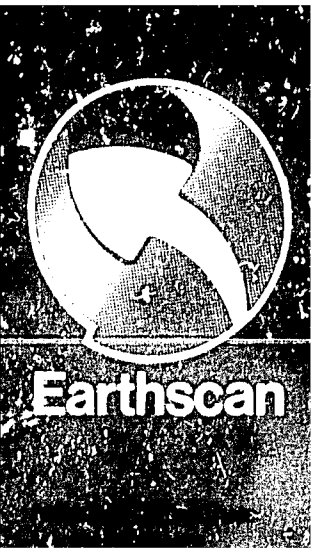

FARM AND COMMUNITY FORESTRY

Gerald Foley
Geoffrey Barnard

Technical Report No.3

FARM AND COMMUNITY FORESTRY

EARTHSCAN — INTERNATIONAL INSTITUTE FOR ENVIRONMENT AND DEVELOPMENT

Watering tree seedlings at a community forestry nursery in Thailand.

Photo: Peyton Johnson/FAO

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Foreword

The purpose of this report is to provide a review and appraisal of the experience to date with farm and community forestry.

The first section, entitled General Appraisal, has been written to give an overview of the whole report. The subsequent three sections contain a more detailed examination of the main issues raised, using examples from different countries. A brief review of some of the main national programmes is provided in Part V. A more extensive listing of projects currently underway with funding from international donor agencies is presented in the Appendix.

A variety of labels have been used to describe the efforts made in recent years to involve rural people in tree growing. In this report, the composite title 'farm and community forestry' is used. This is intended to encompass the full range of approaches which have been tried, both at an individual and a community level.

The term 'social forestry', which has been widely used in the past, is deliberately avoided. This is because many people now feel it to be misleading since it implies that any form of tree growing by farmers or local communities automatically brings social benefits. This is not necessarily the case. With the expression 'farm and community forestry', no assumptons about the effects of programmes are made; indeed, assessing the impact of different types of programmes is a central theme in the analysis.

A major part of the present text is based upon a study of farm and community forestry commissioned by the Forestry Department of FAO. This was carried out between February 1983 and May 1984, and involved a comprehensive literature review together with field visits to projects in several countries. An interim draft of the report was produced in May 1983 and widely circulated for comments.

The study was made possible by funding from the Swedish International Development Authority, the Netherlands Foreign Ministry, FAO, and the US Agency for International Development, to whom grateful acknowledgement is due.

An enormous debt of gratitude is also owed by the authors to the many people who helped with all stages in the preparation of the report; a full list is given in the Acknowledgements. Particular thanks are due to Mr J.E.M. Arnold of FAO, for his support and guidance throughout the project. Responsibility for the view expressed here, however, rests entirely with the authors.

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PART I

GENERAL APPRAISAL

1.0 GENERAL APPRAISAL

Over the past decade, farm and community forestry has emerged as one of the principal responses to the problems caused by the widespread loss of trees and forest cover in the developing world. Its aim is to help people solve their own wood supply problems, meet their own needs, and preserve the environment in which they live by planting trees on their farms and around their villages.

Programmes to promote tree growing in rural areas have been launched in more than 50 countries. These have shown that farm and community forestry can work. Under the appropriate conditions, it has proved itself to be an effective means of providing substantial individual and communal benefits.

But it is also evident that it is an approach which is far from easy. Some programmes have failed completely. Others have had unexpected, and sometimes undesired, side-effects.

This report is an attempt to provide a systematic appraisal of the experience gained to date with farm and community forestry. Its intention is to examine the different programme approaches which have been used, and to analyse the contextual and other factors which determine their scope and limitations.

1.1 Why Farm and Community Forestry?

In dealing with the problem of tree depletion, conventional forestry services are severely restricted in their scope for action. Shortages of manpower and resources mean that few forest departments can consider replanting on the scale necessary to have a significant impact in combating deforestation or meeting the growing demands for tree products.

Moreover, the mandate of forest services is normally restricted to the confines of designated forest reserves. But the need for trees is widely dispersed, extremely varied, and specific to the people involved. Trees have to be grown not just in large plantations and forest reserves, but where they are accessible to those who need them.

Farm and community forestry offers a new approach to dealing with these problems. By assisting rural people to plant trees themselves, the costs of reforestation can be reduced. It allows tree growing to be extended beyond the boundaries of official forest reserves. More importantly, it enables families and communities to decide their own priorities, and grow the types and numbers of trees they choose in the locations they feel are most relevant to their needs.

Farm and community forestry can cause difficulties for forestry services in that it demands unfamiliar skills and changes in attitudes on the part of many officers. But it also opens new and challenging possibilities. It creates an opportunity to break down the barriers of mistrust and antagonism which often exist between forest services and the public, enabling the resources and expertise of foresters to be utilised and made relevant to the community in a way that has seldom happened before.

1.2 The Emergence of Farm and Community Forestry

One of the first countries to embark on a major community reforestation programme was the Peoples' Republic of China. A massive nationwide campaign was launched during the 1950s as a means of replenishing the country's stock of trees after the depletion caused by the previous decades of war, neglect, and over-exploitation.

The programme was carried out, for the most part, by the communes and collective production units established by the new government. Immense publicity was given to the campaign and the areas of forest planted or restored were reported to be extremely large. Although some doubt has recently been cast on the exact magnitude of some of the achievements claimed during the years of the Cultural Revolution, there is no question that in many areas they were very substantial.

The Republic of Korea provides another example of a nationwide tree growing programme which achieved dramatic results. The need for substantial tree growing efforts became apparent in the 1950s and early 1960s, when it was recognised that the country was running into acute wood scarcities and environmental problems due to the rapid deforestation then taking place. In 1962, the promotion of reforestation, on a communal basis, was adopted as a major national priority.

Substantial progress was made during the 1960s but much still remained to be done at the end of the decade. A ten-year National Forest Plan was therefore launched in 1973 with a series of ambitious planting targets. Intensive efforts were made to mobilise village level support and collaboration. By 1977, the basic targets of the Plan had been reached, five years ahead of schedule, though at costs which were higher than originally envisaged.

In India, also, the possibilities of farm and community forestry began to be explored during the 1960s and early 1970s. One of the most significant among these early initiatives was in Tamil Nadu. The state of Gujarat also had a pioneering role, with various types of schemes being devised and promoted. By far the most successful, in terms of the numbers of trees planted, has been the farm forestry programme which is based on encouraging commercial tree growing by farmers on their own lands.

In the Philippines, also during the 1970s, efforts were being made to involve small-holders in tree growing to supply wood to a pulpmill owned by the Paper Industries Corporation of the Philippines (PICOP). Under this scheme, farmers were provided with loans to cover the cost of tree planting, together with seedlings at cost price and technical assistance. The Corporation also guaranteed a minimum market price for the wood produced.

1.3 The Growth of International Support

By the late 1970s, a number of the major international aid agencies had also become convinced of the urgent need to support farm and community as a way of responding to the impending crisis of tree depletion throughout the developing world. The publication in 1978 of the World Bank's 'Forestry Sector Policy Paper', with its acceptance of the need to promote forestry as a means of providing for the broader needs of rural people, particularly the poor, marked a significant shift in emphasis in forestry funding.

The World Forestry Congress held in Jakarta, also in 1978, added to the momentum being built up in the promotion of community forestry with its theme "Forestry for the People". The concept of community forestry was also actively developed and promoted by FAO through its programme of Forestry for Local Community Development. The scope, objectives, and philosophy of this programme, with its emphasis on self-help and community engagement in small-scale tree growing, was set out in the 1978 Forestry Paper, "Forestry for Local Community Development" where it stated that:

> "...the objective is to raise the standard of living of the rural dweller, to involve him in the decision-making processes which affect his very existence, and to transform him into a dynamic citizen capable of contributing to a wider range of activities than he was used to and of which he will be the direct beneficiary... Its ultimate objective is not physical but human. The physical goals which will be set are really means towards achieving the objective of enhancing the lives of human beings" (FAO 1978).

A major change in attitudes to tree growing programmes thus took place during the 1970s. At the beginning of the decade, international aid for farm and community forestry was negligible. Of what little there was, most came through private agencies and voluntary organisations. By the late 1970s, however, funding from international agencies was being chanelled in increasingly large amounts into a variety of different programmes. Many national governments were also taking steps to reorientate their forestry policy towards a greater emphasis on community involvement and basic needs.

In the last ten years, more than 130 programmes have been initiated in over 50 countries. The total amount of funding committed by international donor agencies to farm and community forestry and related activities is in excess of $750 million.

1.4 The Vital Role of Trees

The basic reason for the rapid expansion of interest in farm and community forestry is the increasing recognition of the complex and vital role played by trees in most developing countries. Much has been written about the importance of the world's forests. But trees which grow outside the established forest areas also perform a critical function.

These trees, dotted about the rural landscape, around houses, along field boundaries and roadsides, and in communal grazing areas are seldom recorded in forestry statistics. Yet for the majority of the rural population they are probably of even greater significance than the forests themselves.

Their importance in supplying domestic woodfuel is obvious. In most developing countries, virtually every rural family uses wood for all or part of its cooking and heating needs. In the majority of Third World cities, too, wood and charcoal remain the predominant cooking fuels.

Industries such as tobacco curing, tea and coffee drying, brick making and many others often rely entirely on locally obtained woodfuel. In the towns, there are restaurants, tea shops, bakeries, and other commercial enterprises to add to these demands. In some of the poorest countries, woodfuel accounts for more than 90% of total national energy consumption.

Trees also supply a variety of other important wood products. Wooden building poles, for example, are used extensively both in rural and urban areas. Timber is used by small industries in making furniture, packing cases, agricultural implements, and numerous other products. Larger industries such as paper-making, rayon, and match-making also use considerable quantities of locally-grown wood.

But trees yield many other products and benefits besides wood. Fodder for animals is often the most important. A wide range of foods are also obtained from trees and forest areas, some of which are essential in preserving the nutritional balance in traditional diets. They include leaves and pods, fruit, nuts, honey, insects, and game. Many communities also depend on trees to provide fibres for making ropes, mats, wall coverings, and other woven goods.

In farmlands and grazing areas, trees provide shade for people and animals; they also act as windbreaks, shielding crops and preventing soil erosion. They slow down the run-off of rain, protecting the soil and increasing the

infiltration of water so that ground-water stores are replenished. They also act as nutrient pumps, drawing essential minerals from the subsoil and depositing them, through their leaf-fall, in surface layers where they are accessible to other plants.

No rigid specification of the optimum, or 'correct', number of trees for a particular area is possible. Places where the climate is benign and the soils are stable tend to have less need of the environmental protection of trees than those where the soil is thin and fragile. People who do not use fuelwood, and can afford to purchase most of their other living requirements, are less dependent on the products trees provide.

But for those living at or near the subsistence level, trees are often the only source, not just of products which ease the burden of living, but of some of their very necessities of life. As tree resources are depleted, the supply of these essential products becomes scarcer. The landscape becomes more vulnerable to erosion and degradation. The conditions of life deteriorate and the means of dealing with them are reduced.

1.5 Traditions of Tree Cultivation

Tree growing by rural people is not, of course, entirely dependent on the stimulus of outside intervention. Spontaneous tree cultivation occurs to some extent virtually everywhere there are traditions of settled agriculture. In some parts of the world, it is done in an extremely sophisticated manner, and on a large scale. Even where climatic conditions are difficult, farmers usually grow some trees on their land and around their homes.

Some of the most elaborate tree cultivation systems are found in the 'home gardens' of South East Asia, notably on the island of Java. These consist of multi-layered mixtures of a large number of food, fodder, and timber species, grown in close association to make maximum use of the available sunlight, nutrients and land.

In Costa Rica, and other parts of Central America, trees are traditionally grown to provide shade for coffee plants. Farmers also plant trees along the boundaries of their fields as live fences. These are pruned and used as a source of fuelwood and fodder. Many farmers also grow a few timber trees as a long-term investment.

Elsewhere, traditions of tree cultivation may be less highly developed, but trees are nevertheless widely grown to provide wood, fruit, animal fodder, windbreaks, and a wide range of other reasons. A notable feature of these traditional practices is that tree growing is rarely centred on any single purpose; trees are usually selected and grown for their ability to provide a number of benefits.

1.6 The Depletion of Tree Resources

Over increasingly large areas, forests are under threat and tradicional systems for managing tree resources are breaking down. The reasons vary widely, and in most cases a number of interacting causes are to be found. Understanding the nature and dynamics of this depletion process is an essential preparatory step if effective action to counter it is to be taken.

The greatest pressure causing the destruction of tree resources is usually that of land hunger. Driven by poverty and their lack of alternatives, landless people are crowding into wooded lands virtually everywhere throughout the developing world. In some countries, wherever trees can be felled to provide land for agriculture they are at risk. Economic pressures and the fragmentation of land holdings are leading to the collapse of formerly stable tree cultivation systems.

Grazing animals are also placing severe pressures on open woodlands in many parts of the world, especially in the arid and semi-arid regions. Where formerly these animals could be accommodated without major problems, their increasing numbers, concentrated into ever smaller areas, are now over-stressing the natural ecosystem. The result is that areas which previously supplied fuel, animal fodder, and other tree products are rapidly declining to a state where they can meet none of these needs.

Fuelwood gathering has sometimes been cast as the major culprit in tree depletion. In practice, this is rarely the case; other and more destructive forces are usually at work as well. In most countries it is only in areas of concentrated demand, where there is also a commercial incentive to cut trees, that fuelwood collection is the dominant factor in the destruction of wood resources.

Most often, the breakdown of the traditional equilibrium is a result of a combination of factors. As the agricultural frontier is extended, there is a steady reduction in the available stock of forest resources and tree-growing land. At the same time, increased population leads to a growth in demands for wood, fodder and other tree products which have to be met from the remaining tree resources. Once the natural renewal capacity of the trees in an area is exceeded, the two pressures combine in an accelerating process of depletion.

1.7 Constraints on Tree Growing

There is abundant evidence that, almost everywhere, people appreciate the value and usefulness of trees, and know how to grow them if they want them. The assumption that major educational efforts are needed just to convince people that trees are beneficial is rarely justified.

If they are not growing trees, it does not mean that they are unaware of the problems of disappearing wood resources or are unconcerned about their own future. It is far more likely that there are good local reasons why they are not able to grow them, or have other more urgent priorities. Establishing why more tree growing is not taking place spontaneously is one of the most important steps in planning farm and community forestry programmes.

One of the most basic reasons is that many of the areas in which tree resources are under greatest pressure are common lands. Without effective community collaboration, it is virtually impossible to devise schemes by which the wood resources on these lands can be managed and renewed. Where this collaboration is absent, individual farmers have no means of protecting any trees they plant from being cut and used by others.

Even on their own lands, farmers may have a number of reasons to feel that growing trees will do them more harm than good. They may be afraid, for example, that trees will attract colonies of seed-eating birds. Where land holdings are small, they may feel that the competition of trees for water, sunlight, or nutrients will lead to an unacceptable reduction in crop yield.

Where people have doubts over the ownership of land they are farming, they will almost certainly be unwilling to make the long term investment involved in tree growing. This is particularly a problem for marginal farmers on upland and degraded areas who are often there as squatters with no legal entitlement to the land they farm. The same reluctance to plant trees is often felt by tenant farmers with no permanent rights to their holdings, or to the trees they grow on them. Traditional rights which entitle people to graze their livestock over neighbours' lands at certain times of the year can also make tree growing virtually impossible because of the difficulty of protecting seedlings.

There may also be a variety of legal constraints to tree growing. In some countries, the government owns all the trees, whether they are on private or public lands. Farmers have no rights to cut trees, even if they plant them themselves, without going through the lengthy process of obtaining official permits. Laws of this kind, originally designed to protect forests, can actively discourage tree growing.

In some cases, the greatest obstacle to tree growing may simply be that farmers do not regard it as a priority. This is particularly the case where tree growing is difficult and conflicts with the needs of crop production. In places where farm workers migrate for part of the year to obtain paid employment elsewhere, staying at home to look after seedlings can also mean a substantial loss of earnings. If tree products can still be obtained from nearby forests or common land, whatever the longer term depletion outlook, such sacrifices may be too much for people to make.

A clear recognition of the constraints acting against tree growing programmes is essential when designing farm and community forestry programmes. This does not mean an acceptance that constraints can never be removed. Indeed, removing the barriers to tree growing may be the central function of the programme. But when it is not possible to remove the constraints, the limits to action they impose must be recognised so that programmes are matched to the realities of local circumstances and tailored accordingly.

1.8 Approaches to Farm and Community Forestry

In the work to date, a number of basic lines of approach have been developed to meet the requirements of different contexts and programme objectives. These can be classified under four broad headings:

* farm forestry
* tree growing for family uses
* community forestry
* land allocation schemes

In practice, these categories are not rigidly defined or mutually exclusive. Programmes have often combined several in order to widen the total impact and achieve a broader range of results. Nevertheless, each approach offers different possibilities and is subject to its own particular limitations and constraints.

1.9 Farm Forestry

Farm forestry is the term usually applied to programmes which aim to encourage commercial tree growing by individual farmers on their own private land. In these programmes, trees are regarded as a cash crop, and farmers are provided with assistance in growing them. This may include technical help, free or subsidised seedlings, loans and various market support measures.

There is no doubt that under the appropriate conditions, where there is a strong market demand for wood, tree growing can be a profitable activity. This has already been demonstrated by the successful programmes carried out in the Philippines and India, and promising initial results obtained in Haiti.

The achievements in India have been particularly impressive. In a number of states, demand for seedlings has expanded rapidly as a result of the high rates of return that can be obtained from commercial tree growing. In Gujarat, alone, nearly 200 million seedlings were distributed during the 1983 planting season.

The advantages of farm forestry are considerable. Programmes tend to be simpler to design and run than community based schemes, so costs are usually lower. At the same time, visible returns, measured by the number of trees planted, are often greater. When a programme is successful, it can also become self-supporting, so that the need for subsidies and other support measures diminishes as the financial attractions of tree growing become more obvious to local farmers.

Farm forestry has, however, come under considerable criticism. One reason is that its benefits tend to be concentrated on the richer farmers, as they are better able to devote land to tree growing and can more easily provide the necessary inputs. Though small farmers are not excluded from farm forestry, since they are usually able to plant a few trees, their ability to take advantage of its profitability is inevitably constrained by their lack of resources.

Another criticism of farm forestry is that it often fails to provide the fuelwood and fodder needed by the rural poor. This is because farmers will generally choose to grow the kind of trees that give them the highest rate of return, and when they come to harvest them they will sell them to the highest bidders. Thus, in India, farmers are mainly growing eucalyptus for the urban pole market, or to supply rayon and pulp mills. In such cases, the only addition to local supplies is from the waste and trimmings when the trees are prepared for sale; and in the case of production for rayon, there is virtually nothing left over as the whole tree is taken by the factory.

Widespread adoption of farm forestry can also reduce the local employment opportunities, since tree growing generally requires less labour than food crops. Indeed, one of the reasons why wealthy farmers are turning to farm forestry in India is precisely because it reduces their labour costs and the problems of farm management.

Farm forestry may also be intrinsically unsuited to meeting the environmental objectives sometimes set for it, since tree growing for the sake of individual profit will tend not to take place on the poorest lands, and the areas under greatest environmental stress. Instead, it will be carried out in areas where the yield and profits can be most easily maximised, which is normally on the well-protected and more fertile land.

Part of the reason for the criticisms that have been voiced is that those promoting farm forestry have, at times, suggested that it automatically provides widespread social and environmental benefits. It is clear that this is not the case. Programmes need to be designed so that they actually do involve the smaller farmers, and explicit provision has to be made for the poor if there is a likelihood that they will suffer as a result of tree growing by their more wealthy neighbours.

1.10 Tree Growing for Family Uses

A number of programmes have been based on encouraging tree growing by individual farmers to meet their own family uses. This is done in areas where commercial tree growing is limited by the lack of an adequate market demand for wood. Programmes therefore have to rely primarily on non-market incentives.

Results so far have been mixed. While it is nearly always possible to promote some tree growing, progress tends to be less dramatic than with farm forestry. The scope for programmes is also difficult to predict in advance. In some, the number of trees planted has fallen well short of planners' expectations.

One lesson that has emerged is that fuelwood scarcities, by themselves, rarely seem to be a sufficient incentive for people to grow trees. Where they have adopted tree planting, people more often cite other factors as their primary motive. The exact reasons vary from place to place. In some areas, poles, animal fodder, fruit, and other tree products provide the main incentive; in others, people plant trees for shade or for fences and windbreaks. In such cases, fuelwood is usually seen as a useful byproduct from tree growing, rather than its principal justification.

Programmes of this type therefore depend heavily on the careful identification of the tree species most suited to meeting local needs and preferences. Their greatest potential almost certainly lies in promoting the cultivation of trees which provide multiple benefits rather than simply fuelwood.

1.11 Community Forestry

Community forestry programmes are based on the use of public or communal lands for tree growing. Though generally designed to meet community needs, programmes can involve very different levels of community involvement and participation.

At one end of the scale are those in which the impetus for the programme comes entirely from the promoting agency, and community involvement is largely passive. The bulk of the planting and other work is carried out by the forestry service, which may also be responsible for arranging the harvesting and disposal of the final crop. In other programmes, the level of community participation has been much higher, with the forestry department playing a mainly catalytic role in stimulating and facilitating organised community action.

In areas where there is a commercial wood market, communal programmes often rely on the same commercial incentives as farm forestry, with the main aim

being to maximise the financial returns from the plantation. Under favourable conditions, the cash benefits to the community can be substantial, and may be used for projects such as schools, water supplies, and health care facilities.

Such commercially-oriented programmes are, however, subject to many of the same limitations and criticisms directed at farm forestry. They can work to the disadvantage of the poor unless careful measures are taken to ensure that they do not. This can happen, for example, if poor people are excluded from communal grazing grounds that have been turned over to tree growing without alternatives being made available. As well as losing an important fodder source, they may be unable to benefit from the products from the plantation because they cannot afford to buy them.

Where there is no market incentive to grow trees, communal programmes may be based on a variety of other social or environmental needs. In some cases, plantations have been established entirely at forest department expense, with local people being paid for their work in planting and protecting trees. Other schemes have relied on voluntary contribution of labour, and various 'food for work' arrangements.

Communal programmes, in principle, offer a number of advantages over individual tree growing. By using community lands and resources they can permit landless people to share in the benefits of tree growing. They can also provide a focus for community action to halt the gradual degradation of common lands through over-grazing and excessive wood cutting.

Nevertheless, many community programmes have run into severe problems. This is generally because they require a degree of commitment to a common effort which is often very hard to reach. Establishing the necessary unity of purpose, obtaining effective collaboration in the work of tree growing, and ensuring that there is an equitable distribution of benefits can be very difficult at times.

It is important, however, that the unsatisfactory record of some programmes is not allowed to conceal the real achievements of others. Community programmes will always require a great deal of painstaking preparation. They will rarely produce the spectacular results of the intrinsically easier farm forestry programmes with which they are often compared.

But almost all the different types of community programmes offer opportunities for broad-based socially and environmentally relevant rural development. The main lesson from recent experience is not that community programmes should be abandoned, but that their design and implementation should be improved.

1.2 Land Allocation Schemes

The final programme category is that in which the allocation of land-use rights is used as a way of obtaining local participation in tree growing. In some schemes the rights are given permanently; in others, they are temporary, extending for only a few years.

In most cases where land is allocated permanently, it is in areas of degraded forest, or other state-owned land that is unsuitable for agriculture. Families are allocated plots of lands on condition that they grow trees on them. The aim is to bring the land into productive use, while at the same time providing some of the poorest people in the community with a means of livelihood.

While this approach is particularly effective in meeting the needs of the poor it is restricted in a number of ways. It relies on suitable public land being available for distribution without being subject to claim by other people. It also depends on the existence of an adequate economic incentive to make it worthwhile for people to grow trees on the land once they gain rights to use it. It is therefore limited to areas where there is a strong commercial wood market.

Another type of land allocation approach is the 'taungya' system. In this, plantation workers are paid in kind by being given temporary rights to grow food crops between the rows of young trees during the first few years after they have been planted. When the trees grow large enough to shade out the crops, the workers are moved elsewhere.

The attraction of the taungya approach is that it enables plantations to be established more cheaply than would be possible using conventional techniques. This cuts the cost of replanting degraded forests, or protecting environmentally sensitive areas such as watersheds.

The inherent problem is the conflict of interest between the taungya workers and the plantation owners. After the first couple of years, the trees and crops are in direct competition and the farmers have to be moved to a new location. In the past, taungya plantations have generally only been successful in areas of land scarcity and under-employment where families have few alternative ways of making a living.

In some of the schemes operating today, however, families are provided with a package of benefits, such as schools and health-care facilities, together with a steady cash wage. When it is responsibly used, taungya can thus be attractive for those who engage in it, and an important part of an integrated approach to rural development. But programmes have to be designed to take account of the needs and aspirations of those participating in them if they are not to be labelled and condemned as exploitative.

1.13 Programme Planning and Implementation

Underlying all planning efforts, is the obvious point that programmes must meet locally perceived priorities, rather than externally imposed preconceptions. This means that adequate background data on local needs, preferences, and other relevant factors must be gathered before detailed planning goes ahead. Without this, programme designers can only proceed using guesswork and arbitrary assumptions.

Numerous programmes, for example, have been based on the belief that because fuelwood scarcities appear to be getting worse, people will automatically want to plant fuelwood species. Hence eucalyptus and other fast growing trees have been promoted, sometimes with very poor results. It now appears that people, in many cases, would have been more enthusiastic about planting trees to meet their animal fodder and other needs, with fuelwood being a subsidiary benefit rather than the prime motive.

Another important requirement in planning is the proper definition of programme goals. Simply increasing the number of trees in an area is not necessarily going to produce any significant social or environmental benefits. If programmes are intended to produce such results, the means by which this is expected to occur must be made explicit from the early design stages, and a means of monitoring whether the goals are being attained must be devised. Relying solely on numerical targets as a measure of success or failure provides a very poor indicator of whether programmes are really having their desired effects.

Farm and community forestry also requires a secure and long term foundation of trust between programme promoters and local people. Extension workers play a key role in this. Training suitable extension staff and building up an effective and sustainable back-up system is often a long and costly exercise. It is essential that this is allowed for in both the budget and time scale of programmes.

In many places, the existing forest service can provide the basis for the necessary extension network. But as foresters themselves point out, where there is a legacy of confrontation and animosity between the forest department and local people this can be a major barrier to programme implementation. Traditional forestry training is often completely unsuited to preparing officers for the role of extension workers. Radical changes in training methods will often be required; and there may also be a need to make special provisions for extension workers in the career structures of national forest departments, so as to attract the best candidates.

The potential of voluntary and non-governmental organisations in this context is something which should not be ignored. Often they can provide a much needed bridge between local communities and the authorities promoting tree growing programmes. This is particularly the case when it comes to

ensuring that the interests of women, and the poor and landless are taken into account.

These groups are rarely represented adequately, either in official governmental bodies or in traditional village councils. The support and advocacy of competent voluntary organisations with genuine roots in the rural areas can often help in making sure that programmes are designed and implemented in a manner which ensures that their benefits are distributed to those in greatest need.

1.14 Assessing the Market for Wood

Many programmes rely on the commercial wood market to provide the basic incentive for farmers to plant trees. The results of these programmes, and their implications for the poor, are quite unpredictable without a clear picture of the local wood demand system.

A factor that always needs to be taken into account is that in most rural areas, fuelwood demands are still largely met by people collecting wood from their own surroundings without cash payment. Such consumers will generally not be willing to purchase fuelwood which is produced from plantations. Neither will local farmers who are able to obtain the wood they need from their own lands be interested in planting additional trees to supply local non-commercial wood demands.

The position is changing, however, as wood is increasingly becoming a commercial commodity. This is encouraged both by worsening scarcities, and by rising incomes, which allow those who can afford it to buy fuel instead of collecting it themselves. The process of commercialisation often spreads outwards from towns, where there is a concentrated demand for woodfuel, building poles, and other wood products.

But the fact that there is a market for fuelwood does not necessarily mean that it is profitable to grow trees to meet it. Farmers will only be interested in planting for the fuelwood market when it provides an economic return equivalent to that which can be obtained from other uses of the same land. Rather than fuelwood, it is usually higher value wood products such as building poles which are first to reach a level where tree growing becomes economically attractive.

Assessing the prospects for commercial tree growing and predicting the effects of programmes therefore requires not just quantitative data on consumption, but also a knowledge of the interaction of different local demand sectors with each other and with the external demands of industry and urban consumers. It is only by carrying out a careful analysis of all the relevant aspects of wood supply and demand in an area that the full impact of programmes can be assessed.

1.15 Technical Problems

Farm and community forestry differs in a number of important respects from conventional forestry. It takes place in a dispersed fashion, rather than in centralised and easily-monitored plantations. The local farmers who plant trees may be unfamiliar with the best methods of cultivation. The harvesting techniques, rotation periods, and objectives of tree growing are also likely to be different from those of forestry plantations.

Programme design has to take these factors into account. What might prove optimal in a plantation, may be completely unsuitable when subjected to the vagaries of decentralised and largely uncontrolled planting and cultivation by local farmers. There are examples, particularly in the arid and drought-prone areas, where incorrect species choice or other technical misjudgements have led to the complete failure of programmes.

Although tree growing is relatively easy in areas with a moist climate and good soil conditions, it still cannot be assumed that technical problems will be trivial. In areas where growing conditions are difficult, local trials will always be needed before new species can be used with confidence.

Where there is pressure to push ahead with programmes, the best course of action in most cases will be to proceed using locally proven species, while at the same time running trials with promising alternatives. If these prove satisfactory they can then be introduced at a later stage.

1.16 Conclusions

Farm and community forestry is not an homogeneous entity. Rather it is a range of possibilities, the scope of which varies tremendously from country to country. It is therefore vital that programmes are based on a clear understanding of the realities of local circumstances, and of the constraints they impose on tree growing. If farm and community forestry is to fulfill its true potential, it needs to be protected from the burden of undue expectations.

In many countries there are powerful constraints that make tree growing difficult and sometimes impossible. However strong the imperatives may appear at a national level, people will only take part in tree growing if it is both feasible and attractive from their own point of view. As long as the pressures of land hunger exist, farm and community forestry is unlikely to have a significant impact in slowing or halting the process of deforestation.

Neither should farm and community forestry be regarded as an instrument of social reform which can radically alter the position of the landless and

the poor. Where there are pronounced local inequalities in income, land ownership, and influence, tree growing programmes by themselves are unlikely to change these patterns. Unless specific measures are built into programmes to favour the poor, the tendency will always be for the more affluent and powerful members of the community to derive most of the benefits.

But these limitations should not be allowed to obscure the important potential of farm and community forestry. Local tree growing allows people to become more self-sufficient in wood and other tree products, and less vulnerable to increasing scarcities and rising prices. It can provide a source of income both to individuals and to communities. It yields numerous intangible benefits in the form of shade, shelter, and enhancement of the landscape. And at a local level, it can help in halting the slide towards environmental degradation that is a feature of so many countries.

At a national level, farm and community forestry can also bring significant benefits. It provides an opportunity for stimulating economic activity in rural areas without creating a dependence on foreign markets or imported technology. In some countries it offers a means of reducing imports of paper, pulp, and other wood-based products. By helping to maintain woodfuel supplies, it can also reduce the growth in consumption of kerosene and other petroleum fuels.

Together, these benefits add up to a compelling argument in favour of farm and community forestry. There can be few countries where carefully designed programmes cannot provide significant benefits. Farm and community thus deserves to play an increasingly important part in rural development strategies in the coming decades.

PART II

THE CONTEXT

2.0 Traditions of Tree Cultivation

Tree growing by rural people is nothing new. In many societies, it has been taking place since the beginnings of settled agriculture. The extent to which it happens varies, however, throughout the developing world. It depends greatly on the local ecology, patterns of agriculture, and cultural traditions.

In some parts of the world, trees are a major element in the local agricultural system. In such cases, tree cultivation holds few mysteries for farmers who will readily adopt new species or cultivation methods once their merits are clearly demonstrated to them. In other cases, deliberate tree growing has a more peripheral or even a negligible role. Farmers may be wary of new species, or worried that growing trees on their farms will have unwanted side effects.

Whatever their extent, it is important that local traditions of tree growing are identified in the early stages of planning farm and community forestry programmes. This not only provides information on farmers' attitudes to tree growing; it also helps identify the tree species people will be most willing to plant and the products they are most interested in producing. Building on these traditions is often one of the most effective ways of stimulating additional tree growing.

2.1 Traditional Agroforestry Systems

Agroforestry is the word now widely used to describe the cultivation of trees as an integral part of cropping or livestock systems. Though the term has only been coined in recent years, the practice of growing of trees in association with crops and animals has a long tradition in many parts of the world.

One of the most highly developed forms of traditional agroforestry is found in the 'home gardens' of South East Asia. These are characterised by a multi-layered mixture of a large number of food, fodder, and timber species grown in close association, and yielding a wide variety of products. They commonly exist in small plots, located around individual dwellings. They are carefully tended and are often used for keeping poultry and small animals.

Over the whole of Indonesia, tree gardening in various forms has been estimated to extend over more than a million hectares (Wiersum, 1981). Home gardens play a particularly important role on the island of Java. Though one of most densely populated and intensively cultivated regions of the world, tree growing is a common feature throughout much of the rural areas. Home gardens now cover 20% of the total arable land on the island.

Other types of tree gardens also exist outside villages, using a combination of naturally occurring and deliberately planted species.

The Javanese cultivation of tree gardens has been described as follows:

> "The top layer is occupied by the light-demanding coconut trees, followed by fruit trees below, small trees fill in the space of the lower storey. The ground cover benefits from the remaining solar energy, while climbers make use of the patches of sunshine which come through the leaves and branches of the other plants during part of the day. Horizontally the plants are arranged in the order of their functions and daily use. Bamboos are planted in the backyard, functioning as a fence and used for miscellaneous purposes. Coconut trees are placed far from houses so that nuts do not fall on roofs or playing children. Seasonal fruit bearing trees successively provide vitamins all the year round. Non-seasonal fruit trees are arranged not far from the house to make the harvesting easier. Trees producing sour fruits for cooking are placed not far from the kitchen, usually near to the well" (Hardjosoediro, 1978).

In Costa Rica, the usual method of coffee growing utilises two separate levels of trees. The lower level consists of the leguminous species Erythrina, and provides the majority of the shade. These trees are heavily pruned twice a year, but are allowed to grow back so that they provide heavy shade for the coffee plants during the crucial period of flowering and fruit formation. Prunings are left in the fields to act as green manure. The higher level consists of more widely spaced taller trees, notably the species Cordia alliodora which are cut for their timber on a 10-15 year rotation.

Cordia is also grown with cacao, plantains, and in pasture land in Colombia, Ecuador and Costa Rica. It provides a substantial source of income for farmers who sell the logs at roadside prices of $10-20 per cubic metre. Studies of the yield of cordia grown with coffee and cacao indicate that it can reach a commercial volume of 200 cu.m. per hectare, after 20-25 years. It is estimated that there are 1 million hectares under this kind of agroforestry system in lowland tropical America (Peck, 1983).

Multi-storey cultivation is also practiced in the coffee plantations of the East African Highlands, notably on the slopes of Kilamanjaro and Mount Meru in Northern Tanzania. Here, coffee is grown in combination with banana and beans, under shade provided by tall timber species such as Albizia and Grevillea (Lundgren, 1982).

The ecological and economic advantages of combining trees with crops are numerous. In spite of these benefits, traditional agroforestry systems are, nevertheless, coming under pressure in a number of parts of the world.

Multi-level tree crops in Kerala. Photo: G.Foley/Earthscan

Trials to improve the traditional combinations of coffee plants and shade trees in Costa Rica. Photo: G.Foley/Earthscan

One of the principal reasons is the growth in population, which is causing land holdings to become smaller. A common reponse to this is to increase the intensity of cultivation of the available land. Beyond a certain point, however, this is no longer possible, and farmers may be forced to sacrifice some of the trees within their farming system to ensure the production of staple crops like cassava (Wiersum, 1981).

2.2 Farmland Tree Planting

As well as these examples of complex and sophisticated agroforestry systems, a less systematic form of tree growing on farmlands is traditionally practiced in many other countries. Numerous cases can be cited.

A survey in the villages around Morogoro in Tanzania, for example, showed that a considerable amount of spontaneous tree planting is carried out in the area. In the mountain village of Nyandira, almost every family has a private tree plantation, and most individuals claim to have planted between 100 and 1000 trees personally. Seedlings are normally obtained by transplanting them from places where they have seeded themselves naturally. The species include black wattle, eucalyptus, and various fruit trees.

In a study on farm and community forestry promotion in Tanzania, it was noted that:

> "...this village was classified by the local forestry extension officer who had never visited it, as a 'failure' in afforestation terms, since it had not requested or received seedlings from the Forest Division nursery" (Skutsch, 1983).

Studies in Malawi also show that large numbers of farmers plant trees, mainly for poles, relying frequently on seedlings produced by themselves or collected from under nearby trees. A 1982 survey showed that 40% of the rural families interviewed had planted trees during the previous five years. About two thirds had planted up to 60 trees, and a quarter had planted more than 100 trees. The majority were planted for building poles, and mostly for family uses rather than for sale. Just 15% of the people planted trees for fuelwood (Energy Studies Unit, 1983).

In Kenya, a similar survey has shown that people plant trees for fruit, timber, shade and ornament, as well as for boundaries and windbreaks. Few trees are planted explicitly for fuelwood, but farmers expect to obtain fuel from trees which have been planted for other purposes (Brokensha, Riley and Castro, 1983).

A survey in the area of Fatick in Senegal showed that the heads of extended families virtually all engaged in tree planting. The species included

eucalyptus, neem (Azadirachta indica), and a riety of fruit and nut trees. The average number planted per family was around 30. About half the families raised trees in their own nurseries, and virtually all protected or transplanted seedlings found growing naturally. About one third of the women interviewed also did some planting in their own right (Kone and Jensen, 1982).

The species Acacia albida is valued particularly highly in Senegal and some other parts of the Sahel. It is either deliberately planted or left standing when land is cleared for agriculture. Its role in the local farming system has been described as follows:

> "Its roots go mostly straight downwards rather than sideways, drawing up nutrients and using water that would otherwise be lost to local production. It provides shade for cattle in the dry season but sheds its leaves in the rainy season when agricultural crops are growing, thus providing them with humus and not competing with them for nutrients; and it produces poles, fuelwood, and fodder for local needs" (FAO, 1981e).

Studies in Panama have shown that fruit trees are planted on virtually all small farms. Trees are also planted to provide fencing poles and some firewood, and to form hedges. For the most part, the products are for household consumption; in less than 10% of families are any of them sold (Jones, 1982b).

In Costa Rica, some 48% of the farmers interviewed in a survey in the Valle Occidental said they planted trees as windbreaks. Throughout most of Central America, trees are also used extensively for live fencing (Gewald and Ugalde, 1981). The leguminous species Gliricidia sepium is particularly popular for this purpose. It is easily propagated since even quite large stakes will sprout and grow when planted along a fence line. These trees provide fuelwood and a protein rich fodder which can be eaten by cattle, though it is poisonous to horses and other animals (National Academy of Sciences, 1980). In some other countries, thorny species such as Prosopis juliflora (mesquite) are used for live fencing around farm lands.

Tree planting is widely practiced in rural areas of Nepal. Studies in the Hill Region have shown that households own an average of 28 trees each; in addition, there is an average of 31 seedlings under cultivation. Most of these trees are grown by natural seeding, or by farmers transplanting seedlings from other parts of their land (Campbell and Bhattarai, 1983b). One of the principal motives is to produce tree fodder, which is a vital element in the diet of buffalos, cattle and other farm animals.

Acacia nilotica is grown for fodder in parts of India. With this species, the seed pods provide the major nutritional element and are collected by hand for feeding to animals. Leucaena is traditionally used by small

farmers in the Philippines for backyard cattle fattening. The tree is planted along fences and boundary lines and family members cut the foliage and bring it to the cattle sheds (Peck, 1983).

Even among some of the slash and burn cultivators of New Guinea, tree planting for food, building timber, and landscaping is a deeply embedded tradition. Some eighteen different types of trees and bushes are recorded as having been regularly cultivated by one group in the central highlands (Rappaport, 1968).

The considerable traditional knowledge of rural people about the properties and uses of trees is often overlooked by planners. But as one commentary, based on observations in the arid and semi-arid areas of Kenya and India, observed:

> "All detailed studies of uses and perceptions of trees by rural peoples show that there is an extensive ethnobotanical knowledge, with a keen appreciation of species' properties, and that trees are used for a wide variety of purposes... Parts of trees are used for fuelwood and construction timber and also for tools, weapons, musical instruments, dyes, glues, medicines, poisons, fibres, fences, clothing, adornment, ritual purposes, hanging beehives, and other needs (Burley, 1982).

The baobab, perhaps, provides the supreme example of the multiplicity of uses to which a tree can be put. The leaves may be eaten raw, or dried, powdered and added to soup. The bark is also edible and is used to make a pleasant slightly acid drink. The seeds contain oil and are used in a number of ways. Leaves, bark, and seeds also have a variety of medicinal uses.

The bark is used to produce fibre. The wood, though not particularly good quality, is used to make a range of household utensils, and boats. The property of the trunks of older baobabs to become hollow allows them to be used to store large quantities of water. An estimate made in 1923 was that there were some 30 000 water-holding baobabs in one of the Western Sudan provinces. The same hollow trunk has been used as a burial place for people of special caste such as poets, musicians, and sorcerers in part of Senegal (Owen, undated).

There are even instances where trees are grown for totally spurious reasons. There is a popular belief in some countries that trees cause rain, and that tree cutting can bring about the failure of the monsoon. Though the major forest areas of the world, such as the Amazon Basin, almost certainly have an effect on regional weather patterns, there is little evidence to suggest that this occurs on a local scale.

Another erroneous belief, found even among some foresters, is that tree growing will increase the amount of oxygen in the air, and therefore make it better to breath. The reason for this belief is that during the daytime, when they are engaged in photosynthesis, trees absorb carbon dioxide from the atmosphere and emit oxygen. But the resultant change in the atmospheric level of oxygen in the vicinity of trees is negligible. Over the whole lifespan of a tree, including its decomposition or burning, trees have no net effect on the atmospheric level of oxygen at all.

2.3 Coppicing and Pollarding of Trees

In some countries, there are established traditions of coppicing and pollarding certain species. Coppicing involves cutting the tree down to its stump and allowing it to regrow, normally sending up a number of shoots instead of the original single stem. Pollarding is the technique of cutting off the crown of the tree, leaving it to send out new branches from the top of the remaining stem.

The process, as it takes place on a typical farm on the slopes of Mount Kenya, has been described in detail by Poulsen. The tree species used is Grevillia robusta which is commonly grown in the area, either by direct sowing or transplanting naturally occurring seedlings. On a typical farm they are planted in single lines or are spread across fields at a spacing of about 10 metres by 10 metres. The wood they produce is used both as fuel and timber.

About five years after planting, the trees reach a height of some 10 metres. At this stage they begin to cause problems to the farmer because they start to compete with crops for water; their shade also becomes excessive:

> "The farmer has a simple solution to this which enables him, in fact, to kill three birds with one stone. He will prune the trees severely, removing all branches until nothing is left of each tree but the naked stem, looking rather desolate, like a flag-pole without a flag. In this way he will reduce competition for water and light almost to zero and he will at the same time obtain an always welcome supply of small wood" (Poulsen, 1983).

In spite of the severity of this treatment, the trees start sprouting fresh foliage 'from bottom to top of the denuded stem, making them look like giant bottle brushes' surprisingly quickly. The crown also regrows and after a few years the tree is pruned again. This may be carried out 15-20 times over a period of up to fifty years. The trunk will continue to widen, and will increase in height, unless this is deliberately prevented by pruning it at the top. Whenever the farmer decides it is large enough, or that he wants the money, the trunk is felled and sold for timber.

Different pollarding and pruning techniques are used in other parts of the world. What they all have in common is that they enable a sustained yield of wood or fodder to be obtained from trees over a long period of time. The total lifetime contribution of a tree which is used in this may can be considerably greater than its volume if it is simply allowed to grow and then felled.

This is an aspect of tree management that conventional forestry has largely ignored. Indeed, a great deal remains to be learned about almost every aspect of the way in which rural people manage the wood resources at their disposal. At a quantitative level, the sustained yield capacity of individual trees or areas of woodland is largely unknown. Conventional forestry inventory techniques focus primarily on the measurement of stem volumes of commercial timber. But these provide little relevant information on the amounts of wood which becomes available in the form of dead wood or from trimming, coppicing, or pollarding.

2.4 Trees as Cash Crops

Trees are cultivated as cash crops in many areas. They yield a variety of products including fruit, nuts, oils, spices, fibres, medicines, and gums. In some countries, rubber, coconuts, oil palm, and other tree-based industries are a major element in the local economy. Cultivation of these tree crops is not confined to large commercial plantations; it also provides cash incomes and a means of livelihood for considerable numbers of smallholders and marginal farmers.

Tree crops also provide important byproducts. In coconut growing areas, for example, in addition to the production of copra for sale, coconut palms yield a wide range of other locally useful products. The fibre from the husk, known as coir, is used in numerous small industries for making matting, rope, sacks and other product. Leaves are used for thatching, and the shells, husks, and leaf stems often supply a substantial proportion of local domestic fuel needs.

Rubber trees are an important cash crop in a number of countries. They have a working life of about 15 years after which their productivity declines. At this stage, following a few years years rapid tapping, called slaughter tapping, they are cut and used for fuel. In the south Indian state of Kerala, such wood from rubber plantations is an key source of woodfuel for towns. The prunings from coffee plants are also used as firewood in many areas; and fruit trees can also provide fuel through regular pruning and trimming, without affecting their productivity.

The gum arabic tree, Acacia senegal, is a particularly striking example of a cash crop tree which fills a multiple set of roles in the community. It is a small leguminous tree, which grows extensively in the drier regions of

Trees are essential for shade in hot climates.
Photo: Mark Edwards/Earthscan

An ancient baobab tree in the Sahelian savanna.
Photo: F. Mattioli/FAO

the Sahel. Most trees are produced from naturally established seedlings. Traditionally it has been allowed to grow together with food crops, or it is cut low and allowed to grow back during the fallow period, thereby helping to restore soil fertility (Hammer, 1982).

The gum is tapped during the dry season by cutting and peeling a piece of bark from the branches. It is used in food and textile production, medicines, and in the preparation of paints and printing ink. It has been traded for more than 4000 years. The Sudan is responsible for about 80% of the total world output. In 1978, gum arabic accounted for about 7% of Sudan's total export earnings (GITEC, 1979).

In addition to providing gum, Acacia senegal supplies a number of other locally important products. The foliage and pods are rich in protein and are an important feed source for camels, sheep and goats, particularly during the rainy season and early dry season. The seeds are dried and eaten as vegetables. The hardwood is used for poles and agricultural implements, as well as for firewood and charcoal. A strong fibre can also be obtained from the tree's long flexible surface roots. These are used for rope and fishnets, and for lining wells (National Academy of Sciences, 1980).

In recent years, despite its valued role in the local economy, the system of Acacia senegal cultivation is reportedly being abandoned in some areas. This is a result of the combined effects of shortening fallow periods and increased cutting for sale as fuelwood (Hammer, 1982). In other areas, Acacia senegal is being displaced due to the increased cultivation of groundnuts, wheat, and other crops, using modern intensive agriculture techniques which provide a better cash return than the gum arabic (GITEC, 1979).

2.5 Producing Wood for the Market

Farmers grow trees to produce wood for the market in some countries. Usually, this is carried out on a relatively small scale, and is normally centred on the production of poles, building timber, and other high value wood products, rather than fuelwood.

In Costa Rica and Ecuador, for example, it is common for farmers to plant a few trees around their dwellings and in their fields as a form of long term insurance. These are cut and sold for timber when money is needed for a wedding, a major purchase, or some large cash outlay. In Turkey, it is traditional for trees to be planted on the birth of female child, as a kind of 'down payment' on her wedding.

In the Indian state of Kerala, land holdings are generally very small and often consist of little more than a strip of garden around the house.

Nevertheless, large numbers of trees are grown. The principal species are cash crops such as coconuts and cocoa. Farmers often include a few timber trees as well. Even slow maturing species such as teak and mahogany are sometimes grown as long term investments.

More popular in Kerala, however, is the species Ailanthos malabarica. This is in considerable demand from the match-making industry and can be harvested after 8-10 years. A good sized tree currently fetches around $40. The match industry in southern India has been largely based on small-holder tree growing for many years, and some companies distribute free seedlings to ensure a steady supply of wood.

2.6 Commercial Fuelwood Production

Trees that are grown for fruit, cash crops, and other purposes are often sold as fuelwood when they reach the end of their useful life. The cultivation of trees specifically for the fuelwood market, on the other hand, appears to be much less common. Nevertheless, in a number of countries, it does occur.

In India, for example, private plantations of casuarina are the major source of both firewood and poles for the city of Madras. Originally, casuarina plantations were established to provide wood for the railways in the late 19th century, but were no longer needed when coal was introduced. During the Second World War, however, when wood was again brought into use for the railways, there was such an acute fuelwood shortage in the city of Madras that rationing of wood had to be imposed. Local farmers seized the opportunity and began to plant casuarina for the market.

The practice continues to the present. The trees are grown on a 4-7 year cycle, mostly on saline arable soils. Farmers usually sell the trees to brokers, who organise the felling and transportation to Madras, over distances of up to 150 km. In the city, good quality poles are sold in retail markets at a current price of around $45 per tonne, while split firewood fetches a slightly higher price in the range $48-50 per tonne.

Similar casuarina plantations exist around Bangalore, in Karnataka State, mostly within a radius of 60 km from the city. They appear to be entirely a response to the demands of the urban fuelwood market. Of the total of 700 tonnes of fuelwood recorded at the weighbridges as being brought into the city every day, about 500 tonnes is of casuarina, with the remainder being of traditional fuelwood species such as tamarind, mango, and others (Shiva et al, 1981). Another report calculates the total woodfuel consumption of the city to be about 1000 tonnes per day, of which an estimated 85% comes from private forests (Reddy, 1983).

Planting for the fuelwood market has also been reported around Yogyakarta in Indonesia. It takes place in the hills near the city as well as in the vicinity of the densely populated rice-growing areas. The species planted include, Dalbergia latifolia, teak, sebania, leucaena, and a variety of others (Mellink, 1983).

Ethiopia provides an historical example of tree growing to produce fuelwood for urban areas. In the late 1890s, the Emperor Menelik introduced legislation to exempt land planted with trees from taxation, and arranged for the distribution of seedlings at nominal prices. This was in response to an extreme scarcity of wood around the new capital city of Addis Ababa, which had been established in 1890. The shortage was so severe and the surrounding landscape so extensively denuded of trees that there were fears the capital might have to be moved to another source of wood elsewhere in the country.

The seedlings were mainly eucalyptus varieties introduced around that time by Europeans. The tree growing programme was relatively slow to start, and by 1906 there were only a few scattered clumps of eucalyptus to be seen. Within a few more years, however, many landowners were planting several hectares in the expectation of high profits, and many houses and roads were becoming surrounded by forests. Such was the progress in tree planting that when the Ministry of Agriculture, in 1913, ordered the trees uprooted, because it was believed they dried up water supplies, the proclamation went unheeded (Ellis, 1982).

By 1920, "the streets and paths of Addis Ababa began to look like clearings in a vast continuous forest" (National Academy of Sciences, 1980). The urban fuel problem had disappeared, and by the time of the Italian invasion in 1935 the size of the forest was 4000 hectares. Aerial photographs taken in 1957 showed that the forest, excluding the built-up area of Addis Ababa, covered 10 000 hectares, and by 1964 this had reached 13 500 hectares. Since then, however, though large areas remain, there have been reports of the substantial depletion of these forests.

3.0 The Causes of Tree Depletion

The traditional systems by which people manage and preserve the wood resources on which they depend are breaking down in many parts of the world. Trees resources in open woodlands and around farms and villages are coming under intense pressure. Large areas of closed forests are also being lost each year.

The precise reasons for this breakdown vary. In many cases, the greatest pressure is that of land hunger, and the need to clear forest land for agriculture. But excessive cutting of trees for fuelwood, or overstocking with livestock can also reduce the regenerative capacity of local tree resources, pushing them into an accelerating process of depletion. Various other forces may also be at work.

Discovering why tree resources are being depleted in a particular area is not always easy. Often a number of causes are superimposed on each other; at other times there is a sequence of events in which one type of forest removal creates the conditions for another, and is then superseded by it. Though all result in the loss of trees, the nature of the processes involved and their practical consequences can be entirely different.

In all cases, a clear diagnosis of the causes of the breakdown of traditional systems is essential if effective remedies are to be found. Only when it is known why the loss of trees is taking place, can the potential role of tree planting as a counter-measure be assessed, and programmes be designed which tackle the very real problems at hand.

3.1 Planned Forest Clearance for Agriculture

In the majority of developing countries, the need to provide extra land for agriculture is the most powerful driving force behind large-scale forest clearance. As rural populations grow, there is an increasing number of people for whom food and work must be found. To these are added the large numbers of families which are displaced from their land holdings, or lose their jobs as agriculture is modernised and mechanised.

Throughout human history, forests have been cleared in response to such pressures for more farming land. Many of the Mediterranean and Middle Eastern forests were cut during Biblical times. In Europe, the Middle Ages introduced a long period of forest exploitation and agricultural expansion. For those deprived of the wood resources on which they had previously depended, the result was often considerable hardship. The introduction of the offence of 'hedge tearing' in 16th century England for stealing firewood from hedges is but one example of many which might be quoted illustrating how the poor were affected. This was punishable by the stocks

or substantial fines (Dyer, 1976).

Many developing countries are now undergoing a process of land-use change similar to that which has already taken place in the industrialised nations. Clearing forests to make way for agriculture is an established government policy in some countries, and is carried out as part of integrated development schemes. A well known example is the Transmigration Programme in Indonesia. This began in the early 1970s with the purpose of relieving population pressure on Java by settling families on other less populated islands, notably Sumatra and Kalimantan (Borneo). In Sri Lanka, the Mahaweli irrigation project plans to bring 260 000 hectares of forest under agriculture in the coming years.

In addition to these large officially-sponsored schemes, forest colonisation is actively or implicitly encouraged in a number of other countries. In the immediate years following its independence, India, for example, allocated large areas of forest to landless families. In Latin America, legal and tax incentives have helped stimulate forest clearance. Backed by government support and foreign investment, large tracts of land in Brazil and Central America have been cleared for cattle ranching. Elsewhere, colonisation of forest lands has been indirectly encouraged by the provision of roads and other infrastructure facilities.

The dangers inherent in indiscriminate forest clearance have been amply demonstrated. Even with modern techniques, some forest soils are totally unsuited to permanent agriculture. Once cleared of trees, their fertility can rapidly decline as nutrients tied up in the vegetative layer are leached away, and soil laterisation and wind and water erosion set in. In the worst cases, productive forest land can be transformed to unusable wasteland in a matter of years.

There are many examples where badly conceived and mismanaged forest clearance have led to environmentally disastrous results. The colonisation of the Bragantina zone in the Brazilian Amazon in the early part of this century provides a dramatic illustration. Some 30 000 square kilometers of forest land were converted to agriculture, only to be largely abandoned as fertility declined. Today the area has been reduced to a semi-desert scrubland (Caufield, 1982).

Where the soils are suitable for farming, the transition from forest to agriculture can be achieved without such consequences. Careful land clearance is required, together with the necessary investments in terracing and other soil conservation measures. Once cleared, crops must be chosen so as to reduce the risk of erosion. Perennial tree crops are often the most effective solution, since they partially recreate the protective and stabilising role of the original forest cover.

Many countries have learnt from previous mistakes and are making important strides in improving the environmental control of land clearance projects. The establishment of productive oil palm and rubber plantations in western Malaysia has shown what can be achieved, given careful choice of sites and the appropriate financial and technical support. When properly managed, forest clearance can be a legitimate national policy objective which it would be misleading to link with the damaging and uncontrolled loss of forests.

But more often, the attraction of short-term economic gain remains the deciding factor. Political expediency and commercial pressures still lead to short cuts being taken in forest conversion projects, despite the very real threats they entail for the environment and the future productivity of the land.

3.2 Informal Encroachment of Forest Lands

Whatever the problems caused by officially planned clearance of forest lands, those which arise as a result of informal encroachment are usually considerably worse. In the majority of countries, this is the greatest single cause of deforestation and the breakdown of traditional systems for managing tree resources. Because of the large number of people involved, and their lack of alternative means of earning a living, it is also one of the hardest to control.

The magnitude of the encroachment problem in some countries is immense:

> "The poor people exercising control over the occupied forest are numerous, tenacious, and increasing in number. From either perspective - deteriorating land or growing poverty - the problems posed are expanding. In the Philippines case, 4 to 5 million people, representing 10% of the national population are now illegal occupants of public forest land. Together with the growing numbers of landless lowlanders, they constitute the poorest of the Philippine poor (Gibbs, 1982).

The encroachment of forest land happens in many different ways. Frequently, the people responsible are squatters who have been forced to move into the area in the search for land. In countries with large forest areas still remaining, the construction of new highways may open up areas for colonisation which were previously inaccessible. In Brazil, the opening of the Belem-Brasilia stretch of the Transamazonian Highway brought more than 2 million settlers to the area in the space of ten years (Caufield, 1982).

A similar process has occurred in many of the coastal forests of West Africa where the construction of logging roads has provided a means of

Once cleared, forest land may only be able to sustain crops for a few years. Photo: Mark Edwards/Earthscan

...g trees to prepare land for agriculture on the banks of the Nile ... Photo: Peter Charlesworth/Earthscan

access for squatters. In the Ivory Coast and Nigeria, alone, it has been estimated that nearly 600 000 hectares of closed broadleaf forest were cleared annually between 1976 and 1980. The way in which this occurs has been described as follows:

> "The stages in this deforestation are the following: opening of forest roads, rush of alien populations using these roads to penetrate the forest, each family settling a few hundred metres from its neighbours in order to secure the largest extension possible from the first clearing. The end result is a gradual fragementation of forest areas in which the many clearings become larger and larger and merge after a few years" (Lanly, 1982).

Most types of forest encroachment involve clearing the land of trees, usually by burning, and then cultivating it as long as it will produce crops. On fertile soils, with appropriate farming practices, it may be possible to continue farming indefinitely. Quite often, however, such informal forest clearances mark the beginning a downwards spiral in the productivity of the land.

The main reason is that the squatters who move into forest areas rarely have the knowledge or skills necessary to manage the land sustainably in accordance with traditional practices. Neither do they have the resources needed to practice modern agriculture. Often the land is farmed to exhaustion, leaving it permanently degraded and useless either for agriculture or productive forestry. Squatter families are then forced to move deeper into the forest, and clear new areas to farm.

Since the availability of fertile land is limited in most countries, encroachment often occurs on land which is inherently unsuited for agriculture. Mountainous areas are at particular risk. Converting steep hillsides to permanent agriculture requires a variety of measures such as contour ploughing, the construction of terracing, the selective retention of trees in critical areas, and a careful choice of crops and ground cover plants to protect the soil. Frequently, these are beyond the skills and resources of most squatter families. The fact that many of them have no legal rights to the land acts as a futher deterrent to their making any investment in permanent land protection measures.

3.3 Breakdown of Traditional Shifting Cultivation Systems

In traditional shifting cultivation, an area of forest is cleared, usually by burning its tree cover. The ash provides an initial supply of fertiliser for the soil and the area is cropped intensively for two or three years until its fertility begins to decline. After this, the site is abandoned and the natural tree cover and other vegetation returns. Under moist tropical conditions, this secondary forest rapidly re-establishes

itself. The roots draw up a new supply of nutrients, making it possible to clear the trees and plant new crops after 10 to 20 years.

As long as population densities remain low, and the period of cultivation is short relative to the fallow period, the system is perfectly sustainable. Supplies of wood and other tree products are freely available from adjacent fallow lands and from the trees left growing in the area being cultivated. As one commentator argues:

> "It would be quite wrong to think that shifting cultivation in all its forms was an unsatisfactory form of land use. Indeed, it has been stressed by some of the most respected agriculturalists that until now we have failed to evolve a superior method for staple food cultivation in the tropics" (Oxby, 1983a).

A vital feature of traditional shifting cultivation systems is that the farmers involved have a vested interest in maintaining the stability of the system, and through long experience have learnt the techniques necessary to achieve this. They fully recognise the value of trees as protectors of the soil, restorers of fertility, and providers of wood and many other tree products. When land is cleared, some of the trees are usually left in place. Others are just lopped, so they can grow back quickly.

In some countries, farmers deliberately encourage the regrowth of desired species by seeding the land with fruit and timber trees before it is left fallow. In the Highland Valleys of Papua New Guinea, where shifting cultivation is practiced in semi-grassland areas, it is common for farmers to transplant casuarina seedlings into their 'gardens' before they are abandoned, for subsequent use as fuelwood (Harwood, 1983).

In response to increased competition for land, however, shifting cultivators in many parts of the world are being forced to change their traditional patterns of activity. Fallow periods are being reduced, with the result that trees and shrubs have less time to regenerate, thus undermining their vital role in restoring soil fertility.

Farmers are also cultivating their fields for longer, and more intensively, before leaving them fallow. Tree roots, suckers, and seeds are thus destroyed, so that when the fallow period begins, weeds rather than trees recolonize the area. Tens of millions of hectares in southeast Asia have been lost to alang-alang grass (Imperata cylindrica) in this way.

The primary cause of this breakdown of traditional shifting cultivation systems is population pressure. This is sometimes from within, but in the majority of cases it is due mainly to the influx of newcomers to the area. The result is an increased number of people trying to gain a living from a diminishing area of available forest. Often, the shifting cultivators become indistinguishable from the squatters, and the traditional methods of

preserving the soil are abandoned.

This has been described:

> "Much more serious and on the increase is the impact of shifted cultivators; of displaced peasants and rural landless obliged to penetrate the forest to clear the land from which they scratch a precarious living... The shifted cultivators today being driven to clear forest (often in the wake of the loggers) to grow food for themselves are not the traditional shifting cultivators. The peasant knowledge they bear with them may have little relevance to the new soils and new circumstances they encounter" (Westoby, undated)

As a result of these pressures, there are relatively few places remaining where shifting cultivation in its true traditional form is still being carried out. The current position has been described in these terms:

> "In millions of square kilometres subjected to shifting cultivation by hundreds of millions of farmers in Asia, Africa, or Latin America, the period of fallow has dropped to 2 or 3 years, and no longer allows the soil to recover its fertility. Yields fall, the farmer gets poorer and the young leave the land. The degraded soil which no longer even has time to rebuild a thin plant cover is abandoned; erosion causes further damage, for once the degradation process starts, it tends to accelerate rapidly" (Bochet, 1983).

As with other types of land clearance, the transition from shifting cultivation to permanent agriculture can be achieved successfully, provided the additional inputs such as fertilizer and soil conservation measures are supplied. But, because shifting cultivators tend to be very poor, their choices are heavily restricted. After adapting their agricultural practices as far as they can, and watching the fertility of their soil gradually decl they are often forced to move on and join the mass of landless far om other backgrounds in search of new land or paid labour. The leave behind provides neither crops nor trees.

3.4 The Im azing Animals and Fires

In moderate r ers, grazing animals cause little serious damage to forests. The effect of their browsing upon tree foliage and undergrowth is not sufficient to prevent natural regeneration. Some nomadic pastoral societies have lived in harmony with their natural woodland environments for long periods of history.

It is when livestock numbers increase that problems begin to arise. Trees become damaged through excessive removal of foliage, with consequent stunting of their growth; in some cases they are stripped so severely that they are killed. By eating or trampling young shoots and seedlings, animals also prevent the natural replacement of the forest vegetation.

A dramatic example of the long-term effects of overgrazing is provided in parts of Cyprus. Goats are excluded from graveyards so that the ground cover of trees and grasses is preserved to a much greater extent than on the adjacent land. As a consequence, graveyards are sometimes found at a level several metres higher than the surrounding areas, from which soil has been removed by wind and water erosion.

The damaging impact of livestock grazing and fodder gathering is considerably greater than fuelwood cutting in some woodland areas. This was demonstrated in a study of the Phewa Tal catchment area in Nepal. Here, livestock play an important part in the local agricultural system. They are the only source of draught power for many farmers, and their dung is used extensively for fertilizer. On average, families own 5-6 large animals each.

Fodder for the livestock is supplied from a variety of sources. Public forests, which are now heavily degraded in many areas, are used both for grazing and for the collection of tree fodder by hand. Over the year, they provide about a quarter of the total animal feed requirement, playing a critical role in certain seasons when other fodder sources are unavailable.

The study calculated the amount of forest land needed to supply fodder, fuelwood, and timber needs, given local consumption patterns. The area required for sustainable fodder production was estimated to be three to five times greater than that needed to provide for the combined timber and fuel needs (Wyatt-Smith, 1982). This suggests that the large animal population is probably the most important factor in the forest depletion taking place in the area.

Similar conclusions were reached in a detailed analysis of the Bhogteni village area in the middle hills region in Nepal. Here, the livestock population was found to be 3 to 9 times higher than that which the local land could support.

> "...grazing was found to pose the greatest threat to environmental stablility, followed by tree fodder collection. Contrary to prevailing belief, firewood collection was not a serious threat to the degradation of Bhogteni's public lands. Uncontrolled cutting of trees for fuel is a cause of deforestation and land degradation. But most of Nepal is blessed with rainfall and temperature regimes that allow trees to grow back quickly if they are not trampled and consumed by mauraudiing

livestock. The undue emphasis placed on firewood as the cause of deforestation has obscured the role played by livestock" (Fox, 1982).

Overgrazing by animals is also a major contributory factor in the desertification occurring in many arid regions of the world. As populations of humans and their animals grow, increased herds often combine with reduced pasture availability as land is turned over to permanent agriculture. The result is to concentrate more and more animals into smaller areas.

The environmental degradation, particularly around water holes and along migration routes, can be severe, as has been noted in many of the semi-arid grassland areas in East Africa, the Middle East, and the Sahel (Grainger, 1982). Similar problems have been described in the dry regions of Chile, the Brazilian northwest, parts of Venezuela, the Dominican Republic, and a large part of Haiti (FAO, 1980).

An additional influence in forest degradation, often associated with animal herding, is the deliberate starting of forest fires. The objective is to clear the ground so that a fresh crop of grass, fertilised by the ashes from the fire, is quickly produced when the rains come. In Honduras, an additional reason for farmers to burn their pine stands is that it help to control cattle ticks (Murray, 1981).

The importance of fires is emphasised in the recent FAO report on tropical forest resources:

> "Fires probably represent the most serious factor for degradation in open tree formations and coniferous forests. Accidental fires are rare, the majority of them are started for various reasons: for grazing, for cleaning, for the collection of secondary forest products, for hunting, for cropping, etc ... These fires are rarely controlled and they spread all the more easily, and are all the more destructive, the later they are started in the dry season" (Lanly, 1982)

In arid and semi-arid regions, repeated burning to stimulate grass production can lead to the gradual degradation of the ecology of the area. Because of the fires, the original tree species are reduced to those which are fire-tolerant. These tend to be smaller, less well formed, and much slower growing. The animals which graze the grass produced after the fire also destroy the tree seedlings on which the full regeneration of the forest depends. The final result can be the disappearance of trees completely, with a conversion of forest land to a grass savanna or shrub savanna ecology.

3.5 From Sustainable to Non-sustainable Fuelwood Cutting

Although it is seldom the sole cause of deforestation, fuelwood cutting can contribute significantly to the pressures on tree resources in an area. It is therefore important to examine the process by which fuelwood cutting passes from being a sustainable to a non-sustainable activity.

Where population densities are low, the demand for fuelwood can usually be met without damaging the local standing stock of trees. By travelling short distances from their home, people are able to gather enough wood to meet their needs. It may be possible to incorporate fuelwood gathering with other activities such as animal herding. In some areas it is traditionally done when returning from the fields in the evening.

Depending on local conditions, a variety of wood sources may be used. Those with land holdings may be able to obtain the fuel they need from their own trees. If there are forests nearby, people may have legal or customary rights to gather wood. Otherwise, wood is obtained from common land, roadsides, wastelands, and any other areas where it is freely available. In some areas, local custom may permit people to gather wood from their neighbours' lands.

When trees are plentiful and easily accessible, it is usually only dead wood which is collected. It is lighter to carry than green wood, it is easier to cut, and it burns better. Though branches may be lopped off, whole trees are rarely felled merely to provide fuel.

Under these circumstances, the fuelwood supply and consumption system will be in approximate equilibrium. If the population begins to increase, the extra demand will normally be met by widening the area over which fuelwood collection takes place. Provided sufficient additional sources of wood are available in this extended area, the system will remain in balance. There will, however, be an additional social cost in that there will be a gradual increase in the distance travelled and time required to gather wood.

Problems begin to arise when the time required for collection starts to become an unacceptable burden, or when new sources of supply are no longer available within walking distance. In either case, the collection zone becomes limited and fuelwood gathering from then onwards is concentrated upon a fixed area of wood resources.

These generalised patterns can be illustrated by several concrete examples. Studies of the distance travelled by people in Orissa have noted one village where the average journey to obtain fuel actually fell with increasing scarcity. This was because the main forest resource had receded so far that it had become physically impossible for villagers to travel to it. They had therefore turned to collecting brushwood from the immediately accessible areas around the village (Samanta et al, 1982b). A similar

shortening of the distance travelled as a result of the depletion of former collection areas has been noted in Malawi (Energy Studies Unit, 1981b).

As demand continues to increase, the pressure on the resources in the collection area becomes greater. The quantity of dead wood, or the amount which can be trimmed from trees without damaging them, is no longer sufficient. Excessive lopping of live branches becomes more common, leading to the stunting and eventual death of trees. Instead of relying solely on stemwood, people begin to use twigs, roots, and even leaves for fuel. When wood becomes very scarce, trees may also be deliberately ring-barked in order to kill them.

But the cutting of trees not a completely indiscriminate process. Some species, such as the 'pipal' tree (Ficus religiosa) in Nepal, are never cut for fuel since they are considered sacred or are protected by taboos (Fox, 1983a). Similar religious or traditional restrictions apply to cutting neem, banyan, and a number of other trees in parts of India (Samanta et al, 1982b). The baobab is left standing in many parts of Africa long after the other trees in the vicinity have been cut. In most places, some trees remain in the landscape even when fuelwood is extremely scarce.

Sometimes the pressure of scarcity may bring about social change and a reorganisation of fuelwood collection, thus shifting the fuelwood problem from one area to another. In one village in the central province of Papua New Guinea, up to the early 1970s, fuelwood collection used to be done by women in the vicinity of their homes or on their way home from farm gardens. Now, as a result of shortages of suitable firewood nearby, men have become involved in obtaining family fuel supplies. The method most commonly used is that a group of 5-10 men and women combine to hire a truck to travel about 30 kilometres to a place where mangrove trees are growing. The men chop down the trees and cut them into logs, while the women split them into the smaller pieces required for firewood (Maleva, 1983).

Another of the effects of scarcity is an increasing degree of possessiveness on the part of those who have control over wood resources. It has been noted in Kenya that the practice of farmers allowing neigbours to collect fuelwood from their land has become rarer as scarcities have got worse (Brokensha and Riley, 1978). Informal development of proprietarial rights by some groups over particular collection zones has been occurring in Mali (Bonnet-Madin et al, 1983). Privatisation of common lands, as well as formerly common property crop residues, have also been observed in Upper Volta and Niger (Thomson, 1979).

Such restrictions force people, particulary the poor, to rely on the remaining communal resources, speeding up their eventual depletion. Appearances can therefore be deceptive. Even in areas that seem relatively well stocked with trees, the poor may be facing severe wood scarcities due to their lack of access to the trees that remain.

3.6 The Impact of Urban and Industrial Woodfuel Demands

Provided rural areas remain relatively isolated, the effects of increasing fuelwood pressure will usually be gradual. When areas become subject to concentrated urban or industrial demands, however, this can bring about a dramatic increase in the rate at which depletion takes place. The cash incentive created by these demands means that people have a much stronger motive to cut trees. They will go further afield to gather wood and will take greater risks in entering and illegally cutting trees from forests and unprotected private lands.

The impact of an urban woodfuel market have been described as follows:

> "...(it) creates not only a distinctive spatial character for fuelwood production... but also changes the character of fuelwood exploitation. It is more selective of tree species, whether for charcoal production or urban fuelwood consumers, and it is also more wasteful of the wood resource. It employs paid labour, sometimes specialized in cutting or processing skills, and it has to deal with problems of storage and seasonality in production and supply... It also diverts wood fuel from subsistence use as poor people in areas of short supply sell their wood or charcoal to higher income groups in the towns" (Morgan, 1983).

In some countries, wood cutting is carried out by large well-organised gangs. More often, it is the poor who are mainly involved, as families are forced to turn to wood selling because of the lack of other income earning opportunities. The reasons behind this have been described with specific reference to Karnataka State in India:

> "Denudation of forests has often been viewed merely as the result of rural energy consumption. However, for a villager who has no food, the attack on forests is for collection of firewood for sale in urban and semi-urban centres, rather than his own consumption, because selling firewood is often the only means of subsistence for many poor families. This firewood, with the help of bus and and truck drivers goes to the urban markets like Bangalore .... Theft of wood as a means of survival is becoming the only option left for more and more villagers. Recently 200 villagers were caught stealing firewood in the Sakrabaile forest of Shimoga district and one person was killed in a police encounter" (Shiva et al, 1981).

An example of how this can lead to severe degradation of tree cover is found in the 'sal' forests near Kharagpur in West Bengal. At present, sal scrub (Shorea robusta), standing only a metre or so high, stretches to the horizon in an area which was formerly covered with a full-grown forest. Gradually, and in spite of intense efforts by the forestry service to

Poverty forces people to turn to selling firewood in the cities as a source of livelihood.

Photo:
Mark Edwards/Earthscan

Degraded scrub, remnant of a rich 'sal' forest, stretches to the horizon near Kharagpur in West Bengal.

Photo:
G.Foley/Earthscan

protect it, the forest has been cut by local people for sale in local towns.

Left to itself, the sal forest regenerates quite quickly. This is clearly demonstrated by a plot which has been protected by one village over a two year period. These trees have now reached a height of five or six metres. But the rest of the area, under the unrelenting pressure of small-scale cutting for the market, remains in a severely degraded state.

Trees on private land may also be sold in response to external commercial demands. The amount of such sales will depend on the prices being offered, and on the financial needs of the farmers who own them. In poor areas, or when harvests fail, there may be a tendency for farmers to cut more trees than even they would deem prudent, thus stripping their land of protection and opening it up to degradation. It has been observed in some villages in Tamil Nadu that:

> "...distress sale of trees, because of drought conditions, is reported. This indicates that the villagers resort to short term exploitation of fuel resources in drought periods when their incomes fall drastically, unmindful of the long term consequences of their act" (Neelakantan et al, 1983).

The deforestation that has occurred around the city of Kano in Northern Nigeria over the last 25 years also illustrates this. Formerly there was a tradition whereby farmers used to lop branches from the trees on their land during the dry season and transport them into the town on donkeys to sell in the market. While in town, they picked up dung and sweepings from the streets, which they carried home and used as fertilizer on their fields. With growing wood demands in the city, the incentive to cut trees has increased. As a result, what was once a relatively stable system has broken down to the extent that farming land within a 40 kilometer radius of the city has been largely stripped of trees (Fishwick, 1983).

Charcoal making for the urban market is also a major cause of tree depletion in some areas. In the Sahel, this has a long history. The widespread destruction of Acacia tortilis, for example, can be traced back to charcoal production carried out for the trans-Saharan camel trade. An account of the activities of one particular caravan by Sidi Hamat, a Moroccan active in this trade during the late eighteenth century, is quoted in a recent monograph on environmental change in the West African Sahel:

> "...(with a caravan) of about three thousand camels and eight hundred men....we stopped ten days, and let our camels feed on the bushes, while half the men were employed in getting wood from the mountain and burning in into charcoal, which we put into bags, as it was light, and laid it on the camels over the other goods" (Corillon and Gritzer, 1983).

The opening up of riverine communications, and the consequent improvement of access to woodfuel markets, has led to severe deforestation along the flood plain of the Senegal River, where once extensive stands of Acacia nilotica have been cut for charcoal production. Elsewhere in the Sahel region, improvements in road communications have resulted in similar destruction, as urban charcoal market become accessible to more remote rural areas (Corillon and Gritzer, 1983). In Kenya, the provision of access roads to Mbere district has reportedly led to a substantial increase in the number of trees being felled for charcoal for urban markets, with a total disappearance of large hardwoods such as Albizia tanganykiensis (Brokensha, Riley, and Castro, 1983).

The severe impact of cutting for charcoal has also been noted in a detailed study of the fuelwood position in Haiti (Conway, 1979). Charcoal production was found to be particularly destructive because live trees are harvested, as opposed to the dead branches and twigs which provide the bulk of rural fuelwood supplies. As is frequently the case, charcoal production in Haiti is carried out only by the very poor. The attitude of local people to the resulting deforestation was summarised as follows:

> "Local residents in all of the research sites recognized deforestation as a great problem. Deforestation is seen as contributing to floods and drought. Even young adults can remember when the hillsides, now denuded, were covered with trees. Furthermore, charcoal production is perceived as the cause of this deforestation. More to the point, poverty is seen as the cause of deforestation because only poverty leads a person to make charcoal. Rather than resentment against charcoal makers as destroying a natural resource, there is great sympathy for such people" (Conway, 1979).

Urban woodfuel demand can thus be a major factor in causing deforestation in the area over which it extends. It reinforces local demand and can greatly accelerate the depletion process. But urban demands must be distinguished from local demands when methods of countering the effects of deforestation are being considered. Remedies, such as small scale local plantations, which might be effective in relieving local pressures are likely to be swamped if they are also subjected to urban demands.

3.7 A Worsening Fuelwood Picture

All the above processes causing depletion of tree resources are still continuing, and the conditions they create are worsening and spreading. In 1980, an attempt was made by FAO to assess the fuelwood situation at an overall level. Although there had been isolated studies of fuelwood scarcities, and their human and environmental impacts, the FAO study was the first to highlight the global nature of the problem, and try to

quantify it (de Montalembert and Clement, 1983).

As a starting point, the present balance of wood supply and demand was assessed region by region. For this, estimates were made of the natural growth rates of existing vegetation, the sustainable supply of fuelwood that could be obtained from it, and the proportion that was accessible in practice to the local population. This was then matched with available estimates of fuelwood consumption to give an indication of the relative balance of supply and demand, and the degree of wood scarcity.

An attempt was then made to project forward to the year 2000 to see how scarcities would evolve, given a continuation of existing trends. Allowances were made both for increases in population and the cumulative effects of excessive cutting on the remaining resources.

Countries and sub-regions were classified into zones in accordance with their wood supply positions. 'Acute scarcity situations' were defined as those with:

> "... a very negative balance where the fuelwood supply level is so notoriously inadequate that even overcutting of the resources does not provide people with a sufficient supply, and fuelwood consumption is, therefore, clearly below minimum requirements" (de Montalembert and Clement, 1983).

'Deficit situations' were described as those where people are still able to meet their minimum fuel needs, but only by overcutting the existing resources and jeopardising their future supplies. Other areas were classified as being either in a 'satisfactory situation' or a 'prospective deficit situation'.

It was found that at present more than 100 million people, in some 26 countries, come within the definition of acute scarcity. The most serious situations were identified in the arid and semi-arid regions south of the Sahara, the eastern and south-eastern parts of Africa, the mountain areas and islands of Africa, the Himalayan region, the Andean plateau, and the densely populated areas of Central America and the Caribbean. As well as these critical areas, the study concluded that nearly 1300 million people are cutting fuelwood more rapidly than it is being renewed, equivalent to 39% of the population of the developing countries.

The forward projections revealed a rapidly worsening position virtually everywhere. The condition of those in acute scarcity can only deteriorate further. Many of those now in deficit move into acute scarcity. In other areas, where supplies are satisfactory at present, conditions of deficit or acute scarcity begin to emerge. In all, the projections suggest that nearly 2400 million rural dwellers will be in conditions of acute scarcity or deficit by the year 2000, if the present trends continue.

Such projections are inevitably crude, broad-brush pictures. As the study itself points out, much of the data on which it is based is of an extremely variable and suspect nature. The conclusions inevitably conceal many of the complexities of the problems involved, and the differences that exist in both the causes and effects of the woodfuel scarcities.

Neither do quantifiable supply gaps, or deficits, occur in the real world. Faced with shortages, people have to cope as best they can. They economise on their use of woodfuel. They turn to substitutes such as dung, crop residues, and straw which may have other essential roles in the rural ecological and productive farming systems. They switch to kerosene or bottled gas if they can afford them, and they are available. Or they move to where they believe there is a chance of getting fuel and the money to pay for it. This normally means the already over-burdened cities.

Nevertheless, there is no escaping the underlying trend which is revealed by the FAO study. What the projected deficits point towards is the rapid emergence of profound and deeply dangerous imbalances in the wood supply systems of the developing world. Shortage of fuelwood is very often only a symptom of a much deeper disruption of the rural productive system caused by the loss of trees. The effects of this are likely to be felt throughout the fabric of rural existence, as well as within the ecological and farming systems in which trees play such an important and diverse role.

The fact that tree resources are being depleted, however, does not necessarily imply that tree growing to compensate for this will be feasible or economically viable. Before that can be decided, it is necessary to turn to an examination of the practical constraints which prevent people from growing trees.

4.0 Constraints on Tree Growing

Rural people are well aware of their surroundings and perfectly capable of recognising the depletion of the tree resources on which they depend. If they appear indifferent to this or neglectful of the opportunities offered by tree growing, it is rarely because of ignorance, or lack of concern about their own future. It is far more likely that they are constrained by a variety of factors, and that, for one reason or another, growing trees does not make sense when viewed from a local perspective.

Some of these constraints may be relatively easy to overcome, using readily available programme measures. Others may be of a much more fundamental nature, requiring changes in land tenure arrangements, local power structures, or other basic characteristics of local society. But in all cases, it is essential that programme planning is based on a clear understanding of the reality and nature of these constraints.

The following sections illustrate some of the reasons why people may be unwilling or unable to grow more trees in circumstances where, from an external perspective, it would appear obvious that they should. But no listing of this kind can be complete. Careful local investigation is always required to establish the reasons why tree growing is being prevented or inhibited in particular cases.

4.1 Antipathy to Trees

In some areas, there is a genuine antipathy to trees. This can arise as a result of inherited cultural traditions, or it may be for strictly practical and contemporary reasons.

For example, in some African countries, the normal method of controlling tsetse flies has been to cut down the trees which harbour the insects. This approach has been reinforced by education and extension work over a long period so that people now see trees as a threat to their well being. It can be difficult to reverse the educational line convincingly, and begin to persuade people that trees are beneficial.

In other places, farmers object to trees growing near their crops because they provide a haven for birds. Seeing large flocks of seed-eating birds, such as the weavers (Ploceidae), assembling and nesting in the trees around his fields of corn, a farmer may need quite compelling arguments to convince him that his grain losses would not be reduced if the trees were cut down.

Farmers may have other objections to growing trees, or for avoiding planting them in certain areas. Trees, for example, are widely believed to

lower the water table. In cases where they replace vegetation which is less water-demanding, this may be true. Trees can also compete with adjacent crops for nutrients and sunlight, and thereby lead to a reduction in yields. Where these influences are real, farmers may justifiably feel that the benefits of trees are outweighed by their disadvantages.

In some countries, certain types of trees are associated with malign spirits or taboos. In parts of India, for example, it is believed that tamarind trees are inauspicious, or that those which are growing close to a village may house evil spirits. Thus, despite the fact that they provide edible fruits for human consumption, and are highly valued in other parts of the country, some people are not willing to plant them (Samanta et al, 1982a). Surveys in India have also noted that people in many places are wary of trees and regard them as potential hiding places for thieves and robbers.

The prevalence of such negative attitudes to trees, and the degree to which they represent a barrier to planting programmes is hard to assess. Investigation of a number of villages in Tanzania, where it was expected some of these fears would be expressed, found no evidence for an innate dislike of trees. The only exception was one village where people said they were afraid of owls, which represent spirits, and would not have trees which might harbour them close to their houses (Skutsch, 1983). It has, however, been pointed out that this may be no more than an excuse not to take part in tree growing which is disliked for other reasons (Mnzava, 1982).

4.2 Lack of Incentives or other Priorities

Even where they have no objection to trees, farmers may feel little incentive to plant them. There are still many parts of the world where trees are plentiful. Fuelwood and other tree products can be obtained relatively easily, either legally or illegally, from communal land or nearby forest reserves. For the individuals involved, the fact that this could eventually lead to a total depletion of tree resources may appear totally beyond their control, or irrelevant in the time scale within which they are able to plan their lives.

In other cases, perceptions of wood scarcities and the need for tree growing vary even between individuals in the same area. A survey of local attitudes in Costa Rica revealed that farmers' views on the general availability of wood depended on whether they themselves had trees on their land or not. Those with no trees were of the opinion that there was a severe regional shortage of wood, whereas those with their own trees did not feel that deforestation had yet reached a critical stage (Jones and Campos, 1983).

Farmers and landless people may also have different viewpoints on tree growing. Farmers, who have the opportunity to plant trees, may be able to satisfy their own needs from their existing stocks and feel no necessity to plant more. The landless, on the other hand, may be acutely aware of their own shortage of wood but have no means of responding to it by tree growing.

In other areas with undoubted shortages of wood, tree planting may be low on peoples' list of priorities simply because of the weight of the many other problems they face. This is particularly the case where tree growing is difficult. As one commentary based on work in the Sahel describes:

> "In discussing basic needs in the community, people mentioned that there were things more urgently needed than forestry products. They stated that unless they could have water, health care, education for their children, jobs for young adults, and enough food and income to keep their families together, it did not matter if they planted trees for the future" (Hoskins, 1979).

4.3 Land Tenure Problems

Conditions of land tenure vary greatly from country to country. The most favourable position for tree growing is where land is privately owned and individuals hold a secure title to the holdings they farm. Trees can therefore be grown with full assurance that the benefits will be obtained by the persons who planted them, or by their children.

In many places, however, relatively few people have clear-cut private ownership of land. This greatly complicates the task of planting and protecting trees. Marginal farmers, such as those on upland or degraded areas, are often there on an illegal or semi-legal basis, with a constant threat of expulsion.

Similarly, tenant farmers cannot be expected to respond positively to tree growing programmes without reliable assurances that they will ultimately obtain the benefits of the trees they plant. Their position regarding tree planting, and other long term investments in soil protection, has been described in the following terms:

> "Those who firmly control the land they farm can plan accordingly. But the tenant who expects his landlord to evict him or shift him to another plot after several years to prevent him from establishing title by prescription is not able to plan with the same security. He may be perfectly aware that terracing, live fencing, or windbreaks eventually improve land, and yet be certain that he will gain nothing thereby. Thus he may opt for short-term investments in soil fertility... Although such attempts to maintain soil fertility are probably inadequate in

the long run, given undiminished wind or sheet erosion, the farmer who expects to move on will find them preferable to longer term, more fundamental improvements" (Thomson, 1979).

Tenant farmers and landless labourers make up a large share of the rural populations of Asia and Latin America, and are thus effectively ruled out from individual tree growing. This has been noted in Honduras, where farm tenancies are usually temporary and land titles are often lacking. As a consequence, the planting of trees by farmers is considerably less than in the neighbouring countries (Jones, 1982a).

In some of the Latin American countries, land tenure laws, far from encouraging tree growing, create a positive incentive to clear trees from forest lands. People can gain land rights simply by moving into forest areas, cutting the trees, and planting crops. Their claim to the land becomes stronger the longer they farm it, and after a few years they become the effective owners even though they have no formal ownership papers.

In parts of Costa Rica, colonisation of forest lands is occurring as a two stage process as a result of this. The initial forest clearance is carried out by poor farmers who cultivate the land for a few years. When fertility begins to decline, the farmers sell their squatter's rights to cattle owners and the land is turned over to grazing. The small farmer then moves on to clear other areas, while the cattle owner gains access to new grazing land without having to go through the difficulties of clearing it himself. Forestry officers in the area report that they can usually detect the intentions of squatters by observing their homesteads: those who intend to stay often plant fruit and fodder trees around their homes (Palmer, 1983).

In some countries there is considerable ambiguity in the local land tenure position as a result of the co-existence of traditional land use rights and official laws. Informal customs are often interwoven with the provisions of the written legal codes. This is particularly the case in parts of Africa, where customary laws and rights are strong and continue to exist in parallel with the legislation introduced in the 19th and early 20th centuries by European colonial administrations (Schmithusen, 1981).

Grazing rights may also conflict with the requirements of tree growing. In many countries, animals are traditionally allowed to roam freely during the dry season. This makes the protection of privately planted trees an extremely difficult task, as it means that planters must infringe upon what others in the community view as their rights (Thomson, 1979). In places where nomadic tribesmen pass through at certain times of the year such problems can be particulary severe.

A very serious barrier to tree growing can exist in societies in which land is owned on a communal or semi-communal basis. This is the case, for example, in many traditional African cultures. In these, individuals do

not have permanent possession of land, but are granted rights by the village leaders to farm particular patches of land for a certain period. In some countries, such as Upper Volta, the land is reallocated every few years. Under these circumstances there is no incentive for any farmer to invest effort in the long term enterprise of tree growing.

Where land is allocated in this way, tree growing programmes may be opposed by village leaders. The ability to designate the use to which land is put can be an important source of local influence. When this is done on a year to year basis, the power associated with its reallocation remains strong. If the land is taken over for a tree growing, it is out of control for a much longer period. This may be a reason for the village elite to oppose tree growing programmes which might otherwise win popular support (Hoskins, 1982a).

4.4 Questions of Tree Ownership

Even where farmers have full title to their land, the ownership of trees may be in question. In parts of the Sahel, farmers are unwilling to grow certain valuable tree species because they are on forest departments' lists of protected species (Thomson, 1979). To harvest such trees, farmers have first to prove they planted them, and then go through the laborious and expensive business of obtaining the necessary cutting permits.

Similar fears about the ownership of trees and future rights to exploit them have been noted in Haiti. In a number of tree planting projects, the peasants were told by officials that the trees belonged to the government and that they would be punished if they were cut down. The aim was to ensure that proper care was taken of the trees, but the reverse was probably the result. The trees were seen by the peasants as a threat which could even lead to expropriation of their land itself; rather than taking care of them, the peasants wanted the trees to die (Murray, 1983).

In Pakistan, it has been noted that small farmers have been reluctant to enter into agreements to have trees planted for them on their farms by the forest department. They feared that this would mean they would lose possession or control of their land to the government, or that they would be deprived of access to fodder and grazing. They were not, however, opposed in principle to such cooperation, and most said they were prepared to offer small plots for planting provided they received convincing assurances that the Forest Department would not alienate their lands, and that they would still be able to cut grass for their cattle (Cernea, 1981).

Much of the forest legislation in many countries is, in fact, directed towards the preservation of forests and the creation of restrictions on their use:

> "Most forest law still reflects earlier policies directed primarily towards conservation. It has not generally been conceived as a positive agent of development, but merely as a means of preventing the misuse of the forest, and has been developed chiefly in terms of litigation. The consequence of this emphasis on the deterrent and punitive aspects of forest law is that law becomes an obstacle to development, embodying the constraints on their use of the forest and its benefits that so frustrate forest neighbours" (Bochet, 1983).

Such legislation is not always confined to trees within forest areas. In some countries, such as the Dominican Republic and Honduras, the ownership of all the trees in the country is vested in the government. There are penalties for cutting any trees without permission, even those standing on peasants' own land. The intention is to preserve forest cover and protect trees against indiscriminate cutting, but the effect of this legislation is counter-productive when efforts are being made to engage farmers in tree growing (Murray, 1981).

The Philippines also has legislation which controls the cutting of trees. This is mainly directed at the commercial logging industry, and the process of getting a cutting permit is slow and cumbersome. As a result, some small farmers who have invested in tree growing are finding it difficult to cut and sell their trees (Bulletin Today, 1982).

4.5 Competition for Labour

Competition for labour can hamper tree growing. Although this is unlikely to be a major constraint in areas where the climate is moist, and tree growing is relatively easy, in arid regions it can be a serious problem.

In the very dry areas of the Sahel region, for example, planting can be an extremely difficult task, particularly where it is necessary to break through a sub-surface layer of hardpan in order to allow tree roots to penetrate to the necessary depth. In such areas, the planting season for both crops and trees may only extend for a few weeks each year, with the result that serious competition for labour can exist between the two.

Even when digging machinery is available, the short planting time may make it difficult for farmers to take advantage of it. In such areas it may be necessary to bring in labour from outside in order to assist with the planting if tree growing programmes are to be locally feasible.

Shortage of labour at the appropriate time has also been noted as a constraint on programmes in Tanzania:

Protection against grazing animals can be almost impossible where land ownership is communal rather than private. Photo: Mark Edwards/Earthscan

Weeding plantations is an arduous and time consuming task.
Photo: J.Van Acker/FAO

> "Tree planting always coincides with agricultural activities. And naturally the latter get priority. Moreover, the women who are the fuelwood managers are also so much involved in other activities that they have little time to devote to tree planting" (Mnzava, 1982).

Another factor to be considered is that the labour requirements of tree growing may conflict with opportunities for earning off-farm income. In a number of countries, particularly in Africa, many rural communities have seasonal migration patterns in which a large part of the farm workforce leaves during the slack part of the year to find employment elsewhere. A survey in the Yemen Arab Republic, for example, has found that the attractions of temporary migration from the farming areas is resulting in such severe labour scarcities in some areas that some land is now being left uncultivated (Aulaqi, 1982).

In their early years, plantations tend to require substantial amounts of work. If people have to stay behind to carry out weeding or to protect trees against grazing animals or fires, the benefits of these earnings will have to be foregone. Tree growing may thus require an unacceptable sacrifice of immediate earnings for what may appear an uncertain long term future gain (Hoskins, 1982).

4.6 The Time Factor

Compared to most agricultural operations, tree growing is undoubtedly a long term exercise. Many of the difficulties involved in tree growing are compounded by this fact, a problem which bears particularly on the poorer sections of the community who are least able to invest effort and resources in long term concerns. The time delay between planting trees and obtaining their benefits is therefore often cited as an important constraint on tree growing.

The length of the delay before harvesting varies considerably. In moist tropical conditions, fast growing tree species can be cut for timber in as little as four or five years; sometimes they can produce useful amounts of fodder and even fuelwood in the first year. In arid areas, growth rates can be an order of magnitude slower, as well as being much more variable.

Where growing conditions are unfavourable, local people know from experience that trees will grow extremely slowly. Their traditional way of life has also taught them that the survival of all but the most hardy trees is put at risk by the more or less random occurrence of periods of intense drought. They are unlikely to be persuaded to engage in the long term exercise of tree growing solely on the basis of exhortations from outsiders or the evidence of one or two good years good growing conditions.

The time constraint, however, is not an absolute barrier to tree growing. Provided people are satisfied that the benefits are sufficiently worthwhile, and that they are adequately guaranteed, they will often willingly take part in a variety of long term endeavours. Many of the major cash crops, such as coconuts, oil palm and coffee, for example, take 5 or more years before they start producing. Yet these are widely planted in many countries. The evidence from Tanzania indicates that as long as villagers are able to obtain intermediate benefits such as grass, fruit, small poles or other produce from plantations they are prepared to accept the delay in harvesting (Mnzava, 1982).

In arid areas, people will tend to be more cautious about making major investments of time or resources in tree growing. But this does not mean they are opposed to tree growing in principle. They will often plant a few trees around their houses for fruit, shade and other purpose knowing that they will take many years to reach maturity.

It is when they think the operation is futile, too risky, or simply too much trouble, that the time constraint becomes a dominant consideration. It is here, by demonstrating new, faster-growing species, and suggesting management techniques that allow useful products to be harvested after a shorter period, that tree growing programmes may have an important role in tipping the balance, and persuading farmers that tree growing is worthwhile.

PART III

PROGRAMME APPROACHES

Approaches to Farm and Community Forestry

Over the past two decades, programmes to encourage tree growing by rural people have been launched in over 50 developing countries. Though many of these are still in their early stages, much has already been revealed about the potential, and limitations, of the different approaches being used.

In some cases, programmes have relied primarily on the incentive provided by the commercial wood market. Farmers are helped and encouraged to grow trees for sale. By doing so, they increase the availability of wood products to meet the demands of the market, and provide themselves with a source of income.

Other programmes have placed tree growing within a broader and more ambitious framework of social and environmental goals. In particular, community involvement has been sought in many programmes as a means of widening the range and distribution of benefits, bringing public and community land into productive use, and involving landless people and the poor. Local institution-building and employment generation have also been explicitly stated objectives of some projects.

The differences between individual programmes are thus considerable. But a number of broad approaches can now be distinguished. These can be classified under the following four headings:

* farm forestry
* tree growing for family uses
* community forestry
* land allocation schemes

Within each of these categories, there is a considerable range of flexibility in goals and operating methods, and many programmes have used a combination of approaches in parallel. Nevertheless, each programme approach has its own distinctive features which make it suitable for particular circumstances or permit it to meet certain objectives. At the same time, the intrinsic characteristics of each approach impose quite definite limits on what it can achieve.

In programme planning, it is important that the potential and limitations of these different programme approaches are clearly recognised. In the following chapters, the four programme categories are discussed in detail, using examples from a countries where they have been tried.

5.0 Farm Forestry

Farm forestry is the name commonly given to programmes which promote commercial tree growing by farmers on their own land. Programmes of this type are restricted to areas in which there is an existing market for wood or other tree products, or where one can be created as part of the programme. The approach has been described as "turning peasants into entrepreneurs and producers" (FAO, 1980), and has been used successfully in a number of parts of the world.

In principle, it should be relatively simple to promote tree growing for the market in places where the necessary economic incentives already exist. Once the local market price for poles, fuelwood, or other tree products rises to a level which provides a better rate of return to the farmer than alternative uses of his land, the conditions are theoretically appropriate for tree growing for the market to take place.

In some cases, farmers will take up commercial tree growing of their own accord, in which case there is no need to institute a special programme to encourage them. In practice, however, there may be a variety of obstacles which have to be overcome before local farmers can enter the market. The role of a farm forestry programme is to remove as many of these constraints as possible so that the maximum number of farmers can begin to take part in tree growing. The degree of difficulty in creating the conditions where this can happen vary greatly.

At one end of the scale, there are circumstances where small-scale tree growing is already on the verge of becoming an economically attractive and feasible operation. In these circumstances, farmers may already view tree growing as a beneficial and potentially profitable activity and need little convincing of its merits. All that is required is a relatively small impetus from outside and tree planting will begin to take place. Indeed, the major practical task may be to support the efforts of the smaller farmers and enable them find a place in supplying the market without being swamped by the superior economic power of larger landholders.

At the other end of the scale, there are areas where a potential market for tree products exists, but the practical obstacles to small-scale commercial tree growing are very large. This may be the case in areas where there are major technical problems involved in tree growing due to adverse climatic or soil conditions. Here, the level of external intervention required to make farm forestry feasible is much greater.

In between these two extremes, lies a range of possibilities in which local farmers would be able to engage in tree planting if certain conditions were fulfilled. The extent to which farm forestry programmes will be able to realise the market potential in particular areas will be determined by the

level of resources at the disposal of promoting agencies, and their ability, firstly, to perceive the constraints that farmers face, and then to devise effective measures to remove them.

Farm forestry programmes can thus vary enormously in their scope and complexity, and the degree of intervention that is involved at the local level. Much also depends on the ambitiousness of the objectives that the programme sets itself, and on the extent to which the promoting agency wishes to control or influence its results. But the primary distinguishing characteristic of all farm forestry programmes is that they rely on individual profit as the motivating force to get farmers to grow trees.

5.1 Experience to Date

Probably the most widely known example of a farm forestry programme is that in the Indian state of Gujarat. This was started in the early 1970s and up to now has been based on the distribution of seedlings to farmers free of charge. The majority of the seedlings have been eucalyptus, and the main market at which farmers have aimed is that of building poles.

The original idea was that farmers would use plant the seedlings on unused or marginal land within their own farms. As the project evolved, however, some of the larger farmers began to realise that it was even more profitable to grow trees on their cropland. Tree growing turned out to have several important advantages over conventional food or cash crops. One of these was that it was less labour intensive; moreover, the labour requirements were spread more evenly over the year. This meant that trees could be harvested during the dry season when the demand for labour was slack. As well as cutting the labour costs, this also reduced the problems of managing farm labourers.

Tree farming of eucalyptus has, in fact, emerged in Gujarat as an extremely lucrative exercise. As a result of the high market price for building poles, the rates of return from growing trees on irrigated and fertilized land are now several times greater than from other cash crops. The relative profitability has also been increasing in recent years, since wood prices have risen faster than those of the main cash crop alternatives, notably cotton.

The uptake of trees has been rising rapidly as awareness of the profitability of tree growing has spread. The annual distribution of seedlings rose from 6.1 million seedlings in 1971 to 41.7 million in 1978. In 1982 it had reached 95 million, and preliminary returns for the 1983 planting season indicate a figure of about 200 million.

Farm forestry is also being promoted in a number of other Indian states. One of the largest programmes is in Uttar Pradesh where seedlings are

Leucaena plantation in crop land in Tamil Nadu.

Photo: G.Foley/Earthscan

Below:
Eucalyptus poles grown under a farm forestry project in Gujarat are prepared and graded ready for sale.

Photo: G.Foley/Earthscan

distributed to farmers at cost price. The programme has made most impact in the western part of the state where the average farm size is larger. Seedling production has had to be greatly increased to cope with the demand; the total number distributed in 1982-83 was 156 million, nearly 30 times greater than the projected target.

In the Philippines, a more comprehensive package of incentives has been used to encourage farmers to grow trees for a pulp mill. This was organised by the Paper Industries Corporation of the Philippines (PICOP), and began in the early 1970s. Under the scheme, the Corporation supplies seedlings of the species Albizia falcataria at cost price, and provides technical assistance in growing and harvesting. Loans are given to farmers and there is a guaranteed market for the wood at an annually reviewed price.

The scheme proved popular with farmers, and by 1982 a total of 12 550 hectares had been planted. Though aimed at slash and burn cultivators, most of the planting has been carried out by small-holders with above-average incomes. Because of increasing labour costs, the loan ceiling for farmers was raised in 1979 to a figure equivalent to about $220 per hectare. Discussions were being held in 1981 to raise the loan ceiling further to take into account the high costs of harvesting.

Farmers were also arguing for an increase in the mill-gate price to at least $12 per solid cubic metre, as they claim that the net returns are lower than from alternative crops such as rubber or coffee. Recently, problems have also been encountered due to a typhoon in 1982 which caused considerable damage to trees in some areas (Hyman 1983a).

Using the PICOP project as a model, a number of other projects in the Philippines have aimed at encouraging small holder tree growing, but with mixed success. A loan scheme to encourage tree planting for fuelwood in the Ilocos region of Luzon Island, for example, has had a very poor response. The intention was to stimulate farmers to grow Leucaena leucocephela to supply fuelwood to the large tobacco curing industry in the region. In the first three years, only 37 applicants signed up for the scheme, and the planting rate was only 6% of the target.

A number of reasons have been put forward for the unexpectedly low participation rate. The traditional unwillingness of farmers in that region to take out loans has been suggested as the major factor. Insufficient publicity, competition from other tree planting schemes, and restictions on tree farm size have also been blamed. The package of incentives provided was also less comprehensive than in the PICOP case, and farmers were not directly tied into a marketing contract (Hyman, 1982).

Farm forestry has also been promoted through local non-governmental organisations in Haiti, under a scheme promoted by the Pan American

Development Foundation The philosophy behind the project has been described as follows:

> "...(the project) views the harvesting of wood as an acceptable positive type of economic behaviour. The project explicitly acknowledges the rights of the peasants to expect reasonable short-term returns from their economic activity. The basic argument of the project is that wood can be treated as a cash crop, a product which the peasant has a right to plant and harvest in the same fashion as he plants and harvests corn, millet, sugar cane and other crops. The project intentionally de-emphasizes appeals to patriotism or to concern for future generations as the underlying motive for tree planting, and emphasizes rather the returns to land and labour which even the small farmer can expect if he plants fast growing trees" (Murray, 1983).

Another feature of the Haiti programme is the emphasis the promoters place upon not providing wages or payments in kind to encourage tree growing. This is to ensure that people do not plant trees just to obtain the financial incentive, but only do so because they believe they will personally gain by protecting the trees so that they survive to a harvestable age.

The early results were promising. The programme, which started in 1982, had a goal of 4 million trees to be planted over a period of 4 years. By the end of 1982, some 1.75 million trees had been planted by a total of 4000 farmers.

5.2 Financial Viability of Farm Forestry

From the viewpoint of the individual farmer, the financial viability of farm forestry depends on large number of factors. In most cases, the costs of tree growing will be dominated by labour costs and the material input requirements. The returns will be determined by the growth rate of the tree, the yields of wood and other tree products, and their prevailing prices.

All of these factors vary from place to place. To the farmer, the relative attractiveness of tree growing will depend on how the net returns compare to alternative uses of his land and resources. The price of rice, cotton or other cash crops may thus be as important in this calculation as the price of wood.

But equally important, the overall financial viability will depend on the management approach used and the amount of inputs that the farmer can afford. In the following sections, a high input approach to tree growing is contrasted with a low input approach.

5.21 The High Input Approach

The more prosperous farmers in an area have the greatest resources at their command and the largest number of alternatives open to them. They can consider using fertile agricultural land for tree growing, and have the option of using fertilizer and sometimes even irrigation to increase yields. Hired labour can be employed to supplement family labour. Wealthy farmers can also afford to take greater risks than their less well-off neighbours, and can wait longer for the benefits of tree planting to accrue. When the time comes to harvest the trees, they will often be in a strong bargaining position to obtain a good price for their products.

Within quite broad limits, wealthy farmers will be prepared to increase their inputs to tree farming as long as the marginal gain exceeds the marginal cost. This can lead to an extremely high input approach to tree farming, the potential profitability of which is clearly demonstrated in a detailed analysis of eucalyptus cultivation carried out by Gupta (Gupta, 1979). This is based on actual information obtained from one of the earliest and most successful farmers to have adopted farm forestry in Gujarat.

The principal assumptions used in the analysis were that: eucalyptus is planted on fertile land at a density of 3500 trees per hectare, with cotton grown as an intercrop in the 1st year; fertilizer and irrigation are used throughout the growing cycle; and trees are harvested for poles at the end of the 5th year, followed by three coppice crops on a 4 year cycle.

The total investment required during the first rotation was estimated at $1700 per hectare (assuming $1 = Rs 10) of which the largest single element was the labour required for harvesting. This accounted for 29% of the total costs. Fertilizers represented 23% of the total. At prevailing market prices, the returns worked out at $5900 per hectare. Of this, 88% came from the sale of the wood. Cotton, and other minor products accounted for the balance.

Based on these figures, the net profit for the first rotation amounts to approximately $4200 per hectare. Subsequent rotations would be even more profitable, as coppice growth rates tend to be faster due to the already established root system; whilst the initial inputs required are less. Using discounting techniques, the internal rate of return was calculated to be 129% for the first rotation, and 213% for each of the coppice crops. This is extremely high compared to virtually any other investment likely to be available to a farmer. In absolute terms it is also much greater than can be expected from conventional agricultural crops.

The profitability of tree growing in this example depends to a large extent on the high price that can be obtained for the wood produced. Returns were calculated on the assumption that, of the 3500 trees per hectare planted,

2500 could be harvested and sold as building poles at an average price of $2.10 (equivalent to a wood price of $25 per cubic metre).

The essential feature of this type of farm forestry is that farmers need to have adequate capital to pay for the inputs required during the growth of the trees. In the above example, plantation establishment costs amounted to just over $600 per hectare in the first year. Though these were partly balanced by the revenues from the cotton crop, the overall negative cash flow for the first year was estimated at $110 per hectare. During the following three years further expenditures were required for irrigation and fertilisers. At the time of harvest, the net outlay on the plantation amounted to approximately $520 per hectare. Only when the trees are harvested and sold, is the farmer's investment repaid and the overall profit of $4200 per hectare obtained.

A more extreme example of how financial viability depends on the ability to invest is shown in another scheme suggested for high density eucalyptus plantations (Patel, 1983). This involves planting trees at very close spacings (24 000 trees per hectare), irrigating them continuously, and applying very large amounts of fertilizer (more than a tonne per hectare each year). Under these conditions, it is estimated that annual wood yields of 67 air dry tonnes per hectare could be obtained.

The net profits from a plantation of this kind, harvested after 4 years, were calculated at between $6200 and $20 000 per hectare. The lower figure would apply if trees were sold for firewood (at $30 per tonne) the higher figure would obtain if they were used for building poles. In either case the plantation works out as being highly profitable. The drawback is that a total investment of $.300 per hectare would be required before any trees could be harvested.

5.22 The Low Input Approach

For the small and marginal farmer, farm forestry has to be considered in a very different light. What makes financial sense for a large farmer, with cash savings and access to credit, may be totally impractical for the smaller farmer who is barely producing enough crops to support his family.

Setting aside good agricultural land will often be impossible, unless an alternative source of income is available. This limits tree planting to the infertile areas, and the small patches of unused land within farms. Lack of finance also restricts the small farmer to management approaches that do not require large cash inputs and can be carried out using only family labour.

Perhaps most importantly, the timescale involved in tree growing is much more crucial for a small farmer. Even if a substantial profit can be

expected after 5 to 10 years, tree growing will be ruled out if the farmer is unable to support his family while the trees are growing. Similarly, if there is a significant element of risk in tree growing, a poor family cannot jeopardise its survival whatever the potential profits.

The position of small farmers in Indonesia and the reasons for their inability to take advantage of the opportunities offered by farm forestry programmes have been described as follows:

> "The small farmers plant foodcrops at subsistence level. This is the very root of their inability to raise capital. They often get trapped in an advance payment system which reduces the profit from their produce during harvest time. Without outside help they cannot get improved seed, fertiliser, and agricultural chemicals. They avoid using new technology for fear of failure or devastation" (Mangoendikoro, in FAO 1982b).

If small farmers are to grow trees at all, high input methods will normally be ruled out. But it may still be possible for them to grow a certain number of trees for the market by using a low input approach. Instead of attempting to maximise the profits from tree growing, the objective in this case is to minimise the investment.

If only a few trees are being planted around houses or along field boundaries, for example, the cash investment required is very small. If no fertilizer or irrigation are used, and seedlings are available free, it may be zero. Provided a market exists for the wood, the financial viability of tree growing in such cases is not in doubt.

The main decision for the farmer is whether the promise of financial gains in the future is worth the inconvenience and bother involved. If protection of seedlings from grazing animals is going to be very difficult, and require a lot of effort, the answer may well be no. But as long as trees can be grown fairly easily, without disturbing other farm activities, the farmer will have little to lose. The risks are also small because even if the trees die, he will have forfeited little.

The total number of trees that can be planted in this way depends on the availability of unused land and free family labour. Once land and labour have to be diverted from other productive uses, the financial implications of tree growing become a more direct concern. For the poor farmer, it will often be very difficult to consider tree growing if it has any negative impact on crop production, livestock rearing, or off-farm income earning capacity.

Though small farmers will generally be able to plant some trees, there will always, therefore, be an upper limit on the number that can be planted using a low input approach. To go beyond this, a direct investment of

Farmers loading seedlings to plant on their own farms in Haiti.
Photo: Mark Edwards/Earthscan

Eucalyptus planted along the boundaries of crop fields in Gujarat.
Photo: G.Foley/Earthscan

resources is required, since farmers will have to use crop land, or divert labour from other tasks in order to grow the trees.

Small farmers are thus not ruled out from participating in farm forestry. In the Gujarat farm forestry scheme, for example, of all the free seedlings distributed during the 1982-83 planting season, 37% went to farmers owning less than 2 hectares of land. In Jammu and Kashmir, the figure for the same year was 65% (Guhathakurta, 1983).

The point is that the extent to which small farmers can take part is limited. So too is their ability to obtain the large profits that may be possible for the more wealthy farmer who can afford greater investments and a high input approach.

5.3 Subsidised Seedlings and Cash Incentives

Farm forestry programmes usually rely on the distribution of free or subsidised seedlings as one of their basic promotional measures. In some cases, a limit is set on the number of seedlings which farmers are allowed to take. This can be used as a means of ensuring that richer farmers do not obtain a disproportionate amount of the subsidy available.

The numbers of free seedlings varies considerably between programmes. In the Pan American Development Foundation project in Haiti, in order to ensure that peasants are making a commitment to farm forestry on a reasonably substantial scale, seedlings are only issued to farmers who are prepared to take 500; the maximum number issued is 1500, to avoid an undue proportion going to the large farmers (Murray, 1983). In a project in the state of Karnataka in India, the number of free seedlings per farmer is limited to 2500 in the first year, 1500 in the second year and 750 in the third year, to try to focus the benefit on small farmers (Kemp, 1984).

In Gujarat, the current limit on free seedlings supplied in polythene pots is 10 000. At 20 paise each (2 US cents), this amounts to a subsidy of $200 per farmer if they take the full number. This is a considerable sum in an area where the daily wage rate for an agricultural labourer is $1.00. A move is currently under way to phase out free seedlings entirely from 1984 onwards, though the price to be charged has yet to be decided.

In Tamil Nadu, two farm forestry schemes are being operated in parallel. For large farmers, seedlings are distributed at cost price. For very poor farmers, up to 500 seedlings are provided free and a small cash incentive is paid, based on the number of plants surviving at the end of the first and second years.

Such provision of direct cash incentives for planting has also been included in a number of other farm forestry schemes. In the case of the

very poor, the fact that there is some immediate cash return from their efforts can be an important incentive to participate. But because payments to plant trees does not necessarily guarantee that they will be looked after, most schemes of this kind provide payment on the basis of the number of trees surviving after one or two years.

In some cases, the provision of incentives of this kind can make a major contribution to raising enthusiasm for tree planting. But it also makes heavy demands upon the administration of a programme. Checking the number of trees surviving, allocating payments, and then disbursing them can be a major task if large numbers of farmers are involved.

Any scheme involving financial incentives should therefore be simple, easy to run, and within the administrative capabilities of those responsible for it. If there are long delays in assessing the numbers of surviving trees, or if the methods of claiming and receiving payment are too slow and cumbersome for the farmers involved, such incentive schemes will not be effective; on the contrary, they may actually deter farmers from becoming engaged with tree growing and its attendant complications.

It is now generally accepted that cash subsidies should be used with discretion. Supplying seedlings free, for example, will often help increase the numbers taken, but it will not guarantee they will be looked after. The following comments on renewable energy technologies may be equally relevant to tree growing programmes:

> "In sum, subsidies are the last refuge of the technology-driven. If the system we choose to promote cannot stand the test of reality - or if we simply prefer to avoid this test - we can always subsidize. Almost always, however, such subsidies cause both us and the poor to divert time and money to systems which either need no support or deserve none" (French, 1982).

If the use of subsidies or financial incentives is necessary to persuade people to do something, it is always prudent to question whether it is truly to their benefit. In the case of tree planting by the really poor, however, there may often be a genuine need for the provision of short-term encouragement and incentives to planting, because of the long time interval before any benefits can be obtained. In such instances, subsidies may provide the only effective means of getting tree growing under way.

5.4 Credit Schemes, Market Support Measures, and Tax Incentives

Where farmers are willing to plant trees for a commercial market, their inability to obtain credit may be an important factor in preventing them from doing so. Tree-growing on any significant scale requires an initial investment of effort and money. It also requires at least a temporary

diversion of land from grazing or growing other crops.

The minimum of five or six years delay in any financial return may be a strong deterrent to investing in tree growing, particularly in the case of small farmers who depend on a regular annual cash income. Providing them with a bridging loan to cover this period may make it possible for them to engage on tree growing.

In areas where tree growing is clearly profitable, the inability of small farmers to adopt commercial tree growing can, in fact, contribute to a widening of local inequalities. This may happen if rich farmers are able to obtain superior returns from their land by growing trees, while poor farmers are forced to continue cultivating crops with a lower financial return. In some areas, the result may be a consolidation of landholdings, with richer farmers buying up the land of the smaller farmers around them. The provision of credit facilities to small farmers to enable them to take part in tree farming can help counteract these tendencies.

Under normal circumstances, however, few commercial banks will give loans for tree growing unless they have had previous lending experience in this area, or have very firm assurances that their loans will be repaid. They are particularly unlikely to provide loans to small farmers.

Special credit schemes may therefore have a useful role in encouraging farm forestry. By relaxing collateral requirements and applying concessional interest terms, schemes ca be specifically geared to help the poorer farmers. A package of this kind was used successfully as part of the PICOP pulp project in the Philippines, through an agreement with the Development Bank of the Philippines.

At the same time, the difficulties in these programmes must not be underestimated. The administrative problems of processing a large number of small loan applications, and drawing up and monitoring all the individual contracts, can be considerable. Added to this, there are the uncertainties involved when the tree cultivation is dispersed over a wide area and amongst a large number of farmers, with no firm guarantees that trees will be looked after in the correct fashion. If small farmers are included in the scheme, it may be necessary to accept that a proportion of them may end up defaulting on their loans.

The position of small farmers in relation to credit schemes in El Salvador has been described as follows; the comments would apply with equal relevance in many other countries:

> "For several reasons, peasants in a marginal position in most cases fail to take advantage of such credit facilities, mainly for want of title to the land, insecurity of crop yield and lack of sufficient capital to back their requests for credit. The

lack of financial backing among small tenant farmers in El Salvador has been overcome by means of schemes within which several peasants associate themselves as groups of corporate creditors. However, the lack of entrepreneurial capacity which is typical of marginal peasants in many countries makes them become defaulting creditors whose debts must be written off for insolvency" (FAO, 1980).

Creating a stable commercial market for tree products is another method of providing support for farmers which can be particularly useful in cases where the existing market is uncertain. This can be done in a variety of ways. Guaranteeing wood prices is one of the most direct methods. This was a key element in the strategy used in the PICOP project in the Philippines.

In some instances, the promoting agency may be able to develop an entirely new market for wood, and thereby open up possibilities that would not otherwise exist. Establishing wood-fired power plants, and new wood-using industries are two examples which have been tried in some countries. Naturally, these involve much greater investments and organisational inputs than simply tapping into the existing market.

It may also be possible to stimulate commercial tree growing by improving marketing and transportation facilities, either on a cooperative or state-run basis. There may be a particular need to protect small farmers when they come to harvesting and selling their trees. Those who are unused to commercial dealings, or are suffering from cash shortages, may easily become victims of the economic power and greater experience of wood dealers and felling contractors. Forming small-holder marketing cooperatives may be a way of getting round this problem.

The creation of such a broad-based support system for local farmers, rather than the provision of credit, may indeed be the most important factor in getting tree growing under way in some cases. In the Philippines, less than half the farmers participating in the PICOP project needed to borrow funds. As far as their recruitment to the scheme was concerned: "The existence of an assured market and provision of extension services seem to be the most critical factor" (Development Bank of the Philippines, 1981).

Successful examples from other rural development schemes may be worth following in some cases. One such organisation which has apparently achieved substantial results is the National Dairy Development Board (NDDB) in India. This has a programme specifically directed towards the weaker members of the community, called Operation Flood. It has been described as follows:

"Operation Flood is based on a three tiered structure of cooperatives which has organised the rural milk producers into

powerful cooperative federations owned by the small producers. It has already organised one million farmers in over 5000 village cooperatives. In its next phase it plans to organise another 10.2 million families. The Government of India has also requested the NDDB to use its strategy and structure for organising farmers producing oilseeds, jute, vegetables and horticulture, fisheries, and most recently energy plantations" (Chowdhry, 1983b).

Approaches of this kind could well be relevent to tree planting programmes in countries in which the primary aim is to involve small and economically disadvantaged farmers.

Another method of encouraging tree growing, which has been used in some cases, is to offer tax incentives of various kinds. These can provide relief on income earned from tree planting, from taxes on the land itself, or from death duties when plantations are transferred to other members of the family. The incentive can take the form either of a reduced level of taxation, or complete exemption.

Such tax incentives to promote tree growing already exist in a number of countries. Profits from trees are exempt from tax in Gujarat, for example. A study of Latin America during the mid-1970s showed that of the 19 countries surveyed, 14 had tax incentives of one form or another in operation. The most comprehensive incentive programme was in Brazil, where private plantations were being established on a very large scale (Gregersen, 1983). One of the major limitations on tax incentives, however, is that they function in a way which tends to benefits the rich, since smallholders and subsistence farmers, for the most part, are not taxpayers.

5.5 The Possibility of Market Saturation

Concerns that the rapid adoption of commercial tree growing by farmers will lead to a position of over-supply have recently been expressed, notably in relation to some of the Indian farm forestry programmes.

In the case of the Gujarat programme, calculations carried out by a World Bank mission at the end of 1981 raised the possibility that the pole market could be saturated within five years if tree growing continued at the projected rate of 250 million trees per year. It was thought that even fuelwood demands might be met within ten years at the same rate of planting.

This possibility of market saturation, however, is not a problem unique to tree growing. Many cash crop activities run a similar risk at some stage. This is particularly the case if the returns to those first entering the market are very attractive, and there is a significant delay before the

market demand can be met. This stimulates more farmers to enter production than will eventually be able to sell their produce at the originally anticipated price.

The result of such an over-supply of wood would normally be a fall in the price. This may mean that high grade wood products such as poles, destined for one market, may have to be sold for fuelwood or other lower value uses. There is also the possibility that new markets would be found for any surplus products.

While the producers' expectations would be disappointed were the market to be saturated, the resulting reduction in wood prices would obviously be to the advantage of consumers. It would particularly favour those with lower incomes by making wood supplies more financially accessible to them.

There are also some safeguards for producers. Trees are not perishable commodities like most other cash crops. Although farmers may have to wait longer to realise the results of their investments than anticipated, they are not faced with the same acute problem as occurs when crops have to be destroyed or abandoned in times of glut. Provided farmers are not burdened with unduly onerous loan repayment obligations, the problems arising from a certain amount of over-supply of the wood market are likely to be surmountable without causing excessive hardship.

In the case of Gujarat, a more detailed market assessment was subsequently carried out. The tentative conclusions were that the demand for poles might be considerably larger than originally anticipated due to the possibility of exporting them to neighbouring states. It was also pointed out that if wood does become available in significant quantities, new forest products industries will develop in response, particularly pulp and paper mills, which in other parts of India are running well under capacity due to the lack of raw materials. The study warned, however, that:

> "Because a relatively large amount of wood will become available over a relatively short period of time, there is some concern that the current market structure may fail to protect vulnerable smaller farmers with little marketing experience" (Dewees, 1983).

5.6 Criticisms of Farm Forestry

Farm forestry has met with considerable success in a number of countries. This has provided an opportunity for an examination of its impact in a way which is not yet possible for many other types of programmes because of their slower rate of implementation. As a result of this scrutiny, particularly in India, various criticisms of farm forestry have emerged. Some of these have been extremely severe; in one case the growing of eucalyptus for pulpwood has been referred to as "an unholy alliance between landowners

and industry" (Centre for Science and Environment, 1982).

Broadly the criticisms of farm forestry come under three headings, which can be summarised as follows: firstly, that farm forestry benefits the rich at the expense of the state, and hence is a misuse of subsidies; secondly, that it fails to deliver the social and environmental benefits that have been frequently promised from it; and, thirdly, that there are times when it actively harms the poorest in the community.

All three criticisms can have a degree of validity and need to be carefully considered in the planning and management of programmes.

5.61 Subsidising the Rich

Taking the first criticism, there is no question that where circumstances are favourable, farm forestry can provide substantial financial benefits to farmers. High levels of potential profit for farmers are, however, not usually seen as an objection to the introduction of other cash crops; rather, they are cited as reasons for promoting them. Since encouraging economic activity in rural areas is a primary objective of many national development strategies, there can be no serious criticism of farm forestry solely on the grounds that it is profitable to those who engage in it.

The more important point at issue is that the benefits from farm forestry tend to be selectively appropriated by larger farmers. Other things being equal, the more wealthy farmers in an area will almost always be in the best position to take advantages of subsidised seedlings or other incentives provided to encourage tree growing. The question is particularly relevant when, from the point of view of the forest department, resources and manpower are in scarce supply and might be more effectively deployed in other types of tree growing programmes.

This criticism seems to have been accepted in many cases. There now appears to be a fairly general movement of opinion away from the indiscriminate provision of free or subsidised seedlings. The numbers distributed to each individual are usually restricted, so that rich farmers obtain no more than the poor. Programme promoters are also making considerable efforts to ensure that the smaller farmers are reached by extension services and are more effectively brought into programmes.

5.62 Failure to Provide Social and Environmental Benefits

As far as the accusation of failure to deliver social and environmental benefits is concerned, there can be no doubt that farm forestry is subject to the limitations of all programmes which rely primarily on market incentives. In such circumstances, the primary preoccupation of farmers will not

be with the wider effects of their actions; instead, they will normally be concerned with maximising the financial returns from their efforts. It is unreasonable to suggest that it could be otherwise.

Individual farmers will rarely be willing to engage in activities in which they are expected to make sacrifices or accept reduced returns in order that the community as a whole, or some sections of it, should benefit. The following comments on the position in Haiti might well apply to tree growing programmes in many other areas:

> "No matter how technically sound the project offering, no matter how ecologically suited the particular tree to the particular hillside, if the tree is viewed by the peasant as neutral to his own cash needs, the tree will be politely ignored. If the trees is perceived as negative to his cash-flow interest, it will be firmly rejected" (Murray, 1983).

When they are growing trees for the market, farmers will normally plant the trees which they believe will give them the highest and most secure rate of return. They will use the lands which they themselves judge to be the most suitable for the purpose, rather than those that might be preferred from an environmental standpoint. Thus, while tree planting on degraded hill sides and other barren and ecologically degraded lands might be desirable from a national or community perspective, for the farmer these may be the least attractive. Growing trees on the most fertile land will often be more profitable, particularly if irrigation is available and fertilizer can be afforded.

For these reasons, it can be argued that farm forestry programmes are fundamentally unsuited to achieving many of the more ambitious environmental objectives which promoting agencies have sometimes set. This does not mean that no beneficial environmental effects will accrue from tree growing for the market. But it does suggest that they are unlikely to be concentrated in the places which are most at risk. In many cases, the areas under the worst environmental threat are not even privately owned, so that farm forestry as a means of protecting them is effectively ruled out.

Providing for the wood needs of the rural poor is also frequently cited as an objective of programmes. Here again, farm forestry may be vulnerable to criticism if care is not taken to ensure that the claims made on its behalf are realistic.

The fact that farmers will naturally sell their wood to the highest bidder, will often mean that wood is sold to the cities or for use by industries. Thus, farm forestry may have a relatively limited effect on local wood availability. If the wood is sold to markets that are outside the area where it is grown, the only addition to local supplies will be from the waste and trimmings obtained when the wood is prepared for sale. Even

where the wood is sold locally, it will only go to those who can afford to purchase it.

Farm forestry may therefore provide few direct benefits to local wood consumers who are not in a position to plant trees themselves, or who are too poor to buy wood. The landless and the poor will have to continue to meet their wood needs in the traditional non-commercial manner, and the effects of having wood on sale as a result of a farm forestry programme may be minimal. The depletion of common resources will tend to continue, as will the burning of crop residues and dung by people who cannot afford to buy firewood.

Many of these criticisms are summed up in a report on the achievements of farm forestry in Karnataka state in India, where it is normally referred to under the title of 'social forestry'. The commentary includes the following observations:

> "The experience of social forestry in Kolar indicates that in spite of commitments to the satisfaction of the basic needs of the deprived rural population, none of the objectives of the programme seem to have been satisfied. The failure, in our view, arises from simplistic assumptions about the production and distribution of primary products. One simplistic assumption is that just growing more trees will satisfy the basic needs. Distinction is not made between what trees are grown and who grows them... The second assumption... is that merely producing more of any commodity in a particular locality automatically amounts to a higher availability of that commodity to the local people. This assumption fails under conditions where the purchasing power of distant urban-industrial groups can pull out resources without allowing them to trickle to local people whose need is greater, but who have very little purchasing power" (Shiva et al, 1981).

A failure to provide such social or environmental benefits is not, however, a feature which is peculiar to farm forestry; it applies equally to many other cash crops. The problem arises when it is implied that growing trees for private profit will automatically bring direct environmental and social benefits to the community where it is taking place. This is certainly not the case.

There is, therefore, serious cause for criticism if farm forestry is promoted on the basis of environmental and social benefits which it cannot deliver. Clearly, there is an obligation upon those promoting farm forestry not to attempt to justify it on grounds which others might understandably judge to be fraudulent.

5.63 Harm to the Poor

Finally, there is the accusation that farm forestry can actively harm the poor in an area in which it is being carried out on a large scale. This criticism has been particularly strong in parts of India, and is based on a number of grounds.

One way in which the poor can be harmed is through the reduction in local employment opportunities. This is because tree crops usually require less labour than agricultural crops such as cotton and rice. One of the reasons why farmers are turning to farm forestry in parts of India is precisely because it reduces both their labour costs, and the problems of farm management.

There is also a possibility that farm forestry may actually reduce the local availability of fuel and fodder, despite the fact that it increases the total biomass production in the area. This can happen in places where traditional custom permits farm labourers and other poor villagers to graze animals on farmers' fields after the harvest, and gather dung and crop residues for use as fuel. If these lands are converted to trees and access is prohibited, the poor will be deprived of their former biomass sources.

In compensation for this, there is the possibility that additional biomass in the form of thinnings from the plantations, the grass that grows under them, and the waste products when the trees are felled may become locally available instead. But this will not automatically happen. It will depend upon the market for such products, and on the benevolence or otherwise of those growing the trees.

At worst, therefore, the net result of a major shift to farm forestry in an area can be a reduction in both the employment and fuel resources available to the poor. Were farm forestry to occur on a very large scale with major diversions of land from food crops to trees, there is also the possibility that food prices might rise. These results would certainly be contrary to the expectations of many of those who have given their support to farm forestry on the grounds that it is socially beneficial.

In practice, there are very few reliable data to sustantiate or refute these criticisms. Most programmes are at a relatively early stage and their full effects, whether negative or positive, cannot yet be accurately assessed. It seems likely, however, that the impact will vary greatly from place to place, with much depending on the extent to which tree growing expands to become a significant element in the local agricultural and economic system.

The fact that such negative effects on the poor are quite obviously possible indicates, however, the importance of monitoring the impact of programmes which are currently running. If they are shown to be adversely

effecting the poor, there will be a strong case for withdrawing subsidies and other support for commercial tree growing by large farmers, and for instituting measures to compensate the poor.

5.7 The Scope for Farm Forestry

Building a tree growing programme around individual market incentives has obvious advantages. By relying on the profit motive to attract farmers into tree growing, and to sustain the process once it has begun, it is possible to simplify the design of the programme and reduce its running costs.

Moreover, if the tree growing is truly economically viable, the programme will tend to become self-sustaining. The need for demonstration plots, free seedlings, subsidised credit, and other promotional measures will diminish as the financial viability of tree growing is revealed. This means that a considerable degree of autonomy can be given to the farmers who carry out the tree growing.

The question of land availability, which is a severe constraint in the case of other programme types, is scarcely an issue in farm forestry. The basic question for the farmer is whether tree growing is more profitable than other uses of the land on which the trees are grown. Most farmers can find a place for some trees without using crop or grazing lands, but where it is to their financial advantage to do so they will turn these lands over to tree growing as well.

Once the initial impetus has been provided and commercial tree growing is effectively under way, the results of a farm forestry programme will primarily be determined by the working of market forces. Farmers will continue joining the scheme, or planting trees independently, until it is evident to them that the market is becoming saturated and prices are likely to fall.

As for the ultimate scope of farm forestry programmes, there is little firm basis as yet on which any reliable predictions can be made. In countries where there is a substantial commercial wood demand, and prices are high enough to cover tree growing costs, the scope for farm forestry could well be very large. In many Latin American and Asian countries, for example, there is a high urban demand for building poles, fuelwood and charcoal. There are also substantial demands for raw materials for pulp and rayon mills and other wood-using industries.

Whether such demands can stimulate farm forestry depends entirely on the detailed local economics. In Costa Rica, for example, it has been pointed out that, though there is a strong commercial demand for fuelwood, sugar cane and coffee provide a financial return eight or more times greater than

that from wood (Jones and Campos, 1983). Farmers are therefore reluctant to divert land to growing fuelwood.

Where the price of wood is low, and tree growing is unattractive to farmers, the scope for farm forestry is obviously reduced. This will generally be the case in areas where forest resources are plentiful, and wood can still be easily cheaply, or at no cost, from common lands or forest reserves. This position is found over wide areas of Africa, but is also true of many other parts of the world.

In other cases, wood prices are kept low because large supplies are being made available from areas where land clearance is taking place. This too, can make tree growing uneconomic for farmers, and correspondingly limit the scope for farm forestry programmes.

It is therefore exceedingly important that programmes to promote farm forestry are based on a detailed knowledge of local markets and the demand patterns for wood and other tree products. This will help determine which tree species will be most profitable for farmers to plant. It will also indicate the end uses and destinations to which tree products will most likely be directed. The relative economics of tree growing compared to other farming activities is also an area where further research is sorely needed.

It is also essential that the intrinsic limitations of farm forestry are recognised and that undue expectations are not placed upon programmes. Where broader social and environmental objectives have to be met, and particularly where the needs of the very poor are involved, farm forestry will almost certainly have to complemented by other programmes and intervention measures.

6.0 Tree Growing for Family Uses

The aim of programmes of this type is to increase the number of trees grown by individual farmers for their own family uses. Programmes rely primarily on non-commercial incentives, and are undertaken in areas where commercial tree growing is limited by low prices or the absence of a market demand.

The fact that tree growing is not a financially attractive proposition, does not mean that it is unnecessary. Places where there is little or no commercial incentive to grow trees may well be subject to worsening wood scarcities and increasing environmental degradation. There may therefore be a strong motive for promoting individual tree growing as a way of helping slow down these trends, and possibly reversing them.

Since traditions of tree cultivation already exist in most farming areas areas, at least up to a point, the basic question programme promoters must confront is why people are not planting more trees already. The answers to this will vary considerably from place to place, but will basically determine both the type of measures needed to promote tree growing, and the ultimate scope of any programme which is undertaken. No programme will succeed which is based upon the projection of outside priorities and perceptions on to local people who do not share them.

6.1 Experience to Date

Most countries in which farm and community forestry is being promoted devote some of their efforts to promoting tree growing by farmers for their own family uses. At a minimum, there is a certain amount of general encouragement and exhortation of people to plant trees on their farms. The reasons given range from relatively abstract appeals to people's civic sense and responsibility for the environment, through to more specifically tailored advice, instruction, and encouragement. In practice, the dividing line between programmes to promote tree growing for family use and commercial farm forestry is seldom distinct, since farmers may choose to sell part of the produce from their trees and use the rest themselves.

The woodfuel project in Central America which is run under the auspices of the Centro Agronomico Tropical de Investigacion y Ensenaza (CATIE) incorporates a number of non-commercial tree growing elements. These include schemes to promote private plantations for fuelwood, and a variety of agroforestry systems such as live fences, shade trees, and windbreaks. All are to intended to meet the need of farmers without disrupting their existing systems of cultivation (Jones and Campos, 1983).

In the beginning of this project in Costa Rica in 1981, the belief was that substantial incentives would be needed to persuade farmers to plant trees

on their farms. It quickly became apparent that such incentives were not necessary, and were even counter-productive. Simply providing the seedlings and some technical assistance proved, for example, to be sufficient to persuade about 90 farmers in the area of Piedades Norte to plant around 50 000 trees in 1982 (Jones and Campos, 1983).

In Tanzania, the majority of tree growing programmes are communally based, but as a result of promotional efforts it is also being found that individual farmers have been taking up planting around their own homes and farm boundaries. A striking feature of this is:

> "...the amount of protection and care individuals give their trees. In areas with livestock, strong thorny fences are constructed around each tree to protect them from animal damage, the trees are manured and in some instances watered during the dry season... Farmers also remove weeds around these newly planted trees, which they do not on communal woodlots" (Kaale, 1982).

Concerted efforts to encourage tree planting by peasants have been made in Senegal through the agricultural extension agency, SODEVA (Societe de Developpement et de Vulgarisation Agricole). Working in three of the more densely populated regions of the country, the objectives have been to provide windbreaks, to persuade people to plant the leguminous species Acacia albida as a means of increasing soil fertility, and to provide wood for fuel and other purposes. One of the results has been that a considerable number of peasants have begun to specialise in the production of seedlings themselves, for sale to others (Hoskins and Guigonis, 1979).

In Niger, the American voluntary organisation CARE began a tree growing project in the Majjia Valley in the mid 1970s. This is one of the most important river basins in Niger and runs from northeast to southwest of the country. It is an intensely cultivated area from which most of the natural tree cover has been removed, leaving the soil liable to severe wind and water erosion. Work began in 1975 with the planting of 13 kilometres of double rows of neem trees near the village of Garadoume. Since then, some 350 kilometres have planted and farmers are reporting net gains in cereal production of up to 50%. All the work has been carried out enthusiastically by farmers in the area without any recompense (Tucker et al, 1980; CARE, 1984).

In Kenya, a variety of programmes by official agencies and voluntary groups are promoting tree growing and providing subsidised seedlings. In the Mbere Division of Emba District, the target for seed distribution from the forest department nursery in 1982 was 100 000 seedlings, of a variety of different types including timber trees, fruit trees, and trees for shade and ornament. As well as selling seedlings, the nursery celebrates National Tree Planting Day by providing any person who wants them with ten

Tree planting in Ethiopia.

Photo: F.Botts/FAO

Below:
Sand dune stabilisation project in the Majjia Valley in Niger.

Photo:
Mark Edwards/Earthscan

free seedlings (Brokensha, Riley, and Castro, 1983).

Although commercial wood production dominates most of the farm forestry programmes in India, it is noteworthy that in most schemes some 10-20% of the seedlings distributed by forest department nurseries are of fruit and fodder trees, as well as bamboos. Much of the produce of these will be used by farmers' own families. Forest department nurseries also provide flowering trees which are grown for their aesthetic appeal.

In Kerala, even though land holdings are very small, with most people's plots being already well stocked with trees, there is a widespread willingness to plant a few more. The forestry department is therefore encouraging people to add to their existing stocks of trees, and is making a variety of species available.

The above programmes provide a sample of the many efforts which are being carried out in different countries to promote informal and mainly non-commercial tree growing by farmers. Reliable statistical data on the performance of programmes are, however, rarely available and there has been little follow up to establish survival rates. Though achievements have been less dramatic than in some farm forestry programmes, anecdotal evidence suggests that many of these programmes are having a considerable degree of success in increasing the numbers of trees being planted by farmers.

The spread of the neem tree in the Sahel provides a striking historical example of what can happen when people are provided with a new species which meets their needs. Neem grows quickly, coppices freely, produces excellent quality firewood, timber, and poles and provides good shade throughout the year. It was introduced into Senegal in 1944 and into Mali in 1953, and in some other parts of West Africa was used in the early part of the century by the British and French colonial forest services for roadside planting and woodlots.

Over the past four decades it has spread throughout the Sahel region, making it one of the more common species now found, particularly around areas of human habitation. The demand for seedlings is high, and there are private nurseries around some urban centres. A somewhat similar process is now taking place with the grafted mango. Demand for these is so high that at some times of the year they are being supplied to dealers in Upper Volta from Bamako in Mali, a distance of 550 km (Taylor and Soumare, 1983).

Another reassuring example of what can be achieved through the introduction of an appropriate species is provided by the experience with eucalyptus in Peru. This was introduced from Australia during the last century in an attempt to combat erosion, and is now planted widely in some areas of the highlands. The trees are used to provide families' own fuelwood and for sale. Around the town of Huancarama, for example:

"...all the fields and nearly every path is lined with eucalytpus trees, forming a high willowy boundary between properties. Usually this border is composed of trees in various stages of development from mere saplings to those with a diameter of 1.5 metres. When eucalyptus is felled, new shoots grow automatically from the roots of the former tree. Thus, on the tree stumps of hefty proportions are superimposed the lithe secondary growth. The tree borders are private property and are highly valued as a fuel source despite their having a negative impact on the yield of a given field" (Skar et al, 1982).

The negative impact on yields referred to is a result of the spread of the eucalypts' root systems into the neighbouring maize fields. The effect is most noticeable at the edge of the fields where the above account notes that it 'severely limits' the production capacity of the plants. The very large size to which the trees are allowed to grow is undoubtedly a factor which influences this.

This Peruvian example, however, demonstrates that even clearly obvious negative side effects are not necessarily an absolute barrier to the growing of trees. The crucial question is whether local people judge that the benefits of planting a particular species outweigh the costs.

6.2 Meeting Locally Perceived Needs

The fact that there is no commercial market to dictate what types of trees should be planted, and in what quantities, means that programmes to promote tree growing for family uses need to be carefully attuned to farmers' own preferences and priorities.

The assumption that people would be willing to plant trees for fuelwood has underlain a number of programmes in the past. Experience is showing that in places where the fuel supply is not seen as an immediately serious issue, people are usually uninterested in growing trees exclusively for fuelwood. Indeed, even in places where fuelwood is recognised as being in short supply, or at least becoming scarce, it rarely seems to be a sufficient motive to persuade people to grow trees purely for fuel.

A recent survey of people's attitudes in Malawi has shown that, though people said they were aware fuelwood was becoming more scarce, they were most concerned with the shortage of building poles. As a result, they were more interested in planting trees for poles (Energy Studies Unit, 1981b). In the hill areas of Nepal, a similar survey disclosed that the overriding concern was for tree-fodder for buffalos (Campbell and Bhattarai, 1983).

In Senegal, there have been attempts to promote tree growing for fuelwood which have shown extremely poor results. In some cases it was assumed that

the reason for this was a fundamental local objection to tree growing, or at least an unawareness of its benefits. This appeared to indicate a need for greater educational efforts and a more vigorous promotion of tree growing. It was found, however, that the reluctance to plant trees for fuel did not extend to other types of trees.

A report on the first year of a village plantation project made the following observations:

> "Our visits to village sites conclusively showed that as far as the villagers are concerned, neither firewood nor woodlots for individual villages are foremost in their minds. Rather, what is important to the local population are points not covered in the project documents: shade trees in family compounds, food or fruit trees, small clumps of trees in unused corners, public places, etc. Since these kinds of tree planting efforts can make just as valuable a contribution, not only in wood production but also in socio-economic as well as ecological terms, why not shift project accents in this direction? Particularly if that is what people prefer" (Weber, 1981).

This is not to deny that people need fuel. But the evidence that fuelwood demands, by themselves, do not constitute a sufficient motivation for growing trees is steadily accumulating, particularly in cases where there is no commercial market for fuel. There are numerous instances of where an overemphasis on fuelwood as the principal objective of tree growing programmes has clearly hampered their success.

In general, it seems that trees which provide a variety of different benefits are the most attractive to farmers. In Costa Rica, for example, a survey has shown that farmers are frequently prepared to plant trees without any economic motive. Their reasons included shade for crops, wind protection, soil conservation, and embellishment of the farmland. In particular, farmers preferred species with multiple functions. In no instance was there a single motive given for planting; although people were frequently prepared to specify a principal reason, they always mentioned alternative or complementary uses for the trees they planted (Jones and Campos, 1983).

The fact remains, however, that woodfuel is a basic necessity for large numbers of people and likely to remain so for a considerable time to come. The fact that there is such a high degree of uncertainty about how fuel needs are actually met in many areas, and what the capacity of fruit and other trees is to produce fuelwood by careful lopping, is a major reason for carrying out detailed local research into existing patterns of fuel use and tree management before launching tree growing programmes.

6.3 Programme Implementation

The distribution of tree seedlings forms the backbone of most tree growing programmes of this type. Though people can usually obtain free seedlings from traditional sources if they want them, the advantage of setting up nurseries is that they allow a wider range of species to be offered, together with improved varieties that would not otherwise be available. Having seedlings grown under controlled conditions also helps ensure standards of quality, and provides a degree of protection for farmers' interests. The nursery may also be used as a focal point for other extension and demonstration activities.

But it is extremely important that each nursery is responsive to the requirements in its own area and provides the species that farmers want. A survey in one part of Costa Rica, for example, revealed that the reason a local forest department nursery was not utilised was that it mainly provided pine seedlings, which was what the forestery department was using in large scale plantations in the area. Since these did not meet farmers' preferences, there was little demand (Jones and Campos, 1983).

Such preferences vary widely from place to place. Demands for wood products, fruit, nuts, edible leaves and shoots, animal fodder, tannins, dyes, bark, fibres, medicines, and various gums and oils can all provide an incentive for people to cultivate trees, as can environmental and purely aesthetic reasons. But their relative importance will depend to a large extent on traditional customs, demand patterns, and what problems there are obtaining these products from alternative sources. The best mix of species to stock in a nursery can therefore only be found though careful local surveys.

When new tree species or planting methods are being introduced, demonstration plots will almost certainly be a necessary part of gaining local confidence and support. This is particularly the case when attempts are being made to promote some of the more sophisticated agroforestry techniques in areas where they have not traditionally been used. The close intercropping of trees and agricultural crops, for example, may seem totally alien to some farmers. Even planting trees along farm boundaries may be resisted if farmers are worried about the effects on crop yields and water availability.

Regardless of the theoretical advantages of novel approaches, and the fact that they are used extensively in other parts of the world, local farmers are likely to view them with suspicion until they have been amply proven. It may therefore require a great deal of time and effort to transfer them to new areas. The more radical the departure from existing systems, the greater the problems of local acceptance are likely to be, and the longer it will take to persuade farmers to adopt it.

In most instances, progress will be greatest if efforts are concentrated on increasing the amount of tree growing along locally accepted lines, and gradually introducing small improvements in the system. This is being done, for example, in Costa Rica, where traditional agroforestry systems are already well developed. Volunteer farmers are collaborating in tests of new types of shade trees for their coffee plantations, and promotional efforts are being directed at 'fine tuning' the system to increase its overall productivity.

6.4 Scope and Limitations

The basic issue determining the scope of tree growing for family uses in most areas is whether farmers see the benefits as outweighing the costs. This will depend to a very large extent on the precise local conditions and the various factors which people consider when they weigh up the advantages and disadvantages of tree growing. Even within the same community, some people will be far more responsive to encouragements to plant trees than others. This will depend not just on their land ownership position and financial status; it will also be affected by people's personal preferences, industriousness, and general attitudes.

Where tree are plentiful, wood scarcities are not severe, and most tree products can still be obtained with relative ease, the reasons for planting additional trees will usually not appear particulary compelling. Although trees may be regarded as worthwhile and useful, people may feel little incentive to make special efforts to plant more. Even if the financial cost of planting a few additional trees around the house is minimal, the extra space they take up and the inconvenience of protecting them for animals and other damage may be a sufficient deterrent to prevent them being grown.

Surveys in Malawi, for instance, have confirmed that smallholders recognise that deforestation is a problem. It has been established through interviews with farmers that seedlings and land are available, that knowledge of silviculture is adequate, and there are no serious constraints on tree planting. Indeed, many farmers already grow some trees. Yet, in spite of considerable efforts by the forestry department to promote additional tree growing, progress has been found to be much slower than anticipated.

In examining the reasons why farmers were not prepared to plant more trees, it was concluded that: "The answer seems relatively straightforward: because they don't want to" (Energy Studies Unit, 1982b). It simply confirms that where no commercial market exists for tree products, people will only plant trees up to the number that they themselves deem sufficient for their own needs.

In all cases, tree growing for family use will only make sense where farmers are confident that they or their families will obtain the benefits of the trees they plant. This means that programmes can only have an impact in areas where farmers have secure rights to their land and to the trees that grow on it. Where the long term ownership of either is in doubt, exhortations to plant trees are likely to have a minimal impact.

Where farmers have the necessary security, however, there is generally scope for promoting at least some additional tree growing. There may, for example, be a lack of the seedlings which are most useful or necessary in an area, providing an opening for a nursery to supply them. Farmers may be unaware of advances in silviculture which could be relevant to them; or they may be in need of advice and help in devising ways of dealing with changing and worsening circumstances.

But it is essential that programme planning is based upon a clearly defined set of objectives. The reasons for promoting tree growing must make sense at both the project level, and that of the local farmer. Where the objectives of programmes coincide with local priorities, the prospects of increasing the amount of local tree growing will be promising. But the ultimate scope of programmes will be determined by what farmers themselves see as their needs.

Care is therefore needed in setting targets and making comparisons between programmes of this type and those based on commercial incentives. The smaller number of trees likely to be planted does not necessarily reflect on their importance or usefulness. They may bring extremely important benefits at a family level, as well as playing a role in the environmental protection and enhancement of farmlands.

Whatever the extent to which it is taken up, however, tree growing for family uses will be exempt from the more serious criticisms levelled against farm forestry. Because it does not generate any income directly, planting will usually be restricted to farm boundaries and unused land around the farm or home. There will normally be no question of converting crop lands to tree growing or reducing the local availability of biomass. Neither will there be any adverse effects on employment.

7.0 Community Forestry

Community programmes are based upon growing trees on public or community land as opposed to private farms. The degree of local participation in planting and looking after the trees varies. What all community programmes have in common, is that they are intended to provide benefits which are shared by the community as a whole.

The theoretical attractions of community programmes are considerable. In principle, they provide a means by which landless people can take part in tree growing and thereby obtain benefits which are otherwise reserved for landowners. Some programmes may even be designed so that benefits are deliberately chanelled towards the poor.

Community programmes are also one of the few practical approaches to tackling the problem of the degradation of common lands that occurs as a results of the competing demands of local people. Establishing a degree of mutual cooperation may make it possible to organise concerted action to protect these lands, increase their productivity, and halt their gradual decline into barren wastelands.

The most common type of community forestry programme is that in which the forest department takes on the responsibility for carrying out the planting. Inputs such as fertilizers and seedlings are provided without any outlay by the community. The engagement of the local community in the implementation of schemes of this type is largely passive and is normally restricted to the provision of hired labour for planting, and an agreement to cooperate in protecting the plantation.

Other programmes rely on a much higher level of community participation and control. They are generally designed to use land which is under direct community ownership; or they can take place on state lands which have been specially designated for community control. The main responsibility for planting and looking after the trees is taken by the community itself and the role of the promoting agency is primarily a catalytic one.

Community programmes may use both commercial and non-commercial incentives as a way of stimulating local participation. In all cases, the key to success lies in persuading local people that the programme is in their interests and that the benefits they are promised are securely guaranteed.

7.1 Experience to Date

The first large scale community forestry programme was that of China. This was carried out on a nationwide basis and was launched during the 1950s under the leadership of Chairman Mao. A high level of political motivation

of the population was achieved, and the programme was placed in the context of the general national reconstruction after the previous decades of war.

The work was carried out through the local collective or communal organisations established by the Chinese government as the basis of the country's agricultural and industrial production systems. The achievements of the programme were extremely large: some 28 million hectares of planting were reported to have been completed by 1978, though there have been some questions raised about survival rates and other aspects of the programme, particularly as they were reported during the years of the Cultural Revolution (Smil, 1982).

In South Korea, attempts were made to promote community forestry during the 1960s. Although the achievements during that decade were substantial, many severe problems remained unsolved and there were limitations in much of the work which had been carried out (Gregerson, 1982). A fresh effort to promote community tree growing was therefore undertaken in the early 1970s. The New Community Movement, or Saemaul Undong, which was launched in 1970, played a key part in this. The objective of the Movement was to modernize rural existence, and reforestation was one of the tasks on which it concentrated.

A ten-year National Forest Plan was launched in 1973. Among its targets were the planting of 1 million hectares of trees. Of these, about a third were to be fruit and nut species, another third were to be fast growing species, with about 200 000 hectares devoted to fuelwood trees, and the remainder for long rotation species.

The basic implementation of the Plan at the local level relied on the country's network of Village Forestry Associations. These elected bodies carried out projects under the direction of the government or other official agencies. Profit sharing arrangements were laid down by the government, but site selection was carried out by the local Village Forestry Association. The costs of the programme were shared, with the government bearing about 65% of the total and the remainder being provided, mainly in kind, by the villagers.

The actions taken to bring the Plan into operation incorporated a comprehensive package of technical, social, financial, and legislative measures. This placed the reforestation programme within the totality of the government's rural development strategies. One commentary on the programme states:

> "It involved all aspects of the contribution of forestry to the improvement of community life - soil stabilisation, fuelwood, income from timber production, timber processing, and the provision of non-timber products from the forest. It involved local community organisation... significant pieces of forestry

Trees planted on formerly deforested and eroding slopes in Hubei Province, China. Photo: F.Botts/FAO

Finding communal land suitable for tree growing can be a major problem in community forestry projects; Sudan. Photo: Mark Edwards/Earthscan

and land use legislation... government support at all levels in the form of subsidies, loans, guidance, technical support, and information.. private organisation and participation" (Gregerson, 1982).

By 1977, five years ahead of target, the overall planting target of the Plan had been reached. Although there was a shortfall of about 50% in the number of fruit trees planted, this was compensated by an additional planting of long rotation species. But the final cost of the programme was almost twice that originally estimated.

Korea was thus singularly successful in bringing both its deforestation and fuelwood problems under control. But the picture of how this was achieved is a far from simple one. While community involvement was a crucial factor in achieving the planting targets, massive government intervention and direction were also required.

An additional, and perhaps decisive factor, was the major land reform which took place in 1949, at the end of Second World War and the Japanese occupation of the country. As a result of this, forest ownership became widely dispersed, with almost three quarters of the country's forest in private hands, the majority in relatively small plots. This pattern of ownership provided a framework of responsibility, and incentives, within which the reforestation measures of the 1970s could be implemented.

In India, attempts to engage communities in tree growing date back to the 1950s, though few results were obtained from these early efforts. Since then, however, numerous initiatives have been taken, and India is now one of the leading countries in the promotion of community forestry in a variety of forms.

In 1960, Tamil Nadu introduced a programme of planting on the foreshores of community irrigation reservoirs. These 'tanks', as they are called locally, vary in size from ponds of a few hectares up to lakes of a thousand hectares or more. There are about 38 000 of them in the state, covering an area of 500 000 hectares.

The principal species planted was 'babul' (Acacia nilotica), a thorny tree which can stand prolonged submersion. Its main use is for small timber and fuelwood, but, while it is growing, its pods can be used as animal fodder and are a rich source of protein. The principal purpose of the programme was to create employment, through the hiring of local labour for planting and maintenance work. The plantations were intended to produce firewood and building materials for sale, with the proceeds being used to offset the Forest Department's costs.

Since most of the tanks are under the legal possession or control of the local village councils, or 'panchayats', local cooperation was essential if

plantations were to succeed. The necessary cooperation took some time to emerge:

> "During the earlier period of the scheme its implementation was an uphill task. Instances are many where village panchayats bluntly refused to offer their lands for this scheme. But fortunately the plantations raised in lands, offered but reluctantly by a few panchayats, were significantly successful. Witnessing the success of plantations many panchayats showed interest and came forward gradually to offer their lands too" (Sundaram, 1978).

To increase the level of cooperation, the scheme was modified in 1973. Instead of all the proceeds from the plantation going to the Forest Department, an arrangement was introduced whereby they were split 50:50 with the panchayat. This had the desired effect, and a much greater degree of community involvement was obtained. If plantations on roadsides and canal banks are included, the total area of communal plantations established since the 1950s now amounts to about 176 000 hectares the largest coverage of any state in India.

The state of Gujarat has also been heavily engaged in community forestry programmes. Early efforts concentrated on growing trees by the sides of roads and railways, and along canal banks. The main initiative for these strip plantations came from the Forest Department, which bore the entire project costs. Local cooperation remained largely passive, but the fact that trees were allowed to survive was judged as significant:

> "The very existence of trees in such a wood-scarce area without anything more than token psychological protection is visible evidence of the success of the Gujarat Forest Department in enlisting the support of the people for growing trees" (Karamchandani, 1982).

Under the original scheme, roadside fuelwood trees were to be cut on a 7-10 year cycle, with the proceeds from their sale going to the Forest Department. This was modified in 1980 to an arrangement where the net profits will be split 50:50 with the community. By the end of 1982, the equivalent of 29 500 hectares of strip plantations had been established throughout the state.

A programme model which attempts to achieve a more active level of community participation was introduced in Gujarat in 1974. The Forest Department asked village panchayats to allow it to establish 4 hectare plantations of fuelwood, fodder, and fruit trees on communal village land. In return, villagers were to be allowed access for fruit and fodder collection, and were promised a 50% share in net profits when the trees were cut. Because the major input of work and maintenance was provided by the Forest

Department, these plantations were designated as 'Supervised Woodlots'.

The initial response from villages was slow, mainly because of worries that the government might permanently appropriate any land given over for planting. Local confidence in the Forest Department has gradually improved, however, and by 1982, woodlots had been established in 4000 villages, covering a total of 26 000 hectares. Seedling survival rates are, however, reported to be very low in some areas.

In an attempt to increase community involvement further, a parallel scheme was introduced in 1980 in which villages were encouraged to take over the organisation and management of woodlots themselves. Referred to as the 'Village Self-Help Scheme', the intention was that the Forest Department would provide free seedlings and technical assistance, but would leave the rest of the work to the village panchayat. On harvesting, the village would receive the entire proceeds instead of half.

The response to this scheme has proved disappointing and a mid-term review of progress found that it was the only element in the programme lagging substantially behind target. The conclusion was that the targets for self-help woodlots would not be met and that the Forest Department should concentrate instead on the 'Supervised Woodlot' approach in which the panchayats are not required to play an active role.

A point of particular importance which applies to virtually all the Indian programmes, and which distinguishes them from those in many other parts of the world, is that are being implemented in a context in which there is a strong commercial demand for wood products.

Producing such wood for the market can, in fact, be a highly effective way of generating community funds. In Tamil Nadu, for example, some of the larger tank plantations extend over more than 50 hectares. At current wood prices, plantations of Acacia nilotica are expected to yield a revenue of approximately $500 per hectare after 10 years. For a 50 ha plantation this would correspond to a total revenue of $25 000.

Even after deducting the plantation establishment costs, and giving 50% of the net revenue to the forest department, this represents a sizeable input into the community budget. Panchayats have complete control over such funds and many express an interest in using their community forestry earninga on public works projects such as schools, health facilities, and water supplies.

A very different picture of community forestry emerges from the Sahel. Over the past decade or so, enormous efforts have been made to promote community forestry in the region. There has been major involvement by the World Bank, UNDP, FAO, the EEC, and the US, French and other European Governments. In addition, at least a dozen US and European voluntary

Canal-side planting in Gujarat. Photo: G.Foley/Earthscan

Acacia nilotica growing in an irrigation tank in Tamil Nadu; in the rainy season these plants are almost completely submerged.
Photo: G.Foley/Earthscan

organisations have made significant efforts. According to one estimate, a total of $160 million was spent on projects during the period 1975-82, out of a total of $230 million committed (Weber, 1982).

The achievements, however, have been relatively meagre. In one major area, that of village woodlot planting for fuelwood, the results have been particularly disappointing. It is estimated that a total of 25 000 hectares were afforested in the Sahel in the period 1972-82 but that perhaps a third of it has grown so poorly that it produces little, if any, wood (Weber, 1982).

Where village woodlots have succeeded, it has tended to be because they have been planted and managed by Forest Departments using paid labour. In Niger, because of the failure of early attempts at village plantations, it was decided to concentrate on establishing them as demonstration projects in rural development centres, or 'centres de perfectionnment rural' (Tucker et al, 1980).

In the Sahelian programmes of the early and middle 1970s, the accent was on using heavy machinery to clear land for tree planting and hired labour. In effect, a series of public works emergency programmes was launched with the aim of preventing desertification and providing for fuelwood supplies. The trees planted were mainly rapid growth exotics, such as eucalyptus, neem, and gmelina.

Problems of cost overruns and lower than predicted yields put the financial basis of these efforts into question, and it is now widely accepted that investment in such plantations is rarely going to be economically viable. It is also recognised that the costs to the local population in loss of access to the former open lands which were taken up for planting were greater than originally anticipated. In some cases, this loss of benefits had provoked open resentment on the part of villagers towards the efforts being made to help them.

From 1978 onwards, the emphasis has shifted towards trying to obtain much closer collaboration with local communities. But the difficulties in implementing communal programmes are formidable, both at the technical and institutional level. Although there have been instances of successful projects, they have been on a limited scale. The prospects for the future remain unclear until the causes of past failures have been fully analysed.

One commentator on the Sahelian experience has said:

> "Some social scientists have gone so far as to suggest that no communal projects are possible, and that only family groups or individually owned trees will actually be maintained and distributed with equity. I would not go so far, but would caution that the model of communal woodlots is not an easy one to

apply" (Hoskins, 1982).

In Tanzania, efforts have been under way to promote village woodlots since the late 1960s. The original objective was that every village would start a woodlot both to supply its own needs and to improve the physical environment. The estimated total planting in the country during the 1970s, based on the numbers of seedlings distributed, was only about 22 000 hectares, spread among the country's 8000 villages. This was about 16% of the total planned (Kilimaha, 1980). No figures are available for survival rates, but local observations indicate that in some cases, at least, these have been extremely low (Skutsch, 1983).

Numerous reasons have been suggested for the failure to meet the targets which had been set. Distrust of local community organisations on the part of villagers, administrative weaknesses in the forest service at a local level, non-delivery of seedlings and other inputs, and inappropriate location of plantations have all reportedly played a part in keeping planting efforts at such a low level (Skutsch 1983).

In particular, there appears to have been a widespread lack of local enthusiasm for communal tree-planting. People have shown themselves willing to plant trees on their own lands, but have been much less keen about participating in community efforts. Nevertheless, there have been some recent indications that the position is changing, and programmes may enjoy greater success in the future.

Community tree growing programmes are also under way in many other countries. Most are still at an early stage and evaluation of their results is not yet possible. The experience from the above programmes, however, provides a substantial basis for an initial assessment of the potential for community forestry and a review of the main difficulties that have to be faced.

7.2 The Problem of Land-use Conflicts

Obtaining the necessary land for tree growing is undoubtedly one of the major stumbling blocks in programmes of this type. Community land is frequently scarce, or is being used for a variety of other purposes. Agreement to dedicate it to tree growing can be very difficult to achieve.

The same applies to public lands, in many instances, even though they may officially be under the ownership of the state. In practice, control of these areas is often vested in a variety of agencies and authorities who may be unwilling to surrender their control to forest departments or local organisations. Railway, canal, and water authorities, for example, may have genuine concerns about various safety and other implications of tree growing on their lands. In other cases, agencies may simply wish to

preserve their independent rights to use land for their own future expansion.

In the case of land owned by public authorities, it can be equally essential to obtain the agreement of the local community on using it for tree growing. Though local people do not formally own such land, they frequently have legal or customary rights to use it for grazing, fuel collection, or other purposes.

Even in areas where it is expressly forbidden, people may have long-established customs of utilising public lands. Such informal rights may be of considerable economic importance to them, as has been noted:

> "The illicit private uses of common-property lands have economic value of a magnitude that will not easily be replaced. In fact, the compensation of the losers when public lands do become a priority for new investment is one of the major obstacles to successful public land improvement. New practices will not be sustained if the new arrangements leave some participants in the process worse off than before" (Gibbs, 1982).

If access to such lands is restricted without local consent, the subsequent problems of protecting the plantation will often be insuperable. There have been instances in which attempts to force tree growing programmes on communities have ended with the seedlings being pulled up, or animals being allowed to destroy them. Even if permanent guards are provided by the forestry department to protect the plantation, their efforts can rarely be effective if the majority of local people are not willing to cooperate in keeping their animals out, and refraining from cutting or damaging the trees.

A variety of methods can be used to help resolve such land-use conflicts. Tree planting can be staggered over several years, for example, so that the area of restricted access at any given time is kept as low as possible. When the trees have reached a stage where they will be safe from livestock damage, the area can then be opened to grazing again while another is being planted.

People may also be given access to cut fodder by hand while the trees are still young. In some cases, the amount of herbage produced may actually be greater than if the land was subjected to free grazing. This is particularly the case when the area between the trees is planted with specially selected grass species to increase fodder production.

Provided measures such as these are taken, many of the conflict of interest problems can be avoided. But it is essential that questions of grazing rights and access to common lands are resolved in advance of the project; once conflicts have had time to develop, the whole success of the project

may be put at risk.

Another possibility that has to be borne in mind is that there may well be substantial differences between the officially stated land ownership position and that actually obtaining in practice. Investigations which were carried out during the World Bank's Azad Kashmir programme in Pakistan, for example, revealed a major discrepancy between the planning assumptions about community land and the reality encountered on the ground.

In the early stages of this project, planting was carried out on what was officially designated as community land, the intention being that the returns when the trees were harvested would be shared by the community at large. On investigation it was found that there was a crucial difference between the actual and the official status of the so-called community land. Instead of being communally owned, a large proportion of it was being used as private property by local farmers.

Moreover, it was the larger farmers who had acquired control over these nominally communal areas. The same farmers also turned out to be the most eager to take advantage of the project subsidies for planting on communal land. They were, in fact, hoping to get their lands planted at full government expense, without making any investment themselves (Cernea, 1981). Upon this discovery being made, the programme was altered to bring it into line with its original objectives.

A similar discrepancy between official records and the real position has also been noted in Karnataka in India. A survey of the Kolar district estimates that the amount of 'functionally surviving' community land is about 4900 hectares, whereas that officially recorded is almost 148 000 hectares. The community lands have, in fact, totally disappeared in large parts of the district (Shiva et al, 1981).

7.3 Lack of Identity of Interests

Few communities have a genuine identity of interests among all their members. Practical experience has shown that this can cause a numer of severe problems with community programmes. Where communities are rigidly stratified along social, economic or religious lines, the barriers to communal action can be particularly difficult to remove.

The existence of factions within village has been noted as an important factor in India (Noronha, 1980). In Gujarat, the non-homogeneity of village communities has reportedly been one of the principal reasons behind the lack of success of the 'Village Self-Help' programme. Problems have included a mistrust of the system for ensuring equitable distribution of woodlot output, and disputes among farmers concerning the availability of common land for the establishment of woodlots. The shortage of panchayat

funds for payment of labour and protection of plantations has also created difficulties.

The distribution of the costs and benefits of programmes creates a set of particularly difficult problems. Whether these can be resolved in a way that gains local assent depends very much on the confidence people have in local village institutions, and the degree to which long term communal interests can be established and agreed when the programme is being set up.

It is also important to note that many village organisations, such as the panchayats in India, have a high degree of autonomy. While promoting agencies may have preferences about how the programme should be run at a village level, they may only be able to issue guidelines rather than enforceable directives.

Some of the possible problems arising in this context are illustrated by experience in Tanzania. There, the legal basis for the distribution of benefits from communal activities has been firmly established as part of the national villagisation programme. Thus, a framework for action when the time to harvest community woodlots arrives theoretically exists. Under its provisions, the village government is responsible for overseeing the cutting of the wood, and the selling of it to anyone willing to buy. The money received goes into a village fund for expenditure on communal amenities.

Conversations with villagers, however, reveal that the level of trust placed in the village government varies considerably. Like farmers virtually everywhere, Tanzanian villagers are "intensely suspicious of any financial dealings undertaken on their behalf" and in some villages the fear was expressed that members of the village government might embezzle the money. In 22 out of the 27 villages in one survey, it was found that the question of what to do with the harvest when the village plantation was ready to be cut had not been discussed at all (Nilsson, 1983).

In other villages, different factions were suspicious that their rivals might gain unequal benefits in the sharing of the proceeds of sales. The extent to which villages were prepared to enter into community woodlot planting seemed to be significantly related to the trust people were prepared to place in their village governments (Skutsch, 1983).

In Senegal, a recent survey of a community forestry programme has also highlighted the difficulties that can arise in agreeing a method of sharing the costs and benefits of tree growing. Although the particular project was community-based, virtually everyone regarded their work on it as an income-earning activity. The survey tried to address the question of what would be their reaction in eight or ten years' time when the woodlots are harvested and the benefits distributed in a way which might not accord with their expectations.

A comment made by those conducting the investigation clearly portrays the uncertainty which surrounds the question, and the potential that exists for future misunderstanding and resentment:

> "We have pursued this question with officials and villagers to the edge of their tolerance. Yet, their answers - to us- are still unsatisfactory. Our conclusion is that, under the circumstances, the best thing to do is to keep trying and see what happens" (Weber, 1981).

A similar lack of awareness of how benefits were going to be distributed has been noted elsewhere in the Sahel. When peasants were asked whom they thought would obtain the return from the plantation they gave various answers, including the forestry service, the village chief, or the foreign project designer. Some did not know and were not willing to guess; few believed they personally would receive any of the wood when it was harvested (Hoskins, 1979).

In community schemes where a clear and locally acceptable method of benefit-sharing has not been agreed, the possibility of difficulties arising when the trees are harvested is thus a real prospect. This is causing concern in a number of countries where community plantations established in late 1970s are beginning to reach a harvestable age.

Great care is needed when setting up community programmes to ensure that all the main questions and possibly contentious points likely to arise are settled in advance. This means there must be agreement on the types of trees planted, their care and maintenance, the level of access allowed to them, their harvesting, the work involved in the programme and the distribution of benefits. Preferably, the agreement should be based upon a properly drawn up and legally binding contract between the local organisation and the agency promoting the programme.

The continuation of many projects beyond the first tree harvest will depend heavily on the extent to which the problem of benefit distribution is acceptably resolved at a local level. A careful monitoring of the results of projects currently under way should provide some urgently needed information on how to proceed with future projects.

7.4 Local Institutions

Community tree growing programmes are crucially dependent upon the active collaboration of village councils, community groups, or other local institutions. Programme planning must, therefore, be based upon a clear appreciation of the actual role such organisations play in local affairs, and their potential for realising, or thwarting, the aims of the programme.

In general, local institutions tend to represent and maintain the local patterns of power and interest. The wealthier members of the village usually have the dominant voice in the decisions that are made. In many cases they are able to mobilise support for their own viewpoint because of the numbers of people who depend on them for employment, tenancy, and private loans (Bruszt, 1981). The role and working of village panchayats in India, for example, has been described as follows:

> "The composition of the panchayat is complex. It represents largely the focal points of political power. Obviously the individuals represented in these organisations are vociferous and financially better off. Any programme which would upset these focal points of power would strongly be opposed and resented by the affected people in these organisations" (Dalvi, 1982).

It is, in fact, optimistic in the extreme to suppose that the views expressed by such a body will necessarily represent the interests and preferences of the poor. Those in power at the village level, rather than favouring measures which aim to bring about change and social reform, are more likely to be prepared to oppose and frustrate them. This may be true not just of those with explicit political power, but also of the richer farmers, and even the local agents of the forestry and other government services.

It cannot therefore be assumed that the devolution of power over the direction of programmes and the disposition of their benefits to local organisations will automatically further the cause of the most deprived in the community. A clear, verifiable, and enforceable agreement will normally be needed between promoters and any local organisations which are expected to collaborate in achieving the social goals of a programme.

As one commentary on the role of community organisations in rural development states:

> "Hinging development efforts on the willingness of people to get together for the community good will work well only where the village or groups within it are effective going concerns, capable of organizing the requisite efforts through a working system of rules. But where there exists no going concern - or one whose membership is limited to a small subset of the community population - the costs of getting together may be prohibitive, and people may have to opt for going separately, even though they know such a strategy may leave them worse off in the long run" (Thomson, 1979).

In cases where local institutions are weak, tree growing programmes have sometimes been seen to provide an opportunity for them to strengthen both their organisational capabilities, and their credibility. But caution is

required on the part of those fostering such initiatives. Managing plantations and allocating their costs and benefits requires considerable authority and local respect, something which village organisations may find difficult to muster.

Local institution-building is a lengthy and complex business which must take into full account the real distribution of social, economic, and political power at a village level. A long and careful sequence of steps may be required to build up the capabilities of local institutions and win people's confidence before effective devolution of programmes can take place.

In both the Tamil Nadu and Gujarat programmes in India, for example, the forest department has been keen to transfer additional responsibility for plantations to the local communities. Many of the villages which have cooperated in the schemes, however, prefer the system as it is. This is because delegating responsibility for planting and guarding the plantation to the forestry department avoids disputes about the distribution of work during the planting, and the allocation of blame if something goes wrong. It also avoids some members of the community having to watch over the rest to prevent pilfering.

The picture is not uniform, however. Some panchayats have expressed a willingness to take over full control of plantations. This is so that they will be able to obtain all of the proceeds when the trees are harvested, rather than the 50% share they get when the forest department supervises the plantation (Noronha, 1980).

The fact that panchayats in parts of India, and village bodies elsewhere in the world, are often politicized is also a factor that has to be borne in mind. Issues will therefore not necessarily be considered on their purely local merits, but will tend to be fitted into the framework of broader political battles. The result may be that measures which obtain the support of one party while it is in power will be rejected if it loses the next election. Policies which cannot generate support from both the party in power and the opposition are thereby placed in a vulnerable position in areas where local political control is subject to change.

7.5 Scope for Community Forestry

The inherent complexity of community programmes, with their needs for compromise and reconcilation of opposing interests, means that they will always require a great deal of careful preparation and negotiation. This demands a high level of trust and cooperation between the community and the promoting agency which can, itself, take a long time to create.

It may, in fact, be several years before the credibility of forest services can be established to the extent that communities will be willing to cooperate with them and risk substantial effort or resources in community tree planting programmes. In Gujarat, for example, a special department was set up in the Forest Department to promote community collaboration in forestry projects. It is noteworthy that it took five years before local interest in many of the schemes it was promoting began to pick up.

Community programmes also require a degree of commitment to a common effort within the community which in many cases is difficult to achieve. Establishing the necessary unity, arranging effective methods of collaboration, and ensuring that there is an agreed method for the equitable distribution of benefits may be beyond the abilities of many local communities.

This is particularly so where communities are rigidly divided on the basis of class or caste, or where income inequalities are very great. In such societies, where there is no strong tradition of collaborative action, or where local institutions are weak, the scope for community programmes will often be much less than for those in which farmers participate for their own individual advantage.

Nevertheless, experience has also shown that in the appropriate circumstances, and with effective support from governments and forestry services, very substantial community tree planting achievments can be made. Events in South Korea and China have demonstrated this on an extremely large scale.

In India, also, it has been proved that planting along roads, canals, railways and other waste lands, with the collaboration of the local community, is possible. There have also been notable successes in planting on communal and other lands such as the irrigation tanks in Tamil Nadu. To a certain extent these results have been dwarfed by the rapid progress made in commercial farm forestry. But viewed in their own right they represent considerable achievements.

Recent experience in Nepal has also shown that community forestry projects, provided they are well designed, and appropriate to their context, hold considerable promise. A comment on the programmes to date says:

> "...we have found that communities are generally quite interested and their participation in afforestation and forest management is the basis for community forestry in Nepal. After 3 years of operation there is no indication that this has been a wrong assumption. During a socio-economic survey it was found that 85% of the people are prepared to make common grazing lands available for community plantations. Survival counts of plantations established in 1981 and 1982 indicate that the main reasons for

failure, where it occurs, is technical or administrative rather than socio-economic" (Pelinck, 1983).

The practical limitations of programmes, particularly in their capacity to bring about significant social change, must also be accepted. It is true that community forestry programmes can provide an effective means of helping the poorer members of the community, but this depends almost entirely upon the commitment of the local village organisation to doing so.

If on the other hand, the plantation is treated as a purely commercial enterprise and the wood is sold to dealers from urban areas, the result will be similar to that when a farm forestry programme is introduced. There will be a net increase in the total biomass production in the area, but the available fodder and fuelwood to the poor may well be reduced.

The point is not that community forestry projects necessarily harm the poor; it is that they do not automatically benefit them. If resolving the problems of the poorest members of the community is taken as major objective of a programme, its design and implementation will have to be explicitly tailored so that this objective is reached. Simply ensuring that trees are grown or that power is devolved to local community organisations will not in themselves necessarily bring any worthwhile benefits to the poor.

In the past, many community programmes have been viewed perhaps too optimistically. A considerable number were burdened with rhetoric and over-ambitious objectives. As a consequence, some have failed completely to live up to the expectations placed upon them, and this has caused a certain amount of disillusionment and pessimism about future prospects.

But it is important that the unsatisfactory record of some of these programmes is not allowed to obscure the substantial achievements that have been made in other cases. Community programmes will always require a great deal of painstaking preparation. They may not be able to produce the spectacular results of the farm forestry programmes with which they are often compared. But almost all of the different types of programme which have been developed to date offer opportunities for effective and relevant action under the appropriate conditions.

8.0 Land Allocation Schemes

A number of programmes have relied on the allocation of land-use rights to local people to gain their collaboration in growing trees. This approach can be used as a way of reducing the costs of establishing plantations or rehabilitating degraded forest lands; it can also be a means of providing a livelihood for landless people.

Land-use rights may be allocated on a short-term basis as is done in 'taungya' schemes. In these, people are allowed to grow crops in new plantations in return for their work in planting the trees, and protecting them for the first few years. After this initial period, when the trees begin to shade out the crops, the farmer is assigned a new plot or has to leave.

In other schemes, people are given a permanent title to a parcel of land on condition they grow trees on it. Usually, these are degraded or derelict forest lands which are unsuitable for permanent agriculture. By giving them to landless people, who are then helped to raise trees on them, they can be brought into productive use. At the same time, the families working on them are given a stable and regular source of income.

8.1 Taungya Systems

The taungya system was developed in Burma in the 1850s as a means of replanting teak, and has subsequently been copied in many other countries. In the original version of the system, the labourers were paid only in kind by being allowed temporary use of the land in return for their work in planting and tending the trees. They had no security of tenure or rights to permanent settlement.

A version of taungya, locally called 'tumpangsari', was introduced in Java around 1856 and is still extensively used there today. In this, a contract is drawn up between the landowner and the worker. This specifies the area to be planted, the types of crops that can be grown and the length of crop cultivation allowed. Normally, families are allocated 0.25 hectares each and are permitted to grow food crops for 2 years. Crops are interplanted between alternating rows of direct-seeded teak and Leucaena leucocephala, which acts as a cover crop. In 1981, the area of teak plantations being established in this way amounted to nearly 40 000 hectares per year (Wiersum, 1981).

In some places, various additional incentives have been offered to encourage farmers to take part in taungya schemes. At times, an integrated package is provided with the aim of stimulating a broad-based process of rural development. In the case of Java, for example:

"...the Forest Service also tries to promote the welfare of the taungya farmers by other means, like the provision of water, health services, educational opportunities and sometimes also housing, as well as development of beekeeping, forest grazing in older stands and the cultivation of new tree crops amenable to labour intensive management techniques, which can form the basis for household or village industries" (Wiersum, 1981).

The 'forest village' system in Thailand uses a similar approach. The programme, run by the Forest Industries Organisation, is intended to resettle shifting cultivators, landless labourers, and forest encroachers in areas where forest plantations are being established. Each family is provided with a small piece of land for a homestead. In addition, families are allocated 1.6 hectares each year for planting and raising crops between the trees (Saard Boonkird, 1978a).

The working of the system has been described as follows:

"To encourage people to settle in villages they are provided with roads, electricity, schools, tap water, medical and social services, together with an allocation of land for growing crops, and assistance in obtaining materials for house building and transporting their crops to the market...Transport is also provided to enable farmers to cultivate and tend taungya plantations over a wide area without having to move from the village. Dependence on crop growing is reduced by enabling villagers to earn alternative income. In addition to the proceeds from the crops they grow, they receive a cash payment for the land they clear and plant, and bonuses for extra productivity. They are also given priority in recruitment for forest work" (Arnold, 1981).

The taungya system has also been used extensively in Africa. A modified form, known as the 'shamba' system, was initiated in Kenya in 1910. In this, landless Kikuyu were employed as licensed cultivators to clear and replant low-value degraded forest. Under the system as it was being implemented in the 1960s, workers agreed to work on bush clearing for nine months in the year, to allow the Forest Department to plant trees on the cleared land, and to keep them weeded for three years.

In return, the workers were guaranteed the nine months paid work per year. The forest department also supplied a house, and allowed families to raise crops and animals on the land they cleared. The agricultural produce from the land was considered as part payment for the forestry work carried out. The system was, however, virtually abolished in 1976 when the workers were given permanent full time jobs. If they wished to cultivate land, they had to rent it from the Forest Department (FAO, 1978).

In a scheme introduced in Liberia in 1974, land preparation is carried out entirely by the forest development authority. Farmers then come in and for a fee of $50 per hectare are allowed to plant a crop of rice, maize, or pumpkins between the trees. This fee is charged to control the area given to each household and to help recover part of the cost of land preparation. After harvesting, farmers no longer have access to the land (Oxby, 1983a).

The major attraction of the taungya method is that it is usually considerably cheaper than other means of establishing plantations. Though it is more labour intensive than conventional planting methods, only part of the costs have to be borne by the forest service or plantation owner. In the Java case, for example, the total labour used per hectare of taungya plantation is estimated at 129 man-days, compared to 86-116 man-days using conventional establishment approaches. With taungya plantations, however, only 62 mandays per hectare are paid for by the forest department (Wiersum, 1981).

Another system, sometimes referred to as 'departmental taungya', has been used in Nigeria and several other African countries. In this, intercropping with food or other crops is carried out during the early years of plantation establishment, but there is no specific allocation of land to the workers. The food crops which are produced belong to the forest service and workers are simply engaged as paid agricultural labourers.

If this runs smoothly, it can be a cheaper way of establishing plantations than the conventional taungya method. This has been demonstrated in Nigeria, where both systems have been used for establishing plantations of teak and Gmelina arborea (Ball and Umeh, 1982). Various other taungya approaches have also been used to establish plantations in Bangladesh, India, and Sri Lanka (Chandrasekharan, 1980).

8.2 Problems with Taungya Systems

One of the generic problems with taungya systems is that, after the first couple of years, the interests of the crop cultivators and the tree owners are in competition. Since the farmers gain their income primarily from the food crops, while the forest department is ultimately concerned with growing trees, their basic priorities are inevitably different.

The fact that farmers have to leave once the trees begin shading out the ground crops is the central problem. Even when care is taken to minimise the disruption caused by the need to keep moving to new locations, there is bound to be a substantial degree of conflict between the interests of the cultivators and those of the forest department. In some cases, this has been translated into direct action, with farmers deliberately damaging trees to prolong the period of cultivation.

For farmers with alternative access to land, taungya has relatively few attractions. Compared with traditional methods of shifting agriculture, it requires more work to raise crops. It may also make the farmer's land tenure position worse, since previously he might, at least, have been able to claim customary rights to grow crops within forest areas. Under a taungya scheme the ownership of the land, and the trees on it, are clearly vested with the forest department or plantation owner. For these reasons, successful taungya plantations have tended in the past to be associated with areas of acute land hunger, under-employment, and low standards of living (King, 1968).

Criticisms, in fact, have been voiced about some taungya programmes on the grounds that they exploit the needs and weaknesses of marginal or landless farmers. The incentives provided to taungya cultivators in India, where schemes of this kind have been in operation since the 1930's, have been described as follows:

> "...what does the cultivator get, apart from his crop? He gets very little. The usual inducements that are offered (and by no means at all centres) consist of land for erecting temporary hutments, some inferior timber and thatching material, a hand pump for potable water, sometimes the right to manufacture charcoal from stumps which are too big to be removed otherwise and have to be dug out by the cultivator at the expense of considerable labour, elementary education for his children, and nominal medical facilities. There may or may not be an elementary community organisation or panchayat and small credit facilities...These incentives are primarily linked with benefits to the forest crop rather than with the welfare of the taungya cultivators and are given to them at the minimum possible scale" (Seth, 1981).

The conclusions drawn in this particular report are extremely uncompromising:

> "The system is frankly exploitative in concept and operation and cashes in upon the needs of the landless and poor people to serve its own ends. The much vaunted incentives are only a cloak for uninhibited exploitation, as the savings effected by the Forest Department are many times more than the expenditure incurred on elementary conveniences provided to the working force" (Seth, 1981).

Not all taungya systems, of course, need be subject to such criticism. Workers can be given a guaranteed wage for their labour in addition to the crops they grow. They can be supplied with welfare facilities and opportunities for taking part in alternative income generating activities. If care is taken, their relocation can be planned and carried out in a way

which minimises the disruption which they must undergo. Or they can be given fixed land-holdings for their homes, as they are in Thailand, so that the change from one area of intercropping to another does not require moving the whole family.

When it is responsibly used, taungya can provide considerable benefits to the families engaged in it and can be an important part of an integrated approach to rural development. But, as experience has shown, these beneficial results do not happen automatically. Unless programmes are specifically designed to address the needs and aspirations of those taking part in them, they can easily become little more than a means of exploiting their poverty and lack of alternatives.

8.3 Permanent Land Allocation Schemes

In these schemes, parcels of public land are permanently allocated to individual farmers. The intention is to turn landless people into tree farmers by giving them security of tenure, and other incentives. A key feature of this approach is that the farmer's interests are tied to the trees themselves, rather than just the crops grown between them. This avoids the conflict of interests inherent in taungya schemes.

In West Bengal, a programme is under way in which landless people are given official title to small plots of government-owned wasteland. Individual farmers are allocated one acre plots (0.4 hectare) near to their village. Farmers prepare the pits in which the trees are planted during the dry season so as not to interfere with their main occupation as agricultural labourers.

Up to 750 free seedlings are given to each farmer, together with 50 grams of fertilizer per seedling planted. In the second and third years, a small cash incentive is provided on the basis of surviving trees. The total cash subsidy is about 3 US cents per seedling. If 750 trees are planted, this amounts to roughly $22 over the first three years - equivalent to one month's wage for an agricultural labouring family.

These cash incentives are provided because of the extreme poverty of the people involved. The existence of even a small cash return from the plantation in the first couple of years is a major encouragement to persist with caring for the trees until they reach a size at which their commercial potential begins to become apparent. The arrangement is that participants will receive the full proceeds from the plantations when they are harvested after about 8 years.

The reforestation of degraded forest land in Gujarat is also being tackled using this type of land allocation approach. The scheme is specifically aimed at tribal people who have previously practiced shifting cultivation

Wood prepared for use as fuel in a dendro-thermal power station at Cape Bolinao in the Philippines. Photo: G.Barnard/Earthscan

Eucalyptus planting on degraded land by tribal people in West Bengal. Photo: G.Foley/Earthscan

and have been a major contributory cause of the deforestation in the area. In this case, families are given formal rights to use the land, though they do not gain official title.

Each family is allocated 37.5 hectares of degraded forest land which is planted at a rate of 2.5 hectares per year over a period of 15 years. Groups of 10-12 families are usually allocated land in a single block. The initial land preparation is carried out by the forestry department, including any terracing and soil conservation measures that are necessary. Families are settled on nearby government lands and are responsible for the protection of the trees. They are also allowed access to the plantation to collect building materials and other forest products.

Seedlings and other inputs are provided free. The family is obliged to provide 25 days work per month, and in return is given a fixed monthly wage of $25. The purpose is to create a commercial tree plantation which will be owned by the forest deparment, but the families which created it will receive 20% of the net profit from the tree harvest at the end of 15 years. By 1982, approximately 18 000 hectares of degraded forest had been planted under this scheme.

In the Philippines, a comprehensive package of incentives is being provided in a land allocation scheme designed to encourage tree growing to supply the wood-fired 'dendrothermal' power stations now being constructed. The programme is aimed at farming families squatting on government-owned land.

The farmers do not receive formal title to the land, but by joining in the scheme they gain access to credit facilities, technical advice, and a guaranteed market for their wood. Effective security of tenure is provided by membership of tree-farming associations. These consist of groups of 10-15 families and are the local organisations through which benefits and management transactions are channelled.

The first of 14 power plants currently under construction was opened at Cape Bolinao in Pagasinan Province in February 1984. Designed to generate 3 megawatts of electric power, it is located in a 1100 hectare tree plantation that provides employment for 120 tree-growing families.

8.4 The Scope for Permanent Land Allocation Schemes

Although they are several example where permanent land allocation schemes appear to be operating successfully, their scope is clearly limited by a number of factors. The first among these is the availability of land. Programmes of this type are only possible in areas where the forest department or government has land under its control which it is willing to allocate to landless people.

If the land being allocated is suitable for food crops, however, there will be a natural tendency for people to want to grow food rather than trees, particularly if they are very poor. This means there is a risk that the land will be diverted for non-forestry uses. If this happens, the promoting agency has little alternative but to accept it. Once people have been given official, or semi-official, rights to use land it is difficult to take them away.

Another essential condition for programmes of this type is that there must be a clear economic incentive for people to grow trees on the land once they gain rights to use it. Otherwise they will be unable to earn a living. Land allocation schemes will therefore be restricted to areas where there is a sufficiently strong commercial wood market to make tree growing an economically attractive option.

Nevertheless, in areas where suitable land is available, and the market conditions are appropriate, land allocation schemes offer considerable opportunities for bringing otherwise non-productive land into use, while at the same time providing a permanent source of income for some of the poorest members of the local community.

PART IV

ASPECTS OF PROGRAMME DESIGN AND IMPLEMENTATION

9.0 Programme Promotion and Implementation

All farm and community forestry programmes require promotional measures of some kind. These may range from publicity campaigns aimed at making people more aware of the benefits of tree growing, through to comprehensive schemes providing direct financial or technical support.

The promotional measures required in a particular programme will obviously depend on the context in which it is to take place. The level of literacy and awareness of local farmers, their economic status, their technical abilities, and their access to resources will all have to be taken into account. Areas where there are already existing market incentives for tree growing will be very different from those where there are no opportunities for selling the programme outputs.

The level of promotion will also depend on the ambitiousness of the programme objectives and how closely these are matched by local perceptions and preferences. Stimulating wealthy farmers into producing trees for profit may need little more than a publicity campaign and the provision of the appropriate seedlings and technical advice. But achieving wider social or environmental goals will often require a package of carefully designed and more costly measures.

9.1 Publicity Campaigns

Growing trees often has a low priority among those who might benefit from it. Sometimes this may be because people are unaware of the opportunities open to them and the facilities and assistance available. Countering a lack of information of this kind is an obvious and relatively straightforward task.

The simplest type of campaign may consist of no more than the provision of advertisements and publicity material exhorting people to plant trees and pointing to their benefits. Lines from the poem 'Trees' by Joyce Kilmer, for example, are prominently displayed on roadside billboards in parts of the Philippines. Some countries have organised national tree planting days or festivals. Although participation may at times be little more than a formality for many people, these events help to maintain a general level of awareness about the importance of tree growing.

In Tanzania, there was a publicity campaign in 1980-81 based on the slogan "Forests Are Wealth". Considerably success in arousing people's awareness has been reported as a result. Over 800 letters were received from villagers by the Forest Division Headquarters, enquiring how they might obtain seedlings and go about planting and growing them. In 1981, the number of seedlings taken by villagers visiting forestry department nurseries in part

of the Arusha region averaged 100, a fivefold increase over previous figures (Kaale, 1982).

In 1972, the state government in Gujarat decided to take action to encourage tree planting and, as a part of this, to mount a major publicity campaign. This was built round a month-long annual festival popularly known as Vanamahotsava, the festival of the trees, which had been established in 1950 by the Government of India, but which up to then had never become particularly effective.

The Gujarat publicity campaign has been described as follows:

> "Thus a very forceful campaign came to be launched during the entire month of Vanamahotsava celebrations. Frequent talks on various aspects of forestry, tree culture, and farm forestry were broadcast on All-India radio in the local language. These talks dealt with various aspects of farm forestry and covered topics such as the direct and indirect benefits of trees, planting techniques, the Government's policy on farm forestry, free distribution of seedlings, persons to be contacted for technical advice, costs and investments in raising plantations, financial returns from different forest products etc. Slogans on trees, forests and their benefits were also incorporated in the radio broadcasts between other programmes."

In addition to the mass media, a variety of other publicity methods were used:

> "Publicity material, both for school children as well as adults, in the form of pamphlets, posters, page markers, book labels, car and wall stickers were published and freely distributed in schools, offices, and to the public at large. Film shows were organised in schools, public places, cities, towns, and villages free of cost. A booklet containing information about the numbers and species of trees available at nurseries all over the state was published and widely distributed so that the public had the choice of species at the nurseries most convenient to them. Occasionally, essay competions were arranged in schools and colleges and prizes awarded for the best entries" (Karamchandani, 1982).

This campaign marked a turning point for farm forestry in Gujarat. In 1971, the year before it took place, the take-up of seedlings in the state was about 6.1 million. In 1972 it almost trebled and reached 16.9 million.

The role of political leaders in publicity campaigns can also be extremely influential. The achievements of the Chinese reforestation programmes of the 1950s and 1960s owed a great deal to the leadership of Chairman Mao.

The influence of President Moi in Kenya has also been important in changing attitudes to tree growing in his country. One commentary on tree growing in Kenya describes this:

> "At the national level, President Moi has, from his inauguration in 1978, consistently emphasized the importance of trees. This cannot be dismissed as simply rhetoric, as there has been a distinct effort by several government departments ... to raise awareness about the dangers of deforestation, and to encourage tree growing. The exhortations have been backed by increased support and incentives for reaching the peasant farmers: nurseries are better financed, and agricultural extension officers have been promoting soil conservation and tree planting" (Brokensha, Riley, and Castro, 1983).

Political support of forestry programmes can, however, also have its drawbacks. The support of an influential leader can sometimes lead to over-ambitious officials at lower levels setting unrealistic targets. These can then get in the way of real progress by causing bureaucratic confusion and blockages, with diversion of professional efforts and waste of resources.

9.2 Seedling Distribution Systems

An effective seedling distribution system is a crucial element in virtually all farm and community forestry programmes. In some cases, it forms the basis of the entire programme. Since a number of different approaches can be used, each with its own advantages and drawbacks, there are important choices to be made regarding the location of nurseries and the selection of the most appropriate propagation methods.

Production of seedlings at large centralised nurseries has advantages from the point of view of the forest department. Significant economies of scale may be possible, for example, and it will be easier to maintain standards of quality control. The more centralised a nursery is, however, the greater the problems of distribution tend to be. A large, well-stocked nursery is of little use to a farmer if it is more than a day's journey away.

Establishing a network of decentralised nurseries is often a more efficient way of getting seedlings where they are wanted at the right time of year. In hilly areas, and places without an adequate road system, there may be no alternative. Decentralised nurseries have been used particularly effectively in the tree promotion programme in Gujarat. On average, there is now a one nursery for every ten villages, and this is regarded as being a key factor in the success of the programme.

The experience in Gujarat has influenced programmes in other parts of India. In the programme in Uttar Pradesh, for example, the original plans for nursery establishment were less ambitious and envisaged setting up only one nursery per 100 villages. These have subsequently been modified, because planners felt that the distance farmers would have to travel to obtain seedlings would act as a disincentive to tree planting.

The main difficulty with decentralised systems is that they are expensive. The costs and organisational requirements of setting up a large number of decentralised nurseries over a wide area are substantial. Sites have to be carefully selected and prepared, a water supply has to be laid on, and the nurseries have to be staffed by forest department personnel or trained local workers.

The process of raising seedlings is not, in itself, particularly complicated. Nevertheless, it does require a basic level of technical competence and careful attention to detail. Recommended seed storage and pretreatment procedures have to be followed if high levels of seedling viability are to be obtained. Sowing, watering, transplanting, and other essential tasks have to be carried out properly to ensure that seedlings develop and are ready at the right time for planting.

A certain amount of training and supervision will usually be essential if inexperienced villagers are expected to raise seedlings effectively. This is particularly the case when a variety of species are to be grown, each of which may require special treatment to obtain good results.

The administrative difficulties involved in providing cash and other inputs to a dispersed network of rural nurseries are also significant. This is illustrated by the experience of the Community Forestry Development Project in Nepal. According to a recent progress report:

> "The most important reason for the lack of higher success rates in achieving targets and plantation survival was the small size of seedlings at the time of planting due to untimely seed collection and sowing".

Rather than being the fault of the villagers hired to look after nurseries, the major problem in this case has been at the administrative level. As the report goes on to state:

> "Delay in budget releases, particularly in the initial months when seed must be collected and sown, is perhaps the most important factor in preventing the production of adequate sized seedlings in time for planting, and has affected the morale of the panchayat level workers whose salary is delayed" (Bhattaria and Campbell, 1983).

Watering mango seedlings in the Kitui agroforestry nursery in Kenya.
Photo: F.Mattioli/FAO

Preparation of 'micro-seedlings' in Haiti.
Photo: Mark Edwards/Earthscan

One way of cutting the costs of a decentralised nurseries and making the system more effective is to involve local organisations and individuals. In Gujarat, both private farmers and schools have been successfully encouraged to raise seedlings using a special incentive scheme. The forest department provides free seeds, fencing and other inputs, as well as the necessary technical advice; it also offers to buy seedlings at 15 paise each (1.5 US cents), which is the cost of production in its own nurseries.

The use of schools has the added advantage of playing a useful educational and demonstratation role. They can also provide the focus for other community participation activities. Of the total of 18 000 nurseries established in the state by the end of 1982, more than two thirds were school and private nurseries.

At a technical level, there are also important choices to be made in the methods of supplying planting stock to villagers. The most common approach at present is to raise seedlings in polythene bags, or 'polypots'. By distributing the plants when they have reached a fairly mature stage in these pots, where their roots are protected by the soil in which they have grown, survival rates can be maximised. The disadvantage is that this tends to be expensive. Transporting large numbers of seedlings in pots is also a problem because of their weight and bulk.

Low-cost alternatives are being used in several countries to help spread project resources and reduce the cost to the farmer. In Costa Rica, for example, trials are being carried out in which seedlings, with their roots and stem heavily pruned, are distributed without any soil. This has been found to work well with teak, gmelina, leucaena, calliandra, and glyricidia, though it is not suitable for all species. When this method is used, it is important that the roots are kept moist during transportation, and that the stumps are replanted promptly.

A technique of raising large numbers of seedlings in shallow baskets has been pioneered in Gujarat. The baskets are planted with 1000 seedlings each, and are distributed to farmers while the plants are still at an early age. The baskets have the major advantage of being easy to transport. The seedlings are transplanted to beds or polypots when the farmer gets back to his village.

This enables a substantial reduction to be made in the costs of providing seedlings. Using the basket method, the cost per seedling is less than 3 paise (0.3 US cents), one fifth of that of seedlings raised in polypots. This technique has been found to be particularly effective for Acacia nilotica and Prosopis juliflora.

In Haiti, seedlings are being grown in very small containers which channel the roots so that the nursery soil clings to them when the seedling is removed. Using these 'micro-seedlings,' as they are called, a pick-up

truck is able to transport some 15 000 at a time instead of the 250 which are possible if conventional polypots are used. In fact, a farmer can carry 500 seedlings himself and plant them all in one day (Murray, 1983).

Distribution or sale of seeds to farmers for direct sowing is another alternative. This is being increasingly used in parts of India, and is being introduced in Malawi, Haiti, the Philippines and a number of other countries. It is by far the cheapest way of distributing planting stock, and can potentially reduce establishment costs for the farmer to a very low level.

But direct sowing suffers from the drawback that survival rates tend to be low, particularly in arid areas and on poor sites. The main causes of mortality are inadequate moisture, especially when seeds are first establishing themselves, pests and diseases, and competition from existing vegetation (Kamweti, 1982). This method is therefore only appropriate for certain hardy species, and on favourable sites where plenty of water is available.

In all programmes, the approaches to nursery establishment and seedling production have to be carefully matched to local conditions and the resources available to the project. The optimum solutions will depend to a large extent on climate, site conditions, the species being planted, the available transport networks, and the intended recipients. It is important that preconceptions based on the nursery practices used in conventional forestry projects are not allowed to be become reasons for ignoring potentially useful innovations.

The need for initiative and ability to improvise may also be crucially important, particularly in areas where programmes are on a relatively small scale. In some developing countries, for example, foreign exchange restrictions and transport problems have caused delays in the delivery of polythene pots.

> "Yet foresters sit and wait for these tubes for several months or even for over a year. No wonder 70-90% of all the late tree planting between 1970 and 1980 was attributed to the late arrival of these polythene rolls to the regions and districts. There are other options. Villagers have been using banana peelings to make coffee seedling pots for ages.... Earth balls (a ball-like pot made from clay and other types of soils) have also been tried at the Sao Hill Forest Project. They have been found to give reasonable tree survival and are low in cost: almost a third of the polythene tube costs" (Mnzava, 1983).

9.3 Extension Services

Tree growing programmes are long term, and often complex exercises. If they are to succeed on a significant scale, they need to be integrated into the social and economic context in which they take place, right from the planning stage through to final completion.

This means that in addition to the professional and technical tasks of programme design and implementation, a considerable amount of liaison work with the local population will be required. The function of this is to provide a two-way communication between project staff and the farmers and communities engaging in tree growing.

The ideal extension service and the ideal extension worker do not exist in the abstract. The qualities needed will depend on the programme and tasks they are expected to carry out. The following is an example of some of the work involved in the implementation of the village woodlot programme in Gujarat, where the aim is persuade village panchayats to give up community land for tree planting:

> "...organising meetings of the entire village communities, including women, in order to fully explain the objectives, practices and benefits of the proposed reforestation.... ..visits to successful farm forestry plantings and village woodlots were arranged for panchayat, community, and political leaders in order to show through vivid demonstration that agriculture and forestry can readily co-exist and benefit the people" (Karamchandani, in FAO 1982b).

In the scheme run by the Paper Industries Corporation of the Philippines (PICOP), the practical functions of the company's extension workers include providing assistance in locating suitable land for tree planting, and providing seedlings and technical advice. A company employee has also been specially assigned to helping farmers who 'are in no position to find their way through the usual bureaucratic maze' to get loans for tree farming.

The extension activities of the company's team have been described as follows:

> "PICOP'S agroforestry team can be considered the nerve centre of its small-holder tree farming project. The team is planner, implementor, trouble shooter, farmer's representative, company representative, tree farming technician, and tree farmer organisation all rolled into one. How this 37 man team performs these seemingly overlapping and contradictory roles is a marvel of management. A team member, however, states that trouble between the company and the tree farmer seldom occurs, and if

ever any starts to brew, a compromise is immediately effected between the parties concerned " (Magno, in FAO 1982b).

In many cases, the most important role of the extension services may be the provision of individual encouragement and technical advice to small farmers. Where people are very poor, and particularly where climatic conditions make the results of tree growing uncertain, it is difficult to divert efforts directly related to the present struggle for survival into provision for a relatively remote future. People may need personal assurances that tree planting will work for them and benefit them.

If this is done, however, it means that the responsibility taken on by extension workers is a heavy and continuing one. It makes it particularly important that the advice given is correct and there is an effective continuity in the extension work. Building up a network of trusted workers who can carry out such a task may be a long and difficult process. Severe harm can be caused by over-enthusiastic short term staff who do not have to face the long range consequences of the advice they give and the actions they take.

Care also needs to be taken to ensure that what may appear to be the most efficient methods of achieving progress are, in fact, consistent with the basic objectives of the programme. For example, some successful tree growing programmes rely upon locating the more successful farmers in the community. These are not necessarily those who are in formal positions of authority a local level. Rather, they are: "the more progressive, and more successful in their farm business... and are informally accepted as leaders by their fellow farmers" (Padmanagar, in FAO 1982b). Because of their influence in the community, recruiting these farmers to a programme can be crucially important to its success. There are numerous examples of how innovations have been spread in rural areas by starting with such people, not only in forestry, but in other areas of rural development also.

As a result, there may be a tendency to concentrate extension efforts upon these better off farmers in the hope that they will provide the example which others will follow. But great care is necessary in adopting this approach. Strengthening those who are already in positions of local economic power will not necessarily result in their newly acquired knowledge being passed on to the less fortunate members of the community.

If a dissemination of expertise through to those in the lowest economic psitions is required, explicit efforts may have to be made to reach farmers at each of the different levels of the rural community. The need for this multi-level approach in the definition of extension tasks has been noted as follows:

"Experience has shown that the desired dissemination (trickle down) of improved knowledge to the average and below average

farmers did not take place. In fact, the introduction of improved technology has generally only served to widen the gap between the better off progressive farmers and the rest of the community. It is now more clearly understood that farmers tend to learn mainly from other farmers who are from similar social and economic backgrounds.... Thus special extension efforts are required for each different socio-economic level within a community" (Clark, in FAO 1982b).

9.4 The Role of Forestry Services

In many places the forestry service is the most natural agency to undertake farm and community forestry extension work. It usually has an already existing organisational infrastructure in the rural areas. It also has the greatest store of knowledge about many of the critically important technical aspects of tree growing. Particularly in areas where there are difficult growing conditions, the advice of trained forestry personnel will be needed to ensure that the correct decisions on species and cultivation methods are made.

It is, however, frequently pointed out that the conventional training of foresters does not normally fit them very well for the close liaison with local farmers that is typically required in farm and community forestry. One of the main reasons for this is that the general traditions of most forestry services tend to emphasize forest protection and conservation. In many places this results in a confrontational or authoritarian attitude towards the public.

In the Azad Kashmir Hill Farming project funded by the World Bank in Pakistan, for example, it was found that there were more than 50 000 cases of forest offences pending in the courts when the project began. This meant that one family in six was involved in a legal conflict with the Forest Department which was "directly relevant to the many farmers' reluctance or suspicions regarding participation in development schemes sponsored by the Forest Department" (Cernea, 1981).

A recent survey on the use of forestry officers in community forestry extension work in Tamil Nadu reported:

> "...the erstwhile forest department personnel having had no training in extension work are generally viewed with suspicion and distrust by some of the village respondents. The investigators further feel that forest department personnel evoke fear and not respect or affection. Their uniform symbolises authority which at times is exercised without moderation" (Srinivasan et al, 1983).

In Africa the position has been described in the following terms:

> "A demanding and rigorous education in forestry has given many upper-level European and African foresters a sense of elitism. This training stresses rule enforcement and includes military training, but seldom includes courses on sociology, community development, or extension methods. Rural Africans may have more contact with foresters than with most other government officials but these foresters are usually in uniform, often armed and frequently feared" (Hoskins, 1979).

It is for these reasons that training in new attitudes will generally be needed before forestry officers can undertake the range of duties involved in farm and community forestry. But even this may not be sufficient in some cases, and a more radical approach may be required in which the basic suitability of forestry services for extension work of this kind is questioned.

A problem that has to be considered in this context is the long standing tradition in some countries of corruption and abuse of power by forestry officials (Gibbs, 1982). This needs to be taken seriously when evaluating the potential role of forestry service personnel in providing extension services. A survey of forestry management practices in the Asia-Pacific region said:

> "This is a matter of great concern to senior public forestry administration officials and to politicians met in most Asian countries. Judging from the frequency with which they are mentioned, occasions where officers use their official positions for personal gain abound" (Palin, 1980).

Similar reservations on the abuse of their role by forestry officers have been noted elsewhere. In the Sahelian countries, some local forest officials are said to derive a substantial income from the fines they informally levy on villagers obtaining wood from forest lands. Such people are scarcely likely to be suitable or enthusiastic recruits to the more humble and financially less rewarding role of extension agents, helping people to plant their own trees as an alternative source of fuelwood (Hoskins, 1982).

The key position of the forestry services in providing the scientific and technical backup required for projects is not in question. Professional forestry expertise is particularly necessary where growing conditions are difficult and technical problems are likely to arise. Mounting farm and community forestry programmes in these circumstances without the full-hearted support and collaboration of forestry services would be very difficult indeed.

But this does not necessarily mean that forestry officers are automatically the best choice for the other tasks of extension workers. In places where relations between forest officers and rural people are poor, it may be worth considering establishing independent extension services, though working in collaboration with the forest department.

These may be entirely new organisations; or forestry extension work may be attached to other existing agencies, such as agricultural extension services. Establishing these kind of links is something which, in any case, would be beneficial in most countries, particularly where agroforestry techniques are being promoted.

In a number of Indian States and elsewhere, a separate wing has been set up within the forestry department as a way of dealing with the special problems and challenges posed by farm and community forestry. Over the last few years, new training schools for junior and mid-level personnel have also been established in a number of countries, and professional-level curricula are being amended to reflect the new priorities and imperatives of community-oriented forestry (FAO, 1982b; Burley and Wood, 1983).

Other changes may also needed in the forestry services of some countries. Career structures, for example, may need to be altered so they do not discriminate against what is often seen as the less glamorous work of forestry extension. It is also important that experienced extension workers are not subject to the frequent transfers which are a characteristic of many forestry services.

As has been pointed out:

> "Centrally planned programs tend to regard agency personnel at the village level as units of manpower, homogenous and potentially mobile. Whereas effective participation requires that the local agent become known, respected, and gain substantial knowledge of local conditions" (Gibbs, 1982).

The ability of forest services to perform an effective extension role is undoubtedly improving in many countries. But there is still a long way to go in many cases. This is clearly an area which will require continued attention if the full potential of the forest services in promoting farm and community forestry is to be realised.

9.5 Voluntary and Non-Governmental Organisations

Even in the best of circumstances, government agencies have certain in-built disadvantages when it comes to implementing farm and community forestry programmes. Some would go so far as to say that government agencies are completely unsuited to running small scale tree growing

programmes (Murray, 1983). Certainly, the strength of large bureaucracies rarely lies in the realm of small-scale endeavours, flexibility, informality, and economical use of resources. Yet these are precisely the qualities which characterise the best and most effective voluntary and non-governmental organisations.

These organisations can play an extremely valuable role in many cases where farm and community forestry programmes are being implemented. Their potential has been described as follows:

> "Voluntary organisations are well set to assist in such programmes and can motivate people and bridge the, still often existing, gap between local communities and forest services. Non-governmental organizations can act as an important communication channel both upwards and downwards and may help in the institutionalisation of community forestry" (Basu, 1983).

Such an intermediary role can be an extremely important one. The normal channels of communication between he senior personnel in any bureacracy and local people, particularly the poor, almost invariably pass through lower level government officials. Frequently, these are obstructive, authoritarian, and insensitive to local feelings.

Arrogant use of power by minor bureacrats is a universal phenomenon. Yet higher up, there may may well be officials who are both willing and able to overcome bureacratic traditions and rigidity. The participation of voluntary organisations in the extension activities of farm and community forestry programmes can be extremely effective in giving local people a voice and a way of bypassing uncooperative local officials.

An example of where such a role has shown results is in the Ranchi area in Bihar state in India. Formerly, relations between local villagers and the local forestry officials were extremely poor. In 1977, a consortium of local voluntary organisations was formed to promote community forestry. Immediate liaison was established with the Chief Conservator of Forests who responded by quashing all pending cases of violation of forestry regulations against the people in the area.

At present, a number of projects are under way in which village people are collaborating enthusiastically with the forest department. The survival rate of seedlings planted is 75-80%, indicating that the people care for them and accept the relevance of growing trees. While it is too early to tell how the project will eventually turn out, the outlook at the moment appears promising. The following are said to be among the reasons for the success of the consortium to date:

> "The non-government organisations (NGOs) had the ability, resources, personnel, credibility amongst the people and with the

> Government to play their role of go-between effectively. They were also able to place in the field the necessary personnel to assure an ongoing presence, which inspires confidence among the people... The NGOs did not hesitate to cooperate with the Forest Department and other Government Departments... The NGOs worked together under the forum of the Ranchi Consortium and could thus complement each others' competencies and promote an integral approach to rural development, rather than run only a forestry programme... The NGOs enjoyed a good name with international donor and promotional agencies. This inclined the Forest Department to take account of the them, rather than ignore them... Though this was never done formally, the NGOs were officially 'recognized' and approved by the Forest Department as well as Central Government, for the task they were playing in community forestry" (Basu, 1983).

Another example of successful forestry extension work by a voluntary agency is the Anandniketan Ashram in south Gujarat. This has been involved in a variety of village development projects, with particular emphasis on the very poor over the past 35 years. A tree growing programme was launched in 1981. Within a year, 1.25 million saplings had been planted along bunds and on waste lands, with a reported survival rate of 90%. A number of tree growers' cooperatives have been established, and there are plans to establish nurseries and raise the annual planting rate to 10 million seedlings (Chowdhry, 1983b).

In Kenya, a number of voluntary organisations such as the National Council of Women, and the National Christian Council of Kenya are promoting tree growing in collaboration with the Forest Department. The National Council of Women is an umbrella association of Kenyan women's groups and is backing a 'Green Belt Movement' in the country.

Schemes involving local women's groups may be particularly useful. It has been noted in a number of countries that women are often more interested in tree growing than men. They may also have different preferences from men in the trees they want, and are prepared to cultivate.

Though not strictly 'non-governmental' in all cases, schools can often play an important forestry extension role similar to that of other non-governmental organisations. Enthusiastic teachers not only have a considerable influence over the children they teach, they also tend to have a high standing in their villages.

The number of trees which can be planted through such efforts can reach surprisingly high levels. The 3000 pupils of one large secondary school in India are reported to have planted about 100 000 leucaena trees in 1982, of which 80% were doing well (Chowdhry, 1983b). In Tanzania, some primary schools in the Dodoma, Arusha, and Singida regions have managed to

establish plantations of up to 10 hectares in areas which were previously completely bare of trees (Kaale, 1982).

In some cases, non-governmental organisations have adopted an explicitly confrontational role, and have played an important role in making people's concerns about trees known to those in authority. Perhaps the best known organisation of this kind is the Chipko movement in the Himalyan region of India which relies upon the Ghandian technique of peaceful 'creative conflict'. It came to public attention in 1973 when members demonstrated against commercial tree felling by hugging the trees to prevent contractors from cutting them.

One of the achievements of the campaign was to draw attention to the different interests of men and women in forestry. While men tend to want trees from which they sell the produce, allegedly so that they can buy liquor and tobacco, women prefer fuel and fodder trees. As a means of taking care of women's interests, the Chipko movement is running plantations specially to provide women with the trees they need. These are reported to have a much higher survival rates than those of official forest services, because of the greater care taken (Agarwal and Anand, 1982).

The Chipko movement has maintained an active and often extremely critical presence in the Indian environmental movement over the past decade. As has happened in the case of a number of other environmental protest organisations, there have been some difficulties in defining the precise path forward, once the initial abuses which it was set up to counter have begun to come under control. One largely sympathetic commentary has pointed to this dilemma:

> "The Chipko has won quite a few victories, some easy and some difficult. On the face of it, it was easy where the confrontation was with the State alone, difficult where the local vested interests also joined the State agency, thus raking up opposition at the grass roots itself. Secondly, it has been easier to score a point when the issue was to stop forest felling to prevent environmental deterioration than when it came to changing the exploitative pattern of utilisation of forest resources" (Juyal, 1980).

There has been at times a polarisation between governmental and non-governmental organisations. Support for one has tended to imply opposition to the other. In the case of farm and community forestry, such automatic prejudices clearly have no useful part to play. There is, of course, room for a legitimate and useful disagreement about objectives. From such debates, can come a deeper realisation of what is desirable and what it is possible to achieve through tree growing programmes. But wherever possible, the resources of both should be deployed in as creative and collaborative a way as possible in the interests of rural people.

10.0 Technical Packages

All farm and community forestry programmes must be based on sound technical decisions. The need for this is sometimes obscured by the complexity of the social and economic problems which are also involved. But no programme can succeed unless the key technical issues are satisfactorily resolved.

Each programme requires its own individual and carefully created assembly of technical measures, or technical package. In the following sections, some of the issues which most often need to be considered are discussed. The aim is not to provide a set of universally applicable prescriptions; it is rather to raise some of the most important technical questions which need to be answered in the design of programmes.

10.1 General Technical Problems and Risks

The technical problems involved in farm and community forestry are often regarded as being relatively minor. In cases where growing conditions are very favourable, this may be true. But in others the problems are often much more severe. Solving them may be the critical element on which the success or failure of the programme depends.

Even when projects are based on planting well known commercial tree species, it cannot be assumed that no technical difficulties will arise. There is a considerable difference between the techniques used in conventional forestry plantations and those employed by rural people practicing small scale tree growing.

In conventional forest plantation work, planting sites generally consist of relatively concentrated areas, where soil and microclimatic conditions can be accurately determined through site surveys. The routines of care and maintenance of the commercial species used are normally well-established. The trees have clearly defined end uses for which they can be grown and harvested using well tried methods. Foresters can also rely on supervised labour, machinery, pesticides, and other back-up facilities in dealing with any problems that arise.

The reverse is usually true in farm and community forestry programmes. The sites on which planting is done tend to be small and distributed over a wide area. The cost of providing them with individual attention and services is likely to be prohibitive in most cases. Often, some of the critical site factors are unknown, and the degree of control which foresters are able to exercise over the methods of planting and caring for the trees is poor.

Where educational levels are low, particularly when illiteracy is prevalent, there can be considerable difficulties in conveying technical instructions to people. This is especially the case when trees which are unfamiliar to local people are being planted. In general, therefore, farm and community plantations will receive less skilled care and attention than those carried out by foresters. A working assumption must always be that complicated instructions will not be followed by many people.

A further consideration which emphasizes the need for caution is that of public trust, and the risks and penalties for failure. If people are being persuaded or subsidised to take part in a tree growing programme in which they would not otherwise participate, then this places a heavy responsibility on those promoting it. Unless the technical decisions on which the programme is based are correct, heavy losses may have to be borne by people who are ill-equipped to do so. The result is likely to be a serious loss of local confidence, with the result that the opportunity for tree growing in the area may never be repeated.

That the risks of failure are real can be illustrated by the experience in a number of recent programmes. Neglecting to provide adequate protection against pests, for example, has led to failures in some countries. One leucaena plantation in the Philippines was destroyed completely by snails in the year it was planted. Termites have also been responsible for the destruction of large numbers of Acacia albida, eucalyptus, and other seedlings in some of the Sahelian programmes. In Tanzania, "Wrong choice of species to match the climatic and soil conditions has on various occasions ended in complete failures" (SIDA/FAWCDA, 1982).

There have been cases where trees have been planted and survived through several seasons of good rainfall. But because they were not sufficiently drought resistant, they have all been lost when the inevitable drier year came. Trees have also been known to fail after a number of years because of the tap roots reaching a hard layer which they could not penetrate. In many cases, the exact reason for trees dying is never properly identified.

The following observations therefore have considerable relevance in this context:

> "...any new plantation is a gamble, but especially on a new site, or in a new region. The decision to plant trees often has to be taken with imperfect knowledge and before the chosen species has proved its health, value, and desirability over a full rotation. There is a risk that a tree may prove disappointing at a later age for some unpredictable reason... Virtual extinction can also occur if a parasite finds a host species on a new continent without resistance to it...Many such calamities can be predicted for the future... Diversification is the main line of defense which the forester can build. It does not avert the risks but it

spreads them" (Heybroek, 1982).

There is thus ample reason for care and deliberation in making the technical choices upon which the many years of subsequent work in programme implementation will inevitably depend. If they are to succeed, the technical choices made in the design of programmes, particularly in their initial stages, must be directed towards the provision of robustness, versatility, and adaptability rather than an attempt to maximise yields, speed of growth or other performance characteristics.

10.2 Species Selection

One of the most basic technical choices is that of the tree species to be used in a programme. A large number of factors enter into this decision. Primarily, the species must be chosen so that they meet the demands and preferences of the local people. In addition, they must be suitable for the environmental and other conditions they face, however diverse these may turn out to be when planting is largely at the discretion of local farmers rather than supervised forestry workers.

Species selection for a programme should always begin with a clear identification of the end uses to which the trees will be put. Thus an early decision must be made on whether trees are to be planted for building poles, fuelwood, fodder, shade, windbreaks, or other uses. In many cases, trees will be required which meet a number of these needs. The basic choice in this case should obviously be made by the people who are going to use the trees. This fundamental fact has at times received surprisingly little attention, and many programmes have been based upon the promoters' assumptions rather than local realities. The consequent difficulties in implementing and winning support for the programme are not therefore surprising.

Criticisms of the species selection process on these grounds have been made on a number of occasions about programmes in the Sahel. The following is a fairly typical instance:

> "After talking with preposes (forestry officers) and villagers it became apparent that few if any extension agents or field staff seemed anxious to talk to villagers in order to find out what they wanted to plant, or to discuss how they might best go about planting. Instead the state-of-art Neem-Cassia-Eucalyptus package is presented to them as an unalterable wholly satisfactory technology... They are told how to plant, what to [illegible] where to plant and there appears to be little [illegible] for individual initiatives that depart from the 'norm'" [illegible]om, 1979).

Given good information on site conditions, growing conditions which are not too difficult, and clearly defined end uses, it is often possible for experienced foresters to choose appropriate species with a considerable degree of confidence. It may even be possible to go beyond the species level, and select particular provenances which are known for their adaptation to specific site conditions, or their particularly desirable growth and end-use characteristics. In parts of India, for example, the accumulated experience with some types of native species and a number of exotics permits this level of precision.

The position is markedly different in many other countries, particularly in arid and semi-arid lands where species selection can present particularly severe problems. National experience with many of the more promising exotics tends to be very limited. Even with native species which have never been deliberately cultivated before, there may be a considerable amount to learn about seed preparation and establishment techniques.

The question of yields and growth rates is also crucial in the analysis of programme costs and benefits, both at the local and the project management levels. They determine the return that is obtained, the amount of land that must be used to obtain a given output, and the time that must elapse before investments are repaid. They provide the only basis on which programme promoters and farmers can decide whether tree growing is attractive or not.

With managed plantations of well known species, under clearly defined soil and climatic conditions, yields can be predicted with reasonable accuracy. Trial plantations can also give reliable information on the behaviour of new species under defined and controlled conditions. But much greater caution is required when site conditions and management practices are uncertain, as they frequently are in farm and community forestry projects. The generalised figures that are often quoted can be seriously misleading, since climate, soil conditions and management methods all play a decisive role in determining yields in practice.

Other characteristics which need to be known before species can be used with confidence are the speed of establishment, drought and fire resistance, susceptibility to pests, and ability to withstand damage from grazing animals. The capacity of seedlings to survive these hazards, some of which they would not normally be exposed to in a properly managed forestry plantation, may make the difference between success and failure in many programmes.

Through the efforts of FAO, the International Board for Plant Genetic Resources (IBPGR), the US National Academy of Sciences, and a number of other organisations, the information on non-industrial species has begun to increase over the last few years. In 1977, the FAO Panel of Experts on Forest Gene Resources agreed a list of 35 candidate species for trials and

further investigation to establish their potential for non-industrial uses. These included species for food, fodder, fuelwood, shelterbelts, soil stabilization, and farm forestry. Special emphasis was given to species suitable for arid zones (Burley, 1980).

Following enquiries sent to several hundred plant scientists and foresters aroung the world, the National Academy of Sciences has published two volumes describing some of the most promising fuelwood species for different climatic zones. In total, about 90 species are covered (National Academy of Sciences, 1980; 1983). For each, a summary of the known properties is presented. This includes details of its environmental requirements, establishment methods, susceptibility to pests and diseases, suitability for firewood and other purposes, and the main limitations to which it is subject.

Lists such as these can provide a useful starting point, but it must be accepted that the information available on the majority of species is still very sketchy, with much of it based on isolated reports from different countries. The result of this lack of scientifically established data is that foresters are often expected to work with only a partial knowledge of the properties and tolerance ranges of some of those species being urged upon them by programme promoters and others.

Even when species are well known, there also remains the question of provenances. This can be of critical importance since, at times, the differences between provenances can be as great as those between species. Even with such well known species as Eucalyptus camaldulensis and Leucaena leucocephala, there have been numerous failures because of the selection of inapproriate prevenances for particular areas (Catterson, 1984). The general position with regard to fuelwood species has been summed up as follows:

> "Although it is often said that the establishment of fuelwood plantations does not present serious technical problems, planting programmes of non-industrial species, including arid-zone fuelwood species, are in practice still generally conducted at a species rather than a provenance level, mainly due to the lack of basic biological information. With the exception of some eucalypts, few arid and semi-arid tropical tree species have been sufficiently well explored botanically and genealogically to provide a solid basis for their efficient utilization and conservation" (Palmberg, 1981).

Given time, selection and breeding programmes can greatly improve both the variety and quality of the planting stock available. Provenance trials on various sites allow knowledge to be built up of tree performance under different conditions. Dramatic yield increases can often be achieved, in some cases by several hundred percent. Trials with Eucalyptus

camaldulensis in Nigeria and Israel, for example, boosted yields by 300% and 800%, respectively (Palmberg, 1981).

But this is a slow process. Trials in Kenya on the long-term yields, under coppicing, of the local provenance of Eucalyptus saligna compared with Australian provenances of E. grandis and E. saligna were commenced in 1955, and have only recently been published. They show that the Kenyan provenance is preferable in a number of important aspects, including survival capacity and yield (Kaumi, 1983).

The question of seed availability can also poses a number of problems. The supply of high quality seeds currently obtainable on the world market is restricted to a relatively small number of species. If programmes are designed to rely on other species, the lack of suitable seeds in the quantities required can be a severe limitation. If seed orchards have to be established, it may be a considerable time before seeds become available in quantities large enough to begin widespread distribution. Because of this, programmes envisaging a rapid acceleration of planting rates are often limited by seed availability to local species and a small range of exotics.

Where there are doubts about tree performance, or availability of reliable stocks of seed, the only prudent course is to rely on indigenous species which have already proved themselves to be adapted to the project area. Although the performance may be less than might be obtained with untried exotics, the risks of failure are minimised. Using known tree species may also help to increase the local acceptance of tree planting, as people will tend to be familiar with their properties and products. Meanwhile, the necessary trials to compare the survival capacities, yield, and other characteristics of promising alternatives can be carried out in parallel with the programme.

In some cases, the choice of indigenous species may represent the optimum decision rather than a temporary expedient. This is likely to be so when growing conditions a[illegible]ficult, or the available exotics would have to be used close to th[illegible] of their range. As has been pointed out with reference to plan[illegible] the Sahel:

> "...the exo[illegible]es planted in such projects have in most cases not pe[illegible]early as well as expected, in some cases only margina[illegible]ter than the natural 'bush'. This is particularly t[illegible] for Eucalyptus spp., the workhorse of such schemes, in areas with less than 1000 mm annual rainfall. The plantations at Bandia in Senegal are an instructive case in point: Eucalyptus camaldulensis planted at a cost of $800 plus per hectare is estimated to be producing 1.5 cu metres per hectare per year while the native Acacia seyal forest, bulldozed at great expense to plant the Eucalyptus has been measured to be

producing 0.8-3.2 cu metres per hectare per year, with an average of 1.0-1.5 cu metres per hectare per year under no management" (Taylor and Soumare, 1983).

10.3 The Debate over Eucalyptus

As a group, the eucalypts have proven themselves to be extremely successful in a large number of countries. They have been used, for example, as the basis of the massive plantings to supply charcoal to the Brazilian steel industry. In the highlands and inter-Andean valleys of Bolivia, Peru, Ecuador, and parts of Colombia, eucalypts are the species most sought for fuelwood and other uses. They have been widely planted in Ethiopia and other parts of Africa. So far, they have proved to be the most popular species in the farm forestry programmes in India.

Among the reasons for this popularity are the rapid growth rates and drought resistance of many eucalypts, and their vigorous coppicing ability. Their unpalatability to livestock is another important advantage since it considerably reduces the problems of protecting young plants from browsing by animals.

The use of eucalyptus species has, nevertheless, come under considerable attack in a number of countries. It is argued that they degrade the soil by reducing its fertility, that they lower the water table because of their high consumption of water, that they are a threat to ecological stability because they are often cultivated in large monocultural stands, and that they create 'ecological deserts' almost devoid of local fauna, particularly birds. A number of comments can be made on such arguments.

All plants abstract nutrients from the soil. If they are harvested and the biomass is removed, the soil is thereby depleted and may need to be fertilised. This is a universal occurrence; the rate of loss of nutrients is dictated by the rate at which the biomass is removed. A high-yielding tree crop such as eucalyptus will indeed deplete the soil if no corrective measures are taken. So too will rice, sugar-cane, leucaena, or other fast growing trees.

In practice, the rate at which this soil depletion occurs, and the nature of the problems that arise from it, depend to a large extent on the type of soil and its physical structure. Soils which are inherently fertile can support high yielding crops for many years without productivity declining. Others may be depleted very quickly. But the case against eucalyptus is no different from that which might be made against any other crop.

A similar comment can be made about the use of water. All plants require water to grow, and the faster they grow the more they need. Because eucalyptus is a fast growing tree it inevitably demands a large amount of

Growing conditions in the Sahel are often extremely harsh. This is a one year old Acacia albida plant in Niger. Photo: F.Mattioli/FAO

Eucalyptus has come under widespread criticism in some countries. This stand is in Gujarat. Photo: G.Foley/Earthscan

water. But this is the case with any high yielding tree species; the amount used by eucalyptus per unit of biomass produced may in fact be lower than with some others (Chaturvedi, 1983).

Whether a eucalyptus plantation will affect the water table depends greatly on the hydrological and physical properties of the soil. It is also determined by what kind of vegetation it replaces. If the previous crop was a water hungry one, the water table may well rise. The fact that eucalpyptus roots can break up the soil structure or even a subterranean layer of impervious hardpan thus improving rainwater percolation can also lead to a net positive effect on the groundwater level.

If eucalypts are being planted to replace slow-growing scrub, on the other hand, in an area with a sensitive hydrology, it is quite possible that the water table might fall. The effects can only be predicted through a careful site survey. But the point is that eucalyptus may be no worse than a variety of other species.

The anti-monoculture argument against eucalyptus raises the difficulty that it should logically be applied, with even greater force, to a wide variety of other crops and tree types. Carried to its extreme conclusion, it would demand the abolition of the cultivation of coconuts, rubber, coffee, tea, rice, wheat, and so forth. While there are certainly risks that have to be borne in mind, particularly with regard to the potential spread of pests and diseases, this is not something which has prevented numerous other species being successfully grown as monocultures - many of which, through years of selective breeding, have a much lower degree of genetic diversity than a typical eucalyptus crop.

Summarising the argument about the impoverishing effect of eucalypts on the local ecology, one commentator has said:

> "As to ecological deserts, it all depends on with what a eucalypt plantation is compared. If it is with a nearby natural mixed forest, there is no doubt that the latter is much richer in fauna but if such a plantation is compared with a nearby scarcely covered slope as for instance a burnt over savanna, then it is highly probable that there is more animal life including nesting birds in the eucalypt stand" (Budowski, 1984).

This, however, is not to say that there are never any valid technical or ecological objections to choosing eucalypts. On the contrary, their use needs to examined in all cases to ensure that they are suitable for their purpose and compatible with the environment in which they are growing. As with other tree species, they may have detrimental side effects under certain circumstances, in which cases they should not be planted.

A particular point on which there is considerable doubt at present is whether land which has been used for a eucalyptus plantation can be restored to agricultural use. With the rapid spread of farm forestry in some areas, there is a possibility that there will be at least local pockets of over-supply and a desire on the part of some farmers to revert to agricultural crop growing. It would be useful to know at this stage what precisely is involved in bringing land under eucalypts back into crop production.

A number of criticisms have also been made of eucalypts on the grounds that they are intrinsically incapable of meeting some of the social objectives of most farm and community forestry programmes. In contrast with many of the technical arguments, some of these criticisms appear to more strongly based. Indeed, some of the properties that make eucalypts attractive for farmers to grow are the very ones which reduce their wider social usefulness.

The fact that their leaves are not browsed by livestock is one of the major advantages of growing eucalypts. This is particularly important in areas where protection from grazing animals is difficult. But it also means that eucalyptus plantations are of no help in increasing local fodder supplies, which for the poor may be their main priority.

The suitability of eucalyptus wood for pulp making is also one of its main attractions in a number of parts of India. This guarantees a large and stable market for farmers living near to pulp mills. But it can also work to the disadvantage of the poor and landless who previously relied on access to these farmers' fields for collecting fuel and fodder. Not only does the eucalyptus plantation reduce the amount of fodder, but the fact that pulp mills are prepared to take the whole tree will also decrease the local availability of fuel. When eucalyptus is grown for pulp, there are not even the lops and tops which are left behind when trees are prepared for sale to pole and timber markets.

In a particularly strong critique of the use of eucalypts as the basis of some of the Indian social forestry programmes, the Indian Institute of Management said:

> "While providing maximisation of wood production in the short run, eucalyptus on farms fails to provide for the basic material needs which are often better satisfied in a more integrated manner by traditional farm trees" (Shiva et al, 1981).

There is no doubt that in many cases this comment is entirely valid. But its implications stretch far beyond the choice of eucalyptus as a species for the Indian farm forestry programmes. The success of these has been precisely because they make exceptionally good economic sense in the Indian context. While shifting to other species might, in principle, provide a

better spread of social benefits, the economic viability of such alternatives has yet to be demonstrated to the farmers who ultimately decide which species to plant.

10.4 Developing Agroforestry Systems

Agroforestry is the term used for the deliberate cultivation of trees in association with crops or livestock. The benefits of this can be seen by observing the numerous traditional agroforestry systems that exist in many parts of the world. The potential advantages have been widely described (MacDonald, 1982; Wiersum, 1981). Essentially, these fall into three categories: the ecological benefits from more effective utilisation of sun, nutrients and water, and better soil protection; the economic benefits of increased total productivity; and the socio-economic advantages of evening out labour demands and income, and reducing the risk in farming.

Agroforestry is now widely seen as an important new approach to the problems of environmental deterioration and rural development, particularly on marginal lands. Since 1977, at least a dozen international seminars and conferences specifically focusing on agroforestry have been held. As the foreword to one set of proceedings states:

> "In the last five years there has been a virtual explosion of interest in agroforestry. The concept has spread from a few anthropologists, foresters, and agricultural scientists to become a priority for a number of national and international agencies" (Macdonald, 1982).

Research into agroforestry techniques is now going on, in some form or another, in most developing countries. A prominant role is being played in Latin America by the Centro Agronomico Tropical de Invetigacion y Ensenaza (CATIE) which is based in Costa Rica. This has a research programme with components in different Latin American countries. One of the areas of study is concentrated on the use of different species and combinations of shade trees in coffee plantations.

Other international research institutes involved in agroforestry research include the International Institute for Tropical Agriculture (IITA), in Nigeria, which amongst other things is working with maize and leucaena intercropping systems, and the Central Arid Zones Research Institute (CAZRI), in India, which is carrying out research into silvopastoral systems for semi-arid regions.

The International Council for Research in Agroforestry (ICRAF) which is based in Kenya, has been specially set up to provide a focal point for this new work. As its director explains, in a recent review of agroforestry

knowledge and worldwide experience:

> "There are probably many interrelated reasons for this explosive increase in interest - one no doubt being the built-in dynamics of 'fashion' concepts. But there is much more to it than that - agroforesry is the first concrete concept that builds on a synthesis of much of the practical experience and scientific knowledge acquired over the past decades of tropical agriculture, forestry, ecology, soil science and rural socio-economics. Our increased understanding of the tropical environments, both social and ecological, and the frequent disappointments and failures encountered when trying to implement 'modern' agricultural and forestry technologies in ecologically sensitive and socio-economically complex situations have led to a realization that alternative approaches to land development must be given a higher priority" (Lundgren, 1982).

Though the potential of agroforestry systems is now widely recognised, the science is still in its infancy. There is still very little quantitative information on the interactions between trees, crops, and livestock. The experience in implementing new approaches in practice is even less.

Much of the detailed knowledge that does exist relates to no more than a small subset of the theoretically possible agroforestry combinations. There is now fairly good data, for example, on the effects of growing food crops between some industrial timber species using the taungya approach. There is also extensive experience in some countries in providing shade trees for coffee and tea plantations, and in intercropping food crops with oil palm, coconut, and other commercial tree crops.

But for the many other potential combinations, particularly those incorporating trees within subsistence farming systems, there is a very poor foundation of technical knowledge on which to build promotional programmes. Much remains to be learned before new agroforestry systems can be deployed with confidence under different climatic and environmental conditions, or with new combinations of trees and crops. It has been said in this context that:

> "... in agroforestry there is little scope at present for 'off the shelf' solutions. Our shelves, in fact, are practically empty at least of scientifically understood and validated technologies" (Raintree, 1983a).

A great deal more detailed field research is therefore essential. The biological and economic interactions between components in different agroforestry systems have to be identified and measured. It is also important to have a detailed knowledge of the nature and dynamics of the existing agricultural and socio-economic system within which agroforestry

programmes might take place. Only then can modifications be designed which address the most important local needs, and fit in with local capabilities, priorities and constraints.

The importance of relating agroforestry research to the realities of local conditions has been stressed by Raintree:

> "It is a cardinal rule of medical practice that diagnosis should precede treatment.... it would be unthinkable for the medical profession that it could ever simply dispense without due regard to the specific nature of the patient's illness. The same standard applies no less to the treatment of problems arising from man's use of the earth" (Raintree, 1983a).

Given the diversity of potential agroforestry approaches, selecting research priorities and designing relevant experiments that will produce implementable results is not easy. To assist in the orientation of agroforestry research, a team at ICRAF has spent several years in developing a detailed methodology for identifying research priorities.

This approach is based on the techniques of farming systems research and is referred to as the ICRAF 'Diagnostic and Design Methodology for Agroforestry'. The procedure involves four main stages. The first is called the 'prediagnostic stage', which provides relevant information on existing local systems. The second is the 'diagnostic stage', in which problems and potential opportunities are identified, and specifications for appropriate agroforestry solutions are defined. Next is the 'technology design stage', which involves the selection, design and evaluation of specific agroforestry systems. In the final 'follow up planning stage' the reseach needed to develop these systems is defined and a project implementation plan is made (Raintree, 1983a).

The idea is that the diagnosis and design process should be an iterative one, in which research activities are constantly reviewed on the basis of feedback from trials. In this way, the methodology is designed to provide workable agroforestry solutions in as short a time as possible, and with the minimum wastage of resources. To accompany the publications outlining this approach, ICRAF has produced a handbook containing a detailed set of methodological guidelines and suggested procedures, and a collection of analytic tools and resource materials (Raintree, 1983b).

10.5 The Need for Trials

The degree to which the techniques of farm and community forestry differ from conventional forestry practices is frequently overlooked. Often, there is a series of quite important gaps in the knowledge and experience existing in key areas. Apart from those already mentioned, some of the

other aspects of tree cultivation which are poorly understood at present include the lopping patterns for obtaining sustained yields of small wood and fodder; the optimum spacings to meet the particular needs of different tree planting approaches; and the rotation periods which should be adopted for optimum yields of different products.

An essential factor in ensuring that the correct technical choices are made in the design of programmes, is that an adequate number of practical trials are carried out to establish the validity of the approaches and technical packages being used. One of the most basic requirements in the whole area of farm and community forestry is that adequate funding is provided for such trials.

Where new species are being introduced to an area, a series of species, provenance, and management trials will often be needed if programmes are to be securely based. On difficult or marginal land, or in arid zones, the risks of failure increase substantially and pre-programme trials become even more imperative. Starting from scratch with the introduction of a new exotic species, the minimum period before distribution of seedlings or planting material can take place is likely to be at least five years.

Such delays may be considerably longer than many people think reasonable or acceptable, particularly those concerned with the urgency of the problems being addressed or those engaged in the non-technical aspects of programme design. Optimum silvicultural practices may therefore have to take second place to the practicalities of particular programmes. Projects frequently have to go ahead using the best guesses as to the most appropriate species, and whatever seeds are available at that particular moment. Only systematic trials and testing can provide the remedy for this unsatisfactory position.

11.0 Assessing the Demands for Wood

The principal objective of most of the farm and community forestry programmes carried out to date has been to increase the local supply of wood. A large number of these programmes have been launched with a poor knowledge of the existing supply and demand patterns for wood. As a result, the uncertainities and risks of programme failure have been greatly increased.

Much of the criticism of farm forestry in India, for example, springs from the fact that some programmes have evolved in directions, and with consequences, which were not foreseen by their promoters. With hindsight, it is clear that an initial survey of the actual demand patterns for wood products would have made the outcome of programmes much more predictable and permitted some of the criticisms to be anticipated and perhaps avoided.

The same applies to many of the programmes carried out in the Sahel and elsewhere, in which attempts were made to create village fuelwood plantations. A knowledge of the present wood supply and demand systems, and the extent to which they provide incentives for tree growing, would have revealed that growing trees for fuel in these areas is not economically attractive. Experience is now showing that more broadly based programmes, which cater for other wood needs and other tree product demands, as well as providing environmental benefits, might well have stood a better chance of success.

A prior analysis of wood supply and demand patterns is therefore essential if tree growing programmes are to be planned with any degree of confidence. This takes time, and may delay the start of the programme. But without a clear knowledge of the realities of local demand systems, it is unlikely that programmes can be designed which will meet either their own planting targets, or any set of wider social and environmental goals.

This chapter decribes some of the main features of wood supply and demand systems. It illustrates the diversity that exists between countries, and even within villages, and points out some of the main areas where detailed information is required in the planning and preparation of programmes.

11.1 Rural Domestic Woodfuel Demands

Despite the importance of woodfuels in most developing countries, there are serious deficiencies in the consistency and reliability of much of the published data on their use. Although the position has improved in recent years, this remains an area where a considerable amount of further work is required. Nevertheless, a number of general tendencies can be identified from the surveys carried out to date.

One of the most notable features is the widespread variation in consumption which can exist within countries or even the same community. Families which appear similar often consume greatly different amounts of fuel. Consumption estimates based on small samples may not identify these variations and can hence be extremely misleading.

Not surprisingly, the local availability of woodfuel tends to be the primary determinant of how much is used. Where forest resources are still plentiful and easily accessible, large quantities of fuelwood are commonly consumed. Annual consumption figures of 2600 kg/head have been reported from Tanzania (Fleuret and Fleuret, 1978); in Guatemala, the average per capita consumption in the rural areas has been estimated at 1250 kg/year (Bogach, 1981), whilst annual figures of up to 2865 kg per person have been reported from Nicaragua (Jones and Otarola, 1981).

In areas of wood scarcity, the amounts consumed are generally much lower. People spend a longer time collecting wood and often have to go considerable distances to obtain their daily requirements. As a result, much greater economy is exercised in the use of fuel, as illustrated in a report from Senegal where it is noted that: 'Economy is second nature and women will quench the fire with water or bury the embers in sand immediately after the cooking is through (Evans et al, 1980).

Detailed surveys in six villages in Mali and Niger, found a wood consumption range of 440-660 kg per head per year. The report notes that in the villages where fuel is hardest to find, people switch to non-preferred tree species and try to economise. Nevertheless, in this area, the figure of 440 kg per head appears to constitute a floor below which people find it difficult to reduce their consumption (Bonnet-Madin et al, 1983).

Similar findings are reported from areas of wood scarcity in India. The annual consumption figures in five villages in the state of Orissa, where people rely on fuelwood for virtually all their requirements, are in the range 509-826 kg per head, with an average of 680 kg (Samanta et al, 1982). The annual consumption in 17 villages surveyed in Tamil Nadu had a range of 344-676 kg per head, with a mean of 481 kg (SFMAB, 1982).

As well as fuel availability, factors such as family size also have an important influence on per capita fuel requirements. Larger families, cooking bigger meals, tend to be more efficient in their use of fuel. One survey in Nepal showed that families with between one and four members used an average of 890 kg of firewood per person per year. Families with nine members or more used only about 340 kg per person (Fox, 1983).

Other influences on consumption levels include climate, the types of food cooked, the methods of cooking, and the availability of alternative sources of light other than the cooking fire. In many places there are also

Poles are widely used for constructing traditional dwellings in the rural areas.

Photo: Mark Edwards/Earthscan

Below:
Young women carrying twigs for use as fuel in Niger.

Photo: Mark Edwards/Earthscan

seasonal variations, with consumption increasing in the period after harvest when labour is readily available and wood is easy to obtain, and dropping during the monsoon when collection is difficult and people are heavily occupied with farming tasks.

Home-based industries and commercial activities can add to the domestic demand for wood. Brewing beer is a traditional activity in some areas, as is baking bread for sale. In others, small-scale brick and pottery making is carried out. Wood may also be used in large amounts for special family occasions such as festivals and weddings. In India, cremation of the dead is a substantial consumer of woodfuel with up to 400 kg being used for a single body.

Where wood is becoming hard to find, increasingly materials which would not otherwise be regarded as suitable for fuel tend to come into use. These include thorny tree species, which are difficult to collect and prepare, and others which have a low calorific value or burn with a smoky flame. Twigs and leaves are used to a greater extent, together with crop residues and animal dung.

This process, in which an increasing range of biomass materials is used as fuel, has been called 'energy involution', and described as follows:

> "... where in one year a family or an industry mostly used stemwood grade firewood, the next year they use coconut husks and bamboo roots. Still later, rice hulls, corn stalks, tobacco stalks, rice stalks, and finally dried leaves are commonly used as cooking fuels. In a completely involuted system, no burnable bit of biomass is immune from inclusion in a cooking fire" (Weatherly, 1980).

Shifting to alternative biomass materials opens up a considerably wider resource of potentially burnable materials. Under Indonesian conditions, it was calculated that the total amount of fuel which can come into use in this way is about four times greater than that available when people rely solely on stemwood. What the figure would be for other areas will depend on local patterns of biomass productivity, and the amount of crop residues and other materials consumed by livestock (Weitherly, 1980).

The switch to lower grade fuels may allow people to spend less time in collecting fuel, and therefore help solve their immediate fuel problem. But it also involves a number of direct and indirect costs. These fuels are often less convenient to use, and require more work from the cook in feeding and tending the fire. There are also various environmental and economic costs when organic material that would otherwise be returned to the soil, or used for animal feed and other purposes, has to be burnt.

But little is known about the exact nature of these trade-offs, or how people view them themselves. If they feel these freely available lower grade fuels provide a reasonably acceptable alternative to wood, they will have little motivation to plant trees when their former woodfuel sources are depleted. Much needs to be learned about this important aspect of rural fuel supplies.

11.2 Commercial Woodfuel Markets

In the majority of developing countries, the bulk of the domestic woodfuel supply in rural areas is still obtained on a non-commercial basis. It is collected from forests, common lands or private holdings without any cash payment. Increasingly, however, these traditions are giving way to a commercialised wood market in which woodfuel is bought and sold.

This is often a sign of increased wood scarcity. But it can also take place simply because of rising incomes, and the desire of the more wealthy members of the community to avoid the time and trouble required in collecting and preparing fuelwood. The development of a market to meet the needs of the better-off is further encouraged in areas where fuel is scarce, or if a lot of work is involved in preparing it. In such cases, the collection and supply of wood for sale is often adopted by some of the poor as a way of earning cash.

The position in the village of Kurunchy in Tamil Nadu illustrates this:

> "The extent of fuelwood purchase, or the degree to which fuelwood gets marketised, can depend upon a variety of situations. Salaried employed in the village - teachers, government employees, mill workers, etc - lack time to gather fuel while being able to purchase it. Their proportion increases the market-demand for wood.... Kurunchy provides an interesting example of a village dominated by large and medium farmers who employ in-migrant farm labour and purchase large quantities of fuel for cooking meals for their labourers" (SFMAB, 1982).

Although it is becoming increasingly common almost everywhere, the commercialisation of domestic woodfuel has reached very different stages in different countries. It has been noted in Tanzania, for example, that it is only the salaried public servants such as teachers or rural extension officers who purchase their fuelwood. These families make up less than 2.5% of the rural population (Nkonoki, 1983). In Malawi, a nationwide survey indicated that only 7% of rural families buy any fuelwood, and of these only 1% rely on bought wood entirely (Energy Studies Unit, 1981b).

A survey of the village of Ibb, in the Southern Uplands region of the Yemen Arab Republic, on the other hand, showed that 65% of households obtain a

quarter or more of their fuelwood from the market (Aulaqi, 1982). In Nicaragua, estimates suggest that more than half the country's wood fuel consumption is commercialised, with 70% of all households buying at least some fuelwood (van Buren, 1984).

The development of a commercial woodfuel market in an area can radically change local attitudes towards the question of woodfuel supplies. Studies in the Mbere area of Kenya, for example, found that selling fuelwood was regarded as a sign of poverty when it first began in 1976, but within two years it came to be seen by the whole community as an acceptable way of earning a living (Brokensha and Riley, 1978). As the woodfuel market develops, landowners also become less willing to allow others to collect wood from their land, particularly if is being collected for sale.

In the Yemen Arab Republic it has been found that when people are gathering wood for sale they are much more likely to cut live trees than where there is no market (Aulaqui, 1982). In other African countries, it has been noted that it is only when fuelwood becomes a commercial commodity that men become interested in dealing with it, in 'recognition of a new situation, that is that wood has become a rare and therefore valuable commodity deserving the attention of the male sex' (Ki-Zerbo, 1981).

11.3 Urban Woodfuel Demands and Supply Sources

Most cities in the developing world rely on wood or charcoal to supply a significant part of their domestic fuel needs. In many African cities, charcoal is the most popular fuel, with wood being used only by the very poor. In Latin America, wood is the dominant fuel, while in Asia the picture varies: Bangkok, for example, uses almost exclusively charcoal, while Madras and most other Indian cities cook mainly with wood.

Very few reliable estimates of urban fuelwood or charcoal consumption are available, at either an individual or aggregated level. Official records of charcoal entering Dakar in 1978 indicated an average annual consumption of 100 kg per capita. In Kenya, a range of urban charcoal consumption figures of 100-170 kg/head/year is reported (Burley, 1982).

Tanzanian estimates of the annual consumption of charcoal by urban dwellers vary greatly. According to one estimate is about 170 kg per head (Nkonoki, 1983) and 315 kg per head according to another (Mnzava, 1982). Studies of urban households in Malawi show that the annual urban consumption is about 470 kg of fuelwood and 170 kg of charcoal per person (French, 1983). The estimated annual consumption of fuelwood in Oagadougou has been given as 438 kg per head (Chauvin, 1981).

The supply of urban woodfuels is almost exclusively on a commercial basis. The mechanisms by which this happens, however, vary considerably. In large

cities, the trade is often organised around a series of wholesale depots, from which smaller retailers obtain their supplies. In some cases, Madras for example, these depots may also provide fuel for satellite villages surrounding the city. Trucks loaded with fuelwood can be seen passing each other, one entering the city while the other leaves.

In smaller towns, the supply of woodfuel tends to be more informal. Rural suppliers may themselves transport fuel to the towns, using donkeys or bullock carts, carrying it on buses, or bringing it in by headload. Some sell to dealers, while others trade directly in the market place.

In Tanzania, charcoal comes largely from the open woodlands along the roads leading into Dar es Salaam, and other cities. It is made by itinerant charcoal-makers, the majority of whom are unlicensed, using small earth kilns. Their produce is sold at the roadside and transported into the city by truck. In contrast, much of the supply to Dakar, in Senegal, comes from licensed gangs of charcoal-makers working in designated areas of forest which were killed in the droughts of the 1970s.

The Kenyan charcoal market is to a large extent controlled by truck owners. They purchase the charcoal from rural producers on the way back from delivering other goods to outlying districts. It is then sold through their own outlets in the cities. As they do not have to make trips specially to pick up charcoal, the economics of charcoal transport are completely altered.

This opens up a much wider area of potential sources. As a result, charcoal may sometimes be brought from surprisingly long distances away. As one area is depleted, another can be opened up without the price rising to a level at which urban consumers would begin to switch to other fuels. Some of the trucks carrying charcoal to Nairobi come from as far away as the Sudanese border, 600 kilometres to the north (O'Keefe, 1983).

As trucks and other vehicles are usually the predominant method of transport for woodfuel supplies to urban areas, the road network has a major bearing on the sources of supply. The opening up of forest areas to logging, for example, often results in the development of a concomitant trade in fuelwood. Simply improving a road into a village so that it can be used by a bus may well have the same effect.

Forestry departments are significant suppliers of woodfuel in some countries. This used to be the case in Kerala, in southern India, where wood from state forests was sold at government depots at a controlled price. This supply has been heavily curtailed in recent years due to the reduction in the rate of felling and replanting in government forests.

Land clearance can also provide substantial supplies of woodfuel for urban use. When mature forest land is being cleared, the quantities of wood

produced are extremely large. The total above-ground biomass in a mature temperate forest may be as much as 300 tonnes per hectare, and double that in a tropical moist forest (Hadley and Lanly, 1983).

In Sri Lanka, large areas of forest are being cleared as part of the Mahaweli irrigation scheme. To make use of the waste wood being produced, a charcoal-making project has been started. The plans are to encourage small-scale charcoal production using portable metal kilns. Annual production is projected to rise to 100 000 tonnes in 1985.

The clearing of fallow land when crops are planted is also an important source of woodfuel for urban markets in some countries. Around the town of Bara, in Central Sudan, charcoal is produced by farmers using simple earth kilns, and transported the 16-18 km into town using camels (Hammer, 1980). Firewood supplies for Ibadan, in Nigeria, also come predominantly from the clearing of fallow land. Farmers living near to main roads sell wood to people passing in cars, as well as to traders (Ay, 1980).

Detailed studies of the fuel supply system in Nicaragua show a number of supply mechanisms working side by side (van Buren, 1984). In the south, a major coffee renovation project involving the felling of shade trees and replanting of coffee is releasing a large amount of fuelwood and charcoal on to the urban market. Elsewhere, the expansion of agriculture following the land reform measures of the government is producing a similar result.

In the Las Maderas region, the felling of trees on privately owned grazing land is an important source of supply. This is organised by businessmen, or 'empresarios', who own a truck, and manage the cutting, transportation, and marketing operations. Land owners are paid a small fee for the right to use their land, but are usually cooperative since regular cutting of the trees helps stimulate the growth of grass (Park et al, 1982).

Illegal tree cutting provides an additional source of supply in many countries. Sometimes this is done by individuals removing small quantities of wood for sale in the towns. In other cases contractors working on government or private lands have been known to falsify records and forge permits in order to cut stocks which are officially protected; there are also numerous allegations of collusion between contractors and local forestry officials in evading regulations on cutting in forest lands.

11.4 Woodfuel Demands from Industries and Commerce

In many countries, small-scale rural industries consume large amounts of fuelwood. Such industries include tobacco curing, tea and coffee drying, brick-making, sugar-making, and many others. In towns, commercial enterprises such as restaurants, tea shops, bakeries, and laundries can also add substantially to the demands for fuelwood and charcoal.

Urban fuelwood markets draw wood supplies from the rural areas and hasten the depletion of local wood resources; Dhaka, Bangladesh. Photo: Mark Edwards/Earthscan

Rural industries can consume large amounts of woodfuel; coffee drying plant in Costa Rica. Photo: G.Foley/Earthscan

Tobacco curing can be a particularly heavy user of woodfuel. In parts of Tanzania, for example, 50-60 cubic metres of wood are required to cure a 475 kg batch of green tobacco leaves. This means that under smallholder growing conditions, the yield of one acre of tobacco requires the full standing stock of a hectare of the adjacent savanna, or miombo, woodland (Nkonoki, 1983).

Information on the wood consumption of a number of other rural industries in Tanzania is also available. The fuel requirements of brick-making depend heavily on the quality of clay, its moisture content, and the degree to which the clay is burnt. An average figure is about 35 cubic metres of wood for the 25 000 bricks needed for a family house. Tea drying requires 1 cubic metre of wood to cure 150 kg of green leaves. Brewing the local beer made from maize and other cereals requires 1 cubic metre of wood per 400 litres of beer, and a typical village beer shop makes 800 litres per day (Nkonoki, 1983).

For some industries, the availability of free fuel may be essential for their continued financial viability. This is true of both the tea and tobacco industries in some countries; if they had to pay for the fuel they require they would no longer be competitive on the international market.

More commonly, however, wood must be purchased locally. Wood for brick-making in southern Thailand, for example, is bought from owners of rubber plantations who are felling trees prior to replanting. In Costa Rica, wood for coffee drying is supplied from nearby farms. Industrial demands are therefore superimposed upon those generated by local domestic consumption, and urban woodfuel demands.

The quantities of wood used by local industries can be a surprisingly high proportion of the total consumption of wood in a country. In Kenya, for example, the demand from industries and small commercial enterprises represents around 23% of total woodfuel use (O'Keefe, 1983). In Central America, industries are estimated to account for 18% of the total (Jones and Otarola, 1981). In some of the southern African countries it can be as high as 40% of national woodfuel consumption (Bhagavan, 1984).

11.5 Building Poles, and other Demands for Wood

The fact that woodfuel represents the largest quantitative demand for wood, has at times diverted attention from its other uses. In many places, wood also meets a variety of basic needs for which there are no readily available substitutes. In these particular applications, it will often command a higher price than when sold for fuel.

Poles, especially for building purposes, are widely used and are often in scarce supply. They are needed for many traditional types of dwellings.

In some countries, they provide the framework for the walls which are then coated in mud or covered with thatch or woven mats; poles are also employed as rafters for supporting the roof. For this kind of use, poles which are 2-3 metres in length and 2-5 cm in diameter are commonly used. In one study in the Indian state of Orissa, the number of bamboo poles used each year was estimated at between 35 and 55 per household (Samanta, 1982).

Larger poles may also be used for centre or corner posts, and where additional strength is required. In Nigeria, specially selected forked poles, known locally as 'gwofors', are used for supporting roof beams and fetch a premium in the market (Fishwick, 1983). Short poles are also used for fencing, for the handles of implements, in making carts, and a myriad of other uses around farms and dwellings.

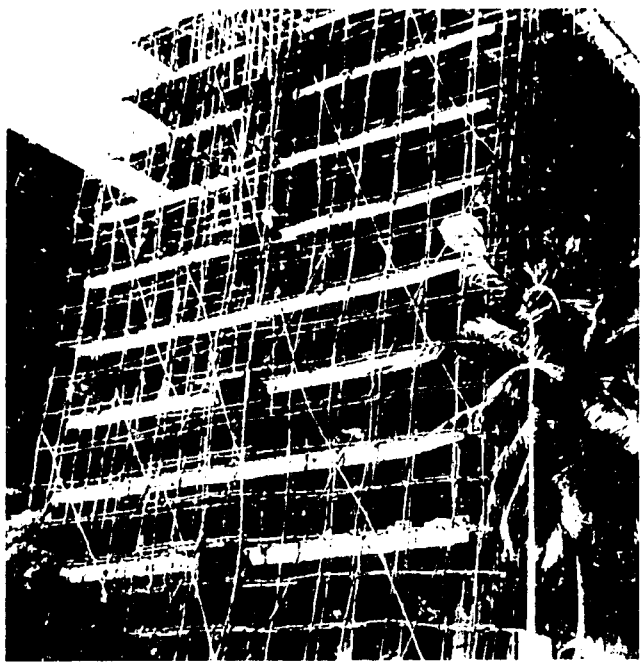
In the cities, poles are used extensively by the poor for low-cost housing. Larger and stronger poles also used for scaffolding and props in the building industry. In addition, they are cut square for use as roof beams and structural members in permanent buildings. These high quality structural timbers may have a diameter of 30 cms or more and a length of 5-6 metres.

Besides building poles, there is usually a variety of other local demands for wood. Sawmills provide an important market in some areas. The sawn wood may be used by the construction industry, in furniture making, for packing cases, and for many other purposes.

Another important wood demand in many countries is for agricultural implement making. Wooden ploughs are still very widely used, for example. These require large pieces of hard, durable wood and may have to be replaced every few years. Although such uses form a very small market in comparison with some of those mentioned above, they still must be met if agricultural production is not to suffer. There may therefore be strong local incentives to grow trees to meet these specialist requirements.

Large wood-using industries can also add substantially to the local demand for wood. In some cases, they dominate the entire wood market. In Karnataka state in India, for example, pulp and rayon mills are willing to buy large amounts of eucalyptus wood from local farmers. The effect, in Kolar District, has been described as follows:

> "The price of eucalyptus offered to the farmers is above the price of firewood. This ensures that eucalyptus wood is supplied to the few paper mills and one rayon mill in the area..... the consumers of the products of pulpwood based industries are urban elites and have almost infinite purchasing power compared to the rural poor. The high price of raw material can therefore be accomodated easily in the price structure without losing the market" (Shiva et al, 1981).



Vast numbers of poles are used in some countries by the construction industry; Madras, India.

Photo:
G.Foley/Earthscan

A truckload of casuarina poles is unloaded at a wholesale depot in Madras. Photo: G.Foley/Earthscan

11.6 Incentives for Tree Growing

When wood supplies become scarce, a variety of hardships begin to occur. But the severity of these problems and the alarming outlook if depletion of wood resources continues, do not necessarily provide a sufficient incentive for farmers to grow trees for anything except their own domestic purposes.

One of the most important reasons for this is that a large proportion of present woodfuel demands are outside the commercial market. In some of the poorer countries, approaching 90% of the total woodfuel demand is not yet commercialised. In many other countries, the proportion is probably 60% or more.

As long as this is the case and the majority of consumers can obtain their supplies on a non-commercial basis, there will be little, if any, incentive for farmers to plant trees for sale. Even when there is a commercial market, the existence of wood resources on common lands or poorly guarded forest reserves will tend to keep the price offered to wood producers below that at which it is attractive to grow trees.

Wood prices, however, tend to rise as depletion continues and supplies become scarcer. As this trend continues, tree growing should eventually become commercially viable. The level of this price threshold will, however, vary substantially from place to place. It will depend on growth rates, input costs, and the returns from alternative uses of land and resources. Projections of what is likely to happen in any particular case will have to be based on a detailed local analysis. Nevertheless, examination of areas at different stages of commercialisation and wood depletion provides some pointers to the probable pattern of future events in many places.

In general, when wood resources are being depleted, poles or other specialised wood products become commercialised at an earlier stage than fuelwood. This is because they are inherently scarcer, and more difficult to obtain. Consequently people are prepared to pay for them, whereas they can obtain all the fuel they need without spending any money.

As scarcity increases and pole prices rise, at some stage it becomes attractive to grow them for the market. Thus, farmers will begin to plant some trees for poles. Since the marginal cost of growing a few trees is small, this will tend to happen even when prices are still quite low. Larger scale planting, however, requires a price level which justifies the more significant investment of inputs and diversion of land involved. This stage has been reached in Gujarat, and a number of other parts of India, where the market price for poles clearly justifies quite large-scale investments in tree growing by farmers.

At a later stage in the depletion of wood resources, fuelwood in its turn becomes commercialised, and with increasing scarcity its price begins to rise. At a certain stage, it also becomes economically viable to plant trees for fuel. It should be noted, however, that if there is already a market in which poles command a higher price than fuelwood this will tend to dominate the farmer's decision.

Even if fuelwood planting is feasible in its own right, farmers will not grow trees specifically for fuel if they can obtain a better return by selling the wood for poles. The sale of lops and tops from pole plantations for fuelwood will provide a welcome additional income, and may even be taken into account when farmers are doing their calculations, but it will not be the primary incentive for tree growing.

Only when the market for poles becomes saturated, and the price of poles and fuelwood begins to coincide, will planting explicitly for fuel start to take place on a large scale. This appears to be the position in Madras, and some neighbouring areas, where the price of poles is now roughly equal to that of fuelwood. But it is not yet commonly found elsewhere.

This is not to say that what has happened in India will necessarily be repeated elsewhere. But it does serve to illustrate one possible path of change; it also demonstrates the complexity of the market system within which farm and community forestry programmes are operating. Without a clear picture of the nature and dynamics of this system, it is virtually impossible to predict the likely outcome of initiatives to promote tree growing.

11.7 Boundaries to the Woodfuel Market

Another important factor which must be taken into account in examining the potential for growing trees for fuelwood is the fact that woodfuel demand itself changes with time, often in a very complicated fashion. There is, for example, an upper limit on fuelwood prices. This is set by the price of alternative fuels such as kerosene and LPG, since people will switch away from woodfuel if it is cheaper to cook with modern commercial fuels.

The calculation people make when changing fuels is not based solely on the unit cost of available energy in the fuel. It will include other factors such as convenience and flexibility in use, security of supply, and the prestige which may go with using fuels that are regarded as modern. Rising income in itself can be sufficient to cause a switch away from woodfuel.

This has been noted in India, where, as one commentator points out:

> "...the more affluent sections of their society always prefer cleaner and more convenient cooking fuels to wood. The poor know

> that there is a hierarchy of cooking fuels and they view changes from fuelwood to charcoal to kerosene to electricity or gas as steps in the improvement of the quality of their life" (Reddy, 1983).

Among the poor, however, such a progression towards modern fuels is often impossible. As woodfuel is commercialised and its price rises, they may be unable to afford the increased cost and be forced to turn to other fuels which they can still obtain without payment, or at least more cheaply than wood. At the bottom end of the economic scale there therefore tends to be a transition towards lower grade fuels such as twigs, leaves, roots, vegetable residues, and dung.

The overall effect may be to create a price zone, the lower limit of which is set by the production costs of wood, while the upper limit is defined by the price of fuelwood substitutes. Within this zone fuelwood production is a viable commercial exercise. Outside it, growing trees for fuelwood is either uneconomic because of low wood prices, or very restricted because the price of wood makes it non-competitive with other fuels.

Determining the exact location of these boundaries will tend to be complicated in practice. There are many factors, for example, influencing the production cost of wood, and the price threshold at which it will become commercially attractive. Transportation costs have to be taken into account since the price a farmer is offered for his wood will often be considerably lower than what the consumer ends up paying in the market. Government regulations and price controls may also have an effect.

Nevertheless, the general concept of a price zone appears to be useful. Depending on local conditions, it may be narrow or broad. If kerosene and LPG are heavily subsidised by the government, or wood production costs are high because of an unfavourable climate, it is possible that the zone will be non-existent. In these circumstances, even if fuelwood prices are rising, it may never become economically feasible to grow trees to meet the demand. Before the price threshold for profitable tree growing is reached, people will have switched to alternative fuels.

When projecting woodfuel demands forward, it cannot therefore be assumed they will automatically continue to increase in line with population growth. The calculation of future woodfuel 'deficits' based upon fixed links between population figures and woodfuel consumption must be viewed with extreme caution. This can produce an exaggerated picture of the likely future demands for woodfuel, distorting planning goals, and leading to an undue emphasis on trying to grow trees to meet fuel needs. The future demand for wood cannot be calculated without taking into account the price at which it is supplied, and the comparative prices of the locally available alternatives.

12.0 Programme Design and Planning

Tree growing programmes are not ends in themselves, with success being measured solely by the numerical targets achieved. Increasing the number of trees in an area may have little beneficial effect unless it is closely related to the needs and priorities of the people living there. The design and planning of farm and community forestry programmes must always be based on a clearly identified set of social, economic and environmental goals.

The ideal design and planning approach for farm and community forestry has been described as follows:

> "Project design must start with the formulation of the goals to be achieved. A community forestry project is one that is a response to a basic need felt by the community, defined in terms of a goal to meet that need....A project should not be designed to 'protect a watershed' as an end in itself. Rather, protection of the watershed is a means to achieve a community goal of maintaining soil fertility so that people can eat (or eat more cheaply); or it may be a means of protecting life and health through maintenance of water quality; or it may be a means of achieving any number of goals associated with the fundamental objectives and needs of local communities" (FAO, 1978).

But circumstances in which all the objectives of a programme coincide in this way, rarely occur in practice. The realities of local conditions usually impose their own complexities and contradictions. Some objectives may even turn out to be incompatible with others under practical conditions. Few programmes are without some negative effects and their design will almost invariably involve a series of compromises and judgements about what is likely to be most acceptable and feasible to all concerned.

The professional work involved in the planning of programmes, and the drawing up of project documents, in most cases, will be dictated by the specific procedural requirements of the organisation in which it is taking place, or those of the agency from whom funding is being requested. The following sections are not, therefore, intended to provide a detailed guide to design and planning working procedures. Their purpose is to draw attention to a number of key issues which need particular care, or which at times have not received the attention they deserve.

12.1 Background Data Requirements

A primary planning requirement in all programmes is adequate background information. Without this, the design and implementation of programmes can only be based on more or less arbitrary assumptions. In practice, this has

been one of the weakest areas in many of the programmes to date. The number of programmes which appear to have been based on almost completely unfounded external judgements about local needs and preferences is surprising.

Collecting the relevant background information is thus a crucial aspect of programme planning. The extent and nature of the data required will depend on the scope and objectives of the programme concerned. The more complex or far reaching the effects being sought, the greater the knowledge of local social, economic, and ecological systems that will be required.

In a recent publication dealing with the design of woodfuel surveys it was pointed out that:

> "Simply measuring wood fuel use and the tree resource, while a necessary part of the whole, will by itself give very little indication of what can and should be done. It has become clear in recent years that in order to provide an adequate information base for planning effective fuelwood related projects it is necessary to draw as well upon the techniques and experience of other disciplines used in the study of rural, and urban, problems and development" (FAO, 1983a).

In many cases it will be difficult and expensive to obtain the necessary information since this cannot normally be acquired through short-term observation by outsiders. Impressions gathered in this way can, in fact, be seriously misleading. Neither are inexperienced or inadequately staffed local institutions necessarily capable of producing relevant, useable, and objective analyses of the true position. Provision for the proper design of surveys and the allocation of the resources necessary for carrying them out is nevertheless essential if rational programme planning is to be carried out.

Emphasizing the need for an adequate information base for programmes, however, must not be interpreted as advocating a widening of the scope of information collection for its own sake. An indiscriminate comprehensiveness in data collection can be totally counter-productive. Large data collection exercises have been known to provide no usable baseline data at all, and to have taken so long in processing that they were of no use in the project design (Chambers, 1978). An excess of information collection must always be avoided.

Background surveys should be designed to obtain only the information that is actually needed. There is no point in collecting information unless the purpose for doing so is clear. The challenge is not to widen the scope of the data collection exercise; it is to apply rigour in defining the exact information needed for planning a programme, and designing methods to obtain it in the most economical fashion.

12.2 Economic Analysis of Projects

Before authorising a project, a funding agency, or government, needs to be satisfied that the returns from it will adequately justify the investment of resources involved. A variety of methods of carrying out the necessary economic and financial analyses have been devised. Their purpose is to provide a systematic way of comparing costs and benefits so that the overall merits of proposed programmes can be objectively assessed.

While the principles on which they are based are simple, in practice such analyses of farm and community forestry projects can pose numerous problems. Partly this is because of the many uncertainties involved in quantifying costs and benefits; partly it is due to the fact that perspectives vary depending on the viewpoint from which the assessment is carried out. Thus it cannot be assumed that because a programme shows an attractive return at a national or project level, it will necessarily be attractive, or even feasible, at the level of the farmer.

12.21 Financial Analysis

Normally, the first stage in assessing the economic feasibility of a project is to perform a financial analysis. This requires the preparation of an estimate of the inputs to the project and the expected outputs from it. These are assigned cash values, using market prices. A year by year cash flow for the project is developed over its lifetime. Costs and benefits are then compared using discounting techniques to provide an measure of the overall profitability. The discounting approach is designed to take account of the cost of borrowed capital, and involves giving greater weight to cash flows that occur early in the project compared to those that occur later on.

In the case of conventional forestry projects aimed at the commercial production of timber or pulp, the techniques of financial analysis are well established (Gregerson and Contreras, 1979). Though laborious, the procedures involved are relatively straightforward. Some types of farm forestry activities can be analysed using a similar approach. The financial appraisal carried out for the PICOP project in the Philippines provides an example of how this can be done (Gregerson, 1979).

In this instance, trees were being grown by smallholders for sale to a pulp mill. The inputs required could be estimated using existing data. Growth rates were well known and, because the market for the wood was guaranteed, the revenues from tree growing could be predicted with reasonable accuracy. The analysis could therefore proceed along conventional lines with a reasonable degree of confidence that it would represent the actual conditions once the project went ahead.

The basic analysis showed a financial rate of return of 39%. To account for the uncertainties involved in estimating some of the factors, however, a sensitivity analysis was performed to test the effect changing certain key assumptions would have on the overall financial position. Because none of the changes made in these assumptions reduced the financial rate of return below 20%, it was concluded that the scheme was financially acceptable.

This project has been under way since 1974 and it is now possible to compare the original analysis with what has transpired in practice. The financial rate of return has been found to be somewhat lower than anticipated, as well as being more variable. But in most cases it has been greater than what is regarded as an acceptable level of 12%. Interestingly, the fact that farmers did not adopt the recommended planting practices has allowed them to obtain a higher rate of return than they would have otherwise achieved (Hyman, 1983b).

The PICOP project, however, is an exception in many respects. Most farm and community forestry projects are much less amenable to such well defined techniques of analysis. They often involve trees being planted over a wide area, under a range of different site conditions. A large number of different groups of people may be involved, many of whom have little training in forestry techniques.

All of this creates a much greater degree of uncertainty about the likely returns from the programme. Thus, it is very difficult to predict survival rates and yields, particularly if new species are being tried with which there is little silvicultural experience in the area in question. While the direct financial costs of such programmes may be relatively easy to quantify, assessing the magnitude of the outputs, let alone putting a cash value on them, can be extremely difficult.

Arriving at an appropriate cash value for inputs and outputs is a particularly difficult problem in cases when they do not have a clear market price. This applies when resources such as land and labour are supplied without any expenditure from the project. One approach used is to estimate the benefits which would have been obtained if these had been used for other productive activities rather than tree growing. To do this accurately, requires detailed knowledge of local agricultural practices and their financial profitibility, as well as information on the alternative employment opportunities in the area.

Assigning a value to non-marketed products is even more problematic. This frequently arises in farm and community forestry programmes aimed at producing firewood for home consumption rather than for sale. If growing trees saves a family from having to buy commercial fuels, the expenditure avoided can be used as a reasonable measure of the value of the wood. If, on the other hand, benefits are mainly in the form of savings in time or

effort the difficulties are much greater.

Time savings are usually valued on the basis of local wage rates or some other measure. But putting a credible financial value on the time of subsistence dwellers is difficult if there are no local opportunities for employment. Devising methods of defining appropriate values for time is a subject of much debate within the economic profession.

In other cases, the value of fuelwood has been estimated on the assumption that increased fuelwood availability will cut down on the amount of dung and crop residues being used for fuel. If farmers apply these to their fields instead, as fertilizer and soil conditioner, the increased agricultural output that results can be used as an indirect measure of the benefits obtained. In the analysis of several projects financed by the World Bank, for example, it is assumed that applying 1 tonne of dung per hectare will increase grain yields by 60 kg.

But it is obvious that such assumptions may bear scant relation to what happens in practice. If dung is scavenged from the roads by very poor people, providing fuelwood for sale from farm forestry programmes is likely to have little or no effect on them, and they will almost certainly continue to collect dung as before. The difficulties in making such calculations credible are obvious, since it is virtually impossible to assess to what extent, if at all, the benefits they are valuing are occurring in practice.

Financial analyses of programmes are nevertheless essential in ensuring that resources are not assigned without some degree of screening and cross-checking. They can be particularly useful as a means of providing a common basis for comparing different programme approaches within the same context. They are also necessary for purely accounting and bugeting purposes. But it must be borne in mind that, in practice, many are based on a series of relatively arbitrary assumptions which have little relation to the real world.

12.22 Economic Analysis

A financial analysis is frequently followed by an economic analysis in which the costs and benefits of the project are recalculated with a view to determining their impact on society as a whole. In most cases, the financial and economic analyses overlap to a considerable extent.

The point of the economic analysis is that it permits a number of additional factors to be taken into account. Thus, the market rates at which certain project inputs or outputs are valued in the financial analysis may be altered up or down to reflect a different view of what the real costs and benefits of tree growing are to a country. Foreign exchange

expenditures, for example, may be revalued in an endeavour to give a better measure of the benefits foregone or opportunity costs involved in using them in the programme. This technique is usually described as shadow pricing.

The indirect effects of projects can also be considered in the economic analysis. These, for example, might include costs such as roads, which have to be specially built at government expense, but which do not appear in the project budget. The indirect benefits might include the value of such project effects as preventing soil erosion and providing watershed protection, or the social benefits of creating employment opportunities in forest industries.

Satisfactorily estimating these indirect effects presents considerable problems. Nevertheless, in many cases the potential environmental benefits are one of the principal reasons for promoting tree growing and they need to be taken into account in deciding whether or not a programme is worthwhile. Windbreak projects, watershed protection, and dune stabilisation schemes all fall into this category.

Unless controlled experiments have been performed in which the actual economic impact of tree growing has been measured over a period of time, it is almost impossible to put a value on these effects with any degree of confidence. The same applies to many agroforestry schemes in which tree growing is integrated with crop production. Without detailed observation of the interactions between trees and other components in the system, the economic benefits from tree growing can only be estimated in a very approximate way.

In practice, the economic analysis of most indirect effects has to rely on a more or less arbitrary assignment of a value to them. Where they cannot be quantified in a meaningful way, they are normally grouped under the general category of 'intangibles'. By carefully listing these effects, they can be brought to attention during the decision-making process and considered as additional factors alongside the detailed results from the financial appraisal.

Given such difficulties at both a practical and a conceptual level, economic analysis of farm and community level forestry programmes is rarely a straightforward or particularly satisfactory process. Obviously, the problems involved will depend to a large extent on the type of scheme being promoted. The PICOP project discussed earlier provides an example of a relatively simple case where careful attention to detail and good field data can provide the basis for a fairly solid economic analysis. Roadside planting projects that use well-tried marketable species, and are carried out under close forest department supervision, are perhaps another.

At the other extreme, assessing the full economic implications to society of a scheme to promote tree planting by farmers for family uses is much more problematic. Even if detailed local information is available, it is very difficult to take an economic analysis very far on other than a purely hypothetical basis.

Nevertheless, economic analysis can have an extremely useful role to play in the design and planning of many types of projects. Provided it is used with discretion, it enables aspects of projects which are undoubtedly important, but are difficult to bring into the financial analysis, to be given weight in the assessment of projects (Romm, 1980).

At a minimum, finding where an economic analysis begins to break down can provide a useful indicator of some of the weaknesses and uncertainties in project design. This can be used as a pointer to show where additional surveys and special monitoring would be useful.

But equally, it is important that economic analyses are used carefully and that their limitations are always made clear. If arbitrary assumptions are used without being signalled as such, an economic analysis can easily serve to obscure the real issues rather than helping to clarify them. This is a particular danger when there are pressures to use economic analysis as a means of justifying projects which are otherwise unsoundly based or badly planned.

12.3 Clarifying Land Tenure and Legal Arrangements

At times, attempts have been made to carry out projects without a clearly defined legal framework which establishes the rights of the farmers involved, and protects their interests. In attempting to implement programmes under such conditions, project workers have found themselves in the untenable position described as follows, where they are:

> "...explaining to the farmers that there is no hidden threat to their lands, while being unable to put in the farmers' hands written assurances in this respect; and requesting the farmers to promise an unspecified contribution towards cost repayments, now or at harvesting time, while not having any contractual framework for definite and acceptable commitments binding both sides in this activity" (Cernea, 1981).

The fact that there may be ambiguities and a lack of formal written titles to land that is being suggested for tree planting should not lead programme planners to the assumption that the actual position is one of casual or informal possession; or that existing arrangments can be easily changed. A consciousness of the framework of rights within which they hold and use their lands is deeply embedded in the minds of most farmers.

As one commentator has pointed out:

> "In many societies, the rules governing the use of natural resources, including land and trees are part of an encompassing social network of reciprocal rights and obligations. This network is very important because it provides the individual with a kind of security in times of need..... It may become necessary to adapt the technical components of the projects to the systems of tree and land tenure rather than assuming that the latter will change the former. Failure to do so may well result in unpleasant surprises for the project implementer" (Fortmann, 1983).

The problems arising in the area of land tenure and customary rights can easily be underestimated. The assumption by planners must always be that farmers will not enter lightly into any arrangements in which their rights are not securely and credibly guaranteed. Above all, they will not participate in schemes which seem to jeopardise whatever title they have to their land. It is the task of those engaged in design and planning to ensure that the programme is based upon accurate information and an effective framework of enforceable local agreements on the allocation of costs and benefits.

12.4 Taking Women's Needs into Account

There is a particular need to ensure that the role of women is considered at the project design stage. It has been found that in some cases development efforts have not just by-passed women, but have actually made their position worse. It has also been noted that failing to consider the role women play in rural society, or excluding them from project planning, has at times resulted in the failure of projects (Edgren, 1982).

In most developing countries it is the women who are primarily responsible for collecting fuelwood. Men are, therefore, frequently isolated from the problems which arise if supplies become scarce. This has been suggested as an important reason why men are often unconcerned about fuel scarcity problems and indifferent to suggestions that they should plant more trees.

Another very practical reason for taking women's views fully into account is that to an increasing extent they are becoming the effective family decision makers in many parts of the world. An increasing number of men are migrating away from small holdings with the consequence that there is a growing number of women-headed rural households. It has been estimated that a third of the world's total households have women as their heads, but this figure would be higher if it took account of the number of households in which men are present but provide little effective economic input (Noskins, 1982).

If programmes are to help women, it is absolutely essential that accurate information on their actual work and role in the community is available. In the case of fuelwood, the statistical approach of recording the distances travelled to collect firewood, the time taken, and the loads carried, provides useful information on the actual physical tasks carried out by women. But it does not provide any information on how women themselves regard their problems, and what they see as realistic possibilities for taking action to ease them.

Particular care must be taken not to impose external values on what is happening at a local level. The collection of fuelwood is normally assumed to be a task which should be reduced or eliminated. But this is not necessarily always the case. In one part of Tanzania, for example, it was found that many of the women prefer wood collection to the work they would otherwise have to be doing. It is apparently seen as a relatively enjoyable task which they carry out in groups (Skutsch, 1983).

Similar instances in which women regarded firewood collection as a pleasant social activity have been noted in other countries (Brokensha and Riley, 1983). Measures for reducing the amount of time spent collecting wood in these cases would not necessarily be viewed by the women as an important improvement in their daily lives. The point is that there is no general rule about attitudes to firewood collection; women's own views must be established in each case. In many cases, such information cannot be obtained by men; women survey staff will often be needed.

The possibility of a conflict between men's and women's interests must also be borne in mind. One example of this comes from the Himalayan district of Chamoli. In discussions as to which trees should be planted in a number of village planting projects, the men's preference was for fruit trees from which they might gain income by selling fruit by the roadside. The women, on the other hand, wanted trees which produced fuel and fodder.

An account of this episode also states that:

> "It is also interesting to note that when the forest department was approached for saplings of fuel and fodder tree species, it had fruit trees (men's trees) or trees which yield good commercial timber. It had few women's trees" (Chowdhry, 1983a).

In Senegal, women often have an independent economic role within the rural family structure. In some areas, for example, the family works together in the cultivation of millet, but both men and women each have their separate areas in which they cultivate crops for their own personal income. Any increase in communal activity which imposes a proportionately greater burden on women, as could well be the case with some types of farm and community forestry programmes, would therefore diminish the opportunity they have for earning money for themselves. For this reason, such

programmes are unlikely to be supported by women.

If women's needs are to be reflected in community programmes, it is highly desirable that they are given official representation within the village organisations involved. This can be done by ensuring that women are elected or nominated to whatever village or community committees are engaged in the negotiation and local planning of projects.

This, however, may not provide an adequate protection of their interests in all cases, since women representatives may be subjected to strong domestic and communal pressures to conform to the conventional norms of their societies. In many cases, women will not speak if men are present, and wil allow men to answer on their behalf even when they know that what men are saying is incorrect. For example, Senegalese men have said that women do not plant trees in spite of the fact that this is untrue, since the fruit trees around the houses are actually planted by women (Hoskins and Guigonis, 1979).

In order to provide a safeguard against such possible distortion or suppression of local women's views, it will often be necessary to ensure that women are adequately represented on the professional planning and executive side of projects. Identifying the specific concerns of women, and translating these into specific provisions in farm and community forestry programmes is a complex process (Hoskins, 1983). It requires a commitment and understanding which are frequently lacking in men. Preferably, it will be achieved by ensuring that women professional staff are appointed with explicit responsibilities for dealing with the impact of the project on women.

12.5 Monitoring and Evaluation

Monitoring and evaluation of programmes while they are in progress is universally accepted as necessary. A number of questions, however, are beginning to arise concerning the actual methods by which monitoring is carried out, and the criteria by which programmes should be evaluated.

Above all, it is being realised that monitoring and evaluation can be expensive and difficult to carry out satisfactorily. It cannot simply be added on to programmes after they have been designed. The methods of monitoring and evaluation must be in mind from the earliest design stages, and provision for them must be built into the programme and its budget.

The following provides an outline description of the basic purposes of programme monitoring, which are to:

> "...suggest improvements in the implementation of the project and to indicate whether mid-course corrections in project design or

new initiatives are necessary. The principal users of this information include project managers, field staff, steering committees, other government agencies, or private corporations directly involved in the project, and international agencies providing funding or technical assistance. Information gathered in the course of monitoring should feed into evaluations in order to reduce costs, save time, and avoid stretching the limits of recall of participants and officials" (Hyman, 1983b).

Basically, three different elements can be distinguished in the process. These can be described as follows:

* monitoring of physical progress

* monitoring and evaluation of the impact

* feedback into the programme

Monitoring of physical progess provides a continuing check on the actual work being carried out in the programme, and its relation to the planned rate of progress. It is usually based on records of expenditure, the numbers of trees or extent of the areas planted, and other quantitative indicators decided at the planning stage.

The essential basis of all monitoring exercises is that the methods of record-keeping and field measurement are reliable and within the capabilities of those expected to carry them out. Particular precautions are obviously required in monitoring the numerical returns from the field. Thus figures for seedlings distributed need occasional checks to establish how well this represents the numbers being planted and surviving. Farmers, for example, have been known to feed seedlings to their goats. As in other activities, the provision of exaggerated figures for local achievements is an ever-present temptation when results are less than the targets set.

There may also be times when the tendency to overstate results is not simply a result of petty local dishonesties. The problem may be deeply engrained in the implementation system of the project itself. A survey of some community forestry projects in India remarks that:

"In some instances there were even instances of the subordinate staff murmuring that the funds get systematically 'diluted' stage by stage before they reach the grass roots planting staff. Hence they confess that they are constrained to contrive means of 'economising' the actual planting area and trees. And hence perhaps the discrepancy between the records and the reality" (Srinivasan et al, 1983).

Monitoring of physical progress provides an effective means of checking whether the implementation of the programme is proceeding in accordance with its planned schedule, and as such fills an extremely important function. Any programme areas where the figures diverge from those intended are automatically brought under scrutiny. Remedial action can be taken to resolve any problems which are found to be occurring

But discretion is needed before these results can be interpreted as measuring the success or failure of the programme. Such a judgement depends on how the targets were decided upon in the first place. The fact that one element in a programme vastly exceeds its planned target while another fails to reach that intended for it, does not necessarily mean that the first is succeeding and the second is failing. It could mean that the design of the programme was at fault, that implementation efforts are being unduly concentrated on one area rather than another, or that misjudgements were made in setting the targets. Targets which are being greatly exceeded could even be a warning that the programme is introducing harmful distortions into the local agricultural economy.

Methods of monitoring the broader impact of programmes also need to be devised at the planning and design stage. This can be a much more complex and difficult task than measuring the physical achievements of the programme, but it is absolutely essential if a proper evaluation of the progress of the programme is to be possible.

Programmes which set themselves objectives such as redistributing rural income, improving the environment, or strengthening local institutions must first establish the indicators by which these changes can be measured. Baseline measurements must also be carried out at the beginning of the programme in order to establish the starting point from which improvements are to be measured. Unless this is done, no objective measurement of the positive or negative impacts of the programme is possible.

Setting social or other goals without providing a means of monitoring whether they are being reached is pointless. It may even be harmful in that it can provide an illusion of purposeful activity as the programme is being implemented. Without any means of checking whether any of its broader goals are being reached, the fact that a programme is achieving its physical targets provides little information of value.

As is the case in other surveys, the collection of irrelevant data must be avoided when monitoring the impact of programmes. The temptation in drawing up questionnaires is to include questions in case the information they provide may turn out to be useful, rather than from any clear idea of how the information can actually be used in the management of the project. Such an approach can make a survey completely useless. The following comments illustrate the point:

"More recently, some monitoring and evaluation systems have consumed large amounts of scarce results with few tangible results. Several World Bank rural development projects are cases in point. Large budgets for monitoring and ongoing evaluation allowed the collection of huge amounts of data. Since project management was not actively involved in the design of the system, much of this information was irrelevant to the needs of decision makers. The processed data were not available on time, and much of the data never underwent processing due to delays in computer work and shortages of skilled staff" (Hyman, 1983b).

The final step, and the ultimate purpose of monitoring and evaluation is to provide effective feedback into the management of the programme. This can take the form of an adjustment of the programme objectives, altering the methods of implementation, or changing the methods of monitoring. Circumstances will dictate which should be done in each particular case, but all programmes must be capable of being changed in quite fundamental respects during the period of their implementation.

12.6 Preparation of Project Proposals

When external funding is being sought a programme, a project proposal must usually be submitted to the agency concerned. This is a key document which, in principle, defines the objectives, scope, cost, and implementation procedures of the project once it has been agreed. In practice, the preparation of project proposals can give rise to a number of problems.

A particular danger is the self-reinforcing cycle of false expectations and unrealisable goals in which some funding agencies and their clients can become trapped. Political pressures, or international fashion, can bring certain deveopment issues to the forefront, whether deservedly or not. These then become incorporated into the budgetary arrangements, lending criteria, and objectives of funding agencies. Funds, for example, may be made available for tree growing provided it is for fuelwood, thus fitting into a renewable energy category, but not if it is for building poles or other products.

In many developing countries, the need for foreign exchange is often such a dominant concern that attempts will be made to obtain funding for projects whether they are practical or not. Objectives are therefore set, and proposals are prepared, irrespective of local realities, in a way which it is hoped will make them as attractive as possible to funding agencies. The fact that the locally prepared project proposals incorporate such targets can then reinforce external preconceptions about their feasibility.

The pressure to promise results too quickly is another to which those engaged in project preparation frequently succumb. This is because funding agencies have an understandable preference for projects which yield visible results at an early stage. But programmes that are hurried can run into major difficulties at a later stage if the basic research on which they are based has been skimped or omitted.

It is always important to ensure that sufficient time is allocated in the project for preparatory work and the creation of adequate infrastructural and back-up facilities. Proposals must aways include a realistic programme covering any trials and testing which may be required. The soundness of the technical package on which programmes are based should not be put in jeopardy because of a desire on the part of donor agencies or local political authorities to see rapid results in the field.

The fact that project preparation can be a long and involved process needs to be taken into account by funding agencies. Local resources of professional and technical expertise are often in scarce supply. The protracted delays which frequently occur and the additional work required during the appraisal and revision of project proposals can be a heavy drain on those looking for funding assistance. To help minimise these problems, the agencies concerned should do all they can to provide clear guidelines describing their requirements for project proposals, and wherever possible to lessen the burden that proposal preparation places on local professional and administrative staff.

PART V

COUNTRY EXPERIENCE

13.0 Review of Selected Country Programmes

The following sections present a brief review of some of the main farm and community forestry programmes on a country by country basis. No attempt is made to be fully comprehensive in the descriptions given. The intention is to provide a broad picture of the type and level of activity, and to supply some further background information on the programmes from which many of the illustrative examples used in the previous chapters have been drawn.

13.1 Peoples' Republic of China

In 1949, the Peoples' Republic of China was established after many decades in which the country had been subjected to the ravages of war. Investment in land development and forestry projects had been negligible and many areas were suffering from deforestation and land degradation. A massive nationwide effort was therefore launched by the new govenment, under Chairman Mao, to engage in tree-growing and land improvement schemes.

The programme was heavily political in character:

> "Chairman Mao's thoughts on forestry and its interdependence with agriculture and animal husbandry, enunciated by him in 1958, have been disseminated to the masses through a system of mass communication, using particularly radio and public address systems which are much in evidence in practically all the production brigades visited. Loud speakers are noticeable not only in commune and production brigade areas, but also in the fields and factories" (FAO, 1978).

Forestry was viewed as an intergral part of the totality of rural development. It was placed in a planning context which included mountains, rivers, croplands, and roads. In the publicity for tree growing and in the guidelines and training manuals issued by the government, the benefits to agriculture from shelterbelts, windbreaks, and slope protection were emphasized; the role of trees in providing fodder for animals which in turn produced organic manure for fields was pointed out. In general, every possible effort was made to ensure that forestry and tree-planting were not seen in isolation, but as complementary to agriculture and interdependent with it.

In planning projects, what was called a 'three-in-one approach' was used. According to this, technical factors were to be given their proper consideration, but the decisions ultimately taken were to be based upon national targets, and the people's needs. A variety of national, regional, and local planning groups were established to draw up and implement programmes throughout the country (FAO, 1978).

Farm and community forestry in China has been carried out, in the main, by the country's collective working units - people's communes, production brigades, and production teams - on their own land. In these organisations, work is usually obligatory, and is paid for in work points, which in turn determine each individual's remuneration, in cash and kind, from the communal resources. People have also been encouraged to plant trees around their own houses, and on their private plots of land.

The tree-growing achievements reported from China over the past twenty five years have been extremely impressive. The total area of forest planting was reported to have reached 28 million hectares by 1976. In addition 5 billion trees had been planted under the "four sides" slogan, that is to say, along roads, along rivers and canals, around houses, and around villages. Eye-witness accounts by expert observers have confirmed the level and quality of the Chinese achievements in the areas visited (FAO, 1978; FAO, 1979).

Much, however, remains to be learnt of the details of programmes, particularly about the precise methods of motivation used to encourage tree growing. In most of the official accounts, the role of individual incentives is implicitly taken to be minimal with the whole impetus for programmes being provided by communal incentives and disciplines, and by patriotic exhortations at a national level.

Some support for the view that arrangements of this kind are unlikely to be sufficient to motivate people to grow trees successfully is given by one recent commentary based upon Chinese internal publications. Very low survival rates, sometimes as little as 10%, are reported in some areas, and a local saying is quoted: "trees everywhere in spring; just half by summer; no care taken in the fall; all gone by winter" (Smil, 1982).

An explanation and analysis of the methods used may ultimately be found twhen the full story of the years 1966-77 is finally revealed. From 1966 onwards, the country was subjected to the various administrative and other excesses of the Cultural Revolution. Many accounts of what took place during that period are now being reviewed, and re-evaluated. Reports of some of the achievements of the period are now acknowledged to have been distorted. Significant alterations are reportedly being made in many of the administrative structures of the country, and the question of incentives at a local level is also said to be under discussion.

The Chinese experience nonetheless remains an impressive example of what it is possible to achieve at a practical and a technical level. As a model for planning, and for the organisation and motivation of people at a local level, it seems of much less relevance to other countries. As more information becomes available, and the country adapts to the new political and administrative programmes being developed by its current government, this, however, may begin to change.

13.2 Republic of Korea

The Republic of Korea has a population of 38 million people. The density is 387 people per square kilometre, which makes it one of the most densely populated countries in the world. The agricultural sector consists almost entirely of small owner-operated family farms. About 80% of the farms are less than 1.5 hectares, and the average cultivated area per family is 1 hectare. Comprehensive land-reform legislation was passed in 1949, and by the mid 1960s some 70% of farmers owned their lands and a further 23% were part owners (Kim, 1982).

A high proportion of the country consists of forest lands. Together, these amount to 6.6 million hectares, or 67% of the total land area. Almost three quarters of the forest land is in private ownership, but usually in small plots. About 96% of the holdings are 10 hectares or less, with an average of 2.6 hectares. Holdings of 10 - 100 hectares account for 33% of the total area, but only 4.2% of the number of owners (FAO, 1962).

In 1955, fuelwood supplied 78% of the country's energy. The total quantity used was 12.2 million tonnes. By 1965, gradual substitution by commercial fuels had reduced wood consumption to 9.7 million tonnes, or 42% of the total. Nonetheless, deforestation of mountain slopes was causing major flooding and erosion problems and this was seen as a major national issue by the government. Reforestation efforts were initiated and laws were passed to preserve the remaining forests. Mutual financing associations for reforesting mountains were set up, as were forestry cooperatives covering the whole country. Some 18 000 village forestry associations were in existence during the 1960s.

Between 1960 and 1970 some 690 000 hectares of fuelwood forest were established. Rather more than half was newly planted, and the remainder was classified as natural forest. In addition, major progress was made in the rehabilitation of forest lands. The amount of forest classed as denuded in 1961 was 2.5 million hectares or 37% of the total; by 1969 this had fallen to 835 000 hectares or 12.6%. Fuelwood consumption had also fallen to 9 million tonnes, so that it contributed only 28% to national energy consumption. Although the figures for afforestation were impressive, they were also in some respects misleading as much of the forested area was in need of further care and improvement (Gregerson, 1982).

The New Community Movement, or Saemaul Undong, was launched in 1970. Its aims were to improve and modernize rural existence. The movement had a spiritual as well as material connotations, and one of its purposes was to modify some of the old Confucian traditions on which village life had been based. It was felt that in some aspects these led to passivity and reluctance to engage in innovation. At a practical level, reforestation was one of the tasks on which attention was concentrated.

The first ten-year National Forest Plan was launched in 1973. This set itself a number of ambitious targets. They included planting about 1 million hectares of trees. Of these, 300 000 hectares were to be fruit and nut species, 205 000 hectares were to be firewood stands, 300 000 hectares were to be other fast growing species, and the remainder long rotation species.

In the fuelwood plantations, the emphasis was placed on growing species which were primarily suited for fuel. Because of uncertainties about future fuel demands, however, the precaution was taken to plant about one third in species which could also be used for timber if fuelwood demands continue to fall. In addition to the tree-planting targets, the Plan envisaged that some 3.8 million hectares of forest lands would be brought into management by weeding, cleaning, pruning, or fertilizing. Finance for the Plan was shared by villages and the central and regional governments. About 65% of the costs were borne by the government; the contributions by villages were provided mainly in kind.

The focal point for implementation of the Plan at a local level in most cases was the Village Forestry Association. These are officially registered bodies, which are elected at village meetings. Their executive functions include forest protection, reforestation, and forest management. They carry out projects under the direction of the government or other official agencies. Forest projects are implemented either with the voluntary collaboration of forest land-owners, or cooperation is enforced by government order. In most cases the Village Forestry Association undertakes the complete management of the project, though in some cases it may be responsible for only certain elements such as the planting.

Profit sharing arrangements are laid down by the government and are formally established by a contract signed by the various parties concerned. These contracts have a duration of up to 20 years for fast growing trees, and 25-30 years for long rotation timber species. The method of sharing in the case of fuelwood plantations, for example, allocates 10% to the owner, 40% to the planter, 30% to the manager, and 20% to the harvester. Selection of the best sites for plantations is done at a village level, and if the forest land is privately owned, powers exist to compel the owner to enter into a production agreement.

The fuelwood planting targets of the Plan were reached in 1977, five years ahead of target. The shortfall in the target for fruit-trees, however, was some 50%; but this was more than compensated for by the additional planting of long-rotation timber species. The targets for forest management were also met. The costs for the implementation of the Plan, however, were approximately double those initially envisaged.

The Korean reforestation experience has thus been extremely impressive. But the picture of how this has been achieved is a far from simple one.

One, perhaps decisively important factor was the comprehensive land-reform legislation enacted in 1949; t created the framework of land-ownership and local responsibility with which the reforestation measures of the 1970s could be implemented.

The level of government involvement was also extremely high, particularly in the early stages. Legislation, encouragement, direction, and finance were all provided by the government. But this emphasis on central direction of Village Forestry Associations was not carried out in isolation from the wishes of the public. Community approval of the actions taken at a local level was an important element.

As one analysis of the Korean experience points out:

> "One thing we can fairly safely assume is that the results achieved would not have been achieved if it were merely a matter of the national government 'requiring' villages to plant and tend trees. It is not conceivable that the immense improvements in forestry in thousands of small villages could have taken place without some local enthusiasm, interest, and voluntary participation" (Gregerson, 1982b).

Another reason for success was the long period of previous activity in forestry in which the foundations for the initiatives of the 1970s were laid. The 1972 Plan was a continuation and acceleration of what had been happening before, rather than an entirely new initiative.

Another noteworthy aspect of the Korean approach is that replanting was not the sole approach taken to dealing with the fuelwood problem. Legislative measures were also taken to prohibit the sale of fuelwood, particularly in cities. The price of coal was subsidised to keep it accessible to low income groups, and it is the main residential fuel used in the cities. Another factor which has reduced fuelwood demand is the significant fall in the rural population; rural depopulation between 1967 and 1979 was 32%. Korean fuelwood consumption has, in fact, fallen to about half its level in 1965, and a third that of a decade earlier.

13.3 India

Efforts to promote community tree planting in India can be traced back to 1950, when the government instituted an annual 'Festival of Tree Planting' as a way of helping to raise public consciousness about trees. This was reinforced in 1952 when the National Forestry Policy included tree planting outside forest reserves as one of its objectives.

Over the next few years, the concrete achievements from these initiatives were only minor. The tree-planting festival continued to be observed, but

mostly as a government ritual rather than an effective tree planting programme and the number of seedlings distributed remained at a low level. (Dalvi, 1982). Since then, however, numerous other initiatives have been taken in India, and it is at present one the leading countries in the promotion of farm and community forestry in a variety of forms.

The total planting achievements under the various farm and community projects in India amounted to 1.2 million hectares up to 1978/79. By the end of the 1983/84 season it is expected that this figure will have nearly doubled; and that a total of more than 2 billion seedlings will have been distributed under the various farm forestry programmes running in different states (Guhathakurta, 1984).

13.31 Tamil Nadu

Tamil Nadu, in the southeast of India, was one of the first states to make any systematic attempts to extend forestry beyond the bounds of official forest areas. Its Forest Department began this in 1956, planting trees along river and canal banks as a way of helping to prevent erosion. The full costs of the programme were borne by the Forest Department. No specific utilisation of the trees by the community was envisaged, but some local employment was created.

In 1960, a programme of planting on village wastelands was started, aimed at "systematically establishing a tree crop on every patch of barren land, a grove of trees on every village common land, a row of trees on every field edge, and an avenue to mark every path way" (Tamil Nadu Forest Department, 1983). In this case, employment generation was the main objective and labour was hired locally for the planting and upkeep of trees. The intention was that the plantations would produce firewood and building materials for sale, with the proceeds going to the Forest Department as a means of offsetting the costs.

The main areas tackled under the scheme were 'tank' foreshores. Tanks are rainwater collection reservoirs, many of which were built during the late Chola period, around the 11th century, using prisoners of war (Wilson, 1983). Altogether, there are more than 38 000 tanks throughout the state, covering a total area of 500 000 hectares. They are usually relatively shallow, with gently sloping beds; they vary in size from small ponds to lakes of 1000 hectares or more. Because of this system of reservoirs, Tamil Nadu is able to carry out irrigated agriculture over substantial areas despite its dry climate.

The tanks become filled with water during the rainy season, so that the whole area of the bed is submerged. As water is let out during the dry season to irrigate the surrounding farmland, the level in the tank drops and an increasingly large area of foreshore is exposed. In many villages,

these areas of temporarily exposed ground are the only sustantial areas of common land on which tree planting might be considered, though they are already used for a certain amount of grazing, and in some cases vegetable growing.

The main species being used for planting on tank foreshores is Acacia nilotica. This yields fuelwood, small timber, and animal fodder. It is also has the essential characteristic of being capable of surviving prolonged submersion. In the first decade of the scheme, the response from the villages was extremely slow. But in 1973, the State Government introduced a measure which gave the panchayats half the profits from the sale of the trees and the number of villages participating increased. By 1976 a total of 55 000 hectares of village plantations had been created (Shanmuga, 1978).

All the farm and community forestry programmes in the state were combined into a new Social Forestry Project in 1981, which is being carried out with support from the Swedish International Development Authority (SIDA). It includes a farm forestry scheme, tree growing for family uses, tree growing on communal lands, the creation of strip plantations along roads, railwys, and canal banks, and the establishment of fodder plantations.

The farm forestry scheme consists of two components: an incentive scheme aimed at poor farmers, and an extension scheme for larger farms in which seedlings are issued at cost price. People only qualify for the incentive scheme if they have identification cards issued by the Tamil Nadu Integrated Rural Development Programme certifying them to be poor or underprivileged. This entitles them to up to 500 free seedlings, as well as a small cash bonus paid on a sliding scale based on the number of trees surviving at the end of the first and second years. Farmers who plant the full quota of 500 seedlings and achieve a 100% survival rate receive a total of Rs 155 ($15.5) over the two years (Tamil Nadu Forest Department, 1983).

Up to the end of 1983, a total of approximately 10 million seedlings had been distributed under these two schemes. Some reservations have however been expressed about the practicability of the incentive scheme because of the administrative problems of checking survival rates and making small payments to a large number of farmers dispersed over a wide area.

Fodder plantations are being established in areas in which there is a demand for fodder for stall-feeding livestock. Trees producing leaf fodder are being planted at wide spacings with grasses and legumes between them. The revenue is being shared equally between the Forest Department and the panchayats. Some 660 hectares had been established by the end of the 1983 planting season.

Most of the planting and management work has been done by the Forest Department. But considerable efforts have been made to obtain the collaboration of villagers in all schemes. A key element in obtaining this has been to make certain that arrangements are made to prevent people suffering hardship from the loss of grazing during the period when plantations are being established. The measures taken include allowing access for hand cutting, and special planting of improved varieties of grass and legumes.

The ultimate aim in most of the community programmes is to transfer responsibility for management and renewal of the plantations to the village panchayats. But in many cases, the villages are not keen to take on the responsibility and work involved and prefer to leave the arrangement as it is at present.

13.32 Gujarat

Gujarat was the first Indian state to set up a separate Community Forestry Wing in its Forest Department. This was done in 1970, and since then the state has played a leading role in developing a series of different approaches to farm and community forestry.

Early efforts concentrated on growing trees by the sides of roads and railways, and along canal banks. These were established by the Forest Department using local labour. In this work, the Forest Department was continuing a tradition of planting shade trees beside roads which stretches back to the great Indian road builder, Sher Shah, in the early fifteenth century, and even further to Emperor Ashoka in the 3rd century B.C.

The scheme involved planting rows of faster growing species for firewood and timber behind the shade trees. Seedlings were protected using thorny branches and by growing euphorbia hedges around the plantation boundary. A watchman for the plantationns was also hired. These precautions were insufficient to thwart any determined efforts to disrupt the plantation and local cooperation was still essential. This was achieved by leaving local people with access to the planted lands but in a controlled fashion. Thus, though they were not permitted to graze their animals freely, they were still allowed to cut grass by hand. Cooperation was also encouraged by the Forest Department grafting improved varieties of the fruit Zizyphus on to naturally occurring plants of that species.

Under the original scheme, the roadside trees were to be cut and sold on a 7-10 year cycle with all the proceeds going to the Forest Department. This was changed in 1980 to a 50:50 arrangement with the local panchayats. By the end of 1982, the equivalent of 29 500 hectares of strip plantation had been established.

The 'Supervised Woodlots' scheme was introduced in 1974. Under this, the Forest Department made arrangements with panchayats for planting 4 hectare lots of fuelwood, fodder, and fruit trees on village communal lands. In return, the villagers were allowed access for fruit and fodder collection, and were promised a 50% share of the profits when the trees were harvested.

By 1982, woodlots had been established in 4000 of the State's 20 000 villages. The total area covered was 28 000 hectares. The success rate of the plantations has, however, been variable. In areas where there is heavy grazing pressure, the survival of seedlings has been as low as 20%; elsewhere, the rates have been much better, and villagers have asked for additional areas of planting to be provided.

As a means of engaging local communities more deeply in tree planting, a 'Village Self-Help Scheme' was begun in 1980. The intention was that the Forest Department would provide free seedlings, advice, and technical assistance, with villagers carrying out the planting work. The full proceeds of the final sale of the trees would go to the villages. Although some villages were enthusiastic, and welcomed the opportunity to increase their incomes, the general response to the programme has been poor. It is unlikely the programme targets will be reached and consideration is being given to concentrating efforts on the Supervised Woodlots scheme instead.

By far the most successful scheme at present, in terms of the the numbers of trees being planted, is the 'Farm Forestry' programme. This was begun in 1972 and is based on the distribution of seedlings to farmers free, or at cost price, for planting on their own land. The original intention was that farmers would use these for planting on unused or marginal land.

In the beginning, the Forest Department concentrated on the persuading larger and more progressive farmers to join the scheme. These efforts were successful and the number of such farmers who adopted the scheme had an important demonstration effect on others in the area.

Some of the larger farmers, however, began to find that it was more profitable to grow trees in their crop fields rather than on marginal lands. Tree growing was less labour intensive, and labour demands were more evenly spread over the year. This meant that trees could be harvested during the dry season when the demand for labour was slack. As well as cutting costs, this reduced the problems of managing farms.

The main species grown is eucalyptus. The annual uptake of tree seedlings has increased from 6.1 million in 1971 to 95 million in 1982, and preliminary estimates for 1983 put the figure at around 200 million. Distribution has been greatly aided by the development of the 'basket system' in which seedlings are raised 1000 at a time in baskets. This reduces nursery costs and eases transportation problems.

From nursery records, it is estimated that of the 95 million seedings distributed during 1982, some 19% went to farmers owning more than 4 hectares, while 44% went to farmers with between 2 and 4 hectares. Both groups took, on average, 4600 seedlings each. Farmers owning less than 2 hectares received 37% of the total number of seedlings distributed, taking an average of 650 each. While there are no data currently available on the breakdown within this category, the figures clearly demonstrate that farm forestry is no by no means restricted only to the richer farmers.

A number of other schemes are also under way in Gujarat. One provides aid for some of the poorest farmers in planting degraded lands on their omn farms. The Forest Department provides free seedlings, help in planting, and an allowance of Rs 250 per hectare for 10 years. The farmer takes the full proceeds from the plantation when it is harvested. As of July 1982, some 566 hectares had been planted under this scheme.

Another scheme is directed towards helping tribal people to take up settled farming instead of shifting agriculture. Families are given plots of land and are paid for their work in establishing plantations on it. The families are paid a wage and allowed access to the plantation for fodder and fuel; in addition they are entitled to 20% of the proceeds when the plantation is harvested. By 1982, around 18 000 hectares of degraded plantations had been planted under this scheme.

13.33 West Bengal

A World Bank funded farm and community forestry programme has been under way in West Bengal since 1981. The per capita forest area in the state is only 0.02 hectares, and is one of the lowest in the country. The average population density, at 610 people per square kilometre, is the second highest.

As in other states, a variety of approaches are being tried. Plans for the period up to 1987 include 20 000 hectares of strip plantations, 6000 hectares of village woodlots, and the rehabilitation of 15 000 hectares of degraded forest. Farm forestry is also being promoted. Under this scheme, special attention is being given to encouraging tree growing on state-owned wastelands by allocating small plots to landless farmers.

Activities are currently concentrated in the south west corner of the state, where there are large tracts of degraded land which was previously under forest cover. Here, the soils are very poor and often laterised, with a hard concretised layer 30 cm or so below the surface. The area is drought prone, and economically viable farming without irrigation is extremely difficult.

In the district of East Midnapore, the state government is distributing 0.4 hectare parcels of this waste land to landless people, with a view to it being used for tree growing; although those who wish may use it for crops. The main species being planted is Eucalyptus tereticornis, with some Acacia auriculiformis. Both have been well proven in the area through extensive use and trials by the Forest Department over the past 20 years.

Farmers prepare the pits in which the trees are planted during the dry season so as not to interfere with their main occupation as agricultural labourers. The Forest Department supplies seedlings and a small amount of free fertiliser. In addition, a cash incentive of up to Rs 220 ($22), based on surviving plants is paid at the end of the second and third years.

The return from a successful eucalyptus plantation of this kind is estimated to be as much as Rs 12 000, which makes it an extremely attractive financial proposition, considering the farmer has to make no financial investment himself. In the light of such potential returns, land owners and panchayats are also beginning to turn over their own waste lands to tree growing.

13.34 Uttar Pradesh

A programme which began in Uttar Pradesh in 1979 was designed to provide 45 000 hectares of village forests on road and rail verges, common lands, and degraded forest reserves on which villages had presviously held collection rights. The main burden of carrying out the project was to be borne by the Forest Department. The programme was intended to have a demonstration effect in a state noted for poverty and loss of forest cover.

Farm forestry is also being promoted through the provision to farmers of cost-price seedlings. As in Gujurat, this scheme has met with considerable success, especially in the western region of the state where the average farm size is larger. Seedling production has had to be greatly increased to cope with the demand; the total distributed to farmers by the end of 1982-83 amounted to 156 million, nearly 30 times the original project target.

Other elements of the programme have also exceeded their planned targets. Roadside planting was 266% above that planned by the end of the 1982/83 season. Planting on degraded forest land and village common lands were also substantially over target.

Progress in village self-help woodlots has, however, been negligible, reaching only 133 hectares out of the planned 1600 hectares. Villages which have been prepared to allow the Forest Department to plant woodlots for them, have not been so willing to undertake the work themselves. As a result, substantial doubts are beginning to emerge about whether self-help

community woodlots are worth the effort being put into their promotion.

13.35 Other States in India

Farm and community forestry programmes are also being carried out in a number of other Indian states. Many of the approaches being used are based on the models developed in Gujurat and Tamil Nadu. As most are still in their early stages, however, conclusive results have yet to emerge.

Financial support for farm and community forestry from the Government of India has been increased substantially in recent years. Funding of Rs 3518 million (approximately $240 million) has been allocated for the period of the Sixth National Plan, 1980-85, and a planting target of 1.5 million hectares has been set.

Foreign assistance for farm and community forestry projects has also grown rapidly in the last few years. World Bank loans to projects in Gujurat, Uttar Pradesh, West Bengal, Jammu and Kashmir, and Haryana now total $122 million. The US Agency for International Development (USAID) is funding community forestry programmes in Madhya Pradesh and Maharashtra. The Swedish International Development Authority (SIDA) is supporting programmes in Tamil Nadu and Orissa, and is reaching the final stages of appraisal for a project in Bihar. In Karnataka, a programme is being jointly funded by the UK Overseas Development Administration and the World Bank. A project in Andhra Pradesh has been funded by the Canadian International Development Agency (CIDA), and a pilot project funded by Federal Republic of Germany is under way in Himachal Pradesh.

Most recently, a National Umbrella Project with a budget of some $800 million to cover the whole country has been proposed for the next Five Year Plan (1985-90). This will be funded jointly by the World Bank and the Government of India.

13.4 Malawi

About 50% of Malawi's land area is covered by forest lands of one type or another. Most of these forests consist of open 'miombo' woodland. The population of the country is 5.9 million with an average growth rate of 3%. Over 90% of the people live in the rural areas, and the average population density is about 60 people per square kilometer.

Firewood is almost universally used in the rural areas., and the cities rely mainly on wood and charcoal. Calculations reveal that wood, both for fuel and poles, is being used more quickly than it is being renewed. Projecting present trends suggests that the demand for wood will double in the next twenty five years, while existing wood supplies will become almost

exhausted.

The Wood Energy Programme which is funded by the World Bank was designed in the light of these projections and formally began in June 1980. Its objective was to promote nationwide planting for fuelwood and poles by smallholders. The basis of the programme was the establishment of 88 seedling nurseries to provide about 100 000 seedlings each for sale to local farmers.

The aim was that farmers would become individually self-sufficient in fuelwood and building poles. Based on current consumption levels, this would require a plantation of about 1000 trees for each family. The main species expected to be used was eucalyptus. In addition, the programme included plans for the creation of twelve fuelwood plantations for supplying urban needs ranging in size from 300-1500 hectares.

The programme has fallen far short of its targets. In the first year, the take-up of seedlings from nurseries was 1% of that projected; in subsequent years it has been about 10%. Farmers have shown themselves unwilling to engage in planting up to the numbers of trees apparently required to make them self-sufficient at their present levels of consumption.

Subsequent surveys have revealed that in the rural areas about two thirds of families already engage in tree planting in order to meet their own needs for building poles. This, of course, requires many fewer trees than would be needed to satisfy a family's full fuelwood demand. The fact that firewood is relatively easy to obtain, though it is widely acknowledged to be getting scarcer, seems to be the reason why only about 15% of farmers plant trees for fuel. Because fuel can still be collected without payment from surrounding areas means that there is relatively little market incentive to plant trees, and the survey found that the proportion of people planting for sale is just 7% (Energy Studies Unit, 1981b).

In the light of progress to date and these findings, the programme is being reconsidered in a number of ways. Although traditional patterns of fuel use are bound to come under pressure as resources are depleted, the incentives for large-scale tree growing by rural people still seem to be lacking. Progress in small holder tree growing is thus likely to considerably less than originally projected for at least the next few years.

13.5 The Sahel

The Sahel has been a focus of worldwide concern since the tragic droughts of the early 1970s. A wide variety of efforts have been made to promote tree growing through farm and community forestry programmes of different kinds. It is estimated that a total of some $160 million was spent in the period 1975-82 (Weber, 1982).

The wide range of initiatives directed towards the Sahelian countries has been described as follows:

> "It would not be far from the truth to state that virtually every conceivable strategy has been proposed by someone at one time or another over the past decade - each strategy with its proponents, many of them with funding for at least a pilot effort. Fortunately, some of the more questionable and costly of these schemes have been avoided, the trans-Sahel Greenbelt, for example, an idea that made neither technical, economic, nor social sense, however compelling the visual image of a line of trees stopping the 'advancing desert'. Many of the other ideas have been tried, with results ranging from excellent, through, questionable, to downright counter-productive" (Taylor and Soumare, 1983).

Probably the most successful project of all has been the Majjia Valley project in Niger. This began in 1975 and has since continued with a high degree of support from local farmers. Since then, some 350 kilometres of windbreaks have been planted. A project in Senegal to encourage the planting of Acacia albida in crop fields has also been successful. There have also been examples where projects to promote live fencing, dune stabilisation, and the planting of gum arabic and fruit trees have proved locally popular.

Among the large number of programmes to promote village woodlots, however, the instances of successes have been comparatively rare. It is estimated that despite the many efforts made, the total area of woodlots is no more than about 25 000 hectares, and that perhaps a third of that is producing very little wood.

Problems have been encountered in persuading villages to provide land suitable for planting. There have been difficulties in devising methods of sharing the work and benefits of communal woodlots in a way which is convincing and acceptable to local people. Moreover, the costs of providing the necessary technical assistance and supervision of a large number of small woodlots have been extremely high. A measure of the problems being faced is that it has been estimated that two out of three trees die or become severely stunted in the first five years after planting.

A reappraisal of many Sahelian programmes is currently under way. It is becoming evident that the way forward must be based on reduced expectations, an awareness and acceptance of what people want, and of the contribution they are prepared to make to projects. A considerable amount has also been learned from the programmes already carried out, whether they have succeeded or failed. The outline of such a programme has been suggested by one experienced Sahelian commentator:

"Details on what could and should be done can easily be developed by following what has been accomplished already... the accent will have to be placed on the existing weakest links which almost without exception deal with issues such as land-use and tree property rights, management autonomy of local natural resources, a more management and service-oriented outlook by administrative and technical government agencies, and social and economic 'feasibilities' as seen by local people" (Weber, 1983).

13.6 Tanzania

Tanzania has a population of about 18 million people, about 90% of whom live in the rural areas. The population density is about 18 persons per square kilometre. Just over 40% of the country's land area is forest, mainly of the open savanna, or 'miombo' type. Wood is universally used as fuel in the rural areas, and charcoal is popular in the larger towns. Virtually all the wood used by rural families is obtained free of charge (Anon, 1982).

Tanzania's natural woodland has a low rate of growth, with an estimated yield of 1-2 cubic metres per hectare per year. The total national sustainable cut has been calculated to be about 19 million cubic metres per year. Wood consumption is relatively high, with an average of around 2 cubic metres per head per year being commonly assumed. Such calculations lead to the conclusion that serious over-cutting of forests is taking place (Araya, 1981).

Efforts have been under way since 1968 to promote village woodlots wth a view to making villages, of which there are about 8200 in the country, self-sufficient in fuel and poles. In some cases, planting is the direct responsibility of the Forest Department, in others it is carried out by villages; it is also done by schools and individuals (Araya, 1981).

The available statistics do not always provide a breakdown between the different types of planting carried out, hence some ambiguities still exist on the exact magnitude of the country's achievements. A total of some 50 000 hectares of village planting of all types is reported for the period 1975-81, with planting increasing from an annual figure of just over 3000 hectares in 1975 up to 12 000 hectares in 1981 (Anon, 1982). These figures, however, are based on the numbers of seedlings distributed rather than actual areas planted. The assumed density of planting is taken to be 2000 seedlings per hectare.

In the period up to 1979, about 37% of this planting was by the Forest Department, 37% by villages, 16% by primary schools, and the remainder by individuals (Araya, 1981). The figures given for village plantations by another author are, however, about 30% higher for the period 1975-79

(Kilimaha, 1980).

The results of the programme have been mixed:

> "Available statistics on areas planted with trees, and visual observation reveal substantial achievements in village afforestation. Scattered trees of all age classes, mainly exotic species, can be seen in many villages, in avenues, in urban centres, around schools, rural institutions, and mission centres. However, as low as 40% field survival has been reported and observed in village woodlots" (Anon, 1982).

Accounts of the Tanzanian experience vary, but in most cases the the broad outlines correspond. In general, the conclusion is that although villagers have been prepared to plant and look after a certain number of trees in their own lands, the rate of implementation of village woodlots has been extremely low, and the survival rate of seedlings has been poor. The range in survival rates suggested by one commentator is: village woodlots 0-40%; individually planted trees 40-70%; and school plantations 75-100% (Brokensha, 1982).

At a detailed implementation level, there have been numerous problems. Distrust of local community leaders by villagers has been a major blockage in the implementation of village woodlots. Administrative weaknesses in the forest service at a local level, non-delivery of seedlings and other inputs, innappropriate location of plantations, and other causes have been cited for local failure to implement programmes (Kaale, 1982; Skutch, 1983).

There are, however, indications that more recent efforts to promote tree growing are achieving greater results. A national tree planting campaign was launched in 1980, under the slogan "Forests are Wealth". This was supported by a national publicity campaign using radio, mobile cinemas, and other techniques. The campaign was selectively directed at about half the country's villages. The total number of seedlings distributed was over 11 million and considerable interest was generated among the villagers concerned (Mnzava, 1882).

13.7 The Philippines

In the Philippines, local participation in commercial tree growing was first organised on a large scale by the Paper Industries Corporation of the Philippines (PICOP) in the early 1970s. Under the scheme, which is designed to provide pulpwood for use in the Bislig Bay pulp mill on Mindanao, the Corporation provides seedlings of Albizia falcataria at cost price, together with technical assistance. Loans are given to farmers, through a special arrangement with the Development Bank of the Philippines, and there

is a guaranteed market for the pulpwood produced at an annually reviewed minimum price.

The programme was expanded in 1974 through a World Bank Loan, and again in 1978. By 1982 a total of 12 550 hectares had been planted (Hyman, 1983a). Though aimed at slash and burn cultivators, most of the planting has been carried out by smallholders with above-average incomes. The land being used is also of rather better quality than was originally intended, and many farmers have adopted a different management regime from that which was recommended. Instead of staggering planting over several years, and setting aside 20% of their land for food crops and livestock, most chose to plant all their land in the first year. In addition, the majority of farmers have not followed the suggested fertilizing and weeding procedures.

Despite this, wood yields of 190-250 cubic metres per hectare have been obtained from eight year old plantations, on harvesting, and a 1982 survey reported that 71% of farmers rate the growth of their trees as 'good' or 'very good'. Problems emerged for some later in the same year when a typhoon hit the island, damaging many trees. As a result, there are concerns that some farmers will find it difficult to repay their loans (Hyman, 1983a).

There has also been some disagreement about the price being offered for the wood, which farmers feel is too low to cover the unexpectedly high costs of harvesting. Farmers are arguing for an increase in the wood price to a millgate price of at least $12 per solid cubic metre, as they claim that after deducting 50% from the millgate price for harvesting, the net returns are lower than for alternative cash crops such as rubber or coffee.

Using the PICOP pulp project as a model, several other tree planting schemes have been initiated in recent years. Success has varied, however. A loan scheme to encourage tree planting for fuelwood in the Ilocos region of Luzon Island has had a very poor response. The intention was to stimulate smallholders to grow Leucaena leucocephala to supply fuelwood to the large tobacco curing industry in the region. In the first three years, only 37 applicants signed up for the scheme, and the planting rate was only 6% of the target. Of the people who have accepted loans, the majority have higher than average incomes and employ hired labourers to carry out most of the work (Hyman, 1982).

The Philippines wood-fired power generation, or 'dendro-thermal' programme is aimed more specifically at marginal farmers, and is based around cooperative rather than individual efforts. The scheme is being promoted by the National Electrification Authority (NEA), through the network of local electric cooperatives that now have responsibility for rural electrification in the country.

Government-owned land is allocated for plantations by the Bureau of Forest Development. Squatter families living in the area are then encouraged to form tree-farming associations. A package of incentives is provided including loans, technical assistance, a guaranteed wood price, and official recognition of land use rights.

All of these incentives are channelled through the farmer associations. These consist of 10-15 families and cover roughly 100 hectares of plantation. Land is pooled, and associations are lent money to cover establishment and maintenance costs. In addition, a loan of $25 per hectare is provided each year until harvest to compensate for the loss of crop production. All work is shared, and loans are repaid over a 6-8 year period once harvesting begins.

If this approach is to be viable on a large scale, it is obviously important that the wood price is set sufficiently high to make tree growing attractive to local people, but not so high that the wood is uneconomic to use. In the Philippines dendrothermal programme, a suitable balance appears to have been achieved. Tree growers are guaranteed a price of $6.50 per tonne, allowing them to earn a steady income of $1200 per year. At this price, it is estimated that electricity can be generated for 4.9 cents per kWh, which is competitive with power from oil fired plants.

A total of 34 projects are now under way as part of the dendrothermal programme. With the help of French and British bilateral aid, 17 wood-fired power plants have already been purchased and 14 of these are currently under construction. Most of the plants being built are designed to generate 3 Megawatts, and require dedicated plantations of roughly 1000 hectares each to supply the necessary wood. To date, a total of 10 000 hectares have been planted in different parts of the country as part of the scheme.

The first power plant was opened in February 1984, and several others are nearing completion. Major problems have been reported with some of the plantations, however, due to very poor tree growth. This has been partly blamed on the heavy reliance on the species Leucaena leucocephala, which has not grown well on acidic sites. Despite recent efforts to diversify the species mix, some of the power plants will have to purchase wood from outside if they are to open on schedule.

In the Philippines, tree growing is also being linked with the use of wood or charcoal for use in producer gas units for powering irrigation pumping engines. The use of these units is financially very attractive for those able to afford the initial outlay. Fuel savings through the use of a producer gas unit can have pay-back periods of less than a year in many cases (Foley and Barnard, 1983). Loans for the installation of units are made to farmer cooperatives provided they undertake to plant and area of 6 hectares for every 50 kW pumping unit installed.

13.8 Nepal

A Community Forestry Development Project is at present under way in Nepal. The organisations involved include the Nepalese Government, the World Bank, FAO, and the United Nations Development Programme (UNDP). It was begun in 1980.

The original aims of the project were to establish 12 000 hectares of panchayat forest, to bring 40 000 hectares of what are called panchayat protected forests under effective management, and to distribute 900 000 seedlings for private planting. The project is also concerned with motivation and education of people so that they will participate in community forestry activities. In addition, there is a target for the development and distribution of 15 000 improved woodstoves.

Th population of Nepal is about 15 million with an annual growth rate of 2.6%. In the cultivated areas of the hills and mountains, the population density is extremely high, reaching a level of 1500 people per square kilometre, against 565 in the plains of the Terai. In many places tree resources are rapidly disappearing as a result of encroachment, planned clearance, and shifting cultivation.

But there are possibilities for constructive action, as has been pointed out in one commentary:

> "With the continuing deterioration of forest wealth, the mountain ecosystem has been badly affected. Numerous publications have drawn the world's attention to the serious erosion problems of the Himalayas affecting the lives of millions of people in the Gangetic plain. However, a recent study has shown that in the larger part of Nepal the environmental degradation has not become irreversible as yet and that the good climatic and soil conditions would favour the stabilization of the soils if the appropriate measures would be taken for the development of stable land use systems" (Manandhar, 1982).

In an attempt to protect them from further depletion, all the forests in Nepal were nationalised in 1956. In addition, according to the Forest Act of 1961, all the land adjoining the forest area and left fallow for two years was defined as forest land.

This legislation, however, is felt by many to have been counterproductive in that led to a breakdown in traditional forest management systems and to their increased exploitation. To provide a basis for the current project, radical new rules had to be introduced in 1978.

Now, any forest land, two thirds of which needs to be replanted, can be officially defined as panchayat forest. Each panchayat is eligible for 125

hectares of such forest for planting. All the income from the sale of forest products goes to the panchayat.

Forest land which needs protection and some enrichment planting can be designated as panchayat protected forest. Each panchayat is entitled to 500 hectares of such forest. The proceeds from the sale of forest products in this case are shared, with 75% going to the panchayat and 25% to the government.

The Community Forestry Development Project has made substantial progress in the first three years of its operation. Virtually the whole of the planned 400 nurseries were operational by mid-1983. Some 3 700 hectares of panchayat forests had also been established, together with 300 hectares of protected panchayat forest. Seedling distribution for private planting was just over 1 million, more than was planned for the whole project, and 2600 improved stoves had been distributed (Bhattarai and Campbell, 1983).

While progress in general is satisfactory, some problems of seedling viability have been found and the survival rates have turned out to be somewhat disappointing. The average is about 65% for all the seedlings planted in 1981 and 1982. A careful analysis of the causes of seedling mortality has been carried out in which 12 specific reasons have been identified.

The principal cause, accounting for 40% of all losses, has been inadequate seedling size or health on planting. Measures to upgrade the performance of the nurseries are therefore being put in hand. Other causes of losses were wrong species choice (13.5%), damage by grazing livestock (10%), weather (8.7%) and lack of weeding (8.2%).

Another smaller community forestry programme is also being carried out in Nepal with the aid of Australian funding. This Nepal-Australia Forestry Project is in the Chataura area. This is a relatively small project of $2.5 million over 5 years for which the memorandum of understanding was signed in 1978. Some 40 nurseries have been established and the planting activities of the programme are similar to those of the above programme. This project is currently under review with a possibility that a further extension of the work and funding may take place (Shepherd and Griffin, 1983).

APPENDIX: List of Projects

This list summarises some of the main farm and community forestry projects being funded by international donor agencies. Since the definitions used by different agencies vary, the boundary between farm and community forestry and other types of forestry activities is not always clear. The criterion used here is that projects should involve local participation in some form or another, or be specifically designed to meet local needs.

Notes

1. The year funded refers to the year the project started, or is expected to start.

2. Funding agencies:

   ADB - Asian Development Bank

   CARE - Cooperative for American Relief Everywhere

   CIDA - Canadian International Development Agency

   FRG - Government of the Federal Republic of Germany

   FRA - Government of France

   IBRD - International Bank for Reconstruction and Development (The World Bank)

   IDA - International Development Association (The concessionary loans branch of the World Bank)

   NETH - Government of the Netherlands

   ODA - United Kingdom Overseas Development Administration

   SIDA - Swedish International Development Authority

   USAID - United States Agency for International Development

3. Foreign funding is listed in million US dollars, and refers to the total funding for projects. Figures should be taken as indicative of the level of funding being provided, rather than accurate values. In some projects, the funding figure includes a variety of non-forestry components, or forestry activities aimed at industrial rather than community objectives.

4. The principal activities and objectives of projects are listed. Many projects have a variety of subsidiary activities and goals in addition.

AFRICA

COUNTRY - PROJECT TITLE	YEAR FUNDED (1)	DONOR AGENCY (2)	AMOUNT OF LOAN/GRANT (3)	PROJECT OBJECTIVES (4)
Regional Programmes				
Sahel - OMVS Integrated Development	1982	USAID	$6.2 M	reforestation seedling supply
Country Programmes				
Benin - Village Woodlots	1983	NETH	$0.77 M	village woodlots nurseries
Burundi - Fuelwood	1978	IDA	$4.3 M	fuelwood
Burundi	1979	FRA	$1.1 M	reforestation communal nurseries
Burundi - Bururi Forest	1981	USAID	$1.14 M	fuelwood, timber
Botswana - Renewable Energy Technology	1980	USAID	$1.7 M	woodlots
Botswana - Rural Sector Grant AE-15	1980	USAID	$0.87 M	nurseries, woodlots rural afforestation
Cameroon - Community Forestation	1982	CARE	$0.72 M	nurseries, woodlots windbreaks, fruit, shade
Cape Verde - Watershed Management	1980	USAID	$0.63 M	nurseries erosion control
Ethiopia - Afforestation and Erosion Control	1974	FRG	$4.7 M	afforestation, erosion control - advisory
Ethiopia - National Forestry Programme	1975	SIDA	$13.0 M	village forestry education, research
Gambia - Forestry Project	1979	USAID	$1.6 M	village woodlots
Guinea - Community Forestry	1980	USAID	$0.46 M	community forestry school tree nurseries
Guinea-Bissau	1977	SIDA	$2.4 M	village forestry forest industries
Kenya - Renewable Energy	1980	USAID	$2.2 M	agroforestry, fuelwood institution building
Kenya - Baringo Fuel and Fodder	1981	NETH	$0.22 M	fuel, fodder
Kenya - Agroforestry Plots	1981	NETH	$0.12 M	agroforestry
Kenya - Agroforestry Development	1982	CARE	$1.11 M	nurseries, agroforestry fuelwood
Kenya - Embu/Meru/Isiolo Forestry Project	1982	ODA	$0.66 M	fuelwood, fodder
Kenya - Fuelwood Development	1983	NETH	$3.0 M	tree planting
Lesotho - Woodlots Project	1973	ODA	$1.48 M	fuelwood

Lesotho - Village Woodlot Development	1983	CIDA	$1.21 M	village woodlots
Malawi - National Rural Development Program, Wood Energy	1980	IDA	$13.8 M	fuelwood, nurseries
Mali - Forestry	1979	IDA	$4.5 M	fuelwood
Mali - OAPF Project	1979	FRA	$0.78 M	reforestation, fuelwood near Bamako
Mali	1980	FRA	$0.38 M	village reforestation forest management
Mali - Village Reforestation	1981	USAID	$0.65 M	village woodlots nurseries
Mali - Village Agroforestry	1983	CARE	$0.76 M	nurseries, windbreaks agroforestry, woodlots
Mali - Segou Reafforestation	1983	NETH	$1.9 M	reforestation, environmental protection
Mali - Agricultural Enterprise Development	1984	USAID	$0.5 M	private tree nurseries
Mauritania - Guidemaka Integrated Rural Development	1979	USAID	$0.18 M	nurseries
Mozambique - MONAP	1978	SIDA	$8.0 M	village forestry forest industries
Niger - Tahoua Reforestation	1974	CARE	$0.96 M	windbreaks, fuelwood dune stabilization
Niger - Forestry	1978	IDA	$4.5 M	fuelwood
Niger	1980	FRA	$0.77 M	agroforestry with Acacia albida
Niger - Niamey Department Development II	1981	USAID	$1.46 M	community forestry nurseries
Niger - Maradi Agroforestry	1982	CARE	$0.88 M	windbreaks, woodlots shade
Niger	1982	FRA	$3.6 M	reforestation, forest management
Niger - Tahua Forestry	1982	NETH	$0.44 M	urban fuelwood plantations
Nigeria - Forestry Plantation	1979	IBRD	$31.0 M	pulpwood, fuelwood
Nigeria - Kano Agricultural Development	1981	IBRD	$2.0 M	watershed, forestry
Rwanda - Integrated Forestry and Livestock Development	1980	IDA	$21.0 M	fuelwood, sawlogs
Senegal	1975	FRG	$6.3 M	afforestation near water holes
Senegal - PARCE Project	1978	FRA	$7.9 M	reforestation, fuelwood forest management
Senegal - Fuelwood Production	1979	USAID	$3.1 M	reforestation
Senegal - Africare Village Woodlot	1980	USAID	$0.21 M	village woodlots nurseries, training

Senegal - Village Woodlots	1982	NETH	$2.7 M	fuelwood, prevention of desertification
Senegal - Sand Dune Fixation	1983	CIDA	$2.0 M	sand dune fixation
Somalia - CDA Forestry Phase I Refugee Areas	1982	USAID	$6.0 M	woodlots, shelterbelts near refugee camps
Somalia - Hiran Refugee Reforestation	1983	CARE	$2.79 M	fuelwood, windbreaks shade
Somalia - Central Grazing Land Development	1983	FRG	$1.2 M	windbreaks
Sudan - Regional Development	1974	FRG	$8.1 M	wood industries
Sudan - Gumbelt Project	1980	NETH	$1.22 M	reafforestation
Sudan - Eastern Reforestation	1982	USAID	$5.29 M	fuelwood, agroforestry near refugee villages
Sudan - Western Sudan Agricultural Research	1982	USAID	$1.3 M	management of acacia gum arabic stands
Sudan - Refugee Reforestation	1983	NETH	$0.53 M	reforestation near refugee camps
Sudan - FAO Reafforestation Project	1983	NETH	$4.33 M	reforestation extension
Sudan - Bor Forestry	1983	NETH	$1.52 M	fuelwood
Sudan - Kassala Reafforestation	1983	NETH	$0.11 M	reforestation for urban fuelwood & poles
Sudan - Refugee Reforestation	1983	CARE	$3.17 M	nurseries, fuelwood agroforestry trials
Tanzania	1975	SIDA	$15.3 M	village forestry industrial plantations
Tanzania - Arusha Regional Planning and Village Development	1976	USAID	$0.16 M	woodlots, nurseries
Uganda - Village Forestry	1984	CARE	$0.78 M	nurseries
Upper Volta	1974	FRG	$4.6 M	afforestation
Upper Volta - Sequenga Integrated Rural Development	1979	USAID	$0.25 M	reforestation nurseries
Upper Volta - Forestry Education and Development	1979	USAID	$6.0 M	reforestation training
Upper Volta - Forestry	1980	IDA	$14.5 M	fuelwood, sawlogs
Upper Volta - Centre Nord and Volta Noire Village Woodlots	1982	NETH	$3.7 M	reafforestation
Upper Volta - Village Reforestation and Fire Protection	1983	CIDA	$8.0 M	village reforestation fire protection
Upper Volta		FRA	$0.34 M	reforestation nurseries
Zimbabwe - Rural Afforestation	1983	IDA	$7.3 M	rural afforestation

ASIA

COUNTRY - PROJECT TITLE	YEAR FUNDED (1)	DONOR AGENCY (2)	AMOUNT OF LOAN/GRANT (3)	PROJECT OBJECTIVES (4)
Bangladesh - Mangrove Afforestation	1980	IDA	$11.0 M	fuelwood, pulpwood sawlogs
Bangladesh - Community Forestry		ADB	$12.8 M	community forestry
Burma - Fuelwood Development		NETH	$4.4 M	fuelwood
India - Uttar Pradesh Social Forestry	1979	IDA	$23.0 M	community forestry
India - Gujurat Community Forestry	1980	IDA	$37.0 M	community forestry
India	1980	FRG	$4.6 M	social forestry
India - Madhya Pradesh Social Forestry	1981	USAID	$25.0 M	community forestry institution building
India - Kandi Watershed and Area Development	1981	IBRD	$5.0 M	watershed protectic
India - Tamil Nadu Social Forestry	1981	SIDA	$25.0 M	community forestry
India - West Bengal Social Forestry	1982	IDA	$21.5 M	community forestry
India - Jammu & Kashmir, and Harayana Social Forestry	1983	IDA	$33.0 M	community forestry
India - Maharashtra Social Forestry	1983	USAID	$25.0 M	community forestry institution building
India - Himalayan Watershed Management (Punjab)	1983	IBRD	$6.0 M	watershed protection
India - Andhra Pradesh Social Forestry	1983	CIDA	$28.2 M	community forestry
India - Hill Areas Land and Wate Development	1984	USAID	$11.0 M	afforestation watershed management
India - Orissa Social Forestry	1984	SIDA	$17.3 M	community forestry
India - Karnataka Social Forestry	1984	ODA	$21.0 M	fuelwood, fodder, pulp
Indonesia - Citanduy II	1980	USAID	$3.3 M	watershed reforestation
Indonesia - Leucaena Farming Systems	1983	CARE	$0.32 M	soil conservation animal fodder, fuelwood
Nepal - Community Forestry and Training	1980	IDA	$17.0 M	community forestry
Nepal - Resource Conservation and Utilization	1980	USAID	$4.5 M	village plantations nurseries, fuelwood watershed protection
Nepal - Rural Area Development	1980	USAID	$3.2 M	institution building watershed improvement community forestry

Nepal - Kosi Hill Area Rural Development	1980	ODA	$0.62	fuelwood, fodder
Nepal - Watershed Rehabilitation	1983	FRG	$1.6 M	watershed research
Nepal - Small Farmers roforestry	1983	CARE	$0.33 M	fuelwood, agroforestry
Pakistan - zara Forestry einvestment	1978	IBRD	$1.7 M	forestry
Pakistan - Forestry Planning and Development	1983	USAID	$25.0 M	institution building fuelwood, nurseries
Philippines - Smallholder Treefarming	1974	IBRD	$2.0 M	pulpwood
Philippines - Smallholder Tree Farming & Forestry II	1978	IBRD	$8.0 M	fuelwood
Philippines - Watershed Management and Erosion Control	1981	IBRD	$38.0 M	watershed management pulpwood, fuelwood
Philippines - Rainfed Resource Development	1982	USAID	$1.4 M	agroforestry
Philippines - BICOL Integrated Area Development	1979	USAID	$0.32 M	agroforestry, woodlots watershed development
Philippines - Nonconventional Energy Development	1978	USAID	$4.5 M	dendrothermal energy plantations
South Korea - Forestry	1975	FRG	$3.9 M	advisory assistance
South Korea	1977	IBRD	$4.4 M	Fuelwood
Sri Lanka - Reforestation and Watershed Management	1980	USAID	$4.4 M	reforestation, agro-forestry, watershed
Sri Lanka - Forest Resources Development	1983	ODA	$9.0 M	
Thailand - Renewable Nonconventional Energy	1979	USAID	$1.4 M	village woodlots
Thailand - Northern Agriculture	1980	IBRD	$2.2 M	fuelwood, poles
Thailand - Mae Chaem Watershed Development	1980	USAID	$0.37 M	watershed management village woodlots
Thailand - Northeast Rainfed Agricultural Development	1981	USAID	$0.32 M	village woodlots watershed management
Thailand - Mae Chaem Agroforestry	1982	CARE	$0.17 M	nurseries, cash crops
Yemen - Haraz Afforestation	1981	FRG	$2.3 M	afforestation institution building

LATIN AMERICA AND THE CARIBBEAN

COUNTRY - PROJECT TITLE	YEAR FUNDED (1)	DONOR AGENCY (2)	AMOUNT OF LOAN/GRANT (3)	PROJECT OBJECTIVES (4)
Bolivia - Integrated Renewable Resource Management	1983	CARE	$0.54 M	nurseries, agroforestry soil conservation
Colombia - Agroforestry		NETH	$0.91 M	agroforestry
Dominican Republic - Natural Resource Management	1981	USAID	$4.5 M	reforestation, erosion control, agroforestry
Dominican Republic - Forestry Conservation and Development	1984	USAID	$15.0 M	institution building reforestation, training
Ecuador - Integrated Rural Development	1980	USAID	$0.59 M	reforestation for soil and water conservation
Ecuador - Community Forestation	1983	CARE	$0.44 M	fuelwood, agroforestry
El Salvador - Public Sector Employment	1980	USAID	$4.9 M	reforestation, soil conservation
Guatemala - Reforestation and Water Conservation	1975	CARE	$1.23 M	nurseries, soil conservation, fuelwood, timber
Guatemala - Altiplano Agricultural Development	1982	USAID	$0.25 M	reforestation on public and private land
Haiti - Agroforestry Outreach	1981	USAID	$8.0 M	smallholder tree planting
Haiti - Northwest Agroforestry Extension	1982	CARE	$1.09 M	fuelwood, agroforestry nurseries
Haiti - Village Woodlot Development	1983	CIDA	$0.4 M	village woodlots
Honduras - Small Watershed Conservation	1982	CARE	$1.09 M	nurseries, fuelwood fruit, watershed
Panama - Watershed Management	1979	USAID	$5.5 M	reforestation
Peru - Watershed Management	1983	USAID	$1.1 M	forest management reforestation
Peru - SEPAS Reforestation Food for Work	1980	USAID	$0.49 M	reforestation soil stabilization
Peru - Rural Energy and Fuelwood		NETH	$3.81 M	rural energy, fuelwood

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