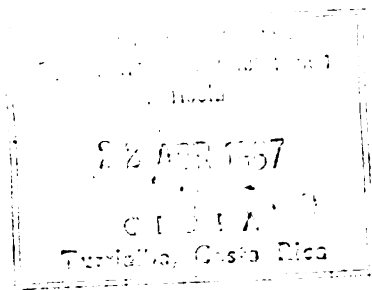


**INCENTIVES FOR TREE GROWING IN RELATION TO
DEFORESTATION AND THE FUELWOOD CRISIS IN CENTRAL AMERICA**

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INCENTIVES FOR TREE GROWING IN RELATION TO
DEFORESTATION AND THE FUELWOOD CRISIS IN CENTRAL AMERICA¹

by

M.S. Luis A. Ugalde. A. and Dr. Hans Gregersen²

INTRODUCTION

The broad objective of this paper is to explore possibilities for creating and promoting incentive mechanisms for encouraging farmers, local communities, cooperatives, the private sector, and government forestry agencies to invest in planting trees for fuelwood and other uses (poles, fodder, windbreaks, nitrogen fixation and so forth). The paper is meant to serve as background for an active research and development program in this area.

As fuelwood becomes scarce due to high demand and increasing deforestation, prices for fuelwood increase. At some level of price increase commercial tree planting will show an acceptable economic rate of return. Also, farmers will start to plant wood for their own use to avoid having to pay the high prices. Appropriate financial mechanisms and organizational options can be designed and implemented to encourage tree growing. With these mechanisms in place, fuelwood scarcity, and the problems associated with uncontrolled deforestation should decrease. However, any action will require a thorough understanding of the different factors and trends affecting a specific situation.

In recent years there has been an increased awareness of the key role that forests and trees play in promoting sustained rural development. It has also been recognized that increased forest management could help to meet the basic needs of rural people and the commercial needs of industry, to improve rural incomes and to combat environmental degradation. However, the ability of forests and trees to provide sustained yields of multi-purpose products such as fuelwood, sawtimber, watershed protection and other services is threatened by the unprecedented rate of deforestation

¹ Most of the information pertaining to Central America presented in this paper is part of the research that has been carried out by the Regional Fuelwood Project (CATIE-ROCAP) in Central America. The senior author has worked with the project since its inception seven years ago; and the junior author was on the final evaluation team for the project and has worked with incentive programs in many countries.

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and forest degradation in many parts of Central America. The rate of tree planting by local farmers, the ones who ultimately will have to build up tree capital in rural areas is far below what is needed to replace the lost forests.

The major cause of tropical deforestation is the demand for new agricultural land. World-wide, slightly less than half of all tropical deforestation is caused by agricultural expansion implemented by slash and burn techniques. Large areas also are cleared for the establishment of large-scale agricultural and livestock enterprises or settlement schemes (Lanly, 1982). In Central America only a minor part of the deforestation is caused directly by forest exploitation. In many cases deforestation is followed by unstable agricultural expansion or extensive land use.

Due to these land use changes, many Central American forests have been converted into agricultural or grazing lands and, often, the agricultural techniques used are not suitable for the local conditions. This results in environmental deterioration, such as soil degradation, erosion, and sedimentation of reservoirs. In other cases, especially in densely populated areas in Central America, the decrease in natural forests has resulted in severe fuelwood shortages, since these natural forests have been the main source of fuelwood supplies in the Central American isthmus.

GLOBAL FUELWOOD SITUATION

In most tropical regions, including Central America, reforestation efforts have not been effective in countering deforestation and inappropriate land use. The annual rate of deforestation in tropical countries is nearly 11 million ha, of which 7.3 million ha consist of closed forest in the more humid parts of the tropics, and 3.8 million is open forest in semi-arid zones. In contrast, the annual rate of plantation establishment is only 1.1 million ha. This means that the total rate of reforestation is only 10 percent of the rate of deforestation. The area ratio of plantation establishment to deforestation is highest in tropical Asia (1:4.5) and lowest in Africa (1:29), and 1:10.5 in tropical America (Lanly, 1982).

Tropical moist forests of which 1 billion ha remains, are spread over some 60 countries, 12 of which have about 80 percent of the total area. Tropical moist forest are currently being destroyed at a faster rate than in any previous period of history. With the current rate of deforestation, an additional 100 million ha will have been degraded or converted to agriculture by the end of the present century (Spears, 1983).

Approximately three-fourths of the population of developing countries depend on wood energy for cooking and heating. Deforestation has resulted in a rapidly decreasing supply of fuelwood for these people. In some countries the problem has already reached alarming proportions. Overall, perhaps 100 million people already have to live with a shortage of fuel for cooking and other basic purposes. Probably a further 1000 million are living in situations where fuel supplies are being maintained only by

destruction of the wood vegetation, so that the incidence of shortages is growing rapidly (World Resources Institute, 1985). As fuelwood shortages grow, people have to walk progressively further to collect it, adding further hardship to their lives.

Recent estimates (FAO, 1981) suggest that in 1980 approximately three-fourths of the population of the developing world (2 billion people) depended on traditional wood fuels for their domestic energy requirements, and that by the year 2000 this number could grow to 3 billion. Wood fuel also is used to varying extent in the commercial, agricultural and industrial sectors, including in some large-scale industries.

About 80 percent of all the wood cut in developing countries is used as fuel. Fuelwood constituted about one-fourth of the total energy consumed in developing countries; varying widely from 10 percent in Asia to nearly 60 percent in Africa. Wood fuels represent as much as 90 percent of total energy use in countries such as Nepal, Tanzania, and Mali. Most developing countries lie in a range from 30 percent to 80 percent or more overall reliance on traditional wood fuels, and the importance may well be increasing.

Despite all the publicity there are still difficulties in finding effective measures to deal with the problem of shortage of wood fuels. One reason for this is that relevant information is often lacking, or it is unclear what sort of basic information needs to be known, and how this information can be collected and be used effectively in planning and implementing programs. This is because fuelwood shortages are usually part of complex local human and resource systems that need to be properly understood in their total context before workable improvements can be suggested.

FUELWOOD SITUATION IN CENTRAL AMERICA

The Central American isthmus includes seven countries: Guatemala, Belize, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama. The total population is approximately 24 million, on an area of about 516,000 km² (Jones and Bauer, 1984). This area can be divided into three general climatic zones: the Atlantic Side of the isthmus, the Central Mountain Range, and the Pacific Side of the isthmus.

Fuelwood is the most important energy source for Central American countries. In combination with other biomass fuels, such as bagasse and coffee bean shells, fuelwood represents approximately 50 percent of all energy consumed in the region. Approximately 73 percent of all families cook with fuelwood. The majority of them come from rural areas, where over 90 percent (15 million people) cook with fuelwood (Jones and Bauer, 1984). Wood provides more than half of the energy requirements of the entire region, ranging from a high of almost 70 percent in Honduras to a low of 23 percent in Panama. Besides meeting energy needs, wood and wood

products have substantial commercial demand within national and export markets (Flores, 1984; Tree Crop Production Project, 1985).

Continuing rapid depletion of the wood supply in Central American will not only have disastrous environmental impacts, but will also have a negative impact on the quality of life, as well as on the economies of the region.

Rapid increases in population, the need for new settlements and land development for agriculture have resulted in a severe reduction of Central American forest reserves. The region's dry zones along the Pacific coast and in some of the more densely populated central highlands have been stripped of their tree cover and are no longer able to meet the local needs for fuel and other wood products. It is estimated (Dulin, 1984) that more than half of the approximately 24 million inhabitants of the region live in areas where the supply of fuelwood is classified as "critical" or "very critical".

Moreover, many rural residents who still have access to wood at little or no cost must travel greater distances to find it. Others use fuelwood substitutes derived from lower quality agricultural residues such as corn cobs. The very poor are particularly disadvantaged because they generally have no affordable substitute for the free wood they have been using.

The rate of forest destruction in Central America is approximately 376,000 ha/year, while the rate of reforestation is less than 20,000 ha/year (only 5 percent of the rate of deforestation). The rate of tree planting, therefore must be increased substantially in the next few years if it is to make up for losses from natural forests. If this does not occur, several countries will have to import a large part of their future wood needs. This situation is already taking place in some countries such as El Salvador. If the current trends continue, Costa Rica's commercial forests will be depleted in about 12 years (Flores, 1984).

Large scale government plantations could not adequately address the problem, in part because approximately 80 percent of the land is privately owned. There are no forestry traditions to handle large projects. The region's Ministries of Agriculture and other governmental organizations have often assigned higher priority to farming and livestock expansion programs, and administratively have not been able to demonstrate their capacity to carry out large, natural resource projects on public land. However, there are signs that this limitation is decreasing in some countries with the introduction of large outside funded projects.

JUSTIFYING INCENTIVES FOR PRIVATE TREE GROWING

Forest plantations often have a much higher yield of both wood and other products per-unit area than do natural forests. This is certainly the case for fast growing species planted in such a way as to insure that full use is made of the site's potential. Yet, as pointed out above, the global requirements for wood are such that immense areas will have to be planted over the next years. Giving an approximate order of magnitude, current levels of tree planting in the developing countries will need to be increased at least five-fold, from 0.5 million to about 2.5 million ha required to attain a reasonable degree of self-sufficiency in fuelwood by the year 2000 (Spears, 1983).

At present, probably no country in Central America is planting more than 2000 ha per year. Clearly, artificial reforestation cannot compensate for the deforestation of watersheds on such an enormous scale (Tschinkel, 1984).

Beyond fuelwood, many plantations and other forms of tree planting provide critically needed environmental benefits. These externalities or social benefits associated with reforestation are not always considered in project appraisals although they often constitute the most important benefits from planting trees. As discussed by Gregersen and McGaughey (1985) the issue is not the existence of externalities — that fact is generally accepted — but their incidence and magnitude. By definition, external benefits are not received directly by the person or group making the investment. Thus, a public subsidy to the investor can be justified to stimulate forestry investment where significant externalities exist and accrue to society.

Forest plantations, while maturing, provide wood for industry and/or domestic consumption. They supply many other products such as food for the local population, fuel for cooking and heat, fodder, poles, protection of watersheds and agricultural land, nitrogen for field crops, amelioration of wind erosion, and they also provide give alternatives to expand cropping systems such as agroforestry practices.

In periods of high unemployment, tree planting may offer the opportunity for rather labor-intensive investments in rural areas. While forestry employment tends to be part-time seasonal for planting and tending activities, in the aggregate it still provides employment and a base level of income for many rural people. Indirect employment opportunities are also created in rural areas, which can be important in areas of high unemployment (Gregersen and McGaughey, 1985).

Reasons to promote and provide incentives for planting trees include:

- existence of significant externalities, e.g., soil conservation, agricultural crop improvements, etc.
- creation of employment opportunities for rural people

- provision of basic environmental benefits
- supplying basic needs of the rural urban poor

CONSTRAINTS AND INCENTIVES AFFECTING FARMERS' DECISIONS TO PLANT TREES

In most countries, forestry is competing for funds with options such as food or cash crop production, education, health, transportation, or other politically more attractive development projects. This is especially true in developing countries due to the scarcity of capital resources. Forestry investments are often too long term to attract capital from private investors. In such cases, financial incentives are needed to stimulate investment. In fact, such incentives are provided in nearly all countries. They have become an accepted part of forestry action plans, as they are in agriculture, health, education and so forth. These could include direct subsidies for planting and management, long term commercial credit, tree seedlings and technical advice, and so forth. Or they merely involve enhancement of latent market forces.

At the last World Forestry Congress in Mexico (1985) experts from international agencies stated that national governments must take the next major step in forestry development. In particular, countries must put in practice effective mechanisms that will provide an incentive for an adequate volume of investment opportunities for private farmers.

This is easier said than done, since the appropriateness of incentive mechanisms depends on a great many factors and complex interrelationships among those factors. For instance, De Camino (1985) describes an incentives system as a function of different variables such as: initial state of the community, type of incentive, objective of the incentive, community motivations, restriction to be overcome through the application of the incentive, definition of long term effects of the incentive, form of incentive distribution within the community, and mode of incentive recuperation. Broadly speaking, incentive mechanisms may be needed to overcome lack of knowledge of what to invest in, lack of ability or resources to invest, or lack of interest in investing in tree planting. In most cases, all three types of constraints exist side by side, although one may also be more serious than the others. Only on-the-ground evaluation will turn up the information needed to assess the nature and strength of each type of constraint or bottleneck. Various methods exist to generate the needed information in a fairly rapid, yet acceptably accurate way (cf. Chambers, 1985, and items cited therein).

The major factors influencing the decision to plant trees for fuelwood or other purposes are identified in Figure 1. Going clockwise from the top, one can see that expected prices for fuelwood influence the decision in two ways, one in terms of what the farmer could sell fuelwood for in the local market, the other in terms of what he will have to pay for fuelwood if he doesn't grow it himself. Another factor influencing the decision is the level of subsidy, if any that is given for tree planting and tending, since subsidies reduce costs to the farmer and thus increase the net benefit

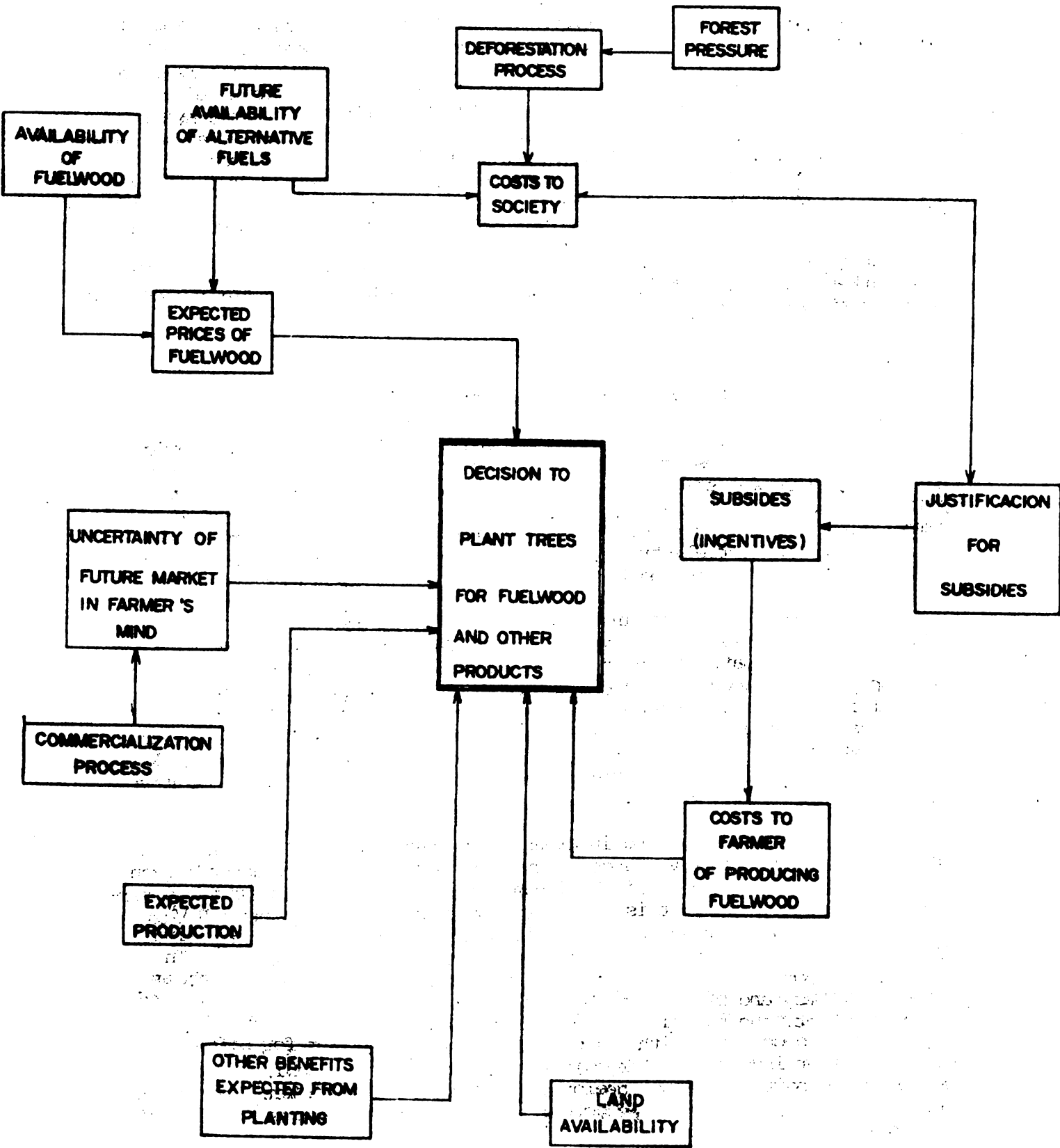


Fig 1. Interaction of different factors affecting decision to plant trees

or profit he gets. Land availability is another obvious factor influencing the decision; it fits in with the constraint of lack of ability or lack of resources, but it also fits with the constraint of lack of interest in the sense that if an individual only has a little land, he is more likely to want to grow food crops and will probably have little interest in tree growing, unless he can be shown that he can have both food and trees without losing any of his food output, e.g., through the use of agroforestry practices. Other factors affecting the decision to plant and tend trees include the expected levels of production and the uncertainty which exists in the potential planter's mind concerning outputs, prices, and so forth.

In the next section we look at incentive mechanisms associated with the market, i.e., market incentives or prices; then in the following section we look at non-market incentives.

MARKET PRICES, INCENTIVES AND INVESTMENT IN TREE GROWING

Market incentives are important ones to consider in Central America. These relate to prices of noncommercial energy such as fuelwood, charcoal, sugarcane, bagasse, sawmill wastes, among other things. Such relative prices are a key factor in investment decisions by small farmers, local communities, and industries. Trends in price of commercial energy such as kerosene, gas, or electricity, can also explain in part the consumption patterns of these fuels and the possible changes in the future.

Historically, in most rural areas in LDC's, no relationship existed between price levels and the consumption of fuelwood. This is explained by the fact that natural forests were the major, and often the only, source of supply of fuelwood for rural population (free fuelwood gathered from natural forests or savannah woodlands). Thus it is not until deforestation has taken place on a very extensive scale that the transportation distances (commercialization process) from forest resources to the marketplace force up the price of fuelwood to levels where sufficient incentive exists to invest in planting.

Rural populations living in areas which have reached this condition of high fuelwood cost may change to other commercial energy, depending on the price levels and the availability and transportation cost of the alternative fuels. However, it is also possible to find situations in which, despite existence of high fuelwood prices, people would still be using fuelwood because its price is still lower than commercial energy. In addition people need not only fuelwood but other wood products such as poles, fruits, and fodder which they could grow along with the fuelwood. At this point, the planting of trees for harvest may become an economic alternative to compete with food crop production, either for small farmers, communities or industries, depending heavily on land availability and ecological conditions. The development and workings of market forces are very complex and involve many factors; it is a very dynamic process as it develops.

The case of the State of Gujarat, India, is an interesting one in terms of the workings of the market (Arnold, 1983). When the rural poor migrate to the towns, they continue to depend on wood fuels for cooking and heating. To date most of the supplies have come from destructive cutting of existing tree resources in nearby rural areas. However, rising prices and shrinking supplies have increasingly encouraged the investment in tree planting. Some urban areas have long been supplied with fuelwood in this way. Fuelwood production is now to be found outside many cities and the scale and incidence of such production is spreading rapidly.

Recently, research carried out by the Fuelwood Project, (CATTIE-ROCAP) in Central America shows a situation where, due to scarcity of fuelwood, industries are becoming more aware and willing to plant trees. With the financial motivation for maintaining fuelwood supplies, wood or charcoal burning industries have started to take action towards the solution of their own fuelwood problems. For instance, in Honduras a tobacco company has begun an independent program of incentives to local tobacco producers for planting fuelwood in the Department of Copan, and the tobacco industry of Costa Rica is presently studying the possibility of fuelwood plantations. In Nicaragua, Costa Rica and Panama, cement producers are considering partial substitution of charcoal for petroleum for kilns. The CONAPROSAL (a salt industry cooperative in Costa Rica) had changed to use of fuelwood, and has begun planting trees for fuelwood production. The Costa Rican coffee industry had been changing from fuelwood to petroleum-based fuels for coffee processing prior to the increase in petroleum prices. But as petroleum prices rose in the seventies, coffee processors switched back to fuelwood. A recent study (Reiche and Campos, 1983) shows that 98 percent of the Costa Rican coffee processors use fuelwood. Also, the National coffee board in Costa Rica has begun to promote the idea of commercial fuelwood plantations to keep operation costs down (Campos, 1982).

The above examples illustrate that there are many trends which should be considered during the process of selecting financial mechanisms for implementing fuelwood programs. These trends may be different depending on the area or region. Only detailed study on a case by case basis will provide adequate information on which to base an investment program which involves both market and nonmarket incentives.

NONMARKET INCENTIVE MECHANISMS USED IN FORESTRY

It is evident from the above discussion that there are broad kinds of factors and limitations affecting the process of creating investment incentives. Incentive mechanisms can be defined as public subsidies given in various forms to the private sector to encourage socially desirable actions by private entities (Gregersen, 1983). The desired action can, of course, be to do nothing, e.g., no cutting on existing forests with critical protection functions. There are two types of incentives, direct and indirect. Direct incentives are tied to a response or action by the landowner or person who receives the incentive. The other is the indirect type of incentives which is not tied directly to any given landowner's response or action.

The implementation of incentive programs may not be easy to carry out, and often they do not meet the needs of the population in general. For example, the use of fiscal incentives for reforestation was criticized at a meeting in South America (Levingston, 1983) because: 1) they ignore agroforestry combinations on farmer's land; 2) they mostly benefit large companies or large land owners, not the small farmers; 3) they often lag behind inflation or devaluation of money; 4) they lack clear distinction between trees producing wood and trees producing nonwood products; 5) they ignore natural regeneration as a means to build up the productivity of secondary forests; 6) they require cumbersome administration.

A clear understanding of these types of factors and the limitations they impose in terms of selection and use of incentive mechanisms is required for overall effectiveness of a program.

In general, in most countries it is accepted that subsidies from the public to the private sector for tree planting are justified for economic reasons. The argument is that society generally benefits more from private tree planting than does the private entity undertaking it, i.e., positive externalities exist (Gregersen and McGaughey, 1985).

Experiences from some countries show the feasibility of carrying on programs of incentives in different ways to promote planting trees, either by individuals or groups, e.g., in India, where government forestry departments have pioneered the introduction of social forestry programs by undertaking activities such as training and extension, establishment of demonstration plots, and provision of free seedlings (Grainger, 1983).

In the Philippines, the Development Bank of the Philippines and Paper Industry Corporation of the Philippines (PICOOP), developed a program for small land holders to encourage them to plant trees on part of their property. To get farmers interested in the program, it was linked to a livestock and fish program, where farmers received various subsidies in the form of free pigs, rabbits and other animals. The incentive used was low interest credit. Loan terms were very favorable; repayments did not start until returns were received from wood sales (Gregersen, 1983).

Another example is the South Korea project which involves a number of different incentives to reduce the problem of fuelwood scarcity for rural development. Incentives included technical assistance, marketing support, free seedlings, fertilizer, among others. This project is also a good example of combining the use of incentive mechanisms, regulations and direct public investment. This project is discussed in detail by Gregersen (1982).

In Nepal, free training and extension strategies for community forestry are some of the main incentive mechanisms considered in social forestry projects. A comprehensive package of activities and support materials for different target groups has been developed. Monitoring and evaluation of the program have indicated a considerable increase in the knowledge and interest of the 300 participating villages. Much of this can be

attributed to the implementation of field extension and training (Pelinck et al., 1983).

In the State of Gujarat, India, market incentives have been a key to success. Much on-farm reforestation has grown spontaneously in response to market factors, most notably rising prices. In some places, the expansion of tree growing has been so rapid, and so large, raising concerns that supplies could soon exceed demand. A market for poles has developed creating a demand logically met by the local production of fast growing species (FAO, 1985).

Other examples of successful fuelwood and agroforestry projects are described in a recent International Task Force report (WRI, 1985 a,b,c) and by Spears (1986). These projects reflect different social, cultural, and land tenure situations, and they take into account the economics of forestry in different marketing situations.

Based on review of experience worldwide, one can identify the main direct and indirect subsidies that are used to overcome constraints in forestry projects. They are shown in Table 1 in relation to their use in overcoming various types of constraints discussed above.

DESIGNING AND IMPLEMENTING INCENTIVE PROGRAM

When developing incentive mechanisms for tree planting in Central America, attention should be paid not only to the objectives of creating various plantation products, but also to overall objectives of the countries and the investors involved. From a social point of view not only are the potential direct outputs important, but also the degree to which reforestation can assist directly or indirectly in achieving societal objectives like the fulfillment of basic needs, sustained economic growth and equity, and the generation of employment and self-sufficiency.

In the process of creating incentives to plant trees, the following points should be kept in mind:

(1) It is necessary to clearly define the problems that affect a specific area or region in terms of needs and scarcity of fuelwood and other products.

(2) It is important to give the externality arguments and other justifications for incentives.

(3) The socio-economic factors and other constraints affecting or limiting the decision to plant trees should be identified.

If the chosen incentive mechanisms meet the needs and overcome the constraints of the population, they should be effective in motivating investments, either by individuals or by groups.

TABLE 1
TYPES OF FORESTRY INCENTIVE MEASURES

Measures	Used to Overcome Constraints		
	Lack of Knowledge	Lack of Interest	Lack of Ability
A. Direct			
1. Cost-sharing			
a) cash grants		X	X
b) goods/materials		X	X
c) services (management, marketing, etc.)		X	X
2. Subsidized credit (low interest rates, grace periods on repayments, etc.)		X	X
3. Fiscal			
a) tax exemptions		X	X
b) tax rebates		X	X
c) special taxes (yield property, etc.)		X	X
4. Reduction of uncertainty*			
a) rental contract	X	X	X
b) price or loan guarantees	X	X	
c) insurance	X	X	
d) forest protection agreements	X	X	
e) land tenure security		X	
B. Indirect			
1. Market information (e.g., price reporting)	X		X
2. Extension/education	X	X	X
3. Research and analysis	X	X	X
4. General forest protection	X	X	X
5. Infrastructure		X	X
6. General preinvestment support			

* Although these types of incentive measures may not directly reduce costs, they do reduce the uncertainty surrounding investments in forestry and thus can influence decisions of private entities, particularly those with high risk aversion characteristics, such as the rural poor. These are direct incentives since they are tied to some action on the part of the private entity.

Source: Gregersen, H. and T. Houghtaling, "Government subsidies to stimulate forestry at the farm and community level." Paper presented at the Eighth World Forestry Congress, Jakarta, Oct. 1978.

Regarding the possibilities and considerations for success in forestry investments, Gregersen and McGaughey (1985) point out that a successful forestry investment program requires commitment on the part of the government, clear public policy guidelines for investment and financing, and institutions that can manage the programs.

These three points are fully as important to keep in mind as is the design of incentive mechanism at the farm level to elicit investment in tree planting. Review of projects worldwide reveals all too clearly the failures that result when top level political support is missing or when institutional capacity to absorb a large infusion of resources is not adequate for the tasks at hand. While the focus of this paper is not on generating political support, it is still strongly stressed that the "incentive" of the political leaders to promote or at least support tree crop projects is a critical factor which needs to be addressed in Central America. If that incentive is lacking, then projects of a large enough scale to be meaningful in terms of meeting the identified needs will not be forthcoming. Further, the political incentive has to be strong enough to be translated into hard commitment for funding and staff support; mere participation in a few tree planting ceremonies is not enough to support action programs. Thus, extension activity for the farmer is critical for action, but so is public education aimed at the high level political figures that control the power and resources of the countries. They need to become aware of the benefits of tree growing.

Some countries have demonstrated that a sustained effort can, within a period of one or two decades, produce enough fuelwood, timber, and other forest products to adequately satisfy domestic demands and ensure protection of vulnerable watersheds. In relation to meeting local fuelwood needs, China, Korea, and India are three outstanding examples (FAO a,b, 1978; FAO, 1980; Spears, 1983; Gregersen, 1982).

Promoting the proper incentives to encourage individual farmers and communities in Central America to start planting trees is important and requires not only an analysis of the various ecological physical factors which interact in wood production, but also investigation of such socio-economic phenomena as land tenure systems, social organization and its effect on land-use, minimal appropriate economic farming unit sizes, traditional land-use practices, and so forth.

In areas with high population pressures and limited soil fertility the land holdings may be too small for viable individual production. It might be necessary to implement some form of cooperative effort. If part of the production is designated for cash markets, proper marketing channels and facilities will be needed.

In a large fuelwood planting programs, market instabilities may be created if a sustained yield, long-term planning program and an investment program are not implemented. This is critical for industries that need a uniform flow of fuelwood over time. Uncertainties in this regard can translate into financing problems, particularly when dealing with private credit institutions.

Figure 2 shows the investment cycle for a forest plantation and the critical moments in time when financing problems can arise. In the case of short rotation fuelwood plantations, the period of maintenance with negative cash flow can be reduced by implementing other production by combining annual crops during the first years of establishment (like taungya) or other agroforestry systems. It would allow the farmer to reduce the costs of tree protection and weeding costs in the earliest phase of plantation. It would also give him an extra income during the critical period. This should yield a positive cash flow depending on the combination grown and the marketing possibilities for the crops produced. General types of financing problems that can be founded in the Region, together with suggested ways of overcoming them are shown in Table 2.

In Central America, experience shows that reforestation can succeed on private land holdings if proven species and simple techniques which produce concrete financial, agricultural and other economic benefits are made available. For example, in the highlands of Costa Rica cypress (*Cupressus lusitanica*) and alder (*Alnus jorullensis*) plantations are prevalent and have been used for a long time. Farmers recognize the wind break effect, soil protection, and grass improvement benefits these trees provide to traditional dairy farming operations. In addition, the wood they produce creates extra income. The subsequent establishment of a sawmill and furniture factory based on the cypress and alder plantations have encouraged more plantings of these species in different areas.

Some projects in Central America have demonstrated that farmers will increase tree planting, once the species, techniques, and benefits are clearly demonstrated. Seedlings are made available, and frequent technical communication is maintained between the farmer and the extension agent. Such is the case in the La Maquina plantation in Guatemala, on the Azuero Peninsula of Panama, in the Hojancha watershed and the San Ramon region of Costa Rica, and many other areas throughout the isthmus. In Costa Rica, several cooperatives have begun to produce and distribute tree seedlings in response to the demand from co-op members.

Based on an evaluation of eleven cases of reforestation in Central America (Tschinkel, 1984), it is recommended that any project that tries to encourage small farmers to plant trees should consider including the following features:

- Selection and demonstration of species and techniques that can be readily incorporated into and will enhance current agricultural practices, and that will therefore not compete for agricultural land.
- Use of species that grow visibly faster than those known to farmers, that provide multiple products and that are easy to propagate and transport.

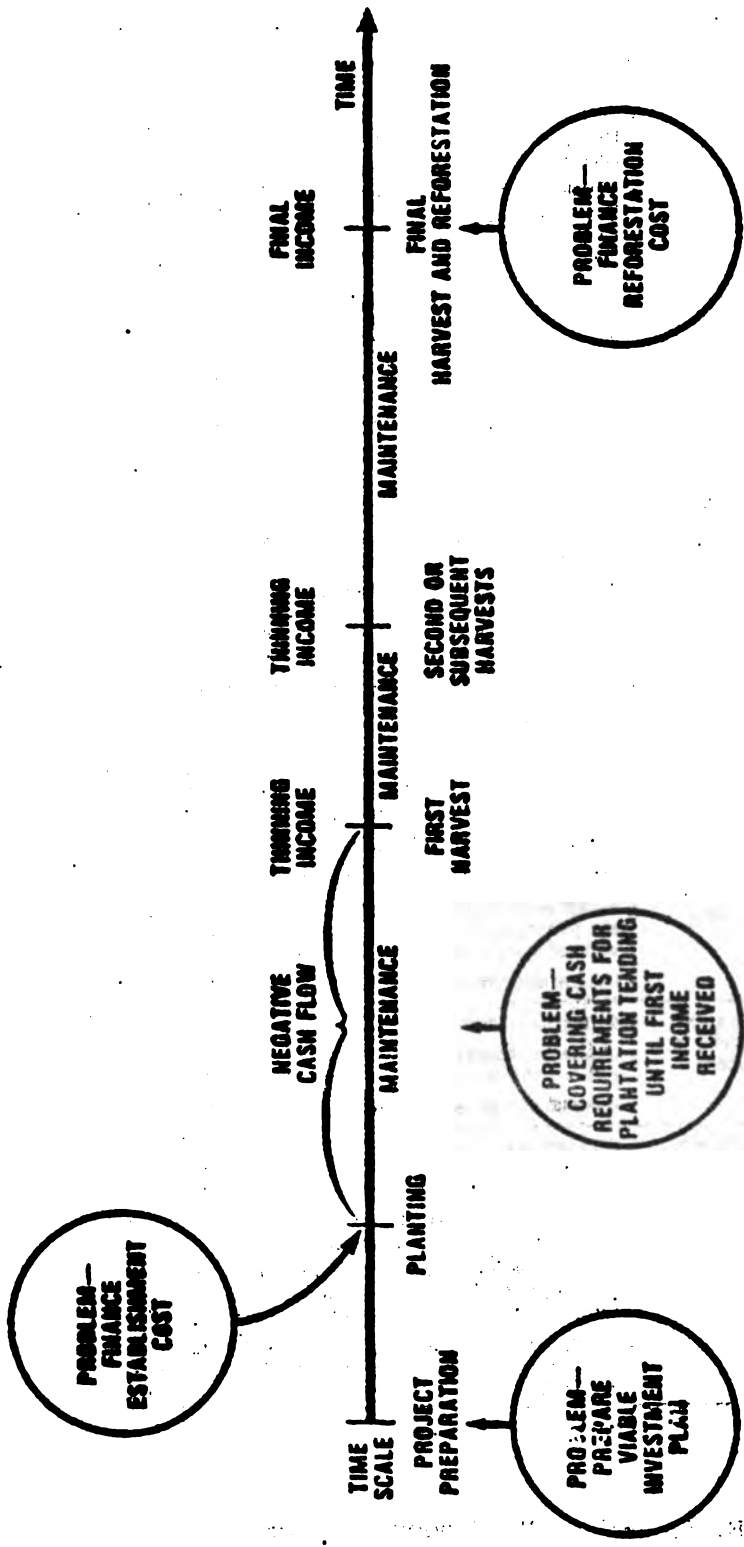


Figure 2. Key problems in forestry project financing.

Source: Gregersen, H. M. and S. E. McGeaghey, 1985.

Table 2. Financing Obstacles and Opportunities.

Obstacles related to financing:	Opportunities (to improve conditions):
1. Financing institutions lack familiarity with forestry.	<ul style="list-style-type: none"> • develop better information on sector opportunities, risks, performance, preinvestment funds, sector studies. Use demonstration projects • educational efforts (possible technical assistance efforts); make financial institutions aware of sector characteristics, opportunities, risks, available support mechanisms, preinvestment funds
2. Many potential borrowers lack credit worthiness.	<ul style="list-style-type: none"> • develop new forms of loan guarantees (e.g., international funds used through country government; guarantees through co-operatives, preinvestment funds) • extending credit on basis of standing trees backed by insurance against loss due to fire, theft • move toward integrated projects which include industrial plant and equipment
3. Financial institution rules which do not meet needs of sector (e.g., related to interest rates, disbursement and grace periods).	<ul style="list-style-type: none"> • move toward project types involving tree species with shorter financial rotations (shorter gestation periods) • introduce policies that permit longer grace and disbursement periods • develop integrated project packages which permit repayments to be speeded up through use of retained earnings from parts of project with short maturation period. (when initial plantations mature, wood operations often become self-financing) • wood processing company financing of smallholder tree farming with guarantees or incentives from government. (Companies generally do not have time restrictions of financial institutions, if return is right)
4. High levels of uncertainty related to the long time period involved (due to inflation and devaluation fears, increased chance of losses due to unforeseen circumstances, changes in government policies over time, market uncertainty).	<ul style="list-style-type: none"> • require higher rates of return to compensate for higher risk and uncertainty (normal procedures) • use insurance schemes, to cover losses due to fire, insects • use government guarantees and incentives • market uncertainty can be reduced through future markets; also pointing out that great flexibility exists in terms of holding wood on stump until good markets develop • improve land tenure conditions and land use security
5. Some individual investors are too small to be handled efficiently by conventional loan institutions.	<ul style="list-style-type: none"> • develop global credit schemes • include smallholder in larger scale integrated development projects or umbrella projects (rural development and others) • demonstration projects e.g., use IDB small projects program
6. Lack of adequate returns to compete for private funds.	<ul style="list-style-type: none"> • if no particular social benefits exist (beyond normal ones associated with commercial projects competing for funds) then follows commercial financing schemes in attempt to: <ul style="list-style-type: none"> • develop integrated project packages where total return is great enough (e.g., integrated forestry-forest industry) • develop other innovative project packages (e.g., where immediate harvest returns from old growth helps bring up return—and helps finance subsequent plantations) • if particular (important) social benefits are associated with projects. Then provide fiscal incentives to bring rate of return up to commercial standards

Source: McGaughey, E. S. and H. M. Gregersen, 1983.

Very personal, intensive extension service with frequent follow-up visits until the farmer has achieved confidence with his tree plantation. Careful coordination of agricultural and forestry extension so as to ensure the essential integration of tree planting with agricultural practices.

Initiation at a modest scale, amenable to detailed monitoring with very intensive extension aimed at creating a few successful, highly visible demonstration on the land of some of the more progressive farmers.

- Plants readily available, on time, either free or for sale. Other incentives kept at minimum needed to sway already interested farmers.

ASSESSMENT OF INCENTIVE MECHANISMS FOR CENTRAL AMERICAN COUNTRIES

All of the above examples from Central America are basically anecdotal, isolated examples, picked up informally and incidentally during field visits. It is recognized by many that fuelwood and multipurpose tree growing demonstration activity undertaken by countries through the Fuelwood Project has had positive results in some areas and much less favorable results in other areas. However, no systematic assessment or evaluation of experience to date has been undertaken. Such an assessment is a first step in developing the background information needed to design effective incentive mechanisms for the Region. In other words, first learn what incentives have worked under what conditions, and then design mechanisms that can be used to deliberately introduce such incentives into future programs so they can work elsewhere and with others. This parallels the approach of farming systems research, where best practices are observed in the field, they are improved upon by research, and then they are extended in their improved form back to the field.

The Central American Fuelwood Project and its successor, the Tree Crops Project, have created a unique opportunity to build up a set of data related to the socio-economic environments in which tree growing demonstration activity has or has not been associated with effective incentives for tree growing. Already available is biological/silvicultural and some cost information generated for the demonstration plots (over 940 in total) established by the Fuelwood Project. Also available through interviews and reports are the experiences and observations of the field personnel who were involved over the past six years in the demonstration activity. These data sources can be combined with socio-economic data generated through field surveys to provide an overall data base that should be adequate to carry out an assessment of what types of incentives do and do not work under the conditions (or in the environments) of given demonstration plots or areas.

Systematic analysis of the data should lead to identification of incentive types. The next step then involves design of mechanisms (see Table 1) that could be introduced under the various conditions found in the demonstration plot environments to provide the identified types of

incentives. Such design naturally has to consider local institutional constraints — legal, social, and financial, among others. The final step is then to prepare incentive packages for testing in the field. The actual introduction of the incentive packages into local environments will, of course, hinge on active involvement of various governmental decision-makers. Thus, one gets back to the point made earlier: we cannot neglect the incentive systems and the education of high level officials and politicians.

The above provides a framework for i) developing information on incentives that actually work and then ii) designing incentive packages for Central American countries. If implemented, such an assessment and design program should go a long way towards establishment of a more productive environment for tree growing in Central America, where the incentives — both market and nonmarket — will exist for widespread investment in tree cropping, and perhaps for reduction in the current trend of harmful deforestation.

CONCLUSIONS AND RECOMMENDATIONS

The fuelwood crisis affecting many developing countries in tropical areas is a complex problem. A strategy is required to overcome the problem. Many programs and projects that have encouraged and supported reforestation for local community development in Central America serve as examples of what can be done. Furthermore, in several countries success has already been achieved in both large-scale reforestation programs and small-scale tree planting activities by farmers and communities.

Nevertheless, many problems remain to be solved. Enough is known to justify an increase of current reforestation rates in most developing countries in the near future. However, the process of learning and identifying the requirements for success in forestry projects is still at an early stage. Better understanding is required of the different economic, social, physical, and organizational constraints affecting specific regions.

The successful forestry projects described in this paper show that the common key of success is an appropriate selection and implementation of incentives and subsidies. They must meet the needs and constraints of local populations. Greater attention should be given to creating incentives for local participation and ensuring that communities are involved in project planning and implementation.

Project design for incentives must be based on sufficient knowledge of local, cultural, and ecological conditions as well as people's perceptions and attitudes. As demonstrated in many social forestry projects, people will not participate in tree planting or related activities if they do not perceive it to be in their interest.

A program of assessment and design of incentive mechanisms in Central America is proposed. The program, building on available data from earlier projects, could go a long way toward establishing a more positive environment for tree growing and a more negative environment for harmful deforestation.

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