 4 SUMMARY OF BASIC CHARACTERISTICS OF FOREST-BASED SMALL-SCALE INDUSTRIES IN SELECTED COUNTRIES[1]

Source: Fisseha, 1987. In Small-Scale Forest-Based Processing Enterprises, FAO.

[1] A small-scale manufacturing or repair business based on raw materials from forests, employing less than 50 people, privately owned & operating from a fixed location. With the exception of Zambia excludes enterprises producing fuelwood and charcoal.

cannot afford the capital and labour costs of agricultural production. Trees are also planted by the poor to help maintain the productivity of their land when the cost of alternatives such as fertilizer, herbicide, and irrigation are beyond their means (Conway 1987, Lagemann 1977, Soemarwoto and Soemarwoto 1984, World Bank 1986).

As was noted earlier, trees provide a measure of insurance and can be harvested in times of emergency cash needs. For poor farmers who live at or below subsistence level, the reduction of risk may be an overriding objective. In addition, the income earned from tree crops may provide poor farmers the capital to invest in agricultural assets such as better land or livestock.

3.0 THE IMPACTS OF CHANGE ON THE USES OF FOREST AND FARM TREE RESOURCES

Rural people, especially the poor, employ a diversity of means to help meet basic needs: food crop production, forest product gathering, consumption, processing and sale, cash crop production and income earning enterprises both on and off the farm. The impact of changes in the physical, social and economic environment will affect people in different ways, depending on their available resources and opportunities.

The following section focuses on two aspects of change: the diminishing forest resource base and the implications of the growing importance of the cash economy in rural areas.

3.1 Impact of diminishing forest resources

Throughout the developing world forest resources are rapidly being logged, degraded, cleared for agriculture and cordoned off for private or government use. In many regions, the result is that an ever-expanding rural population must rely on decreasing forest and land resources. In terms of household food security, this trend implies diminishing availability and use of forest food resources as well as diminishing knowledge about their utility, fewer income earning

opportunities for the rural poor, and increased burdens on households in their efforts to meet their basic needs.

Declining consumption of forest food

The role that forest food plays in household nutrition has changed with the diminishing availability, penetration of rural markets by new products, and changing tastes. In many regions forest food is no longer consumed, and knowledge about its use is vanishing, although this trend is not universal.

In some areas forests still supply a readily available source of food and fodder. In addition, commercialisation and rapid migration have led to expanded markets for some forest food. In other instances it is sought after for its traditional social value, while still in other cases it is valued for medicinal qualities. Throughout West Africa, for example, the urban bushmeat market has been expanding rapidly, causing prices to soar well above those of domesticated meats. Several studies report that the consumption of gathered food is not declining; but even in these cases the diversity of gathered food consumed may have decreased (Fleuret 1979, Ogle and Grivetti 1985, Asibey 1986).

The impact of the declining consumption of forest food is not clear. In some cases these changes have led to a poorer quality diet; most notably diets are becoming less diverse as people rely on purchased food. Wild animal consumption provides a good example of the effects of forest decline on food consumption. In Southern Nigeria, for example, where there are large forest reserves, bushmeat accounts for the greater part of meat consumed, but in other areas with poor forest conditions and no reserves, bushmeat is rarely consumed (Charter, 1973). In Southern Cameroon, villagers relate that their food base has become less diverse, mentioning particularly the decline in wild animal meat consumption (Laburthe-Tolra, 1981).

Perhaps the worst impact of the loss of forest food is that poorer people's food options will be further reduced, especially during seasonal and emergency hardship periods.

Energy and household nutrition

As was illustrated in Figure 1, fuelwood supply can affect household food security influencing the time women have for cooking, childcare, food production and income earning, the quality of cooked food, and possibly the prices of processed food. While few studies have focused on the impact of fuelwood scarcity on nutrition, a few important linkages can be discerned. Fuelwood supply may influence the amount of food supplied or cooked, and in some instances fewer meals are cooked.f This trend may have a particularly damaging effect on child nutrition, as children may be unable to consume enough of the often-starchy staple food in one meal. Fuelwood shortages may also affect the quality of food consumed as well as the quality and supply of processed food. If women cook for less time, the consumption of uncooked and reheated food may increase, which could cause a serious increase in disease incidence. In some areas the increasing prices of fuelwood have forced the costs of processing food such as smoked fish to increase, and these increases are in turn passed on to the consumer (Cecelski, 1987).

The increasing time needed for fuelwood collection may reduce the time available for cooking. In some areas the result may be that people consume more fast food and purchased snack food, often of lower nutritional quality. However, it should be noted that many other factors are associated with changes in dietary customs which should not be attributed to fuelwood shortages alone. In addition, fuelwood shortages may indirectly affect household food security: as women are forced to spend more time collecting fuelwood they have less time to spend on food production or income earning activities.

Dwindling raw materials for forest-based small enterprises

Over-exploitation of forest resources has resulted in a dwindling supply of raw materials for small enterprises, and fewer income earning possibilities for the rural poor. For example, over-exploitation and deforestation in rattan producing areas in Southeast Asia are leading to diminished supplies, lower quality materials, and reduced returns for the poor involved in its collection and trade. In addition, access by the poor to forests and other formerly 'common' lands is often restricted by increasing privatisation. As a result, they are gradually losing a source of income, as only wealthier gatherers are able to pay the fees to use private lands.

The supply of raw materials for both wood and non-wood products is likely to become an increasing problem for many small enterprises. Small enterprises are rarely able to create or conserve their own resources for future use on a sustained basis. This is an area where involvement of foresters could be most useful: both in terms of managing forests for these locally needed products and in redirecting forest policy and laws to incorporate the needs of small enterprises.

Incorporation of trees into farms

Another response to the declining availability of forest resources is the protection and incorporation of these resources into farming systems, both for home consumption and trade. Generally, trees are incorporated into these systems for a variety of products and overlapping motivations. Thus, while trees may be planted for marketable fruits or poles, these products and many others are also valued for consumption and use by the household. The intensification of management of farm and fallow lands for a combination of tree and annual plant products can be seen as a response to the changing availability of resources and opportunities for the farmer. some of these responses, which are summarised in Table 5, are discussed further in the following section.

3.2 Implications of increasing dependence on the cash economy

As the physical resources of both agricultural and forest lands available to them decrease, poor farmers are forced to rely increasingly on the cash economy. In many cases, diminishing size and productivity of farm holdings forces farmers to rely on off-farm cash earning opportunities. The resulting decline in labour available for their farming obliges them to shift to planting low input cash crops on their farms.

In some cases, farmers are increasing the value of production from farm land by processing higher value products such as coconut sugar, and
producing more products from the same area such as fuelwood and charcoal, byproducts of land clearing (Penny and Singarimbun, 1973). In a farming

study in rural Sierra Leone many farmers noted that non-agricultural activities such as fuelwood collection, hunting, fishing, oil processing, craft production and palm wine tapping are of major importance for them, both in terms of their time and the benefits for the households (Engel, 1984).

As was noted earlier, as farm productivity decreases to a point where farmers must turn to earning cash income, trees may be grown as cash

TABLE 5 FARMER RESPONSES BASED ON TREE-GROWING COMPONENTS

crops in order to take advantage of growing markets for forest products. For example, in Haiti, trees are being planted by farmers for the pole and charcoal markets. Trees are often chosen over other cash crops as they tend to entail low establishment costs and require less labour, minimal costs throughout the year, less water after establishment and thus lower susceptibility to drought. For poor farmers, the possibility of accumulating capital through tree growing may also be important (Chambers and Leach, 1987).

The impact of the penetration of the cash economy on household food security is unclear. Results from some studies suggest that overall household nutrition conditions decline with increasing reliance on cash crops (Longhurst 1987, Hassan 1985). Production for cash crops may lead to increasing food prices as land is transferred from food production. Reliance on cash crops makes households dependent on the vagaries of market prices for these products: a drop in cash crop prices will mean a household has less with which to purchase food. In situations where the shift from food to cash crop production entails a shift in control of household income from women to men, household nutrition may be affected as women are most closely involved with provision of the household's food. There are some studies which indicate that women are most concerned with subsistence needs, while others suggest that they are equally involved and interested in cash earning. Obviously, these factors vary greatly, depending on the culture, economy, available opportunities for women, and household situation. Nonetheless, some nutrition studies indicate that where women have control of household income, overall family nutrition may improve.

In the case of tree growing, the potentially negative aspects of cash crop production may be offset by other features of tree growing. As was discussed earlier, the transfer of land from food to tree crops is often in response to changing conditions which make food crop cultivation impracticable, such as increasingly scarce land and labour. Thus, the shifting emphasis from food to cash crops may be unavoidable. Most trees provide other products in addition to those for cash sale. In addition, tree crops provide a great deal of flexibility as they can be harvested when the farmer most needs them, i.e. for emergencies and to meet lump sum cash needs. For these reasons, they may be most appropriate for poor households.

4.0 CONCLUSIONS

Forestry's contribution to household food security must be viewed in perspective. Forests and farm trees are components of complex rural environments. Forestry efforts alone cannot substantially alter fundamental social, economic and political factors at the root of many food supply inequalities. Nor would it be correct to conclude that the answer to declining availability of food, income or employment from forest-based sources necessarily lies in forest-based interventions. Alternatives to forest food, fuel and products exist or could be made available in nearly every situation.

However, forests and tree resources have played an important role in household food security, especially during seasonal and emergency hardship periods. Evidently, the management of forests and the planning of agroforestry activities could and should include consideration of these uses of forest and tree outputs much more widely than is the case at present.

This cannot be a static process, amenable to use of standard models and approaches. The importance of trees and tree products varies greatly from community to community and also between households within communities. Their use and role within the household economy are changing as rural areas become increasingly commercialised, forest resources are progressively degraded, and farm productivity declines. Planners and managers, therefore, need to be aware of and responsive to these changes, and to the new opportunities as well as the growing demands which they are creating for forestry and agroforestry in each situation.

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