COMMONWEALTH FORESTRY INITIATIVE

Forests and Forestry in Sri Lanka

An Historical Perspective

by V.R. Nanayakkara

Commonwealth Secretariat

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V. R. Nanayakkara

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SUMMARY

The history of forest management in Sri Lanka can be traced back to the beginning of the country's recorded history. There is no doubt that, even prior to then, forests would have played a major role in the lives of inhabitants. Buddhist philosophy has had a great influence on forest and wild life conservation in the country. The chronicles of Sri Lanka and stone edicts record the profound importance given to forests by the country's rulers, including their reservation as national parks and as hermitage forests for the use of forest monks.

In this report, an attempt has been made to review critically the historical development of forest management approaches in Sri Lanka; to describe the environmental, social and economic importance of these forests; to trace the history, impact and future plans of the forest plantation sub-sector; to discuss the possible linkages between natural forest conservation and management; to examine the history of forest research work; and finally, to examine options for the possible integration of forestry with land-use planning. In so doing, it is hoped that the influence of political will, the impacts of growing populations and of conflicts over land-use, and the effects on forestry of the varying expressions of the concept of "development" will become apparent.

In the historical development of forest management in the country, it is quite evident that the early Sinhalese rulers were mindful of the need to conserve their forests and their wildlife with the principal objectives of providing stable environmental conditions and forest products; provision of continued supplies of water for agricultural purposes through a complicated nexus of irrigation reservoirs, channels, streams and rivers; to develop the art of home garden agroforestry; and to provide habitats for wildlife. Also in the minds of the rulers was the need for forests to act as a barrier against foreign invaders. The old kingdoms resisted capture by foreign powers mainly because of the protective barriers provided by the forests and the deftness of the local soldiers in the art of jungle warfare prevalent in those times.

Forest management fluctuated between extremes of forest conservation and forest exploitation during the course of the country's history. With the subjugation of the country by the British in 1815 came the almost total des-

truction of the central montane watershed and catchment forests and home gardens. This clearance met both colonial security concerns and allowed the large-scale planting of coffee, and later tea. More enlightened British foresters who came later, realising the need to protect and manage the forests of the country, advised the Government to appoint a Conservator of Forests and set up a Forest Department to scientifically manage the forests. The first Conservator of Forests was appointed in 1887. Subsequent to this date, some form of forest conservation was practised with certain forest management rules. Later, a start was made to manage the country's forests scientifically.

In the meantime, however, forests continued to be denuded by uncontrolled timber exploitation and shifting cultivation known as *chena* cultivation, the lifestyles of rural people were considerably changed, and poverty spread to rural areas, especially in the dry and montane zones. A desperate attempt was made by the Forest Department to stem further forest loss, but this was not easy. In addition to the changes in lifestyles, new ideas of development and social standards had also taken root in the country.

From 1948, after the country regained independence, in order to keep pace with development and to supply the needs of an increasing population, a large number of development projects were launched. In the beginning, most of these took the form of large-scale irrigation and settlement projects in several parts of the country. Some of the old irrigation works were restored and developed, leading up to the massive Accelerated Mahaweli River Development Project of the 1980s. All these development projects were at the expense of the environment - mainly the forest cover which dropped steeply - making it obligatory for the Government to conserve and manage the remaining forests more carefully. Thus, the development processes begun in 1948 resulted in a state of extreme forest exploitation and destruction once again, but this time the loss of forests in a spatial sense was much larger than in the 19th century.

The closed forest cover dropped from about 70% at the turn of the century to 44% in 1956, 26% in 1983 and 24% in 1992. Meanwhile the population had more than trebled. Although concerted efforts were made to put back forests on the eroding central mountain regions now in tea, political intransigence on the part of one small political group has slowed down these efforts.

In response to the rapid depletion of forest cover and the marked reduction in growing stock, the Government imposed a logging ban in natural forests in 1990 which is still in force and there is evidence of some increases in new forest growth as a result. Hence, the tide has turned once again towards a policy of forest conservation, the main objectives being to increase the extent and economic value of the country's forests, and to conserve their biodiversity and genetic resources for the benefit of future generations. The logging ban, coupled with the decline in forest clearance after Mahaweli, should result in a reduced deforestation rate.

As for people in forests, the few Veddhas who comprise the remnants of the last tribe of forest dwellers in Sri Lanka have been allotted a parcel of a forest in the eastern part of the country. However, they hardly practise their traditional jungle pursuits and have more or less been absorbed into the farming community. Peripheral village farmers living near forests who practise agriculture and other pursuits depend only on a few items of value from the forest proper. These are mainly fuelwood, palm syrup and sugar, and indigenous medicinal plants. This situation makes natural forest management, by whatever method, easier in Sri Lanka than in some other countries where entire forest tribals have made the forest their permanent home and are totally forest-dependent.

Meanwhile, the large areas of forest plantations established in Sri Lanka are being managed to meet the needs of the nation, along with imports and timber from the large areas of non-forest vegetation in the country, including rubber and coconut plantations, home gardens and miscellaneous plantings. The current policy for the forest plantations sub-sector is to raise forest plantations on the shifting cultivated lands, degraded and abandoned tea estates, and in other critical areas such as grasslands, coastal sandy areas, the montane zone and other derelict lands.

Since the start of a National Forest Inventory in 1979, the country has received substantial foreign assistance, both financial and technical, to undertake diverse and comprehensive programmes of forestry development activities.

The unique Sinharaja tropical humid forest was listed as a World Heritage Site by UNESCO in 1988. Conservation plans are now being undertaken and

conservation management plans are being prepared for the country's natural forests. This will be an on-going concern.

Forest research is carried out by the Forest Department country-wide. It has recorded several achievements in the past, in the fields of silviculture, timber utilisation research, and management operations. The Forest Department Research Branch is now a storehouse of valuable research information. Forestry research is now receiving the support of universities, especially in the important fields of forest ecology, biodiversity and conservation of natural forest ecosystems.

Plans are being implemented to bring in the private sector to support forest development, principally in the forest plantation sub-sector in order to speed up the rate of reforestation in the country. Efforts to make agroforestry a standard forestry development strategy throughout the country by making it attractive to rural farmers, is well advanced.

The "all benefits" sustainable management of natural forests is still a distant dream. It is felt that it may be more appropriate to adopt a wise, thoughtful and pragmatic management policy for the natural forests in view of a complex of issues, including people pressure on forests and the prevailing socio-politico-economic situations near to and around the forests. The management of forest plantations under new management plans continues as far as possible in a sustained manner with respect to timber. Modern computerised management planning based on strategic planning is being undertaken, having replaced the earlier conservative, classical Working Plans systems. However, some caution will be needed to prevent over-cutting through these new computerised management plans, especially in the case of commercial fellings and pre-commercial fellings. Ground-checking and supervision will be important.

Due to certain aspects of Sri Lanka's colonial history in the period 1815 to 1948 and deforestation for development after that, it is difficult as yet to integrate forestry into the developing Land Use Planning System for the whole country. Rather, they have to move together in a parallel process linked to a new National Land Use Authority that should be established at the highest possible decision-making level. Since some thirty-three agencies and several

ministries are involved in land-use operations or decisions, it is considered that this Authority should be above any one ministry. The final goal, however, would be to make forestry an integral part of a National Land Use Planning System, but this should evolve in such a way that it does not upset the environmental balance and other goods and services presently being provided by the existing forests.

CHAPTER 1

AN INTRODUCTION TO SRI LANKA AND ITS FORESTS

1.1 Location, topography and climate

Sri Lanka is a tropical island nation, 65,610 km^2 in area. It consists of a coastal plain and a central highland massif, whose highest point is Piduratalagala (2,524 m) (figure 1.1). It has climatic conditions determined partly by altitude and partly by degree of exposure to the monsoonal winds; conditions range from hot to cool, and from wet to arid (figure 1.2). The average mean temperature for the coast is about 26.7^{0}C, and for the hill country 19.2^{0}C. Temperatures at elevations over 1,800 m altitude, in the heart of the rugged central montane massif, can drop to freezing, bringing regular ground frosts in places. Rainfall is generally monsoonal. In the dry zone (the lowland plains of the north and east) rainfall is generally below 1,900 mm per year, dropping to about 125 mm per year in the driest (semi-arid and arid) areas. In the wet zone (the south and west), rainfall ranges between 1,900 mm and 5,000 mm per year.

1.2 People and forests

The country is divided administratively into nine Provinces and 25 Districts (figures 1.3 and 1.4). The population of the country is estimated at 18.1 million (1995), increasing at the rate of around 1.2% per year. Life expectancy is higher than for most developing countries, and the country's literacy rate is now over 90 per cent. Population increase has continued while forest cover has declined over the last century (Nanayakkara, 1982). From covering an estimated 84% of the land in 1884, it was reduced to 24% in 1992 (table 1.1; figure 1.5).

Date	Area (ha)	%
1884	5,540,000	84
1900	4,610,000	70
1953	3,295,000	50
1956	2,900,000	44
1983	1,760,000	26
1992	1,582,756	24

Table 1.1
Estimated forest cover in Sri Lanka, 1884 to 1992. Note that the table refers to closed canopy forest only: estimates for open canopy and scrub are only available for 1983 (625,000 ha) and 1992 (463,842 ha). The 1992 assessment is from the Landsat Thematic Mapping project.

Natural forest types in Sri Lanka depend on the prevailing climatic conditions. To facilitate management planning, and indeed for the purposes of this report, the following main types are recognised:

- Montane forest
- Sub-montane forest
- Lowland rain forest
- Moist (wet or humid) monsoon forest
- Dry monsoon forest
- Riverine forest
- Mangrove forest
- Sparse forest

Some of the most commonly occurring tree species in the lowland rain forest, the moist monsoon forest, and the dry monsoon forest, are given in Box 1.1. Table 1.2 shows the extent of each forest type in the nine provinces of Sri Lanka in 1992.

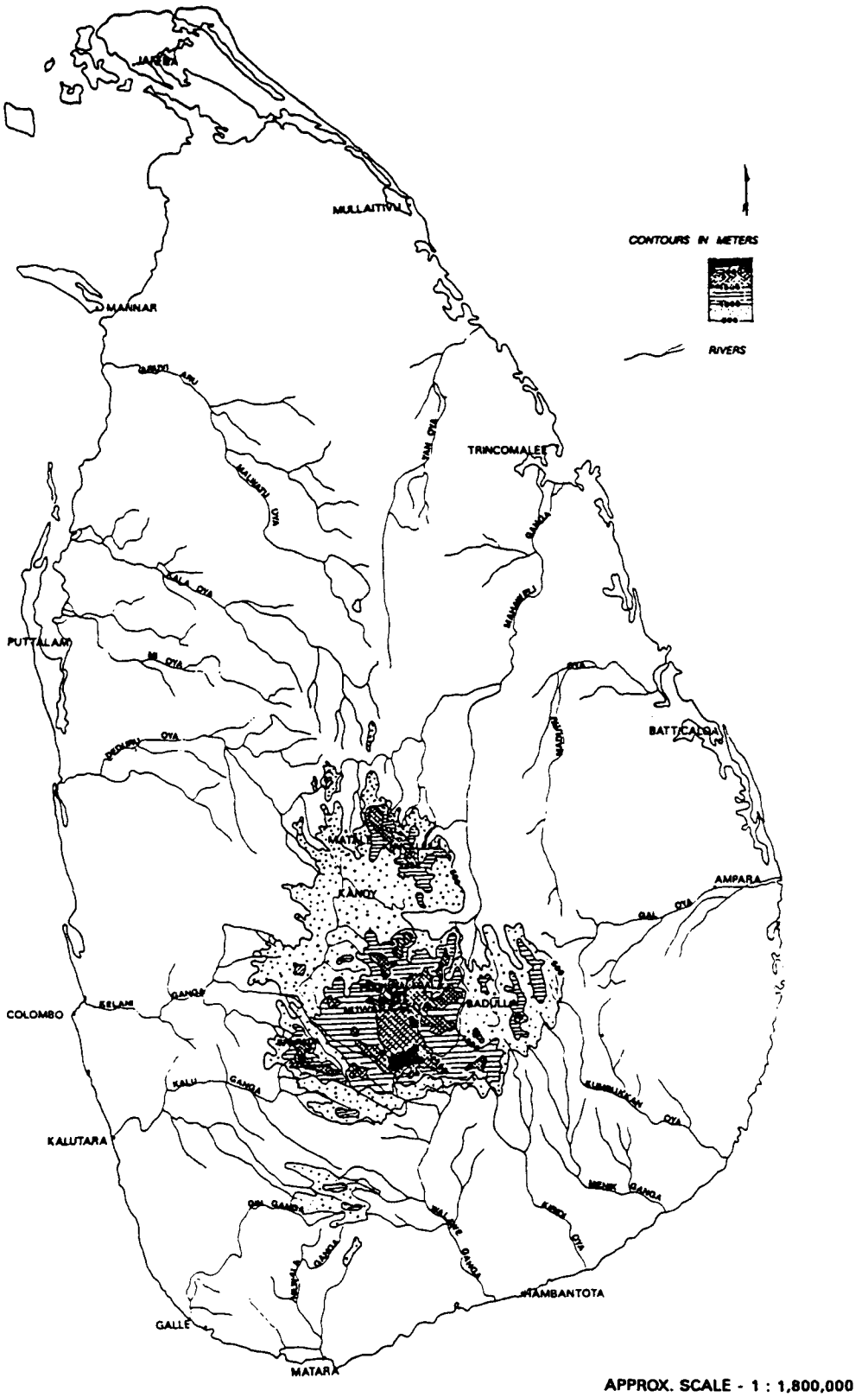

Figure 1.1. Sri Lanka: relief and major rivers

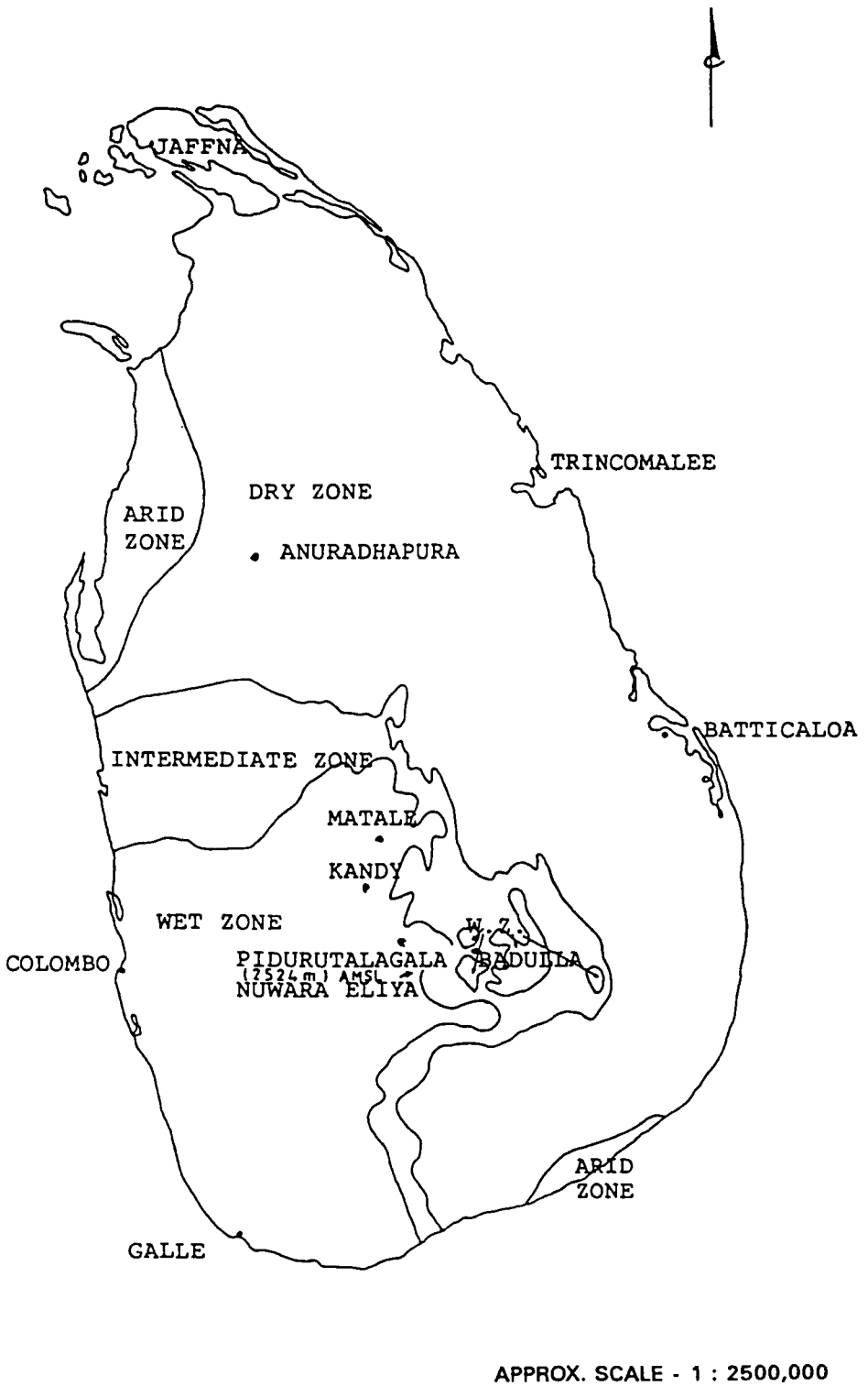

Figure 1.2. Sri Lanka: climatic zones

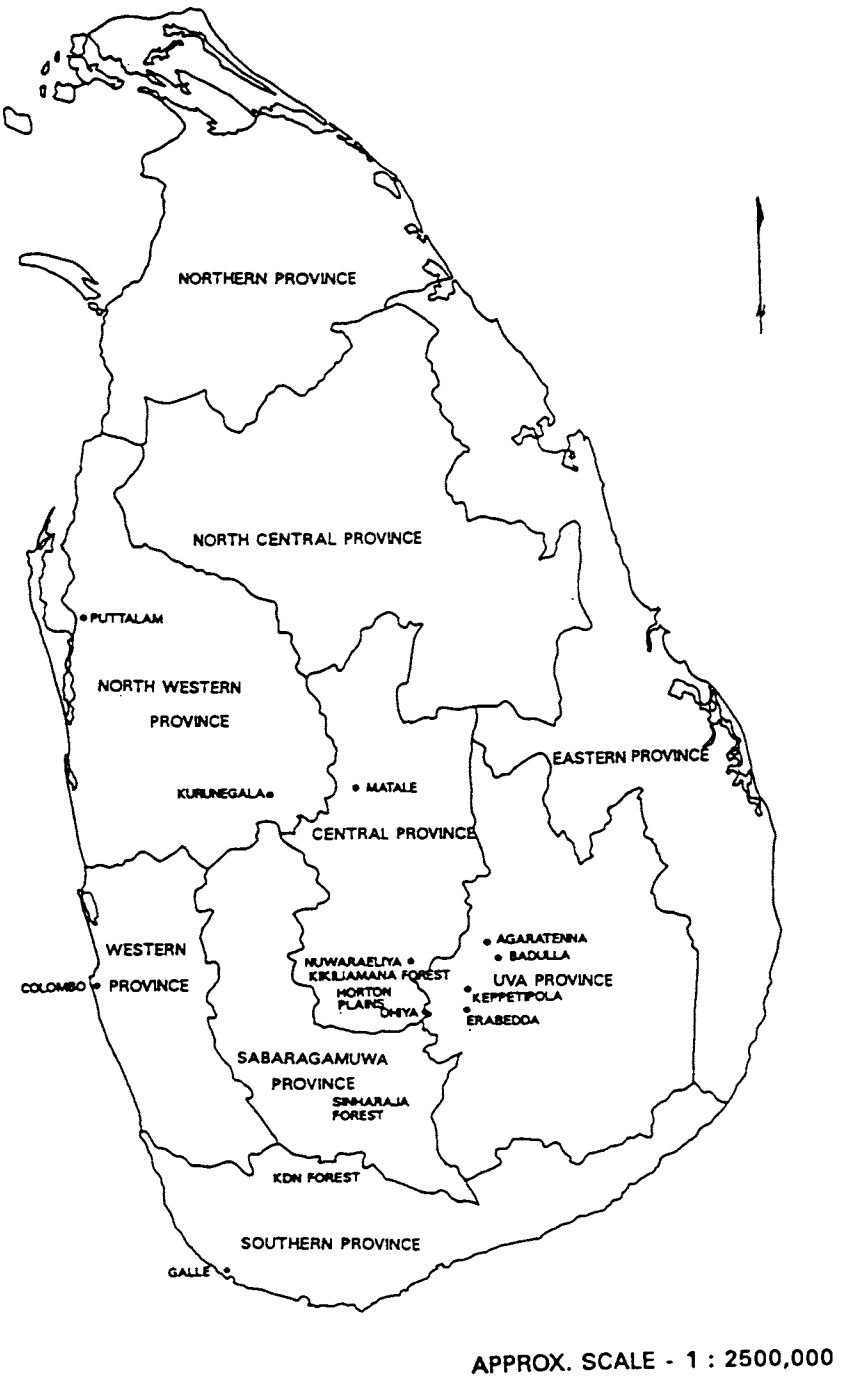

Figure 1.3. Sri Lanka: provinces

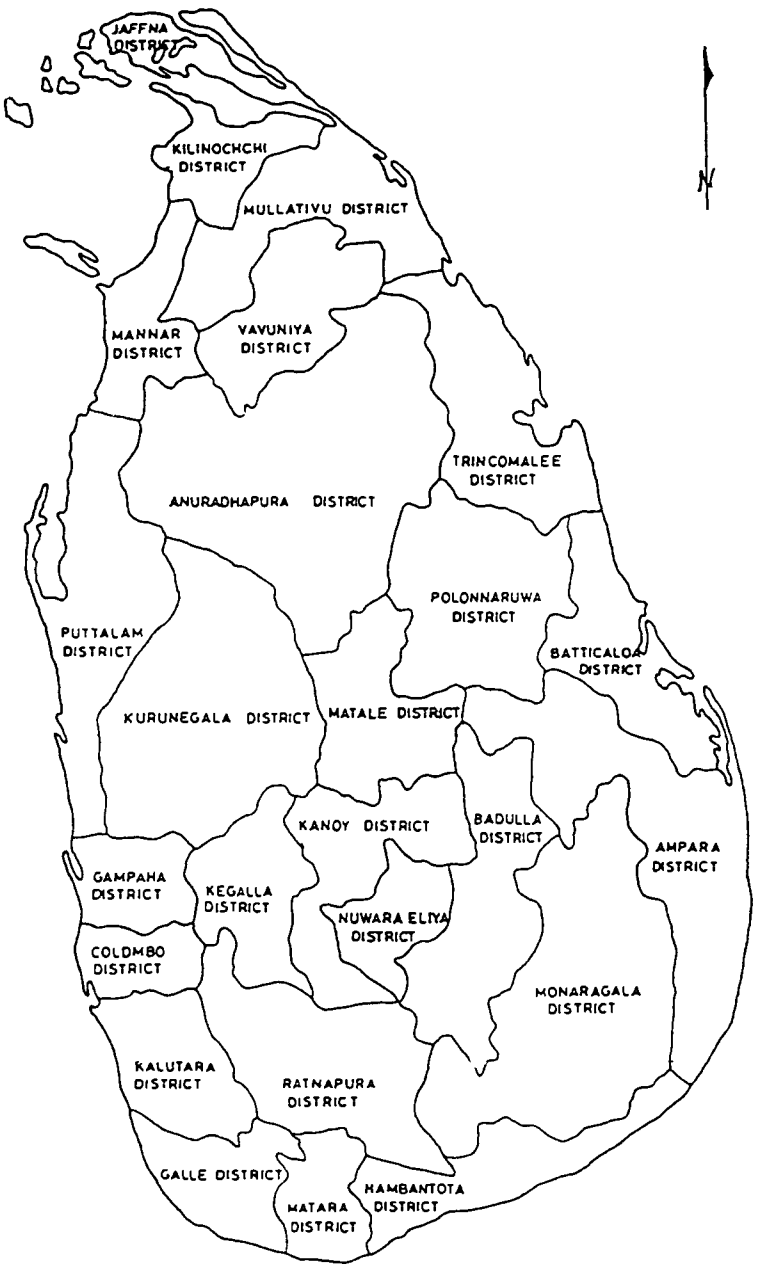

Figure 1.4. Sri Lanka: administrative districts

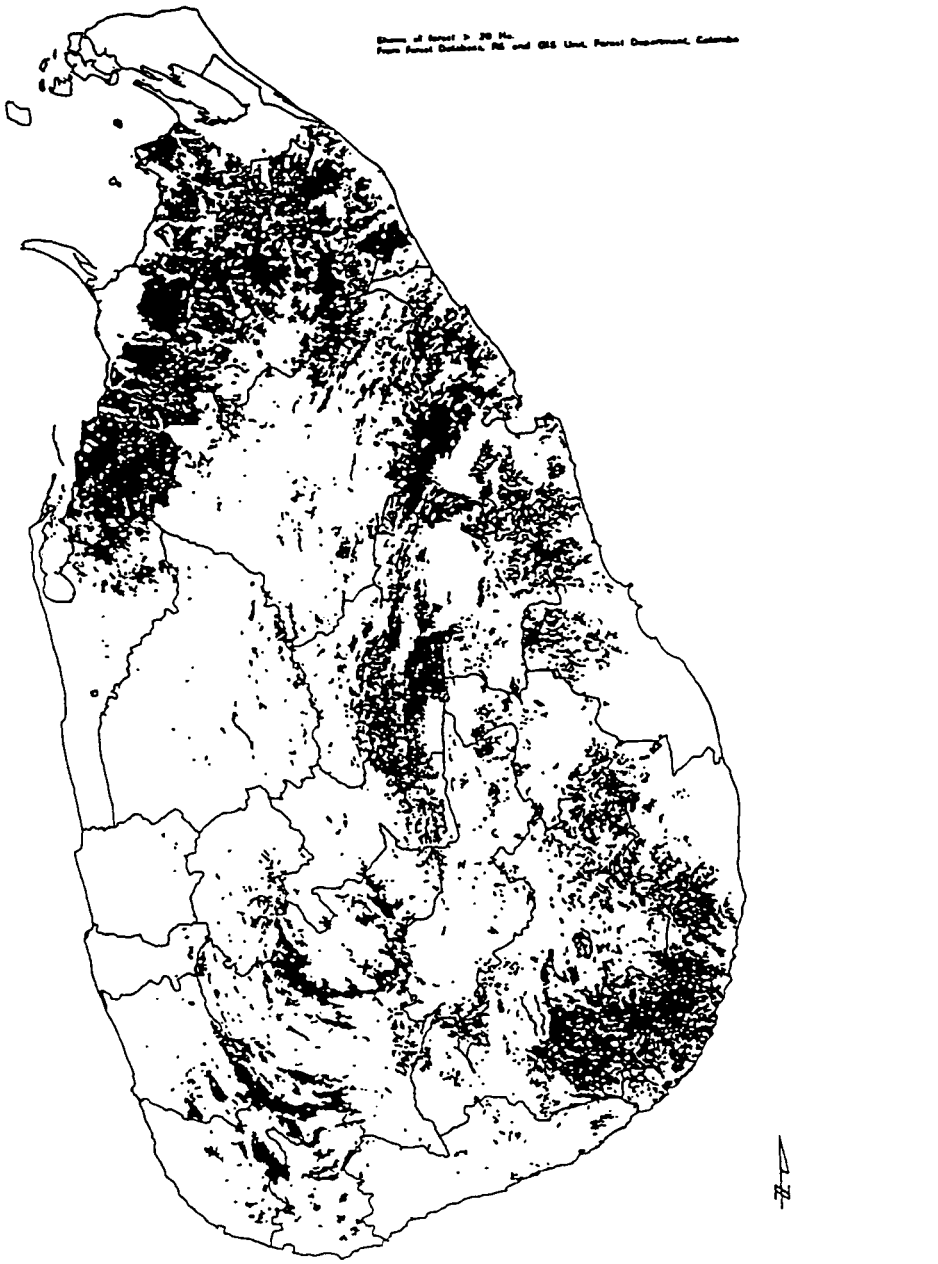

Figure 1.5. Sri Lanka: extent of closed canopy natural forest, 1992

Box 1.1
Some of the most commonly occurring tree species in three forest types in Sri Lanka

Lowland rain forest	Moist monsoon forest	Dry monsoon forest
Alstonia	Daminiya	Daminiya
Alstonia spp.	*Grewia tiliifolia*	*Grewia tilifolia*
Alubo	Domba	Kahata
Syzygium makul	*Syzygium gardneri*	*Grewia arborea*
Del	Hama	Kaluwara
Artocarpus nobilis	*Tetrameles nudiflora*	*Diospyros quaesita*
Diyapara	Kahata	Kaluwella
Wormia triquetra	*Careya arborea*	*Diospyros* spp.
Dun	Kenda	Ketakela
Shorea spp., *Hopea* spp.	*Macaranga peltata*	*Bridelia retusa*
Etamba	Milla	Milla
Mangifera zeylanica	*Vitex pinnata*	*Vitex pinnata*
Godapara	Mora	Mora
Dillenia retusa	*Euphorbia longana*	*Euphorbia longana*
Hedawaka	Satin/Buruta	Palu
Chaetocarpus castanocarpus	*Chloroxylon swietenia*	*Manilkara hexandra*
Hora	Velan/Welang	Satin/Buruta
Dipterocarpus zeylanicus	*Pterospermum canascens*	*Chloroxylon swietenia*
Kirihembiliya	Wira/Vira	Teak
Palaqium petiolare	*Drypetes sepiaria*	*Tectona grandis*
Malaboda		Velan/Welang
Myristica dactyloides		*Pterospermum canascens*
Milla		Wira/Vira
Vitex pinnata		*Drypetes sepiaria*
Pelen		
Kurrumia zeylanica		
Welipenna		
Anisophyllea cinnamonoides		

Table 1.2

Natural forest cover by province, 1992 ('000 ha). The figures refer to "dense" or "closed" forest with a canopy closure of 70% or more.

	Mon-tane	Sub-mont-ane	Low-land rain	Moist mon-soon	Dry mon-soon	River-ine	Mang rove	Sparse	Total
Eastern	0.0	0.0	0.0	58.5	201.5	12.0	3.2	75.7	350.9
North-ern	0.0	0.0	0.0	0.0	401.5	0.8	2.3	52.6	457.2
North-central	0.0	0.0	0.0	47.3	248.2	0.5	0.0	139.6	435.6
North-western	0.0	0.0	0.0	1.8	87.6	0.8	2.3	31.9	124.4
Uva	0.1	4.0	2.3	81.1	117.0	4.6	0.0	80.4	289.5
Central	3.0	44.9	31.1	47.5	15.2	0.0	0.0	18.5	160.2
Western	0.0	0.0	22.3	0.0	0.0	0.0	0.2	1.3	23.8
South-ern	0.0	0.5	35.8	2.9	19.7	3.7	0.7	58.8	122.1
Sabar-agam-uwa	<0.1	19.4	50.0	4.8	3.6	0.0	0.0	5.0	82.8
Total	3.1	68.8	141.5	243.9	1094.3	22.4	8.7	463.8	2046.5

CHAPTER 2

HISTORICAL DEVELOPMENT OF FOREST MANAGEMENT

2.1 Introduction

Sri Lanka provides a very interesting case study in the development of forest management, for two reasons:

- it has a long history of forest management, under varying social conditions;
- forest management has been relatively well-documented throughout most of this period.

Since people first began to impact on the forests over two thousand years ago, three phases in the evolution of forest management can be recognised:

- pre-colonial;
- colonial;
- post-colonial.

Although it would be unfair to state that each had absolutely unique ways of managing the forests, there are nevertheless good grounds for considering them as quite distinct periods in Sri Lanka's history, and this document follows such a path.

2.2 The pre-colonial period

Sri Lanka is famous for its home gardens, which represent a form of management of forest or agroforestry that goes back many centuries to the early days of the Sinhalese culture. References to the management of such forests and home gardens have been recorded in the Sinhalese chronicles of Sri

Lanka, including the Mahawamsa, the Rajaratnacari and the Rajavaliya, and as stone edicts by the Sinhalese kings. These edicts often place a major emphasis on forest conservation.

The "policy", if it can be called that, to conserve forests was to a great degree influenced by Buddhist philosophy which inculcates in man a love for trees, wildlife, forests and nature in general. To quote from Gautama Buddha:

> *"the forest is a peculiar organism of unlimited kindness and benevolence that makes no demand for its sustenance and extends generously the products of its life's activity. It affords protection to all beings, offering shade even to the axeman who destroys it."*

This quotation is now the preface to *The Sri Lanka Forester*, the journal of the Sri Lanka Forest Department.

In order to appreciate the historical development of forest management practices in Sri Lanka, it is necessary to have some idea of what forestry practices were prevalent in ancient times during the periods the country was ruled by Sinhalese kings. Box 2.1 provides some examples taken from Sri Lanka's recorded history (Geiger, 1912; Nanayakkara, 1987; Ainslie, 1920; Vincent, 1882).

Box 2.1
References to forestry under the Sinhalese kings

- *543 B.C – King Vijaya*: During the time of King Vijaya, social tree planting practices were common, village communities were well organised and home gardens were planted with flowering and fruit-bearing trees.
- *247 to 207 B.C – King Tissa*: There are records of forests being used for meditation by Buddhist monks, and that wildlife was protected.
- *161 to 137 B.C. – King Dutugemunu*: rules for forest protection and for the use of forest products had been drawn up, and forest plantations raised.
- *1187 to 1196 A.D – King Kirti Nissanga*: During this period there are descriptions of the protective role of the forest from a military standpoint.
- *1284 to 1310 A.D – King Parakramabahu the Great*: There are references again to the protective role of the forest, and how soldiers sojourned inside the forests and defeated the enemy.
- *1373 to 1406 A.D – King Buvenekabahu V*: Forest officials had been appointed, and forests granted to people for services performed for the King or State.

According to Ainslie (1920), Sinhalese kings appointed Forest Officers, whose duties were largely confined to providing game and fruit for the Royal household, to the prevention of poaching, the protection of royal trees, and the settlement of land claims. Therefore, although the present relationship of the state to the forests is very recent, it can be seen as being the direct result of the past history of the forests. In the time of the Sinhalese Kings and before the arrival of the Europeans, the King of Sri Lanka himself was generally considered to be the owner of the forest lands, but from time to time large grants of these lands were made to individuals, and to various Buddhist communities and so on. Some of those grants still hold good.

In the mid-seventeenth century, Knox (1681) referred to the existence in the Kandyan kingdom of extensive dense natural forests, and to the carefully protected and managed dense forest belts that served as boundaries of districts, and which were protected for security purposes. According to Vincent (1882), the protective belt around the Kandyan Kingdom was 30 to 40 miles wide. This belt of forest, which protected the Kandyans so effectively, is no longer traceable, and the area occupied by it is now largely given over to *chena* (shifting) cultivation.

Although it is tempting to think of the pre-colonial period as one in which people lived in harmony with the forest, this is probably a simplistic view. As time went on and the Sinhalese civilisation reached its zenith (with palaces and complex irrigation systems, for example), demand for land and resources inevitably increased. It seems likely that laws and edicts passed at that time would reflect this situation. Indeed, it could be argued that they would not have been necessary if the forest resource had not been under some kind of pressure.

Furthermore, whilst in the nineteenth century the British found most of the island to be forested, much of that forest may have been relatively young. According to Vincent (1882), a large part of the forests existing then were but a secondary growth which sprang up on the disappearance of a large population, some time between the 8th and 12th centuries. Yet in the 13th century, during the reign of the monarch Parakramabahu the Great, the country is said to have boasted a population of 30 million, perhaps suggesting that forests were not a hindrance to, but supportive of, a healthy and prosperous living for a large population. If this figure of 30 million is to be believed, and

if at the time much of the country was forested, then it suggests that the forests were being managed in some rational or scientific way. Whatever the real situation, it seems likely that human populations fluctuated dramatically, and were sometimes high, even by today's standards. The only assigned causes of sudden depopulation are frequent Tamil invasions and massacres, or disease. As a result Sinhalese culture, built on the tenets of Buddhist philosophy, was also gradually eroded and as it did so, forest cover may have started to decline.

One example of the effects of depopulation can be seen in the ancient irrigation networks that once criss-crossed the dry zone plains, and to some extent still do. These supplied water to farmlands which were available for cultivation throughout the year. Linked to these were highly productive home gardens carrying a bewildering array of timber, fuelwood, fruit, fodder, medicinal and multi-purpose trees. Many of these areas have now reverted to dry monsoon forest and scrub, and have only begun to be re-colonised in the last few decades as populations have risen again.

2.3 The colonial period

Forest management under the Portuguese and Dutch, 1500s to 1815

The Portuguese and Dutch only ruled maritime parts of Sri Lanka. Reference to forest management practices during these administrations are scant. During Portuguese times, it is known that large-scale cutting and export of coastal timbers and spices took place. During the Dutch maritime administration, valuable timber like calamander and ebony were exported to the Netherlands with the connivance of local people in the hinterland. Traditional forest management practices in the Kandyan kingdom continued until the arrival of the British.

Forest management under the British, 1815 to 1948

Early exploitation and clearance of forests

Forest management under the British reflected the changing needs of the colonial authorities, as well as the sociological changes that colonialism brought to the islanders.

Large-scale forest clearance in the central montane zone was undertaken by the colonial administration after Britain annexed the country in 1815, first for its own security and then for the planting of coffee and later tea. Forest clearance was stepped up after the unsuccessful Sinhalese rebellions of 1818 and 1848.

Forests in the lowlands in the wet zone were also cleared for planting rubber and coconut. As a result, the cleared hills started to erode, frequently resulting in soil loss and floods. In addition, valuable tropical hardwood timbers continued to be cut and exported from the country's southern forests, in a continuation of what was started by the Portuguese and Dutch. Partly as a result of this intensification of activity in and around the island's forests, and the ensuing sociological change, people who had been accustomed to living a relatively healthy and prosperous life as farming communities in forested regions began to become more and more impoverished or alienated from the forest.

One result of this turmoil was the spread of *chena* cultivation. People resorted to it in order to subsist under repressive conditions, or in order to make a living under conditions of expanding human populations. This resulted in further loss of forest cover.

Hence, the earlier scenario, in which a certain amount of forest conservation had been part of the culture, now turned into one of wholesale forest denudation. Until the latter part of the 19th century, the British colonial administration did not seem to be aware of the need for forest management in the sustainable exploitation of the country's natural resources; indeed, there was little concern for sustainability at all.

However, the rational exploitation of the timber, reflected in the adoption of felling rules in 1835 and a timber-cutting licence and management system in

1879 indicated a change in approach. There was also an Ordinance of 1848, allowing the declaration of Forest Reserves, although it was not until 1890 that the first Reserve (a small area of some 800 acres in the wet zone) was proclaimed. The enlightened British forester Ainslie has put it like this:

> *"In 1873, a few totally unqualified men were appointed `Foresters' and worked under the supervision of the Government Agents. In those days, however, the* raison d'être *of the forests was felt to be exploitation only, and as a system of "share and share alike" had been introduced, the over-exploitation resulting from the practically unrestricted co-operation of a contractor eager to make money, and a Government official equally eager to make revenue, can be better imagined than described. It is safe to say that during this period the greater part of the remaining dry zone forest was silviculturally ruined for at least half a century."* (Ainslie, 1920).

This is not to say that some individuals were not concerned about the damage to the forests. For example, in 1873, the British naturalist Joseph Hooker strongly advocated the conservation of forests above 5,000 feet for environmental, soil and water conservation reasons. He proposed that Climatic Forest Reserves should be reserved on mountainous and other critical areas. It was, however, a recommendation which unfortunately did not pass into legislation, and deforestation in these highlands continued to provide more space for tea plantations.

Along with deforestation, the deliberate decimation of wildlife commenced in this period, sometimes on what today would be considered a vast scale. For instance, a British hunter and explorer called Samuel Baker is said to have killed almost all the forest elephants in the Moon Plains plateau in the montane zone, as well as in some lowland forest areas in the East (Baker, 1855).

Rationalisation of exploitation and the first signs of forest conservation

Some sort of enlightenment eventually came in 1887 when, realising the need to curb further forest denudation and to start forest management, the British colonial government appointed a Conservator of Forests for the whole country

(Nanayakkara, 1987), whose duties included establishing a Forest Department. Hence, there began again a trend towards forest conservation and an approach to scientific forest management. Despite the fact that the forests in the vital watersheds of the montane zone had been ravaged, the country still had, in 1881, an extensive forest cover of about 84%, mainly in the dry zone, and this had only been reduced to about 70% by the turn of the century. Unfortunately, from a modern planning point of view, the distribution of the remaining forests was far from ideal. Many of the remaining forests were likely to have been secondary forests that grew on abandoned areas where the old Sinhalese civilisations had flourished, and were therefore likely to be on good agricultural land. Meanwhile, many of the important watershed forests of the mountain areas, and other forests on steep slopes, had been cleared to make way for extensive cash crops like coffee and tea.

Thus, by the end of the nineteenth century, the approach to forest management under the colonial administration had begun to shift, from one that allowed over-exploitation and encouraged shifting cultivation, towards scientific forest management and conservation, in what was a difficult attempt to stem the tide of deforestation. The credit for this change in thinking goes to the enlightened British foresters and naturalists who arrived in the country at this time. On their advice, which in turn reflected an empire-wide change in thinking about forest management, the District Administrators framed legislation to enable the declaration and demarcation of Forest Reserves or Proposed Reserves in order to protect forest cover. Despite this, timber continued to be felled indiscriminately on licences which were rarely checked. Most of the timber found its way to Europe, and the rare timber, calamander, became virtually extinct.

One problem at this time was that there was no official forest policy to guide the colonial administration in forest management. This kind of forest administration without a policy and without supervision soon got out of hand and came to the notice of the British Auditor General who made proposals to improve forest management in the country.

Forest management under the Forest Department

In 1899, the newly-formed Forest Department assumed responsibility for forest management in all forests, except in some less valuable provincial forests

which continued to be managed by the District Administrators until 1904 when all the island's forests were brought under its control. The duties of the Forest Department were the conservation, protection, and systematic management of the State forests in order to produce a sustained and permanent yield. To achieve these objectives, a straightforward working circle system of management was established, with the whole country divided into six working circles. This later changed to five and then seven forest divisions, subdivided into ranges and beats. A new Forest Ordinance was brought into being to cover protection and management of the entire forest estate of the country.

The damaging effects of earlier exploitation of the forests took many years to subside. Although in 1920 it was reported that the forest cover was still high, very little of it was marketable timber (Ainslie, 1920). But with the progressive introduction of regeneration fellings and proper sustained yield timber management to ensure highest productivity, under the supervision of qualified foresters, the marketable timber stock gradually increased again.

Forest management activities were strengthened by the promulgation of a new Forest Policy in 1929 (revised in 1953, after independence). These policies continued to emphasise the sustained yield of timber, but were weak in that the importance of forests in the overall improvement of the environment was not a principal consideration, and there was no mention of any participatory aspects in forestry development. This was not surprising, because the country still had a high forest cover and did not yet feel the pinch of a timber shortage, even though in many forest areas the volume of stock continued its downward slide.

On the credit side, apart from the decisive action taken to conserve and manage the forests on a scientific basis, the Colonial Government had considered it necessary to grant free collection rights to the now poor rural people to collect fuelwood within a three mile radius of their villages if located near or within forest areas.

In 1933, on the advice given to government by Champion, forest management took on the system of management through classical scientific Working Plans, and both selective felling and selection felling forest management practices were introduced in different forest areas. Forest inventories were initiated by the Forest Department to determine the existing forest stock. Research began

on how to regenerate these forests to ensure sustained out-turn in perpetuity and the rate of growth, and hence the permissible rate of exploitation (Champion, 1936; 1957). Selective fellings in the early stages were confined to trees over six feet in girth. Although this may have been considered the correct approach to forest management, in 1934 sustained yield forest management received a set-back when forest administration was fragmented again by the transferral of "other crown forests" to the Government Agents running the District Administrations.

Plantation forestry was also begun on *patana* grasslands and by conversion of natural forests in the montane dry and intermediate zones, necessitating the writing of Working Plans for their management as well. Species planted were mainly teak, *Pinus*, eucalypts and *Artocarpus* (jak), as well as mahogany and *Albizia*. Forest plantations were at first managed under what were called "schemes", but these were ineffective and only good on paper. The first ten-year Working Plan for the montane plantations was prepared in 1915, before Champion's advice (of 1930), and was for eucalypt plantations to meet the specific demand for wooden railway sleepers and some utility timber. Later, a form of selection system of management was adopted for a dense canopied mixed plantation forest block rich in timber, the Sundapola mahogany/jak plantation in the north-west intermediate zone, using two Working Circles - a Uniform Working Circle and a Mixed Selection Working Circle. A Working Plan Management System for the growing montane forest plantations was prepared in 1938 and revised twice subsequently.

During World War II, Working Plans prescriptions could not be adhered to and forests were overcut for the war effort.

2.4 The post-independence period

Introduction

The optimism that took hold following independence produced a change of outlook amongst those in control of the country's resources, with major ramifications for the forests and forestry. The national thrust became "development" in which forests were to play a part but not necessarily the part

for which the Forest Department had been prepared. Development meant different things at different times. Sometimes it involved trying to get more from the natural resources through intensification of management (although sometimes without the qualified manpower to do the job); at other times it meant subjugating natural resource management for what were seen as more prestigious or economically important development activities.

Evolution of Forest Department activities to suit changing needs

From independence in 1948, the Working Plans system of forest management was extended to cover forests in most of the Forest Divisions. This was in keeping with the greater need for forest protection and the need for timber and other forest products to meet the needs of an expanding population. The Working Plans were for fixed periods, to be revised regularly. This period in Sri Lanka's history saw forest management planning moving from emphasis on a single resource (timber) to emphasis on multiple resources and, as a result, responsibilities have evolved from custodianship to intensive integrated management (Sahajananthan, 1987). In the revised Forest Policy of 1953, reforestation, conservation of water, and the preservation of indigenous fauna and flora were given high priority, but the export of high value timber was still encouraged. In 1958, the "other crown forests" were handed back to the Forest Department and sustained yield management suffered again: timber yields could not be sustained because forest administrations changed hands frequently, records were lost and forest staffing was inadequate to carry out Working Plan prescriptions.

This new approach to forest management took the form of all management planning and operations being in the hands of the Forest Department (Box 2.2), based on the Champion recommendations which were also being applied at that time in India and Burma.

The preparation of scientific Working Plans was a slow process because of staffing problems and some government-instituted intrusions into forest areas in the form of *ad hoc* excisions for purposes other than forestry. Nevertheless, the classical forest management approach that was prevalent at the time of independence was continued, and included both natural forests and plantations. For instance, Working Plans for the dry zone and intermediate zone teak plantations were prepared in 1956. The Working Plans systems of sustained

yield management remained in vogue for decades, and were only replaced recently by Management Plans prepared under a system of strategic forest management planning.

In the early 1960s, zonal management of forests was tried, the zones being defined on a geographical basis. However, this experiment was a total failure, because of inadequate infrastructure and ignorance of basic forestry principles. Within half a year the "zonal system" was abandoned.

Box 2.2
Early post-independence approaches to forest management

Wet zone forests

- Coppice Working Circle, for fuelwood and small poles, with a 25-year rotation, to supply different centres of consumption.
- Clear felling Working Circle, for fuelwood and timber and subsequent planting. This was primarily of an experimental nature around '*chena*' reforestation areas in small annual coupes.
- Local supplies Selective Working Circle for timber.
- Railway sleeper supply Working Circle. The recommended felling was on a selection system with an exploitable girth for *Dipterocarpus zeylanicus* (Hora) at the same 6ft level, on a 20-year felling cycle.

Dry zone forests

- Selective Working Circle for timber on a 40-year felling cycle.
- Conversion Working Circle with several felling series for locations suited for growing Teak where *chena* reafforestation could be done effectively.

Montane forests

- Growing of general utility timber on *patana* grassland afforestation areas, rather than specific purpose timber.
- Continuation of tea estate fuelwood plantation coupes.

Development brings changing fortunes for forestry

Despite all these increasingly scientific approaches to forest management, forest denudation returned. The reasons for this included not only rapidly

growing human populations with growing needs and aspirations but also the implementation of giant irrigation, settlement, hydro-power, export agriculture, tourist hotels, and shrimp farming projects. Military and terrorist activities also played a part.

The first such project was the Gal-Oya Development project in the Eastern Province. The most recent major project was the massive Mahaweli Development project which, in the 1980s, caused the loss of 243,000 ha of forest, including both teak plantations and natural forest. Nearly 809,000 ha of forest have been lost in the name of development since 1948, resulting in a steep decline in forest cover. More forests were also lost because of continued "irreversible *chena*" cultivation and illegal felling. Moreover, after Mahaweli, State forest clearance for development declined, and regrowth has been recorded.

As the general interest in forestry grew, further forest inventories were carried out, in 1956, 1965/68, and 1979/85, to take stock of the fast-depleting forest resource and to prepare forest resource development plans. Forest inventories cost a lot of money but fortunately, a fair amount of foreign funding was forthcoming since they were considered by donors to be a high priority activity.

The 1956 Inventory was undertaken with assistance from Canada through the Colombo Plan technical assistance programme (Andrews, 1961). The inventory report showed 44% of closed forest cover and contained recommendations to establish management units and the preparation of management plans for these units. Details of compartments, demarcation, annual coupes, short-term cutting plans and road plans were built into the inventory. This was a comprehensive inventory with a new approach to forest management. The allowable cut was a surprising over-estimate of 850,000 m^3/yr along with a still surprising recommendation that only 25% of the country be permanently dedicated to forests. This was a common approach to development at the time which emphasised rapid conversion of natural resources into financial assets so as to boost economic development. Fortunately for the forests, this recommendation was not accepted, and the thinking today is that the country should have one third of its area under closed forest cover. One output of the inventory was a good forest type map for the whole country.

By 1965, the Government was faced with conflicting and competing demands for land use. There was also, by then, a policy decision to develop industries based on sustained supplies of forest wood. This resulted in the FAO/UNDP survey and inventory of selected forest areas including forest plantations. The 1956 data were updated with amendments to the inventories of the wet zone and the montane zone plantation forests. The survey showed that with the correct management, the country could enjoy for all time, an adequate supply of forest produce (mainly timber) and a protective forest environment. The expansion of forest plantations in the dry and montane zones was recommended, as well as the expansion of timber supplies through selective logging.

Another result of this survey was the breakaway in 1968 of the timber supplies, conversion, marketing and timber sales activities from the Forest Department, with the formation of the State Timber Corporation. However, this development also ran into difficulties as it did not foresee the oncoming threat to forests in the form of more large-scale development projects such as the Mahaweli. Thus, although inventories should lead to sound management systems, in Sri Lanka the inadequacy of institutional links between development and conservation agencies made it difficult to prepare implementable management systems. Another reason is lack of scientifically-informed political will. These constraints reflected the need for a broad-based National Planning Council with all relevant institutions represented on it at the highest level. In this the importance of forestry was recognised and the voice of concerned foresters and naturalists heard.

Reassertion of forestry as a tool of development, and the growth of conservation awareness

The post-1979 period saw many forestry development projects being implemented, and new thinking emerged on how best to expand forestry activities. Paradoxically, this was also the period of the Mahaweli Development project which saw the clearing of large tracts of forest.

The third forest inventory began in 1979/80 with FAO/UNDP assistance (FAO, 1987). The inventory found that the percentage of closed forest cover was, by 1983, down to about 25% (corrected to about 26% by a later forest cover

monitoring project). It also found that natural high forest, forest plantations over five years and scrubland totalled 37.5% of the area of the country (Sahajananthan, 1987). The all-island deforestation rate, including Mahaweli forest loss, was around 42,000 ha per year. Furthermore, the inventory found:

- a significant proportion of over-exploited natural humid forests;
- non-stocked fallow lands that could be made productive;
- unmanaged forest plantations giving low yields.

The results of this inventory, and the trend in deforestation revealed by it, led to the start-up, in 1983, of the Forest Resources Development Project (FRDP), funded by the World Bank, Finland and Sri Lanka, and the Master Plan for Forestry (Poyry, 1986), both directly attached to the Ministry of Lands and Land Development. New thinking and new approaches emerged as to how forests should be managed in the future, but not all met with approval from foresters and forest scientists.

The Master Plan, which ran into widespread criticism, indicated that intensive exploitation of forests was needed, especially in the dry zone, and that adequate timber could be made available. The Plan had earlier proposed (in its draft) the importation of a large number of sawmills and other expensive equipment to do the chopping and cutting.

Almost all environmentalists, many respected senior university academics, members of the public and the Forest Department itself criticised these proposals. The Plan, even in its final form, had not paid due attention to environmental considerations and conservation of genetic resources which were considered essential by so many people at the time, and which were key components of the Forest Policy. This policy (Section 2.4.5) identified the need "*to maintain, conserve and create forests for the preservation and amelioration of the environment*", and "*to involve the local community in the development of private woodlots and forestry farms through a programme of social forestry*". Critics of the Master Plan were of the opinion that the undue emphasis on timber exploitation was due to the agendas of the donor agencies.

The Master Plan made the assumption, which has not gone unchallenged, that deforestation in the dry zone (which carried most of the country's remaining forests) was inevitable and that it would also gain momentum. That was

apparently also one of the reasons for the proposed importation of the sawmills and equipment: the mills were to expedite this inevitable process of forest denudation. Some of the sawmills that were to have been imported were mobile lumber harvesters, small in size but with a high capacity because they could readily be transported from one forest to another. These mobile harvesters could, in the long run, do more damage to forests than the larger static sawmills.

A close scrutiny of the dry zone forest cover today proves that the Master Plan had made a grave and erroneous assumption. Latest reports indicate an increase in new natural forest growth in some dry zone districts, not a decrease. Fortunately, local protests were supported by an FAO study, and the proposed importation of sawmills was removed from the Master Plan, but the absence of strategies for environmental improvement and conservation of genetic resources remained. Another criticism of the Master Plan was that it was a plan without a plan, there being not a single map to indicate at least the forest management areas.

Despite these criticisms, some useful studies emerged during this period. Two of especial value were a study on demand and supply of timber and fuelwood, and a study on non-forest wood resources. The latter determined that only 50% of timber and 20% of fuelwood consumed in the country came from forests proper in 1986, while the remaining 50% timber and 80% fuelwood came from the country's large tracts of non-forest vegetation, including industrial plantations such as rubber and coconut, as well as home gardens and miscellaneous plantings. Within such a situation, the management of non-forest wood resources should go parallel with forest management. Further, by a logical increase in and management of non-forest areas, the pressure on the remaining forests would be reduced. By complete utilisation of the "lop-and-top" from non-forest trees, the fuelwood yield from non-forest areas could also be increased. Management approaches with this strategy in mind are now gaining ground. Many governmental and private sector agencies would have to be involved in the management of these non-forest wood resources.

The FRDP was followed by the Forest Sector Development Project (FSDP) in 1990 with added funding and technical assistance from the British ODA, UNDP, FAO and IUCN. The FSDP is on-going.

The National Forest Inventory and the two Forest Development Projects paved the way for a new approach to forest management. Computerised management planning was being developed for forests on a district-by-district and a plantation-by-plantation basis. The Forestry Planning Unit (FPU) of the Ministry in charge of Forestry (initially the Ministry of Lands and Land Development), which also had the task of supervising the projects, was responsible for the development of this management system. The foreign-funded components of the FSDP are being supervised by the FPU. They are:

- Environmental Management
- Forest Management
- Silviculture
- Education and Training
- Research and Information
- University of Peradeniya – Oxford Forestry Institute Link
- Institutional Development

Forest Management is the key component and a continuation from the FRDP.

The 1980 National Forest Policy

Introduction

The guiding principles for the National Forest Inventory for forest management planning, the FRDP, the Forestry Master Plan and the continuation FSDP, was to be the 1980 National Forest Policy (Nanayakkara, 1981). Forest management policy was now being considered under three broad areas:

(i) The management of productive and enriched natural forests;
(ii) The management of plantation forests;
(iii) The conservation of natural forests.

However, forest management suffered a setback in the late 1980s. This time it was the socio-political problem that took the form of violent insurgencies.

Insurgencies in the south and the north of the country did not permit entry into forests by foresters and forest workers. The southern insurgency ended, but

the one in the north continues. Non-entry into the southern forests, however, had its good points because it drove unscrupulous timber contractors and illicit fellers out of the forest through sheer fear of the consequences if they entered. Labels affixed to trees in forests of the south carried the legend that timber fellers and forest trespassers would be "dealt with".

Management of productive and enriched natural forests

The 1986 Natural Forest Inventory report identified 23 management units in the wet and intermediate zones, including the mahogany-enriched forests. A model management plan for one group of natural wet zone forests (the Delwala-Walankanda-Madampe group in the south west wet zone) was prepared with an operational plan, and a modern forest management system emerged. This management system included provision for close monitoring of several components of forestry, including:

- annual coupe area locations;
- road building plan;
- boundary line demarcation;
- reafforestation of unstocked areas;
- enrichment planting with mahogany and dipterocarps;
- establishment of sample plots for monitoring growth and yield.

Management felling prescriptions are on the basis of a selection system of management. All lands coming within Management Plans would be permanently demarcated on the ground, permanently dedicated to the cause of forestry, and managed on a sustained yield basis.

Management of plantation forests

Management plans for plantation stands were prepared with prescriptions for volume production, timing of thinnings and final felling per type of site/growth index class. The computerised Forest Management System (FMS) was built and made operational. It incorporated programmes for yield prediction based on provisional yield tables for each plantation type and site/growth class. Each plantation stand is registered in the system (Sahajananthan, 1987).

Unfortunately, these plans appeared to be more weighted towards wood production. The beneficiary would be the State Timber Corporation which carried out all harvesting operations through contractors or its own logging units. The State Timber Corporation, although well-conceived, is however more often seen these days as an obstacle to sound forestry, because its main interest is in obtaining a financial return from the forests; it has rather less interest in ensuring that forests are thinned, or oversize trees removed, or in ensuring that its contractors keep to the rule-book. As such, it is doubtful whether the productivity from these computerised management plan operations could be sustained in the long term, as was possible under the earlier Champion's conservative Working Plan System for management (Sahajananthan, 1987; Champion, 1936). New environmental guidelines in harvesting and conversion have been introduced in the hope of rectifying the situation.

In 1994, the FMS database for forest plantation management, was transferred to the Forest Department from the FPU. There had been some managerial problems regarding the implementation of the FMS in the field, because Forest Department staff had found the FMS somewhat inaccessible for their use, not least because the manual was prepared by a non-forester and was not user-friendly. Such managerial problems are bound to arise when computerised management systems are developed and used. They inevitably raise difficult questions, for which firm decisions are required. If the management system were to break down then there is the chance that *ad hoc* cutting programmes would be resorted to and the forest plantations ruined. In the meantime a Forest Data Computer Program (FORDATA) has been developed by the University of Colombo for forest plantations. This database computer programme has been installed in three forest divisions of the Forest Department.

Conservation of natural forests

The policy to conserve forests was pursued with some vigour by the Forest Department as was recommended in the National Forest Inventory report. This ecosystem approach to forestry is today important in the management of natural forests in the country, although there is some debate as to how absolute the conservation should be. In general, it is strongly backed by the powerful environmental lobby in the country.

Forest management in the 1990s

The 1990 logging ban

In 1990, one of the most positive actions with respect to the management of the natural forests was taken: a logging ban was imposed by Government. In view of the depleted state of forest growing stock, overcutting and the resulting adverse environmental effects, the Forest Department strongly agitated for the ban and was supported by all environmental groups. The ban is still on in the natural forests, and there is a strong movement in the country to keep it so, until such time as depleted forests are replenished and forest areas increased. Meanwhile, a new inventory of the growing stock of all natural forests is required. A start was made in 1992/93 with an indicative inventory.

The ban has been popular with people living in the countryside, who are generally averse to seeing logging trucks damaging fair weather roads and culverts in or on the approaches to their villages when transporting timber from neighbouring forests. Their aversion is more so when they feel that they do not benefit by the timber extraction and that only the contractors and the State Timber Corporation benefit – although in theory every citizen should benefit from the royalties and taxes raised for government, if indeed the contractors and corporation paid them as they are supposed to.

The logging ban in natural forests prevails over most of the country except in the north where, because of the insurgency, some forests, including teak plantations along roadsides, have been cleared and timber removed for various purposes by the opposing sides. In these areas there is no forest management of any sort in either the forest plantations or natural forests. As it happens, the larger part of the natural forests of the country are located in these areas of insurgency, rather than in the eroding central tea districts where forests could be so valuable. Some increase in the natural forest cover has been noted in the North, especially in the Mullaitivu district. It is hoped that when the problems in the North are settled, the forests there will again come under management plans.

There is some concern that if renewed management operations are started involving felling of natural forest timber before the forests are adequately

restocked, then denudation will set in again. The stocking of natural forests is now considered too low and too dispersed, and the general consensus among foresters and environmentalists is that these forests have to be rested for a long time. Indeed, some may require total protection indefinitely. In the meantime, it will be important to increase the 18 Forest Divisions to 25, thereby covering all the Districts of the country, in order to intensify management and all other forestry activities. Any lifting of the logging ban has to be carefully considered as it likely to be resisted at present by rural people.

The rise of people participation

Until recently, the "top-down" approach was adopted in the management of forests, as the thinking on new participatory forestry concepts was in its infancy. However, the first steps were taken in the south when local people debarred contractors and illicit fellers, who were backed by powerful people, from entering forests. With respect to plantation establishment through agroforestry, participatory action is now well established.

On Forest Department advice, the Government decided that, in a small country like Sri Lanka, the environmental benefits of large expanses of forests would pervade the whole country and everyone should benefit equally from the goods and services forests provide. This decision was in response to the formulation of the Provincial Councils system for decentralising local government functions and development activities under the 13th amendment to the Constitution of Sri Lanka. The management of forests was always to stay at the centre as a reserved subject, but it was decided that social forestry could be practised by the new Provincial Councils concurrently with the centre. The situation may be reconsidered, and if necessary changed, to suit new Constitutional reforms being prepared by Government. If good sense prevails, natural forests, which influence the macro environment so much, will remain under central control.

Donor involvement in forestry

The British ODA is providing funds on a grant basis and technical assistance to promote scientific forest management and other activities. These bilateral

projects are the Forest Management and Planting project (FORMP) and the interconnected Forestry Land Use Mapping project (FORLUMP). Funds are also provided by the World Bank on a loan basis. These funds are from the IDA of the World Bank. ODA is working in close collaboration with the Forest Department to prepare management plans for the hill country (montane zone) in the Kandy, Matale, Kegalle, Badulla, and Nuwaraeliya Forest Divisions. The World Bank is providing loan funds to prepare plans for other locations. The forestry activities involved in these foreign-aided bilateral projects are:

- Silvicultural treatment for about 60,000 ha of established forest plantations and 40,000 ha of natural forests.

- Mapping, inventory and preparation of management plans for about 35,000 ha of forest plantations and 100,000 ha of natural forests in the dry zone.

- Mapping and an indicative inventory of about 500,000 ha of degraded forests in the dry zone.

- Management of about 40,000 ha of natural forest in the wet zone under a 30-year felling cycle as prescribed in the existing management plans. No fellings will be done as the forests now come under the logging ban.

- Some pilot social forestry activities are also included.

FORLUMP is under the Mahaweli Authority in its Kandy Branch. The project prepares maps using remote sensing techniques for the Upper Mahaweli project areas in the montane zone. The Forest Department purchases these maps to determine sites for its forest planting programme in the montane Upper Mahaweli catchment. A national forest cover map on the scale 1:250,000 was also prepared with ODA assistance in 1992, using remote sensing techniques. Most recently (1995) FORMP has prepared a 1:50,000 scale forest map of Sri Lanka with improved data, replacing the earlier 1:250,000 scale coverage. The new map provides up-to-date information for forest management planning. It provides a baseline for interpreting future changes and developments. FORMP has developed land identification techniques. Several detailed district maps have been prepared for the Kandy and Nuwaraeliya districts of the montane zone. A methodology to identify reafforestation sites in the dry zone has also

been drawn up. The ODA activities are also useful in that they provide for building up an increased awareness of forestry and land use options through seminars, workshops and meetings.

This foreign bilateral assistance, although it has taken some time to get off the ground because of some linkage and staffing problems, is now on track. It is also part of a less controversial assistance package because the aid is in theform of a grant. Such foreign assistance has been found to serve as an impetus to development activities, and in this case is timely in view of the resurgence of forestry interest in the country. ODA is thus providing key support in the first step in Forest Management Planning by the preparation of maps and monitoring of forest cover.

The 1992 timber inventory

Table 2.1 gives the total timber volumes for three categories of forest in the dry zone and wet zone.

In the dry zone, volumes occuring in the larger diameter classes are of species which are of the least acceptable quality and thus not valuable. It has also been determined that the stem number of the smaller diameter classes are insufficient to ensure adequate restocking.

Table 2.1
1992 Volumes per hectare by minimum dbh limits, in m^3, for dry zone and wet zone forests.

Category	>10 cm dbh	>20 cm dbh	>30 cm dbh	>40 cm dbh	>50 cm dbh	>60 cm db	Totals
All dry monsoon forest	21		15		6	4	46
Nat. dry monsoon forest	44		33		11	8	96
Regen. *chena* in dry zone	7		4		2	0	13
All lowl. wet zone forest		168	126	86		35	415
High forest in wet zone		241	188	133		62	624
Regen. wet zone forest		170	126	24		30	350

The bulk of the trees that remain are of low value; it may not even be economic to harvest the trees, even for fuelwood. This indicates the complex nature of management prescriptions that need to be adopted to restock the forests with valuable species. Under the new system of forest management planning, a cautious approach is needed. Meanwhile, these remaining natural forests need to be zealously protected.

The situation in the lowland wet zone is far better. The forests are fairly well stocked in all diameter classes. The latest inventory results, however, show substantially lower volumes in natural forests when compared with the 1985 inventory results for the wet zone. Also, the extent of the natural forests in the wet zone is very small relative to the dry zone.

2.5 Towards a re-definition of sustained yield forestry

Sustained yield in natural forest management has been used in the past to describe the production of timber and fuelwood of the same quantity plus some increment year after year. But studies that might show whether or not the forest condition has deteriorated as a result of this management are inadequate. Sustained yield should in fact really be a sustained production of all benefits, services and products that a forest can provide, but at the moment this appears to be yet another nebulous concept, a distant dream. Sustainability in the real sense of the word, is something foresters have yet to achieve. The degraded nature of Sri Lanka's natural forests because of overcutting, both by State agencies and illegal loggers, shows how difficult it is to manage natural forests in a truly sustainable manner.

Even the very concept of sustained yield in tropical forests has been questioned – one writer referred to it as "empty words" (Pushparajah, 1986). This indicates clearly how poorly or how rarely the foresters' and forest scientists' knowledge of the dynamics of a tropical forest ecosystem (or for that matter even a man-made forest stand) has been translated into practical forest management. Sri Lanka appears to have made a start, through research workers from the universities, to find some answers to this difficult question of how tropical natural forest ecosystems can be sustainably managed. Continuing to pay lip-service to words like "sustainability" and "sustained"

without proven applications will not improve the quality of forests or benefit the people. Nevertheless, the concept of sustained yield management is always in the minds of Sri Lanka's foresters who are trying to ensure that forest production does not continue to decline. This production includes not only timber but also fuelwood, food, medicines, fauna, and other goods and services. Among the other benefits a forest should maintain are microclimate and the dryweather flow of water. However, finding the correct answers is not going to be an easy task.

To quote FAO (1993):

> "*the concept of sustainable forest management is now seen as the multi-purpose management of the forest so that its overall capacity to provide goods and services is not diminished.*"

CHAPTER 3

THE ENVIRONMENTAL IMPORTANCE OF SRI LANKA'S FORESTS

3.1 The history of deforestation

Even up to the period in which Sinhalese civilisation reached its height, Sri Lanka possessed extensive areas of natural forest and home gardens. These provided a predominantly farming people with a good climate, clean water and a healthy living. The montane zone was fully covered with such vegetation, and the rivers running down from it, including the mighty Mahaweli, were clear; floods were a rare occurrence. However, the passage of time, the ravages of frequent foreign invasions from south India and the ensuing disease, contributed to the collapse of this civilisation. The centre of government shifted from the ancient cities of Anuradhapura and Polonnaruwa in the north, to Kotte and Kandy in the centre and eventually to Colombo on the west coast. As this happened, so many of the island's managed and carefully protected forests gave way to relatively low-value and under-managed secondary growth.

Further clearing of the island's central montane forests (arguably the nation's "lungs") took place under the British administration in the 19th century to make way for tea and coffee plantations. Sport hunting also decimated game populations at this time. It was not until later that century that more enlightened British foresters and naturalists insisted that their government take immediate steps to conserve forests and improve environmental conditions again.

Forests continued to deteriorate post-Independence, because of population growth, growing consumerism and a "development" ethic that frequently argued for more and more forest clearance to provide land for settlements, large irrigation and hydro-power projects, hotels and sporting grounds to meet the needs of tourists, shrimp farming and other activities.

3.2 The environmental need for planning for a permanent forest estate

Forests provide numerous "services" in addition to the "goods" with which we normally associate them (Box 3.1).

Sri Lanka is densely populated. Because of population increase, the per capita extent of forest, which was about 0.8 ha in 1902 (Seneviratne, 1982), has now dropped to about 0.11 ha. The present population is in the region of 18.1 million and rising rapidly – yet the area of land is finite. Planning for forests and people therefore needs to go hand in hand. With closed forest cover of only about 24% of the area of the country, many people, both within and outside Sri Lanka, are beginning to press for the complete protection of the remaining forests.

Box 3.1
Some of the services provided by forests

- they provide good microclimates for a comfortable living;
- they help conserve topsoils and prevent erosion, siltation, earthslips and landslides;
- they serve as barriers to strong dessicating winds, storms and cyclones;
- they ensure dry-weather flow of water in streams;
- they stabilise the oxygen/carbon dioxide ratio in the atmosphere; and
- they even help trap damaging ultraviolet radiation that reaches the earth through the thinning ozone layer of the upper atmosphere.

Pressure is also mounting to increase the area of closed forest cover to one third (Nanayakkara, 1992), with particular emphasis being placed on reforesting the wetter parts of the country, especially the montane zone where space could still be found to do so.

Partly as a result of increased public awareness of environmental issues, especially forests, an Environmental Management Division (EMD) was established in the Forest Department in 1989. Since then, it has prepared a computerised database – the "Environmental Information Management System"

(EIMS) – to cover all environmental information, species data and values of the natural forests of Sri Lanka. A comprehensive user's manual has also been prepared. All effects of conservation measures are also recorded in this database and updated regularly. This is a valuable storehouse of information that acts as a guide to the practical management of the forested environment. The manual is intended for use by both the Forest Department and the Department of Wild Life Conservation.

3.3 Forests and the agroclimatic zones

Coastal zone forests

Mangrove forest ecosystems covered many sections of the coastline of Sri Lanka in the past, especially the estuaries and mouths of rivers, shores of lagoons and islands. Most of these mangroves were cut by merchants and traders in the past. They continue to be cut by coastal village folk for fuelwood and domestic wood. The Forest Department and the District Administrators also issued permits (on the payment of a fee) for the collection of mangrove bark. In general, though, this level cutting is controlled and there is little damage as the mangroves regenerate well.

A bigger threat to the mangroves today is their wholesale clearance to make room for tourist hotels and numerous export-oriented shrimp farms. This is despite protests from foresters, university academics and environmentalists. There seems to be no political will to stop this calamity, even though there is meant to be a logging ban operational in all natural forests.

The extent of mangroves in 1986 was estimated to be only about 10,000 ha, the largest part of it along the north western coastline (Nanayakkara, 1986a). Backed by UNESCO assistance, a National Mangrove Committee was formed in the 1980s and action is now being followed up to regenerate, protect and manage whatever mangroves are left. However, the conflict with tourism and export-oriented shrimp culture continues, and environmental NGOs are now leading the fight to protect the mangrove ecosystem. Awareness programmes are being launched on the importance of mangrove vegetation in protecting the coastline, in improving coastal fish breeding grounds (which benefit the small-time fishing communities), in improving the supply of fuelwood, domestic

wood and other forest products, and on the important part mangroves play in providing nesting grounds for migrating birds during the northern Eurasian winter.

What is missing, however, seems to be the lack of awareness or willingness among business entrepreneurs who continue to promote mangrove forest destruction with support from foreign financiers who co-finance shrimp export projects. The state-owned Board of Investment, which approves foreign-collaborated projects, should be cautious in regard to shrimp culture projects in or near mangrove areas if the country's coastal environment is not to degrade further.

Dry zone forests

Although the dry zone is not well-stocked with timber, there are extensive forest areas of the low dry evergreen or monsoon type in the Northern, North Central and Eastern Provinces. The importance of the dry zone forests was reflected in the FAO/UNDP National Forest Inventory completed in 1986, which indicated a dry zone/wet zone forest ratio of almost nine to one (FAO, 1987). As would be imagined, the main benefit of the large expanses of these dry zone forests is environmental. For example, the dry zone forests play an important role in ameliorating the harsh climatic conditions that prevail in most parts of the zone, especially the high temperatures during the drought periods and desiccating winds from the east, as well as the occasional cyclone. The Eastern Province experienced devastating cyclones in 1964 and 1978 when large tracts of coconut and teak plantations were destroyed, but there was hardly any damage to the natural forests and the coastal mangroves which served as a buffer.

In a small country like Sri Lanka, these forests not only help to maintain environmental balance over the whole country, they also serve as important habitats for wildlife and enable *in situ* conservation of genetic resources and endangered species. For this reason, their conversion to plantation forests is prohibited. They are havens for wildlife, harbouring, for example, most of the island's remaining elephants. In line with their conservation importance, most of the reserves in the national Protected Areas Network (which covers 14% of the country) are located in the dry zone. In some, wildlife protection is insufficient (especially in "no go" areas), while in others game numbers are

now so high that they threaten natural regeneration of the forest during dry periods (Nanayakkara, 1981; 1982). In Yala National Park in the south-east, for example, a regeneration plan has had to be initiated, involving periodically fencing off areas of the park to promote regeneration.

Lowland wet zone forests

Located in the south-western part of the country, this is a critical agro-ecological-climatic zone where the natural forest cover has been reduced to about 9 per cent. The zone is nevertheless well stocked with home gardens with several canopy layers, and agro-based industrial plantations such as coconut and rubber. To some extent, these complement the environmental benefits provided by the limited extent of natural forests in this zone.

The removal of natural forest cover in this zone has led to regular floods, mainly because silt-laden rivers burst their banks and overflow during the rainy season. Two such rivers are the Kalu Ganga and the Kelani Ganga which both enter the sea in the south-west. In order to ameliorate environmental conditions, therefore, reafforestation of the upper reaches of these two rivers is desirable. All remaining areas of natural forest, except for part of the Sinharaja World Heritage Site, had been exploited for timber in the past and need to be rested for decades to enable them to regain their environmental importance and timber value.

Montane wet zone forests

This area, on the western side of the montane zone, is the most critical area where forests are needed to ameliorate environmental conditions. The natural humid evergreen forests in most of the area have been replaced by eroding tea plantations. As a result, destructive floods, soil erosion, earthslips, rock slides and landslides are quite common, causing much loss of life and property. Small but vital areas of natural forest and forest plantations, located mostly on the peaks in the high-elevation district of Nuwaraeliya, are being protected and managed to maintain an environmental balance in that region. Still, even here, illegal fuelwood cutting by tea estate workers, and some illicit felling of timber, have resulted in eroding footpaths and skid trails, again causing environmental problems.

It should be noted that the favourable climate and scenic beauty in the whole montane zone, particularly in the Nuwaraeliya district, depends in part on the existence of these residual forests. For instance, the montane city of Nuwaraeliya is a popular holiday resort. The district's popularity as a holiday resort, both for local and foreign tourists, is proof of the contribution of the forests in the district to favourable environmental conditions. Beneficial effects of the forests, such as the cooling winds and precipitation, also spread into the surrounding lowlands.

The Forest Department, with bilateral assistance from the USA, has established several catchment forests in the zone. As a result, streams run clear again and the hazards of earthslips and landslides have been reduced. Reafforestation efforts by the Forest Department are continuing, supported by further assistance from agencies like the AsDB, ODA and the World Bank, in order to further improve environmental conditions in the zone.

A major problem in improving environmental conditions through forestry in the zone is the difficulty in regaining control of tea estates that are either uneconomic or that are located on steep slopes. Both types would be suitable for reafforestation, but the intransigence of some of those who wield political influence in the region has often prevented this idea from becoming reality. Although reafforestation and forest conservation measures improve environmental conditions, and hence ultimately the well-being of local people and the nation, many politicians in this region are more likely to be interested in giving land or jobs to people on the tea estates in order to get their votes at an election. Plantations are often unpopular with local people, who may even set fire to them. However, there are now several green-minded political groups that are keen on restoring the forest cover in the montane zone. These groups do not have vested interests in this region, and therefore may stand more chance of success in the long term.

Regarding the Kandyan home gardens in this zone, for which Sri Lanka is famous, it needs to be mentioned that although they do simulate natural forests in structure and species diversity, on closer inspection, because of scraping and working of the soil under the canopy for cultivation of crops, there is a certain amount of top soil erosion during heavy rain, especially in the steeper areas. From an environmental point of view therefore, the natural forests in the montane zone have no better substitute. The thinking of many people now is

that, wherever possible, natural forest cover should be restored to these eroding hills.

In this zone, wet grasslands, known as wet *patanas*, intersperse forests at high elevations. Some are edaphic and others biotic in origin. Thick grass holds the topsoil together, and hence they do not have such an adverse effect on the environment as might be supposed. The only danger occurs during the dry season (around February to April) when fires may occur, destroying the protective grass cover. The classic example of annual fires that cause environmental problems is in the Horton Plains National Park at an attitude of over 2,200 metres. The Park comes under the jurisdiction of the Department of Wild Life Conservation. Joint action is taken by the Forest Department and the Department of Wild Life Conservation to try and keep fire damage to a minimum.

Montane dry zone forests

This zone occupies the eastern side of the central montane region. Natural forests are sparser and rainfall much less. Grasslands known as dry *patanas* exist in between scattered forests. The need to establish forests quickly over this area has been accepted after the positive results obtained by the Forest Department's efforts at reafforesting the wind-swept slopes of critical areas, for example at Erabedda, Bandarawela and Badulla. Even in this region, the indigenous natural forest had been cleared and tea plantations established during colonial times, resulting in earthslips and landslides during occasional spells of heavy rain.

A famous example of the influence of forests on the environment in this zone is at Palugama, an area whose name means "the desolate land". In the 1940s, because of the foresight of the then political leaders, eucalypt shelterbelts were established scientifically on a barren windswept grassland by the Forest Department. This has since resulted in the development of a green and now bustling agricultural township, Keppetipola, named after a famous freedom-fighter of the early 19th Century (Tisseveerasinghe, 1987).

Arid zone forests

Two areas in the north-west (Mannar District) and south-east (Hambantota District) constitute this arid to semi-arid zone. It is a very dry, sandy region with scattered sparse scrubby vegetation with *Prosopis* and cactus. The Forest Department has started planting species like *Eucalyptus camaldulensis*, *Casuarina equisetifolia*, and *Prosopis* to stem the spread of sand dunes in bare areas and thereby improve environmental conditions. The environmental effect of this planting is now considerable.

3.4 Summary

Sri Lanka's forests are extremely varied, and each forest type is worthy of conservation in its own right. In addition, the nation's forests play an important role in producing favourable environmental conditions for the population – as becomes all too clear when forests are cleared from land that cannot sustain any other uses. The deforestation trend has been continuing for many hundreds of years, and has accelerated recently; the size of the forest estate has probably reached an all-time low. The time has come for forest clearance to stop unless there is a pressing need, and for degraded areas to be returned to forest where at all possible. However, after the logging ban and the decline in State forest clearance, there are signs of a decline in the deforestation trend, but in no way should any increases in new growth that result be construed as an increase in timber stocking.

CHAPTER 4

THE SOCIAL IMPORTANCE OF SRI LANKA'S FORESTS

4.1 Introduction

In a country like Sri Lanka with a long tradition of forestry practice and management, and of forest and wildlife conservation supported by royal and government patronage, the social values of forests are many, and include:

- local use of forests;
- tourism and recreation;
- scientific study;
- religious retreats.

4.2 Local use of forests

Forest peoples

There are probably no more than a thousand true forest tribals now living in Sri Lanka. Those that remain constitute the Veddha people, found in the east of the country. There they have been "given" a block of forest to enable them to pursue some of their forest-based activities – although whether they really do still pursue them is debatable. In fact, many Veddhas now earn quite a lot of money from foreign tourists. Some of them are also permanently employed in agriculture and even work as paid workers in the Forest Department's afforestation projects, for instance in the Co-operative Reafforestation Scheme.

The absence of forest-dwelling tribes from remaining forests should enable Sri Lanka to manage its forests as is done in developed countries. Of course, people living on the borderlines of forests, or in villages within forest boundaries, do need to be able to gather limited non-wood forest products. The chief ones are medicinal plants and honey which have been used as part

of the indigenous medical system since ancient times. But even these people are primarily farmers. Living near the forest, they make use of a few goods from the forest that benefit their lives, but they are not forest-dependent as such.

Non-forest rural peoples

The present Forest Ordinance continues to allow the free collection rights for fallen fuelwood and minor forest produce that were first incorporated in the Forest Ordinances of the British period. This satisfies some aspects of the social needs of rural people who live in or on the periphery of forests. As the latest on-going studies show, only about 7% of the fuelwood needs of people come from forests and most of this comes from the operation of these rights. The bulk of fuelwood consumed by people in the country comes from non-forest vegetation. This is a healthy sign both from a forest and environment viewpoint because it suggests that there will be little pressure on forests for fuelwood.

Studies have revealed that, on average for the whole country, rural people do not have to walk more than one mile to fetch the fuelwood needed for their domestic chores (Wijesinghe, 1981). Thus the fuelwood situation in Sri Lanka is better than in some other countries. However, fuelwood is still the major domestic fuel in the country and is likely to remain so for a long time. As the population increases and forest resources are depleted, the fuelwood situation may deteriorate. This suggests that countrywide increases in the planting of agroforesty home gardens through participatory methods may be of high social importance, since it would further reduce the efforts and cost needed to obtain fuelwood.

People's participation is at the core of the new AsDB-funded participatory forestry project which includes components of establishing block plantations, agroforests, watershed forests and countrywide amenity plantings. This project will also no doubt improve environmental conditions, thereby demonstrating the value of grassroots participatory approaches to forestry practice. People will be made beneficiaries under this project.

4.3 Tourism and recreation

Many forests are visited by the public, including students, for recreation purposes with permission from the agencies in charge. Some blocks of mixed forest plantations raised by the Forest Department are no longer being managed for timber because of their location near cities, and their amenity and micro-environmental values. Some of those which straddle the highways entering cities now serve as picnic spots for school children, family groups or the general public. Here the Forest Department provides facilities for picnicking that blend with the surroundings of these forests. A good example is the picnic site in the Badagamuwa area which is now a well-stocked, high-canopied, mixed forest just outside the town of Kurunegala in the north-west intermediate zone.

In addition to Forest Reserves, approximately 14% of the country is gazetted as protected areas, mainly National Parks. Apart from local visitors, these also attract large numbers of tourists.

4.4 Scientific study

Student and environmental groups use the forests for study purposes. Since forestry was included as a subject in curricula on the initiative of the Forest Department, student visitation of forests for scientific study has increased.

In a new development started in 1988, strictly-protected, unique natural forests are being opened for regulated visits, mainly for the purposes of scientific study. One such forest is the Sinharaja Forest Reserve in the south-west which is listed as a natural World Heritage Site with UNESCO. It is also declared a National Wilderness area under the Sri Lanka Wilderness Areas Act. More forests are being earmarked for listing as World Heritage sites. However, it takes a long time to secure approval for such a listing and some new interventions are needed to quicken the process. Sinharaja listing started with the despatch of colour slides to UNESCO in 1983, and took nearly five years. One reason for the delay was because part of Sinharaja had been exploited for the supply of logs to a giant plywood/chipboard/furniture complex in the 1970s. This followed a feasibility study done on the advice of a World Bank expert (Rajapkase, 1974; Nanayakkara, 1985). Scientific studies conducted in

Sinharaja have subsequently helped in obtaining assistance from international agencies for intensive forest conservation and management of Sinharaja and other unique forest ecosystems, thus increasing their social importance as well.

Often it is found that many forests, especially those in the dry zone, cover the ruins of old civilisations which are of great archaeological importance and provide archaeologists and other serious study groups with a seemingly endless source of material. Ritigala Forest Reserve, a high peak in the dry zone, is a striking example and has been declared an Archaeological Reserve. Apart from ruins, this forest has many distinct vegetation types which are also of interest to students and scientists.

4.5 Religious retreats

The Forest Department, which is the custodian of about two thirds of the forests of the country, issues permits at a very nominal fee for small blocks of natural forest which are termed hermitage or *aranya* forests, for the use of Buddhist forest monks as residential places for meditation. This is one of the practices that has come down from the days when Sinhalese kings ruled the country. It is also a good method of forest protection and no illegal fellings take place in such forest blocks. In some instances, resident monks have assisted the Forest Department to enrich blank areas with indigenous species in adjacent forests. No cultivation is carried out in these forests, and there is a good rapport between the monks (some of whom are from foreign countries) and the local Forest Department staff. The practice is one that should be encouraged, even though the areas involved are small.

CHAPTER 5

THE ECONOMIC IMPORTANCE OF SRI LANKA'S FORESTS

5.1 The economic importance of timber

It is quite clear that timber from forests has contributed to the economic development of Sri Lanka, and continues to do so. Historically, Sri Lanka has had a well-developed woodworking industry dating back over 2,500 years, as can be seen from the doors, windows and other strong and massive wooden structures that have been found, or recorded, in historical buildings (Pushparajah, 1987). Even solid wooden bridges constructed using ironwood (*Messua ferrea*) lasted for centuries. The ironwood tree is the national tree of Sri Lanka. Most of the finer outside woodworking was done by highly-skilled and experienced craftsmen and artisans.

New equipment for logging and conversion of timber on a large scale came during the Dutch period when valuable tough timbers like ebony and calamander were extracted and shipped to the Netherlands. The economic importance of the country's forests grew even further when other valuable tropical hardwoods such as satinwood were cut and shipped to Europe or used as sleepers in the construction of railways. Large timbers were also supplied to the United Kingdom during the Second World War.

Subsequently, the forests' timber potential played a major role in the development process that ensued after Independence in 1948, by meeting the needs of large-scale housing and construction programmes. These have included the housing programmes, the Mahaweli Development programme and other similar development projects. However, the recently-liberalised economy and the processes of industrialisation demand very large quantities of timber which the country's natural forests can no longer supply in full. Although dense-canopied, the natural forests are generally poorly stocked with marketable timber because of over-exploitation, earlier by the Forest Department, and later, since 1968, by the State Timber Corporation, and because of illegal felling. One writer admits that the State Timber Corporation has grown by leaps and bounds, of course at the expense of the forested

environment (Abeysekera, 1987). The largest quantities of timber ever harvested by the State Timber Corporation were from the Mahaweli Development Authority command area in the 1980s.

Fortunately, the country has a fair-sized plantation forest estate which is being continuously increased and which could meet part of this increased demand. Special-purpose timbers are being supplied to meet the requirements of the government building sector, the Railway Department and the agencies requiring electrical and telegraph poles. Private-sector institutions generally import their timber now. Today, the State Timber Corporation on its own cannot meet the rising demand for timber. Pressure on the forests has also been reduced by timber coming out of the non-forest wood resources. These sources, together with the relaxation of timber import controls, have enabled the country to rest its over-exploited and degraded natural forests.

High demand for timber, coupled with limited supply, has meant a steady escalation of timber prices. It is now only a wealthy man who could afford to purchase prime hardwood timber for his house or furniture. Even cane and rattan furniture is now quite expensive.

5.2 The economic importance of other wood products

Some of the forest wood products, other than sawnwood, that contribute to the economic importance of forests include:

- electrical transmission poles;
- telegraph poles;
- fuelwood;
- charcoal;
- fence posts;
- plywood;
- pulpwood;
- cane furniture;
- bamboo;
- curios;
- toys;
- other miscellaneous value-added items.

A value estimate of all this, plus the value of log and sawn timber, will run into billions of rupees every year. Recognising the economic value of forests, the country continues its forestation programmes. Some charcoal is being produced by the State Timber Corporation from forest wood, chiefly from the "lop-and-top" and unwanted tree species from salvage forest coupes.

Also, recognising the environmental, ecological and genetic importance of natural forests, the Government decided that, from 1981, no more natural forests would be converted to plantation forests, and only highly-degraded lands, grasslands, *chena* lands, degraded tea estates, coastal areas and areas of special or critical importance would be forested.

5.3 The economic importance of non-wood forest products

Other forest products of economic importance include:

- medicines;
- honey;
- thatch;
- food, including fruits, fodder, fish and game meat.

Although hunting in forests is not encouraged, and many wild fauna are on the protected list, there is a demand for wild meat in some tourist hotels, with the result that there is some illicit trafficking. There is also some evidence of the illegal smuggling of leopard and crocodile skins out of the country which is causing problems for the Department of Wild Life Conservation. Honey has been an important product from natural forests from prehistoric times and continues to be so today; honey from forest plantations is also popular - beehives in eucalypt plantations yield very good honey.

5.4 Demand for wood products

The demand for industrial timber is growing steadily and by the year 2000 it will be in the region of 1,444,000 m^3. The demand for industrial timber in 1995 was 1,357,000 m^3, compared with 980,000 m^3 ten years previously (NARESA, 1991).

Table 5.1 gives the wood requirements of the Sri Lankan forest industry for the period 1995 to 2020 by different categories in a self-sufficiency scenario.

In view of the prevailing moratorium on logging in natural forests, an expanded afforestation programme, together with careful management of existing forest plantations and continuation of imports, will be essential. This will enable the forestry sector to continue to make its contribution to the economy of the country and to meet projected demands for timber and other forest products in perpetuity.

Table 5.1
Wood requirements of the Sri Lankan forest industry
1995-2020, self-sufficiency scenario, million m^3

Year	Sawnwood	Plywood (mostly rubberwood plylogs)	Pulp and paper(mostly *Albizia* and *Eucalyptus* pulpwood)	Total
1995	1.320	0.016	0.009	1.345
2000	1.427	0.008	0.009	1.444
2005	1.536	0.004	0.009	1.549
2010	1.649	0.004	0	1.653
2015	1.759	0.004	0	1.763
2020	1.864	0.004	0	1.868

5.5 Forestry, industry and employment

Approximately 200,000 people are employed in the forestry sector. About 60,000 are employed throughout the year in the activities of the Forest Department alone. Most of the forest-planting work, nursery work, some building work and some maintenance work is done by women. The wood industry includes about 300 sawmills for subsequent processing of timber for the local market, around 8,000 furniture-cum-carpentry industries and nearly 400 other wood products industries.

Some of these are on a small scale. All sawmills and all sales outlets of timber, numbering around 1,500, are registered and pay licence fees to the government. All these industries consume around one million m^3 of wood per year. However, not all timber for these industries comes from the forest proper. About half comes from the non-forest wood sector. Also, now that the import of timber is permitted, there is the likelihood that wood industries will grow and, with the large extents of forest plantation gaining maturity for harvesting under sustained-yield management, the economic importance of forestry will no doubt grow.

5.6 Summary

The demonstrated economic value of forestry is now leading to private sector establishment of industrial and agroforestry plantations, with government support. The Forest Department tried private sector forestry some years ago but at that time it was not successful, because of various restrictions and land tenurial problems. With a liberal policy being adopted today, there is great potential in the field of private sector forestry for industry, and would-be entrepreneurs are aware of the economic benefits from long-term forestry. With the technology of establishing fast-growing timber species like eucalypts, pines and mahogany now well-known, private sector forestry has a good future. It should further reduce the pressure on the hard-pressed and over-exploited natural forests of the country. However, in order for private enterprise forestry to succeed, there needs to be security of land tenure and a ready market for the forest products. Private sector forest industries may not be profitable ventures, except in the case of a venture growing small wood for pulp and paper industries, or for power generation. Sri Lanka is planning to set up a pilot plant to generate power from small wood gassification. As land is available at the moment, this could be a success.

Unfortunately, the total economic importance of the forestry sector is not adequately recognised in the state's accounting system, which generally shows a GDP contribution of about two per cent. This is a serious underestimate of the true worth of forests and forestry. Important benefits are not included or register only very poorly in GDP statistics. These would include the economic contribution of forestry to the total energy needs; the value of all value-added products; the costs and benefits of harvesting and transporting timber;

intersectoral linkage benefits; and, above all, the environmental and social benefits of forests. It is important that this underestimate is eliminated in order to improve awareness among the people of the total benefits and economic importance of the country's forests.

CHAPTER 6

FOREST PLANTATIONS

6.1 Introduction

The forest plantation (or man-made forests) sub-sector has had a mixed history in Sri Lanka. From small beginnings, it is today playing an important role in meeting the timber and fuelwood requirements of the nation, and looks set to develop further over the coming decades. This chapter looks at the historical development of the sub-sector and at current activities.

6.2 The historical development of plantation forestry

Introduction

Plantation forest of some sort was in existence centuries ago. The earliest record of a forest plantation was in the reign of King Dutugemunu, 161 - 137 B.C., recorded in the Mahavamsa (Nanayakkara, 1987). However, the need for large areas of planted forest was realised only in the latter part of the 19th century after most of the montane forests had been cut and replaced with coffee and tea plantations (Fernando, 1987). For convenience, the historical development of the forest plantation subsector since the start of the colonial period is divided below into five periods.

Early colonial plantation forestry: small-scale plantings of hardwoods predominate

The first teak tree (*Tectona grandis*) is reported to have been planted in Matale in the Central Province in 1680 by a visiting Dutchman by the name of Van Rhede on a visit to the Sinhalese kingdom at the time (Perera, 1962). Although there are no records of teak plantations having been established then, it could be safely assumed that more trees had been planted in the maritime areas, as well as possibly in the form of small blocks by about that time.

In 1880, small areas of teak plantations had been established (17 lots totalling 50 acres), in the wet zone in the south and west of the country. The earliest record of any planting technique was in Puttalam in the north-west dry zone coast when a spacing of 12ft x 12 ft was adopted. About the same time the Burmese *taungya* system of planting was tried out on *chena* or shifting cultivated lands. In 1876, some teak seed had been sown with Indian corn in the dry zone but there are no records of the results. However, subsequent plantings of teak in the dry zone were successful. Thus, although teak was first planted in the wet zone, it really gained ground in the harsher dry agro-ecological-climatic zone of the country.

Around the same time, some jak (*Artocarpus heterophyllus*), *Melia dubia* and *Cassia siamea* had been planted in the wet zone, but they were a failure. In 1888, *Eucalyptus saligna* was first planted in the montane zone. In four years the trees had assumed a height of 40 feet and a girth of 17 inches.

The beginnings of the now famous Sundapola plantation in the North Western province were in 1889. The first species planted there were jak, teak, satin (*Chloroxylon swietenia)* and Honduras mahogany (*Swietenia macrophylla).*

A form of planting in strips was introduced in 1890, and small extents of forest plantations continued to be raised using different species and planting methods. However, they were not all that successful. By 1890, there were around 900 acres (365 ha) of forest plantations, most of which were of teak. A contributory cause of failure was that every new official in charge selected a new area to plant and neglected the earlier ones.

The British colonial period: earlier over-exploitation of natural forest and their continued clearance leads to a growing need for plantations

During the British colonial period, forest plantation establishment was stepped up, mainly teak in the dry zone and eucalyptus in the montane zone. Other species introduced included *Eucalyptus microcorys, E. pilularis, Cupressus macrocarpa, Callitris*, *Tristania conferta*, *Cedrela serrata*, *Acacia decurrens*, *Pinus khasya*, and *P. caribaea* in the montane zone, mostly on the *patana* grasslands. Degraded and poor quality forests were converted to forest plantations, as were *patana* grasslands in the wet and dry montane zones. The

plantation extent had been raised, according to the records, from 570 ha at the turn of the century to 6,071 ha in 1926. Although only degraded and poor quality forests were earmarked for this conversion, in fact some well-stocked natural forests with closed canopy had also been cleared for planting.

The tea estates also started establishing blocks of plantations referred to as fuel coupes. Grassland planting done at a spacing of 6 ft x 6 ft was later enlarged to 10 ft x 10 ft. Records indicate that by 1953 there were 10,522 ha of forest plantations.

Some *Pericopsis mooniana* (Nedun) and *Casuarina equisetifolia* (kasa) were also planted in the low wet zone.

Planting in the montane zone was also encouraged by British foresters as it was a comfortable region to work in because of the gentle climate, unlike the steaming wet zone and the dry heat of the dry zone. Ultimately, the Nuwaraeliya Forest Division at high altitude became the most sought-after station by foresters. The main "problem" areas requiring a forester's attention were also in the montane zone. This was fortunate because the knowledge gained in planting was later utilised to advance forest establishment in critical mountain soils which had been severely degraded over a long period by the planting of tea.

The early post-Independence years: plantation forestry continues to expand at the expense of natural forest

In view of the fact that wet zone natural forests had been over-exploited over the years for various reasons (including the need for big timber during the Second World War), forest plantation activities were stepped up, including conversion of so-called "degraded" natural forests to planted forests, a strategy that gave rise to much debate in later years. After 1948, natural forests were cleared for many development programmes, starting with the Galoya Development project in the eastern dry zone. Forestry activities undertaken were:

- establishment of new nurseries with improved nursery practices;
- afforestation schemes in the montane zone;
- conversion of montane evergreen forests;

- wind-break cum improved-pasture schemes;
- *"Taungya"*, or Co-operative Reafforestation Scheme and departmental planting to raise teak, jak, and mahogany in the dry zone;
- enrichment planting in wet zone natural forests;
- forestation of sandy beaches, and arid tracts in the arid zone;
- social tree planting campaigns.

By the end of 1952, the planted area was recorded as being 10,522 ha and by 1962 the area is reported to have doubled to around 21,044 ha. Technical assistance was provided by the FAO in 1953 to place forest plantation establishment on a more scientific footing, including support for mechanised cultivation on the montane grasslands. Mechanised planting, however, was abandoned because of the high cost, the difficult hilly terrain, and some logistical problems.

1962 - 1981: further afforestation despite limited funding

The need for new timber sources increased in view of the many state sponsored development programmes and the clearing of natural forests for irrigation reservoirs, hydropower systems and associated settlements. Many dry zone natural forests that had not already been degraded were converted to forest plantations, as were many natural montane forests. The taungya system, now termed the Co-operative Reafforestation Scheme, expanded as the main form of forest plantation establishment through a conversion system, supported by departmental planting on a paid-labour basis on bare lands, grasslands, sandy shores and abandoned tea lands secured by the Forest Department (with difficulty) from the tea estate sector. Forest plantations were established on an island-wide basis in the different Forest Divisions. There was a great demand for timber from government departments including the Department of Railways, the Department of Buildings, the Electrical and Telegraph Departments and the Mahaweli Development Authority. The rapid increase in plantation forests was to some extent offset by the effects of cyclones. Particularly damaging were the 1964 and 1979 cyclones, which brought down large tracts of teak and other planted forests.

Although afforestation was an urgent need, funding inadequacy restricted forestry development activities, including plantation establishment. Foreign funds were secured from 1979 to complement government funding.

The afforestation component of a World Bank-supported National Agricultural Diversification and Settlement Authority (NADSA) project, which was successfully implemented by the Forest Department, provided funds for planting forests on hillsides in the Kandy District from 1979. (NADSA's other components were not successful). The highest recorded planting rate was in 1980, the last year of the standard Co-operative Reafforestation Scheme, when 31,236 acres (or 12,642 ha) were planted by the Forest Department.

Plantation forestry since 1981: responding to environmental concerns

1981 was a significant year as the Co-operative Reafforestation Scheme was abandoned on a government directive because of continuous agitation by environmental groups that natural forests should no longer be cleared in this way. However, in later years, the Forest Department was permitted to plant very degraded scrubland under a much-modified co-operative system with more financial incentives as an inducement to entice co-operative reafforestation by leaseholding participants (Nanayakkara, 1983; 1986b).

At this time, the variety of timber species being planted was also increased to include many indigenous species. Although this brought public support, many indigenous species fared rather poorly in practice, and the planting of proven exotics had to be continued alongside the few proven indigenous species. Among the indigenous species tried out successfully, and being planted out on a limited scale are, *Azadiracta indica* (margosa or kohomba), *Filicium decipiens* (pihimbiya), *Berrya cordifolia* (halmilla), *Chukrassia tabularis* (hulanhik), *Terminalia arjuna* (kumbuk), *Dipterocarpus zeylanicus* (hora), *Albizzia odoratissima* (suriyamara), and *Cassia fistula* (ehela).

The State Timber Corporation also became involved in reafforestation, partly in order to address the criticism of environmentalists that the STC was only bent on over-cutting timber trees. This was not a success, however, and most of the areas planted by the STC failed.

By 1992, the extent of forest plantations, determined through the interpretation of satellite imagery, was 125,000 ha. This figure is an underestimate because some plantations do not show up well in this kind of remote-sensing interpretation if they are young, weed-ridden or fire-damaged. The 1995

planting programme of the Forest Department is 11,300 ha, which includes industrial block plantations, home garden agroforests, fuelwood plantations, protective woodlots on hilly slopes and miscellaneous plantations. A private sector planting programme was launched in 1995 with an overall target of 40,000 ha.

One of the major setbacks to the environment was the accelerated implementation of the Mahaweli project, by which the project's implementation period was reduced from thirty to eight years, without a forestry component. In the eight-year period, the country lost about 242,820 ha of forest. It was left to the Forest Department to plant up parts of the catchment with departmental funds and funds from bilateral, foreign-aided projects. The Mahaweli Authority also started raising plantations on the Mahaweli Ganga (river) upper montane catchment lands, with funds from Germany, but success was minimal.

From 1981 onwards, as a general principle, forest plantations were established only on the following land-types:

- *patana* grasslands;
- abandoned and degraded tea estates handed over to the Forest Department by the estate sector;
- degraded rubber lands;
- catchments and watersheds devoid of trees;
- highly degraded scrub land in the dry zone;
- some sandy tracts on the coastline.

This principle continues. It is still a continuing policy of Government not to clear any more natural forests for development or for conversion to plantation forests. The adverse effects of clear-cutting the remaining natural forests are now felt to be too great to risk any further clearance.

The National Conservation Strategy (NCS) for Sri Lanka also advocates:

> *"all degraded agricultural land, especially those in the mid- and up-country areas, should be converted into forests or agro-forests. Land currently under agriculture, but unsuited for it*

should be allowed to revert to forest or be brought under the agroforestry programme." (CEA, 1988).

6.3 Foreign-aided plantation projects in the Forest Department

Recent years have seen the growing involvement of, and dependence on, donor-driven forestry projects in Sri Lanka. Box 6.1 lists some of those that have contributed to the establishment of forest plantations in the country. These projects were funded by the donors with government providing counterpart support.

6.4 The future of plantation forestry: contributing to national development while addressing environmental and social concerns

The emergence of a clearer understanding of plantation forestry's potential and impacts

Given that plantation forestry is now more responsive to environmental and social concerns, many more people now appreciate the positive role that it can play in development (Box 6.2). Nevertheless, plantations are never likely to be a panacea. Professional foresters and economists are now more willing to accept that plantation forestry also has a down side (Box 6.3), which must be given the utmost consideration in the on-going debate on forestry's role in development.

Box 6.1
Some recent foreign-aided plantation forestry projects with plantation components

- USAID, from 1981: Afforestation of the Mahaweli catchment and watershed in the wet montane zone, and the establishment of block fuelwood plantations in the lower Mahaweli plains in the dry zone.

- Community Forestry Project I, funded by the AsDB in 5 Districts, from 1982: block plantations and agroforestry farmers woodlots established with people's participation were the main activities.

- Integrated Rural Development Projects (IRDP) in several districts. These bilateral projects were multidisciplinary projects with forestry components, comprising the establishment of small forest plantations in pre-selected locations. A certain amount of participatory activity was involved in these plantings. The donor countries were Netherlands, Norway and Finland.

- Industrial Wood Plantation Project, a component of the Forest Resources Development Project and its follow-up the Forest Sector Development Project. The latter project is on-going.

- The AsDB Participatory Forestry Project or Community Forestry Project II, a follow up project to the AsDB's Community Forestry Project I. This is a broad-based, multifaceted, country-wide project including the establishment of watershed plantations, agroforests, amenity plantations, avenue and strip plantations, and shelterbelts. The project is on-going.

Box 6.2
Some current aspects of the positive role of plantation forestry

- Plantations forests in the dry zone have an economic potential from harvested timber of about 40 times that of a standard dry zone evergreen natural forest.
- Marginal lands not preferred for agriculture are now being put under forest plantations, for industrial and fuelwood, thereby adding to their value.
- Raising forest plantations is a method of raising "compensatory" forests of greater economic value in lieu of degraded forests that have been released for the Government's other urgent development projects. (However, considering the areas planted, in no way does it compensate for the areas released or taken for other projects, on an area basis.
- Forest plantations established in the Mahaweli river catchment in the wet montane zone have dramatically checked soil erosion, earthslips, landslides and rock slides, resulting in much clearer run-off into the river.
- Windswept barren countryside has been converted into flourishing vegetable garden townships by the scientific planting of shelter belts, mainly of eucalyptus.
- Coastal sandy stretches have been planted at selected sites with casuarina and eucalyptus to reduce the adverse effects of wind and to improve environmental conditions.
- Agroforestry plantations now being established are having an impact on increased food production because of the large number of crops permitted for inter-cultivation.
- Off-season, workers who are normally engaged in agricultural pursuits, are hired for forestry work on forest plantations, providing them with an added source of income. This employment impact of the forest plantation subsector is of great socio-economic importance.
- Participatory forest plantation blocks are given to participants on long lease. As a result more people are attracted to new and innovative agroforestry practices on state land.
- Private planting entrepreneurship is being encouraged in an attempt to reduce the burden on the State to plant forests. Factors that encourage this include changes to tree and land tenurial rights. Forestry's contribution to the GDP would be enhanced with the growth of private sector forestry. This activity needs to be confined to local people and restricted to difficult lands so that it would not in any way interfere with the agroforestry lots leased to farmers.
- Self-sufficiency in certain timbers could be maintained especially of fast growing hardwoods, e.g. all-purpose poles of different sizes, some special purpose industrial wood and plywood species. Important plywood species have been grown as plantations, e.g. *Albizzia*. Rubber wood is also being tried out now as a forest crop.
- One possible advantage of adopting wide spacing during planting is the possibility of raising a mixed-type of natural plus exotic plantation forest. This type of forest would provide better environmental balance and a more welcome habitat for wildlife. Currently, the forest cover is largely inadequate to meet the habitat needs of Sri Lanka's diverse wild fauna, even though 14% of the land has been specially set apart for this.
- Eucalypt plantations in the montane zone, especially *E. robusta* have given a boost to honey production, which is being developed as an economically-viable cottage industry in the mid-montane zone.

Box 6.2 contd.

- Although pine plantations were originally raised for the production of pulpwood, they have not been utilised for that purpose. A new use, that of resin-tapping, has made the pine plantations a valuable national asset, although this will only continue to be the case if some way is found to keep tapping within sustainable limits. There is also the possibility that pines and eucalypt wood could be used for paper production, especially newsprint, in the future, without resorting to imports at a colossal cost in foreign exchange.
- As changes in planting techniques evolve with the advent of participatory methodology, the socio-economic impact will become more marked and, together with the resulting overall environmental impact, the forest plantation sub-sector will have a major impact on the life of the nation. Already, the socio-economic levels and quality of life of people in the montane zone have improved as a result of the forest plantations drive.
- The tea sector in the montane zone has also reduced costs of tea production by reverting to woodfuel for tea-leaf drying, thereby using less fossil fuel. On the advice of the Forest Department in 1980, tea estates have been trying to plant 10% of their land with fuelwood plantings to meet both their factory needs and the domestic needs of their workers.
- The tobacco industry has also been induced by the Forest Department to grow its own plantations for the production of fuelwood for curing tobacco. This has reduced the irregular and often illegal trade in fuelwood coming from the natural forest.
- In the montane grasslands, forest plantations and pasture grasslands have created a multi-purpose land use between pasturing of cattle and tree growth. Cattle are thereby not ousted from their traditional grazing areas. Where pasture grass is not present between trees, there is the risk that village people will set fire to the ground flora of the plantation before rains, to get a new flush of grass with the rains so that they can graze cattle. These fires then spread into adjacent forests with dire consequences. Hence, forest plantations with managed pasture grass in between trees is a sound management practice.
- In agroforestry woodlot plantations, livestock will also gradually be introduced, along with more undercultivated crops, in a further development of agroforestry systems. Beekeeping and freshwater fishery would be included. Some agroforestry participants are already doing this.
- Species diversity is also benefited by *ex situ* conservation in plantation.
- Forests are established with mixed species. Some rare timber species and medicinal plants are conserved *ex situ* in this way.

Box 6.3
Some negative impacts of plantation forestry

- There has been some antagonism by some village people to block the development of forest plantations, but this is mainly because they fear that they may lose lands which they have been eyeing for future settlement. There is often a political motive allied to business interests which sees forest planting as an impediment. Many rural people are apprehensive over forestry expansion, whether it is a planted forest or natural. Their eyes are on the future expansion of their agribusiness. Eucalypts and pines are the scapegoats because these are the trees that do best and grow quickly on harsh open grasslands and on the degraded soils of tea estates.
- At times there are adverse criticisms that streams dry up as a result of forest plantations being established and that there are no birds or bees in a planted forest. These really are misconceptions. It has been proved in Sri Lanka that, with correct spacing, and depending on where the plantations are raised, some fauna and flora can be established in forest plantations. Some of the tall eucalypt plantations in the high rainfall montane zone sites of Ohiya and Kikiliyamana are virtually impenetrable because of dense undergrowth.
- Even some scientists and environmentalists have protested in the past against plantation forests, especially of eucalypts and pines. However, one well-known Sri Lankan environmentalist who boasted that he could establish a natural forest on a wet montane grassland using a computerised model, failed totally in his efforts, and the Forest Department had to return to the area and plant it up with proven plantation species. This shows that it is good to provide critics a chance to prove their theories.

Expansion of private-sector planting

An afforestation drive by the private sector is being planned on a basis similar to the participatory farmers' agroforestry woodlots planting programme, on lease agreements. For a start, 500 ha were expected to be planted in 1995 in five districts. Plans are afoot to make it a countrywide campaign. This will also boost annual afforestation planting targets in the whole country.

Proposals have been made to plant 12,000 ha in 1995, but as the project is new, officials expect only about 500 ha to be planted.

Private sector planting was tried earlier in the 1980s, but it was not successful because participating lessees tried to obtain lands that had timber which they could cut and sell. As a result, they neglected the planting. Also, there was no secure land tenure as lease permits were for short periods. In the new system, the lease will initially be for a longer period of about 30 years. This will be extended for a further period if the results are good. Depending on the

economic status of the participants, other incentives may have to be considered. Food aid, as well as free planting material and fertiliser, should be considered for the poorest participants.

The land provided will be degraded scrub or "cleared" land. Problems of inducement may arise in view of the distance of the land from villages where some of the participants may reside. However, the programme will have to be monitored closely to ensure that the desired results are being achieved. Otherwise the programme will have to be scrapped and State planting with hired workers resorted to, at great cost. A long lease with government ownership retained may be the answer for distant areas that are to be planted with industrial timber species, but with a proviso in the Agreement for the Forest Department to evict the lessee in case of failure at any stage of the exercise.

Expansion of medicinal plant cultivation

Other future plans will include the expansion of the medicinal species-planting programmes started in the 1980s. Trees and other plants of medicinal value have been tried on a pilot basis in the different agro-ecological zones. Some of the problems, in the case of small medicinal plants or shrubs, is the need for careful nurture after planting.

Medicinal plants are of value in the market and they have been permitted for introduction into the participatory agroforestry woodlots programme. This, in fact, is a better method to ensure *ex situ* survival. Some medicinal plant cultivation by the Indigenous Drugs Corporation on forest land and grasslands at high elevations was a failure because of the lack of after-care. As young plants they are very susceptible to wind and frost damage.

Although the regeneration of medicinal plants has not been considered a traditional forest activity, the Forest Department has taken it up on the suggestion of Government because it has the infrastructure to get the activity moving. By participating in this programme, the Forest Department is taking on a new field on a large scale. Progress needs to be closely monitored, as the *ex situ* planting of indigenous medicinal plants is of great importance to the large number of practitioners of indigenous medicine in the country. With the

denudation and degradation of natural forests, many medicinal plants have become rare.

Improved nursery management

Modern techniques are to be established in the Forest Department nurseries. Research is being conducted into the use of root trainers in raising seedlings for management planting. This has already been tried and should yield better results in plantation establishment. Other experimentation is in the use of polythene-potted teak seedlings for planting out, instead of the traditional bare root stumps. In these techniques, even if the cost is more, the results have been shown to be better.

Margosa planting

Azadiracta indica (Margosa, Kohomba or Neem) will be tried on a larger scale than in the past. It is a successful indigenous tree with a wide variety of desirable properties. It has been planted since the 1980s on a significant scale. One characteristic is that it is a slow starter, but picks up growth after about the 5th year. Hitherto, it has been restricted to the dry zone, but its planting is to be extended, both as departmental or state planting and in agroforestry woodlots. It is also to be planted extensively on roadsides and avenues and as ornamental trees. It is a tree with multiple uses and its bark and leaves have antiseptic properties. It is often planted near the windows of houses for good luck.

Expansion of participatory agroforestry

People's participation in the establishment of agroforestry woodlots will be extended and established as standard forestry practice in the country. The overall aim is to extend vegetative cover in the country and improve the quality of life, especially of rural people. The socio-economic benefits to rural people can be tremendous. In the late 1980s, these woodlots were restricted to the five districts of Matale, Kandy, Nuwaraeliya, Badulla and Batticaloa. In this new development, participatory forestry will be extended to cover the whole country, initially under the AsDB's Participatory Forestry Project. People's participation in agroforestry will succeed where the beneficiaries are able to earn more income and where employment prospects are bright, but it

has to be in a situation where natural forests or other natural resources are not adversely affected as a result.

Expansion of strip plantings

The planting of rows or strips along roads, canals and railway lines is to be expanded. During the last decade or so, this type of planting has been done by the Extension Branch of the Forest Department. Trees are planted in rows two or three deep instead of the usual one. Quite a large extent of land can be covered by such strip or line plantings.

Participatory approach to planting up watersheds

Earlier, watersheds and catchments in the montane zone were planted by the Forest Department, but in a recent development, a participatory approach in the planting of watersheds and critical areas is being tried. Participating lessees will plant up the areas on lease agreements under stipulated conditions. The cost of forest plantation establishment of watersheds may be reduced if this method is successful. The lease agreements will be entered into with the Forest Department.

Afforestation of "problem" areas

The main areas of the country that are in greatest need of afforestation continue to be the dry zone *chena* lands, the montane zone catchments and watersheds which are mostly in tea, Mahaweli settlements, and critical areas along sections of the coastline. The FAO has contributed specifically in the preparation of an excellent field manual for plantation establishment in the dry zone. It tackles many of the establishment problems in the field (Stevens, 1992a). Mechanised soil-working is being tried out to get better results in the dry zone's compacted *chena*ed soils (Stevens, 1992b), and the silviculture of sandy shores has been perfected, as has the artificial regeneration of coastal mangroves. However, the most urgent need is to put back the forest tree cover on the montane degraded tea lands. Here, although the planting techniques have been perfected, the political commitment to get the land for forestry is not forthcoming.

6.5 Summary

Much has to be accomplished in the forest plantations sub-sector. The land is available, the technologies are known and local expertise is available. There has been a major change in attitude amongst foresters, environmentalists and the general public that could now enable plantation forestry to be far more acceptable and successful. The problem is to find the funds to accomplish the task.

CHAPTER 7

NATURAL FOREST MANAGEMENT AND CONSERVATION

7.1 Introduction

As indicated earlier, the sustainability of the productive use of a forest is a debatable and controversial issue. As such, it is open to question as to whether such a forest used for production could be conserved in the real sense of the word. It is clear, however, that linkages between institutions are needed to conserve the forests which are or have been badly degraded by external influences.

Sri Lanka's natural forest resources continue to supply part of the timber and fuelwood needs of the nation, along with other goods such as fodder for animals, medicines for man, and many items of food value, and services such as recreation, amenity, aesthetic enjoyment, and academic study. However, because of forest clearance to meet the need for land of a growing population and the fast depletion of the forest resources to meet development needs, the productive use of these forests has certainly not been sustained. As a result, the country has now got to rely on timber imports.

Currently, Sri Lanka is undertaking studies in certain forest areas, to determine whether productive use, not only of timber but also of other goods and services, could be sustained without altering the complex forest structure and the dynamics of forest ecosystems.

In this regard, the approach suggested by the Oxford Conference on the Wise Management of Tropical Forests held in 1992 is commendable (OFI, 1992). By advocating wise management, the conference introduces a concept which existed in Sri Lanka centuries ago when forestry was a part of Sri Lanka's culture. This concept of wise management could serve as an impetus to the country to reintroduce the wise forest management systems that most certainly would have existed in the past. It is appropriate to state here the broad conclusions of the conference, which are basically what Sri Lankan foresters

and forest scientists hope will succeed again in Sri Lanka. They are:

(i) Wisely-managed forests can and will continue to supply goods on an ecologically-sustainable basis.

(ii) Appropriate political, social and economic conditions must be in place before wise management, through ecologically-sound silvicultural practices, can succeed.

(iii) Involvement of local communities in management decisions is vital in circumstances where government institutions are no longer able to manage effectively.

Wise and thoughtful management had, in effect, been practised in times when benevolent and wise monarchs ruled the country. This has led to a strong acceptance today of natural forest conservation by the people of Sri Lanka. In fact, as history has recorded, one of the first wildlife sanctuaries in the world was established in Sri Lanka in the third century BC.

Wise management can therefore be seen as an honest and credible approach to planning forest management systems, and an acceptable approach to determining whether forest sustainability is a practical proposition. By this, the linkages between wise management in the productive use of Sri Lanka's forest resources and the need for conservation of these resources can be determined in order to sustain forest structure and forest quality. The Oxford conclusion on the need for ecological sustainability is significant and very appropriate to the Sri Lankan situation. It also indicates the direction tropical forest ecology should take in Sri Lanka.

7.2 Conservation of natural forests in the early post-Independence period

Small areas of natural forest that were automatically conserved fully were the *aranya* or hermitage forests, and forests in and around archaeological sites. These had been conserved from pre-Independence times. Forests with archaeological sites are also Archaeological Reserves. All are very small forests.

Apart from the formation of National Parks, one of the first attempts at absolute conservation in the post-independence period was the demarcation of 50-acre arboreta under the International Biological Programme (IBP) of UNESCO. The local sub-committee of the IBP headed by the Forest Chief was initially under the National Science Council, but later shifted to the Forest Department. The objective of demarcation was to exclude such areas from timber exploitation or other forms of interference. Nine forest blocks were demarcated.

In 1975, this programme was renamed the Man and Biosphere Programme (MAB), and larger blocks of forest were demarcated, including some forest plantations. Two unique forest ecosystems that were granted international MAB status at that time were the Sinharaja in the lowland wet zone and Hurulu in the dry zone (Sri Bharathie, 1979). Forest areas conserved under the MAB programme numbered forty-seven, covering 119,883 ha and distributed amongst the different agro-ecological-climatic zones (Bandaratilleke, 1990). These forests were either gazetted and proclaimed Forest Reserves or Proposed Forest Reserves.

7.3 Conservation of natural forests in the 1980s

State conservation measures gathered momentum in the 1980s through the Department of Wildlife Conservation in the form of a new Protected Areas Network. Many NGOs and environmentalists backed the Fauna and Flora Protection Ordinance as the best instrument for forest conservation, rather than the Forest Ordinance which provided for selective logging in some Forest Reserves, even though some of those Forest Reserves were actually more important for wildlife conservation than other protected areas (Gunatilleke and Gunatilleke, 1983a).

Therefore, after decades of development activities necessitating the overcutting, denudation and degradation of most of the country's natural forests after 1948, once again, since 1989, a new era of natural forest conservation has dawned in Sri Lanka. This was a long overdue step which could not be taken earlier because of pressures emanating from the State Timber Corporation and vested interests that enjoyed some support through political patronage.

Eventually, the voice of concerned foresters, forest scientists, environmentalists and concerned citizens at large was heard and the logging ban imposed. Action was then taken to assess the conservation value of these natural forests, first in the wet zone and later in all other zones. For this exercise, the Forest Department is assisted by the UNDP and the FAO, through the IUCN.

7.4 Conservation of natural forests in the 1990s

The 1990 logging ban

In 1990, the Government imposed a logging ban on timber from natural forests. This move followed the revelations that the nation's forests had been over-exploited for a long time, together with pressure from rural people, public-spirited citizens, professors and environmentalists, and because of the marked decline in Sri Lanka's forest cover. This was also linked to fears created by the Southern insurgency in 1989 that prevented loggers from entering the forests. There is, as yet, no ban on state logging in forest plantations, but there is agitation from environmentalists and the Forest Department to ban logging in the montane plantations above 5,000 ft, thus going back to a recommendation made by British naturalist Joseph Hooker in 1873 (Nanayakkara, 1987; Sahajananthan, 1987).

The strategy to be adopted is to allow the planted forests above this elevation to develop into a type of mixed forest with simple silvicultural treatment. Sri Lanka thus follows the example set by many South-East Asian countries which have imposed logging bans to conserve natural forest ecosystems, wildlife habitats and genetic resources.

The Accelerated Conservation Review (ACR)

An ACR was first carried out for the wet zone forests. It was a rapid appraisal of the ecological, hydrological and biological status of the greater part of the country's wet zone forests. Based on this study, the Forest Department decided in 1990 to place a total of 13 wet zone forests on the critical list, and place them under a form of conservation management, taking these parameters and those of cultural importance into account.

Conservation Management Plans

Following the ACR was the programme to prepare 13 Conservation Management Plans for these wet zone forests. These are apart from the Conservation Management Plans for two of the country's most important forests, namely the Sinharaja World Heritage Site, and the Knuckles range of forests in the northern part of the central montane zone. Seven plans had been completed by the beginning of 1995, four in the Matara district and three in the Galle district, both in the Southern Province. The preparation of all 13 Management Plans is expected to be completed by the middle of 1995.

The buffer zone principle is being adopted for the conservation of all wet zone forests. This principle was first adopted by the Forest Department for Sinharaja. The factors being taken into account also include the socio-economy of the villages in or near the forests, boundary demarcation and legal status.

One alarming tendency noted is the belief of some overseas consultants and some of their local scientific counterparts that Sri Lanka's forests are home to indigenous forest-dwellers. There is a problem of definition as the main activity of these groups is agriculture. Apart from the Veddhas, the people referred to are in fact farmers living in villages in peripheral areas of forests or in encroachments inside forests. There are also a few villages inside forests, but the people are farmers. Their dependence on forests is limited to some fuelwood collection and possibly the gathering of medicinal plants and collection of honey. Some of their other activities are illegal felling, the collection of fauna and flora for outsiders and some illegal hunting to meet the "needs" of hotels. Much publicity has been given to the preparation of these Conservation Management Plans, especially to strategies and programmes of activities to ensure a supposed "sustainability" in the use of these forests (IUCN, 1994c). However, this is, at present, a difficult concept and could be destructive in practice in the long term. As such, even in the case of these wet zone forests, it may well be better to provide local village folk with a more lucrative income in nearby industries and in agroforestry in buffer zones and outside, rather than encourage continued and increased activities in the forests which would only degrade the forests further. Ideally, human-forest interactions ought to be kept to a minimum.

Possible inter-institutional linkages in a future management scenario for these forests would include linkages between the Forest Department as the Central body supported by the active Sri Lanka Research Agencies, mainly the Universities, the Department of Wildlife Conservation and the Divisional Secretariats which look after the education, health and social welfare of any nearby village people.

The National Conservation Review (NCR)

A National Conservation Review to cover all natural forests, which had been put forward by the Forest Department long ago, finally began in 1991. The study encompasses all natural and near-natural forests in the country, including scrub-cum-grasslands and coastal mangrove ecosystems. It is being carried out by the Forest Department/IUCN, utilising UNDP funds channelled through the FAO. It is part of the Forest Department's "Environmental Management in Forestry Development" project, implemented by the Department's Environmental Management Division. At first, it was confined to the wet zone forests. In 1994, dry zone natural forests were added to the study. Both flora and fauna were covered and the work was scheduled to be completed by March 1996. It will also cover the existing "Protected Areas Network" for wildlife conservation.

Conservation of biodiversity is the main aim of the NCR. The IUCN leaves room for releasing under-stocked areas for other development, which is surprising. It seems advisable not to encourage the release of low-stocked natural forest areas that appear to be of low conservation priority, because with appropriate protection and management they have the potential of becoming high priority forests later. Instead, restocking with indigenous species and adopting simple silvicultural treatment to encourage natural regeneration where possible should be the aim. The country cannot afford to lose any more natural forests, and this is supported by public opinion.

A transect sampling methodology is used in the study and data collected is computerised. Positioning of plots is by a Global Positioning System (GPS). Many endangered species have been found during surveys, indicating thenecessity to conserve *in situ*. New species have also been recorded. The limitations of the sampling method and the time available have been

recognised and there is a possibility the biodiversity richness is under-estimated.

The number of forests expected to be covered in the low wet zone is thirty-two. The forest areas in the dry zone of the Northern Province and in other "no go" areas are expected to be sampled later.

7.5 Conservation into the next century

Today, the Protected Areas Network under the charge of the Department of Wild Life Conservation is about 14% of the area of the country, which is considered something of a record. This network includes National Parks, Strict Natural Reserves, Nature Reserves, Wild Life Corridors, Intermediate Wild Life Zones and Sanctuaries. The total extent was some 780,920 ha (Bandaratilleke, 1990). This has now been exceeded. This is a significant achievement for Sri Lanka and is in keeping with the country's strong historical traditions and culture of conservation.

A significant development in implementing conservation measures was the re-organisation of the Forest Department to include a new Environmental Management Division (EMD) in 1989 and the continuing policy of increasing the number of Forest Divisions for more intensive forest management and protection. The Forest Department also established close links with the Department of Wild Life Conservation through the EMD to carry out joint conservation action, as for example in the Horton Plains National Park and surrounding forests in the wet montane zone.

The conservation measures have strong support in the country, except where there is pressure on land. Conservation suffers especially at the hands of politicians with an eye on the vote at a future general election: it has been a regular pattern that requests for the release of forest land to settle people build up just before a general election. Some politicians have been openly against forest and wildlife conservation in the belief that all rural people have to be provided with land for their livelihood.

If such beliefs continue, then Sri Lanka's forests will rapidly disappear. It is hoped, though, that they may change through the awareness campaigns being promoted by the Forest Department and the Department of Wild Life Conservation.

Fortunately, seminars, workshops and meetings at grassroots level by both these Departments, the inclusion of the subject of forestry in school curricula on the recommendation of the Forest Department, and the formation of Village Forest Societies (VFS) have most certainly improved people's awareness of the importance of forestry. As a result, forest conservation programmes now tend to be widely accepted.

Studies have shown that if the management of some key Forest Reserves for conservation is not carried forward, many animals may become extinct in the near future. According to one well-known researcher who has worked in Sri Lanka (Erdelen, 1988):

- There should be an immediate stop to the clearing of natural forests, whatever the purpose.

- All areas still under natural forest, or almost natural forest cover, should immediately be strictly and totally protected.

- Effective protection of reserves and other so-called protected areas is essential.

The first recommendation is already in force, at least in theory. Thus, the question of the protection of forests needs to be addressed very urgently as present policing arrangements have not had the desired effect.

Some kind of participatory action is also needed to assist in protection, possibly a kind of "participatory forest police" composed of grassroots volunteers. However, a formal police force cannot really be dispensed with because most illicit timber fellers are armed and dangerous. That said, the present Forest Guard system, operated by the Forest Department, and the Wild Life Guard System, operated by the Department of Wild Life Conservation, is inadequate.

From ecological and ecosystem points of view, there is no doubt that the effects of introducing conservation management of Forest Reserves will be positive, if conservation measures are not upset. Already in some "no go" areas, natural forest cover has increased. Studies on these matters are progressing. With time, the positive effects of conservation on the nation's well-being may be quantified.

Meanwhile, the negative effect of the shortfall in timber production from natural forests is being met by imports. There is also the compensatory effects of new regeneration in the protected and thus undisturbed forests, as well as the new timber forest plantations that are being grown at an expanded rate.

7.6 Forest conservation in action: the case of Sinharaja

Background

The Sinharaja World Heritage site in the south-west wet zone contains portions of primeval forests never exploited for timber. Trees reach heights of over 70 metres with girths of over 3 metres. One hundred per cent canopy closure is quite common in many places. It is the best example of Sri Lanka's tropical humid evergreen forest. The great scientific value of it is now well documented, and has even been described as the last refuge of one of the world's most magnificent ecosystems (McDermott *et al.*, 1990). Briefly, the forest contains at least 184 tree species and 147 species of birds (de Zoysa and Raheem, 1990). Seventy-six tree species are endemic (Gunatilleke and Gunatilleke, 1980), as are many of the bird species. The forest also contains a bewildering array of other forest products (Gunatilleke and Gunatilleke, 1985), ranging from those of food value to those of medicinal value, spices, oils and honey. Bamboos and rattans are prolific.

Its difficult rugged terrain, thick forest and surrounding rivers have kept it inaccessible and thus fairly well protected from both illegal and legal loggers in the past. Elevations of the forest range from 100 metres to 1170 metres. The extent of the forest in 1988 was 8,864 acres to which a further extent was added from the east in 1990, making the total area of the forest a continuous extent of 11,331 ha.

Logging in Sinharaja

There was no road access to Sinharaja until the early 1960s when a road trace was opened up, but the intention at that time was to have a jeep track for exploratory and research purposes and not for the exploitation of timber. The first sod for this road was cut in 1963 from the north west. However, in the 1970s, as the timber stocking in the forest came to be known, the Government, on ill-conceived advice and with Canadian aid, decided to log a portion of it for plywood manufacture. The original jeep track was enlarged to form a costly broad-gauged roadway.

In 1978, because of growing protests from environmentalists and the general public, the Government terminated all logging activities in the forest and the Forest Department regained full control (Gunatilleke and Gunatilleke, 1983b). Prior to the actual termination, logging had already been scaled down, following a report of a Parliamentary Committee (Rajapkase, 1974).

Sinharaja as a World Heritage Site

From 1983 to 1988, the Forest Department pressed for the recognition of Sinharaja as a natural World Heritage site by UNESCO. There was intensive lobbying by the Forest Department and the Sri Lanka ambassador in Paris, which finally succeeded and today the Sinharaja World Heritage site is a world-recognised centre for tropical humid forest research. Many national and foreign universities carry out research in this forest.

International agencies like the World Wide Fund for Nature (WWF), the Norwegian Government, the International Union for Conservation of Nature (IUCN) and the FAO support the Government's efforts at conserving the forest. The University of Peradeniya and the NGO the "March for Conservation" lead the local research efforts in addition to the Forest Department. Simultaneously, with the listing of Sinharaja as a World Heritage site, the Government declared it a National Heritage Wilderness area. The new legislation was called the National Heritage Wilderness Areas Act.

The Norwegian Government, with support from the Sri Lanka Government, provided funds for a revised Management Plan for Sinharaja for the Conservation Management of the forest, which work was contracted to IUCN

(now called the World Conservation Union). It is a five-year management plan which will be reviewed half-way through and continued by Government after the present foreign funding lapses. The underlying direction of the plan is acceptable to foresters and naturalists alike, keeping activities in the forests to a minimum.

As a result of the plan, much scientific work has been done in and around Sinharaja by Sri Lankan and foreign scientists, and now Sinharaja is firmly on the world forest conservation map. The plan was prepared in 1993. The main objective of the plan is to propose strategies and prepare a programme of priorities which would:

> *"ensure the maximum possible protection of Sinharaja whilst not adversely affecting the livelihood of the people in the surrounding villages"* (IUCN, 1994a).

Some of the recommendations are basic, such as the re-demarcation of boundaries, exclusion of old encroached settlements, completion of boundary marking, strengthening research, encouraging publicity, the need for additional staff, and restriction on entry.

Sinharaja and local people

At present, there are 32 village settlements in and around Sinharaja, mostly on the periphery of the forest. The total population of these villages is only about 5,000, although this is much more than the likely 1963 figure of about two thousand. The people in these villages are very poor - some of the poorest in the country. They have been rather neglected by successive regimes, resulting in their being used by unscrupulous businessmen to undertake illegal felling in some accessible areas. They are not forest tribals or forest dwellers as are the Veddhas, and practise agriculture as their main occupation. The forest is also surrounded by eight tea estates, some of which are degraded and uneconomic, where only a few of the village people have seasonal employment. However, in view of the permanent workforce on the tea estates, there is still competition for new jobs on the estates.

It is only since Sinharaja gained prominence that the basic needs of these people are being addressed by the District administration. The Extension

Branch of the Forest Department has enlisted the services of medical personnel on a voluntary basis to help these unfortunate people. The recommendations in the plan also include the translocation of some families if it becomes necessary to do so. Immigration (a result of overcrowding elsewhere in the country) may also need to be addressed. Organising buffer-zone programmes, establishing a Protection Fund, securing the support of community-based organisations to protect the forest, and permitting restricted use of non-wood resources, are other components of the plan.

The plan also recommends a research programme to include a broad socio-economic baseline survey, including institutional aspects, which will determine the linkages that have to be established to conserve the forest, whilst at the same time permitting any possible limited productive use of the forest's resources. As yet, there are no forests in modern Sri Lanka where a management system is in operation where links have been established between conservation and sustainable use of the forest resources. Some small-scale sporadic surveys have been done by the Forest Department but they are not broad-based enough for planning purposes.

The broad-based socio-economic study would be directed to the following areas:

(i) Links between the peoples of the different villages as far they affect the management of the buffer zone that surrounds the forest.
(ii) The extent of their dependence on the Sinharaja Conservation Area.
(iii) Attitudinal studies vis-à-vis the estate-owners and the village people.
(iv) The process of establishment and operation of community-based organisations.
(v) The collection of baseline data pertaining to the livelihood of the people.
(vi) Issues concerning the operation of various concerned agencies.

Once the results of this research survey are known, it should be possible to determine the linkages that have to be established between the village people and the concerned agencies and between the agencies in order to protect the forest, regenerate logged and old cultivated areas in the forest, and ensure, if possible, some form of sustainable or wise use of the forest. The Forest Department had already started on this initiative. Concurrently, the plan

should aim at providing the measures that would also improve the quality of life of the people. One alternative may be to provide the people with a better quality of life elsewhere or nearby on the tea estates or other industries, that would enable them to get better and regular employment and a higher income. It may be better if the degraded, uneconomic tea estates were converted to agroforestry. These will then serve as an additional buffer to Sinharaja where the people could be engaged in profitable agroforestry. This may ultimately be the correct approach rather than trying to persuade these people to continue their present frugal agricultural practices which are just sufficient to ensure survival, with a few added benefits from forest products like honey and palm sugar - bearing in mind that the practice of felling of timber would be strictly prohibited.

It should not be the policy of agencies to try and force, coax or exploit these people to protect Sinharaja. On the other hand, some participatory action would be forthcoming to protect the forest if earning capacity and quality of life were improved in the ways suggested. The approach of the Extension Branch of the Forest Department is happily in this direction. In former times, when Sri Lanka had an established forest culture of its own, the people were healthy, well fed and prosperous. Today, they are just able to eke out an existence on the fringes of the forest.

This broad-based socio-economic study would be started concurrently with other organised studies, such as ecology. It is important that the researchers approach people with an open mind and do not have preconceived ideas. Socio-economic studies that have been started in this way elsewhere have led to problems, as in the first AsDB community forestry project. If the outcome of the survey is positive, then a trial plot could be established to determine whether conservation and some form of sustainable productive use of the forest is possible. Hitherto, participatory action has proved to be a success only in the establishment of agroforestry plantations.

Apart from this FD/IUCN-proposed study, some recent investigations have been done by individual scientists on the socio-economic implications at Sinharaja, including some by staff of the University of Peradeniya. One study discusses the non-wood products and other uses of the forest by nearby villagers. These products include sugar syrup from kithul *(Carryota urens)*, rattan (*Calamus* spp), cardamon (*Eletteria cardamomum*), resins (from *Shorea*

spp), gemstones, medicines, and food. Some timber is cut and removed illegally and so is fuelwood. String, rope and thatch are other products. The author of this study advocates a system of participatory management for the forest to ensure its conservation, starting with the buffer zone, and introducing the concept of "extractive reserve" management in the core area of Sinharaja, to enable village people to use forest products from the core areas (McDermott *et al.*, 1990). Currently, however, even the limited use of the forest by these villages degrades the forest resource and it is doubtful whether this kind of participatory management could rectify matters, and it could even make matters worse.

Future direction of management of Sinharaja

The present situation at Sinharaja is that it is well conserved by the Forest Department, although there is some degradation by unsustainable use of a few products by people living in peripheral villages. Whether conservation and productive use are compatible at Sinharaja and what linkages are needed to make them so in a sustainable management system are yet to be determined.

It is also unlikely that all the revenue from this forest, including visitor fees will go as inputs into village development, although some hand-picked villagers could be trained and employed as forest/wildlife guides or instructors to visitors. They could also be taken as salaried staff, hired for forest protection. The number who would benefit would, however, be very small.

7.7 Further case-studies of conservation in action

Conservation of the Knuckles Range

The Knuckles Range of forests in the northern part of the Central province is a series of more or less parallel peaks giving the appearance of a clenched fist when viewed from afar. This forest ecosystem is markedly influenced by topography and varying climatic conditions. Its high peaks are covered with unique natural vegetation types that have been conditioned by strong winds, in some places resulting in dwarfed forests, and its steep, rugged, misty terrain reaches heights of 2,000 metres, making the range one of the most beautiful parts of Sri Lanka. Its unique forest ecosystems and the threat to the forest by

illegal fellings and cultivation of cardamon led the Forest Department to take it up as a high priority conservation area after Sinharaja.

The Forest Department commenced conservation activities in this forest in mid-1987, and sought technical assistance from international agencies to prepare a Conservation Management Plan. The initial stage of this activity was by the Forest Department, while later funding was provided by the Norwegian Government and technical assistance contracted to the IUCN. The Forest Department organised socio-economic surveys, habitat identification, mapping, ecological research and started a programme of awareness generation for nearby communities. Here, the communities do not live near the forest areas because of the very rugged topography, high cold winds and generally difficult climatic conditions. In fact, what remains of the forest is the part that escaped the coffee and tea planters. The communities live in valleys around the forest range. Its sheer inaccessibility has been its saviour. The Government decided in 1988 that all the forest above 3,500ft (1,067 m) would be absolutely protected. Conservation activities are being continued in a follow-up phase with the same agencies involved, and a Conservation Management Plan has been prepared after identifying what should be the Knuckles Conservation Area (IUCN, 1994b).

Cardamon cultivation under partial canopy shade has destroyed most of the forest's natural regeneration in quite a large area. This is because the undergrowth is cleared and the exposed forest soil is scraped or worked before cardamon cultivation. Here too, political will is most important to make this Conservation Management System a success, but there are no signs of it as yet. The people who cultivate cardamon only do so for some rich businessmen from the cities and it would not be difficult to ensure conservation if the right corrective approach is adopted.

Alternative work for the villagers suggested includes agroforestry plots on long-term land-use tenure outside the forest on other state land, mostly scrubland lower down or in the valleys. Thus, the multitude of agroforestry systems in Sri Lanka could be made use of as a magnet to entice people away from these unique forests. Agroforestry should supply more benefits and more income to the people in the long term.

In a few critical areas, people live nearer the forest. They are extremely poor and suffer from malnutrition and iodine deficiency. A recent study recommends voluntary re-location of some of the people who will only stand to benefit by the exercise (Kayirawasam, 1991). As long as people get a better income and better living facilities they will surely move out. Relocation from the Knuckles range of forests would be an easier proposition than relocation from some other forest areas because of the harsher climatic conditions in and around Knuckles.

Knuckles is a high priority conservation area, and in no way would any forester or environmentalist recommend the exploitation of this forest for wood products or for the cultivation of cardamon. The Forest Department is zealously protecting this forest and where cardamon cultivators are evicted, enrichment planting with locally-occurring plants is being undertaken. Local linkages with the surrounding tea estate management, the Forest Department, the Department of Wild Life Conservation and the Divisional Secretariats are needed to ensure successful conservation management, with the Forest Department occupying the central position.

Conservation of Kanneliya-Dediyagala-Nakiadeniya forests

The Kanneliya-Dediyagala-Nakiadeniya (KDN) complex of tropical evergreen humid natural forest ecosystems, 11,100 ha in extent in the south-west wet zone has been given a total conservation status from 1989 by the Forest Department. This group of forests had been leased out to the Plywoods Corporation for many years, and even prior to that it had been exploited for timber by the Forest Department, including the supply of timber during the Second World War. As a result, the forest structure had been adversely altered and in many places the forest has been encroached. Logging was suspended in 1988 after pressure was exerted on the Corporation by the Forest Department. In 1990, the Forest Department took management control of the forest complex again and it is now being rested and subjected to silvicultural improvement. Already blanks are being covered up with natural regeneration, and encroachments are being planted up (Singhakumara, 1994).

A Conservation Management Plan prepared by IUCN (1994 c) recommends the utilisation of the timber potential after a resting period. This was first recommended by the Forest Department. In fact, the first report of the NCR

is clear. It states: "*the forest will take a long time to recover from past logging, even with strict protection*".

The Kanneliya Forest Reserve part in particular is rich in Dipterocarps, in fact richer in this respect than the Sinharaja World Heritage Site. It is also considered a good candidate for recognition as another natural World Heritage Site on its own merits. The Forest Department was at first going it alone on this project but some bilateral aid is forthcoming from the New Zealand Government for the IUCN work. It is also reported that the IUCN is also investing a small sum of money of its own for sporadic KDN forest conservation activities.

Conservation of mangrove forests

The mangroves are a special case in view of their rapid destruction to near extinction. The total area in the country, estimated in 1986, was only around 10,000 ha (Nanayakkara, 1986a). Satellite imagery interpretation in 1992 reveal an extent of 6,877 ha, but it could be a little more as there are small scattered extents not clearly seen. Conservation measures have to be taken concurrently with the progress of the survey study.

Conservation supporting agriculture

Along with the conservation of natural forests, efforts are being made by the Forest Department to demonstrate to village people and farmers that forests are supportive of their activities to increase productivity in agriculture and other farming systems, that forests improve dry weather supply of water to streams, and that natural forests are not merely a "land bank" to be cut whenever they want to expand their activities.

All these activities are important, but first action is necessary to see:

- that there is no further forest loss;
- that depleted natural forest areas are enriched or reafforested;
- whether productive use of these forest ecosystems could be carried out in a sustained manner.

It takes time, but it is important for future environmental stability for meeting the needs of future generations in the country.

7.8 Conclusions

Whilst sustainable productive use of non-critical natural forest is in theory a valid concept, in Sri Lanka, as in most other developing countries, it is not yet realised. The country is still in the process of establishing the correct linkages with concerned institutions and decision-makers, to sustain conservation and improve species diversity and timber stocking in its overlogged and encroached natural forests after the emergence of the natural forest conservation thrust of the Forest Department in 1989.

The examples quoted, the Sinharaja World Heritage Site, the Knuckles range of forests, the KDN forest complex, the Mangroves, and all the remaining forests coming under the scrutiny of the NCR, form the lungs of Sri Lanka. Immediate action has to be taken to protect them. Experimentation on how to conserve and protect is important and requires discussion, but it is time-consuming. By the time experimentation is over, half the forests may be gone. Hence the need for immediate political will, legislation and state action to conserve these forests for posterity. The IUCN also has a responsibility and an obligation to recommend such action to the Government. Otherwise the forests would have disappeared, leaving behind only a library full of publications of academic interest.

CHAPTER 8

FOREST RESEARCH

8.1 Introduction

Forest research is something that is frequently neglected in the rush for exploitation or national development. The history of forest research in Sri Lanka reflects a mixture of this short-sightedness with some notable examples of visionary work. The emphasis of research has changed from supporting exploitation of natural forests towards promoting the wider values of forests, and from internally-managed research programmes within the Forestry Department towards national and international co-operation in research. This trend looks set to continue.

8.2 The development of forest research up to Independence

Champion (1935) paved the way for organised forest research in Sri Lanka. In that paper he recommended the appointment of a Silvicultural Research Officer and the establishment of a separate Silvicultural Research Unit in the Forest Department. This was done in 1937. Like most new ventures this unit was adversely affected by very limited staff and resources to implement its ambitious research programmes that were considered priority areas at that time (Vivekanandan, 1981).

8.3 Research in the post-Independence period

Budgetary support for forestry research has been very low in many developing countries, and following Independence, Sri Lanka was no exception. Decision-makers, who were almost always non-scientists, considered forestry research to be a low priority, but in recent years, with a fast-declining forest cover and inadequate growing stock, both the Government and international agencies have provided the much-needed support. In the early 1960s the budget for research by the Forest Department was only a meagre Rs. 10,000, a mere

pittance compared to what other Research Units, like Agriculture, received at that time.

In its formative years, the Research Unit of the Forest Department handled mainly practical problems encountered in the regeneration, establishment, and management of forest (Nanayakkara and Vivekanandan (1986). In 1949, a Timber Utilisation Research section was established with the objective of studying the strength properties, durability, preservation and utilisation of Sri Lankan timbers, and for the study of lesser-known and less-utilised tree species. Unfortunately in 1985, the Timber Utilisation Branch, which was producing excellent results, was shifted to the State Timber Corporation in a misjudged decision by the bureaucracy, without heeding the advice of the Forest Department. This was a retrogressive step as the Corporation had no staff qualified to undertake the research work. The impasse created in this period was a setback to timber utilisation research. As anticipated, the activity has now been shifted back to the Forest Department, headquartered at Battaramulla (a suburb of Colombo), where, since 1987, it has been co-ordinated by the Research Branch and monitored by a Research Co-ordinating Committee, chaired by the Conservator of Forests.

Although forest research was earlier confined to the Forest Department, over the last decade other institutions - first the University of Peradeniya and then the University of Sri Jayewardenepura - and individual scientists have been conducting research programmes with firm linkages with the Forest Department which co-ordinates the research. Forestry research linkages have been established by the University of Peradeniya with Oxford University in the UK, and by the University of Sri Jayewardenepura with the University of Bangor, in the UK, and with other overseas institutions discussed below. So it would be correct to say that forestry research in Sri Lanka is now firmly established and is a growing concern with international support. International assistance to forestry research is seen as a recognition of the approaches Sri Lanka is taking for the conservation, expansion and wise management of its natural forests.

8.4 The development of forestry research institutions

Currently, the main forestry research institutions in Sri Lanka are:

- Mid-Country Forestry Research Station (MICOFORS), Agaratenna;
- Low-Country Forestry Research Station (LOCOFORS), Kurunegala;
- Forest Research Institute, Kurunegala (proposal for upgrading);
- Sri Lanka Forestry Institute (SLFI), Nuwaraeliya;
- University of Sri Jayewardenepura;
- University of Peradeniya.

Forestry research was decentralised to a certain extent with the establishment of MICOFORS in Agaratenna in the dry, mid-montane zone of Uva province in 1986, and LOCOFORS in the dry-to-intermediate zone at Kurunegala in the North-Western Province in 1988. Proposals have been made to upgrade LOCOFORS into a fully-fledged Forest Research Institute and planning has been set in motion to meet this goal, aided by international agencies. It is hoped that political will will prevail to get this expedited. Research is also being conducted at the new SLFI at Nuwaraeliya in the montane zone which started its teaching activities in 1990. The Institute now has its own experimental forest at Kandapola near Nuwaraeliya at an altitude of 1,986 metres.

MSc. course research work for the University of Sri Jayewardenepura is carried out at the Yagirala experimental forest in the wet zone. This forest was handed over to the University as its experimental forest in 1990. It is an ideal site for certain special subject research work by the postgraduate students. For example, pine underplanting with *Ochlandra stridula* has been done successfully at Yagirala (and at some other sites).

This research aspect of work at the University is new and close co-operation between this institution and the others is now needed to build up a forest research reputation at this University.

Forest research conducted by the University of Peradeniya concentrates on forest ecology, natural forest regeneration, biodiversity, the use of MPTS in agroforestry and some studies on socio-economics. All research, however, is co-ordinated by a central research committee chaired by the Head of the Forest Department, the Conservator of Forests. The progress of the research work is also monitored by the Committee which meets regularly. A significant contribution has been made by the Agriculture Faculty of the University of Peradeniya, jointly with F/FRED, to the scientific practice of the old art of

agroforestry in the country. Agroforestry is now influencing forest management practices and these influences are going to be widespread when agroforestry becomes the mainstay of forestry development in Sri Lanka. When no more suitable land is found for large blocks of industrial forest plantations, emphasis will be on agroforestry and agroforestry pastoral development. Regional workshops have been held by the university on multi-purpose tree species research and development and the proceedings have been disseminated through the Forest Department to all its field foresters (Gunasena, 1993). Agroforestry research findings are of importance in the management of the participatory agroforestry lots that are being established under the on-going AsDB/Forest Department Participatory Forestry Project. A large number of tree species and crops are now permitted for use in agroforestry.

It is important that the research results coming out of the universities are also disseminated to field staff and given more publicity. There is much research being done on forestry subjects and related disciplines at most of the universities in Sri Lanka and some co-ordination is called for in dispersing important research findings connected with forestry for the better establishment, conservation and management of forests.

8.5 The current forestry research situation

Introduction

Currently, the main objectives of forest research as seen by the Forest Department are:

- provision of technical support to national forestry development programmes through research and development efforts;
- formulating research programmes in keeping with national priorities;
- dissemination of useful research findings among field staff and other end users;
- providing technical advisory services.

The important aspects, mainly those of dissemination and provision of advisory services, gained ground only after 1985 when research staffing was increased. Research is also being continued into species evaluation, tree improvement and propagation, bamboo and cane planting, under-planting and inter-planting, fire control, site/species matching, plantation conversion, and neo-agroforestry.

Natural forest silviculture

The main trend in forestry research in the early years concerned the need for regeneration of the main timber species in the heavily-exploited natural forests in the different climatic zones. These included research on seeds, establishment of seedlings, silviculture and planting techniques. Twelve research centres were established countrywide, despite the chronic shortage of staff, a hundred different species were studied and around five hundred field trials were set up on different sites. Records were maintained, although the analysis of results took time due to a lack of staff. The Research Branch became a virtual storehouse or archive for these records (Vivekanandan, 1987). Other studies undertaken were the phenology of natural forest trees; *ex situ* establishment of species under different soil and climatic conditions; silvicultural treatment of natural forests to improve species composition and distribution; and the yield improvement of forests.

Research into the girdling of unwanted trees, either by purely mechanical means or by poison frill girdling, was carried out in the early years to ensure the success of difficult thinning-type tree removal operations without causing damage to neighbouring trees and regeneration. This also had some influence on management operations in the implementation of the earlier Working Plans. It is also being continued in the implementation of management rules in some of the working circles of the present management plans, especially for natural forests. Only trees that were over-mature, obstructive, dead or dying, dwarf or whip trees were cleaned out by this method.

Plantation silviculture and watershed forestry

In view of the fact that plantation forestry has become the mainstay of the Forest Department, it is not surprising that the directions taken by forest research led to the establishment of better plantations, better yields on different sites in the different climatic zones, and research into vital nursery practices

to meet the needs of the newly-synergised plantation forest establishment. Spacing research trials have also influenced management planting operations in the case of teak in the dry zone and pine in the montane zone. Teak planted earlier at 10ft x 10ft and then at 3m x 3m is now planted at 5m x 2m, while montane planting of pine is now done mostly at 2m x 5m. Earlier planting was at 8ft x 8ft or 2.5m x 2.5 m. With wider spacing on matching sites, both eucalypt and pine plantations have profuse undergrowth.

The new system of management planning differs from the old Working Plans system and includes operations referred to in operation management terminology as pre-commercial thinnings, commercial thinnings, clean-up cutting, and regeneration cutting. Other felling activities are also added to these when and where needed, and working circles modified accordingly.

All these operations need to be carefully monitored as there is the distinct possibility that they may result in overcutting of stands. Thinning research is therefore indicated to determine how judiciously these operations have to be performed. Conservative foresters and forest scientists are generally also very suspicious, when words like commercial, cutting and pre-commercial are used in management prescriptions.

Experiments in stand conversion have had management implications. The conversion was resorted to after some criticism (generally not justified) of the successful planting of *Pinus caribaea* monocultures to serve as catchment forests in the montane Mahaweli river catchment. Conversion of such stands has been successfully achieved by the introduction of broad-leaved species in mainly hilly terrain, but their effectiveness in preventing top soil erosion has yet to be studied. Best results are achieved where the pine trees are planted at a wider spacing and where rainfall is high.

Watershed catchment studies carried out by the University of Georgia, USA, proved the phenomenal success of the *Pinus caribaea* catchment forestation project in reducing siltation and run-off to minimum levels. Hitherto, this has proven to be the best tree cover for catchment purposes. The best example is in the Ginigathhena area in the wet, mid-montane region. The management implications of this research for watershed forestry are therefore clear. Under the catchment-watershed afforestation component of the USAID/Forest

Department of Sri Lanka project, 10,118 ha of steep land had been planted by mid-1988. It was a show-piece planting effort by the Forest Department.

Indigenous tree silviculture and nursery practice

Research into the *ex situ* establishment of indigenous species was also given priority as the Forest Department envisaged the establishment of ten per cent of its annual planting target with indigenous species, but fell far short of expectations in view of the natural difficulty of establishing indigenous species in open barren lands and for the want of adequate aftercare, which is dependent on the cost factor. Research into the growth and establishment of new species and provenances, and into modern nursery techniques and plantation establishment techniques also continued. Forest Department nurseries raise planting stock for the Department's planting programmes, and for raising high quality seedlings and "instant" trees for social tree-planting programmes by the Government and NGOs.

Research into the transport of plants to planting sites is needed however, as at times there is much damage to planting stock during transport. It is often difficult to locate nursery sites close to the planting area. Much thought should be given to the selection of nursery sites, especially in hilly terrain, and the correct transport of seedlings to planting sites adopted. Research into nursery practices is providing interesting results which are sure to pay rich dividends.

Traditional nursery and planting-out practices, especially in the dry zone, have had to change because the land to be planted now is highly-degraded scrub-cum-grass *chena* lands and the traditional planting material (such as bare-root stumps of teak or containerised, polythene-tubed plants of other species) do not give good results. As a result, in the case of teak, the use of bare root stumps is being abandoned in favour of containerised plants or stumps, and "root trainers" for other species. Teak is quite hardy and the root system is fairly well developed at planting, while in other species it is not quite so. In management planting operations these new techniques have been found to be highly successful with good survival. They could therefore revolutionise the planting of both dry zone natural forest species and exotics on the compacted soils of the dry agro-ecological-climatic zone. As for teak, a change from

bare-root stumps to even-tubed plants in this terrain have given superior results.

Forest protection

Research also looked into the nature of diseases of timber and forest trees caused by insects and fungi, and into the damage to forest plantations by deer and elephant. Practical applications were found for controlling defoliation and leaf skeletonisation attacks on teak, borer attacks on satin logs, pinhole borer attacks on rubber wood and fungal attacks on sawn timber. Research has also helped to tackle diseases of seedlings in central and site nurseries.

Utilisation

Timber utilisation research increased the number of species available to the market through promotion of less-known species into the timber classification, while less-used species became more popular. Rubber wood, a disregarded species earlier except for fuelwood, came into the market as a furniture timber as a result of pioneering research in the Forest Department through the use of boron salts to preserve the wood. Now rubber wood is used for furniture not only in Sri Lanka, but also in other countries of the region. The end-splitting of eucalypt logs cut for transmission poles or industrial use has been reduced or controlled by the use of "gang-nail-plates", a development of utilisation research. A reduction in the number of end-split poles has also been achieved by the timing of felling operations, a principle that has management implications in the management of montane eucalypt plantations for transmission poles, railway sleepers and industrial timber.

Research now under way into oleoresin tapping from pine plantations will have a significant impact in the country in view of the value of resin as an export. Value-added resin is of still greater importance. Almost all *Pinus caribaea* plantations are in great demand for resin-tapping. However, care needs to be taken to ensure that tapping levels do not exceed sustainable levels, and it must also be remembered that tapping can easily ruin the prospects of a worthwhile timber harvest.

Afforestation of denuded lands

From the late 1950s, the Forest Research Branch has had to determine quickly, species that could be grown fast and satisfactorily in many denuded forest lands, including *chena* and grasslands that had to be planted up in the dry, wet, and montane zones. This continued with great success for almost two decades. The ground available for planting was infertile, eroding in some places, open, windswept, and in places, subject to foraging mammals like free-grazing cattle, deer and elephant – a tall order for the researchers. The most successful species were *Eucalyptus camaldulensis*, *E terreticornis*, *Pinus caribaea*, *Acacia auriculiformis*, *A. mangium* and *Leucaena leucocephala.*

The low, wet zone, denuded forest areas were fast turning into indigenous fernlands which were of no economic use. One species that was used for planting up in the 1960s was *Fragraea fragrans*, but it had no timber or utility value. The Research Branch, with only one Research Officer supported by Divisional Forest staff (who were also engaged in other duties), set up a series of trials both in the low, wet zone where invasive grass was a problem and in the montane, wet zone where both edaphic and biotic *patana* grasslands presented a challenge to afforestation.

Many species were tried out, including exotics and indigenous tree species, but *Pinus caribaea*, with its phenomenal growth rate and easier establishment and management, was the obvious choice. Indigenous species failed miserably as they were far too demanding and needed much tending and care at great cost to succeed on harsh open sites. Large blocks of *P. caribaea* were established successfully and became one of the principal species to be planted. The use of this species has had a multiplier effect and it is today a valuable national asset. Apart from use for wood pulp, the tree can be used for rosin, resin and turpentine production. It is the best tree for mid-montane catchments and watersheds. When grown at the correct spacing, indigenous flora creep in and form a dense undergrowth.

With the suspension of the conversion of natural forests into teak under the Co-operative Reafforestation Scheme in 1981, teak was tried out in scrubland reafforestation in a "Modified Co-operative Reafforestation Scheme", but the teak fared poorly because of the unsatisfactory pre-planting burn provided by the cut scrub and a consequent paucity of nutrients for the initial take-off of

the teak. Indigenous dry zone species tried out on these scrublands (which were really lands subjected to intensive shifting cultivation) fared very badly. Species trials demonstrated finally the success of two eucalypts, namely *E. camaldulensis* and *E. terreticornis* for these lands. Success at planting, however, had mixed results because on some sites, the provenances used did not respond well, for example at Puttalam. However, in some areas of the North Central Province dry zone, eucalypts have proved promising. In an analysis of the results, it was concluded that the provenances used for planting out should be chosen with the utmost care.

Multi-purpose tree and cane species

The Forest Department, in its planting efforts, did try to pacify the lobby that was against the planting of exotic species by once again starting up research into *ex situ* planting, this time of species like *Acacias* and other multi-purpose tree species. The irrational antagonism against exotic trees was partly on environmental grounds, but was perhaps more of a reaction against forestry development on lands which interested parties wanted for future industrial crops, rather than a genuine concern for species choice. This reaction was successfully countered by the Forest Department's awareness programmes, publicity in the press, and practical demonstrations in the field of the success and value of exotic species. The end result was that criticisms of the planting of exotics gradually died down and are today at a low level.

Of the multi-purpose tree species tried out, *Acacia auriculiformis* and *A. mangium* are now used on a management scale in the dry and wet zones respectively. *A. mangium* has also been successfully established in wet, mid-montane regions. Because they are fast-growing and dense-canopied, both species are also popular for amenity planting, hedgerows and home gardens. They are also used for roadside and avenue planting.

Research, sponsored by the IDRC/Forest Department project, continues to be conducted into the planting of bamboo and rattan, the establishment of which is becoming popular. The potential for bamboo and rattan in the country is enormous as they are in great demand for the manufacture of furniture, matting, curtains, curios for export and miscellaneous artefacts. Promising results with management implications have been obtained in the seed propagation of the following species of exotic bamboo: *Thyrostachys*

siamensis, *Dendrocalamus membranaceous*, *Dendrocalamus broundisii*, and *Bambusa arundinacea*. Species site trials are being carried out in Anuradhapura and Kurunegala Forest Divisions. Under-planting plantation forests with rattan cane has been successful, especially in the case of pines. A mixed-management system is being evolved for this new kind of intervention. Cane has also been introduced into wet zone natural forests and into mixed jak/mahogany plantations in the wet and intermediate zones.

Agroforestry and participatory management

Research activities directed at improving production from participatory agroforestry woodlots is under way at the Forest Department's two regional research stations and in the Forest Divisions of Kandy, Matale, Nuwaraeliya and Badulla, where farmers' agroforestry woodlots were successfully established under the AsDB's Community Forestry Project I. They are now being continued under the AsDB's second project. Agroforestry practices in an abandoned tea plantation at Welimada (in which the tea is left as one of the crops) have also been a success. Many popular vegetables have been grown in these agroforestry plots along with trees.

Collaborative research

Foreign institutions play an increasing role in determining the direction of forestry research in Sri Lanka, or at least in helping to implement it. Those currently or recently involved in collaborative research include:

- University of Oxford, UK;
- University of Bangor, UK;
- University of Hawaii, USA;
- Overseas Development Administration (ODA), UK;
- Danish International Development Agency (DANIDA);
- Tropenbos, Netherlands;
- Commonwealth Scientific and Industrial Organisation (CSIRO), Australia;
- International Union of Forest Research Organisations (IUFRO), Austria;
- Food and Agriculture Organisation of the United Nations (FAO).

Apart from the current collaboration in forest research between the Forest Department, Peradeniya University, Sri Jayewardenepura University, Oxford

University and the University of Bangor, it should be recorded that the Forest Department has established research and exchange linkages with many other organisations. These international linkages have enabled the country to benefit from an exchange of research results, participation in seminars, workshops and consultations, thereby gaining more research knowledge, as well as from an exchange of germplasm.

The Forest Department co-operates with the University of Hawaii on *Leucaena leucocephala* (ipil ipil), and with the Commonwealth Scientific and Industrial Organisation (CSIRO) Australia on the supply of genetic materials (Vivekanandan, 1981). Another important link was with the USAID-sponsored F/FRED (Forestry Fuelwood Research and Development) project with support from Winrock International USA (located in Bangkok), with which the Forest Department signed a memorandum of understanding in 1986. The University of Peradeniya followed suit later with its own memorandum of understanding with F/FRED. Much data on multi-purpose tree species planting in the region was obtained as a result of this technology transfer linkage and Sri Lanka's agroforestry programmes benefited. The Forest Department is a Council member of the International Union of Forest Research Organisations (IUFRO). The F/FRED project was conceived and developed at the IUFRO Research Planning workshop for developing countries hosted by Sri Lanka in Kandy in 1984. Other research linkages are with the Danish International Development Agency (DANIDA) and the Food and Agriculture Organisation of the United Nations (FAO). In 1986, a linkage was also established with TROPENBOS of Netherlands whose objective is for "*a united approach for research in the Humid Tropical Forests*", and stresses a co-operative approach (Nanayakkara, 1986c). TROPENBOS is the Dutch word for tropical forest. In an important development in 1994 a Forest Nursery Manual was prepared for the country by the Forest Department with support from the ODA and FAO. It is a useful manual which is now used at all nurseries.

Foreign-aided forestry projects in the country have their own forestry research components with links with the Forest Department. These have included USAID, AsDB, World Bank and IDRC projects. The Forest Tree Improvement Programme, mentioned on page 89 para 8.5, is supported by UNDP/FAO and Australia.

8.6 Future direction of research: development of a Forest Research Master Plan

A National Forest Research Master Plan (Neil, 1991) for Sri Lanka has been mooted and preliminary action has been taken to consider the views of all concerned agencies. However, a Master Plan for Research, like the Forestry Master Plan, could end in controversy if a rational approach is not taken in its preparation and if national needs and national views are not given due consideration. There is, therefore, a need for some participatory influences to guide the preparation of this Research Master Plan. It should be prepared by national foresters and forest scientists in a process driven by them and not by the bureaucracy and donor interests as was the Forestry Master Plan.

Most constraints to the future development of forest research have been overcome with the provision of new staff over the last decade. However, studies have revealed that yet more research staff are required, especially in the eighteen Forest Divisions. As forest research is a long-term business, it is important that research staff are able to conduct their assignments over long periods, without being subject to frequent transfers. The output to date of the research conducted by a small branch with limited funds, such as the Research Branch of the Forest Department, is therefore most creditable, to say the least.

CHAPTER 9

FORESTRY AND LAND-USE PLANNING

9.1 Introduction

In discussing the integration of forestry into a land-use planning system, it must not be forgotten that Sri Lanka had, for a long time, an extensive forest cover which provided good environmental conditions for healthy and prosperous living. In short, the country had what could be termed a "forest culture" of its own. At that time, man was closely linked with forests and the environment in general with which he lived in relative harmony, whilst practising agriculture. Also, it should be remembered that today, Sri Lanka is a developing country with a drastically-reduced forest cover, the greater part of it not in the most suitable places and poorly stocked. There is also a growing population and economy moving towards a newly-industrialised status. It is in this scenario that planners are trying to devise a land-use planning system for the whole country.

Before the arrival of the British in 1815, the central montane massif was covered with natural forests and Kandyan home gardens that simulated natural forests. They provided clear water to rivers and reservoirs in the plains below where the rich rice fields and other agricultural lands were situated. Nearly 90% of these montane forests were cut down to make room for large coffee estates and later tea. Other forests in the lowlands were cut for rubber, some coconut, and for other purposes. Home gardens were also acquired and converted to these crops. So today, the situation is reversed. Most of the forests are secondary and found in the dry zone, while the central massif, mostly covered by shrubby tea, could be considered an eroding disaster area, from an environmental point of view. Eighty-seven per cent of the country's forests are now located in the plains of the dry zone.

9.2 The historical development of land-use planning

The colonial period and from Independence to the early 1980s: early experiments in land-use planning

Ad hoc land-use plans have been prepared in the past for individual districts, but these have not been able to get off the ground because of their rigidity and the presence of too many details on paper, details which could not be implemented on the ground because of socio-economic factors and political meddling.

Since the 1970s, land-use planning has been introduced into the agenda of government ministries. This was thought necessary in view of the growth of population, expansion of agriculture, and the conflict between traditional uses and new developments like export agriculture, industries and tourism. A need, therefore, arose to implement a scientific land-use plan for the whole country. Assumptions made were that land-use should be optimised to make it mandatory to allocate land on the basis of land-use characteristics, and that lands should be managed in the most appropriate manner, not only to sustain, but also to improve their desirable qualities (CEA, 1988). This was only ever really valid in theory, especially the assumption regarding land allocation. Many conflicting situations arise in the course of trying to implement such a scheme of land allocation in a complex society.

The 1980s: the emergence of a national land-use policy planning division

There is severe competition for land by the major land-using sectors, such as agriculture, forestry, wildlife, animal husbandry, social use, tourist hotels and other structures. The losers are nearly always the forestry and wildlife sectors. Some politicians, and bureaucrats who want to please them, adopt a short-sighted policy, thereby serving interests other than forestry or wildlife. For example, in 1988 the *chena* cultivation system, based on permits issued by Government Agents of Districts, was officially terminated because there was a much-shortened fallow period between cropping cycles. Soils were becoming badly degraded and exposed. This old agroforestry system was becoming destructive, but the ban on this type of land-use did not have the desired effect because of the lack of political will. Politicians did not want to

lose favour with those people who were continuing to practise this form of destructive land-use. So illegal *chena* cultivation continued. There are many examples like this to demonstrate why standard scientific land-use planning on the developed country model is still difficult in Sri Lanka.

Box 9.1 plots the development of active scientific land-use planning at the country level in the 1980s (Jayasinghe, 1995).

The 1990s: finalising the national land-use planning guidelines, and the emergence of land-use planning committees

In 1991, National Land-Use Planning guidelines were finalised. From 1991 to 1993 there was a lull in the work of the LUPPD, but since 1993, LUPPD work has been expedited to frame a National Land-Use Policy and to prepare a Plan. Provincial, divisional (old assistant government agent), and village-level plans are also being prepared.

In 1994, a programme and criteria for the preparation of Indicative Land-Use Maps were drawn up. This is a very useful step as good indicative plans are really what are needed as they have the characteristic of being flexible. Characteristics to be indicated are several land-use categories under the following sub-divisions:

(i) intensively-used land;
(ii) semi-intensively-used land;
(iii) sparsely-used land;
(iv) conservation land.

Forest as a land-use category is provided for under categories (ii) to (iv).

Box 9.1
Steps in the development of scientific land-use planning in Sri Lanka in the 1980s

- 1982 – establishment of a Land-use Planning Division in the Ministry in charge of the subject of Lands as a result of the recommendation of the Conference on Land and Water Resources Development held in 1979.

- 1983 – UNDP and FAO assistance was obtained to set up a natural resources data bank and to advise the Government on land-use planning. The idea was to adopt a comprehensive approach to land-use planning, based on scientific criteria (Ridgeway, 1988).

- 1987 – AsDB assistance was obtained to strengthen the LUPPD already started and for the establishment of District Land-use Planning Committees (FAO, 1988).

- 1989 – Assistance to the Survey and Irrigation Departments to increase their capability to provide data and information needed for scientific land-use planning.

In a new approach, the basic objectives of the LUPPD are to *formulate land-use policies and prepare plans to rationally allocate the land resources among competing needs of the country for optimal and sustainable use while maintaining an environmental balance* (Jayasinghe, 1995). As a result, LUPPD activities have expanded to include:

(i) Preparation of Land-use Plans at National, Provincial, Divisional, Local and Plot Levels, based on formulated guidelines and procedures.

(ii) Establishment of Land-use Planning Committees at national, provincial, division and village levels, and accompanying plans and maps and a GIS/LIS section (Legg, 1995).

(iii) Establishment of Land-use Planning Units at the provincial and district (cluster) levels, resulting in specific land-use studies.

Although a rational scientific approach is now being adopted to prepare land-use plans for the whole country, the end results may face the same problems as the *ad hoc* plans prepared in the earlier years for districts because of social, economic and political pressures. For instance, with so many development

schemes implemented and protected areas established, it has been found most difficult to translocate people on a large scale. On a small scale it is possible. In this context, it may be better to plan taking the existing land status picture into consideration as a starting point. This approach would be more practical and acceptable, although it might not look good on paper.

Under this emerging land-use planning system, the key instrument in a decentralised situation would be the Divisional Land-Use Planning Committee. The divisions referred to are the former assistant government agent divisions, which are sub-divisions of the 25 districts of Sri Lanka. Two hundred and twenty such Committees have already been established, including three in the northern Jaffna district. Once the troubles in the north are settled, the full complement of Committees will be set up. The established Committees are already functioning.

The Land-Use Planning Committees at the different levels are multi-disciplinary bodies for decision-making, co-ordinating, implementation and monitoring land-use planning activities. Forestry interests will be represented on all these Committees. The stated objective is to devolve the land-use planning process as far as possible at each level.

Land-use priorities and the need for changes would be decided by the different Committees, taking into account the baseline Indicative Land-Use Plans prepared at each level. Any matter that cannot be resolved would be referred to the Committee at the next level above. Training of staff is now going ahead to set the process in motion.

However, this type of exercise is going to be expensive in terms of infrastructure; it will need many staff; it will be time-consuming, and very complex. Many socio-economic and political problems will emerge, considering the high political consciousness in the different parliamentary electorates. Thus, the progress of this system, especially regarding its approach to forestry, should be watched with interest. Imposing modern scientific land-use systems to replace the traditional is not going to be easy, although it has to be the ultimate goal.

9.3 The next stage: development of a national land-use policy

A National Land-Use Policy is being prepared for the government approval, but it will have to be placed before the people at public sittings in order to obtain their views. Some element of a participatory approach may give a Land-Use System more flexibility, thereby making it easier to implement.

Thirty-three government agencies and organisations have links with the LUPPD, indicating further the complexity and difficulty of smooth land-use planning in the country. Chief among these are the Forest Department, Agrarian Services Department, Agriculture Department, Coast Conservation Department, Land Commissioner's Department, Geological Survey Department, Department of Wild Life Conservation, Central Environmental Authority, District Administrations and the Mahaweli Authority.

Land-use planning cells are to be set up in all other ministries concerned with land-use, apart from the present ministry (the Ministry of Agriculture, Lands and Forests) under which the LUPPD functions. The fact that many ministries are to be involved means that land-use activities have to be co-ordinated at a very high administrative level.

A Land-Use Planning Act is to be prepared to give statutory legal effect to land-use planning decisions. In the interim period, close co-ordination between the Divisional Land-Use Planning Committees and other Committees, like the Divisional Agricultural Committees and Divisional Co-ordinating Committees, has been suggested. Passing legislation needs to be done with great care in order to prevent reactions against it. In any case, the laws thus passed have to be tested and, if necessary, amended later. Too rigid a land-use system will never work in a country like Sri Lanka which is mainly agricultural but which is fast developing into a mixed economy. Rigid land-use laws could slow down this development. Flexibility should therefore be the key word in a new land-use management system.

Land-use legislation will also have to take into consideration already existing laws, especially the Forest Ordinance and the Fauna and Flora Protection Ordinance with which it should be complementary.

9.4 How the Land-Use Policy Planning Division might work

Creating awareness of land-use planning

Suggestions have been made by the LUPPD to create awareness of land-use planning among all staff, and, more importantly, at grassroots level amongst the land-users. The latter is to be done by establishing demonstrations of suitable and sustainable land-use. This is crucial and needs to be undertaken immediately, and well before the system becomes wholly operative. In general, in most projects, the first year or so is always problematical and slow-moving because of the lack of awareness of the issues at hand, lack of infrastructure and lack of adequate staff.

The Land-Use Policy Planning Division and Forestry

As a land-use planning system is to be introduced to facilitate overall systematic development in a scientific manner in the country, forestry should not be considered an obstacle but rather as supportive of development. Considering the poor forestry situation today, more space will need to be found for forestry. Village or rural people, especially farmers, are unhappy to see forests being planted near their fields or even near their villages, although these forests are essential to the community. Therefore the awareness programmes of the Forest Department should run together, in parallel with those of the LUPPD at grassroots-level seminars, workshops and rural gatherings.

However, the establishment of forests on watersheds, catchments, hilly areas, windswept lands, and as line plantings, amenity plantings, timber stands, fuelwood plantations, and so on are of paramount importance. So is the establishment of protected areas for wildlife, conservation forests, stream forest reservations and so on. Awareness programmes, therefore, have to be launched for land-users on the importance of all these types of plantings and forests in general.

The classic example of unsuitable land-use – the planting of tea – should be given wide publicity. Six years' of research, conducted by the Irrigation Department, has revealed that an average of 300,000 tons of soil had been eroded every year from one section of the Mahaweli river's montane catchment

which was in degraded, uneconomic tea. Even normal forestry management

operations in areas such as the selective felling of trees have had adverse effects on the hydrology of wet zone forest catchments, indicating the need for foresters to pull back from such land-degrading practices (Ponnadurai, 1982). Forestry representatives could take this up in the land-use committees.

Another classic case of improper land-use was when a unilateral political decision was taken by a Government to plant potatoes on a large scale after mechanised soil working on the Horton Plains Reserve. This is a unique forest/grassland ecosystem located on a plateau in the wet montane zone at an elevation of over 2,200 metres. The result was an environmental disaster. Mounting public pressure brought this ill-conceived land-use practice to a halt. This could have been prevented if foresters and naturalists could have gone to a powerful land-use committee. Therefore, similar problems which are bound to arise, could be solved if foresters and naturalists had a voice within a Divisional Land-Use Committee with statutory powers. Hence the importance of a continuous dialogue with the LUPPD Committee.

Other noteworthy examples where forests have been adversely affected by improper land-use are the establishment of sporting complexes, sporting grounds and hotel projects in or near critical forest reserves, mainly for the benefit of tourists. Shrimp farming has damaged the mangroves in many places. Forestry interventions through land-use committees can play an important part in saving remaining forests from being put to further inappropriate uses. For this reason, forestry representation on these new committees by the Forest Department should come from the higher ranks so that forestry interests have a stronger say.

Fortunately, the importance of forest conservation has been taught in schools for some years now and at least school children are aware of this importance. These are the men and women of tomorrow who will have a say in future land-use policies.

The success of the integration of forestry and land-use systems would promote valuable interaction and give-and-take between the Forestry and Wild Life authorities and the LUPPD. The *give-and-take* policy would be most meaningful in relation to the lowland, dry zone where most of Sri Lanka's

forests are located, and in relation to the tea estates on the eroding central montane region.

With emphasis on participatory agroforestry development, there is also the indication that forestry and agriculture in certain situations will move closer together. The land-use planning system will therefore have to recognise this trend in order to ensure the smooth complementarity of these two disciplines in such situations.

The land/man ratio as at 1991 was 0.36 ha and the projection for the year 2000 is 0.33 ha. This is a reflection of the belief among most decision-makers that all farming people have to be given land. As population increases therefore, more land is required and politicians look at the forest as a land bank to meet this requirement. This belief is now being broadly criticised and plans are being drawn up to replace sprawling, low-rise settlements with higher-rise ones. This is the right approach which would, if adopted, provide still more land for new forests to meet the country's goals, both of scientific and economic development and of environmental balance.

Land-use planners in Sri Lanka must recognise that forestry is the answer wherever amelioration of the climate; stabilisation of the soil; provision of timber and fuelwood; conservation of genetic resources and endangered species; provision of habitats for wildlife; improvement of hydrology; and increased employment opportunities for people are concerned.

The LUPPD and other agencies

Forestry Land-use Mapping Project (FORLUMP)

Land-use planning activities are also undertaken by the Mahaweli Authority and land-use maps for forestry in the montane areas are prepared in the ODA-assisted FORLUMP project. Other agencies concerned with the preparation of land-use maps of specific nature are the Survey Department and the Irrigation Department. Unfortunately, close co-ordination of all these activities is lacking and it is felt that the LUPPD should play a pivotal role in this connection in the future, when land-use planning becomes established in the field.

Maps of available sites in the montane region are being prepared for the Forest Department's annual afforestation programmes. These maps, which promise to be of great and long-lasting use, are accepted and passed by the district administrations so that the Forest Department's afforestation drive can be carried out smoothly, without having to face any objections by other competing interests.

The Mahaweli Authority of Sri Lanka (MASL)

MASL continues one of its original tasks of land-use planning for the Mahaweli Authority Command Area. The purpose is to plan human settlements in the Mahaweli scheme where social, amenity and doorstep agroforestry tree and crop planting is practised, with support from the Forest Department's Extension Branch. Also, technical advice is provided by the Forest Department as well as some planting material. The tree and agroforestry woodlots planted are owned by the settlers. In this case, therefore, there is integration of social forestry and agroforestry in the land-use system that prevails in the Mahaweli Area. This specialist agency has an enormous task not only to plant trees on settlements but also to regenerate large areas of forest land which were unnecessarily cleared ahead of development in the mistaken belief that forests are an impediment to development.

The German agency, GTZ is funding part of a new afforestation drive along with local NGOs in the Mahaweli Area of Authority, but results are not completely satisfactory. The Forest Department's independent afforestation of sites in the upper catchment of the Mahaweli Area are on schedule. The problem has been the absence of a proper infrastructure in the Mahaweli Authority to implement forestry activities in the field. It may be advisable for Government to negotiate for GTZ funding to go direct to the Forest Department, as the latter has the infrastructure and staff to implement afforestation projects (although planting and tending targets were behind schedule in 1993). Earlier, an NGO referred to as the "Nation Builders" also failed in its attempts to reafforest the Mahaweli river's montane catchments.

The Irrigation Department

Land-use planning activities are also carried out countrywide by another specialised agency, the Irrigation Department, but these are now restricted tosoil surveys in connection with numerous irrigation development projects in the country. Some reorganisation is needed here as the Forestry authorities have repeatedly pointed out the need to closely integrate forestry with irrigation land-use systems for better regulated water yields and sustainable irrigated agriculture. The country's dry zone is dotted with networks of small irrigation reservoirs called tanks and an interconnected system of larger reservoirs, but most of their catchments are bare or with only scattered trees or shrubs. Afforestation of these catchments will therefore improve environmental conditions in the dry zone. When these bare individual extents are totalled up, they will amount to a sizeable area. This is one of the priority areas in the dry zone which will require the active involvement of foresters and irrigation engineers, and financial assistance from donors because the total area involved is very large. These large areas should, without hesitation, be included in a land-use plan and dedicated to catchment forestry.

The Survey Department

The Survey Department, in addition to its normal tasks, is also called upon to undertake sporadic surveys to prepare plans for the Forest Department to carry out urgent or new afforestation programmes requiring quick implementation. It is also required to prepare legally acceptable plans for the granting of title deeds to rural beneficiaries living near forest reserves and to settle disputes regarding land tenurial rights. This Department has therefore an important supportive role to play in the legal aspects of land tenure in a land-use planning system. From the point of view of the Forest Department, only plans surveyed by the Survey Department are upheld in courts of law.

9.5 For the future: a national land-use authority

The ideal land-use policy, from the point of view of forestry, is to reforest the mountains, if necessary at the expense of neglecting the conservation of some dry zone lowland forests. In practical terms, however, even with hard bargaining, with politicians with influence in the montane tea zone it would

take a century or more to do so. Then again, clearing the secondary dry zone forests and forests in the wet zone to make way for other land-use options such as settlements, export agriculture, tourism, irrigation/hydro projects and so on (as provided for in district land-use plans) could eventually leave the country without a forest cover.

Hence, a land-use planning system has to take account of the fact that the existing natural forests have to be conserved and other land-use activities integrated with these forests in a scientific manner, with the emphasis on increasing forest cover in the critical central montane zone. In a developed country, everything is laid out quite clearly and land for forests, cities, agriculture, industries, roads and so on are already committed and accepted, to a large degree, by planners and the public.

Sri Lanka, which is trying to achieve a developed economic status, needs to adopt a disciplined and thoughtful approach in evolving a land-use system peculiar to and suited to the country, instead of borrowing one from another country. For instance, a land-use planning system taken from a long-developed country cannot be foisted on Sri Lanka at the present stage of its development.

This argument diverges from the traditional view which assumes that forestry should be just one component of a land-use system, as in many developed countries in the North. For Sri Lanka, at present, agriculture and forestry considered as an integrated land-use is a better approach.

Although there is no proper statutory scientific land-use system being applied in the country as yet, many specified agencies are concerned with land-use activities, involving a need for closer integration of land-use activities and forestry. As the linkages between these grow, it may be necessary to streamline the operations of the LUPPD, giving it a more powerful status, which could lead to the formation of an independent National Land-Use Authority. The LUPPD is presently only a division within the Ministry of Agriculture, Lands and Forests. In future, it is also hoped that the awareness of a need for integrated land-use planning, with forestry included, will influence decision-makers and result in a more balanced land-use policy. The LUPPD or the National Land-Use Authority will then be the centre point, with

other specialised agencies playing supportive roles in a changed, but acceptable and national, land-use approach.

Already the LUPPD has established a rapport with rural people through its local-level activities and is on the way to establishing large-scale demonstration plots involving all types of land-use practices, including watershed/catchment forests, stream reservation forests, block forest plantations, agroforests and social forestry.

A National Land-Use Authority responsible for a countrywide land-use planning system augurs well for forestry development without socio-politico-economic problems, and the foresters' and environmentalists' dream of expediting reafforestation of the eroding massif of central Sri Lanka could be fulfilled. This in turn would bring back the environmental stability of old, and enable the wise and thoughtful management of the country's forests.

CHAPTER 10

CONCLUDING REMARKS

This document has attempted to illustrate the changing roles of forestry over the course of Sri Lanka's history, and how these have been linked to, and influenced by, the changing fates of Sri Lanka's forests. It is hoped that in doing so, it may point the way to the future role of the forestry sector in Sri Lanka's development.

Much of the country was once forested, and, despite the longstanding prevalence of settled agricultural communities, forests continued to dominate the landscape until the relatively recent past. But it seems that with increasing contact with the outside world, especially with colonial powers, the relationship of Sri Lanka's peoples with her forests shifted. Human populations increased, levels of forest exploitation increased, and many people suffered from a sense of alienation from the land or from the tiers of society that maintained control over that land. Forests were increasingly used for the short-term gain rather than for the long-term advantage of society at large.

As the nature of society changed, forests tended to lose value relative to other land-uses, although this was not necessarily true of individual forest products. The pace of change continues to quicken, and as it does so it threatens to outpace the rate at which the forest estate can change to cope with the ever-increasing demands placed upon it.

At the same time, there has been a worldwide realisation that the goal of development cannot be achieved without reference to the natural resources on which we all ultimately depend, and that development must take issues of equity on board as well. This realisation is only now beginning to be translated into action. In Sri Lanka's case, it is manifesting itself in an increasing concern for the fate of the natural forests and the importance of managing the forest estate sustainably, not just for timber but for a variety of goods and services, many of which have been badly neglected in the past.

The international importance of certain forests for the conservation of biodiversity is also now realised. Meanwhile, the complementary role of plantation forestry is now better understood.

The future of the forestry sector in Sri Lanka is secure, but there are likely to be changes. The dependence on external funding seems likely to continue for the time being, although if industrialisation goes to plan and the insecurity in the north abates, then there may be more national resources available too. Ultimately, forestry has to be treated alongside other land-uses on an equal footing, through the development of all-encompassing land-use policies that put the environment and sustainable development first. This may result in increasing areas of natural forest being dedicated to conservation or non-intervention, or to the production of forest products other than timber. At the same time, the area under forest plantation looks set to increase, but the plantations of the future will hopefully be designed more appropriately than many of those of the past.

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