A SURVEY OF OCCURRENCE AND SOME BIOLOGICAL ASPECTS OF RARE, INDIGENOUS AND MULTIPURPOSE TREE SPECIES IN DRY ZONE HOMEGARDENS IN MONERAGALA DISTRICT

By

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DECLARATION

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AFFECTIONATELY DEDICATED TO
MY EVER LOVING
PARENTS AND SISTERS

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ABSTRACT

With the ever-increasing demand for timber resources more and more emphasis is placed on the forest plantations to bridge the gap between supply and demand. However the indigenous tree species are now getting more and more scarce as there is no concerted attempt to conserve and propagate them.

The survey was designed with the objective of assessing the prevalence, biology and potential for planting indigenous, multipurpose tree species in dry zone homegardens.

The project was conducted in Moneragala District. After a reconnaissance survey five traditional villages were selected; Illukpitiya, Dikyaya, Udagama, Mahagodayaya and Pettaganwela. 50 homegardens were selected randomly. The survey was carried out by a questionnaire survey, informal and formal interviews with homegardeners, village leaders etc. Through the questionnaire acquired information about the prevalence and ages of the tree species as well as people's indigenous knowledge about growth rates of trees (approximately), flowering fruiting and harvesting seasons, harvesting patterns, age of 1st fruiting, uses of trees, religious beliefs towards these trees and their attitudes towards conservation of these species. The most important 12 indigenous tree species were selected by screening all the questionnaires, which occur rarely but provide multiple benefits as food, fodder, timber, fuelwood, medicine and ecological and environmental improvements.

The results obtained from the survey indicate that is a 91.66% of willingness for planting these trees. Among the 50 homegardens 80% of homegardens contained *Chloroxylon swietenia*. *Schleichera oleosa* tree had the second highest occurrence of 70%. The presence of selected indigenous tree species was approximately 4 trees/ha and most of them are propagated naturally. The highest occurrence of indigenous tree species could be observed in Illukpitiya and the lowest in Dikyaya. The family monthly income was most being between Rs 1000-3000. Considering the education level of the people, 38% of the people had gone to school only up to year five. 4% had not gone to school at all. However, the prevalence of indigenous knowledge in these communities on the biology, uses was quite high and they had a good understanding about the need for conservation of these tree species.

CONTENTS

ABBREVIATIONS

CFP	Community Forestry Project
FSMP	Forestry Sector Master Plan
ha	hectare
ICRAF	International Council for Research in Agroforestry
m^2	square meter
NADSA	National Agricultural Diversification and Settlement Authority.
NARESA	Natural Resources, Energy and Science Authority of Sri Lanka
NGOs	Non-governmental organizations
PFP	Participatory Forestry Project
SALT	Sloping Agriculture Land Technology
SCOR	Shared Control of Natural Resources

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CHAPTER 1

1.0 INTRODUCTION

It is well known that the area of natural forest cover has been declined drastically during the last 100 years (Hewage, 1998). The rate of deforestation in Sri Lanka was about 42000 ha per annum for the 1970's and 1980's (Pushparajah, 1987). The average annual percent declination of total forest cover in 1980-1990 and 1990-1995 is subsequently 1.0% and 1.1% respectively. The average annual percent depletion of natural forests in 1980-1990 and 1990-1995 was 1.4% & 1.2% respectively (World Resource Institute, 1998).

In the dry zone intensive felling and shifting cultivation are the major causes that accelerate the forest clearance. Because of the illicit felling most of the indigenous tree species grown in the dry zone gradually disappear, followed by replacing the lands with thorny shrubs such as Andara (*Dichrostachys cinera*) Hin Katupila (*Flueggea leucopyrus*), and the like forming an unproductive scrub (Rodrigo, 1990).

The alarming rate of deforestation and forest degradation has caused grave environmental problems, as well as regional shortages of fuel wood and timber.

Today, reforestation is indispensable for nature conservation and environmental improvement and in particular to preserve valuable plants that are in danger of being such as illicit felling for timber and fuel wood (Rodrigo, 1990). In the case of wood supply, which is derived from non-forest resources (70%) can be expected to continue for the next 25 years (FSMP, 1995).

In order to mitigate drastic shortages and to relieve pressure on natural forest resources it has become necessary to devise alternative strategies for sustainable forest plantation development. Establishment of man made forest plantations help to compensate this loss of forest cover and to meet part of the present and future demand of timber, fuel wood and other forest products (Kaluthota et al., 2000).

It has been realized the Forest Department alone cannot create the tree cover necessary to meet all of the needs without rural community participation. Only the using of state land for plantation is not enough. Under these circumstances, ways and means have to be found for increasing the part played by the rural community in tree growing especially in private lands, home gardens and the like through the application of Agroforestry systems.

Our ancestors who had inseparable relationship with indigenous trees endowed with a wealth of information about tree biology and its uses. These people have utilized indigenous trees in a sustainable manner. Therefore they had conserved indigenous tree species in their home gardens. But unfortunately with the indiscriminate application of exotic species in to forest plantations has caused grave environmental problems and gradually wiped out the indigenous tree species from forest plantations as well as from homegardens.

In Sri Lanka most of forest plantation programmes were mainly intended to introduce species as effective monoculture plantation, which at later stages, created so many side effects. Therefore, it is of primary importance to use indigenous tree species well adapted to our environment. It is socio-economically viable to introduce indigenous tree species in to plantation programmes in home gardens that would provide numerous benefits to rural people. It may also give a higher contribution to conserve these tree species as well.

1.1 Objectives of the study

The objective of this study is to assess the prevalence, biology and potential for planting indigenous, multipurpose tree species in dry zone home gardens.

CHAPTER 2

2.0 LITERATURE REVIEW

2.1 Homestead agroforestry system

Traditionally people are growing different trees, shrubs and vegetables, in a mixture, on their homesteads, based on their manifold needs and generation old experience. The arrangement of different tree species around the house, taking into account the needs for wind-break, shade and open space as well as the distribution of different shrubs and annual vegetables in different micro niches, are quite appropriate and time proven (Abedin and Quaddus, 1988).

The history of cultivating trees in home garden, social tree planting and management of forests, and protection and appreciation of wildlife and the beauties of nature in Sri Lanka go back to over 25 centuries. In chronicles there are references to social tree planting practices, well-organized village communities, and home gardens planted with flowering and fruit bearing trees (Nanayakkara, 1991).

Sri Lanka's home gardens are frequently sited as a highly developed example agroforestry. Their composition in different localities is influenced greatly by climate and the availability of irrigation water; in the wet zone large number of tree species is cultivated. But in dry zone Teak is commonly grown as a timber species (Jewell, 1995). Most of the home gardens in Sri Lanka are less than a quarter of a hectare in size (Senaratne & Amarasinghe, 1996).

Since the primary objective of a home garden is to produce a range of commodities primarily for the consumption by the farm family, all the operations leading to the sustenance of a home garden are performed within and around the family (Jejwani, 1994). But this can be further expanded in order to fulfil other national requirements also.

Deforestation is, however still a serious problem in Sri Lanka, having an adverse impact on forest cover biodiversity. Here home gardens have become a veritable storehouse of the nations plant genetic resources. The development of a home garden over time is usually ad-hoc, and fashioned to the needs of the farmer and the family. The trees grown are often 'multipurpose', providing the rural community with various subsistence needs, i.e., food, fruit, medicinal products and fodder in addition to wood (Weerakoon, 1996).

The home gardens vary in structure and composition with climate and elevation. What little research has been undertaken on forest gardens in Sri Lanka has focused on those below 1,000 m elevation – the 'mid country' Kandyan spice gardens (Jacob and Alles, 1987).

A fully developed home garden affords excellent conservation possibilities similar to that of a natural forest. However in most home gardens haphazard placement of trees and other crop denies these benefits; more careful, and more scientific arrangement of trees and management of canopies can increase production (NARESA, 1991).

2.1.1 Homegarden system in other countries

The home garden system is practiced very extensively in the tropical high rainfall areas in India, Sri Lanka, Thailand, Malaysia, Indonesia, Papua New Guinea, and in South and South East Asia (Jejwani, 1994).

Homegarden system is a common feature especially in South East Asian countries than the rest. In Bangladesh this system is widely used by rural people as a system of combining crops, trees, livestock, fish and poultry. The same situation can be observed in Indonesia and Philippines. In Vietnam homegardens are commonly found in many areas. In these gardens, MPTS are planted for fruits, fuel wood and timber. Vietnamese farmers are well versed in establishing and maintaining these homegardens and derive considerable economic benefits. Management of homestead gardens is quite common in South Eastern part of Nigeria (Bandyopadhyay, 1997). Not only the tropical countries but also the temperate countries apply this system as one of the best method for grinding poverty from rural community.

2.1.2 Contribution to country's wood demand

According to FSMP (1995), about 70% of the supply of construction and industrial wood comes from home gardens, especially Kandyan home gardens. Home gardens, after a highly diversified and economically viable form of land use, found around a house. Home gardens will produce on average about 0.95m3 of saw logs & 0.5m3 of poles per hectare per year. The estimates are based on the survey conducted under the 1986 Forestry Master Plan. FSMP further emphasized on home garden systems because of its effectiveness as one sort of ex-situ conservation measures that can be achieved sustainable.

Sri Lanka's increasing wood demand could be met or at least strongly supplemented, by enhancing home garden agoforestry system and increasing land use in order to expand the various forms of home gardens. However the availability of suitable lands for home gardens and other agroforestry practices is a main issue (Weerakoon, 1996).

2.1.3 Benefits to local people

The benefits of agroforestry and social forestry to local people mostly to the rural poor are many. With expanding the populations and difficulty found in land space for classical forestry practice and land space for permanent agriculture, rural people find it more and more difficult to obtain their needs of fuel wood, domestic wood, fodder and most importantly of all their food. Agroforestry and social forestry as alternate forestry practices solves to some extent this problem faced by the rural people. Broadly speaking benefits could be categorized as:

- Jobs and income
- Household consumption
- Environmental effects

The first increases incomes and job opportunities. The second provides materials for consumption at household level or on the farm, and the third improves the environment. Social forestry will thereby save the needs of rural folk more than any other development process in rural areas. In addition to these direct benefits certain indirect benefits also accrue to local populations and their environments by Agroforestry and social forestry programmes. Thus it is clear that appropriate agroforestry practices will alleviate the acute socio-economic problems of rural people living tropical countries especially the poorest of the poor (Nanayakkara,1991).

2.2 Homegardens' expansion

Home gardens have been increasing every year with hardly any government support. Their expansion is limited mainly by the availability of suitable land. There is a little room for expansion of home gardens in the wet zone, but there is room in dry zone, provided the farming can be protected from damage caused by wildlife, particularly elephants. Any how FSMP (1995) has revealed that one of the results of widespread interest in home garden

and the population increase in Sri Lanka, is that the total area under trees in Sri Lanka is actually expanding because the area under home gardens of one form or another is increasing. The results of the land use studies for the FSMP showed that the area under home gardens has been increasing by about 3% annually since the 1980's & in 1992, there were some 918, 300 ha planted.

2.2.1 Constraints and development

There are several constraints on the development of appropriate agroforestry systems in Sri Lanka. Weerakoon (1996) has well documented the constraints and development of agroforestry. Those are therefore common to the home garden agroforestry systems too. The main problems can be outlined as:

- Land use considerations
- The role of rural people
- Profitability—The economic profitability
- Policy and legislations
- The institutional framework

Therefore the Forest Department as well as other institutions has been involved in a number of initiatives aimed at raising the well-being of rural people. Sri Lanka's increasing wood demand could be met or at least strongly supplemented, by enhancing the utilization of existing home garden agroforestry system, and intensifying land use in order to expand the various forms of home garden. However, the availability of suitable lands for home gardens and other agroforestry systems is a major issue. The CFP, a most ambitious attempt at social forestry which ran for 8 years 1982, demonstrated that most land selected for farming woodlots was degraded, offering only limited possibilities for agroforestry and other forms of intercropping. Today most of the state lands available for agroforestry are found in the dry zone and are marginal.

Recently published land use information about Sri Lanka has largely been based on aerial photography and remote sensing data carried out in 1982. These have shown that the area that is under-utilized and or partially or completely degraded through soil erosion or burning etc. is about 1 million has. Most of these lands are located in the dry zone. Under the Task Force on Land utilization and Distribution, identified for distribution to 500,000 families for the

purposes of agriculture, housing and industry, and some 110,000 ha, have been alienated to landless farmers (January, 1994). Since these lands are designated mainly for the purpose of settled farming. They will eventually be converted to homestead forms. Clearly there is a need to improve the productivity of these degraded rain fed lands as quickly as possible. To do this it is necessary to adopt appropriate soil and water conservation measures and diversify crops to include tree species and perennials, as we see in home garden agroforestry. This will also increase cropping intensities. NADSA and SALT programmes follow such land use practices and can help stabilize rain fed farming.

Home gardens could also be established on deforested state lands, as well as on agricultural lands where shifting cultivation is practiced at present, provided they can compete economically with crop production or other agricultural enterprises.

The PFP in Sri Lanka currently in progress provides government lands to farmers on long-term leases for the purpose of tree growing in the form of farmers' woodlots. This is another project, which has additional scope to expand even further agroforestry practices as home gardens and Taungya. The selection of trees would then be broadened to cover the whole range of farmers' needs in addition to wood production and those that could be used with appropriate soil and water conservation measures (for example species such as *Gliricidia* grow together with Pavatta or Sunflower to help stabilize the hedge). Annual cropping is permitted in these state lands until the tree canopy cover is formed so that the farmer can secure short-term cash income.

The SCOR project has encouraged the rural community to grow trees along the Yan Oya riverbank reservation following the multi-strata agroforestry model. This specific method will protect the riverbank and also supply agroforestry products to the community.

2.3 Dry zone homegardens

Less intensive managed home gardens are found in most other districts of Sri Lanka especially in the low country wet zone in Western and Southern coastal belts and in the low dry zone (Nanayakkara, 1991).

Traditional settlements in the dry zone have under gone several changes. Observations indicate that these home gardens are slowly developing towards ecologically sound vegetation, which consists of a mixture of endemic and introduced plant species. Hence, the

anatomy of matured home gardens in the dry zone can be used in planning new settlement area, as it has been time tested to be sustainable. A survey carried out in the central dry zone showed that the presence of a water source makes a significant impact on the floristic composition of the homestead. There is a distinct ratio between the large tree density of endemic and introduced plant species but the ratio depends upon the availability of water. Although the total plant density of introduced species is higher than that of endemic species, a higher density of natural large trees is found in the dry zone home gardens. This indicated that endemic species grow better under the harsh soil and moisture conditions creating a favourable microclimate for the introduced species. Adoption of such a strategy learnt from nature could result in a successful home garden model for the dry zone (Dharmasena, 1994).

2.3.1 Types of dry zone homegardens

Dharmasena (1994) has stated three categories of dry zone home gardens as traditional village home gardens, recently evolved home gardens and finally colony gardens on the basis of their relative locations in the catena and the process of development taken place during the initial phase of establishment. These three types are described below.

- Traditional village home gardens (Gangoda)

These are located immediately below the tank bund and close to the paddy field in imperfectly drained lands. The growth of perennial vegetation is influenced by the ground water table (Leach, 1961). Gardens do not have distinct boundaries and the vegetation is not dense. Although soil is moist and fertile, number of species found in these home gardens is few (Broheier, 1973).

- Recently evolved home gardens

These are located on well-drained uplands, which have been cultivated as chena for years. Soil fertility is low and moisture deficiency is a problem for the growth of introduced plant species. Thus, the vegetation includes a considerable percentage of endemic species, which can withstand frequent moisture stresses experienced by the soil. Composition of the vegetation varies according to the availability of a water source in the home garden or any influence of a water body (Dharmasena, 1993). In addition to perennials, some seasonal crops and vegetables are also grown in a portion of the homestead.

- Colony gardens

These are planned settlements made under major irrigation schemes. Unirrigable lands were alienated to beneficiaries after clearing the forest (Brohier, 1975). Original trees were seldom left as heavy machineries were used to remove the vegetation. Ground water table is mostly raised by irrigation canals. Due to land levelling, soil is not much fertile. Most of the planting materials have been supplied by the government and some incentives were given for development (Dharmasene, 1994).

Although floristic composition is different in these three types of homegardens, services that the occupants expect are somewhat similar. Most important purposes are firewood, fruits, timber, shade and vegetables.

2.3.2 Floristic composition and MPTS in dry zone homegardens

Floristic composition of wet zone homegardens is different from dry zone homegardens in Sri Lanka due to distinct climatic disparities. Their functions and services also vary accordingly. The dry zone homegardens mainly serve purposes such as firewood, fruit and timber (Dharmasena, 1993).

These homegardens usually consist of a mixture of tree species some of which are endemic and grown naturally. In the dry zone homegardens Coconut, Mango, Banana, Jak, Papaya, Orange and Guava are amongst the most common species found. Indigenous tree species including Halmilla, Satinwood, Teak, Tamarind and Margosa form substantial private planting and farmlands. *Gliricidia sepium*, *Leucaena leucocephala*, *Thespesia populnia*, and *Euphorbic* species are commonly planted along homestead boundaries and live fences (Weerakoon, 1996). Those species are the most popular multipurpose tree species that can be seen in dry zone homegardens.

The dry zone homegarden area is thin but less attention is paid to their management by farmers. In the dry zone and intermediate zone canopy closure of homegarden species were less than 75% (Nanayakkara, 1991).

One of the researches carried out by Dharmasena (1994) has indicated that there were 140 plant species found in the dry zone homegardens, half of which are derived from natural vegetation. About 80% of large canopy tree species was endemic. The maximum possible

plant density of dry zone homegardens 10 plants/100m^2, but most gardens are sparsely planted (Dharmasena, 1994).

But most of the homegardens are operating far below its potential efficiency as the homegarden vegetation is usually unplanned and almost occurred naturally in the dry zone homegardens (Weerakoon, 1989).

2.4 Problems and potentials of indigenous MPTS

MPTS offer many opportunities but they do not guarantee benefits. Selection of proper species of plants, which suits the requirement, is more important. While selecting the species care should be taken to fit well in the local environment. Species found growing well in natural stands nearby or trees growing well in neighbouring areas are good choices. The species may be indigenous or exotics. But introducing an exotic species may create undesirable effects also. Knowledge of the species is necessary for successful introduction and use of MPTS in agroforestry systems (Bandyopadhyay, 1997).

2.4.1 Application of indigenous MPTS for reforestation

Indigenous forest species are generally hard to establish in deforested areas. But these species can be successfully established and such lands can be gradually converted to woodlands with the assistance of appropriate silvicultural methods (Weerawardena, 1999).

However Weerawardana (1989) has stated that the survival of local species was better than that of exotics, but their growth rates were generally low.

The very important attempt has been made to reforest degraded lands in the dry zone of Sri Lanka with selected medicinal forest species as ex-situ conservation (Rodrigo, 1998).

There have been only a few attempts to plant *Melia dubia* species in the dry zone. Its fast growth was observed in an another species trial establish in the Southern dry zone (Purey-Cust, 1989). Another experimental block planted at Habarana in dry zone performing well (Thilakaratne and Weerawardana, 1992).

Most of the regeneration programmes have been focused on fast growing exotics but the introduction of indigenous trees was a few in numbers. Only *Azadirachta indica*, *Terminalia chebula*, *Aegle marmelos* and *Phyllanthus emblica* are the mostly using indigenous trees.

A successful attempt has been made to reforest degraded land in dry zone of Sri Lanka, with selected medicinal forest species including *Terminalia chebula*, *Terminalia belerica*, *Aegle marmelos*, *Pterocarpus marsupium*, *Azadirachta indica*, *Phyllanthus emblica* and *Tamarindus indica* . The results have revealed more than 80% of survival from every species (Rodrigo, 1990).

Under the Evaluation of the initial performance of six timber species in dry zone survival was best in *Azadirachta indica* and *Khaya senegalensis*. *Melia dubia* has showed the poorest survival but its height growth was the fast. *Azadirachta indica*, *Khaya senegalensis*, *Holoptelia integrifolia*, and *Melia dubia* were capable of growing in dry zone. These tree species have a great potential for use in the routine planting programmes (Weerawardena and Thilakaratna, 1992).

2.4.2 Agroforestry application of selected multipurpose trees

The agroforestry application of some tree species have discussed by some researches especially in South Asian and Pacific region.

Agroforestry application of *Terminalia belerica* can be out lined as a tree has been grown in Taungya plantations along with agricultural crops, which may be grown for 2-3 years between the lines of trees generally 3-4m apart. Crops can be grown continuously if the trees are wider spaced and are regularly pollarded.

Madhuca longifolia is a tree valued for specially its timber and fruits. Because of its wide spreading dense crown the tree is not usually planted in agricultural lands, but when the seedlings come up naturally they are nurtured because of their high economic value. For the same reason, this tree is rarely felled while clearing forestland for cultivation, rather it is maintained and crops grown around it (Hocking,).

Aegle marmelos is a common in homegardens and is not cultivated in large scale. *Euphoria longan* is one of the best popular fruit species in dry zone. Although it is cultivated commercially in some countries like China, Thaiwan and Thailand, in Sri Lanka it grows wild

in forest and not applied yet to the homegarden agoforestry systems. *Schleichera oleosa* is also normally not using in plantation programmes, which grows naturally specially in dry zone and has a great economic potential of its fruit and timber. But it is important the number of trees is reducing at an alarming rate due to the destruction of forests (Rajapaksha, 1998).

2.4.3 Multi purpose medicinal trees for homegardens

Medicinal trees in Sri Lanka receive recognition for their multipurpose uses. Besides medicinal and timber values, medicinal trees are famous for a large number of economic products such as essential oils, beverage, dyes and tans, fibres, spices, fodder, vegetable, edible fruits etc. (Silva, 1991).

Out of these numerous benefits almost all households have given priority for species that produce fruits/foods. Since the land is limited further expansion is difficult. Therefore major needs have to be met by a multiple land use systems. This multiplicity could be achieved either by introducing new tree species or by growing traditionally known MPTS or by both (Silva, 1992).

The link between the human health and the food production are obvious. Amarasinghe and Senaratne (1996) have recommended *Terminalia chebula*,*Terminalia belerica*, *Phyllanthus emblica* and *Aegle marmelos* as good medicinal as well as food potential MPTS for homestead agroforestry.

Silva (1992) has indicated, 12 species out of 25 indigenous plants as appropriate multipurpose medicinal plants for homegardens including *Aegle marmelos* and *Phyllanthus emblica*.

2.5 Indigenous knowledge

Knowledge is the property of the community; it covers ecosystems, composition, spatial relationships, distribution, seasonalities, uses, the phonological cycles for species, harvesting methods, processing and also the social regulations under which rights of the communities and the limits to resource utilization are determined. These aspects are important not only for local community involvement in biodiversity conservation, but also in appraising the resources. Our information about the local uses of biological diversity and

about traditional knowledge systems in general is sketchy. The people have developed special skills, techniques and knowledge in using the biological resources. According to local people the continuity of local knowledge of biological resources is as indicator of sustainable utilization (Wickramasinghe, 1998).

In Bangalore in India, a system of "community registers" has been started to document local uses of biological diversity and the related knowledge, skills, and technology (Bhatia et al., 1996).

From point of view research and planning, local knowledge on the seasonalities of forest products is very useful. It provides information on the annual cycle of forest product availability, which in turn demonstrates the nature of people's contacts and involvement. The transmission of local knowledge of the ecosystem from ancestors to later generations, the social contacts through which it is transmitted, and the first hand local experience from which it has been evolved all have a direct connection with the integrity of the community (Wickramasinghe, 1998).

Today traditional knowledge of agroforestry is being developed and expanded, with the objective of further improving the living standards of rural people in Sri Lanka, improving environmental conditions consequent to the resulting increase in the country's vegetative cover, and relieving pressure on the natural forests (Nanayakkara, 1991).

The Sri Lankan people have co-existed with the forests for centuries and have close cultural and sometimes even spiritual ties with them (FSMP, 1995).

Our ancestors knew about the ecosystem in which they lived, and practiced ways of ensuring the sustainable utilization of the natural resources. Not only did they use large range of plant species, but also developed a large number of varieties adaptive to the different climatic conditions. People ate a large number of food varieties (Sannasgala, 1989). This knowledge was transmitted from generation to generation from mother to daughter. Most of this knowledge is fast disappearing, but thanks to the Aurvedic system of traditional medicine, knowledge on nutritional and therapeutic values are still remaining. This knowledge was transmitted from one generation to another orally and by practice. Unfortunately this knowledge and skills related to traditional farming are rapidly disappearing, along with the people themselves (Rajapaksha, 1998).

2.5.1 Indigenous knowledge on MPTS

From a perspective of indigenous knowledge few species are being covered by the researches. Two main ones are Jack (*Artocarpus heterophyllus*) and Neem (*Azadirachta indica*). While utilization practices including cultural and aspects related to rituals of Jack have been investigated with heavy focus on food production (Wickramasinghe, 1991) and medicinal uses (Wickramasinghe, 1992).

2.5.2 Variables affecting the native of the knowledge

Once a community has been chosen for study, the problem then arises of whom to approach for knowledge gathering. There are many variables affecting the distribution of indigenous knowledge in a rural community and the main ones are outlined below (Southern, 1994).

1. Age affects the degree of life experience of an individual. It may be expected that elderly members of the community are most knowledgeable about the history and development
2. Education, either formal or informal, can be expected to affect the type of knowledge held and particularly the way in knowledge on information is expressed. Level of education attainment may also reflect social factors such as wealth etc.
3. Gender can be expected to affect the type of knowledge held by an individual.
4. Environment or home location of an individual may well affect the type of knowledge held since some knowledge will be site specific, and only more mobile members of the community will have had experience of knowledge relating to different sites.

2.5.3 Knowledge acquisition

Knowledge acquisition has been described as a three stages process by knowledge engineers (Southern, 1994). Those steps can be out lined as:

1. the definition stage, when decisions are made about what knowledge is needed;
2. the elicitation stage, when knowledge is gathered from various sources and is interpreted; and
3. the representation stage, when knowledge is documented in a form, which enables it to be used by others.

CHAPTER 3

3.0 MATERIALS & METHODS

3.1 Methodolgy

The survey was carried out in systematically selected five villages as Illukpitiya, Pettaganwela, Mahagodayaya, Dikyaya and Udagama in Moneragala District during the month of September 2001. The selection was based on a reconnaissance survey and discussions with villagers, discussions with the officials of the Divisional Secretary and other village leaders.

3.2 Study sites

Out of the systematically selected indigenous villages, Illukpitiya, Pettaganwela and Mahagodayaya are less populated villages. These villagers' socio-economic status is very low because most of them are farmers or casual workers. Since these villages locate close proximity to the forest, homegardens are rich with naturally occurred indigenous tree species. But the other two villages are almost small townships and because of that socio-economic status has somewhat enhanced. The population is higher in these areas than the above three villages. Most of the people in these villages are doing business or other off-farm jobs.

3.3 Selection of homegardens

40 homegardens were selected randomly and information was gathered by way field recordings, formal and informal interviews and discussions with the homegardeners, other villagers and their leaders.

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3.4 Data collection

3.4.1 Language

During the whole process the used language was sinhala as it was the best medium to communicate with rural people and to get more reliable details.

3.4.2 Questionnaire survey

The used questionnaire was well structured, comprising four parts as; family description, information about homegardens including the tree and crop species present, their origin, biology of the indigenous tree species prevalent, the uses they are put into, people's attitude towards conservation and large scale propagation programs. (see Appendix 5)

Formal in informal discussions helped to build up a rapport with the homegardeners

3.5 Data analysis and recording knowledge

The results of the survey were analysed and correlations were established between the socio-economic status of the people, their indigenous knowledge on the practice of homegardening with special reference to the biology, propagation etc. of the indigenous species which are rare and endangered. The results are presented in a standard descriptive manner.

In recording the knowledge care was taken to present the information provided by more than 50% respondents since the knowledge from one person to the other can be vary in a vast range.

CHAPTER 4

4.0 RESULTS AND DISCUSSION

4.1 Results

To get an idea about the socio-economics of these people I obtained information about their ages, family monthly income, main income source and education level. All the raw data are included in Appendix 1 and the analysed results are shown in Table 4.1. The survey has indicated that out of 50 respondents their average family size was 4.08.

Table 4.1: The age, family monthly income, main income or occupation and education level of rural people in the surveyed area

- Ages of respondents

Age group	25-35	36-46	47-57	>57
% respondents	30	36	28	6

- Family monthly income

Income group (Rs)	<1000	1000-2000	2000-3000	3000-4000	>4000
% respondents	16	34	42	6	2

- Main income method or occupation

	Farming	casual workers	permanent workers
% respondents	46	32	22

- Education level

	No schooling	upto year 5	year 5 to O/L	O/L to A/L	>A/L
% respondents	10	28	58	4	

Most of the surveyed homegardens were very old. The analysed information about initial type of landspace, age of homegarden, percentage of planned or unplanned homegardens and the area of homegardens are tabulated in Table 4.2. The raw data are given in Appendix 2.

Table 4.2: The initial types of land, age of homegardens, percentage of planned and unplanned homegardens and the area of homegardens

- Initial type of the land

	A	B	C	D	E
% homegardens	20	14	46	12	8

(A – forest, B – barren land, C – scrub land D – chena, E – other type)

- Ages of homegardens

Age group	<5	5-10	10-15	>15
% homegardens	12	28	46	14

- Planned homegardens

	Y	N
% homegardens	12	88

- Area of homegardens

Area group (ha)	<0.5	0.5-1	1-2	2-3	>3
% homegardens	34	9	4	1	2

Analysed results revealed there was 91.66% of willingness to participate agroforestry programs out of 50 respondents. Their attitude towards plantation of indigenous multipurpose trees in homegardens was somewhat in a satisfactory level. 62% of respondents gave their willingness to plant multipurpose trees in their homegardens.

With regard to the observed information there were main three reasons that highly affect on rapid disappearance of indigenous trees or natural forest cover; illicit logging, human encroachment and chena cultivation.

Among number of variables age of a person is the most important one that highly affect on the distribution of indigenous knowledge. In the surveyed area the distribution of indigenous knowledge with age of respondents are shown in Table 4.3.

Table 4.3: Distribution of indigenous knowledge with the age of respondents

Age group	Number of respondents	A		B		C	
		No.	%	No.	%	No.	%
25-35	15	2	4	9	18	4	8
36-46	18	8	16	9	18	1	2
47-57	14	10	20	4	8	-	-
58-68	3	3	6		-	-	-
Total	50	23		22		5	

Knowledge category on the basis of Identification of indigenous trees, knowledge about biology, propagation methods and their uses.

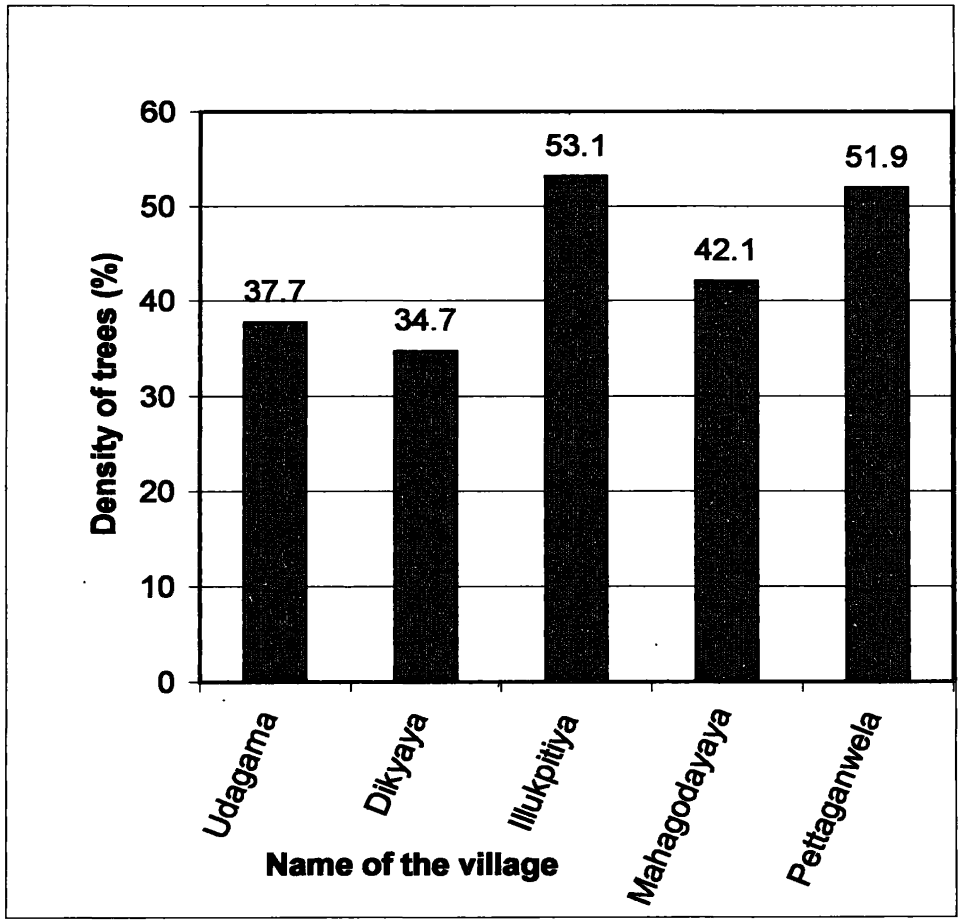
A— >8 trees

B—3 to 7 trees

C—3 trees or low

The prevalence of selected indigenous trees are shown in Figure 1 and it is highlighted that the highest prevalence in Illukpitiya and lowest in Dikyaya. The raw data are given in Appendix 3.

Figure 4.1: The selected indigenous tree species distribution in DZHGs

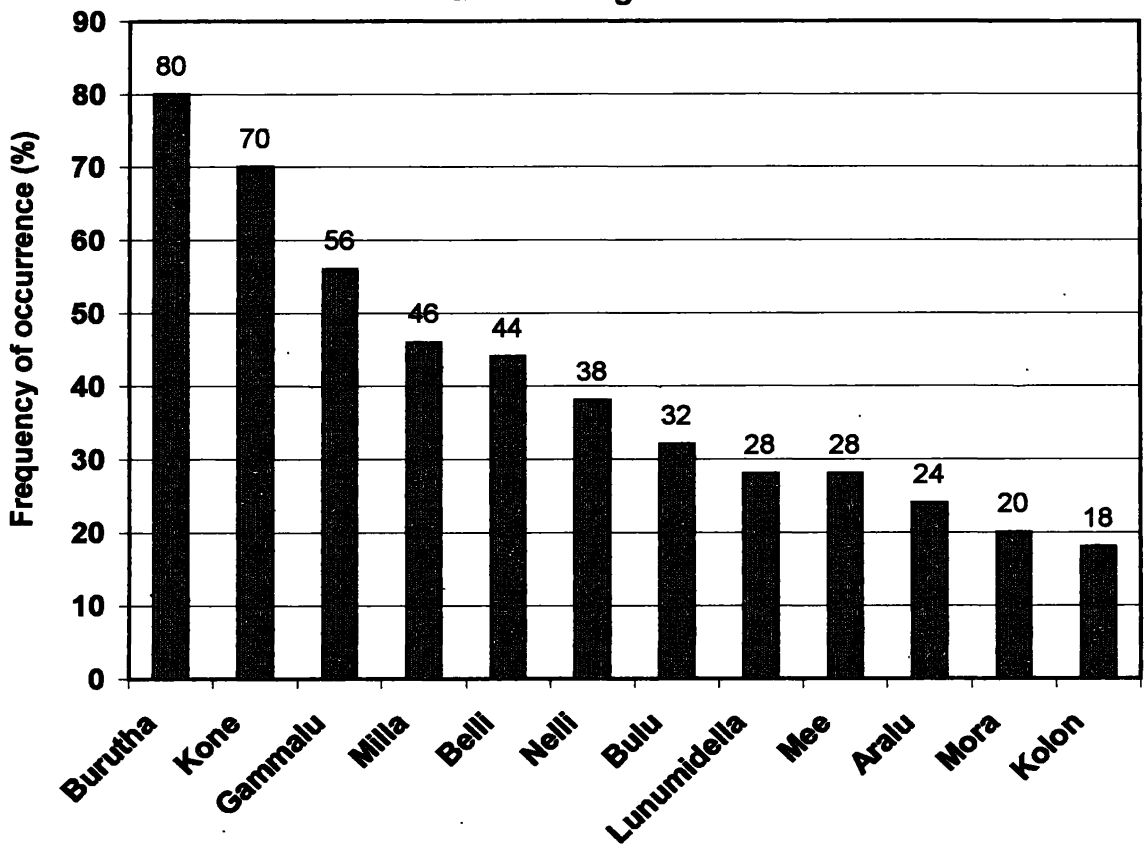


Through the questionnaire survey, selected most important indigenous tree species that can be used for future plantation programmes especially in dry zone homegardens are:

Burutha	(*Chloroxylon swietenia*),
Kone	(*Schleichera oleosa*),
Gammalu	(*Pterocarpus marsupium*),
Milla	(*Vitex altissima*),
Beli	(*Aegle marmelos*),
Nelli	(*Phyllanthus emblica*),
Bulu	(*Terminalia belerica*),
Lunumidella	(*Melia dubia*),
Mee	(*Madhuca longifolia*),
Aralu	(*Terminalia chebula*)
Mora	(*Euphoria longan*)
Kolon	(*Adina cordifolia*).

It is evident that the size of homegardens ranged from 0.5 ha to 5 ha, most being between 0.5 ha and 2 ha. Among 60 homegardens 80 % contained *Chloroxylon swietenia* while *Schleichera oleosa* occurred 70 % (Figure 4.2). The frequency of occurrence of 12 trees can be calculated as approximately four trees per ha (raw data are shown in Appendix 4).

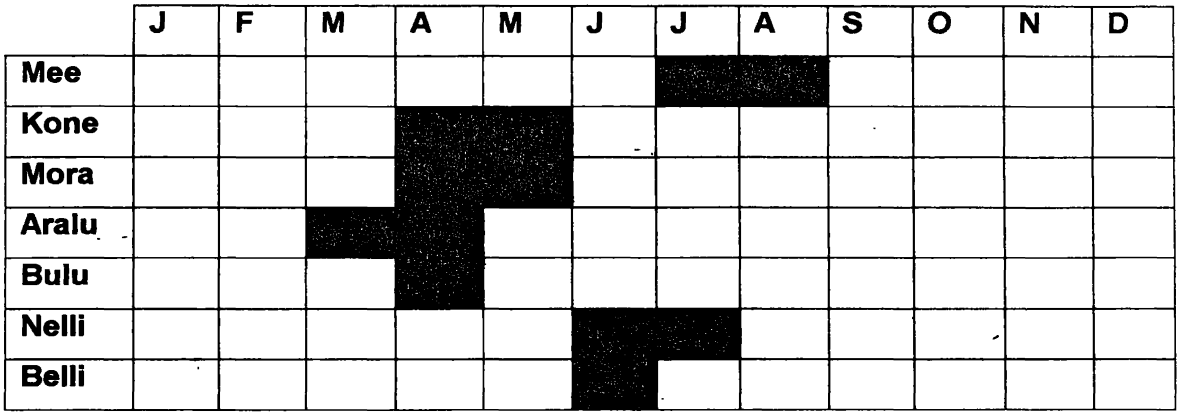
Figure 4.2: The selected indigenou tree species assembly in dry zone homegardens



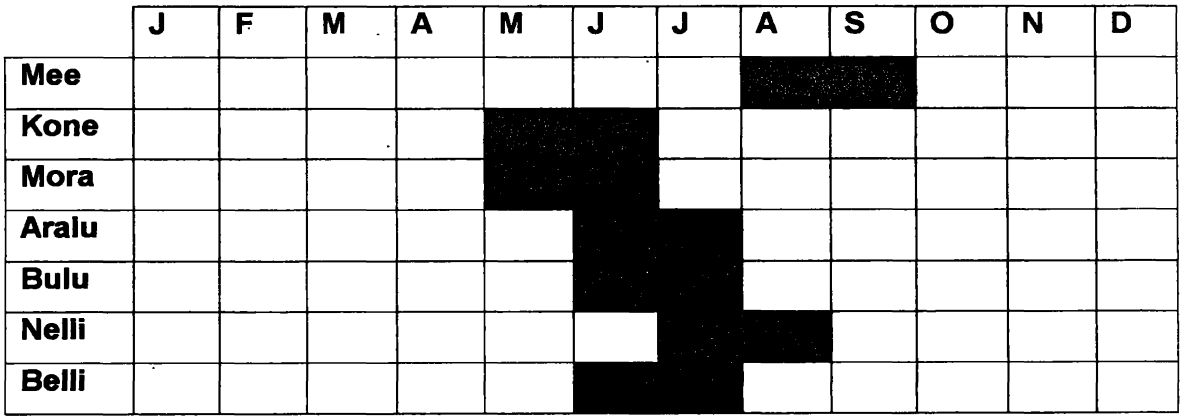
In order to gather indigenous knowledge about tree biology obtained information about the seasonalities in the flowering, fruiting and harvesting, can be figured as Figure 4.3 and the ages of prevailing trees, planting methods, growth rate of trees, age of first fruiting and besides that the usable harvesting methods are shown in Table 4.4.

Figure 4.3: Seasonalities in the flowering, fruiting and harvesting of selected indigenous trees.

Flowering season



Fruiting season



Harvesting season

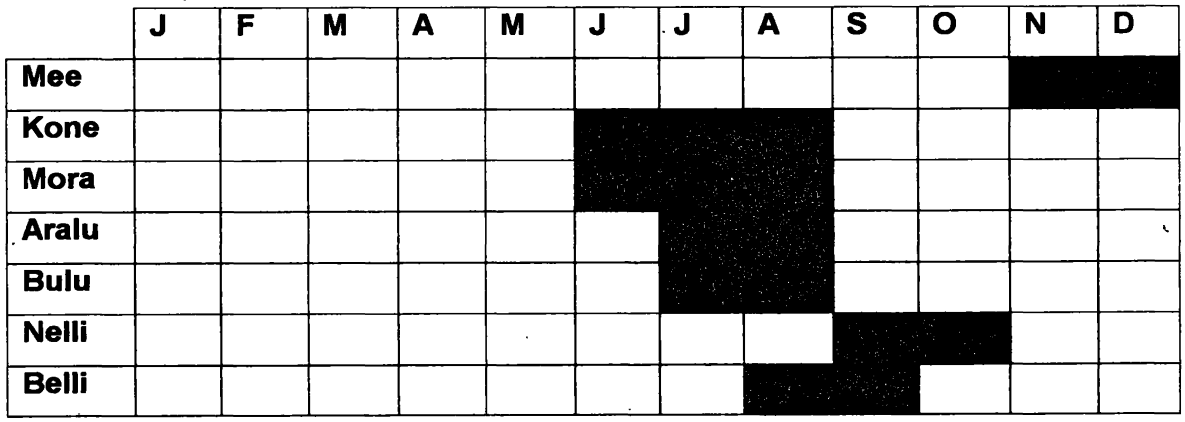


Table 4.4: Ages, planting methods, growth rates, age of first fruiting and harvesting methods of selected indigenous tree species.

Tree species	Ages of trees				Planting methods	Growth rate	Age of 1st fruiting	Harvesting method
	5-10	10-15	15-20	20<				
Aralu		4	11		A, B, C	Q	6-8	X
Beli	7	17			A,E	Q	8-10	X,Z
Bulu	3	12	4	5	A,B,C	Q	6-8	X
Burutha	11	15	9	13	B	R/Q		
Gammalu	8	10	11	6	A,B,C	R	15	
Kolon		3	6		A	Q		
Kone		4	7	11	E	R	10-12	Y
Lunumidella	5	8	2		A,B	P	8-10	Z
Mee			9	5	A	R	10	X,Z
Milla	1	8	15		B	Q		
Mora			9	5	A,b	R	10-12	Y
Nelli	2	18	2		A,	P	5-8	Z

Planting method	Growth rate	Harvesting method
A—Direct sowing	P—Fast	X—Collect fallen seeds or fruits
B—Entire planting	Q—Moderate	Y—harvest fruitful branches
C—Stump planting	R—Slow	Z—harvest only fruits
D—Branch planting		
E—Root suckers		

Out of the bunch of planting methods the used methods were only entire planting and direct sowing. Out of the selected indigenous tree species, *Madhuca longifolia*, *Schleichera oleosa*, *Euphoria longan*, *Pterocarpus marsupium* and *Chloroxylon swietenia* could be observed as live fences or in the corner of the homegarden but the rest occurred anywhere else in the homegarden even with food or cash crop vegetation.

The information about the multiple uses of these indigenous tree species are summarized as below in order to make it understand easily by outsiders.

- Food --- Tender leaves of Kone and fruits of Nelli
- Beverages— fruits of Nelli, Beli, Mora and Kone and flowers of Beli
- Fruits— Mora, Nelli, Kone, Beli, Aralu
- Fodder— leaves of Mee and Bulu
- Fuelwood— Bulu, Mee, Aralu, Milla, Kone, Burutha
- Shade— Mee, Kone
- Live fences— Burutha, Mee, Kone, Beli, Gammalu

Table 4.5 and 4.6 consist of timber values and medicinal values.

Table 4.5: Timber values of selected indigenous tree species.

Sinhala name	Timber quality	Uses
Aralu	Moderately heavy	Small timber poles
Beli	Pale wood	Used in carving, make walking sticks
Bulu	Moderately heavy	Rafters, packing cases
*Burutha	Strong, hard and durable	High quality furniture, doors, windows and frames
*Gammalu	Strong, hard and durable	House buildings, doors, window frames, rafters, beams and posts, cabinet works
Kolon	Strong, hard and moderately durable	Carpentry rafters, ceiling boards
Kone	Strong and tough	Posts, ceiling joists
Lunumidella	Not strong, light and not durable	Ceiling, cigar boxes
*Mee	Strong, hard and durable	Super quality for ceilings, gate posts,
*Milla	Very heavy, hard and durable	Home constructions, posts, joists, doors, windows, furniture
Mora	Hard wood	Rafters, purling, ridges and hips, cabinet and for posts
Nelli	Hard	Household implements

Table 4.6: Medicinal values of selected indigenous trees

	Medicinal uses									Medicinal properties											
Tree	1	2	3	4	5	6	7	8	9	a	b	c	d	e	f	g	h	i	j	k	l
Aralu									F	C						F					C
Beli	F				D				Q				F			O		F	D		
Bulu									F					F		C					
Burutha			C																		
Gammalu	G								C												
Kolon									K			K									
Kone	P	P					C	C	F		F			C							
Lunumidella										F							C				C
Mee	E	P	G					F						F							
Milla		K						K													
Mora	F	C	C			F		C	F		F	C								E	
Nelli		F			F				F	N	F		F	F			F	F			

1 digestive system
2 the skin & the musculature system
3 respiratory system
4 reproductive system
5 eye & the ear
6 nervous system
7 circulatory system
8 skeletal system
9 multiple system (any two or more)

a-- alterative
b--anthelmintic
c--anticeotic
d--aperient
e--astringent
f--carminative
g--cathartic
h--diuretic
I--emetic
j--expectorant
k--antidote
l--cardiotonic

C- bark
D- leaves
E- flowers
F- fruits
G-stem & bark
K-bark & leaves
N-leaves & fruits
O-flowers & fruits
P-bark & fruits
Q- roots

4.2 Discussion

An attempt has been made in the present study to assess the prevalence of indigenous, rare and multipurpose tree species, the indigenous knowledge on their biology and propagation etc. and to assess the attitudes of homegardeners and others on the conservation and sustainable utilisation of them.

The results revealed the highest occurrence in homegardens was shown by Burutha (*Chloroxylon swietenia*) as 80% species followed by Kone (*Schleichera oleosa*) as70%. Out of the five villages surveyed the highest occurrence of these tree species could be observed in Illukpitiya, which was at close proximity to the forest and lowest in Dikyaya, which was almost a small township.

Despite the fact that all the 12 tree species selected were multipurpose trees with timber, fuelwood and medicinal values etc. Most of the trees are not currently utilised by homegardeners widely because of fast invasion of western medicinal methods and their ease of use. According to Dreke Hocking ( ) Mee (*Madhuca longifolia*), Lunumidella (*Melia dubia*), Aralu (*Terminalia chebula*) and Bulu (*Terminalia belerica*) were the best fuel wood for dry lands.

The propagation methods were hardly used, only found entire planting of *Melia dubia, Chloroxylon swietenia* and *Aegle marmelos* species. But fortunately these people have the knowledge even though they didn't apply. Establishment of *Madhuca longifolia* species by seeds was rather difficult. Under perfect conditions other trees can be established according to their view. Though it is absence plantation of Mora (*Euphoria longan)* species commercially in Sri Lanka, in China it was a good commercially planted tree specially for making beverages (Rajapaksha, 1998).

From the discussions with the homegardeners it was gathered that slow growth rate and long life cycles of these indigenous trees are major deterrents affecting the propagation of these species although they are proven multipurpose trees. Regeneration potential was high in *Chloroxylon swietenia* and moderate in *Madhuca longifolia* and *Vitex altissima* (Weerawardena, 1999).

The results further revealed that, villagers do not usually plant these economically viable indigenous multi purpose tree species but when they occur naturally they protect them for later use. Propagation methods were not used because people can obtain benefits when go

to the adjacent forest very easily than planting these trees in their limited landspace. From respondents point of view uneasiness of propagation, slow growth rate, time taken to obtain benefits, unsatisfactory marketing opportunities, a huge area covered by most of trees which reduce the cultivation of seasonal crops were the major reasons for low prevalence of these trees. Farmers, as rational economic agents who have a positive time preference, do not wait such a long time to gain benefits from large indigenous trees. These farmers were motivated themselves to have subsistence food crops and cash crops on the available limited land.

However, there was considerable evidence to show that people were willing to conserve these trees especially due to their multipurpose nature. Villagers eat fruits of *Euphoria longan*, *Schleichera oleosa*, *Phyllanthus emblica*, *Aegle marmelos* and *Terminalia chebula*, rich in nutrients and taste. Some of them were taken to the village fair to sell during the harvesting season. However, unavailability of a proper marketing facility and also the unsustainable harvesting methods used in collection of fruits and other harvestable products and poor post harvest methods had affected the sustainability of the trees in the garden.

Some of these trees had a sacred/religious value too attached to them. For example, *Aegle marmelos* tree was considered as "shri pala" because people think it gives them the prosperity as well as it was named "sada pala" as it bears fruits several times of the times during a year. People think plantation of this tree in homegarden is a blessed thing. Therefore they are unwilling to cut this tree.

The socio-economic conditions and the ages of the members of the house families also had a positive influence on the willingness to participate in programs for conservation/sustainable utilisation of these trees. There was a considerably low education level of these people as more than three fourth had only primary education (up to year five). The main reason for the low literacy level is their poverty. Most of the respondents were doing farming and casual works. So their income was highly affected by the ever changing harsh climatic conditions in the environment as well.

As these people highly concerned about the outcome of the forest tree species their willingness to participate forest regeneration programmes was remarkably high.

Handewela (1998) has stressed the younger householders were not familiar with the indigenous tree species even common species like *Vitex altissima*. But the present study revealed that even young people (25-35) were endowed with considerably high level of

indigenous knowledge since their relationship with the forest was quite high. Forest is the main income for some families.

Reasons for rapid disappearance of forest in these villages were illegal timber logging, chena cultivation and human encroachment. Apart from that some have mentioned poor institutional framework on forest maintenance, absence of appropriate conservation measures and hardly found plantation programs in these areas played considerable role in accelerating the rate of forest clearance. Under these circumstances it is important to enhance the support and extension services to these areas with the objective of enriching these gardens with indigenous and multipurpose tree species, which are especially getting redundant due to the lack of knowledge and recognition.

There were several difficulties I had to face during the survey. Most of the people were reluctant to discuss information about very valuable biological resources what they had protected since immemorial time and they respect to protect it without allowing exploiting by outsiders. Indigenous knowledge about the medicinal values was very hard to gather since it against their traditional rules and rights. Therefore, more time was spent on explaining the objective and the benefits of the propagation programmes before accurate information was obtained.

CHAPTER 5

5.0 CONCLUSIONS AND RECOMMENDATION

- *Madhuca longifolia*, *Euphoria longan*, *Schleichera oleosa*, *Aegle marmelos*,*Terminalia chebula*, *Terminalia belerica*, *Phyllanthus emblica*, *Pterocarpus marsupium*, *Adina cordifolia*, *Chloroxylon swietenia*, *Melia dubia* and *Vitex altissima* tree species have a great potential to use in plantation programs in dry zone homegardens
- *Chloroxylon swietenia* species has the highest frequency of occurrence in dry zone homegardens as 80%.
- Out of five villages Illukpitiya has the highest density of selected tree species and lowest in Dikyaya.
- Willingness to participate forestry programs is very high as 91.66%.
- These people are remarkably endowed with indigenous knowledge about the biology, uses and propagating methods.
- Impediments for the absence of propagation of these trees were, uneasiness of propagation, poor technology, slow growth rate, time taken to obtain benefits, lack of financial and other facilities and unsatisfactory market facilities.
- Therefore it could be concluded that there is an opportunity to conduct agroforestry programs with the objectives of propagating the rare and indigenous tree species in the dry zone homegardens in Moneragala District towards the development of the rural and as a good conservation measure

I recommend to the responsible authorities these indigenous tree species can be used in future plantation programs in dry zone homegardens by winning the shortcomings above mentioned as the best ways and means of conservation of indigenous trees with grinding poverty from rural community.

This study was carried out for a small area and covered only a very small part of a research on acquisition of indigenous knowledge from rural community. However, further studies should be carried out over a long period by covering a vast area for better results.

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APPENDIX 1

No.	Family monthly Income	Age	Main income source	Education level
1	3	2	1	3
2	2	2	2	3
3	3	1	1	2
4	3	2	3	3
5	3	1	2	2
6	4	1	1	4
7	1	1	2	3
8	3	2	1	3
9	2	2	3	2
10	3	2	1	3
11	3	4	1	1
12	4	3	2	4
13	3	3	3	3
14	2	2	1	2
15	3	1	3	3
16	2	3	2	3
17	2	2	1	2
18	3	1	2	3
19	1	2	2	3
20	1	3	3	3
21	3	1	1	3
22	2	2	2	3
23	2	1	1	2
24	3	1	3	3
25	2	3	1	3
26	2	1	1	2
27	1	2	1	2
28	3	1	2	3
29	1	2	3	3
30	2	3	1	3
31	1	2	2	3
32	3	3	3	3

33	2	3	1	1
34	3	3	1	2
35	3	1	3	3
36	4	2	1	3
37	2	2	1	2
38	3	3	3	3
39	2	1	1	3
40	2	1	2	2
41	2	2	1	1
42	1	2	3	2
43	3	3	2	2
44	2	3	2	3
45	1	3	1	3
46	3	1	2	2
47	2	2	1	3
48	5	4	1	1
49	3	4	2	1
50	3	1	2	3

Family monthly income groups are (Rs):

1 –(<1000), **2** – (1000-2000), **3** – (2000-3000) **4** – (3000-4000), **5** –(>4000)

Age groups **1** – (25-35), **2** – (36-46), **3** – (47-57), **4** –(>58)

Main income sources **1** – farming (chena or any other type) **2** – casual working
3 – permanent job

Education level groups **1** – no schooling **2** – upto year 5 **3** – year 5 to O/L
4 – O/L to A/L **5**–>A/L

APPENDIX 2

No	Initial type	Age of HG	Area of HG (ha)	Planned or not
1	A	3	3	Y
2	C	2	1	N
3	B	1	2	N
4	A	3	4	N
5	C	1	.5	Y
6	A	2	2	N
7	E	1	.1	N
8	A	2	1	N
9	A	3	2	N
10	C	3	.25	N
11	A	4	1	N
12	A	3	4	N
13	D	4	.1	N
14	A	3	1	N
15	C	2	.1	N
16	C	4	1	Y
17	D	1	.5	N
18	A	2	1	N
19	D	3	.1	N
20	C	3	.25	N
21	B	2	.1	N
22	C	3	.5	Y
23	B	2	.5	N
24	D	2	.1	N
25	C	3	.5	N
26	C	2	.1	N
27	D	3	.1	N
28	C	2	1	N
29	A	3	.5	N
30	D	3	.5	N
31	C	3	.5	N

32	C	3	.1	N
33	C	4	.1	N
34	C	4	.25	Y
35	E	2	.5	N
36	C	2	.5	N
37	C	3	.25	N
38	C	3	.1	N
39	C	1	.1	N
40	B	1	2	Y
41	C	3	.5	N
42	E	3	.1	N
43	C	3	1	N
44	E	3	.5	N
45	B	3	.5	N
46	B	2	.25	N
47	C	3	.25	N
48	C	4	.5	N
49	B	4	.25	N
50	C	2	1	N

Initial type of the land

A – Forest **B** – Barren land **C** – Scrub land **D** – Chena **E**- Other type

Age groups

1 - <5 **2** – 5-10 **3** – 10-15 **4** –>15

Planned - Y

Unplanned - N

APPENDIX 3

Village	Area of Home Gardens (ha)	Observed no. of trees	Density of trees (no. of trees per ha)
Dikyaya	3.45	12	3.47
Udagama	4.5	17	3.77
Illukpitiya	14.5	77	5.31
Mahagodayaya	9.25	39	4.21
Pettaganwela	6.35	33	5.19

APPENDIX 4

Tree species	Mee	Mora	Kone	Lunumidella	Burutha	Gammalu	Nelli	Aralu	Bulu	Kolon	Milla	Beli
Observed no.of H.Gs	14	10	35	14	40	28	19	12	16	9	23	22
Presence of trees	7	9	29	8	37	21	13	11	12	9	5	17
No. of trees planted	0	0	0	6	0	0	0	0	0	0	0	4
Frequency of occurrence %	28	20	70	28	80	56	38	24	32	18	46	44

APPENDIX 5

QUESTIONNAIRE

FAMILY DESCRIPTION

1. Grama niladhari division.....
2. Age (25-35, 36-46, 47-57, >58)
3. What is the main income source? (Farming, casual workers, permanent workers)
4. How much does the family monthly expenses (approximately) .....
5. Does the income fulfill your monthly expences? (Yes, No)
6. How much can you save per month (approximately) .....
7. How many members in the family

   male..... ,female .....
8. Education level,

   (no schooling, upto year 5, year 5 to O/L, O/Lto A/L, >A/L)

HOMEGARDEN

1. What was the initial type of the land when you settle down here?

   (forest, barren land, scrubland, chena, or other type)
2. How old is to this home garden? (<5, 5-10, 10-15, >15)
3. Did you plan before making the home garden? (Yes, No)
4. what is the area extent of the home garden?.....

CONSERVATION

1. Does the forest cover have declined than previous time when you come here for the first time? (yes, no) If yes,

   Give reasons

   .....
2. Do you like to grow indigenous, multipurpose trees in your home garden? (yes, no)

   If yes , then preferred Species.....

.....

INFORMATION ABOUT TREES IN DRY ZONE HOMEGARDENS

Tree species	No. of trees	Propagated no.	Propagated type	Location	Age	Growth rate	Flowering season	Fruiting season	Harvesting season	Age of 1st fruiting	Harvesting type	Harvest per year	Marketability
Aralu													
Bulu													
Nelli													
Beli													
Gammalu													
Mee													
Kohomba													
Siyambala													
Mora													
Kumbuk													
Kos													
Pol													
Dan													
Kolon													
Burutha													
Divul													
Lunumidella													
Milla													
Kone													
Others													

situated places

close to the house **A**

away from the house **B**

near to the well or streams etc. **C**

the food crops scattered in the H.G **D**

in the fence **E**

Propagation type

seeds **Q**

Plants **R**

Rhizome **S**

Cuttings **T**

Any other **U**

Tree	timber		fuelwood	food	fodder	Medicinal value	Religious & other beliefs	Raw material
	Y/n	for						
Aralu								
Bulu								
Nelli								
Beli								
Gammalu								
Mee								
Kohomba								
Siyambala								
Mora								
Kumbuk								
Kos								
Pol								
Dan								
Kolon								
Burutha								
Divul								
Lunumidella								
Milla								
Kone								
Others								

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