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**TREE USE PRACTICES IN SELECTED
VILLAGES OF INDIA**

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Chapter 1

Introduction

Trees are an integral part of small subsistence farming systems in South Asia. Trees which provide shade, shelter, food, fodder, fuelwood, timber and, in some cases, improve soil fertility have traditionally been integrated into the production system. These systems include crop production, livestock husbandry and forestry. Thus, many of these trees are multipurpose.

Though forestry is an old profession in South Asia and there has been substantial research on several species, few attempts have been made to understand the uses of multipurpose tree species (MPTS) within the integrated production system context of farmers. Virtually none of the many species grown on farm boundaries, field bunds and homesteads have been researched.

With the major reconstruction of forestry as a profession, a developmental approach is now being adopted by foresters and other researchers. Research and resources which were directed towards single-use species of industrial and commercial value, are now being focused on MPTS and forestry practices that have been carried out for hundreds of years. Farmer oriented research requires a clear idea of the end users and their specific needs. In order to produce results that have widespread effects for the farmer, MPTS research has to have information on the types of trees farmers would most like to grow.

The F/FRED Project has initiated a multidisciplinary study; the objectives of which are 'to define and describe ideotypes desirable by small farmers in Asia'. This study seeks to provide the basis for genetic improvement of MPTS by researchers in Asia and will give research and development institutions data on species selection and breeding. The major questions asked through this study are:

- i are traditional timber definitions such as a straight, clear bole to 16m suitable definitions for improved MPTS for small farmers?
- ii. can a more relevant set of ideotypes for MPTS breeding programmes be defined?

The Study Region

The region being surveyed is India, Nepal and Bangladesh. 21 villages are covered: four in Nepal, two in Bangladesh and 15 in India. An attempt to cover agroecological zones distinct from each other was made. A brief description of the agroclimatic zones covered in India is given in the following paragraphs.

The Government of India has divided the country into 15 agroclimatic regions on the basis of climate, soil type, topography, water resources and irrigation facilities and relating them to requirements of output and employment (Government of India, 1989). These 15 zones have been further delineated into sub zones on the basis of their characteristics of soil, climate, topography and water resources. The district forms the lowest unit of reckoning. These zones are to be the basis for agricultural planning in the Eighth Five Year Plan period. A brief description of the zones in which the study villages are located and the areas of development recommended by the Government of India is presented in the following pages. Little mention has been made of the potential for forestry with the exception of horticultural species. The author has, in some instances, added her own views on the potential for forestry in these areas.

The Indian villages covered in the study are Sukhomajri in the state of Haryana; Sahajpur, Shiradhon, Shindwane, Kadus, Satara and Yavat in Maharashtra; Manki, Malagi, Thadasur, Tadkod, Kibbenhallipalya and Holemannur in Karnataka; Vadapalanji and Thennalur in Tamil Nadu. Table 1.1 gives the agroclimatic zones, and sub zones in which these villages fall and their features. Fig. 1.1 will give readers a rough idea of the geographic location of these villages within India.

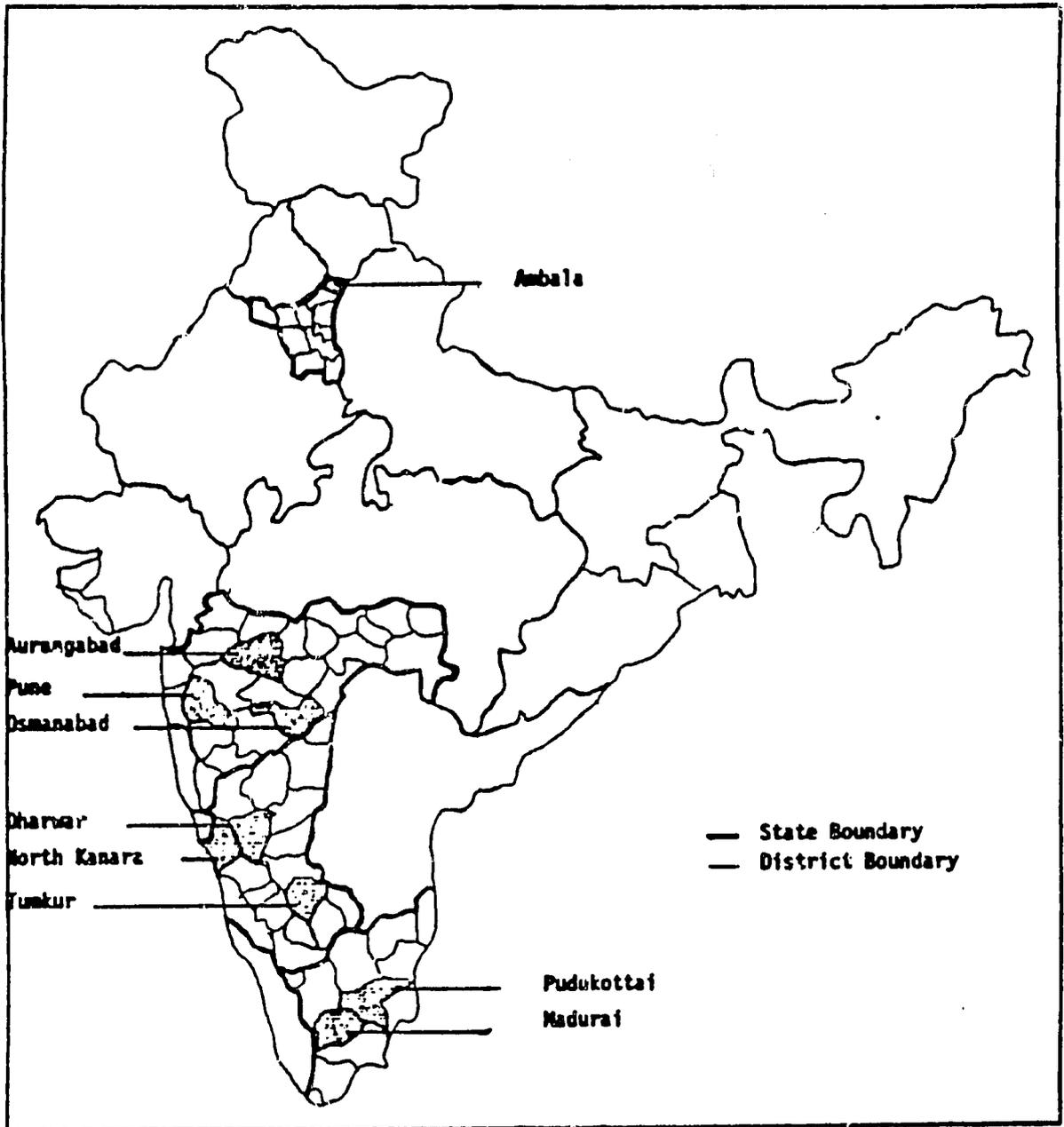
The Trans-Gangetic Plains region wherein Sukhomajri lies has emerged as a major producer of surplus food from a food deficit one. The highest net sown area, highest irrigated area, least poverty, high literacy and high cropping intensity are its major characteristics. Ground water utilization is about 115%. This zone is the major contributor of rice and wheat to the national pool. The Government of India in its overall plan for the region has recommended that the thrust of developmental activity in this region should be the correction of water logged areas, soil salinity and nutrient imbalance, improvement of irrigation use efficiency, flood control and drainage. It also recommends that horticulture be more intensively taken up and the target area under fruit trees be increased to 500,000 ha in the coming 5 year plan period. High quality fodder crops are also to be developed and the area under fodder production is to be increased by a further 10%. All the recommended activities see a role for trees to play. The potential for growing trees is, thus, very high in this region.

All the Maharashtra villages come under the Western Plateau and Hills region though the scrub zones vary. Forests occupy only 11% of this region. Irrigation is limited and canals form the main source of irrigation for the sub zone wherein the villages Satara and Shiradhon lie. This zone is known for its fruit crops like banana, oranges and grapes. The major developmental thrust in this region is integrated watershed development. In order to conserve water, an integrated approach with forestry, agro-forestry, grasslands and crop production is recommended. An increase in fruit production is also a major recommendation. Mango and *Zizyphus* are among the species to be promoted. Both are MPTS.

Table 1.1 Selected Agroclimatic Features of the Sub Zones

| Zone and Sub Zone | Village | Rainfall | Climate | Soils | Crops |
|--|-------------------------------------|----------|----------------------------|---|--|
| Trans-Gangetic Plains Region VI - Foothills of Shivalik and Himalayas | Sukhomajri | 890 | Semi-arid to dry sub-humid | Alluvial (recent), calcareous | Wheat, Rice Maize, Sugarcane |
| Western Plateau & Hills Region IX - Hills | Kadus, Shināwane Yavat, Sahajpur | 988 | Semi-arid | Medium to deep black, shallow red, red loamy | Sorghum, Pearl Rice, Groundnut |
| - Plateau North | Satara, Shirdhone | 874 | Semi-arid | Medium black, deep black, mixed red and black, shallow red | Sorghum, Cotton |
| ω Southern Plateau & Hills Region X - Sub Zone 1 | Tadkod, Holemannur | 769 | Semi-arid & arid | Medium black, laterite, deep black, red loamy | Sorghum, Cotton Pigeonpea, Pearl Millet |
| - Sub Zone 2 | Kibbenhallipalya Thadasur | 677 | Semi-arid | Red loamy, medium black, red sandy coastal alluvium, laterite | Groundnut, Finger Sorghum, Rice |
| - Sub Zone 6 | Vadapalanji, thennalur | 841 | Semi-arid to dry sub-humid | Mixed red and black, red loam, deltaic alluvium | Rice, Sorghum Groundnut, Pearl Millet |
| West Coast Plains & Ghat Region XII - Coastal Hilly | Manki, Malagi | 3649 | Per humid & humid | Laterite, red loamy, coastal alluvium | Rice, Finger Millet, Sesamum, Nigerseed |

Figure 1.1
Geographical location of districts covered in the study.



Tadkod, Holemannur, Kibbenhallipalya, Thadasur, Vadapalanji and Thennalur fall into the Southern Plateau and Hills region. It is semi-arid with only 50% cultivated area. Low value cereals and minor millets predominate due to rainfed farming. Water conservation and watershed development are major priority areas for development. Fruit trees like mango and *Zizyphus* are to be promoted and the target area is 250,000 ha. Wastelands development through forestry and agroforestry are a major area of interest.

The West Coast Plains and Ghat region runs along the west coast. Manki and Malagi fall into this zone. India's remaining rain forests are found in this region. It is an important zone for plantation crops like tea, coffee, coconut, rubber and spices. Rainfall is unimodal in some sub zones and bimodal in others. High rainfall, good water resources and a long coastline call for protection of this zone from salinity. Soil erosion is likely to be an important factor which can be controlled through the use of trees.

The Approach

The raw material for this report comes from household surveys conducted in the selected villages of Nepal, India and Bangladesh. The studies were initiated in July 1989 and aimed towards a listing of tree species used and preferred by subsistence level farmers and landless households.

Researchers working in the field of forestry or interested in forestry issues were contacted for the study. They were of varied backgrounds, from economists and sociologists working in Universities and research institutions to non governmental organizations. The researchers were entrusted with the task of gathering information on tree use practices in a village or villages of their choice (see Appendix 1). Investigators recruited by the researchers did the data collection under the joint supervision of the researcher and coordinator of the study for this region, viz. the author of this report. Background information relating to each of the villages, as supplied by the researchers is in Appendix 2.

There were three stages of data collection. The main information sought in the first phase was on the different uses to which trees are put, the species utilized for each of these end-uses and preferences for various species. Related information like the source from which trees are obtained, the seasonality of its use, nature of consumption, age/sex of the collector was also collected. After obtaining a list of species used (and preferred) and their products, researchers initiated the second stage of data collection. Information sought in this phase was more descriptive and related to characteristics of the species liked and disliked, method of planting, source of the planting material and finally an ideotype for each species. After summarizing this data, a group discussion was held in the village with as many households as possible. A consensus of opinions on the ideotype of each species was

sought. An attempt was made to include women at every stage of the study and where it was found that women were not able to express their views freely, a separate gathering of only the women was organized.

Focus and Limitations

This report covers some of the major findings of the study. Important end uses, species used for these purposes and their ideotypes are discussed in the coming chapters. Results from Bangladesh, Nepal and the Indian state of Karnataka have not been included in this report. For administrative reasons the F/FRED office dealt with Bangladesh and till the time of writing this report no data was received from either of the researchers in Nepal. Data for the 6 villages in Karnataka was not complete. Because of the short time period between receiving data for the other villages and presenting the results to the Coordinating Committee, this report only discusses in detail, the salient findings of the study. Some researchers have summarized the data and put them into a tabular form. Others were not able to do so because of already having delayed sending the results to the author. The summarized data has not been presented in their tabular form but have been explained in a subjective fashion in the text of the report.

A brief mention is made of some of the problems faced by the researchers and the author. The timing of the study has caused the researchers some problems while collecting data. The study period coincided with the onset of the monsoon season. With the agricultural season in full swing it was very difficult to conduct interviews. The questionnaires were, of necessity, long and detailed and there was some difficulty in getting the respondent to spend the required time answering questions and holding his interest.

Translating the questionnaire into 6 languages and then the information back into English will have introduced some inconsistencies into the results. In addition, some reporter bias is sure to have been introduced into the data by the two stages of reporting, first by the investigator and second by the researcher. The author, even with the advantage of speaking 3 of the 4 Indian languages used while collecting data and being familiar with the fourth, was not able to ensure that there was a consistent interpretation of the questions by investigators. This has led to some trouble with interpreting the results.

A major problem faced by the author has been coordinating the study. The study villages are spread over a very large area and the researcher always based in a town/city. Traveling to the study sites required a fair amount of advance planning and communication channels within India and with neighbouring countries were not always open and easy. Postal delays and, in some instances, letters lost in the post made planning and adhering to schedules a difficult task. Matters were further complicated by floods, riots, sudden and unexpected changes in flight/rail timings and unavailability of tickets! While in most

instances there were no dire consequences, it has led to one village being inadequately surveyed. Efforts were made to rectify this situation at Sukhomajri but the results are only partially satisfactory. The author was to have visited all the villages but given the time frame and the above mentioned problems it was well nigh impossible.

Despite these limitations, the information generated by the researchers is of interest and goes a long way in building a data base about past and current tree use practices and farmers attitudes/knowledge/requirements towards and of trees.

Chapter 2

Tree Use Practices

By common practice a multipurpose tree is defined as one capable of producing a range of products. Loppings for fodder and mulch, fuelwood for home consumption, fruit and food wood for house construction, timber for other construction and agricultural implements are only a few of the uses that households in the study villages have for trees. Almost all species of trees used (and preferred) by these households would classify as multipurpose because of their varied and specific end uses. For reasons of practicality, this report includes only those species that are widely used and have clear, specific end uses.

End uses have been broadly classified into three categories - Environmental, Tree Crops and Wood Products. The first category includes shade, soil stability and nutrition, and vegetative barriers and shelterbelts. Under the category Tree Crops fodder, food and fruits are included. The section Wood Products includes medicinal uses, fuelwood, timber and poles for agricultural implements, wood and other material for house and other construction. Minor end uses like toy making, fibre, wood carving, handicrafts and so on are not included because there is insufficient information on these end uses. This chapter examines the list of major MPTS end uses, the physical and environmental requirement from species and other technical, managerial and socio economic considerations. Other related information like availability of tree products for the different end uses, source(s) of its supply, age/sex of the collector are also discussed under the relevant categories.

Results from each village or region are presented for all categories. Maximum information is available for the Tamil Nadu and Maharashtra villages. Data for Sukhomajri, as mentioned earlier, is incomplete but inferences that could be drawn from the existing data have been included. Since all the information for the Karnataka villages was not available to the author at the time of writing the report, they have not been included.

Some of the information presented in the coming sections may not be borne out by the raw data or be backed by numbers. The author often picked up nuggets of information through informal discussions with both respondents and researchers; information that was overlooked by the investigators while filling out the questionnaires or not considered important. Management practices or uncommon end uses particular to certain species was the kind of information investigators didn't pick up or, if they did, record.

The reader will naturally find the same species being discussed under the different end use categories. Under each section, only those characteristics that are relevant to the end use being discussed will be mentioned. A complete picture of the species can be obtained from the next chapter where along with the ideotypes, general features about the species are described.

Environmental End Uses

Soil Improvement through Tree Mulches

Productivity advantages from using tree biomass as mulch are generally obtained from alley or hedgerow cropping trees with annuals. Such systems maintain soil fertility through nutrient recycling and mulch incorporation. Trees in such systems are usually nitrogen fixing. They have the ability to fix atmospheric nitrogen in a form usable by individual plants.

Little research has been done to evaluate yield advantages accrued through the use of tree mulch. Only one species has been the focus of much work - *Leucaena*. Some researchers report improved yields while others have not observed much advantage from using *Leucaena* prunings. No conclusions have yet been drawn. Walker (1987) discusses the possible sources from which economic benefits (through the use of tree mulches) could be gained: the cost of land clearing with conventional cropping and bush fallowing, the progressive yield erosion under bush fallowing, the scope for double cropping a cereal, prohibitively expensive and/or unavailable fertiliser. He concludes that in India's semi-arid regions, there is little economic advantage that flows from these four sources.

However, in the Tamil Nadu villages, the practice of tree mulching was very evident. At the start of the cropping season leaves, green branches and farm yard manure are mixed into the soil. Fields are kept wet and the soil turned at regular intervals. 5-6 days are deemed sufficient for the mulch to have decomposed and released its nutrient value to the soil. Paddy seedlings are transplanted soon after. Farmers are keen to mulch the second (and sometimes the third) crop too but shortage of water is a severe constraint.

Tree species used for mulch are generally grown in close proximity to crops. Most often they are grown on field bunds and farm boundaries. In Thonnalur, *Delonix elata*, *Thespesia populnea*, *Gliricidia sepium*, *Cassia* spp. and *Albizia* spp. are specially grown for their leaves. All of them are nitrogen fixing trees. *Ailanthus excelsa* is also a popular mulch. Thorny species like *Acacia*, though leguminous, are not used as mulch. *Gliricidia* has been introduced only recently into the village by the Agriculture Dept. and a few farmers have some trees but it is fast gaining popularity as a mulch species. *Leucaena* was introduced into the village by the Forest Dept. but few trees survived in the alkaline soils of Thennalur.

At the group meeting, farmers were very vocal about the need for more mulch trees. Mulching emerged as the second most important reason for planting trees after wood for timber and house construction. Relative merits of the mulch species used was also the subject of extensive discussion. *Delonix elata* was rated best because of the 'quality' of the leaves (they were unable to be specify what quality was), its ability to decompose quickly, regenerate profusely and in time for the next crop. High on their list of desirable trees were *Azadirachta indica* and *Ailanthus*. *Albizia lebbek* was rated as superior because of the

quality of its leaves but they were also found to be slowest to decompose. *Thespesia* was also favoured but constant lopping made the tree susceptible to disease and this reduced its vigour and its ability to regenerate. The general ideotype of a mulch species is a many branched tree with dense foliage, large but thin leaves and an ability to regenerate quickly and profusely after lopping.

At Vadapalanji too the practice of tree mulches exists but the households covered in the study were predominantly small and marginal farmers and landless. Their landholdings are small and crops generally rainfed. Tree mulching is practiced more commonly by farmers with access to irrigation and then primarily for a paddy crop.

The practice of mulching is not prevalent in the Maharashtra villages. In fact there is a general belief that the leaves and more specifically, flowers of *Acacia nilotica* var. *indica* are toxic and adversely affect the yield of the annual crop. They also reported that the soil near these trees developed a whitish crust. All trees are commonly planted on the farm boundaries. *Leucaena*, *Acacias*, *Sesbania*, *Prosopis* and other non leguminous trees are grown on the farm. But side branches of most trees are only lopped to minimize the effect of shade on the crops. Leaf litter accumulating in the dry season is left on the field.

In Tamil Nadu *Azadirachta indica* leaves are incorporated into the mulch for its insecticidal properties. Farmers in Maharashtra do not use the leaves on their fields but are certain of its beneficial effect from just being planted in fair proximity to the crops. The slight loss in yield due to shading is acceptable to them.

Shade and Shelter

This end use featured often in discussions with farmers. However, the emphasis was on the negative impact of shade. Farmers want to plant most of their trees on the field bunds and farm boundaries and then manage them so as to minimize the effect of shade on the crops. Only one or two households said they planted trees for shade, both for themselves and their livestock.

Shade for livestock is generally not considered as an end use because animals are grazed or allowed to roam untethered on open access areas during the day. The farmer has little control over trees in such areas. Trees growing in such areas, despite the grazing, are generally unpalatable and probably have little use for the farmer and are thus taken for granted. At Thennalur, Vadapalanji and Sahajpur open access areas are overgrown with *Prosopis juliflora* and farmers said these trees provided shade to grazing livestock. At Sukhomajri, animals are not allowed to graze freely and are stall fed. But no specific mention of trees used as shade was recorded by the researcher. In most of the other villages trees are used to construct cattlesheds as shelter from rain and sun. But this end use of the tree is more appropriately dealt with under the category Wood Products.

Vegetative Barriers and Windbreaks

These end uses are a means to reduce soil erosion and increase resource use efficiency. Vegetative barriers are intended to protect against soil losses due to surface runoff and shelterbelts reduce the effects of wind erosion. Wind erosion was not a matter of concern in the study villages and windbreaks are not used.

Sukhomajri provides a perfect example of a village where vegetative barriers are used to reduce surface runoff. At this point in time, use of trees as vegetative barriers cannot be considered a traditional practice. It may have existed in the past but today's farmers were introduced to it only a decade or so ago. The use of trees as vegetative barriers is practiced at the community level than at the individual farmer level. Sukhomajri is discussed in more detail in the coming paragraphs because of the special role trees play in protecting the hills that nestle Sukhomajri from severe soil erosion.

Sukhomajri is a small village in the foothills of the Shivalik range of hills. Since the seventies, it has been the scene of intense efforts by government and non government agencies to stem the severe environmental degradation that was occurring. Barely 5% of the slopes were found to have any vegetative cover. Deep gullies were forming in the hill sides and farmers were losing their fields due to severe and unchecked soil erosion. The main causes were identified as indiscriminate felling of trees, excessive grazing and land clearance. Watershed development and management was deemed the best and immediate solution to the problem. A project was conceived keeping in view the interests of the people in the command area. The mechanics of the project along with its socio-economic impact is detailed in Seckler and Joshi (1981), Mishra and Jain (1987) and Chopra et al. (1988).

The salient features of the project were construction of storage dams and protection of the catchment area with tree and grass species. The choice of species was guided by the need to increase infiltration of water and guard against rapid siltation of the storage reservoir. *Acacia catechu* was planted on the slopes of the watershed and *Dalbergia sissoo* to provide protection to the gully walls. Bhabhar grass (*Eulaliopsis binata*) was planted on the ridges. This community forest was protected from grazing animals and illicit felling by the residents of the village. As a result of the protection the natural vegetation of the region also sprang up. Fodder and fuelwood of which there was great shortage were again available. In the initial stages, water was the most significant new resource, but in the end forest produce turned out to be an equally important one.

With the aim of protecting the hills from erosion and providing the village with tree products, the Forest Dept. raised *Prosopis* and *Leucaena* on forest land. A section of the village was entrusted with the job of raising and protecting these trees. This has however created some, yet unresolved, problems relating to usufruct and tenurial rights to the land on which the trees are planted. Social tensions within the village about distribution of

produce have also arisen. These issues are, of course extraneous to the main use of trees, but bring alive the inherent problems that crop up with social forestry programmes.

In the other villages trees are planted as a vegetative barrier around the fields, but more as a fence to keep animals out. Species that are thorny, have at least partial tolerance to heavy browsing or are unpalatable to animals, and can withstand soil compaction from animals walking or camping beneath them are planted on the outer boundaries. *Euphorbias*, *Acacias*, *Prosopis*, *Adathcda vasica*, *Lantana camaris* are popular species.

Tree Crops

Fruit

Fruit trees and other woody perennials are important sources of nutrition and income to rural households. Walker and Ryan (in press) report that in the villages included in their study, mangoes and other seasonal fruits were the source of a substantial share of beta-carotene intake for children. The importance of fruits like coconut in rural economies is well documented. In response to expanding market opportunities, farmers are planting large quantities of fruit trees. The Government of India is placing great emphasis on the development of horticultural crops in almost all of the agroclimatic zones represented in the study. A list of MPTS grown for fruit in the study villages is given in Table 2.1.

Monocultures of fruit trees is generally practiced on large holdings. Smaller farmers like those covered in this study plant fruit trees in ones and twos in their homegardens or on field boundaries. This situation is undergoing a gradual but steady change as more and more farmers find fruit trees more remunerative than subsistence farming. Small orchards around dug wells are growing in numbers. Trees in the homestead or around dug wells are protected, watered and allowed to grow unhindered as they don't shade any crops. The practice of planting fruit trees on field margins and farm boundaries is also quite prevalent. Some farmers are willing to accept lower yields from agricultural crops when fruit species are planted on field margins, only if they generate adequate income or yield large quantities of fruit. Thorny species like *Zizyphus* are planted on field boundaries but not generally on those which are easily accessed by children and other passers by. Farmers prefer to grow some species on common lands or government land. These are species not quite 'domesticated' like *Carissa*, *Zizyphus* and *Syzygium*. Species that grow big are generally planted on open fields and away from agricultural crops if possible, e.g. *Tamarindus indica* and *Syzygium*. Mango and *Psidium guajava* are grown on homesteads and around dug wells. *Borassus flabellifer* and coconut are grown on field bunds. *Pithecellobium dulce* is grown on farm boundaries and used more as a fodder and fuelwood species.

The mulberry tree yields fruit only when the leaves are not constantly harvested as food for the silk worm. Sericulture is not practiced in Sukhomajri; the tree is allowed to

grow without being lopped and yields berries which are a great favourite with children. It generally grows on common lands. *Carissa spinarum* is a little known species which grows in the sub-Himalayan region on wastelands and forests. It is a spiny hardy bush and can grow on very poor soils. Its small fruit are edible and rich in protein. Each bush can yield upto 300 g of fruit (Parmar, 1988). Fruits are only a secondary use for species like *Carissa*, *Borassus flabellifer* and *Morus serrata*. Table 2.1 also gives the alternate uses of these fruit species. The seeds of *Azadirachta indica* are edible when in the form of an oil. The oil is used for medicinal purposes and is discussed more in detail later in the chapter.

In Tamil Nadu the Forest Dept. raises tamarind trees on roadsides. Almost all national highways are lined with trees that are 'auctioned' every year or so. The highest bidder gets usufruct rights for a stipulated time period. But because of the good price pods command in the market, farmers are keen to grow their own trees. Since the trees grow big only households with uncultivated farms or open land are able to grow them. Seeds are a source of starch and are sold for use in the textile industry.

Farmers preference for fruit trees is guided, to some extent, by market conditions. Mango, *Zizyphus* and *Syzygium* are almost universally grown or preferred because a good market exists for these species. Raw and ripe mangoes are very popular. Sahajpur, Thennalur and Vadapalanji grow very few mango trees but the demand for them is no less than in the other villages. Mango trees are generally raised from seed in many of the villages but there is a demand for grafted varieties. Grafted mango trees fruit much earlier than those raised from seed.

Zizyphus is very popular in Maharashtra. The fruit is collected from trees growing on government and common lands by women and children. There is a good demand for this fruit from urban areas and farmers are keen to exploit the market potential. A variety known as 'Ahmedabadi' is preferred. Its fruits are large, fleshy and keep better. They are also less susceptible to insects. Farmers in Maharashtra are keen to plant *Zizyphus* whereas in Sukhomajri and Tamil Nadu, only a few small farmers grow it. A market as well developed as the one in Maharashtra does not exist in Tamil Nadu.

The Forest Dept. is unable to satisfy the demand for fruit trees. The Agriculture and Horticulture Departments also supply fruit species but the demand outreaches the supply. Private nurseries exist only in areas where fruit is grown as a plantation crop. The seedlings sold are expensive and most small farmers are unable to afford them.

The management of trees depends on whether the product is a vegetative part - wood, leaves, pith, bark or resin - or a reproductory part - fruit or seeds (Cannell, forthcoming). Pruning for instance can be done to alter the tree shape or the total dry matter production or the distribution of growth within the tree. Because of the multipurpose nature of the fruit species, management practices may be in conflict. For instance a tree managed for fruit may be kept short and stocky with wide canopies and planted far apart.

Those managed for timber may be required to be tall and straight with no branches low on the stem. Closer spacing may also be desirable.

Farmers in the study villages have reconciled these conflicting objectives of management by reaching a compromise. With the exception of some species like *Carissa*, the date palm and *Morus*, fruit species are grown with fruit as the primary end use but the long term view to use them for alternate purposes is not neglected. These trees are thus encouraged to grow reasonably straight and tall with the exception of *Zizyphus* which is allowed to branch from low on the stem. Branches are favoured but not too low on the stem. Species that fruit on young shoots and on the outside of the canopy like mango and guava are not pruned. *Zizyphus* is pruned every year as it fruits on old wood. The pruned branches are used as fuelwood.

Table 2.1 Multiple Uses of Fruit Species

| Species | Fruit | End uses | | | Other** |
|-----------------------------|-------|----------|--------|----------------|---------|
| | | Fuelwood | Timber | House Constr.* | |
| <i>Mangifera indica</i> | / | / | / | | |
| <i>Syzygium cuminii</i> | / | / | / | | |
| <i>Zizyphus mauritiana</i> | / | / | | | / |
| <i>Cocus nucifera</i> | / | / | / | / | |
| <i>Borassus flabellifer</i> | / | / | | / | / |
| <i>Carissa spinarum</i> | / | / | | | / |
| <i>Morus serrata</i> | / | / | | | / |
| <i>Psidium guajava</i> | / | / | / | | |
| <i>Tamarindus indica</i> | / | / | / | | |
| <i>Azadirachta indica</i> | / | / | / | / | / |
| <i>Moringa oleifera</i> | / | / | | | / |
| <i>Pithecellobium dulce</i> | / | / | | | / |

* House construction includes use of wood as poles, reepers and leaves for thatching

** This category includes leaves as fodder and minor end uses like tannin, fibre, handicrafts

*** The seeds of the fruit are used to extract a medicinal oil

Farmers are in general not very familiar with nursery techniques like grafting and budding. Specialised management techniques are also unknown to them. For instance, mango often bears fruit biennially or irregularly but farmers have not been able overcome this problem by selecting regular bearing cultivars. One of the reasons for this may be the availability of mango saplings.

Fodder

Demand for fodder has been growing at a steady rate in India. Increasing livestock populations and declining productivity of grazing lands around villages are the major causes for the acute shortage that grips the country with monotonous regularity. Common property resources which serve as grazing land for many villages are being eroded gradually. The shortage of fodder is fuelled by the demand for milk from urban centres. Fodder prices have risen steadily over the years and more than kept pace with the demand.

In most of India, rainfall is spread over a few months of the year and natural grazing is available for only some months. Crop residues form a major portion of fodder. Tree leaves and pods are generally used as a supplement to traditional grasses and crop residues during periods of shortage. Tree leaves are rich in crude protein compared to cultivated fodder and indigenous grasses and have a high calcium content (Sabnis et al. 1989). Despite its promise, use of leguminous tree foliage is restricted in the study villages.

Not much can be inferred about livestock populations in the study villages from the number of livestock owned by the sample households. Nonetheless, the impression gained is that more and more households are rearing goats and sheep. Rising mutton prices and easy husbandry make goats and sheep an attractive proposition. The indiscriminate feeding habits of goats do not present households with problems of fodder. On the whole they are a low investment with high returns.

Thennalur has the highest population of goats and sheep. This is despite the ban that was imposed by the village some years ago on rearing goats. No family was allowed to increase his stock of goats. The ban was motivated by the indiscriminate grazing habits of goats. Though the edict was adhered to earlier, there is some resistance to it now and it is the cause of tension between lower and high income groups in the village. Low income households generally rear goats. Stall feeding is not practiced and goats are allowed to roam untethered. Supplemental tree fodder is fed to them only sometimes. *Acacia nilotica* and *Prosopis* pods are sometimes stall fed.

With the exception of Sukhomajri where the goat population is very small and free grazing is not allowed, in all the other villages, goats roam untethered. Sheep are in smaller numbers and a young boy generally shepherds them. Tree fodder is collected sometimes to supplement their diet.

94% of all households in Sukhomajri own cattle. The common forest raised as part of the watershed development project is the primary source of fodder grasses for landless and small land holders. The grass is cut from November to March and stored for the whole year. Use of tree fodder is only occasional. *Leucaena* was introduced into the village as a multipurpose tree species but there are not enough to supply all the households with fodder. Secondly, grasses are preferred to tree fodder. Some large farmers have trees scattered on

their lands, some even have small plantations of *Leucaena*. Their cattle are allowed to browse directly from the tree. Purchased feed and crop residues are a secondary source of fodder.

Yavat and Sahajpur have the least number of milch animals. In addition to grazing and crop residues, the use of tree fodder is relatively high. The two species used are *Sesbania sesban* and *Leucaena*. In Sahajpur, investigators report that *Sesbania* leaves are even purchased. These two species are grown in common areas (this information could not be verified). It is possible that the voluntary organization working in these villages has raised *Leucaena* plantations, in homegardens and on farms in what the researcher calls an agroforestry system. There is a practice, common to many villages in Maharashtra, of growing *Sesbania* with the sugarcane crop and harvesting the tree at the same time as the crop. In the interim period the tree is lopped regularly for fodder. Alternatively, since both these species are generally grown on farm boundaries in close proximity to annuals, the system may have been termed agroforestry.

In Kadus, Shindwane, Shiradhon, Satara and Vadapalanji, households with milch cattle own an average of 4 - 5 animals each. In the Maharashtra villages, tree fodder from *Sesbania* and *Leucaena* is commonly used but the extent of its usage varies from village to village. The highest usage of both is in Shindwane, only *Sesbania* is used in Kadus and there is only a very occasional use in Satara and Shiradhon. At Vadapalanji households say they use tree fodder but again, very infrequently. *Prosopis* and other thorny species dominate the landscape at Vadapalanji and there were few other trees whose leaves could be used as fodder. Households have expressed their preference for *Pithecellobium dulce* as a fodder species.

Thennalur has the highest cattle population for the sample households. The species used as fodder number more than in any other village. *Delonix*, *Thespesia*, *Albizia lebbek*, *Ailanthus* are all used occasionally for fodder. The use of tree leaves for fodder comes secondary to the use of leaves as mulch. Since other forms of fodder are available, tree leaves are used for mulch.

Table 2.2 gives the use of different tree species as fodder and the extent of their use. The frequency of use is a subjective matter and the author bases her decision on information gleaned from both the questionnaires and discussions with cattle owners.

There is concern in the villages about the availability of fodder. Households are engaged in collection of fodder-crop residues from farms, grasses from forest and other lands, tree fodder from various sources - almost through out the year. One expects the major responsibility for the collection of fodder to lie with the adult females of the household. But contrary to expectation responsibility rests with the adult male in many of the sampled villages. At Sukhomajri, social norms prevent women and older female children from going to public places like the common forest and market. Since the common

Table 2.2 Fodder Species and the Frequency of their Use

| Species | Village | | | | | | | | |
|---|-----------|-------------|-------|-------|----------|--------|-----------|-----------|------------|
| | Thennalur | Vadapalanji | Kadus | Yavat | Sahajpur | Satara | Shindwane | Shiradhon | Suhkomajri |
| <i>Azadirachta indica</i> | 2 | 2 | | 2 | | 2 | | 2 | |
| <i>Acacia nilotica</i> var. <i>indica</i> | 1 | 1 | 1 | 1 | 1 | 1 | | 1 | |
| <i>Delonix elata</i> | 1 | | | | | | | | |
| <i>Thespesia populnea</i> | 2 | | | | | | | | |
| <i>Prosopis juliflora</i> | 1 | 1 | | | 1 | | | | |
| <i>Albizia lebbek</i> | 1 | 1 | | | | | | | |
| <i>Ailanthus excelsa</i> | 2 | | | | | | | | |
| <i>Albizia amara</i> | 2 | | | | | | | | |
| <i>Tamarindus indica</i> | 2 | 2 | | 2 | | 2 | | 2 | |
| <i>Mangifera indica</i> | | | | | | 2 | | 2 | |
| <i>Pithecellobium dulce</i> | 2 | 1 | | | | | | | |
| <i>Leucaena leucocephala</i> | | | 2 | 1 | 1 | 2 | 1 | 2 | 2 |
| <i>Acacia nilotica</i> var. <i>cupressiformis</i> | | | 1 | 2 | | | | | |
| <i>Sesbania sesban</i> | | | 2 | 1 | 1 | 2 | 1 | 1 | |
| <i>Zizyphus mauritiana</i> | | | | 2 | | 2 | 2 | 2 | |
| <i>Prosopis spicigera</i> | | | | | | | | | 2 |
| <i>Merus serrata</i> | | | | | | | | | 2 |

1: Frequent use 2: Occasional use

forest and purchased feed together constitute the major sources of fodder, male members have the major responsibility of collecting fodder.

At Kadus, Satara and Thennalur, the task of collecting fodder is shared by men and women. The greater responsibility rests with the male. Feed is purchased almost entirely by men. At Shindwane, Shiradhon, Sahajpur and Yavat male members are primarily responsible for the collection of fodder with some help from the female members in the collection of non tree products from and off the farm.

Vadapalanji is the only village which conforms with the expected result. Women are almost entirely responsible for the collection of fodder.

There are some generalizations that can be made about the use of tree fodder. The potential of tree fodder has not yet been fully realized. When asked why tree leaves are not exploited for their use as fodder, many households replied that their milch animals do not like tree fodder and eat them only when there is a shortage of traditional fodder. With the exception of Sukhomajri which needed a massive soil erosion problem before stall feeding was adopted, no other village shows any vigorous signs of changing over from grazing to stall feeding. Extension efforts need to be intensified.

In the Tamil Nadu villages there is no extension work done either by the Animal Husbandry Dept. nor the Forest Dept. to promote fodder trees. At Thennalur the practice of mulching will probably conflict with the use of leguminous tree leaves as fodder. Bharatiya Agro Industries Foundation, an NGO, has done much to popularize *Leucaena* in the Maharashtra villages. The weedy nature of *Leucaena* is disliked by many farmers, while others find protecting saplings from grazing animals a problem. But it is slowly being accepted as a useful tree.

Wood Products

Only three major uses are discussed in this section. There is inadequate information on minor uses like handicrafts and exudates.

Medicinal Uses

Halos (1988) records the use of some selected trees and woody perennials for medicinal purposes in the Philippines. Some of these practices are common to India also. But researchers often neglected to record the use of tree products for medicinal purposes. Some information was obtained during the course of informal discussions with village elders.

Knowledge of herbal medicines seemed to be most in the Tamil Nadu villages. This is not to say there was little or no knowledge in other villages, but the author came across

more references to medicinal uses in Thennalur and Vadapalanji. Older members of the village were able to point out many shrubs and trees which were used indigenously as cures for some ailments. The pods of *Cassia fistula*, recorded as poisonous in some books, is used to make a decoction for treatment of stomach disorders. *Strychnos nux vomica*, all parts of which are reportedly extremely poisonous, is used in minute quantities as an antiseptic. Pods of other species, botanic names of which are not known, are used to rid persons having body and hair lice. The leaves of *Carissa* are used to treat skin blisters. The leaves of *Moringa oleifera* are useful to lactating mothers. Sadly the use of medicinal herbs is on the decline and knowledge which was passed on from father to son is dying with the older generation. Other MPTS which are used for medicinal purposes are *Pithecellobium dulce*, *Melia azaderach*, and *Artocarpus heterophyllus*, but the ailments they cure were not specified.

One medicinal use which all researchers reported was the use of oil extracted from the seeds of *Azadirachta indica*. The oil is reputedly a panacea for all ills. Body pain, fever, boils, blisters and other wounds are all treated with Neem oil. In some villages Neem oil is drunk for general health. Tender green branches are chewed on and serve the same purpose as an astringent mouth wash. They are also used in the treatment of gum infections.

Fuelwood

The need for fuelwood would seem to be large in Indian villages from various newspaper and other reports. But the effective demand for fuelwood in all but one of the study villages is relatively low. The widespread diffusion and proliferation of *Prosopis juliflora* on village wastelands and other open access lands has done much to increase the availability of firewood in many Indian states, including Tamil Nadu and Maharashtra.

At Vadapalanji and Thennalur in Tamil Nadu, vast areas are covered with *Prosopis*. At Thennalur, 100% of all households interviewed use it as firewood. The corresponding number for Vadapalanji (36%) does not reflect the extensive use of *Prosopis*. Similarly in Sahajpur in Maharashtra, all households present at the group discussion said they used *Prosopis* and that it was a major, if not the only, source of fuelwood for many families. Information gathered from earlier interviews and discussions did not reveal this widespread use. The researchers explain this by saying that the proliferation of *Prosopis* is a recent phenomena and villagers do not still consider it to be a tree worth mentioning. Women from villages where there is no *Prosopis* growing are keen to grow it as they have heard about its excellent burning quality, easy diffusion and coppicing ability. Farmers are more reserved in their opinions and are concerned about its possible spread into their fields.

At Thennalur, farmers and landless households are aware of its use as a fodder species, yet the practice of harvesting its pods as fodder for goats and sheep is not a regular one. (Grazing goats and sheep are the major reason for the wide dispersal of the seeds). There was also some talk of its heartwood being suitable for making farm implements.

However the tree is rarely left to grow and put on the girth required for such a use.

The qualities needed for fuelwood can be divided into the physical and silvicultural/environmental properties of the species. The wood should be easy to split and have a low moisture content or be relatively fast drying as considerable heat is lost in burning moist wood. For health reasons, smoke should be minimal and non toxic as ventilation is poor in most village constructions. Fast growing species often have inferior burning qualities compared to those that have grown more slowly. Thornless species are easier to cut and transport.

The silvicultural properties of fuelwood trees are what every tree grower wants from his trees irrespective of the end use. These include rapid growth, even on poor soils, ability to stabilize and improve the environment, minimal management, disease and pest resistance, ability to coppice, hardiness to survive drought and other environmental stresses and of course, be multipurpose.

The study shows that in the sample villages, other than *Prosopis*, there are only a few species for which firewood is the primary end use - *Acacia leucophloea*, *Morus serrata*, *Carissa spinarum* and *Albizia amara* - and one for which firewood is the only end use, *Euphorbia* spp. All the other species have alternate uses which the farmer considers more important than firewood. Table 2.3 gives a list of species used as firewood.

Not all the species given in the list have the desirable qualities required of a species being used as firewood. The *Euphorbias* have a high moisture content and are slow drying, have spines and emit smoke when burning. Yet the villagers of Vadapalanji have to resort often to using *Euphorbia* because there is a shortage of better species. *Sesbania*, *Leucaena* and *Delonix elata* are considered to be inferior firewood. The species universally recommended as superior fuelwood are *Acacia*, *Prosopis* and *Azadirachta indica*. Small branches of *Azadirachta* which have no other use are used as firewood. In the Maharashtra and Tamil Nadu villages, these three species registered the largest number of users. *Dalbergia* and *Anogeissus* are essentially timber species and wood of inferior quality is used as firewood. The fruit species Mango, *Psidium* and *Syzygium* are used when the yield of fruit is on the decline or no other wood is available. *Carissa* and *Morus* are used primarily as firewood.

The use of alternate cooking fuels is also prevalent. Crop residues, a primary source of fodder also finds use as cooking fuel in times of shortage. In villages with large cattle populations dung cakes are used. Charcoal is not used in any of the villages. *Prosopis* is sold in Thennalur to charcoal manufacturers. Tamarind trees past the stage of bearing fruit are felled for conversion to charcoal.

Table 2.3 List of Species Used as Fuelwood

| | |
|------------------------------|---|
| <i>Azadirachta indica</i> | <i>Melia azaderach</i> |
| <i>Sesbania sesban</i> | <i>Acacia nilotica</i> var. <i>indica</i> |
| <i>Leucaena leucocephala</i> | <i>Mangifera indica</i> |
| <i>Zizyphus mauritiana</i> | <i>Prosopis juliflora</i> |
| <i>Tamarindus indica</i> | <i>Syzygium cuminii</i> |
| <i>Morinda tinctoria</i> | <i>Euphorbia</i> spp. |
| <i>Albizia lebbek</i> | <i>Thespesia populnea</i> |
| <i>Albizia amara</i> | <i>Borassus flabellifer</i> |
| <i>Acacia leucophloea</i> | <i>Acacia catechu</i> |
| <i>Prosopis spicigera</i> | <i>Eucalyptus</i> spp. |
| <i>Dalbergia sissoo</i> | <i>Morus serrata</i> |
| <i>Psidium guajava</i> | <i>Carissa spinarum</i> |
| <i>Anogeissus latifolia</i> | <i>Delonix elata</i> |
| <i>Pithecellobium dulce</i> | <i>Acacia nilotica</i> var. <i>cupressiformis</i> |

There are few generalizations that can be made about the role of men and women in the collection or provision of firewood. In Vadapalanji, the entire responsibility of collecting firewood lies with the female members of the family. Women and children (with the exception of male children above the age of 15 years) set out to collect firewood in the early hours of the morning and take anything up to 3 hours. Moderate to large sized woody shrubs and trees are cut by the men but the women have the task of making smaller bundles and transporting it back to the house. *Prosopis* roots are greatly preferred and women wanted *Prosopis* roots to grow laterally to enable them to dig it out easily. The men of the village wanted roots to go down deep so that they did not interfere with cultural operations on the field. Vadapalanji is the only village that saw such extensive use of roots as fuelwood. Roots of *Acacia nilotica* and *Commiphora* spp. are commonly used as firewood.

In Shiradhon collecting fuelwood is almost exclusively a male task. In Satara men and women collect firewood. Men have the greater responsibility of collecting firewood from their farms which have scattered trees on them whereas the collection of non tree products both on and off farms is almost exclusively a female task. In Sahajpur more women gathered fuel from common lands than men but collection of firewood from farmlands with trees on it was the man's job. In Yavat and Thennalur both men and women share the task equally. In Kadus and Shindwane on the whole, men play a more dominant role in the task of collecting firewood. At Sukhomajri, the only north Indian village in the sample, social norms prevent women from going to common lands, the common forest and markets to collect/purchase firewood. But collection from the homestead is exclusively a female task.

An interesting feature in the study villages is that few households are willing to grow trees for the exclusive purpose of domestic firewood. In Vadapalanji, Thennalur and Kadus, the state forest departments have raised plantations of *Acacia nilotica* and other species. Few in these villages view these plantations as supplying firewood to the village. The wood is auctioned to timber and firewood merchants and the proceeds go towards building roads, school buildings and such like works. Walker (1987) also makes the same observation. He quotes Blair (1986, p.1318), who observed that in Maharashtra 'Gram panchayats (village governments) as well thought of their plantations on common land as being primarily for poles and small timbers with consideration for fodder but almost none for fuelwood. Typically their plans for distribution of the produce revolved around either auctioning off the wood and fodder, or selling them at concessional rates to local people.' Blair also goes on to say that the first objective of social forestry had become its last. One of the reasons cited for the above observation is that rural men view the opportunity cost of women's and children's labor as low. And since the bulk of all fuel used is collected free of cost by women and children, provision of fuelwood trees is not a major concern. This is not entirely true for the sample villages. Men and women share the task of collecting firewood.

There is some difference in the kinds of species preferred by men and women. Women want more *Acacia* but men prefer to keep the wood for other uses. Similarly, women prefer *Azadirachta* but since the wood is so useful and important for other purposes, are willing to use alternate species. In general no strong female-male bias with respect to species is observed. Women share and appreciate the men's concern for wood to make agricultural implements, bullock carts, etc. with and are also keen to get a cash return for their tree products.

Timber for House and other Construction

From a farmers perspective, tree products for house construction in the form of beams, supports and thatches, doors and windows, small timber for furniture and agricultural implements and timber for ploughs and bullock carts are almost the most important end use of a tree. They feel any wood can be burnt as firewood, alternate kinds of fodder to tree leaves can be fed to livestock, tablets can be ingested in place of herbal medicines, but a plough or a cart wheel can be made only with specific types of wood. Wood incapable of taking high cross loads is useless in house building. Similarly wood susceptible to wood borers is of little use while making a plough. In other words, poles and timber for construction and small timber for other uses are star performers in conflicting end uses.

Wood and poles for construction must have the following physical characteristics. They should be durable, light, capable of taking high cross loads, have minimal spirality to avoid opening up when in use, be resistant to termites and other wood borers or be capable of taking preservatives easily. Silviculturally, they must be straight and have strong apical dominance, have few or thin branches, and preferably be self pruning without leaving knots that cause weakness. The bark should strip easily and the tree must have little taper.

Sometimes it is important for the wood to be durable in the ground and in water.

Many species with only timber as the end use have been used in the past in the study villages. *Shorea robusta*, *Tectona grandis*, *Dichrostachys cinerea*, *Anogeissus latifolia*, *Diospyrus ebenum*, *Cedrela toona* are only a few timber species that households have used in the past for house construction. These houses have stood for over 40 years and have weathered well. But these species are now almost impossible to get and farmers are using species that are multipurpose and have excellent timber qualities in addition to other end uses.

In Thennalur where there are a large number of species still available (knowledge of over 70 species was recorded by the investigator), different species are used for specific purposes. For instance, the bullock cart wheel is made only from some particular species and other species are considered unsuitable. The outer rim of the wheel is made from *Acacia nilotica* or *Albizia lebbek*. The hub and the axle are made from *Acacia leucophloea* and the spokes are made from either of the three species. The cart itself is made from same three species but each is used for specific parts of the cart. Lighter wood is used for the yoke for the bullocks and the species preferred are *Wrightia tinctoria*, *Zizyphus* or *Thespesia*. The plough is made from *Acacia* and *Albizia amara*. The implement used for levelling the soil needs a species of wood that is hard, long and straight. *Acacia leucophloea* and *Albizia lebbek* fit the bill. *Delonix elata* is used as a lining in wells because of its durability under water and forms the foundation on which the stone wall is built.

Due to the unavailability of some of these species farmers are forced to try out new ones. One that is finding acceptance is *Prosopis*. The heartwood is found to be hard enough to use as handles for agricultural implements and as a pestle like implement for pounding rice. It is also being used in ploughs. Such detailed information on the specific uses of timber is not available for the other villages. In the other villages the use of so many species is also not so prevalent. *Acacia nilotica*, *Azadirachta indica* and *Melia azaderach* are commonly used for making agricultural implements in the villages of Maharashtra. *Prosopis spicigera*, *Dalbergia sissoo*, *Eucalyptus* and *Mangifera indica* are used in Sukhomajri but the specific uses of each of these species is not known. Table 2.4 gives some of the specific timber uses of the MPTS.

MPT species used for house construction in Thennalur are *Borassus flabellifer*, *Cocus nucifera*, *Azadirachta indica*, *Thespesia* and *Ailanthus*. The date palm and coconut trunks are used as central supports for the house, while their leaves are used for thatching. Fibres drawn from the outer covering of the coconut flower are used to bind horizontal beams together.

Table 2.4 Specific Timber Uses of MPTS

| Species | Uses |
|------------------------------------|---|
| <i>Morus serrata</i> | Agricultural implements, cart wheels, cabinets, furniture, toys |
| <i>Acacia nilotica var. indica</i> | Outer rim of cart wheel, bullock carts, handles for farm implements, wood carving, spokes of cart wheel |
| <i>Azadirachta indica</i> | Horizontal beam for house construction, inner doors and windows, furniture |
| <i>Thespesia populnea</i> | Supports for roofs, cross beams, yoke for bullocks |
| <i>Melia azaderach</i> | Central supports and beams in house construction, furniture, handles for farm implements |
| <i>Borassus flabellifer</i> | Leaves as thatching for roofs, trunk as central support and split sections as frame for the roof in house construction |
| <i>Cocus nucifera</i> | Leaves as thatching for roofs, trunk as central support in house construction, fibre drawn from outer covering of flower for binding beams together |
| <i>Prosopis juliflora</i> | Handles for agricultural implements, parts of plough |
| <i>Albizzia lebbek</i> | Outer rim of cart wheel, spokes and implement for levelling the soil |
| <i>Ailanthus excelsa</i> | Split sections as cross beams in house construction, toy making |
| <i>Albizzia amara</i> | Doors and windows |
| <i>Mangifera indica</i> | Small timber used in making furniture |
| <i>Acacia leucophloea</i> | Agricultural implements, furniture, beams in house construction |

Table 2.4 (Continued)

| Species | Uses |
|--|---|
| <i>Syzygium cuminii</i> | Small timber used in making furniture |
| <i>Sesbania sesban</i> | Supports for temporary sheds |
| <i>Acacia nilotica</i> var. <i>cupressiformis</i> | Agricultural implements, bullock carts, cart wheels and spokes |
| <i>Dalbergia sissoo</i> | Agricultural implements, furniture, cart wheels |
| <i>Prosopis spicigera</i> | Handles for agricultural implements posts, supports for house construction |

Horizontal beams are also made from sections of the *Borassus* trunk. *Thespesia* and *Ailanthus* are used in house construction. Neem wood is used for doors and windows because of its strength and resistance to wood borers and termites. But Neem is also known to develop cracks if exposed to the elements. Its use in making agricultural implements is limited for this reason. *Acacia leucophloea* is also used for making doors and windows. In the Maharashtra villages *Melia azadirach* is used to make central supports and cross beams. *Acacia nilotica* is not used because it is easily prey to wood borers. A practice specific to and common in Maharashtra is the use of *Sesbania* in the construction of temporary shelters for cattle and humans. After constant lopping for fodder for 2-3 years *Sesbania* loses the ability to regenerate. The tree is then felled and the pole used to construct cattlesheds.

Farm forestry systems based primarily on *Eucalyptus* and *Casuarina* are rapidly growing in India. A huge market exists for poles for scaffolding and house construction. *Casuarina* is also sold as fuelwood in urban centres in Tamil Nadu. A few farmers went in for *Eucalyptus* plantations in Sukhomajri expecting good prices for poles. Prices have reportedly declined in many regions of India and farmers are now complaining about the ill effects of growing *Eucalyptus*. The researcher however was cynical in her comments that once the prices went up again all complaints would cease. Sukhomajri, in her opinion, has become extremely commerce minded after the amount of money that was poured into the village for the watershed project. In the Tamil Nadu villages, there is some demand for *Casuarina* because it is a good fuelwood and timber species.

Chapter 3

Multipurpose Tree Species Ideotypes

Awareness of the importance of forestry to rural development and the pressure to achieve useful results make it imperative that reliable knowledge is available on the planting site, the proposed end uses of the trees and the range of potentially suitable species. The previous chapter examined some of the end uses that farmers have for trees. This chapter gives an ideotype for all the MPT species used in the study villages.

Ideotypes for the same species from the different villages in Maharashtra have been combined to give a composite one. This has been done as there was little difference in the ideotype described in each of the villages. Similarly, if the description for the species common to the Tamil Nadu villages was the same, they have been combined and a composite one presented. Ideotypes for species used in Sukhomajri have been pieced together from information gleaned about the species from the various stages of data collection. The ideotype described for mango and *Leucaena* in Sukhomajri is similar to that from Maharashtra. Table 3.1 gives the list of species for which ideotypes have been described and the uses to which they have (and can) be put. The villages in which these species are used is given in Table 3.2.

In addition to the species for which ideotypes have been described, other species are also used in the villages. But the ideotype has not been described because either the species are not multipurpose or not being used by more than one or two households. In the latter case it was difficult to get an ideotype which the village could comment on during the group discussion. This instance is particular to Vadapalanji.

It was particularly hard to get villagers at Vadapalanji to describe their ideal type of tree. In the authors' opinion the acute shortage of trees, other than the thorny shrubs which dominate, make the people very undemanding of the tree in terms of its shape, foliage characteristics and so on. It was extremely hard for the people to imagine a familiar species with a new shape or with different characteristics.

At Thennalur 69 species were used. 13 were truly multipurpose and used by good number of the sample households. Knowledge of the multipurpose nature of these 13 species was widespread. Quite a number of the 69 had very specialized and single uses, like making religious figurines or some special farm implement or toys for children. Many others were fruit species like *Citrus*. The sample included a carpenter who had at some point in the past used more than a dozen species the end use of which were only timber.

At Vadapalanji woody shrubs like *Lapidagathis cristata*, *Crotolaria juncia*, *Dalbergia multiflora* and *Euphorbias* are used for firewood. The *Euphorbias* are quite unsuited for use

Table 3.1 Multipurpose Tree Species and their End Uses

| Species | End Uses | | | | | | | | | |
|--|----------|----------|----------|-------|--------------|--------|-----------------|-------|-------------|---------|
| | Fodder | Fuelwood | Charcoal | Fruit | House constr | Timber | Medicinal value | Mulch | Handicrafts | Others* |
| <i>Azadirachta indica</i> | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | | 1 |
| <i>Acacia nilotica</i> var. <i>indica</i> | 1 | 1 | | 1 | | 1 | | | | 1 |
| <i>Delonix elata</i> | 1 | 1 | | | | | | 1 | | 1 |
| <i>Thespesia populnea</i> | 1 | 1 | | | 1 | 1 | | 1 | | |
| <i>Prosopis juliflora</i> | 1 | 1 | 1 | 1 | | 1 | | | | 1 |
| <i>Albizia lebbek</i> | 1 | 1 | | | | 1 | | 1 | | |
| <i>Ailanthus excelsa</i> | 1 | 1 | | | 1 | | | 1 | | 1 |
| <i>Albizia amara</i> | 1 | 1 | | | 1 | | | | | |
| <i>Borassus flabellifer</i> | | 1 | | 1 | 1 | | | | 1 | 1 |
| <i>Tamarindus indica</i> | 1 | 1 | 1 | 1 | | | 1 | | | |
| <i>Mangifera indica</i> | 1 | 1 | | 1 | | 1 | 1 | | | |
| <i>Acacia leucophloea</i> | | 1 | | 1 | 1 | 1 | | | | 1 |
| <i>Cocus nucifera</i> | | | | 1 | 1 | | | | 1 | 1 |
| <i>Pithecellobium dulce</i> | 1 | 1 | | 1 | | | 1 | 1 | | 1 |

Table 3.1 (Continued)

| Species | End Uses | | | | | | | | | |
|-------------------------------|----------|----------|----------|-------|--------------|--------|-----------------|-------|-------------|---------|
| | Fodder | Fuelwood | Charcoal | Fruit | House constr | Timber | Medicinal value | Mulch | Handicrafts | Others* |
| <i>Melia azadirach</i> | 1 | 1 | | | 1 | 1 | | | | |
| <i>Zizyphus mauritiana</i> | | 1 | | 1 | | | | | | 1 |
| <i>Syzygium cuminii</i> | | 1 | | 1 | 1 | 1 | | | | |
| <i>Prosopis spicigera</i> | | 1 | | | | 1 | | | | 1 |
| <i>Dalbergia sissoo</i> | | 1 | | | 1 | 1 | | | | 1 |
| <i>Morus serrata</i> | 1 | 1 | | 1 | | 1 | | | 1 | |
| <i>Carissa spinaram</i> | | 1 | | 1 | | | 1 | | | 1 |
| <i>Leucaena leucoccephala</i> | 1 | 1 | | | | | | | | |

*Others include minor uses like fencing, tannin, gum etc.

Table 3.2 Use of Multipurpose Tree Species in the Study Villages

| Species | Village | | | | | | | | |
|--|-----------|-------------|-------|-------|----------|--------|-----------|-----------|------------|
| | Thennalur | Vadapalanji | Kadus | Yavat | Sahajpur | Satara | Shindwanc | Shiradhon | Suhkomajri |
| <i>Acadirachta indica</i> | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| <i>Acacia nilotica</i> var. <i>indica</i> | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| <i>Delonix elata</i> | 1 | | | | | | | | |
| <i>Thespesia populnea</i> | 1 | | | 3 | | | 3 | | |
| <i>Prosopis juliflora</i> | 1 | 1 | 3 | | 1 | | | | |
| <i>Albizzia lebbek</i> | 1 | 1 | | | | | | | |
| <i>Ailanthus excelsa</i> | 1 | | | | | | | | |
| <i>Albizzia amara</i> | 1 | | | | | | | | |
| <i>Borassus flabellifer</i> | 1 | 1 | | | | | | | |
| <i>Tamarindus indica</i> | 1 | 1 | | 1 | | 1 | 1 | 1 | |
| <i>Mangifera indica</i> | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| <i>Acacia leucophloea</i> | 1 | | | | | | | | |
| <i>Cocus n' ifera</i> | 1 | 1 | | | | | | | |
| <i>Morinda tinctoria</i> | 2 | 1 | | | | | | | |
| <i>Pithecellobium dulce</i> | 2 | 1 | | | | | | | |

Table 3.2 (Continued)

| Species | Village | | | | | | | | |
|--|-----------|-------------|-------|-------|----------|--------|-----------|-----------|------------|
| | Thennalur | Vadapaianji | Kadus | Yavat | Sahajpur | Satara | Shindwane | Shiradhon | Suhkomajri |
| <i>Commiphora berryii</i> | 2 | 1 | | | | | | | |
| <i>Euphorbia</i> spp. | | 1 | | | | | | | |
| <i>Ceiba pentandra</i> | | 2 | | | | | | | |
| <i>Ficus macrocarpa</i> | | 2 | | | | | | | |
| <i>Dalbergia multiflora</i> | | 1 | | | | | | | |
| <i>Leucaena leucocephala</i> | | | 2 | 1 | 1 | 2 | 1 | 2 | 2 |
| <i>Acacia nilotica</i> var. <i>cupressiformis</i> | | | 1 | 1 | | | 1 | 1 | |
| <i>Sesbania sesban</i> | | | 1 | 1 | 1 | 1 | 1 | | |
| <i>Melia azadirach</i> | | | 1 | 1 | 1 | | 1 | | |
| <i>Zizyphus mauritiana</i> | 2 | | 1 | 1 | | 1 | 1 | 1 | |
| <i>Syzygium cuminii</i> | | | 1 | 1 | | 2 | 1 | 1 | 1 |
| <i>Prosopis spicigera</i> | | | | | | | | | 1 |
| <i>Dalbergia sissoo</i> | | | | | | | | | 1 |
| <i>Morus serrata</i> | | | | | | | | | 1 |
| <i>Carissa spinarum</i> | | | | | | | | | 1 |
| <i>Acacia catechu</i> | | | | | | | | | 2 |

1: Regular use 2: Occasional use 3: Preferred use

as firewood. The wood has a high moisture content, is slow to dry and smokes while burning. There was an occasional mention of species like *Ceiba pentandra*, *Ficus macrocarpa* and *Acacia intsia*. But these species are virtually unseen except for a solitary tree in a garden or park. *Morinda tinctoria* was also used for firewood and timber. These species have not been included in the list of MPTS.

Sukhomajri also saw the use of some specific timber species as firewood but this was more the exception than the rule. Two households reported the use of *Anogeissus latifolia* as fodder and some the use of *Terminalia belerica* and *Cedrela toona* as firewood. *Acacia catechu*, Neem and *Acacia nilotica* were not used very much.

Ideotypes

Tamil Nadu

1. Azadirachta indica.

Products and service required (given in order of importance):

- Wood for construction of houses and agricultural implements
- woody branches for fuelwood and agricultural implements
- leaves for green manure and fodder
- fruit for extraction of oil for medicinal purposes
- shade for cattle.

Discussion: Extensively used and is one of the most valued trees. Found on wastelands, dry lands owned by farmers, homesteads and field margins. Regenerates naturally, withstands drought conditions, lopping and pruning is possible.

Management practices: Except in the middle of paddy fields, the tree is nurtured wherever it sprouts naturally. Side branches are pruned in order to have a long bole. Only very small branches are harvested for fuelwood since even small to medium sized branches have some use in the making of furniture, bullock carts, doors and windows. Leaves are valued for their insecticidal properties and trees are lopped for mulch in paddy fields. Effect of its shade on crops is negligible because it is lopped for mulch in the paddy growing season. Leaves are also lopped for fodder for goats but this is only secondary to use as mulch.

IDEOTYPE DESCRIPTION

Crown: Large but not too spreading, with many branches positioned high up on stem. Dense foliage.

Stem: Straight and thick with no branches upto a height of 10-15 ft. Long bole very

important because of its various but specific uses.

Roots: Deep rooted with no horizontally extending roots obstructing cultural operations on agricultural fields.

Response to management: Prolific regrowth after lopping for mulch.

Fruit: Big seeds for greater production of oil and prolific fruiting.

2. *Acacia nilotica* var. *indica*

Products and service required (given in order of importance):

- Wood and woody branches for fuelwood,
- wood for timber and construction purposes, agricultural implements and bullock carts
- leaves and pods as forage for goats and sheep
- gum

Discussion: Found on wastelands, dry lands owned by farmers, homesteads and field margins. Forest Department has a large plantation on the village tank foreshores. Regenerates naturally, withstands drought conditions, pollarding is possible.

Management practices: Pollarded for fuelwood. Medium to large branches are used for agricultural implements like the plough. Handles of various other small agricultural implements are made from smaller branches. Green branches are cut and goats eat the leaves and pods while the wood is being dried for use as fuelwood.

IDEOTYPE DESCRIPTION

Crown: No particular shape, but with many branches high up on the stem.

Stem: Single or multiple stem acceptable. Long and straight bole important.

3. *Delonix elata*

Products and service required: (given in order of importance):

- Leaves for mulch and fodder
- wood and woody branches for fuelwood and in the construction of wells.

Discussion: A leguminous tree grown on field bunds and boundaries and homesteads. Farmers believe the leaves are the mulch available for use in paddy fields. Wood does not

dry quickly and produces much smoke when burn't.

Management practices: Trees are pollarded at a height of about 2 m and green leaves are incorporated into the soil. Branches are used as fuelwood.

IDEOTYPE DESCRIPTION:

Crown: Lots of branches with dense foliage.

Stem: Single stem with no branches upto 10 ft.

Foliage characteristics: Larger sized leaves.

Response to management: Quick and good regrowth after pollarding.

4. *Thespesia populnea*

Product and service required (given in order of importance):

- Wood and woody branches for fuelwood, construction of houses and yoke for bullocks
- leaves as mulch and fodder
- roots and barkfor fuelwood

Discussion: Grown from cuttings and planted on farm bunds and boundaries, homesteads and dry lands not used for agricultural purposes. Growth rate of the tree is enhanced by regular pollarding. It is often susceptible to disease when pollarded leaving the wood hollow and weak.

Management practices: Leaves are lopped and applied as green manure for the paddy crop. Some shoots are allowed to grow as straight poles and harvested in about 2-3 years. Trees reaching the required girth and height are cut for making agricultural implements.

IDEOTYPE DESCRIPTION

Crown: Large with many b:anches and dense foliage.

Stem: Single stem with no branches upto a height of 10 ft.

Response to management: Prolific regrowth on pollarding and resistance to disease.

5. *Prosopis juliflora*

Product and service required (given in order of importance):

- Wood, woody branches and roots for fuelwood
- wood for charcoal
- pods for forage
- wood for agricultural implements
- thorny branches as fences

Discussion: Found on common lands, wastelands, uncultivated farm land, farm boundaries and homesteads. Coppices profusely. Quick germination from seeds dispersed by goats eating the pods.

Management practices: None

IDEOTYPE DESCRIPTION:

Stem: Single or multiple stems with many branches.

Root: In order to be able to dig the root out for sale and use as fuelwood and charcoal, roots should not grow very deep.

Fruit: Many pods, big and fleshy.

Other: Fewer or no thorns which are not poisonous.

6. *Albizia lebbek*

Product and service required (given in order of importance):

- Wood for agricultural implements and furniture
- leaves for mulch and fodder
- woody branches for fuelwood

Discussion: Though the wood is valued, superstition prohibits its use in house construction. Though the practice of using tree leaves as fodder is not widely practiced, in the summer months leaves of this tree is fed to livestock. Raised on farm boundaries, field bunds, homesteads.

Management practices: Pollarded for mulch and fodder in the agricultural and dry seasons. The main trunk is cut as and when the need for the heart wood arises.

IDEOTYPE DESCRIPTION:

Crown: Large but with only 4-5 major branches high on the stem, dense foliage.

Stem: Single stem and as long as possible without any branches low on the stem.

Deciduousness: Low period of leaflessness (presently it is about 30 days).

Roots: Deep rooted so that it does not keel over due to wind.

Response to management: Quick regeneration of leaves after pollarding for mulch and fodder.

7. *Ailanthus excelsa*

Product and service required (given in order of importance):

- wood and woody branches for house construction
- leaves for mulch and fodder
- wood for fuelwood and toy making

Discussion: There is good demand for the wood and leaves of this tree. But is not found in large numbers. Raised on farms as scattered trees.

Management practice: Pollarded for mulch.

IDEOTYPE DESCRIPTION:

Crown: Large with many branches high on the stem. Each branch should be quite thick. Dense foliage.

Stem: Straight and thick bole of 10-12 ft.

Foliage characteristics: Leaves should be bigger and thinner to be more useful as mulch.

Response to management: Quick regeneration after pollarding.

8. *Albizzia amara*

Product and service required (given in order of importance):

- Wood and woody branches for doors, windows and firewood
- leaves for fodder

Discussion: Considered to be quick growing (15-20 years to reach a width of 1.5 ft.) it is

found on wastelands in the village. Leaves are not used for mulch and is fed, occasionally, only to buffaloes. When the wood is seasoned, it is used for making doors and windows. Good fuelwood.

Management practice: Not known.

IDEOTYPE DESCRIPTIONS:

Stem: Single or multiple stems.

Foliage characteristics: Leaves should be larger so that it can be used as mulch.

Roots: Should be deep rooting.

9. *Borassus flabellifer*

Product and service required (given in order of importance):

- Trunk for house construction and fuel
- leaves for thatching roofs and weaving baskets
- sap for alcohol
- fruit

Discussion: Found scattered on farms, it is extensively used for house construction. It is raised from seed and is a very slow growing species.

Management practice: None.

IDEOTYPE DESCRIPTION:

Quality of wood: The heart wood should be stronger.

Fruit: Should fruit earlier than the average tree and the fruit should be bigger.

Other: The tree should grow more quickly.

10. *Tamarindus indica*

Product and service required (given in order of importance):

- Pods for edible pulp
- wood for fuelwood, timber and charcoal
- leaves for fodder seed for extraction of starch for textile and paper production

Discussion: Greatly desired by both landed and landless people. Found on farms as scattered trees and on homesteads. Generally its products are purchased because there aren't enough trees.

Management practice: Grown almost exclusively for its pods, the wood value is realized only after the tree stops fruiting.

IDEOTYPE DESCRIPTION

Crown: Round, large canopy with many branches. Fruit set is on the branches and to enhance the production of fruit, there should be many branches.

Stem: Large with no branches upto a height of 6 ft. on the stem.

Fruit: Production should begin in the fourth or fifth year. There should be a greater yield of fruit and a good yield every year instead of the current cyclical pattern in yield. The season when it fruits could be longer. The fruit itself should be bigger and fleshier.

11. Mangifera indica

Product and service required (given in order of importance):

- Fruit
- wood for timber and fuelwood
- leaves as fodder

Discussion: There are few mango trees in the village. Most farmers would like to plant mango trees primarily for its fruits.

IDEOTYPE DESCRIPTION:

Crown: Large canopy with many branches, not very high on the stem.

Stem: Straight with no low branches (to be used as timber after the tree no longer bears fruits).

Fruit: The tree should yield fruit in the fourth or fifth year and on a yearly basis. Fruits should be large and fleshy.

12. Acacia leucoploea

Product and service required (given in order of importance):

- wood for fuelwood, agricultural implements and house construction
- pods for forage
- bark in the making of alcohol

Discussion: Found on common lands, wastelands and scattered on farm lands. There is profuse germination of seeds in the monsoon season. The seeds are dispersed by livestock after they eat the pods. The pods provide a high protein supplement to fodder in the dry season.

Management practices: Side branches are pruned so that the tree has a clear and straight bole. Pods are harvested and fed to livestock.

IDEOTYPE DESCRIPTION:

Crown: Large with many branches high on the stem.

Stem: Long, clear bole with no branches upto a height of 20 ft.

Response to management: Should be resistant to disease when side branches are pruned.

Other: Less thorns.

13. Cocus nucifera

Product and service requirements (given in order of importance):

- Fruit
- wood for house construction
- leaves for thatching and weaving
- other minor produce

Discussion: A tree of value, both commercial and otherwise. Its uses are numerous and all households would like some coconut trees in their homestead.

Management practices: None.

IDEOTYPE DESCRIPTION:

Stem: Tall and strong (for its use in house construction).

Fruit: Fruit set should be earlier than it is now and in large quantities.

14. *Pithecellobium dulce*

Product and service required (given in order of importance):

- fruit
- leaves for fodder and mulch
- wood and woody branches for fuelwood

Discussion: Tolerates drought and grows on a variety of soils. Raised by farmers from seed, it is grown on field margins, scattered on fields, homesteads, common lands and privately owned wastelands. The tree is liked because of its fruit and use as fodder.

Management practices: Though it is preferred for its fruit, farmers use it for both firewood and fodder. There is thus no particular management practice.

IDEOTYPE DESCRIPTION:

Crown: Large with many branches.

Stem: Of medium length before branching so that the tree is not browsed by cattle.

Fruit: Big pods and sweet in taste.

Roots: Deep roots required so as not to obstruct cultural operations on the field.

Response to management: Since the tree is lopped for its leaves and woody branches, it should put on fresh growth quickly.

Maharashtra

1. *Azadirachta indica*

Product and service required (given in order of importance):

- Wood and woody branches for agricultural implements, bullock carts, house construction and fuelwood
- seeds for extraction of medicinal oil and neem cake
- leaves for fodder

Discussion: Tolerates drought and grows on a variety of soils. Raised by farmers from seed, it is grown on field margins, scattered on fields, homesteads, common lands and privately owned wastelands. The shade cast by a fully grown tree is tolerated because of the value of the wood. Farmers appreciate the insecticidal properties of the tree.

Management practices: Valued for its wood, it is managed almost exclusively for timber. Side branches are pruned in the early growing stages to have a long clear bole. Since it is often planted on field bunds and boundaries of farms, side branches are lopped every year to reduce the effect of shade on the crops. Only small branches are used as fuelwood.

IDEOTYPE DESCRIPTION:

Stem: Long, clear bole with no branches low down on the stem.

Fruit: Bigger seeds for increased quantity of oil extracted.

Roots: Deep roots required so as not to obstruct cultural operations on the field.

Response to management: Depending on the planting niche, the canopy shape changes. For planting in homesteads and open spaces, a large crown with many branches is preferred; plants on field margins, require a tall and narrow crown. Pruning, lopping and pollarding should not affect the quality of wood.

2. *Acacia nilotica var. indica*

Product and service required (given in order of importance):

- Wood and woody branches for agricultural implements, bullock carts and fuelwood
- pods (and leaves occasionally) as fodder for sheep and goats
- bark for tannin in curing leather

Discussion: Both drought resistant and able to withstand occasional water logging. Found on common lands and farm boundaries. The effect of its shade on crops is thought to be severe and farmers believe that the flowers and leaves are toxic. Not used for house construction because the wood is prone to an insect attack which leaves the wood hollow.

Management practice: Pruned and lopped for long clear bole upto a height of 10 ft. On fields, trees are lopped regularly to reduce the effect of shade. Pods are harvested and fed to goats and sheep.

IDEOTYPE DESCRIPTION:

Stem: Single or multiple stems acceptable. Should be straight and free from smaller branches low on the stem(s).

Response to management: Crown shape changes according to the planting niche. Large and many branched canopy for trees in open spaces and a narrow one for trees planted on fields.

Manipulation of tree in early growing stage should not affect the quality of the wood.

Root: Deep roots required to prevent tree from falling over and minimize obstruction to cultural operations.

Pods: Longer, fleshier and in greater number.

Other: Reduction in the number of thorns or their size. Improve the keeping quality of the wood.

3. *Acacia nilotica* var. *cupressiformis*

Product and service required (given in order of importance):

- wood and woody branches for agricultural implements, timber, house construction and fuelwood.
- leaves for fodder.

Discussion: Preferred to *Acacia nilotica* var. *indica* because of its canopy shape. Grows erect and ideally suited for areas with annual rainfall between 200 and 400 mm. Less thorny than the other *Acacia*.

Management practice: None

IDEOTYPE DESCRIPTION:

Crown: Narrow with branches growing almost parallel to the main stem.

Stem: Long bole with no branches low on the stem.

4. *Leucaena Leucocephala*

Product and service required (given in order of importance):

- leaves, green branches and green pods as fodder
- wood for fuelwood

Discussion: A fast growing tree being extensively planted under social forestry schemes. Grown on farm boundaries, field margins, wastelands and sometimes in association with crops. Farmers want to now plant it only on wastelands because of the weed like growth of seedlings.

Management practice: Lopped regularly for fodder.

IDEOTYPE DESCRIPTION:

Crown: Large crown with many branches when planted on wastelands. Narrow crown if planted on farm boundaries and field bunds.

Stem: Single or multiple stems acceptable.

Foliage: Should be dense and leaves should be of bigger size.

Fruit: Less pods because profuse seeding a nuisance on fields.

5. *Sesbania sesban*

Product and service required (given in order of importance):

- leaves for fodder
- wood as a temporary construction material
- wood and woody branches as fuelwood

Discussion: Found on farm boundaries, field margins, in combination with crops and on common lands. There is a good demand for its fodder from urban buffalo and goat owners.

Management practice: Managed as a short term tree crop for 2-3 years. Side branches are lopped regularly for fodder, and at the end of 3 years the tree is harvested, to be used either as poles for constructing temporary sheds or fuelwood. The tree loses its vigour if the foliage is harvested continuously for more than a year.

IDEOTYPE DESCRIPTION:

Crown: Narrow crown to avoid shading agricultural crops, but dense foliage.

Stem: Single or multiple stems acceptable with no branches low on the stem(s).

Response to management: Good regrowth of foliage after lopping for fodder.

Other: Improve burning quality of wood.

6. *Melia azadirach*

Product and service required (given in order of importance):

- wood for agricultural implements, bullock carts and house constuction

- woody branches for fuelwood
- leaves as fodder for sheep and goats

Discussion: Fast growing even in drought conditions. In 3-4 years the tree achieves a girth which is sufficient for house construction. It is preferred to Acacia for making agricultural implements because the wood is not attacked by insects. Found on field margins, scattered on fields and on common lands.

Management practice: Side branches are pruned in order to have a tree with a clear bole and minimize the effect of shade on crops.

IDEOTYPE DESCRIPTIONS:

Crown: Medium sized canopy with a few branches high up on the stem.

Stem: Single stem, straight with no branches up to a height of 12 ft.

Roots: deep rooting to avoid obstruction during cultural operations.

7. *Zizyphus mauritiana*

Product and service required (given in order of importance):

- fruit
- wood and woody branches for fuelwood
- leaves as fodder for sheep
- green and woody branches as fencing material for sheep and goat pens

Discussion: Found on wastelands, common lands and on farms. Good demand for fruits.

Management practice: The branches are lopped every year for better yield of fruit. Leaves from the lopped branches are fed to sheep and goat and the wood used either as fences or fuelwood.

IDEOTYPE DESCRIPTION:

Crown. Large with many branches for increased yield of fruit.

Stem: Multiple stems with many branches.

Fruit: Fruit must be large, fleshy, sweet and red/green in colour. They should be less susceptible to insects and keep for a longer period than the average fruit now.

Other: Less number or no thorns.

8. *Syzygium cuminii*

Product and service required (given in order of importance):

- fruit
- wood and woody branches for fuelwood
- wood for timber, house construction

Discussion: Mostly found on common lands and wastelands as the effect of shade on crops is very severe. Farmers would like to plant on farm boundaries if the effect of shade can be minimized. Fruits are of most value as the quality of wood is not good.

Management practice: None

IDEOTYPE DESCRIPTION:

Crown: Narrow to moderate sized canopy to minimize shade to crops.

Stem: Single or multiple with branches moderately high on stem(s).

Fruit: Large and sweet. Fruit set should start earlier than it is now on the average tree.

9. *Mangifera indica*

Product and service required (given in order of importance):

- fruit
- wood for house construction
- woody branches for fuelwood
- leaves as fodder for goats

Discussion: There are few mango trees in these village. Most farmers would like to plant mango trees primarily for its fruits.

IDEOTYPE DESCRIPTION:

Crown: Large canopy with many branches, not very high on the stem.

Stem: Straight with no low branches (to be used as timber after the tree no longer bears fruits).

Fruit: The tree should yield fruit in the fourth or fifth year and on a yearly basis. Fruits

should be large and fleshy.

10. Tamarindus indica

Product and service required (given in order of importance):

- Pods for edible pulp
- wood for fuelwood, timber and charcoal
- leaves for fodder.

Discussion: There are few trees at present. Found on farms as scattered trees and on homesteads.

Management practice: Grown almost exclusively for its pods, the wood value is realized only after the tree stops fruiting.

IDEOTYPE DESCRIPTION

Crown: Round, large canopy with many branches. Fruit set is on the branches and to enhance the production of fruit, there should be many branches.

Stem: Large with no branches upto a height of 6-8 ft. on the stem.

Fruit: Production should begin in the fourth or fifth year. There should be a greater yield of fruit and a good yield every year instead of the current cyclical pattern in yield. The season when it fruits could be longer. The fruit itself should be bigger and fleshier.

11. Thespesia populnea

Product and service required (given in order of importance):

- wood for agricultural implements, bullock carts and house construction
- woody branches for fuelwood

Discussion: There is no experience of growing this species in these villages. However, households would like to grow it.

IDEOTYPE DESCRIPTION:

Crown: Moderately large canopy with few branches high on the stem to minimize shading the crops.

Stem: Single with no branches upto a height of 10-12 ft.

12. *Prosopis juliflora*

Product and service required (given in order of importance):

- wood and woody branches for fuelwood
- pods as fodder

Discussion: Growing at present in only one of the 6 villages on the river banks and wastelands. Women of another village had heard of it and were keen to grow it.

Management practice: Branches are cut whenever fuelwood is needed.

IDEOTYPE DESCRIPTION:

Stem: Multiple stems with many branches.

Response to management: Prolific regrowth on cutting.

Sukhomajri

1. *Syzygium cuminii*

Product and service required (given in order of importance):

- fruit
- wood and woody branches for fuelwood
- wood for timber, house construction

Discussion: Mostly found in the common forest, on homesteads and as scattered trees on large farmers lands. Fruits are of most value and though the quality of wood is not very superior it is used as fuelwood and small timber.

Management practice: None

IDEOTYPE DESCRIPTION:

Crown: Moderate sized canopy with many branches.

Stem: Single or multiple with branches moderately high on stem(s).

Fruit: Large and sweet. Fruit set should start earlier than it is now on the average tree.

2. *Morus serrata*

Product and service required (given in order of importance):

- wood and woody branches for fuelwood
- fruit
- green branches for weaving baskets

Discussion: Moderate to large tree found in mixed lower western Himalayan forest at 1,200 - 2700 m elevation. Though it can be used for fodder, timber and fuelwood, it is only for fuelwood. Wood is excellent for furniture, carving, cabinet making, sporting goods, toys and agricultural implements. Its fruit are sweet and edible. It is found growing in the common forest and scattered on farmers fields.

Management practice: None

IDEOTYPE DESCRIPTION:

Crown: Moderate sized canopy with many branches.

Stem: Single or multiple with branches moderately high on stem(s).

Fruit: Large and sweet. Fruit set should start earlier than it is now on the average tree.

3. *Carissa spinarum*

Product and service required (given in order of importance):

- wood and woody branches for fuelwood
- wood for handles, combs and other household articles
- fruit

Discussion: The spiny bushes of this hardy species can be found growing in the forests and wastelands of the sub Himalayan region. It can grow on poor soils. Though it has many medicinal uses, it used most often as fuelwood. Its fruit are edible and rich in protein.

Management practice: None

IDEOTYPE DESCRIPTION:

None given

4. *Prosopis spicigera*

Product and service required (given in order of importance):

- wood for fuelwood
- wood for making agricultural implements
- leaves for fodder

Discussion: A thorny tree it grows 5-9 m high and has an open crown. Because of its deep taproot, it does not compete with annuals, which may be grown close to its trunk. Its wood is preferred for cooking and its fodder value is high.

Management practice: None

IDEOTYPE DESCRIPTION:

None given

5. *Dalbergia sissoo*

Product and service required (given in order of importance):

- wood for furniture, agricultural implements, cart wheels
- wood for house construction
- wood and woody branches for fuelwood

Discussion: Large, moderately fast growing tree that occurs through out the Indian sub continent. It is grown as irrigated plantations and as scattered trees on farmers fields. Strong development of root suckers and runners make the species popular as a living barrier against soil erosion.

Management practice: None given

IDEOTYPE DESCRIPTION:

Crown: Large with many branches but high on the stem.

Stem: Single, straight with no branches low on the stem, little taper.

Roots: Deep with little lateral spread.

Chapter 4

Prospects for Tree Planting

The study makes it fairly obvious that trees cannot be divorced from a production system involving crop production and animal husbandry. It also reveals that every farm household contains a combination of different tree species, each serving distinct purposes. The particular species mix is determined by prevailing tradition, area and climatic conditions. Trees in the farm and home garden were once sufficient to meet all the requirements of the household, today there are increasing shortages of fodder, fuelwood and timber. Efforts by government and non government bodies are on to help farm households become self sufficient again. But what are the prospects for more trees to be planted, some the same as those that have been planted for generations, others exotic?

Preferences and Opportunities

Farmers do not generally plant tree species specifically for fuel or fodder. There is a scarcity of fuelwood even in villages where *Prosopis* has done much to alleviate the scarcity of cooking fuel. The use of species barely suitable for burning in Vadapalanji is testimony to the fact that despite the proliferation of *Prosopis* there is a shortage of fuelwood. There can be no doubt either that there is a growing shortage of fodder too. Crop residues compete for use either as fuelwood or fodder. Despite this there is clearly a contradiction between farmers needs and perceptions. Farmers give top priority to timber species followed by mulch or fruit species.

A large number of tree species that farmers use and prefer are MPTS; fuel can be obtained by cutting the branches of these timber or fruit trees, or by felling unproductive fruit trees. Fuelwood is also procured from shrubs and tree species that naturally grow in the area. The prospects for timber, fruit and mulch trees that are MPTS are very good. If there are adequate number of these trees to provide households with the desired end use the requirement for fuelwood will automatically be met.

The same however cannot be said about fodder. Farmers still need to be persuaded that tree fodder can fill the gap between demand and supply of traditional fodder. Fodder species with alternate uses will always prefer the competing use to fodder. A specific case in point is the use of leguminous trees as mulch in Tamil Nadu. Extension efforts by concerned agencies needs to be stepped up till farmers accept that tree fodders are good supplements to traditional fodders.

Little needs to be said about the potential for fruit trees. Fruit trees come a close second to farmers' preference for an MPTS that provides, first and foremost timber. The growing market for fruit make MPTS which yield fruit specially attractive. Varieties like mango, coconut and tamarind already have an established market potential. Forest species

like *Zizyphus*, mulberry and *Syzygium* are experiencing a growing urban demand.

Constraints

Lack of seedlings is perceived to be the major constraint to farmers planting trees. The Forest Dept., while doing its best, is neither able to supply seedlings entirely of the farmers choice nor in the numbers that farmers want. Much has already been written about the choice of seedlings supplied by the Forest Dept., about their bias towards species of commercial value and their distribution methods. But in favour of the Forest Dept. it also has to be said that the task of supplying all the species preferred by farmers is a mammoth one and requires far more resources, both financial and personnel, than they have or will have, given the existing government policy.

Seedlings on sale from private nurseries are expensive and constrain the buyer from purchasing the number he requires. This is particularly true of fruit species which the Forest Dept. supplies only in limited quantities. Beyond the limitation of inadequate resources, the Forest Dept. believes that the supply of fruit seedlings falls outside of its ambit. The Horticulture Dept. is constrained by its budget and cannot meet the demand.

The distance from the nearest nursery and the difficulty of transporting seedlings also prevents the farmer from procuring seedlings. Protection of seedlings from grazing cattle is yet another constraint to farmers planting trees.

Agriculture is of primary importance in these villages. Few resources are likely to be diverted from this activity. Land, water and labour are all concentrated on growing food crops. Tree planting and the agricultural season compete for labour resources during the monsoons. Labour requirements for tree planting is relatively low when compared to agriculture yet, few households are willing to divert their diminishing resources to trees. For better and quicker growth and perhaps even survival, saplings require to be watered during the dry months. Most of the villages suffer from shortage of water. Even drinking water is scarce in the dry months. Availability or rather the unavailability of land is of course, the most important constraint to landless households and small farmers.

Concluding Remarks

Despite all the above mentioned constraints, farmers are willing to try and overcome them and plant trees. The Government of India has social forestry programmes which anticipate these problems and try to find solutions for them. But lack of political will is perhaps the biggest hurdle that farmers face. Farmers are aware of the value of trees and will plant them, with a little help.

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Appendix 1

Names and Addresses of the Researchers and the Sample Villages

| <u>Name and Address</u> | <u>Village, State</u> |
|---|--|
| 1. Dr. Kanchan Chopra Professor Institute of Economic Growth University Enclave Delhi 110 007 | Sukhomajri, Haryana |
| 2. Dr. L Tharabai Professor Dept. of Sociology Madurai Kamaraj University Palkalai Nagar Madurai 625 021 | Vadapalanji, Tamil Nadu |
| 3. Dr. C. Thangamuthu Professor Dept. of Economics Bharathidasan University Tiruchirapalli 620 024 | Thennalur, Tamil Nadu |
| 4. Dr. N. G. Hegde Vice President Bharatiya Agro Industries Foundation 'Kamadhenu' Senapati Bapat Road Pune 411 016 | Kadus, Satara, Shiradhon, Shindwane, Yavat, Sahajpur; Maharashtra Thadasur, Thadkod, Manki, Malagi, Kibbenhallipalya, Holemannur; Karnataka |

Area of the village: 160 ha

Land Use Pattern

Land under forests (ha): Nil
Total agricultural land (ha): 80
Irrigated land (ha): 50
Culturable wasteland (ha): 10
Land not available for cultivation (ha): 20
Pasture land (ha): Nil

Crops grown: Paddy, Groundnut, Banana, Vegetables

Soil type: Shallow sandy loam of recent origin

Topography: Flat

Annual rainfall: 575 mm (ave for 1984-86)

Distribution of rainfall: Sept, Oct and Nov (NE Monsoon)
June, July and Aug (SW Monsoon)

Minimum and maximum temperatures: mean max. 34 deg C
mean min. 24.3 deg C

3. Village name: Sukhomajri
Taluka, District and State: Kalka, Ambala, Haryana

Population

Total: 538 Male: 298 Female: 240

No. of households: 83

Area of the village:

Land Use Pattern

Land under forests (ha): 493
Total agricultural land (ha): 92.15
Irrigated land (ha): 10.23
Culturable wasteland (ha): n.a
Land not available for cultivation (ha): n.a
Pasture land (ha): Nil

Crops grown: Maize, Sugarcane, Wheat, Vegetables, Fodder grasses

Soil type: Sandy loam on surface, loam in lower layers

Topography: Undulating, slope upto 10%

Annual rainfall: 1137 mm

Distribution of rainfall: 82% of rainfall between June and Sept.

Minimum and maximum temperatures: June: Max. 43 deg C
Min. 20.2 deg C
Jan.: Max. 23 deg C
Min. 2 deg C

4. Village name: Sahajpur
Taluka, District and State: Daund, Pune, Maharashtra

Population

Total: 1294 Male: 375 Female: 360 Children: 550

No. of households: 327

Area of the village: 796.8 ha

Land Use Pattern

Land under forests (ha): 12.4
Total agricultural land (ha): 606
Irrigated land (ha): 560
Culturable wasteland (ha): Nil
Land not available for cultivation (ha): 166.4
Pasture land (ha): 12

Crops grown: Wheat, Sugarcane, Vegetables, Sorghum, Groundnut
Pearl Millet, Fruits

Soil type:

Topography:

Annual rainfall: 463 mm, coeff of var. 28.61%, no. of rainy days 31

Distribution of rainfall:

Minimum and maximum temperatures:

5. Village name: Yavat
Taluka, District and State: Daund, Pune, Maharashtra

Population:

Total: 7167 Male: 3717 Female: 3450

No. of households: 2829

Area of the village: 4121 ha

Land Use Pattern

Land under forests (ha): 186

Total agricultural land (ha): 3054

Irrigated land (ha): 1034

Culturable wasteland (ha): 350

Land not available for cultivation (ha): 881

Pasture land (ha): Nil

Crops grown: Wheat, Sugarcane, Vegetables, Sorghum, Groundnut
Pearl Millet

Soil type:

Topography:

Annual rainfall: 463 mm, coeff of var. 28.61%, no. of rainy days 31

Distribution of rainfall:

Minimum and maximum temperatures:

6. Village name: Shiradhon
Taluka, District and State: Kallam, Osmanabad, Maharashtra

Population

Total: 7000 Male: Female:

No. of households: 1246

Area of the village:

Land Use Pattern

Land under forests (ha): 172

Total agricultural land (ha): 519

Irrigated land (ha): 240

Culturable wasteland (ha): 100
Land not available for cultivation (ha): 20
Pasture land (ha): 132

Crops grown: Pearl Millet, Sunflower, Pigeonpea, Sugarcane

Soil type: Black

Topography: Undulating

Annual rainfall: 810 mm, coeff of var. 24.22%, no. of rainy days 51

Distribution of rainfall:

Minimum and maximum temperatures:

7. Village name: Kadus
Taluka, District and State: Rajgurunagar, Pune, Maharashtra

Population

Total: 9632 Male: 4789 Female: 4843

No. of households: 1367

Area of the village: 4381 ha

Land Use Pattern

Land under forests (ha):
Total agricultural land (ha): 3281
Irrigated land (ha): 714
Culturable wasteland (ha):
Land not available for cultivation (ha): 1025
Pasture land (ha): 6

Crops grown: Sorghum, Pearl Millet, Groundnut, Potato, Vegetable,
Onion, Wheat

Soil type:

Topography: undulating

Annual rainfall: 750 - 1250 mm

Distribution of rainfall: 4 Months

Minimum and maximum temperatures:

8. Village name: Satara

Taluka, District and State: Aurangabad, Aurangabad, Maharashtra

Population

Total: 2176 Male: 1119 Female: 1057

No. of households: 387

Area of the village: 2793.82 ha

Land Use Pattern

Land under forests (ha): 67.8

Total agricultural land (ha): 1597.45

Irrigated land (ha): 80.15

Culturable wasteland (ha): 378.26

Land not available for cultivation (ha): 750.31

Pasture land (ha):

Crops grown: Permal Millet, Sorghum, Sugarcane, Cotton,
Sunflower, Vegetable, Maize, P.Pea, Mung

Soil type: Light and Medium black soil

Topography: Hilly

Annual rainfall: 724 mm

Distribution of rainfall: June to Sept.

Minimum and maximum temperatures: 6.2 and 43.4 deg C

9. Village name: Shindawane

Taluka, District and State: Haveli, Pune, Maharashtra

Population

Total: 2361 Male: 1252 Female: 1109

No. of households: 600

Area of the village: 2009 ha

Land Use Pattern

Land under forests (ha): 239

Total agricultural land (ha):1531

Irrigated land (ha): 1000

Culturable wasteland (ha): 531

Land not available for cultivation (ha): 239

Pasture land (ha):

Crops grown: Pearl Millet, Sorghum, Sugarcane, Wheat,
Vegetable, Onion

Soil type:

Topography:

Annual rainfall: 500 mm

Distribution of rainfall:

Minimum and maximum temperatures: