FORESTS AND THE ENVIRONMENT

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The vegetation cover of the earth or the biosphere constitutes its green mantle. The autotrophic components of this mantle absorb photosynthetically active radiations and transform light energy into chemical energy for organic syntheses. This primary productivity sustains all biological species and processes on the planet earth. Photosynthesis is essential for life as we know it. Besides producing food, plants maintain the balance of oxygen and carbon dioxide in the atmosphere. Forests and other plant communities sustain many interrelated life supporting ecological processes. Man has brought about many changes in natural eco-systems. Many of these changes have resulted in environmental degradation making large areas unsuitable for crop production and human habitation. Many studies and international reports, especially the 1972 United Nations Conference on the Human Environment held in Stockholm highlight these problems. Adverse consequences to the environment have largely resulted from intensified agricultural operations (monoculture, mechanized tilling, chemical fertilizer, pesticides etc.) industrialization and urbanization. Economic development is closely interlocked with environmental protection. The human environment has greatly deteriorated both in developed and developing countries. Soil erosion, floods, droughts, salinisation of arable lands, pollution of inland and inshore waters, build up of pests

and diseases, acid rain etc., are some of the major environmental problems faced by all nations. These problems transgress national boundaries. They have greatly reduced the productivity of land and water bodies (agriculture, forestry and fisheries) bringing about great economic losses and social distress. The ecological approach to sustainable development and protection of the environment is a scientific and holistic way of meeting many of the environmental issues confronting us.

Large scale denudation of forests spread over two centuries have given rise to large areas of unproductive degraded lands in the low country wet zone and the hill country of Sri Lanka. Accelerated hydro-power and agricultural development schemes over the past three decades have resulted in further clearing and dwindling of our forest cover. Accelerated economic development has resulted in rapid depletion of our natural resources, widespread environmental degradation, ecological damage and other problems. We will examine the biological features and ecological importance of three of the major natural forest types of Sri Lanka and discuss the importance of conserving adequate areas of these forest eco-systems.

Vegetation cover may be broadly grouped into natural, semi-natural and man-made formations. These plant formations or communities are in a state of dynamic change and are influenced by environmental parameters and human interference. Eco-systems are broadly grouped into

(1) Marine and Maritime Eco-systems

(2) Fresh water and Marsh Eco-systems and

(3) Terrestrial Eco-systems.

The terrestrial eco-systems comprise mainly of forests, savannas and grasslands. Forest plantations and agricultural eco-systems are man-made eco-systems. Time will permit us to examine only three of the major and ecologically interesting natural forest eco-systems of Sri Lanka. I will describe the tropical lowland rainforests and the montane cloud forests of the wet zone of Sri Lanka.

Size, Relief and Climate of Sri Lanka

Sri Lanka is a moderate sized (area = 65, 610 km^2), tropical island situated at the south eastern tip of peninsular India between longitudes E 79° and 81° 53', and latitudes N 5° 54' and ± 52'. The continental shelf surrounding the island is continuous with that of the Indian mainland and is separated from southern India by the shallow Palk Strait and Gulf of Mannar (Sethu Samudra).

As regards relief, the island can be subdivided into three peneplains with average altitudes of 30 m - 1800 m (upcountry and montane zone). The second and third peneplains form the south centrally situated highlands (Central Highlands) of Sri Lanka. This mountainous terrain of Sri Lanka comprises of the Central Massif (west-Adams Peak;

centre-Pidurutalagala - 2524 m; east-Namunukula), the North Eastern Knuckles Range and the South Western Rakwana - Deniyaya Hills (Gongala).

Climatologists (Domros, 1976) usually divide Sri Lanka into two major zones called the wet zone (southwestern region) and the dry zone (rest of the island). Floristic and agro-ecological features recognize the occurrence of an intermediate zone and two separated semi arid zones in the North Western (Mannar) and the South Eastern (Hambantota) parts of the island.

Mean annual temperatures are around 27°C at sea level and around 15°C at elevations of about 1900 m. Relative humidity ranges from 80-85% and tends to be generally high throughout the year.

Forests of Sri Lanka

The early classification of the forests of Sri Lanka were based on those of Burt-Day, Champion and Seth, Chapman, De Rosayro and Holmes. Using Whitmore's updated terminology, the existing natural forest types of Sri Lanka can be classified as follows:

(1) Lowland wet evergreen rain forests
(2) Mid-elevational or submontane rain forests
(3) Montane evergreen rain forest or cloud forests
(4) Intermediate zone semi-evergreen forests
(5) Seasonally dry mixed deciduous evergreen forests or monsoon forests.
(6) Thorn scrub formations or scrub jungle
(7) Edaphically influenced mangrove forests or Mangal Communities
(8) Anthropogenically influenced fire Savannas (Aralu, Bulu, Nelli, Kelle).

Lowland wet evergreen forests or the rain forests of Sri Lanka

The lowland wetzone of Sri Lanka is situated in the southwestern part comprising the Western, Sabaragamuwa and parts of the Southern and Central Provinces of Sri Lanka. This zone is characterised by high annual precipitation ranging from 2500mm to 5500mm with heavy rains during May to August and also during October to December. It is described as a hot, humid, everwet climate and the area once supported large extents of tropical evergreen forests from sea level upto 1000m. These forests were cleared for rubber plantations and human settlements during the past two hundred years.

The lowland tropical wet evergreen forests of Sri Lanka

The hot humid everwet equatorial lowland climate of the tropics favour the development of luxuriant species rich forest ecosystems, called evergreen rain forests. Tropical lowland evergreen rain forests are found mostly in the Amazonian and Orinoco basins of Brazil and Venezuela; the Congo basin of tropical Africa and Indo-Malayan realm. In Sri Lanka and many of the wet countries of the Malayan Archipelago, tree species belonging to the family Dipterocarpaceae (Hora or Dun family) dominate the lowland rain forests. As such, these lowland rain forests are called the mixed dipterocarp forests. In Sri Lanka foresters usually call these forests Na-Dun forests.

Some of the characteristic features of lowland wet evergreen rain forests

Seventy percent or more of the individuals occurring in a rain forest are woody species. The trees reach a height of about 30-45m and

some emergent trees may be as tall as 60m. Three storeys are usually recognisable in a rain forest; an upper canopy layer, a sub-canopy layer and an understorey of young trees (pole-trees) treelets and shrubs. The lowland rain forest is multi-storeyed The ground layer or the herb layer is very poor in species except along streams and within 'gaps' or in clearings. Some species reach the canopy by climbing on trees. Many of these climbers are woody vines or lianas. Besides trees, treelets, shrubs and lianas, there are many epiphytes and epiphyllous mosses and liverworts in rain forests. Heterotrophic flowering plants (saprophytes or parasites), hemiparasitic mistletoes and a variety of wood and litter decomposing fungi, microbes and mesofauna are found in rain forests. Though many of these different life forms are present in a rain forest they are not so conspicuous as the trees, lianas and epiphytes.

The trees of the lowland rain forests are tall and have a clean bole. Branching begins high up in the crown and when viewed from above appear to have spherical crowns. Trees of various diameter classes are found in natural lowland rain forests. Some of the larger trees have butresses. Many tree species have shallow root systems with surface feeding mycotrophic roots confined to the upper layers of the soils. The leaf areas are relatively large compared to those of tree species found in montane rain forests. The leaves are described as belonging to the mesophyllous leaf size class (compare montane cloud forests, which have microphyllous leaves). The leaves are evergreen, membranous or leathery and they usually have drip tips. The leaves have a relatively long life span. The young leaves or flushes are white or brightly coloured. Flowers of the tree species of rain forests are in general not very conspicuous

cauliflory or ramiflory is common in the tropics. Besides insects, bats and birds pollinate many rain forest species. Fruits and seeds of many rain forests germinate without a period of dormancy. Many aspects of the pollination biology, fruit and seed dispersal and seeds physiology and survival of rain forest species have not been well studied and documented. Generalization should be treated with caution.

Rain forests are productive and support a large biomass per unit area. These forests, however, grow on highly weathered acidic nutrient poor soils (ultisols). The nutrients are largely in the biomass. Nutrient cycling and nutrient conserving machanisms have been investigated in detail for some neotropical lowland rain forest sites.

Selective logging, clear felling as well as slash and burn agriculture (chena cultivation) in areas occupied by rain forests rapidly leads to erosion of top soil, compaction of the soil surface, lowering of the fertility of soils and overall impoverishment and deterioration of the site. The abandoned sites are colonized by Dicranopteris linearis (kekilla), Melastoma malabathrica (maha-bowitiya) Hedyotis fruticosa (weraniya) and Pennisetum polystachyon (elephant grass). Macaranga peltata (kenda), Trema orientale (geduma) etc., may appear as secondary tree colonizes. It may take many, many years to reforest such degraded kekilla lands. Indigenous tree species find it difficult to germinate and establish themselves in degraded kekilla lands. Rehabilitation of such degraded lands has been a serious problem that was taken up by FAO experts, local scientists and administrators attached to the Land Reform Commission (LRC), National Agricultural Diversification and Settlement Authority (NADSA), Janawasama (JEDB) and other concerned state sector agencies and Non Governmental Organizations (NGO's). The Forest Department has successfully grown Pinus caribea on these

kekilla lands but these plantations are still prone to fire and do cause some ecological damage and environmental degradation. The problem is one of national importance and one facing many other developing tropical countries. Research on soil amendments and manipulations along with educational and extension programmes are necessary to make local people aware of these ecological problems. Their participation and co-operation are essential in re-developing these degraded ecosystems in the humid tropics. It is important that we re-develop these unproductive kekilla and patana lands into self sustaining forest plantations, agroforestry or community forestry plantations especially on vulnerable hill slopes and other abandoned plantations.