



Forestry Department

Food and Agriculture Organization of the United Nations

FRA 2000

**FOREST RESOURCES OF
SRI LANKA**

COUNTRY REPORT

Rome, 2001



The Forest Resources Assessment Programme

Forests are crucial for the well-being of humanity. They provide foundations for life on earth through ecological functions, by regulating the climate and water resources, and by serving as habitats for plants and animals. Forests also furnish a wide range of essential goods such as wood, food, fodder and medicines, in addition to opportunities for recreation, spiritual renewal and other services.

Today, forests are under pressure from expanding human populations, which frequently leads to the conversion or degradation of forests into unsustainable forms of land use. When forests are lost or severely degraded, their capacity to function as regulators of the environment is also lost, increasing flood and erosion hazards, reducing soil fertility, and contributing to the loss of plant and animal life. As a result, the sustainable provision of goods and services from forests is jeopardized.

FAO, at the request of the member nations and the world community, regularly monitors the world's forests through the Forest Resources Assessment Programme. The next report, the Global Forest Resources Assessment 2000 (FRA 2000), will review the forest situation by the end of the millennium. FRA 2000 will include country-level information based on existing forest inventory data, regional investigations of land-cover change processes, and a number of global studies focusing on the interaction between people and forests. The FRA 2000 report will be made public and distributed on the world wide web in the year 2000.

The Forest Resources Assessment Programme is organized under the Forest Resources Division (FOR) at FAO headquarters in Rome. Contact persons are:

Robert Davis FRA Programme Coordinator robert.davis@fao.org

Peter Holmgren FRA Project Director peter.holmgren@fao.org

or use the e-mail address: fra@fao.org

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Paper drafted by: Kailash Govil, Regional Project Coordinator GCP/RAS/162/JPN
Editorial Assistance by: Patrizia Pugliese, FRA Programme

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1 Introduction

The Food and agriculture Organization of the United Nations (FAO) carries out regular reviews and assessments of the forestry sector at the national and sub national level. The FAO Project, "Strengthening Country Capacity in Forest Resources Assessment for Sustainable Forest Planning in the Asia Pacific Region (GCP/RAS/162/JPN)", is reviewing the status, planning efforts and databases of forests in South Asian countries.

One objective of the project is to produce working papers on each of the South Asian countries. These working papers will provide current information on the forest resources, the eco-socio-political context, forest policy and forest planning processes. The contents of these working papers will differ due to variation in the extent and depth of the information that is available. However, an attempt has been made to provide the maximum conformity among them. These papers are mainly based on published information but creditable unpublished information that is available at the national, regional or sub-national level has also been utilized. The digital version of these papers will be available on the project web site "FAO-ICFRE.UP.NIC.IN. FAO welcomes suggestions and information that can improve the utility of these working papers.

Dr. Kailash Govil
Regional Project Coordinator
(GCP/RAS/162/JPN)
Email: rpccb@nde.vsnl.net.in

2 Executive Summary

Assessment of forest resources of 1992 of Sri Lanka indicates that the total forest cover including forest plantations is around 32.2 percent of its total land area (6.616 million ha). The percentage of closed-canopy natural forest areas is 23.9 percent, sparse and open forests is about 7.0 percent, and that of the forest plantations is about 1.3 percent of total land area in Sri Lanka (Legg and Jwell, 1995). Rest of the land is under agriculture (about 35 %), Trees Outside Forests (about 24%), and other landuse (about 9%).

Mature and well-established forest plantations cover an area of about 72,340 ha (1.1 % of the total land area of the country). Out of this, about 15,600 ha is under Conifers, about 8,400 ha is under Eucalyptus, and about 33,000 ha is under Teak plantations. In addition to the above, fuelwood plantations have also been raised over about 13,000 ha.

Trees Outside Forests (TOF) cover a very large area (1.675 million ha. in Homegarden, Rubber and Coconut plantations, Four perennials (cinnamon, cocoa, coffee, and Palmyra), Tea estates, Roadsides and Settlements etc.) and make major contribution to wood and fuelwood supplies in Sri Lanka. International and national prices of rubber, coconut and tea and other produce directly impact the area under such crops and thus control area, age, planting and replanting of TOF.

Although, Sri Lanka is one of the geographically small countries in Asia yet, it supports the largest bio-diversity per unit area in its natural forests. The bio-diversity at ecosystem level in Sri Lanka has been well studied by different researchers. However, the biodiversity at species level has been less studied than at the ecosystem level. The species gradient of biodiversity declines from wet zone to dry zone with "natural tropical rain forest" possessing the maximum level of floral diversity.

Despite increasing population pressure, the Protected Area (PA) network has increased in number and extent at a fast rate during last two decades. About 13 conservation forests in the wet zone and the Knuckles conservation forest in the wet and intermediate zone have come under conservation. Currently PAs span over about 1,888,781 ha which is about 28.5% of the total area of the country. The Forest Development (FD) manages about 56.5 percent of PA network and Department of Wildlife Conservation "DWLC" administers the remaining area under PAs (43.5 percent).

Population of Sri Lanka has grown from 2.4 million in 1946 to 18.5 million in 1997 but the rate of population growth is declining. The government is very optimistic about this decline in population growth rate and predicts a steady state (zero growth rate) in labor force from 2010 onwards. However, increase in population though at reduced rates is continually increasing pressure on limited and declining forest resources of Sri Lanka.

The most important change in agriculture after independence of Sri Lanka has been an increase in the production of rice due to increase in the productivity and the diversion of forest land for cultivation. The diversion of additional land to agriculture has adversely affected the forest cover. Similarly, the population of livestock, which is an integral part of Sri Lankan farming system, is increasing. If this trend continues for quite some time then it may endanger the sustainability of forest resources.

The main concerns for sustenance of natural forests in Sri Lanka include deforestation, fragmentation, land degradation, poaching of wildlife, coastal degradation and pollution. Sri Lanka has lost its closed canopy forest cover from about 84 percent in 1881 to about 23.9 percent in 1992 due to conversion of forests to other types of land use, such as human settlements, plantation crops, agriculture and shifting cultivation. During last ten years (1982-1992), thirteen districts (Ampara, Anuradhapura, Badulla, Batticaloa, Gampaha, Hambantota, Kandy, Kilinochchi, Kurunegala, Moneragala, Polonnaruwa, Trincomalee and Vavuniya) have suffered loss of forest while the rest 10 districts (Colombo, Galle, Jaffna, Kalutara, Kegalle, Mannar, Matara, Mullaittivu, Puttalam, and Ratanpura districts) have shown some increase in the forest cover. Most of the remaining forests are dry monsoon forests, sparse forests and fragments of tropical rain forests.

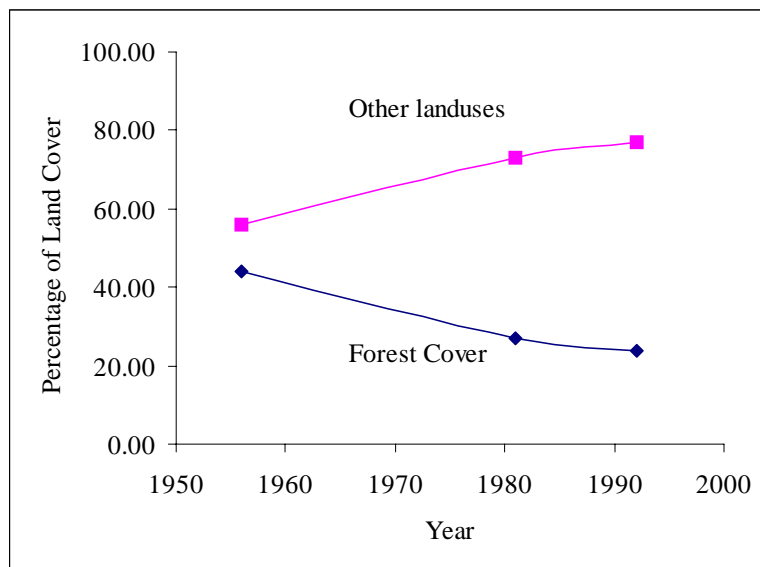


Figure: Declining forest cover in Sri Lanka

A comparison between percentage change in tree cover under "homegardens" and "close forests" in different districts of Sri Lanka for the period between 1992 and 1983, drawn up with the help of coarse (3-meter) imagery, demonstrate a clear relationship between the extent of these two types of tree covers (homegardens and forests). This relationship indicates an increase in area of homegardens with decline in forest cover and decrease in homegardens with increase in forests cover. Detailed information on "other tree resources" is not available to estimate changes.

Sri Lanka currently enjoys almost self-sufficiency in meeting its domestic requirement of forest products except for plywood, paper and paperboards. The country roughly meets its domestic wood requirement mainly from Trees Outside Forest (TOF) and conserves its natural forests. The TOF provide about 1.951 million m³ of wood where as natural forest contribute only about 0.009 million m³ of wood every year. Among TOF, the home gardens make maximum contribution of about 0.551 million m³ of sawn logs and 0.786 million m³ of poles per annum and the trees along roadside and settlements contribute the least (0.005 million m³). The production from natural forest is likely to decline and that from forest plantations and TOF is likely to increase over years.

The use of Non Wood Forest Products (NWFPs) is very common in Sri Lanka and linked with its local culture, vegetation and ecology. The NWFPs are means of livelihood for many poor people and there is a clear relationship between ecological zones and the percentage of households that collect edible plants and other NWFPs from the local forests. For example, in the intermediate and dry zones, about 60 to 70 percent of the households collect edible plants whereas in montane zones, only about 20 percent of the households collect the edible plants. Due to incomplete data on extraction rates, market prices, and time spent on collection and consumption etc., it is difficult to assess the total contribution of NWFP to the society.

Sri Lanka has a long history of forest planning with identified mission, objectives and priorities in forestry. The first priority of the Sri Lanka is to set aside forests for conservation and second is to sustainably manage remaining forests for meeting the domestic demand of wood and non-wood products and other services. The government currently emphasizes involvement of private sector in all forestry development activities, and "empowerment and participation" of local people and rural communities to manage and protect multiple-use forests. Like other South Asian countries, the enforceability of rules and regulations for protection of forests is continuously declining in Sri Lanka, which is also leading to deforestation and degradation of forest resources.

The Gross Domestic Product (GDP) is growing at a moderate rate of 4-5 percent after Sri Lanka made a major transformation in 1977 to a market based economy. The current economic growth is inducing additional pressure on forest resources through increased demand and consumption of forest product and services. Further, there is a general resistance for including environmental considerations into every aspect of development planning. Such pressures are adversely affecting the sustenance of forest in Sri Lanka. In addition, the share of "agriculture sector" in GDP is consistently declining and that of manufacturing sector is consistently increasing.

The forestry and livestock sub-sectors within "agriculture sector" are continually losing their ability to define the growth rate of "agriculture" sector because the relative contribution from other sub-sectors of "agriculture" like fisheries, tea and other agricultural crops to GDP is increasing. Therefore, the capacity of factors that affect "sub-sectors other than forests", like variation in tea prices, efficiency of management of tea estates, impact of natural calamities on paddy, increased access to potential fishing areas, and growth of inland fishing, is increasing in defining growth rate of the "agriculture sector" and the economy as a whole.

Finally, Sri Lanka faces a wide range of environmental management challenges that are tied to its economic development and increase in population. The issues in the forestry and environment sectors are linked very closely with its national development and are inseparable. Despite past and continuing forest conservation efforts, there is net deforestation, with severe implications for the environment, leading to long term adverse effect on the welfare of the rural people, agricultural and other inter-linked sectors. However, the focused efforts and investments in conservation of bio-diversity in selected areas are increasing and leading to a good network of well-conserved forest resources. Further, the improvements in literacy, education and health are creating conditions that are suitable for better conservation of forests and ecosystems both in the short and long term.

3 The Sri Lanka

This chapter describes the ecological, political, and social governance that control forest conditions (extent, content, health productivity, and sustainability etc.) at local, national and global levels.

3.1 General

The Democratic Socialist Republic of Sri Lanka (Sri Lanka) is an island in the Indian Ocean to the south of India. It is situated between 5°55' and 9°55' N and longitudes 79°41' and 81°54' E and has about 1,340 km long coastline. Total area of Sri Lanka, including all inland water bodies but excluding open bays and lagoons along the coast as estimated from interpretation of satellite imagery by Legg and Jwell (1995) is 6,616,627 ha. This differs from other figures like 6,515,600 ha (FSMP, 1995), and 6,525,000 ha (National Atlas of Sri Lanka, Survey Department, Sri Lanka, 1988). About 1,500 km of railways, 98,600 km of highways, and about 400 km of waterways span the entire country. Colombo, Galle, Jaffna, and Trincomalee are its four main ports and harbors.

3.2 Geology and Soil

About 90 percent of Sri Lanka's surface lies on Precambrian strata of more than 2 billion years in age. The island contains a relatively limited strata of sedimentation surrounding its ancient hills. Aside from recent deposits along river valleys, only two small fragments of Jurassic (140 to 190 million years ago) sediment occur in Puttalam District, while a more extensive belt of Miocene (5 to 20 million years ago) limestone is found along the northwest coast, overlain in many areas by Pleistocene (1 million years ago) deposits. The northwest coast is part of the deep Cauvery (Kaveri) river basin of south-east India, which has been collecting sediments from the highlands of India and Sri Lanka since the breakup of the famous Gondwanaland. The soils of Sri Lanka belong to two major categories, those derived from the parent material and their erosion products and those derived from transported materials. The former are generally clayey soils whereas the latter are light sandy loams (ABE, 1977).

3.3 Topography

Sri Lanka is irregular and dissected with its central massif dominating the south. The lowest location is at sea level and the highest elevation is at Pidurutalagala (2,524 meters). However, the Adam's Peak (2,243 meters), which is a destination of interfaith pilgrimage, is commonly known as the highest mountain of Sri Lanka. The coastal belt (less than 100 meters elevation) of varying width extends from seashore to foothills of central massif. In the northern half of island, topography falls away to rolling plain, relieved by isolated ridges.

3.4 Climate

The climate of Sri Lanka is tropical and maritime. The mean temperature ranges from a low of 15.8⁰ C in Nuwara Eliya in the Central Highlands to a high of 29⁰ C in Trincomalee on the northeast coast (where temperature may reach 37⁰ C). The average yearly temperature for the country ranges

between 26° C to 28° C and the day and night temperatures may vary by 4⁰ to 7⁰C. Rainfall is abundant and varies from 750 mm to 1850 mm annually. The monsoon winds of the Indian Ocean and Bay of Bengal influence the rainfall and also mark four seasons. The first is from mid-May to October, when winds originate in the south-west, bringing moisture from the Indian Ocean. The second season occurs in October and November, the inter-monsoon months. During this season, periodic squalls occur and sometimes tropical cyclones bring overcast skies and rains to the southwest, northeast, and eastern parts of the island. During the third season, December to March, monsoon winds come from the northeast, bringing moisture from the Bay of Bengal. Another inter-monsoon period occurs from March until mid-May, with light, variable winds and evening thundershowers.

3.5 River System and Coastal area

Most of the rivers in Sri Lanka flow in a radial pattern from central massif toward the sea. About twelve rivers that are longer than 100 kilometers in length carry about 75 percent of the mean river discharge of the entire country. Mahaweli Ganga (335 kilometers) and the Aruvi Aru (170 kilometers) are two most lengthy rivers. Human intervention has altered the flows of some rivers in order to develop hydroelectric, irrigation, and transportation projects in Sri Lanka. Several hundred kilometers of canals link inland waterways in the southwestern part of Sri Lanka, most of which were built by the Dutch in the eighteenth century. Coastal area is a belt of about thirty meters above the mean sea level that surrounds the island. The coastline is regular but indented by numerous lagoons and marked by sandy beaches.

3.6 Ecological Zones

Topographically, Sri Lanka is divided into three zones that are distinguishable by elevation: the central highlands, the plains, and the coastal belt. The "Central Highlands" is the heart of the country and is a high plateau, running north-south for approximately sixty-five kilometres flanked with two lower plateaux. The "Plains" zone consists of the island's surface between 30 and 200 meters above sea level. The south-west region is highly eroded and the ridges and valleys rise gradually to merge with the Central Highlands. The south-east region has a red, lateritic soil cover with relatively level ground studded with bare, monolithic hills. The "Coastal" zone is a belt of about thirty meters above the sea level that surrounds the island. Much of the coast consists of sandy beaches indented by coastal lagoons.

Climatically, Sri Lanka is generally classified under three zones (Wet, Intermediate and Dry). First two are in south-west and central highlands and the third is towards north and east of the country. The dry zone occupies almost two thirds of the country and consists mainly of flat and undulating land where major irrigation schemes are in operation and the bulk of the agricultural and forestry activities take place. Following Wijesinghe et al. (1993), these three climatic zones are further subdivided into six bio-climatic zones to distinguish low-lands or mid lands from montane zone through altitude and to identify "arid" (less than 1250 mm annual rain fall) from dry zones through isotherms. Table 1 at Annex, provides a brief description of these groups under five categories instead of six because two zones (Low/Mid Country Intermediate zone and Montane Intermediate zone) have been grouped into one category.

Greller and Balasubramaniam (1993) recognize eight forest zones (Table 2 at Annex) related to macroclimate in their study on “Physiognomic, Floristic and Bio-climatological Characterization of the Major Forest types of Sri Lanka”. They follow Walter’s (1985) “Zonobiome” and “Orobiome” vegetation classification. The “Zonobiomes (ZB)” are based on macroclimate and “Orobiomes (OB)” describe climate and vegetation on mountains within “Zonobiomes”. The altitude defines the boundary of “Orobiomes”. Legg and Jwell (1995) follow Grellier and Balasubramanian (1980 and 1993) method of using elevation, in developing the first digital map of Forest Vegetation types in Sri Lanka. They use elevation, isohyets and vegetation to develop their classification that provides a general idea of major climatically controlled ecological units of the natural forests. The district wise area under different forest types developed by Legg and Jwell is given at Table 3 at Annex.

3.7 Institutions of Governance

Sri Lanka is a democratic republic country and is an Independent member of the Commonwealth of Nations. The Sri Lankan Parliament is a uni-cameral assembly. The universal suffrage began in 1931 and the voting age is 18. The President serves for a maximum two terms and each term has a maximum period of 6 years. The current constitution was adopted in 1978.

The President constitutes a "Cabinet of Ministers" and appoints a Prime Minister from among the members of Parliament. The Parliament consists of 225 representatives elected for a 6-year term at periodical general elections through a system of proportional representation.

An independent judiciary exercises the judicial power of the people. The Chief Justice who is appointed by the President heads the Judiciary. Sri Lanka has four levels of the judiciary (Supreme Court, Court of Appeal, High Court and Courts of first instance and tribunals).

The country is administered through nine provinces (Central, North Central, North Eastern, North Western, Sabaragamuwa, Southern, Uva, and Western) consisting of 25 districts. An appointed district minister heads each district. Local government institutions have a limited role in the political process because Sri Lanka is a unitary rather than a federal state. The country is suffering from political unrest since few decades, which is affecting its economic growth and development.

3.8 Summary

This chapter dealt with ecological, biophysical and political governance of Sri Lanka. These alternative regimes of governance define the capacity of different factors that control the sustenance of natural resources like forests in Sri Lanka. The continuance of unrest in its northern region for quite sometime is affecting its overall growth and is likely to have a negative impact on the sustenance of its natural resources in the long run.

4 Forest Resources

This chapter presents the current state and change in the forest cover and the landuse pattern of Sri Lanka including trees outside forest areas. This information provides the basis for policy and management decisions that support sustenance of forest resources in Sri Lanka.

4.1 General

Sri Lanka is bestowed with many natural resources like limestone, graphite, minerals, sands, gems, phosphates, and clay. About fourteen percent (0.55 million ha) of land is arable, fifteen percent under permanent crops, seven percent under permanent pastures, thirty two percent under forests and woodland, and the rest 32% is under other uses. The main agricultural products are rice, sugarcane, grains, pulses, oilseed, roots, spices, tea, rubber, and coconuts.

Similar to some tropical countries, the forests in Sri Lanka have lost more than sixty percent of their crown cover (from over 84% in 1881 to about 24% in 1992) during past two decades. Future prospects are also not very bright unless special care is taken to conserve and develop remaining forest areas. Most of the information in this chapter is based on the satellite imageries and other information collected between 1991 and 1993 for “1994” assessment of its forest resources. This chapter starts with the general landuse pattern and then focuses on the natural forests and finally presents some information on the Trees Outside Forests (TOF) in Sri Lanka.

4.2 Landuse

FRMP, 1995 (Figure 1) broadly indicates that about 35 % of land is under some form of agriculture, about 32% under natural forests and forest plantations, about 24 % under TOF, and the remaining 9% is under other uses (Table 4 at Annex)

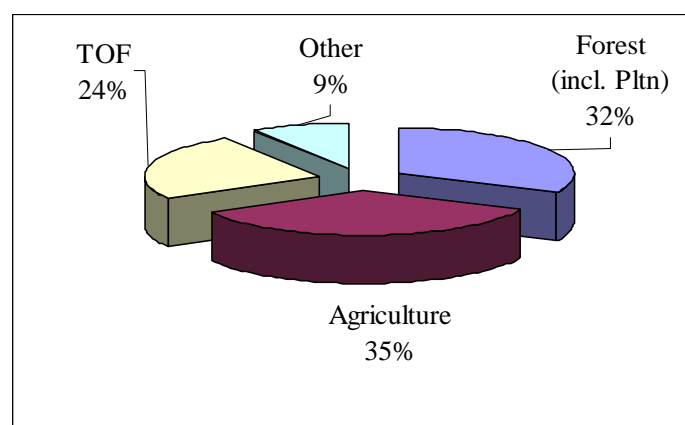


Fig. 1. Landuse in Sri Lanka

4.3 Forests

The natural forests of Sri Lanka are currently classified into eight types; Lowland Mesophyllous Evergreen Dipterocarp Forests, Low Land Mesophyllous Evergreen Mixed Rain Forests, Lower Montane Notophyllous Dipterocarp Rain Forests, Lower Montane Notophyllous Evergreen Mixed Rain Forests, Upper Montane Microphyllous Evergreen Dipterocarp Rain Forests, Upper Montane Microphyllous Evergreen Mixed Rain Forests, Low Land Semi-Deciduous Forests, and Low Land Semi-Deciduous Wood Land / Thorn Shrub.

Lowland Mesophyllous Evergreen Dipterocarp Forests

This forest type is common in wet zone on elevations up to 900 M. The main species are *Dipterocarpus hispidus*, *Doona congestiflora*, *Doona macrophylla*, *Shorea oblongifolia*, *Canarium zeylanicum*, *Palaquium petiolare*, *Mesua ferrea*, *Doona affinis*, *Doona disticha*, *Anisophyllea cinnamomoides*, *Bhesa ceylanica*, *Calophyllum thwaitesii*, *Chaetocarpus castanocarpus*, *Cullenia zeylanica*, *Dillenia (Wormia) triquetra*, *Myristica dactyloides*, *Syzygium firmum*, *Syzygium makul*, *Garcinia hermonii*, *Xylopia championii*, *Hopea juncunda*, *Schumacheria castanefolia*, *Timonius jambosella*, *Agrostistachys hookeri*, *Desmos elegans*, *Uncaris elliptica*, *Cannarus championii*, *Dalbergia pseudo-sisoo*, *Freycinetia pycnophylla*, *Ficus diversiformis*, *Psychotria sarmentosa*, *Gaertnera veginans*, *Lasianthus strigosus*, *Apama siliquosa*, *Litsea longifolia*, *Acrotrema* spp. *Neurocalyx* spp. *Acranthera coylanica*, *Schizostigma hirsutum*, and species of Zingiberaceae family.

Lowland Mesophyllous Evergreen Mixed Rain Forests

This forest type is widespread in intermediate zone at or below 900 M elevation. The main species are *Mangifera zeylanica*, *Pometia eximia*, *Artocarpus nobilis*, *Filicum decipiens*, *Turpinia malabarica*, *Rejoua dichotoma*, *Annamirta cocculus*, *Artabotrys uncinatus*, *Paramignya monophylla*, *Anodendron manubriatum*, *Entada* spp. *Pothos scandens* *Micromelum ceylanicum*, *Entada* sp. *Pothos scandens* *Micromelum ceylanicum*, *Goniothalamus* spp. *Dracaena thwaitesii*, *Ophiorrhiza mungos*.

Lower Montane Notophyllous Dipterocarp Rain Forests

This forest type is common in the wet zone, especially on the southern encampment of the wilderness at an elevation between 900 to 1525 M. The main species are *Doona gardneri*, *Doona zeylanica*, *Stemonoporus cordifolius*, *Stemonoporusj latisepalum*, *Stemonoporus acuminatus*, *Cryptocarya wightiana*, *Syzygium aqueum*, *Myristica dactyloides*, *Meliosma simplicifolia*, *Mappia ovata*, *Acronychia pedunculata*, *Hortonia floribunda*, *Wormia triquetra*, *Memecylon gardneri*, *Euonymus walkeri*, *Chloranthus glaber*, *Chassalia ambigua*, *Lindsaea* sp.

Lower Montane Notophyllous Evergreen Mixed Rain Forests

This forest type is common at an elevation ranging between 900 M to 1370 M. The main species are *Eleaeocarpus glandulifer*, *Myristica dactyloides*, *Semecarpus nigro-viridis*, *Cryptocarya wightiana*, *Palaquium hinmolpedde*, *Aglaia congylos*, *Calophyllum acidus*, *Fahrenheltia* spp, *Pygeum zeylanicum*, *Bhesa montana*, *Gordonia ceylanica*, *Nothopegia beddomei*, *Hortonia floribunda*

Elaeagnus latifolia, *Asparagus falcatus*, *Freycinetia walkeri*, *Fagraea ceilanica*, *Pothos remotiflorus*, *Rauwolfia densiflora*, *Agrostichachys coriacea*, *Strobilanthes* spp. *Hedyotis* spp. *Scutellaria*, *Pogostemon*, *Impatiens* spp.

Upper Montane Microphyllous Evergreen Dipterocarp Rain Forests

Such forests are widespread in the southern escarpment above 1525 M. The main species are *Stemonoporus rigidus*, *Stemonoporus cordifolius*, *Stemonoporus gardneri*, *Garcinia echinocarpa*, *Alphonsea coriacea*, *Gordonia* spp., *Palaquium rubiginosum*, *Syzygium* spp., *Mastixia* sp., *Cinnamomum ovalifolium*, *Semecarpus* spp., *Agrostistachys coriacea*, *Strobilanthes* spp. *Indocalamus*, *Hedyotis*, *Psychotria*, *Lasianthus Leucocodon reticulatum*, *Kendrickia walkeri* *Impatiens* spp., *Sonerila* spp., *Hymenophyllaceae*, *Orchidaceae*, Bryophyta and Hepatophyta.

Upper Montane Microphyllous Evergreen Mixed Rain Forests

These forests are common at elevations above 1370 M. The main species are *Calophyllum walkeri*, *Palaquium rubiginosum*, *Calophyllum trapezifolium*, *Cinnamomum ovalifolium*, *Garcinia echinocarpa*, *Neolitsea fuscata*, *Michelia anilagirica*, *Syzygium rotundifolium*, *Gordonia speciosa*, *Gordonia ceylanica*, *Actinodaphne speciosa*, *Symplocos* spp. *Glochidion montanum*, *Microtropis ramiflora*, *Eugenia cyclophyllu*, *Actinodaphne speciosa*, *Symplocos* spp. *Glochidion montanum*, *Microtropis ramiflora*, *Eugenia cyclophyllum*, *Disporum leschenaultianum*, *Exacum walkeri*, Lichenes, Hepatophyta, Bryophyta, Orchidaceae.

Low Land Semi-Deciduous Forests

This forest type is widespread in lowlands of the dry zone and consists mainly of deciduous species like *Chloroxylon swietenia*, *Vitex pinnata*, *Grewia polygama*, and *Berrya cordifolia*, evergreen species like *Mainlkara hexandra*, *Alseodaphne semecarpifolia*, *Diospyros ebenum*, *Drypetes sepiaria*, *Lepisanthes tetraphylla*, *Eugenia breteata*, *Garcinia spicata*, and *Walsura piscidia*, deciduous or semi-evergreen species like *Diospyros ovalifolia*, *Cassia fistula*, *Mitragyna parvifolia*, *Dimorphocalyx glabellus*, *Ventilago maderaspatana*, *Derris scandens*, *Glycosmis pentaphylla*, *Phyllanthus polyphyllus*, *Croton laccifer*, *Polyalthia korinthii*, and *Stenosiphonium cordifolium*, *Barleria mysorensis*.

Low Land Semideciduous Wood Land / Thorn Shrub

These forests are found wide spread in the low land areas of Arid zones. The main species are *Manilkara hexandra* (evergreen dominant), *Sapium insigne* (deciduous), *Sapindus emarginatus*, *Strychnos potatorum*, *Diospyros ferrea*, *Randia dumetorum*, *Dichrostachys cinerea*, *Flueggia leucopyrus*, *Carissa spinarum*, *Gymnosporia emarginata*, *Azima tetracantha*, *Memecylon umbellatum*, *Cassia auriculata*, *Cissus quadrangularis*, *Abrus praecatorius*, *Hugonia mystax*, *Sansevieria zeylanica*, *Aloe barbadensis*, *Vicoa indica*, *Eragrostis viscosa*, and *Dactyloctenium aegyptium*

4.4 Forest Cover

Legg and Jwell (1995) have done the last assessment of forest cover during 1992 and 1994 with the help of twenty three TM quadrant and two TM full scenes from NRSA, India, six TM quadrant and four full TM scenes from Thailand, twenty two IRS-1 LISS-2 images from NRSA, India and twenty SPOT XS from an International distributor in Europe. These images cover the period from July 25, 1991 to June 11, 1993. The draught condition, during early 1992, helped in providing good quality cloud-free imagery for the whole country during a short span of time. Topographic maps at 1:63,360 (1 inch = 1 mile) and 1:50,000 scale produced by Survey Department, Sri Lanka were used for digitizing, control and geometric corrections.

The “digital vegetation map” (Legg and Jwell, 1995) classifies the natural forest into modified eight categories (Low-land rain forest, Moist monsoon forest, Dry monsoon forest, Sub- montane forest, Montane forest, Mangrove, Riverine forest, and Sparse/Open forest) and the forest plantations into four categories based on their main species (Conifer, Eucalyptus, Teak, and Mahogany). The forest types or eco-floristic zones of Legg and Jwell (1995) are based on intersection of natural forest boundaries, elevation and rainfall. This classification roughly correspond to the main classification of natural forests by Greller and Balasubramaniam (1980) but does not follow further sub-classifications suggested by them. The range of elevation and rainfall defines the boundaries of first four categories (Lowland rain forest, Moist monsoon forest, Dry monsoon forest, and Sub- montane forest) carved out of the closed natural forest (Table 5). The ground truthing (not a “statistical” checking) has indicated that the accuracy in case of closed canopy natural forest is about 90% and in case of sparse and open forest is about 75%.

The total forest cover excluding forest plantations is around 30.9 percent. District and climatic wise forest types or eco-floristic zones (Table 3) indicates that the percentage of closed-canopy natural forest areas to total land area (6.616 million ha) is 23.9 percent (Legg and Jwell, 1995) and that of sparse and open forests is about 7.0 percent. Further that the forest plantations span over an additional 1.3 percent of total land area in Sri Lanka.

4.5 Change in Forest Cover and Trees Outside Forests

Legg and Jwell (1995) develop estimate of changes in forest cover by comparing their figures for 1992 to 1994 with that from FAO/GOSL forest census of 1983. They consider only “dense forests” or “closed canopy” forests to provide a reliable indication of changes in forest cover (Table 6 at Annex). Their assessment indicates that Sri Lanka has lost its closed canopy cover from about 84 percent in 1881 to about 23.9 percent in 1992 due to conversion to other types of land use, such as human settlements, plantation crops, agriculture and shifting cultivation. Thirteen districts (Ampara, Anuradhapura, Badulla, Batticaloa, Gampaha, Hambantota, Kandy, Kilinochchi, Kurunegala, Moneragala, Polonnaruwa, Trincomalee and Vavuniya) have suffered loss of forest while the rest 10 districts (Colombo, Galle, Jaffna, Kalutara, Kegalle, Mannar, Matara, Mullaittivu, Puttalam, and Ratanpura districts) show increase in their forest cover. They also indicate that the remaining forests are mostly dry monsoon forests, sparse forests and fragments of tropical rain forests.

A comparison between percentage change in tree cover under homegardens and forests in different districts of Sri Lanka for the period between 1992 and 1983 (Table 7) drawn up with the help of

coarse (3-meter) imagery demonstrates a clear relationship between them (Legg and Jwell, 1995). The relationship relates to increase in homegarden with decline in forests and decrease in homegardens with increase in forests (Fig. 2).

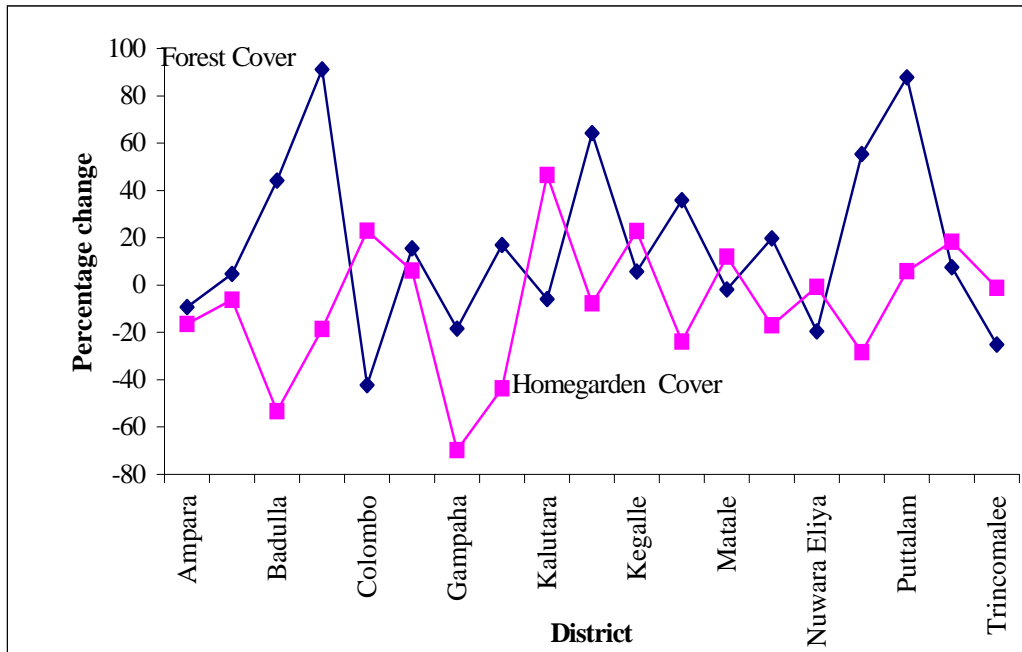


Fig. 2. Percentage change in Forest Cover and Homegardens between 1982 and 1992

Detailed information on "other tree resources" is not available to estimate changes. However, FSMP has attempted (Table 8 at Annex) to develop an indication (Fig.3) of changes in tree resources under other land uses (settlements, road sides, tea estate, rubber and tea coconut plantations) between 1995 and 2000.

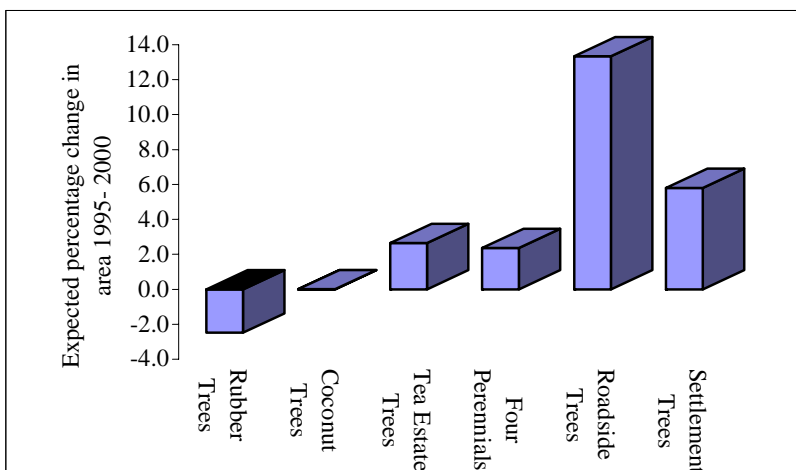


Fig. 3. Expected Change in Area (percentage) during 1995 and 2000

4.6 Forest Plantations

Large-scale forest tree planting in Sri Lanka started in late 1950's and till December 1996 has covered about 135,052 ha of forest plantations, of which, about 87,000 ha belong to the Forest Department. The main plantation species are Teak, Eucalyptus (mainly *Eucalyptus grandis*), Pine (*Pinus caribaea*) and Mahogany.

Most of the fuel wood (*Eucalyptus camaldulensis*, *E. tereticornis* and Acacias), miscellaneous hardwood and teak plantations are located in the dry zones of Sri Lanka. The Eucalyptus (mainly *E. grandis*, but also *E. microcorys*, *E. globulus* and *E. robusta*) and Pines (*P. caribaea* and *P. patula*) plantations are mostly in the upland and in the Galle and Ratanpura forest divisions. The Mahogany plantations are situated in Kurunegala and Kegalle civil districts.

Planting of Teak was stopped in 1926 due to adverse silvicultural reports and was resumed again in 1939 in patana (natural grassland). The *Pinus caribaea* was planted between 1965 and 1984 while *Pinus patula* was planted during 1966 to 1976 especially at higher altitudes. During the 1970s and 1980s, *Eucalyptus camaldulensis* and *E. tereticornis* were established extensively in the dry zone, together with an increasing proportion of *Acacia auriculiformis* and Margosa (Neem). The current emphasis is on indigenous hardwood like Teak and Margosa while planting of Pines is banned and Eucalyptus is being planted only on a very limited scale.

Legg and Jwell, (1995) estimated the total area (Table 9 at Annex) of all mature and well-established forest plantations at 72,340 ha (1.1 % of the total land area of the country or 4.6 % of the area under closed canopy natural forests). The area under plantations are being regularly revised by successive plantation inventories mainly for the development of Plantation Management Plans, for example, Conifers (15,600 ha), Eucalyptus (8,400 ha), and Teak (33,000 ha). Normal and not "rigorous statistical" ground truthing for the assessment of plantation areas indicates that accuracy is 80% for remotely sensed mature upland plantations (Conifers and Eucalyptus) and 60% for the low-land dry zone plantations (Teak and Eucalyptus).

In addition to the above, fuelwood plantations have been raised over 18,002 ha till 1992, of which about 5,000 ha are located in Tea Estates and Tobacco Companies lands. District wise breakdown of fuelwood plantations raised till 1992 is presented in Table 10 at Annex and for the period between 1993 to 1996 period (AR, 1993; AR, 1994; AR 1995; and AR 1996) in Table 11 at Annex. Trees planted on homesteads and farmers woodlot etc. under "Participatory Forestry" project are not included in these tables.

4.7 Trees outside forest areas

This section provides information on tree resources outside forest areas in Sri Lanka. It includes homegardens, plantations of Rubber and Coconut, and trees raised in tea estates, agriculture fields, and other locations.

4.7.1 Homegardens

FSMP (1995) provides an estimate of the area (858,490 ha) under homegardens in all the districts of Sri Lanka. However, due to coarse resolution (30 meter) the imagery has not provided very reliable estimates, particularly in sparse home gardens in the dry zone. Therefore accuracy is lower for sparse open canopy home gardens and higher for home gardens with continuous canopy cover. Further, there is a possibility of misclassification in districts with higher percentage of tea and rubber plantations. Similarly, Jwell (1995) provides area (Table 12 at Annex) of home gardens for only 20 districts but fails to give any information on their reliability. He, therefore, did not proceed further to assess the area of homegardens in rest of the four districts (Killnoochchi, Jaffna, Mullaittivu and Mannar) of Sri Lanka. Difference in the two (Jwell and FSMP) sets of information is more at district level than at national level. Figure 2 indicates percentage change in tree cover in homegardens in different districts of Sri Lanka.

4.7.2 Rubber, coconut and tea

Plantations of Rubber and Coconut and "trees in tea estates" cover about 687, 000 ha and make significant contribution to wood and fuelwood production (Table 13 at Annex). International and national prices of rubber, coconut and tea directly impact the area under these crops in Sri Lanka and thus control area, age, planting and replanting of trees in such areas.

Currently, about one-third of the trees in Rubber plantations are mature and are more than 32 years of age. With current level of harvesting, an equitable distribution of trees among the six age classes (Table 14 at Annex) is expected by the end of this century. However, since 1995 the area of re-planting (Table 15 at Annex) has substantially declined from an average level of 5,000 ha per annum mainly due to adverse market conditions.

The Coconut production has recovered from past draught and has registered a small growth. Unlike rubber, most of the coconut production (66 percent) is consumed locally. The stand structure of coconut plantations (Table 16 at Annex) in terms of five age classes is more complex than Rubber plantations due to large (40%) number of trees in the mid age group (30 to 50 years) alone. Therefore, the Coconut plantations will take more time than rubber plantations to achieve an equitable distribution of trees among different age classes.

Like rubber, the area of planting and replanting (Table 17 at Annex) under coconut gets affected both by international and national market prices. The export prices have increased marginally but the domestic prices have increased by more than twenty six percent. The area under re-planting and new planting of coconut is therefore increasing but with a large variation in the annual rates of replanting of coconut.

The land under coconut continues to fragment under high demand of land from industrial, housing and other sectors. About 1000 hectare of land under coconut plantation is diverted to alternative uses every year. The maximum pressure of fragmentation is in the low-land districts like Gampha and Kalutara, which incidentally are the districts with the maximum land under rubber and coconut plantations.

During last few years, the trees in the tea estates have increased with the expansion of Tea estates mainly due to privatization and favorable tea prices (Table 18 at Annex).

4.7.3 Other tree resources

Other tree resources (Table 19 at Annex) under “four perennials” (cinnamon, cocoa, coffee, and Palmyra) cover about 101, 600 ha, along roadside span over an area of about 1,540 ha. and in human settlements occupy another 27, 600 ha. of land. These trees also make substantial local contribution to the production of timber and fuelwood in Sri Lanka.

4.8 Annual yield

Trees outside Forest (TOF) provide about 1.951 million m³ of wood where as natural forest contribute only about 0.009 million m³ every year. Among TOF, the home gardens make maximum contribution of about 0.551 million m³ of sawn logs and 0.786 million m³ of poles per annum and the trees along roadside and settlements contribute the least (0.005 million m³) (Table 20 at Annex).

4.9 Biomass production

The natural forests, forest plantations and trees outside forests annually provide about 1456.2 m³ of industrial wood and sawn wood. In addition, these sources also contribute a total of about 9.871 million tones of bio-fuel (Table No.21 at Annex) every year in Sri Lanka.

4.10 Biological diversity

Although, Sri Lanka is one of the geographically small countries in Asia yet, it supports the largest bio-diversity in its natural forests.

The bio-diversity at ecosystem level has been well studied and defined by different researchers (Chapman, 1947; De Rosayro 1950, Holmes, 1958a and 1958b; Koelmeyer, 1961, Andrews, 1964; Gausson et al., 1975; Perrier, 1980; Greller and Balasubramanian, 1980; Greller and Balasubramanian, 1993, and Wijesinghe, 1993). Greller and Balasubramanium, 1993 follow Walter’s (1985) “Zonobiome” and “Orobiome” vegetation classification to create eight forest zones (Table 2 at Annex), while Wijesinghe *et al.* (1993) follow boundaries of climatic zones to develop six bio-climatic zones (Table1 at Annex) for Sri Lanka.

The species level biodiversity has been less studied than the ecosystem biodiversity. Its biodiversity species gradient declines from wet zone to dry zone. The natural lowland tropical rain forest having the maximum level of floral diversity. About 30% angiosperms and 18% ferns are endemic. The wet zone forests possess the highest endemism (Liyanage, 1995). Table 22 lists the identified species of vascular plants, vertebrates and selected invertebrates, and number of endemic species that demonstrates the high level of biodiversity in Sri Lankan forests.

Researchers have invested least efforts to investigate biodiversity at genetic level, which is only limited to the economically important floral species (FSMP, 1995). Similarly there are very few studies on genetic diversity of fauna and are limited to large vertebrates like elephants and leopards.

Table 23 and Table 24 at Annex present the biodiversity of tropical wet evergreen forests over wet zone areas of Matara, Galle, Kalutara and Ratnapura districts. It indicates a total of 619 woody flora species, of which, 302 are endemic. It also reveals a high level of faunal diversity with 25 molluscs, 52 insects, 30 fishes, 30 amphibians, 50 reptiles, 111 birds and 25 mammalian species. Floral and faunal diversity as well as the hydrological importance of the 15 forests of protected area network under the Forest Department in the low country wet zone is presented in Table 25 at Annex. Table 26 at Annex lists additional 17 forest areas suggested by a study for inclusion in the conservation programme to protect their biodiversity and hydrological regime.

4.11 Conservation of biodiversity

Government of Sri Lanka (GOSL) demonstrates a high level of commitment for biodiversity conservation and many forest areas that were traditionally under production have been brought under conservation. Table 27 at Annex provides past history of initiatives taken by GOSL to conserve biodiversity. The country has developed its National Conservation Strategy in 1988. High levels of biodiversity have attracted international conservation initiatives (Table 28 at Annex) and more than 11,000 ha forests are conserved under different conservation initiatives. GOSL is responsive to international environmental initiatives and has signed many agreements linked to biodiversity, climate change, endangered species, environmental modification, hazardous wastes, law of the sea, nuclear test ban, ozone layer protection, wetlands, whaling and marine life conservation.

4.12 Protected areas

Despite increasing population pressures, the Protected Area network has increased in number and extent at a fast rate during last two decades. About 13 conservation forests in the wet zone and the Knuckles conservation forest in the wet and intermediate zone have come under conservation. Currently PAs contain about 1,888,781 ha (Table 29 at Annex) which is about 28.5% (Table 29 at Annex) of the total area of the country.

4.13 Management of the protected areas

The Forest Development (FD) manages about 56.5 percent of the area under PA network while another department of the government (Department of Wildlife Conservation "DWLC" administers the remaining area under PAs (43.5 percent). The Wildlife Institute of India is assisting DWLC in development of management plans and human resources for all the PAs under control of DWLC.

4.14 Summary

This chapter provides information on forest resources and biological diversity contained in the forests of Sri Lanka. Sri Lanka is a unique country of South Asia with maximum biodiversity per unit area, and large extent of home gardens. The country is attempting to meet its domestic wood requirement from home gardens and forest plantations rather than its natural forests. The main concerns for sustenance of its natural forests include deforestation, soil erosion, wildlife poaching and coastal degradation from mining activities and pollution.

5 Factors affecting forest resources

Various contextual factors affect dynamics of forest resources in a complex manner and in turn also get affected by it. This chapter attempts to provide an indication of the dynamics of some such contextual factors like population, agriculture, livestock, and economic growth in Sri Lanka.

5.1 General

Natural forests of Sri Lanka face direct pressure from human population, agriculture and livestock and induced pressure from rapid economic development. The four principal crops (tea, rubber coconut and rice) continue to maintain their traditional dominance in Sri Lankan farm portfolio. The rice is consumed domestically while most of the tea, rubber, and coconut are exported to other countries. The area under agriculture is increasing. Although, the importance of other crops has increased over time but none has been able to challenge any of these traditional "four" crops. The human and livestock population continue to rise and exert increasing pressure on shrinking forest resources though at reduced rates. However, fast improvement in development of human resources show a positive sign in Sri Lanka and are contributing towards creation of conditions that in the longrun are conducive for the sustenance of natural resources.

5.2 Human population

The human population of Sri Lanka has grown from 2.4 million in 1946 to 18.5 million in 1997 (Fig. 4). Table 30 at Annex provides districtwise distribution of this population. The majority (66%) of the population is in the age group of 15-64 years. The females have higher life expectancy (75 years) than males (70 years). The decline in infant mortality and increase in the life expectancy (about 72 years) is also contributing towards increase in the population (Figure 4) though at reduced rates (Figure 5).

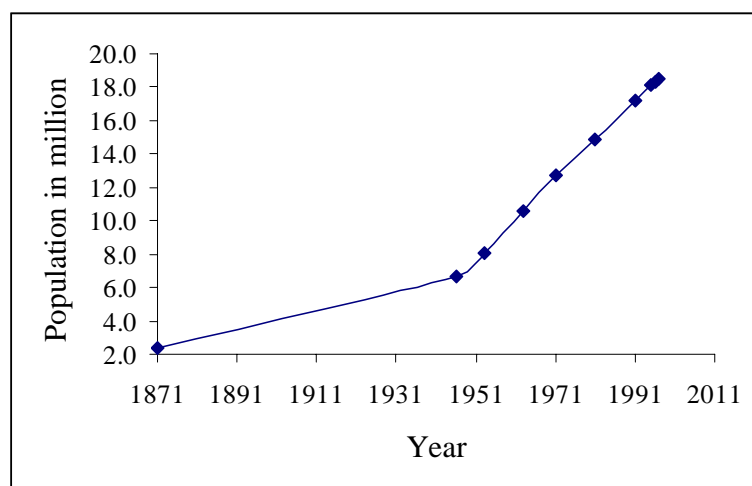


Fig. 4. Increase in human population

During last decade, the population has grown at 1.2%, slower (Figure 5) by about 0.3% than previous decade (1981-91). The increasing share of females and aged in the total population and the labor force is creating new and complex gender and unemployment issues. However, the government is very optimistic about decline in population growth rates and predicts a steady state (zero growth rate) in labor force from 2010 onwards.

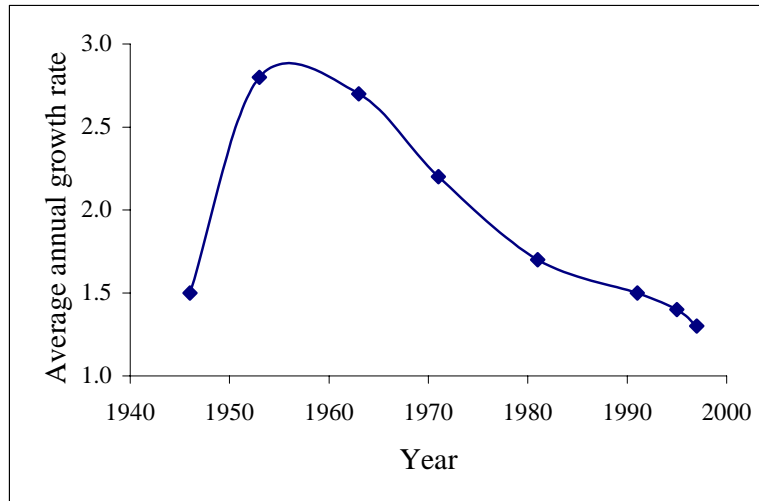


Fig. 5. Trend in annual growth rate of human population

5.3 Agriculture

The colonial administration sold large tracts of land to private persons and companies for developing coffee and tea plantations to augment their revenue generation from exports. The precise impact of the plantations on village society remains controversial, but it is widely believed in Sri Lanka that the standard of living of villagers has suffered when they lost forest lands.

From 1930s the focus of agricultural development shifted from the wet zone to the dry zone and from plantation crops to rice as it became clear that very little additional cultivable land is available in the wet zone. The Mahaweli Program in 1980s has accelerated this approach and promoted cultivation in the dry zone. The most important change in agriculture after independence of Sri Lanka has been an increase in the production of rice due to increase in the productivity and the diversion of additional land for rice cultivation.

The principal export crops (Tea and Rubber) show modest gains in productivity even when the productivity of tea crops with small holders is increasing (AR, 1997). The declining profitability in coconut cultivation coupled with increasing demand of land by industries, housing and other development programs is leading to fragmentation of areas under coconut cultivation. Rubber plantations are facing similar pressures.

5.4 Livestock

Sri Lankan farming households maintain livestock for draft power and source of cash income (goats and poultry) with women looking after them. It is an integral part of the farming system. The livestock population has increased since 1996 (Figure 6, and Table 31). If this trend continues for quite some time then it may pose sustainability problem for forest resources.

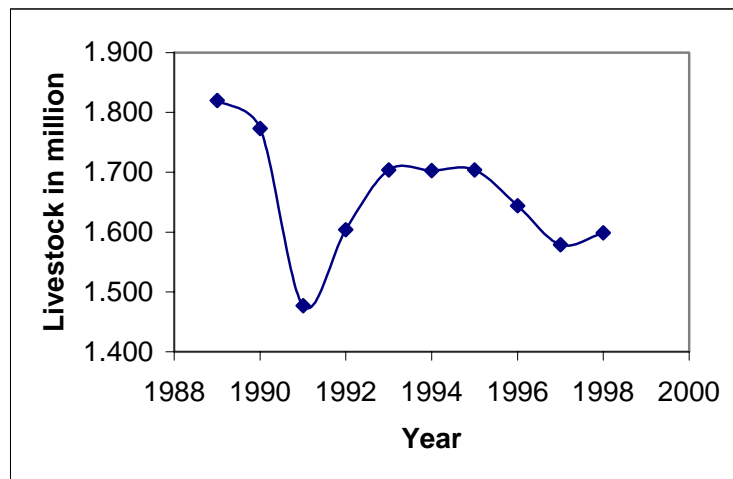


Fig. 6. Livestock population

5.5 Human development

Due to government commitment for good health, many of Sri Lanka's social indicators compare favorably with advanced countries. Infant mortality rates have fallen from 48 per 1,000 live births in 1970 to 16 per 1,000 in 1996, maternal mortality rate has dropped from 90 per 100,000 live births in 1980 to 30 in 1996, and birth rates have declined from 4 births per woman to a near replacement level of 2.4 births per woman.

The national unemployment rate is declining due to additional employment provided by the private sector but the real wages are deteriorating in almost all sectors. The manufacturing sector continues to register increase in labor absorption (15 % in 1996 to 16 % in 1997) and in the share of female workers. However, wide disparities exist in socio-economic status and access to employment opportunities.

Sri Lanka, therefore, has better conditions to sustain natural resources than other South Asian countries due to its higher level of human development as indicated by improving health, higher literacy, better education and lower unemployment rates. Sri Lanka has achieved highest level of literacy rates (92 percent) among South Asian countries (Table 32 at Annex). About 56 percent of its population has attained the secondary and higher level of education.

5.6 Economic growth and development

In 1977, Sri Lanka made major transformation to move from an inward-looking socialist system to a market economy based system with deregulated foreign investment regime. Since then, the gross domestic product (GDP) has grown at a moderate rate of 4-5 percent a year. This performance, however, has been well below the country's potential, due in part to slow implementation of fiscal reforms, particularly in the public sector, agriculture, and banking.

Sri Lankan economy is growing at about 6.4 percent (1997) and main industries are engaged in processing of rubber, tea, coconuts, other agricultural commodities, clothing, cement, petroleum refining, textiles, and tobacco. The per capita income (US\$814 in 1997) in Sri Lanka is approaching the level of middle income countries. The growth of exports is higher than that of imports.

The recent macro-economic improvements in Sri Lankan economy are contributing to stability of domestic financial markets and equitable income distribution but the economic growth has not been sufficiently broad-based to absorb under- and unemployed labor throughout the country and the performance is fragile due to slow progress towards its social and political stability.

The current economic growth is inducing pressures on forest and other natural resources through increased demand and consumption of forest product and services. There is a general resistance for including environmental considerations into every aspect of development planning. Such pressures are adversely affecting the sustenance of forest and other natural resources in Sri Lanka.

5.7 Inter and Intra - Sectoral growth

The manufacturing sector provides the highest support to the economic growth of Sri Lanka. The mining sector makes the least contribution (about one percent) to the growth of national economy (Table 33 at Annex). The share of agriculture sector including forestry is consistently declining and that of manufacturing sector is consistently increasing (Figure 7).

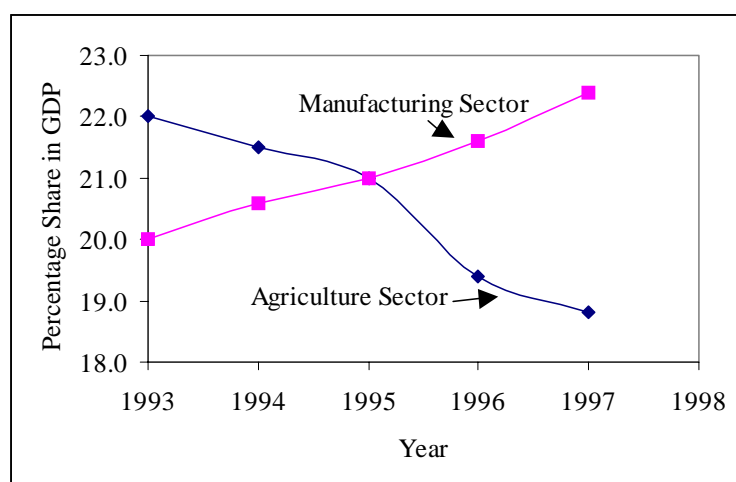


Fig. 7. Trend of share of different sectors in GDP

The forestry and livestock sub-sectors under "agriculture" sector are continually losing (Figure 8) their ability to define the growth rate of "agriculture" sector in Sri Lanka (Table 34 at Annex) because the relative contribution to GDP from other sub-sectors of "agriculture" like fisheries, tea and other agricultural crops is increasing (Table 35 at Annex). Therefore, the capacity of other factors, that affect sub-sectors other than forests like variation in tea prices, efficiency of management of tea estates, impact of natural calamities and weather on paddy, increased access to potential fishing areas, and growth of inland fishing, is increasing in defining growth rate of agriculture and the economy as a whole.

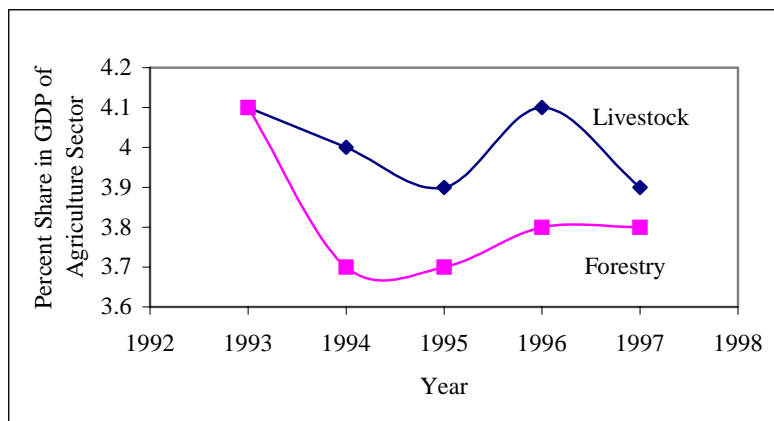


Fig. 8. Percent share of Forestry and Livestock in GDP of Agriculture Sector

5.8 Economic linkage with other sectors

The current estimate of contribution of forestry sector in the national economy is about four times more than what is reflected in the national accounts of Sri Lanka (FSMP, 1995). The current national accounting system does not include the contribution of “Non Marketed Goods and Services” from forests and under estimates the contribution of wood to national economy by about 10 percent. Further, the current national account do not appreciate that the forest sector supplies more than 44 percent of the total energy in Sri Lanka (FSMP, 1995).

The national accounts indicate that the contribution of agriculture sector including forestry to the labor absorption is continually declining for example from 38 percent in 1996 to 35 percent in 1997. However, special studies done for FSMP (1995) reveal that the total employment in the forestry sector alone is around 330,000 that is almost double of the official figure of 171,000.

5.9 Summary

The tree resources in Sri Lanka are under typical South Asian conditions. While, on one hand, high unemployment, increasing population, expanding agriculture, rapid economic growth and low capacity of law enforcement are mounting adverse pressure on tree resources, on the other hand, high levels of literacy, education and health are favoring better conservation measures both in short and long term.

6 Use of Forest Resources

This chapter presents use of forest resources in Sri Lanka including trees outside forest areas. It provides information on marketed and non-marketed forest products including Non Timber Forest Products, which are very important in the rural economy as a contributor to subsistence support, cash income and employment to the rural poor.

6.1 General

Sri Lanka currently enjoys almost self-sufficiency in meeting its domestic requirement of forest products except for plywood, paper and paperboards. The growing emphasis on sustainable management of remaining natural forests and conservation of biodiversity may reduce the sustainable levels of supply and limit the current production possibilities of saw mills and plywood industries.

The Non Timber Forest Products (NTFP) are contributing to the raw material for small industries, earning foreign exchange from the export of both unprocessed and processed products in addition to helping rural poor. Most important NTFP in Sri Lanka are medicinal plants, rattan, bamboo, products of kithul palm, and edible plants. Due to incomplete data on extraction rates, market prices, and time spent on collection and consumption etc., it is difficult to assess the total contribution of NTFP to the society.

6.2 Firewood and other bio-fuels

Price and availability are the main factors that determine the use of alternative sources of energy in Sri Lanka (FSMP, 1995). The fuelwood continues to be the cheapest source of energy for industries as well as households. It satisfies about 49 percent of the total industrial energy consumption. The tea, hotel, brick and tile industries together account for about 73 percent of total industrial fuelwood consumption. The households consume about 61 percent of total energy and their share in total energy consumption is steadily increasing while that of the industry is declining.

Various studies (Wijesinghe, 1983, FMP, 1985 and FSMP, 1995) have assessed (Table 36 at Annex) the household consumption of fuelwood in Sri Lanka. The last study by FSMP (1990) is more intensive than the past studies and is based on the following four basic assumptions; declining per capita consumption, increasing population, declining percentage of population using bio-fuels, and increase in real Gross Domestic Product. This study provides the estimates of per capita daily household consumption of fuelwood, projection of domestic fuelwood consumption for next three decades (Table 37 at Annex), and industrial fuel wood consumption (Table 38 at Annex). The study indicates a decline in the industrial bio-fuel requirements (Table 39 at Annex) due to improved technology of fuelwood consumption in the Tea sector, which alone consumes maximum (43.2%) amount of industrial fuelwood in Sri Lanka.

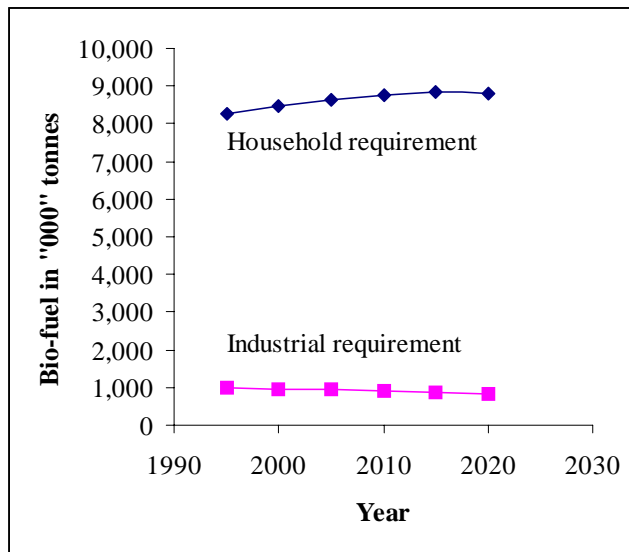


Fig. 9. Requirement of biofuels

The share of bio-energy in the total energy production of the country has remained roughly the same (66% in 1992 to 68% in 1982). Table 40 at Annex presents bio-energy estimates at the national level by each district to indicate the spatial variation in the balance (gap) between demand and supply of bio-fuel. Rubber plantations provide about one-sixth, crop residues about one-third and other sources provide rest of the bio-fuel (Table 41 at Annex). The trees outside forest make maximum contribution (Fig. 9), followed by the natural forest and the forest plantations (Table 42 at the Annex).

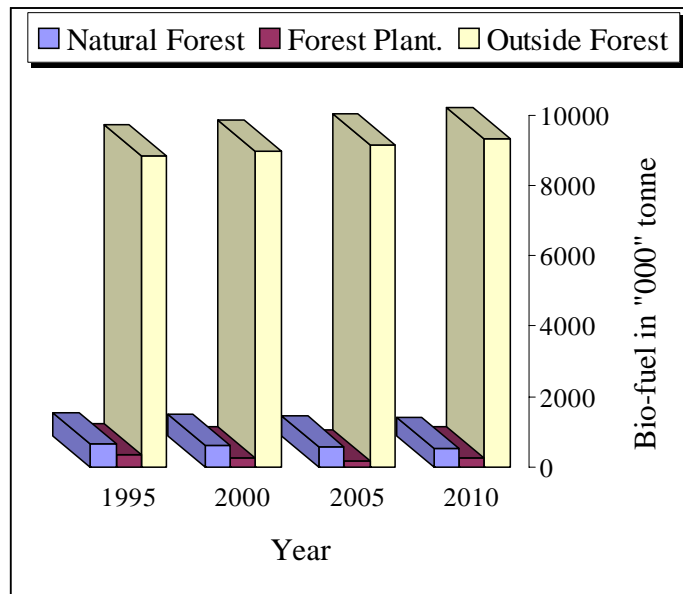


Fig. 10. Contribution of different landuse to biofuels

At the National level, the production of bio-fuels from TOF makes Sri Lanka surplus in bio-fuels (Table 43 and 44 at Annex). Among TOF, the total contribution of rubber towards total bio-energy is about 17 percent and that of coconut is about 22 percent. Recent increases in demand of rubber for sawn wood are reducing its current and future contribution to the supply of industrial fuelwood. However, FSMP (1995) expects that with increase in production from other trees under TOF, the total production of bio-fuel is likely to improve in the near future (Figure 11).

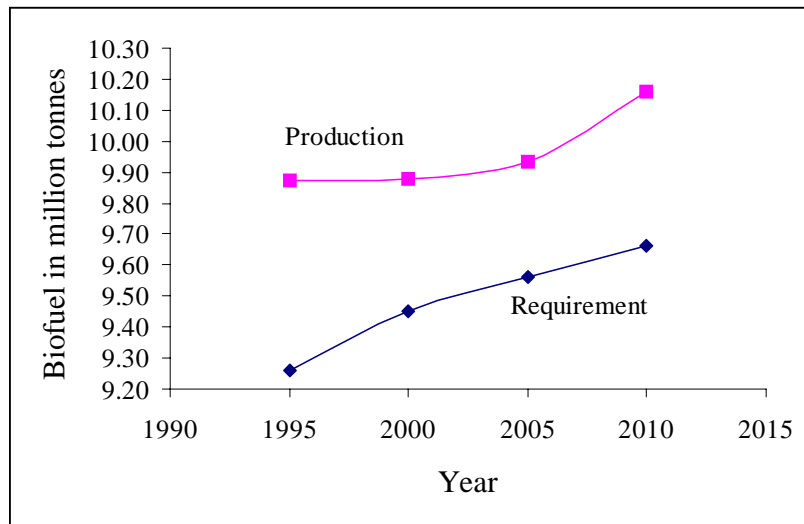


Fig. 11. Production and Requirement of Bio-fuels

6.3 Wood

Forest Sector Master Plan (FSMP, 1995) estimates that sawn wood requirement will increase from 0.031M³ per capita in 1993 to 0.039 M³ in 2020 and the requirement of wood as fibre for paper pulp will remain constant due to the low levels of availability of domestic raw material despite of expected growth in the demand of paper at the rate of 4.3 percent per annum. The FSMP forecasts that the requirement of wood for plywood may even decline as some of the old pulpwood plants may close down due to obsolescence and inefficiency. It indicates that the demand of wooden electricity poles will stay around 20 to 25 thousand poles (300 m³) due to limited domestic supply and that of telephone poles may even decline due to their replacement with concrete poles.

FSMP, 1995 estimates that production of wood from natural forest will decline (Figure 12) and that from forest plantation and TOF will increase over years (Table 44 at Annex). The FSMP estimation is based on the following assumptions,

- one ha. of home-garden produces 0.95 m³ of sawlogs, and 0.5 m³ of poles per hectare per year
- one ha. of Rubber plantation provides 0.24 m³ logs, 65 m³ sawlogs, and 127 m³ fuelwood
- one hectare of Coconut plantation yields 49.4 m³ sawlogs, 51.6 m³ fuelwood, and 6.862 tonne other biomass
- one hectare of trees on Teas estate give 0.48 M³ of poles and 0.40 m³ wood

- one hectare of trees on Settlements Teas estate give 0.48 M³ of poles and 0.10 m³ wood
- one hectare of trees on Other areas give 0.48 M³ of poles and 0.69 m³ wood
- trees from one kilometer along roadside plantation may provide about 0.69 M³ of saw logs.

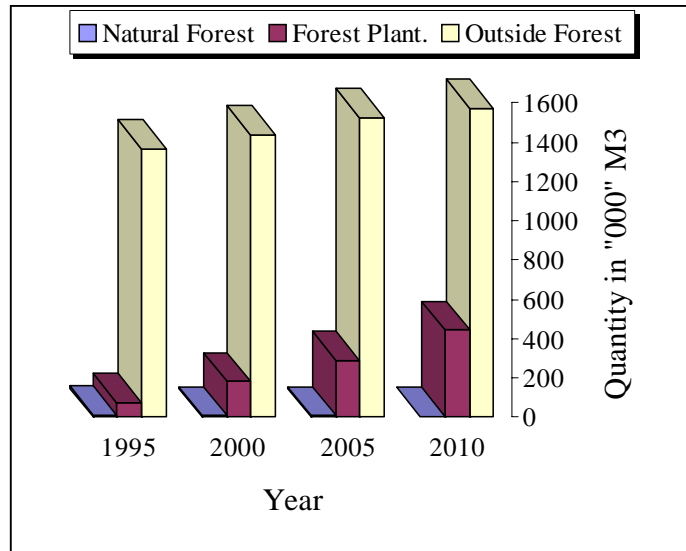


Fig. 12. Production of Wood from different sources

The domestic production of wood is sufficient to meet about 95 percent of the national requirements (Table 43 and 44 at Annex). Like bio-fuels, Sri Lanka is in a comfortable position (Table 45 at Annex) with surplus in production of sawn wood (Figure 13). This surplus is likely to increase with expected increase in production from plantations and TOFs (Table 46 to 53).

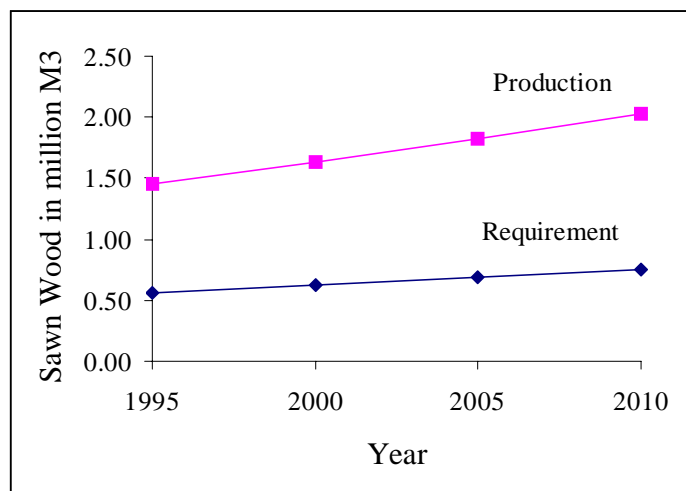


Fig. 13. Production of Sawn Wood

A recent census (1995) of timber based enterprises in 19 districts of Sri Lanka indicates that most of timber-based enterprises are not been registered with the Forest Department and their use spans

about 203 species. Such diversity of species used for timber is more in modern cities and less in other cities. The maximum demand of timber is for furniture, roofing and doorframes. The case of plywood is just reverse, where imports meet majority (82%) of the national requirement (0.28 million M³ in 1993). The particleboard and fibre board industries depend entirely on the imports. The domestic resources contribute about 61% of the national requirement of about 0.031 million tonnes of fibre for making paper and the balance (39%) quantity is imported. The main domestic source is waste paper and the wood contributes very little (6%) for this purpose. The domestic industry uses old technology and needs lot of investment for modernization. Accordingly, the domestic production of paper contributes only about 21.5 percent towards satisfaction of the total national consumption (0.130 million tonnes 1993) of paper.

6.4 Rubber

The Rubber productions during last few years have declined by about six percent mainly because of fall in prices, shortage of labor, increase in rainy days, and low fertilizer application. The average export price has declined by five percent and the average cost has increased by ten percent leading to decline in the profitability of rubber production. More than sixty percent of the production is exported to other countries. The impact of “East Asian Currency Crisis,” coupled with low profitability and low yields have adversely affected “Rubber” growers. Lower levels of replanting and “new planting” clearly demonstrate this impact.

6.5 Medicinal plants

About fifty percent of the rural people in Sri Lanka use more than 1000 plant species as Ayurveda medicine out of a total of about 3,500 plant species identified in the country. The level of employment in the medicinal plant sector is not known, as extraction is not recorded, and is not done on a full time basis. Most of the families living close to the natural forests collect medicinal plants but there are no estimates of total quantity of medicinal plants used in the country or their prices. Table 54 at Annex attempt to indicate the level of medicinal herbs collected by an average family based on a small socio-economic survey (IUCN, 1995). Table 55 at Annex presents some information about the international trade of medicinal plants and herbs in Sri Lanka. In recent years, both the imports and exports of medicinal plants have increased. These exports are mainly to India, Pakistan, France and the Netherlands.

6.6 Rattan

Rattans (*Calamus* spp.) are spiny climbing plants, which are mainly used in furniture, ornaments, housing and construction, as utensils, and binding material. Eight out of ten species (Table 56 at Annex) of Rattan present in Sri Lanka, are exploited for commercial purposes. It provides employment to about 2,200 craftsmen from 700 families, which is about three times more than from bamboo. The rattan industry is spread over 13 districts. Tourists and expatriates purchase about 65% of the high quality rattan products. The demand of rattan products far exceed local production, therefore, the producers of high quality rattan furniture import rattan from Indonesia, Singapore, and Malaysia because of the scarcity of good quality rattan in Sri Lanka.

6.7 Bamboo

Bamboo resources in Sri Lanka are not as abundant as in many South Asian countries, and consequently the importance of bamboo in the household economy, construction, and in cottage industry is comparatively less. The availability of indigenous bamboo species in forest areas, such as *Ochlandra stridula*, is decreasing because of deforestation and over-exploitation. However, they can still be found abundantly in a few areas, e.g. in Ratnapura and Kalutara Districts.

The bigger diameter bamboos are mostly introduced species (*Bambusa vulagris* and *Dendracalamus giganteus*), which are cultivated (Table 46 at Annex) in homegardens, and along roadsides and riverbanks. The bamboo handicraft industry uses *B. vulagris* and *O. stridula* species and the construction industry uses *B. vulagris* and *D. giganteus*. Bamboo industry supports about 250 families and 690 workers. According to a survey by the Forest Department about 80 percent of people who collect bamboos process it for household consumption and rest 20 percent people either process it for domestic use as well as sell them to processors. The price of bamboo has increased much faster than the rate of inflation, which suggests that the availability of bamboo has gone down in relation to the demand.

6.8 Kithul

Kithul or Kitul (*Caryta urens*) is a multiple-use tree of considerable economic value in Sri Lanka. Its pith is used for food, medicine, fodder and wood. The sap is tapped from the flowering shoot for "toddy" (a hard drink), "treacle", and jaggery. Figures of employment provided by Kithul are not available. A special caste of people that live in two major clusters in the natural forests, tap the sap and make jaggery. Table 58 at Annex presents an estimate of income from Kitul products (CR, 1997).

6.9 Edible plants

There is a relationship between ecological zones and the percentage of households that collect edible plants from the local forests. In the intermediate and dry zones, about 60 to 70 percent of the households collect edible plants whereas in montane zones, only about 20 percent of the households collect the edible plants. The Table 59 at Annex contains an estimate of annual income generated by rural communities living adjacent to the forests by selling edible plants.

6.10 Summary

Sri Lanka currently enjoys almost self-sufficiency in meeting its domestic requirement of forest products except for plywood, paper and paperboards. The current strategic planning for sustainable management of remaining natural forests and conservation of biodiversity may reduce the sustainable levels of supply. The FSMP, 1995 estimates that production from natural forest will decline and that forest plantation and TOF will increase over years. The use of Non Wood Forest Products (NWFPs) is very common and linked with local culture vegetation and ecology. NWFPs are also means of livelihood for many poor people.

7 Forest planning and management

Forest planning is a planned intervention to alter or maintain the forest dynamics for providing sustained flow of good and services to satisfy the desired objectives in an efficient manner. Practice of planning in forestry in Sri Lanka has a long history. The efficiency of forest planning depends on clarity of the objectives and mission, and precise assessment of inputs and outputs. Sri Lanka has achieved this with development of its Forestry Sector Master Plan of 1995. This chapter provides a general and brief view of forest planning and detailed information on selected issues.

7.1 General

Sri Lanka has a good system of forest planning. Ministry of Forestry and Environment (MOFE) has identified its mission and to achieve its mission the MOFE has its set objectives and priorities in forestry. The first priority is to set aside forests for conservation, wherever it is necessary. The next priority is to manage the remaining forests for meeting the domestic demand for wood and non-wood products and other services. The government is now emphasizing involvement of non-state sector in all forestry development activities, and empowering people and rural communities to manage and protect multiple-use forests.

7.2 Main problems

Sri Lanka faces a wide range of environmental management challenges that are tied to its economic development (SYDP, 1998). These challenges emanate from high population density, unemployment, deforestation, and pollution etc. in the country. The issues in the forestry and environment sectors are linked very closely with the national development and are inseparable. Future trends in these sectors are centered on increase of population, poverty, nature of the economy, trade liberalization etc.

FSMP, 1995 has identified and quantified a strong link between population, deforestation and forest degradation in Sri Lanka. Sri Lanka's population is increasing at a rate of 1.2 percent a year and more than 20 percent of the population lives in absolute poverty and one-third of families receive poverty alleviation grants. Agricultural production in Sri Lanka is increasing mainly due to extensive rather than intensive agricultural practices for satisfying increasing demands of its growing population. This is leading to decline in the area under forest cover.

Despite past and continuing forest conservation efforts, there is still net deforestation, with severe implications for the environment, leading to long run adverse effect on the welfare of the rural people, agricultural and other inter-linked sectors, and the country as a whole. Among the poor, women tend to suffer disproportionately from environmental degradation, as they are traditionally responsible for collecting water and fuelwood, cooking and other domestic work.

7.3 National forest policy

Sri Lanka has developed its National Forest Policy (NFP) on the basis of its Forest Sector Master Plan with following main objectives,

- To conserve forests for posterity, with particular regard to biodiversity, soils, water, and historical, cultural, religious and aesthetic values.
- To increase the tree cover and productivity of the forests to meet the needs of present and future generations for forest products and services.
- To enhance the contribution of forestry to the welfare of the rural population, and strengthen the national economy, with special attention paid to equity in economic development.

To achieve these objectives, NFP provides policy guidelines for management of state and private forest resources. The main features of these guidelines for state owned forest resources include the following,

- All state forest resources will be brought under sustainable management both in terms of the continued existence of important ecosystems and the flow of forest products and services.
- The traditional rights, cultural values, and religious beliefs of people living within or adjacent to forest areas will be recognized and respected.
- The natural forests will be allocated firstly for conservation, and secondly for regulated multiple-use production forestry.
- For the management and protection of the natural forests and forest plantations, the state will, where appropriate, form partnerships with local people, rural communities and other stakeholders, and introduce appropriate tenurial arrangements.
- The establishment and management of industrial forest plantations on the state lands will be entrusted progressively to local people, rural communities, industries and other private bodies, in pace with institutionalising effective environmental safeguards.
- Degraded forest land will be rehabilitated as forest for conservation and multiple-use production, where it is economically and technically feasible, mainly for the benefit of local people.
- Planned conversion of forests into other land uses will take place only in accordance with procedures defined in legislation and with accepted conservation and scientific norms.

Similarly, the policy guidelines for privately owned forests and trees state that,

- Tree growing on homesteads, and other agroforestry, will be promoted as a main strategy to supply wood and other forest products for meeting household and market needs.
- The establishment, management, and harvesting of industrial forest plantations by local people, communities, industries, and others in the private sector will be promoted.
- The state will promote tree growing by local people, rural communities, NGOs and other non-state sector bodies for the protection of environmentally sensitive areas.

Apart from these, the NFP has very specific guidelines for "wood and non-wood forest products, industries and marketing", "institutional support for forestry development including NGO", "inter-

sectoral linkages", and "international forestry related conventions". In addition to statement of such policy guidelines, the NFP provides strategies for their implementation.

7.4 Forest planning process

Sri Lanka follows a systematic forest planning process and FSMP, 1995 provides a sound basis for this purpose. FRMP, 1995 has analyzed past information to identify trends and projected scenarios of land use and production under alternative feasible management regimes. It is actually a Policy Planning document for next 25 years. The Ministry of Forestry and Environment (MOFE) and the Forest Department have utilized this document (FRMP, 1995) to develop, enact and adopt a new National Forest Policy in 1995 itself.

The MOFE has also identified its national mission as to "provide leadership to manage the environment, in order to ensure national commitment for sustainable development for the benefit of the present and future generations" (SYDP, 1998). To achieve its mission the MOFE has set the following objectives:

- Formulation, development and review of national policy framework for sustainable development.
- Research to support the elaboration of the national environmental policy.
- Identification of policy gaps and facilitating the development of sectoral environmental policies.
- Provide legislative support for the regulatory framework.
- Coordinate the national response and participation in the international environmental conventions.
- Collection, storage, retrieval and dissemination of national environmental data and information.
- Promotion of awareness about sustainable development of environment and natural resources.
- Training of public/private agencies at national and sub-national levels.
- Development of institutional capacity at national and sub-national levels for sustainable development.

The government has also clearly set its priority in forestry. The first priority is to set aside forests for conservation, wherever it is necessary. The next priority is to manage the remaining forests for meeting the domestic demand for wood and non-wood products and other services. To achieve this, the GOSL is emphasizing involvement of non-state sector in all forestry development activities, and empowering people and rural communities to manage and protect multiple-use forests. The non-state sector means the private sector, NGOs, village based organizations, and communities or even certain individuals interested in being involved in environment and forestry related activities.

Therefore, forest planning addresses two main areas for sustainable development of forest resources.

- (a) Conservation of remaining natural forests primarily for bio-diversity and watershed protection and for other environmental services.

(b) Development of forest plantations and non-forest wood resources to satisfy national requirements.

The forest department develops a Five year Implementation Programme (FYIP, 1997) to translate the FSMP, 1995 proposals into action in accordance with the National Forest Policy, 1995 and current management plans. The forest department develops annual macro and micro level “Work Plans” to implement the FYIP. The annual work levels are based on the actual availability of financial resources in that particular year. All this planning is done centrally by experienced foresters at the national headquarters of forest department in consultation with field staff. The GOSL has recently changed the National Planning period from five years to six years. MOFE has accordingly developed a Six Year Development Programme (SYDP) from 1999-2004.

The MOFE follows a consultative planning process for each of its two agencies (Forest Department and Central Environmental Authority) for the development of SYDP. To achieve this, the MOFE first develops a framework for the joint consultative planning based on the guidelines provided by the National Planning Department of Sri Lanka. The MOFE also identifies main thrust or priority areas including its components, activities and sub-activities like the following:

- Establishment of National Forest Estate
- Forest Management
- Non state sector participation in Forest Plantation Development
- Forest law enforcement
- Forestry Research
- Human Resources Development

The MOFE then constitutes different working groups to estimate the financial resources required for each activity with detailed breakdown into capital and recurrent expenditures and work targets for the period of SYDP and to draft the SYDP. The draft SYDP is presented, discussed and modified in a participatory consultative manner in different meetings chaired by the Secretary, MOFE.

The final SYDP takes into account the resource availability and needs of both the public and private sector for implementing the plan. This becomes important because GOSL has taken decision to allow private sector to play a major role in forestry development activities including; forest plantation development, forest plantation management, harvesting and extraction. Further, the private sector is a major partner in pollution control, waste management, green house gas reduction etc. Therefore, it becomes necessary to include the anticipated contribution of the private sector in the forestry and environmental fields during the plan period. In addition to this, the SYDP mentions the contribution of the households in increasing and maintaining the tree cover.

7.5 Forestry and five year plans

FSMP, 1995 recognized the complexity of forest planning and its inter-linkages with other sectors of the economy and therefore, provided for an integrated planning model for forest sector. MOFE is following the direction contained in FSMP, 1995 and ensures that Forest Department considers all provisions of Five Year Implementation Programme (FYIP) and Six year Development Programme (SYDP) to implement various provisions of NFP, 1995.

The NFP and the FSMP emphasize on obtaining participation of the non-state sector in all forestry development activities. The MOFE and FD have initiated several activities for this purpose like the extraction of resin from pine plantations is currently being carried out with the non-state sector participation, where nearly 4,000 ha are leased for resin tapping and 8,000 ha will be leased soon. Apart from this over 11,000 ha of degraded land in the dry zone will be leased on a long-term basis for reforestation. The response received so far for this scheme has been very encouraging, which shows the interest of the people in becoming partners in forest developmental activities. Depending on the progress, this scheme will be improved and expanded in the future.

Plans are also underway for leasing of forest plantations for management to the non-state sector. Initially leasing will be carried out on a pilot basis where small extents will be leased for management, extraction and reforestation by the non-state sector. The forest Department will provide technical advice and guidance to the private sector engaged in these activities and will also closely monitor the progress. Preliminary estimates reveal that the investments from the non-state sector for the above mentioned activities would be in the range of over Rs. 200 million.

7.6 Forest management plans

In the past, the forests were used for hunting wild animals, grazing by village cattle, gathering wild fruit, and extracting timber for domestic use and revenue. In some villages, especially in the dry zone, there was little rice cultivation, and people depended on the home gardens and forests for their livelihood. In 1840, the government appropriated ownership of most of the forest land in Sri Lanka by enacting legislation and since then scientific management and planning of public forests is under government control.

The GOSL took a major initiative in early 1990s to develop its FSMP. It is an integrated long-term forest management plan and provides direction and guidelines for short-term and annual planning. It was prepared at national level through a participatory approach. Its emphasis is on identifying and analyzing major sectoral issues, defining sectoral objectives and strategies, and developing alternative scenarios. The FSMP helps in formulation of "Five Year Implementation Plan" (FYIP), which in turn provide basis to design annual work plans. The FYIP consists of following five components with forest conservation as its main component.

- Forest Conservation Management
- Forest Land Allocation and Macro Level Planning
- Multiple-Use Management of Natural Forests
- Commercial Plantation Development
- Social / Agro-forestry and Extension

7.6.1 Forest Conservation Management

The purpose of the Forest Conservation Management component of FYIP is to maintain and enhance biodiversity, soil and water resources, while fostering sustainable use of resources. This purpose is consistent with the national, as well as present international policies on conservation. The main strategy adopted to conserve natural forests is to establish a national forestry estate and to

create a protective area system. This includes the categorization or zoning and mapping of existing forests and the preparation and implementation of management plans.

7.6.2 Forest Land Allocation and Macro Level Zoning

GOSL considers that an important pre-requisite for the sustenance of forest resources is to establish a National Forest Estate (NFE) classified into two main categories (Conservation and Multiple Use) having its own broad management objectives.

These conservation forests set aside for conservation of bio-diversity or soil and water resources are further sub-divided into two classes (Class I and Class II). The class I conservation forests are fully conserved and only approved research and controlled visiting rights are permitted. In the class II conservation forests, in addition to approved research and visiting rights, controlled extraction of Non Wood Forest Products is also permitted.

The forests other than conservation forests are managed as Multiple Use Forests for Production purposes. The production forests are further classified into two categories (Class III, and Class IV). The Class III forests are managed by the State, and Class IV by local communities with the assistance of the State. The chief strategy is to increase tree cover and the productivity of forests and forest plantations.

The forest areas outside NFE are classified as class V forests and the GOSL plans to provide assistance to increase the tree cover and productivity in this class of forests. The social forestry and agro-forestry and extension component of the FYIP attempts to support Class V forests.

7.6.3 Multiple Use Management of Natural Forests

The aim of the multiple use management of natural forests component is to produce a mixture of products and services on a sustainable basis to meet the needs of a range of clients, preferably rural poor. To achieve this, the GOSL is attempting to develop participatory forest planning and management procedures and appropriate forest management plans based on experiences from a limited number of pilot sites (initially 6) with a total of 12 forest management plans prepared during the 5 year period.

7.6.4 Commercial Forest Plantation Development

The commercial plantation development component has a purpose to increase tree cover and sustainable production of commercial forest products and services. The strategy during to FYIP is to increase private investment in plantation establishment and management of existing plantation initially on a pilot basis, and bringing all potentially commercial plantations under productive management through an autonomous body. The GOSL proposes to establish 20,000 ha. of new plantations within next 5 years with the involvement of private sector and to increase the current production of 35,000 m³ of sawlogs to 150,000 m³ during next five years. For new plantation management, scheme for leasing suitable state lands on long leases to private individuals and companies is already under consideration of the government following the principles enunciated in the National Forestry Policy, 1995.

7.6.5 Social Forestry and Agroforestry and Extension

The "social forestry and agroforestry and extension" component has the purpose to establish a network of "sustainable and productive social forestry" in home gardens and unutilized public lands. These resources currently satisfy more than 50 percent of the total bio-energy demand and about 41 percent demand for the sawn logs. The FYIP suggests the strategy for developing institutional capacity to provide more efficient extension support to implement social forestry programs based on experience being generated by testing sustainable models (developed during the program period) in limited pilot sites (initially 100 villages). Currently, the government proposes to extend this component to additional 600 villages and also desires to create favorable conditions for marketing and land tenure for possible further expansion of activities in near future.

7.7 Micro or local level planning

FSMP, 1995 clearly directs that "In the future, mechanisms have to be developed for introducing bottom-up planning at the implementation stage, and feedback from implementation at local level to be integrated into National level planning". In practice, the forest department attempts bottom up local planning approach for participatory or locally managed multiple use forestry only. It follows the centralized and functional model of spatial and temporal forest planning for state or commercially managed production forestry and develops the FYIP, the plantation management plans, and the district level annual work plans at the national level.

7.8 Forestry organization

The Ministry of Agriculture, Lands, and Forestry look after the forest sector. The ministry has four main divisions (Planning Division, Forestry Planning Unit (FPU), Forestry and Environment Division, and Land Use Policy Planning Division) that deal with forestry sector. The Planning Division ensures that the plans produced in the ministry are in line with the national and ministerial policies, helps in identifying sources of funds, and looks after environmental impact assessments. The Forestry Planning Unit (FPU) unit is headed by a Director and assisted by many deputy directors. It coordinates and implements long-term sectoral plans like FSMP, development plans, and overviews the use of funds. The FPU is also responsible for sectoral policy formulation together with the Forestry and Environment Division. At present, long-term sectoral planning is mainly based on projects. The Land Use Policy Planning Division plays the key role in land-use policy planning at national, provincial and district levels, land alienation and reforms, zoning, and leasing.

The Forestry and Environment Division is responsible for regulating and coordinating activities and matters related to forestry and the environment and conservation. It reviews and drafts legislation. The division covers the Forest Department, State Trading Corporation (STC) and to some extent the FPU. The functions of this division and the FPU overlap especially when it comes to policy planning and coordination.

Three different departments look after the forest, wildlife, and environment. Each is under separate ministry and has its own mandate but there are many fields in which their functions overlap with each other. The following provides a brief description about the forest department, the department

of wild life conservation, the State Trading Corporation, other ministries related to forest and environment, and important forestry actors in non-government sector like farmers, estate and NGOs.

7.8.1 Forest Department (FD)

The FD is responsible for managing the forest area under its jurisdiction, which includes production forests (both natural and plantation forests) and protection areas. The FD is also responsible for extension and research. The main mission of the FD has been the production of wood (for the state) on state lands and protection of forests but recently, environmental conservation has emerged as one of its central functions. Increased emphasis on conservation has been a positive development, but at the same time it has meant that there are now two major government agencies (FD and Department of Wild Life Conservation) responsible for nature conservation and protected-area management with some overlapping functions between them.

A Conservator of Forests leads the Sri Lankan Forest Department with the support of three Additional Conservators responsible for research, operations, and administration and personnel. The Additional Conservators are assisted by Deputy Conservators who are directly responsible for the various sections at the headquarters like Operations, Silviculture, Forest Inventory and Management, Environmental Management, Extension and Education, Planning and Monitoring Enforcement, and Protection and Legal Enforcement. In addition, there is a personnel, administration and finance division to ensure that all FD activities are in accordance with the government's administrative and financial regulations.

Most of the operations are carried out in the field through 18 Divisional Forest Officers (DFOs) in charge of 18 divisions, comprising of 68 ranges and 341 forest beats. The field staff uses more than 50% of their time on legal enforcement activities, and on granting and monitoring the use of various permits.

Forestry research is done through two research stations under Forestry Research Division (former Research Branch). This division also looks after "Forest library" and "Forestry Information Service". The national importance and coverage of forestry research is declining and at present the research serves a limited number of beneficiaries.

7.8.2 Department of Wildlife Conservation (DWLC)

The DWLC is responsible for the conservation of wildlife in the areas under its jurisdiction. It was part of the Ministry of Forestry and Irrigation till late 1994, when it was transferred to the Ministry of Public Administration, Local Government, Plantation Industries and Parliamentary Affairs. Thus forestry and wildlife are now separated from each other through their allocations to different ministries. A Director who is assisted by an additional director and five deputy directors head the department. The deputy directors are responsible for management, administration, field operations, research and training, and promotions.

The field operations wing of the DWLC is responsible for the operation and management of the National Parks, Strict Natural Reserves, Natural Reserves, Jungle Corridors and Sanctuaries, and for the enforcement of the Fauna and Flora Protection Ordinance. It covers the country through five

regions, each under an Assistant Director. The DWLC has to balance the two main but opposite complex tasks (a) to provide services to people by conserving and managing the resource base, and (b) try to conserve the resource base by excluding people from the protected areas.

7.8.3 State Timber Corporation (STC)

The STC is a government corporation that looks after the procurement and sale of logs mainly from the state-owned forests, and production and sale of sawn wood and furniture. Government has entrusted STC with some additional functions like import of timber, afforestation, forest management and agricultural production. However, it has not yet engaged itself in the last two functions. It operates nine sawmills, five impregnation plants, two furniture factories, two mechanical workshops and 42 wood depots. The STC is not a major producer and its importance as a wood supplier is small in relation to the total consumption.

7.8.4 Other ministries and government bodies related to forestry and wildlife

The Ministry of Transport, Highways, Environment and Women's Affairs and its Central Environmental Authority are responsible for the development; enforcement and monitoring of environmental policy and legislation and coordinating environmental impact assessments. Provincial and local governments are not much involved in forestry activities. Local authorities are involved to some extent through participatory forestry activities.

7.8.5 Non-state sector

More than 200 other NGOs are directly or indirectly engaged in forestry related activities, though their involvement in the forestry sector is not yet institutionalized. Farmers and other small-scale tree growers are very important because they are the most important producers and consumers of timber and bio-energy in Sri Lanka. However their contribution has not been institutionalized to receive support from forestry organizations in adopting sustainable natural forest management and utilization practices.

A Wildlife Trust has been created in 1991, with the participation of the government, NGOs and the private sector, to complement and facilitate the implementation of those aspects of wildlife policy in which the DWLC may be impeded or delayed. A major objective of the Trust is the conservation and enhancement of natural heritage by enhancing opportunities for public and private investment in the conservation and enjoyment of these resources.

Rubber estates are one of the major producers of timber and fuelwood while tea estates (industry) are the main (industrial) consumer of fuelwood in Sri Lanka. The Tea estates have yet not utilized their potential in form of land and technology to contribute to timber and fuelwood production.

7.9 Summary

Sri Lanka faces a wide range of environmental management challenges that emanate from high population density, unemployment, deforestation, and pollution etc. in the country. Despite the past and present forest conservation efforts, there is still net deforestation, with severe implications for

the country as a whole. Three different departments look after the forest, wildlife, and environment. Each is under separate ministry and has its own mandate but there are many fields in which their functions overlap with each other.

Sri Lanka has a long history of forest planning and has identified its mission, objectives and priorities in forestry. The first priority of the Sri Lanka is to set aside forests for conservation and second is sustainable management of the remaining forests for meeting the domestic demand for wood and non-wood products and other services. The government is currently emphasizing involvement of the private sector in all forestry development activities, and "empowerment and participation" of local people and rural communities to manage and protect multiple-use forests.

8 Forest Regulation

This chapter deals with forest regulations that affect state and growth of forest and allied natural resources. These regulations are important because they change the property right regimes and entitlements of goods and services to people and thus directly affect the fabric of social institutions that in-turn provides sustenance to forest and natural resources.

8.1 General

The enforceability of rules and regulations for protection and conservation of forests is continuously declining in Sri Lanka, which is leading to deforestation and degradation of forest resources. However, efforts and investments for conservation of bio-diversity in selected areas is continuously increasing leading to a good network of well conserved forest resources. This chapter first presents laws other than on forest that directly or indirectly affect forest resources and then describes the laws relating to forest resources in Sri Lanka.

8.2 Land Settlement Act, Land Development Act and Crown Lands Act

Three acts dealing with land allocation (Land Settlement Act of 1931, Land Development Act of 1935, and Crown Lands Act No 8 of 1947) deal with control and allocation of lands in Sri Lanka. These acts, particularly the first two, have made great impact on the allocation and management of forest land. Many land allocation decisions have been made under these acts without considering the ecological status of the forest and the land that supported them. This at places has led to irreversible erosion of the ecosystems and fragmentation of forest resources.

8.3 Soil Conservation Act

The Soil Conservation Act, No 25 of 1951 amended in 1953 and 1981, looks after the conservation of soil resources including protection of land against damage by floods and drought. Although the act is administered by the Ministry of Agriculture but is implemented by different agencies. At many locations, different agencies implementing the act have overlapping jurisdictions like in case of the Forest Department and the Mahaweli Authority. Such overlapping of jurisdictions coupled with ambiguous definitions of responsibilities and power between agencies has adversely affected the conditions of forest and soil resources.

8.4 Timber Act

The Timber Act (No. 2 of 1822) was the first forest related legislation enacted by the British. It mainly dealt with the harvesting of timber and prohibited the cutting of trees without a license on the then "crown" lands and of "jak" trees on private lands. Many amendments, repeals, and enactments of new acts have taken place since then to utilize, protect and conserve forest resources of Sri Lanka.

8.5 Wastelands Ordinance

The Wastelands Act 1840 and its amendment in 1879 appropriated the common property resources from its holders such as "villages" and "families" and chena (shifting cultivation) holders and vested large tracts of appropriated forests and other land in the state. This act paved the way for the management and control of forest resources by the state. Prior to the British colonial rule, the forest had belonged to the local king, but social tenures, access and local control of forest resources for grazing of animals, collection of firewood and doing chenas were recognized. This act ignored and eroded the local social institutions and the status of titles held according to ancient custom, or traditional tenures. However, inadequate capacity of the state to implement this act has led to confusion such that in many parts of the country there is still an assertion of tenurial rights in some forest reserves,

8.6 Forest Act

Forest Act No 10 of 1885 tightened the control on and access to forest resources and carved out reserved forests to allow very limited access to public. The primary emphasis of the act was to control exploitation of forest resources to ensure sustained yield of marketable goods. However, the act was also utilized for establishing two uninhabited forests, Yala and Wilpattu, as sanctuaries for the protection of wildlife.

This act was replaced with Forest Act, No 16 of 1907, and is the basis of the present law relating to forests and plant protection. The act has been amended many times to address specific problems but its initial structure has remained intact. The act facilitates maximization of the public revenue and cares more about the interests of the state at large than the needs and interest of local public and communities. The act does not address trees outside forests (TOF). The state implements the act through Forest Department and regulates the sale and transport of forest produce and timber.

8.7 National Heritage and Wilderness Areas Act

The Forest Act has failed to meet the high expectations of Sri Lankan society to conserve natural heritage and wilderness including bio-diversity in Sri Lanka. The Sri Lankan government enacted the National Heritage and Wilderness Areas Act No. 3 in 1988 to address this specific problem of the forest department. The Forest Department now administers this act that aims at the protection of state lands having unique ecosystems, genetic resources, or outstanding natural features.

8.8 Fauna and Flora Protection Act

The Fauna and Flora Protection Act No.2 of 1937, with subsequent amendments addresses the protection of wildlife and flora in national reserves of Sri Lanka. The Department of Wildlife Conservation (DWLC) enforces this law within the areas under its. The act was originally developed for the protection of game, rather than for wildlife conservation that explains the large extent of protected areas in the dry zone.

8.9 Enforcement of Forest Regulations

The capacity of Forest department (FD) as well as DWLC to enforce the law is declining with time due to general fall in social values. Despite the severe penalties, the quality and extent of forest cover continues to decline. Forest protection rather than forest management has become the main objective of forest department. This has resulted in heavy cost of policing, inefficient use of forestry professional, increased corruption and abuse, and disincentives to private tree growers and markets.

Some of the important reasons for inefficiency of these acts are that (a) their boundaries are not well drawn, (b) the acts have not been implemented in a coordinated manner by FD and DWLC, and (c) the poor sensitivity and flexibility of these acts to adapt to quickly changing social and political conditions. For example, boundaries of forests and protected areas in Forest and Wildlife legislations are not very clear. The protection, conservation and development of forest resources are intimately related with other sectors but the forest planning and management process in Sri Lanka is not participative (with stakeholders), integrated within forestry sector and coordinated with other sectors of the economy. The process to make changes in the legislation is very slow and bureaucratic. Finally the system is not designed to not make optimal use of local knowledge.

8.10 Summary

Different legislations have been introduced over the years to meet various temporal needs to sustain forest and wildlife resources of Sri Lanka. Most of the past rationales on which these acts are based have lost full or part of their justification under present social and political environment. The past legislations support forest revenue collection by the state, while the conservation through people's participation is the current key word. The country needs new legislation conducive to participatory framework with clear definitions and boundaries of mandates, functions and accountability of various agencies and users.

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Table 1. Wijesinghe et al.'s (1993) Forest Type

Forest type	Dominant Communities or Species	Bio-Climatic zone
Wet Evergreen Forest (Tropical Rainforest)	Dipterocarpus (low and mid altitudes) Mesua-Doona-Shorea (mid Altitudes) Camnosperma- Zeylanica (Adam's Peak range) Vitex-Wormia-chaetocarpus-Anisophyllea (low altitudes)	Low and Mid Country Wet zone
Tropical Montane Forest	Syzygium –Colophyllum-Gordonia-Michelia (widespread) Stemonoporus (Adam's Peak range)	Montane Wet Zone
Intermediate Evergreen Forest	Intermediate between Wet evergreen and Dry Mixed Evergreen	Low and Mid Country Intermediate Zone, and Montane Intermediate Zone
Dry Mixed Evergreen Forest	Manikara-Drypetes-Chloroxylon (wide spread) Alseodaphne – Berrya - Diospyros (more humid conditions)	Dry Zone
Semi-Evergreen Thorn Forest	Manikara hexandra, Salvadora persica, Dichrostachys cinera, Acacia Spp.	Arid Zone

(Wijesinghe et al., 1993)

Table 2. Greller and Balasubramanian (1993) – Forest types

Forest Classification	Characteristic Species of the Community (Greller and Balasubramanian, 1980)
ZBI/1 Meso-phyllous Evergreen Dipterocarp (rain forest)	Doona – Dipterocarp – Mesua Zone
OBI/1-1 Notophyllous Evergreen Dipterocarp	Doona- Calophyllum-Syzygium Zone (lower montane of ZBI/1)
OBI/2-1 Notophyllus Evergreen Mixed	Myristica – Cullenia-Aglaiia Litsea Zone – (lower montane of ZBI/2)
OBI/1-2 Microphyllus Evergreen Dipterocarp	Stemona Zone (upper montane of ZBI/1)
OBI/2-2 Microphyllus Evergreen Mixed	Calophyllum Zone – (upper montane of ZBI/2)
ZBI/2 Meso-phyllus Evergreen Mixed (rain forest)	Artocarpus, Pometia, Filicium Zone
ZBII/1 Semi Deciduous Forest	Vitex-Berrya-Schleichera-Drypetes Zone
ZBII/2 Semi Deciduous Wood land/ Thorn Scrub	Manikara – Randia - Dichrostachya Zone

Source: Greller and Balasubramanian, 1993

Table 3. Districtwise Natural Forest (1992) by Forest Types

(Area in hectares)

DISTRICT	Montane Forest	Sub Montane Forest	Lowland Rain Forest	Moist Monsoon Forest	Dry Monsoon Forest	Riverine Dry Forest	Mangrove	Sparse Forest	Total
Ampara				45190	69265	10160	292	41760	166667
Anuradhapura					180083	0	0	116693	296776
Badulla	93	3888	1577	17517	3353	0	0	27843	54271
Batticaloa				13302	21770	0	1421	16325	52818
Colombo			1832	0	0	0	0	36	1868
Galle			18903	0	0	0	187	1699	20789
Gampaha			273	14	0	0	122	20	429
Hambantota			220	739	19169	3710	539	55077	79454
Jaffna					822	0	260	298	1380
Kalutara			20240	0	0	0	70	1266	21576
Kandy	935	8504	14258	3545	0	0	0	5980	33222
Kegalle		3655	11791	0	0	0	0	492	15938
Kilinochchi					32373	0	312	6042	38727
Kurunegala				1827	8153	0	0	14766	24746
Mannar					111389	795	1261	11762	125207
Matale	89	5314	12831	41337	15237	0	0	9207	84015
Matara		519	16686	2174	516	0	6	2076	21977
Moneragala		65	768	63558	113627	4584	0	52569	235171
Millaittivu					153769	0	463	17987	172219
Nuwara Eliya	1943	31078	3977	2649	0	0	0	3273	42920
Polonnaruwa				47266	68093	523	0	22949	138831
Puttalam					79452	814	2264	17104	99634
Ratnapura	48	15816	38194	4755	3545	0	0	4491	66849
Trincomalee				4	110491	1826	1491	17629	131441
Vavuniya					103182	0	0	16504	119686
Totals (ha)	3108	68839	141550	243877	1094289	22412	8688	463848	2046611

(Source: Legg and Jwell, 1995)

Table 4. Landuse in Sri Lanka

Land category	Specific land use	Area (ha)
Urban land		
	Built-up land	22,640
	Associated non-agricultural land	7,319
Agricultural land		
	Homesteads	781,280
	Tree & Other Perennial Crops	
	Tea	201,630
	Rubber	166,500
	Coconut	332,140
	Cinnamon	8,880
	Cashew	580
	Oil-palm	1,070
	Other perennial crops	54,740
Crop land		
	Paddy	494,460
	Sparsely used cropland	1,069,990
	Other crop land	599,110
Forestland		
	Natural Forest	
	Dense forest	1,582,700
	Open Forest	463,800
	Forest plantations	72,300
Range land		
	Scrub land	205,630
	Grass land	91,190
Wet land		
	Forested	
	Mangroves	20,150
	Non-forested	
	Marsh	42,400
Water		290,520
Barren land		77,480
Total		6,586,509

(Source: Asia-Pacific Agroforestry Profiles: Sri Lanka Profile, 1996)

Table 5. Legg and Jwell criteria for classification of Closed Forest

Category of Closed Canopy Forest	Rainfall (mm)	Elevation (meter)
Low-land rain forest	greater than 2500	less than 1000 meter
Moist monsoon forest	between 1800 to 2500	less than 1000 meter
Sub-montane forest	greater than 1800	more than 1000 meter
Dry monsoon forest	less than 1800	

(Source: Legg and Jwell, 1995)

Table 6. Changes in Forest cover between 1983 and 1992

DISTRICT	Total land Area	Total Closed Forest 1992	Total Closed Forest 1983	Change 1983-92	
	(in ha)	(in ha)	(in ha)	(in ha)	(in percent)
Ampara	450031	124908	149330	-24422	-16.4
Anuradhapura	722178	180083	191890	-11807	-6.2
Badulla	285673	26428	56720	-30292	-53.4
Batticaloa	263983	36493	44801	-8317	-18.6
Colombo	68469	1832	1490	342	23.0
2Galle	161256	19089	17980	1109	6.2
Gampaha	141890	409	1350	-941	-69.7
Hambantota	262307	24377	43250	-18874	-43.6
Jaffna	107848	1081	680	401	59.0
Kalutara	164391	20310	13860	6450	46.5
Kandy	192808	27241	29525	-2284	-7.7
Kegalle	168328	15446	12575	2871	22.8
Kilinochchi	132499	32686	102590	-69904	-68.1
Kurunegala	489787	9980	13110	-3130	-23.9
Mannar	200148	113445	107910	5535	5.1
Matale	206050	74809	66760	8049	12.1
Matara	130829	19901	16800	3101	18.5
Moneragala	576763	182601	219995	-37394	-17.0
Mullaittivu	260946	154232	100290	53942	53.8
Nuwara Eliya	174109	39646	39930	-284	-0.7
Polonnaruwa	344988	115881	161735	-45854	-28.4
Puttalam	315485	82529	77900	4629	5.9
Ratnapura	327034	62357	52645	9712	18.4
Trincomalee	267991	113812	115070	-1258	-1.1
Vavuniya	200836	103182	119800	-16619	-13.9
TOTALS	6616628	1582756	1757995	-175240	-10.0

(Source: Legg and Jwell, 1995)

Table 7. Change in forest cover of Homegardens (1992)

DISTRICT	District area (in ha)	Home garden 1983 (in ha)	Home garden 1992 (in ha)	Change 1983-1992 (in ha)	Change 1983-1992 (in %)
Ampara	450,031	17,910	16,245	-1,665	-9.3
Anuradhapura	722,178	53,600	56,143	2,543	4.7
Badulla	285,673	35,230	50,764	15,534	44.1
Batticaloa	263,983	7,510	14,359	6,849	91.2
Colombo	68,469	14,840	8,577	-6,263	-42.2
Galle and Matara	292,085	85,620	99,000	13,380	15.6
Gampaha	141,890	69,670	56,884	-12,786	-18.4
Hambantota	262,307	38,390	44,922	6,532	17.0
Kalutara	164,391	35,230	33,156	-2,074	-5.9
Kandy	192,808	37,160	61,029	23,869	64.2
Kegalle	168,328	44,270	46,782	2,512	5.7
Kurunegula	489,787	53,640	72,892	19,252	35.9
Matale	206,050	20,650	20,258	-392	-1.9
Moneragala	576,763	47,380	56,739	9,359	19.8
Nuwara Eliya	174,109	11,400	9,172	-2,228	-19.5
Polonnaruwa	344,988	23,280	36,180	12,900	55.4
Puttalam	315,848	34,480	64,747	30,267	87.8
Ratnapura	327,034	52,480	56,462	3,982	7.6
Trincomalee	267,991	18,830	14,083	-4747	-25.2
Totals	5,714,713	701,570	818,394		

(Jwell, 1995)

Table 8. Expected Changes in area under other Tree Resources in 1992

(Area in "000" ha)

Category	Year 1995	Year 2000
Rubber	193.5	188.7
Coconut	300.7	300.7
Tea	189.0	194.0
Mixed and Four Perennials	101.6	104.0
Roads with Trees*	1.5	1.7
Settlements	27.6	29.2

(* Kilometers have been converted 1 km = 0.1 ha; FSMP, 1995)

Table 9. Area of Forest Timber Plantations in 1992

(Area in hectares)

DISTRICT	Conifers	Eucalyptus	Teak	Mahogany	Total
Ampara		61	4602		4663
Anuradhapura		395	4464		4859
Badulla	3781	3876	1		7658
Batticaloa			3989		3989
Colombo	128				128
Galle	357				357
Gampaha	63			283	346
Hambantota	284	312	1504		2100
Jaffna	95				95
Kalutara	1069				1069
Kandy	3167	916			4083
Kegalle	198	48		314	560
Kilinochchi					
Kurunegela	50	413	2944	3239	6646
Mannar			119		119
Matale	874	923	1780	5	3582
Matara	890	14			904
Moneragala	67	463	4927	3	5460
Mullaittivu		40	1996		2036
Nuwara Eliya	2510	6469			8979
Polonnaruwa		1044	2649		3693
Puttalam		944	5292	211	6447
Ratnapura	3233	131	584		3948
Trincomalee		153	281		434
Vavuniya			138		138
Totals	16,766	16,202	35,270	4,055	72,293

(Legg and Jwell, 1995)

Table 10. Districtwise Area of Fuelwood Plantations

(Area in hectares)

DISTRICT	Area of Fuelwood Plantations (ha)
Ampara	443
Anuradhapura	261
Badulla	1141
Batticaloa	0
Colombo	0
Galle	65
Gampaha	0
Hambantota	2527
Jaffna – Vavuniya	181
Kalutara	0
Kandy	8
Kegalle	0
Kilinochchi	0
Kurunegula	224
Mannar	0
Matale	173
Matara	0
Moneragala	327
Mullaivivu	0
Nuwara Eliya	96
Polonnaruwa	1274
Puttalam	5289
Ratnapura	0
Trincomalee	0
Totals	12.009

(FSMP, 1995)

Table 11. Forest Plantations raised during 1993 to 1996

(Area in hectares)

DISTRICT	1993	1994	199	1996	Total
Ampara	60	137	33	50	280
Anuradhapura	150	350	350	350	1,200
Badulla	200	250	195	80	725
Batticaloa	0	0	0	0	0
Colombo	0	0	0	0	0
Galle	325	248	185	200	958
Gampaha	0	0	0	0	0
Hambantota	250	30	85	60	425
Jaffna	0	0	0	0	0
Kalutara	332	100	418	206	1,056
Kandy	400	585	568	209	1,762
Kegalle	50	100	32	20	202
Kilinochchi	0	0	0	0	0
Kurunegula	200	381	194	100	875
Mannar	0	0	0	0	0
Matale	166	265	174	283	888
Matara	0	0	0	0	0
Moneragala	282	380	75	250	987
Mullaittivu	0	0	0	0	0
Nuwara Eliya	509	338	322	187	1,356
Polonnaruwa	60	300	326	245	931
Puttalam	206	300	154	506	1,166
Ratnapura	344	320	288	350	1,302
Trincomalee	0	0	0	0	0
Vavuniya	0	0	0	0	0
Totals	3,534	4,084	3,399	3,096	14,113

(AR)

Table 12. Districtwise Area of Homegardens in 1992

DISTRICT	Home garden (in 000 ha)	Home garden (in 000 ha)
Source	(Jwell 1995)	(FSMP, 1995)
Ampara	16.2	17.9
Anuradhapura	56.1	56.1
Badulla	50.8	49.6
Batticaloa	14.3	11.4
Colombo	8.6	8.6
Galle	99.0	36.1
Gampaha	56.9	34.9
Hambantota	44.9	38.9
Jaffna	With Galle	42.3
Kalutara	33.1	31.9
Kandy	61.0	58.0
Kegalle	46.8	39.2
Kilinochchi	NA	16.6
Kurunegula	72.9	72.9
Mannar	NA	4.8
Matale	20.2	23.2
Matara	NA	46.4
Moneragala	56.7	55.1
Mullaittivu	NA	16.6
Nuwara Eliya	9.2	9.1
Polonnaruwa	36.2	34.0
Puttalam	64.7	64.7
Ratnapura	56.5	51.5
Trincomalee	14.1	18.8
Vavuniya	NA	19.9
Totals	818.2	858.5

NA = Information Not Available

Source: FSMP, 1995 and Jwell, 1995

Table 13. Districtwise Area of Rubber, Coconut and Tea Plantations in 1992

DISTRICT	Rubber in 000 ha	Coconut in 000 ha	Tea in 000 ha
Ampara		2.8	0
Anuradhapura		4.1	0
Badulla	1.5	0.6	29.3
Batticaloa	0	2.9	0
Colombo	10.9	6.7	.3
Galle	18.7	9.6	14.9
Gampaha	10.9	41.3	0
Hambantota	0.1	14.8	0.1
Jaffna	0	7.2	0
Kalutara	45.7	8.9	3.4
Kandy	3.8	6.0	58.5
Kegalle	52.7	14.8	8.8
Kilinochchi	0	0.3	0
Kurunegula	3.7	108.0	0.3
Mannar	0	0.1	0
Matale	3.8	6.7	5.9
Matara	7.6	10.4	14.7
Moneragala	1.5	3.0	0
Mullaittivu	0	1.6	0
Nuwara Eliya	0	0.6	34.1
Polonnaruwa	0	2.2	0
Puttalam	0	37.5	0
Ratnapura	35.6	9.0	19.5
Trincomalee	0	1.3	0
Vavuniya	0	0.3	0
Totals	196.5	300.7	189.8

(Source: FSMP, 1995 and Legg and Jwell, 1995)

Table 14. Stand Structure of Rubber Plantations

Age in years	Area in 000 ha	
	1995	2000
More than 25	55.7	32.2
21- 25	16.8	20.0
16-20	20.0	38.6
11-15	38.6	34.4
6-10	34.4	28.0
Less than 6	28.0	35.5
Total	193.5	188.7
Annual felling level	8.0	8.1

(Source: FSMP, 1995)

Table 15. Area of New Planting and Replanting of Rubber

(Area in hectares)

Year	New Planting	Re-Planting
1970	112	4,144
1975	155	3,229
1980	977	5,434
1985	2,723	6,514
1990	1,297	5,202
1995	829	3,239
1996	1,297	3,443
1997	751	1,033

(Source: FSMP 1995 and AR, 1997)

Table 16. Stand Structure of Coconut Plantations

Age in years	Area in 000 ha	
	1995	2000
More than 70	38.8	23.2
50-70	87.5	94.6
30-50	115.8	99.2
10-30	49.6	41.7
Less than 10	9.0	42.0
Total	300.7	300.7
Annual felling level	7.0	8.0

(Source: FSMP, 1995)

Table 17. Replanting and New Planting of Coconut (CCB Schemes)

(Area in hectares)

Planting	1995	1996	1997
Replanting	986	578	1,221
New Planting	1,250	841	931

(AR, 1997)

Table 18. Area under Tea Sector

Year	Area in “000” hectares
1995	189
1996	189
1997	194

(AR, 1997)

Table 19. Area of Tree Resources under Other Categories

(Area in “000” ha)

Category	Year 1995	Year 2000
Mixed and Four Perennials	101.6	104.1
Roads with Trees*	1.54	1.7
Settlements	27.6	29.2

(* Kilometers have been converted 1 km = 0.1 ha. Source: FSMP, 1995)

Table 20. Total Estimated Accessible Wood Supply from Trees Outside Forest

(in 000 cubic meters of round wood))

Wood	Tree Resource	Wood Availability		
		1992	1995	2000
Peeler Logs	Rubber	1	1	1
	Sub Total	1	1	1
Saw Logs	Home gardens	515	551	570
	Rubber Plantation	250	252	255
	Coconut and Palmyra Plantation	157	168	202
	Trees on Tea Garden	76	76	76
	Other Perennials	65	66	69
	Roadside and Settlements	5	5	5
	Sub Total	1,068	1118	1177
Poles	Homegardens	730	786	813
	Other Perennial	45	46	48
	Sub Total	775	832	861
TOTAL	Total	1,844	1,951	2,039

(Source: FSMP, 1995)

Table 21. Total Accessible Production

Products	Source	Unit	Year 1995	Year 2000	Year 2005	Year 2010
Industrial and Sawn Wood	Natural Forest	000 M ³	9.2	8.6	8.0	7.4
	Forest Plant.	000 M ³	78.8	182.3	290.6	443.8
	Outside Forest	000 M ³	1368.2	1435.9	1525.1	1574.6
	Total	000 M³	1456.2	1626.8	1823.7	2025.8
Bio-fuel	Natural Forest	000 tonne	664.3	621.6	582.8	546.6
	Forest Plant.	000 tonne	372.0	264.0	192.4	279.1
	Outside Forest	000 tonne	8834.6	8993.6	9158.9	9331.0
	Total	000 tonne	9870.9	9879.2	9934.1	10156.7

(FSMP, 1995)

Table 22. Number of Species And Levels of Endemism and Threat

Group	Species			Endemic Species		
	Total	Threatened Species		No.	Threatened Endemic species	
		National Criteria	Global Criteria		National Criteria	Global Criteria
Pteridophyte	314	90(29%)	36(11%)	57(18%)	30(53%)	35(61%)
Gymnosperms	1	1(100%)	0(0%)	0(0%)	0(0%)	0(0%)
Angiosperms	3,368	487(14%)	413(12%)	879(26%)	227(26%)	399(45%)
Butterflies	>242	81(33%)	3(1%)	14(6%)	11(79%)	3(21%)
Spiders	>400	14(4%)	0(0%)	0(0%)	0(0%)	0(0%)
Land molluscs	266	152(57%)	0(0%)	201(76%)	152(76%)	0(0%)
Freshwater fishes	65	30(46%)	19(29%)	29(45%)	28(97%)	19(66%)
Amphibians	48	29(60%)	0(0%)	29(60%)	29(100%)	0(0%)
Reptiles	162	113(70%)	9(6%)	79(49%)	78(99%)	1(1%)
Birds	419	56(13%)	8(2%)	24(6%)	17(71%)	6(25%)
Mammals	89	39(44%)	9(10%)	12(13%)	11(92%)	0(0%)

(FSMP, 1995)

Table 23. Forest areas studied under NCR

District	Number of forests studied	Total forest area in ha.	Floristic diversity				Faunal diversity
			Spp	Gen	Fam	End.	Spp
Matara	17	12539	418	447	252	198	426
Galle	19	36130	420	261	266	205	426
Kalutara	11	18782	399	257	260	194	402
Ratnapura	36	40640	628	332	338	266	555

(Spp= Species, Gen= Genus, Fam = Family, End = Endemism; FAMP, 1995)

Table 24. Diversity in Galle, Matara, Kalutara, and Rathnapura Districts

Selected group	No. of species recorded in rain/moist monsoon forest				
	No. of species in group	Total	Rare	Endemic	Rare endemic
Woody plants	1,496	619(41%)	119(8%)	299(20%)	49(3%)
Butterflies	>242	50(21%)	14(6%)	2(1%)	0(0%)
Molluscs	266	>27(10%)	9(3%)	22(8%)	6(2%)
Freshwater fishes	65	21(32%)	10(15%)	13(20%)	3(5%)
Amphibians	48	27(56%)	8(17%)	14(29%)	3(6%)
Reptiles	162	44(27%)	13(8%)	22(14%)	5(3%)
Birds	419	109(26%)	22(5%)	19(5%)	1(+%)
Mammals	89	25(28%)	5(6%)	3(3%)	0(0%)

(Source: FSMP, 1995)

Table 25. Floral and Faunal Diversity and Hydrological importance of Forests

Forest	Floristic Diversity			Faunal Diversity			Hydrology		
	New Sp.	Prot. Sp.	N.P. Sp.	Tot Sp.	End Sp.	Thr. Sp.	Ero. Rnk.	Hyd. Rnk.	Fi. Rnk.
Sinharaja	337	337	141	106	40	38	84	7	18
Kanneliya	27	415	63	64	26	18	97	13	33
Gilimale-Eratna	51	388	90	103	47	34	65	23	14
Kalugala	14	49	49	68	30	25	97	44	54
Massenna	13	442	36	44	18	16	5	104	30
Bambarabotuwa	11	453	25	86	28	20	81	35	40
Dellawa	8	461	17	82	27	26	26	14	4
Nahiti Mukulana	5	466	12	63	20	17	155	153	174
Oliyagankele	4	470	8	0	8	5	182	251	238
Velihena	3	473	5	24	4	4	181	224	227
Delwala	2	475	3	55	27	21	63	50	37
Kombala-Kottawa	2	477	1	57	23	19	187	131	178
Kekanadura	1	478	0	20	8	5	228	251	263
Viharakele	0	478	0	28	10	9	180	203	217
Kandewattegoda	0	478	0	26	8	3	155	228	216

(Source: FSMP, 1995)

Table 26. Additional Proposed Forests Areas for Conservation of Biodiversity

Forest	Floristic Diversity			Faunal Diversity			Hydrology		
	New Sp.	Prot. Sp.	N.P. Sp.	Tot. Sp.	End Sp.	Thr. Sp.	Ero. Rnk.	Hyd. Rnk.	Fl. Rnk.
Morapitiya-R'kanda	248	248	269	81	28	24	50	31	35
Handapan Ella	72	320	197	57	21	16	58	10	11
Rammalakanda	54	374	143	72	26	23	9	105	38
Naklyndenlya	37	411	106	60	22	17	117	26	59
Walawe Basin	18	429	88	46	13	11	34	24	7
Kalubowitiyana	14	443	74	40	14	9	1	93	19
Kiribatgala	13	456	61	52	19	19	96	164	139
Ingiriya	10	466	51	43	13	8	168	173	192
Haycock	9	475	42	43	20	14	15	160	72
Morahela	8	483	34	62	24	19	54	54	29
Ranwaragalakanda	7	490	27	37	7	3	98	134	186
Kurulugala	7	497	20	28	12	8	93	147	115
Diyadawa	5	502	15	88	22	20	16	15	3
Gongala	5	507	10	38	17	11	70	34	25
Yagirala	4	511	6	39	12	7	141	98	114
Silverkanda	3	514	3	31	12	10	43	94	49
Tiboruwakota	3	517	0	33	14	10	12	120	46

(Source: FSMP, 1995)

Table 27. Initiatives for Conservation of Biodiversity in the Forest Areas

Year	Indicator	Provision for Biodiversity Conservation
1848	Timber Ordinance No.24	Reservation of forests, largely for timber production.
1873		Hooker advocates protection of natural forests above 5000 feet as climatic reserves.
1885	Forest Ordinance No. 10	Protection of forests and their products in reserved forest and villages forests, primarily for sustained production; also, protection of wildlife in sanctuaries.
1907	Forest Ordinance No 16	Protection of forests and their products in reserved forests and village forests, primarily to provide for controlled exploitation of timber.
1929	First authoritative forest policy statement	Preservation of indigenous flora and fauna.
1938	Amended	Clearing of forests prohibited above 5000 feet Plantations to be converted to indigenous species.
1937	Fauna and Flora Protection Ordinance No.2	Protection of wildlife in national reserves and sanctuaries (comprising both crown and private land).
	Amendment Act No.44 in 1964	Nature reserve and jungle corridor incorporated as categories of national reserve.
	Amendment Act No.1 in 1970	Intermediate zone to provide for controlled hunting, was removed from ordinance.
	Amendment Act No. 49 in 1993	Refuge marine reserve and buffer zone as additional categories of national reserve.
	1953 National Forest Policy. Re-stated in 1972 and 1980	For conserving forests to preserve and ameliorate the environment, and to protect flora and fauna.
	1969 UNESCO Biological Programme and 1975 UNESCO Man and Biosphere Programme	Arboreta representative of the main bio-climatic zones established and demarcated in forest and reserves.
1982	Mahaweli Environmental Project	Network of protected areas established to mitigate impact of Mahaweli Development Project on wildlife and to protect catchments of Mahaweli Ganga.
1988	National Heritage Wilderness Area Act No.3	Protection of state land having unique ecosystem, genetic resources, or outstanding natural features.
1990	National Policy for Wildlife Conservation	For maintenance of ecological processes and preservation of genetic diversity; ex-situ conservation recognized as important for threatened species.
1990	Forestry Sector Development Programme	Logging of forests banned in wet zone, pending review of their watershed and biodiversity conservation roles.
1995	National Forest Policy	Priority given to biodiversity conservation

(Source: FSMP, 1995)

Table 28. Sites designated for conservation under international initiatives

International initiative	Protected area	Year	Area (ha)
Ramsar Wetland Conservation	Bundala S	1990	6,216
UNESCO MAB Programme	Hurulu FR Sinharaja FR/PR	1977 1978	524 8,864
World Heritage Convention	Sinharaja NHWA	1988	11,187

(Source: FSMP, 1995)

Table 29. Extent of designated areas administrated by FD and DWLC

National Designation	Number, Area (in hectare) and proportion of total land area %		
	No.	Area as declared and proportion in bracket	Area as in 1994 and proportion in bracket
Forestry Department			
Forest reserve	177	518,199 (7.8%)	466,335(7.1%)
Proposed reserve	217	621,147 / (9.4%)	589,388(8.9%)
National Heritage			
Wilderness area	1	11,187 / (0.2%)	11,187(0.2%)
Total with FD	395	1,150,533(17.4%)	1,066,910(16.1%)
DWLC			
Jungle Corridor*	1	10,360(0.2%)	10,360(0.2%)
National Park	12	462,448(7.0%)	462,448(7.0%)
Nature Reserve	3	33,372(0.5%)	33,372(0.5%)
Sanctuary	52	284,117(4.3%)	284,117(4.3%)
Strict Natural			
Reserve	3	31,574(0.5%)	31,574(0.55%)
Total with DWLC	71	821,871(12.4%)	821,871(12.4%)

(* not in existence since in 1995, FSMP, 1995)

Table 30. Distribution of Population by Districts

District	(Population in "000" Persons)										
	1981	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997*
1. Colombo	1,698	1,891	1,915	1,935	1,965	1,994	2,026	2,062	2,095	2,128	2,164
2. Gampaha	1,389	1,494	1,506	1,518	1,532	1,543	1,555	1,568	1,582	1,595	1,608
3. Kalutara	827	914	925	934	945	952	961	969	979	988	997
4. Galle	815	910	922	932	946	958	971	983	996	1,007	1,019
5. Matara	644	744	757	765	776	786	797	810	822	832	842
6. Ham6.bantota	424	494	502	510	517	524	531	537	544	549	554
7. Badulla	643	689	698	701	718	716	724	735	748	756	770
8. Moneragala	280	334	340	344	351	356	361	367	374	379	384
9. Kandy	1,126	1,214	1,227	1,236	1,258	1,257	1,269	1,286	1,306	1,319	1,340
10. Matale	357	405	410	414	421	423	429	434	440	445	451
11. Nuwara Eliya	522	525	531	530	541	533	535	541	550	552	561
12. Kegalle	682	733	739	743	751	752	758	763	770	773	778
13. Ratnapura	796	899	913	923	941	948	960	972	984	994	1,006
14. Kurunegala	1,212	1,373	1,391	1,410	1,428	1,445	1,462	1,481	1,499	1,513	1,528
15. Puttalam	493	571	580	589	598	607	617	626	636	645	655
16. Ampara	389	461	470	474	482	492	501	512	522	531	540
17. Batticaloa	331	393	401	409	417	425	433	443	452	461	471
18. Trincomalee	257	302	307	311	315	319	323	327	331	336	343
19. Anuradhapura	588	682	694	705	716	728	741	750	763	772	783
20. Polonnaruwa	263	304	310	314	319	325	329	336	340	344	347
21. Jaffna	831	844	856	863	871	875	879	896	905	911	916
22. Kilinochchi	-	99	101	99	101	104	107	110	112	115	119
23. Mannar	107	124	127	129	132	134	137	140	141	143	144
24. Mulativu	78	90	91	91	92	94	96	98	100	103	106
25. Vavuniya	96	110	112	114	114	115	117	119	121	124	126
Total	14,848	16,599	16,825	16,993	17,247	17,405	17,619	17,865	18,112	18,315	18,552

(* = Provisional Figures, AR, 1997)

Table 31. Livestock population (in million)

Animal	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Neat cattle	1.8199	1.7727	1.4768	1.6038	1.704	1.7025	1.704	1.644	1.5788	1.599
Buffaloe	0.967	0.9581	0.825	0.8966	0.794	0.7911	0.764	0.761	0.7258	0.721
Sheep	0.0298	0.026	0.0203	0.0222	0.02	0.0202	0.019	0.011	0.0106	0.012
Goat	0.5183	0.5217	0.46	0.5283	0.583	0.5878	0.591	0.535	0.5207	0.519
Pig (swine)	0.0944	0.085	0.0835	0.0912	0.09	0.0938	0.087	0.085	0.0803	0.076

Source: Department of Census and Statistics, Sri Lanka

Table 32. Literacy and Education Levels

	1953	1963	1973	1978	1981	1986	1996
Literacy (%)	NA	82.2	80.8	86.2	85.4	88.6	92.1
Secondary and higher level (%)	11.6	24.1	29.9	36.7	37.1	47.1	56.0

Source: Department of Census and Statistics, Sri Lanka

Table 33. Percentage Contribution by different sectors to GDP

Sectors	1993	1994	1995	1996	1997
Agriculture etc.	22	21.5	21	19.4	18.8
Mining and quarrying	1	1.1	1.1	1.2	1.2
Manufacturing	20	20.6	21	21.6	22.4
Electricity, gas and water	2	2.1	2.2	2.1	2
Construction	7.2	7.3	7.5	7.5	7.5
Trade and hotels	21.7	21.8	21.6	21.9	21.9
Transport	9.8	9.7	9.5	9.7	9.7
Banking	5.1	5.2	5.5	5.8	5.9
Ownership and dwellings	0.9	0.8	0.8	0.8	0.7
Services	10.3	10	9.8	10	9.9
Total	100	100	100	100	100

Source: Department of Census and Statistics, Sri Lanka

Table 34. Percentage Contribution to GDP within Agriculture Sector

Sectors	1993	1994	1995	1996	1997
Livestock	4.1	4	3.9	4.1	3.9
Forestry	4.1	3.7	3.7	3.8	3.8
Fisheries	9.2	9.1	9.2	9.2	9.4
Agriculture crops "sub sector"	82.6	83.2	83.3	82.9	82.9
Total Agriculture Sector	100	100	100	100	100

Source: Department of Census and Statistics, Sri Lanka

Table 35. Percentage Contribution of Different Agriculture Crops to GDP

Crops	1993	1994	1995	1996	1997
Tea	12.7	12.8	12.6	13.8	14.4
Rubber	2	1.9	1.9	2.1	1.9
Coconut	6.5	7.6	7.7	7.5	7.5
Minor export crops	4.3	4.2	4.1	4.3	3.7
Paddy	19.2	19.4	19.7	15	15.9
Other food crops	30.6	29.8	29.8	32.1	31.2
Tobacco	0.4	0.4	0.4	0.4	0.4
Betel and areca nuts	1.3	1.2	1.2	1.3	1.2
Other agricultural products	1.8	2	2.2	2.2	2.4
Plantation development	3.8	3.8	3.7	4.2	4.3
Total Agriculture sub-sector	82.6	83.1	83.3	82.9	82.9

Source: Department of Census and Statistics, Sri Lanka

Table 36. Per capita Consumption of Fuelwood

Study	Year	Daily Consumption (Kg/person)
Natural Resources, Energy and Science Authority "NARESA" (Wijesinghe, 1983)	1981-1983	1.36
Forestry Master Plan	1985	1.56
Consumer finance and Socio-Economic survey	1987	1.48
Forestry Sector Master Plan	1993	1.35

(Source: FSMP, 1995)

Table 37. Total Consumption of Bio-energy by Household sector

Year	Total population (millions)	% using fuelwood	Consumption per capita (kg/day)	Total consumption (million tonne)
1993	17.69	93.8	1.35	8.15
1994	17.90	93.6	1.34	8.21
1995	18.10	93.4	1.34	8.26
2000	19.09	92.3	1.32	8.48
2005	20.06	90.8	1.30	8.63
2010	21.02	89.3	1.28	8.76
2015	21.86	87.8	1.26	8.83
2020	22.57	86.3	1.24	8.82

(FSMP, 1995)

Table 38. Industrial Consumption of fuelwood

Sub Sector	Fuelwood Consumption (1000 tonne)
Tea	455 (43.2%)
Hotels and Eating Houses	164 (15.6%)
Brick and Tiles	150 (14.2%)
Coconut	51 (4.8%)
Bakeries	99 (9%)
Rubber	72 (6.8%)
Tobacco	13 (1.2%)
Others	49 (4.7%)

(FSMP, 1995)

Table 39. Requirements for Bio-fuel in Industrial and Commercial Sector

(in million tonnes)

Year	Projected fuelwood requirements								
	Tea	Hotels etc.	Brick & tile	Coconut	Bakery	Rubber	Tobacco	Others	Total
1993	410	177	150	50	99	72	13	49	1.02
1994	408	174	150	48	99	72	12	49	1.02
1995	406	170	150	42	99	72	12	49	1.00
2000	396	153	150	40	99	72	9.5	49	0.97
2005	386	133	150	33	99	72	9.5	49	0.93
2010	376	119	150	26	99	72	9.5	49	0.90
2015	367	118	150	19	99	72	9.5	49	0.88
2020	358	115	150	12	99	72	9.5	49	0.82

(Source: FSMP, 1995)

Table 40. Demand and Production of biomass at national and district level

(in '000 tonnes)

District	1995			2020		
	Demand	Supply	Balance	Demand	Supply	Balance
Ampara	221	397	176	253	406	170
Anuradhapura	385	423	37	411	423	13
Badulla	515	487	(28)	530	502	(27)
Batticaloa	190	301	111	202	333	131
Colombo	844	151	(694)	874	152	(722)
Galle	491	452	(39)	512	467	(45)
Gampaha	759	499	(260)	801	500	(301)
Hambantota	253	421	169	268	432	164
Jaffna	406	205	(201)	431	220	(211)
Kalutara	489	481	(7)	515	486	(28)
Kandy	656	657	1	691	692	1
Kegalle	444	544	100	463	544	82
Killinochchi	47	82	35	50	89	39
Kurunegala	729	1,298	569	772	1,292	520
Mannar	68	89	21	72	91	19
Matale	214	283	69	227	289	62
Matara	434	392	(42)	460	415	(45)
Moneragala	184	399	215	196	413	217
Mullaittivu	46	142	96	49	145	96
Nuwara Eliya	579	292	(286)	585	290	(296)
Polonnaruwa	173	320	147	184	340	156
Puttalam	373	674	301	390	677	287
Ratnapura	557	593	36	576	609	33
Trincomalee	146	173	27	155	177	21
Vavuniya	57	119	62	61	124	63
Total	9,260	9,872	612	9,709	10,109	401

(FSMP, 1995)

Table 41. Supply of Bio-fuel by different Sources

Source	Unit	1995	2000	2005	2010
Natural Forest	000 tonne	664.3	621.6	582.8	546.6
Forest Plant.	000 tonne	372.0	264.0	192.4	279.1
Outside Forest	000 tonne	8834.6	8993.6	9158.9	9331.0
Total	000 tonne	9870.9	9879.2	9934.1	10156.7

(Source: FSMP, 1995)

Table 42. Total Supply of Fuelwood from Alternative Sources

(in percentage)

Study	Rubber wood	Crop Residues	Other Fuel Wood
1986-1987 Consumer Survey	17%	22%	52%
1983 NARESA	18%	29%	53%
1993 FSMP	15%	33%	52%

(Source: FSMP, 1995)

Table 43. Requirement of Wood and Bio-fuel

Product	Unit	1995	2000	2005	2010	2015	2020
Sawn wood	000 m ³	567	624	688	753	820	885
Plywood	000 m ³	30	34	39	45	52	59
Other panels	000 m ³	5	7	10	13	18	23
Fibre for Paper	000 t	30	30	30	30	30	30
Paper	000 tonne	145	182	223	272	333	407
Pulpwood	000 tonne	9	9	9	0	0	0
Poles (wooden)	000 m ³	390	411	432	453	471	486
Poles (bamboo)	000 m ³	77	81	85	85	85	85
Bio-fuel (household)	000 tonne	8,260	8,480	8,630	8,760	8,830	8,820
Bio-fuel (industrial)	000 tonne	1000	970	930	900	880	820

(Source: FSMP, 1995)

Table 44. Total Accessible Production

Products	Source	Unit	Year 1995	Year 2000	Year 2005	Year 2010
Industrial and Sawn Wood	Natural Forest	000 M ³	9.2	8.6	8.0	7.4
	Forest Plant.	000 M ³	78.8	182.3	290.6	443.8
	Outside Forest	000 M ³	1368.2	1435.9	1525.1	1574.6
	Total	000 M³	1456.2	1626.8	1823.7	2025.8
Bio-fuel	Natural Forest	000 tonne	664.3	621.6	582.8	546.6
	Forest Plant.	000 tonne	372.0	264.0	192.4	279.1
	Outside Forest	000 tonne	8834.6	8993.6	9158.9	9331.0
	Total	000 tonne	9870.9	9879.2	9934.1	10156.7

(FSMP, 1995)

Table 45. Consumption, Production and Import Scenario for Wood

Product			Year			
			1995	2000	2005	2010
	Unit					
Sawnwood	Consumption	Million M ³	0.567	0.626	0.688	0.753
	Production	Million M ³	0.539	0.563	0.585	0.640
	Imports	Million M ³	0.028	0.063	0.103	0.113
Plywood and Other wood Based panels	Consumption	Million M ³	0.035	0.041	0.049	0.058
	Production	Million M ³	0.005	0.005	0.005	0.005
	Imports	Million M ³	0.030	0.036	0.044	0.053
Paper	Consumption	Million tonne	0.145	0.182	0.223	0.272
	Production	Million tonne	0.029	0.029	0.029	0.029
	Imports	Million tonne	0.116	0.153	0.194	0.243
Fibre for Paper Making	Consumption	Million tonne	0.030	0.030	0.030	0.030
	Production	Million tonne	0.021	0.21	0.021	0.015
	Imports	Million tonne	0.009	0.009	0.009	0.015

(Source: FSMP, 1995)

Table 46. Production from Tree Resources within Forest Areas

Products	Source	Unit	Year 1995	Year 2000	Year 2005	Year 2010
Industrial and Sawn Wood	Natural Forest	000 M ³	9.2	8.6	8.0	7.4
	Forest Plant.	000 M ³	78.8	182.3	290.6	443.8
	TOTAL		88.0	190.9	298.6	451.2

(Source: FSMP, 1995)

Table 47. Total Estimated Production from Trees Outside Forest

(in 000 cubic meters)

Wood	Tree Resource	Wood Availability	
		1992	2000
Peeler Logs	Rubber	1	1
	Sub Total	1	1
Saw Logs	Home gardens	551	570
	Rubber Plantation	333	337
	Coconut and Palmyra Plantation	208	237
	Trees on Tea Garden	76	76
	Other Perennial	66	69
	Roadside and Settlements	5	5
	Sub Total	1239	1294
Poles	Homegardens	786	813
	Other Perennial	46	48
	Sub Total	832	861
TOTAL	Total	2072	2156

(Source: FSMP, 1995)

Table 48. Total Estimated Accessible Wood Supply from Trees Outside Forest

(in 000 cubic meters of round wood))

Wood	Tree Resource	Wood Availability		
		1992	1995	2000
Peeler Logs				
	Rubber	1	1	1
	Sub Total	1	1	1
Saw Logs				
	Home gardens	515	551	570
	Rubber Plantation	250	252	255
	Coconut and Palmyra Plantation	157	168	202
	Trees on Tea Garden	76	76	76
	Other Perennials	65	66	69
	Roadside and Settlements	5	5	5
	Sub Total	1,068	1118	1177
Poles				
	Homegardens	730	786	813
	Other Perennial	45	46	48
	Sub Total	775	832	861
TOTAL	Total	1,844	1,951	2,039

(Source: FSMP, 1995)

Table 49. Potential Production from Home gardens

Wood	Production in 000 cubic meters	
	1992	2000
Saw logs	551	570
Poles	786	813
	1,337	1,383

(Source: FSMP, 1995)

Table 50. Potential Production of Wood Fibre from Rubber Plantations

Wood	Unit	Potential		Availability (%)		Production	
		1995	2000	1995	2000	1995	2000
Peeler log	000 cub. Meter	1.9	1.9	64	64	1.2	1.2
Saw log	000 cub. Meter	520	526	64	64	333	337
Fuelwood	000 cub. Meter	1,016	1,208	95	95	965	977

(Source: FSMP, 1995)

Table 51. Potential Production in 1995 and 2000 from Coconut Plantation

Wood	Unit	Potential		Availability (%)		Production	
		1995	2000	1995	2000	1995	2000
Saw logs	000 cub. meter	346	395	60	60	208	237
Fuelwood	000 cub. meter	361	412	85	85	307	351
Biomass	000 tonne	2014	1833	80	80	1611	1467

(Source: FSMP, 1995)

Table 52. Per hectare Production from Other Tree Resources

Wood	Tree Resource	Production in cubic meters
		1995
Saw logs		
	Trees on Tea land	0.4 /ha
	Other perennials	0.69/ha
	Roadsides	0.13/km
	Settlements	0.1/ha
Poles		
	Other perennials	0.48/ha

(Source: FSMP, 1995)

Table 53. Estimated Accessible Wood Supply from Other Trees Outside Forest

(in 000 cubic meters of round wood))

Wood	Tree Resource	Wood Availability		
		1992	1995	2000
Saw Logs				
	Trees on Tea Garden	76	76	76
	Other Perennials	65	66	69
	Roadside and Settlements	5	5	5
	Sub Total	146	147	150
Poles	Other Perennial	45	46	48
	Sub Total	45	46	48
TOTAL	Total	191	193	198

(Source: FSMP, 1995)

Table 54. Value of Medicinal Herbs collected per family

Name of the Forests	Value in Rs. Per family per year
Delwala	255.50
Kekunadura	112.00
Dellawa	15.00
Kalugala	423.50
Kottawa Kohomba	358.80
Welihena	153.00
Wiharakele	848.00
Oligankele	104.00
Kandewattegoda	19.00
Nahitiya Madampe	136.00
Knuckles	2,500.00

(Socio-Economic Survey, IUCN, 1995) and CR, 1997)

Table 55. Imports and Exports of Medicinal Plants

(In Million Rs)

Year	Imports	Exports
1990	0.76	7.87
1991	0.20	6.29
1992	34.83	32.11
1993	42.31	101.31

(Socio-Economic Survey, IUCN, 1995)

Table 56. Regional distribution of various rattan species, and average diameter

Species	Diameter	Distribution
Thambotu wel (<i>Calamus zeylanicus</i>)	2.5 cm	Wet zone
Thuda rena, sudu wewel (<i>Calamus ovoideus</i>)	2.5 cm	Wet zone
Ma wewel, wanduru wel, periya pirambu (<i>Calamus thwaitesii</i>)	3.5 cm	Wet and intermediate zones (dry zone in Ritigala)
Heen wewel, kola hangala (<i>Calamus pseudotenuis</i>)	1.5 cm	Wet zone
Kaha wewel, ela wewel (<i>Calamus rivalis</i>)	1.5 cm	Intermediate and wet zones
Narawel (<i>Calamus delicatulus</i>)	1.0 cm	Wet zone
Wewel, heen wewel, Polonnaru wel, pirambu (<i>Calamus rotang</i>)	1.0 cm	Dry zone
Kukulu wel (<i>Calamus digitalis</i> , <i>C. radiatus</i> , <i>C. Pachystemonus</i>)	0.5 cm	Wet zone

(FSMP, 1995)

Table 57. Distribution of Bamboo species, and their average diameter

Species	Diameter	Distribution
Bata (<i>O.stridula</i>)	1-2.5 cm	Found extensively in wet zone lowlands, growing naturally
Bata (<i>Davidsea attenuata</i>)	1-2.5 cm	Wet and intermediate zone mountains, growing naturally
Una bambu, Kaha una, Kola una (<i>Bambusa vulgaris</i>)	5-10 cm	Wet zone lowlands, widely cultivated
Yodha bambu (<i>Dendrocalamus giganteus</i>)	10-35 cm	Wet zone mountains, cultivated on a small scale

(FSMP, 1995)

Table 58. Value of Kitul products from Wet Zone Forest Areas

Name of forest	Income (Rs per hectare)
Dellawa	9,260
Erathna-Gilimale	15,749
Kalugala	2,399
Bambarabotuwa	13,741
Delwala	17,762
Nahitiya /Madampe	7,410

(CR, 1997)

Table 59. Value of Collectable Edible Plants

Name of the forests	Value (Rs. Per Annum)
Oliyagankele	595
Dellawa	888
Nahitiya/Madampe	223
Delwala	3360
Kottawa Kombala	2,116
Welihena	2,240
Viharakele	2,204
Kandewattegoda	985
Kekunadura	226
Kalugala	448

(CR, 1997)

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