Tropical Rain Forest - II

by

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Schimper used the term tropische Regenwald or tropical rain forest to distinguish the luxuriant species rich forests from the deciduous monsoon forests of the tropics. According to Schimper rain forests are evergreen, moisture loving (hygrophilous) with trees above 30 metres in height and with many thick stemmed lianes (woody vines) and epiphytes. Lianes are woody climbers which are often carried up into the canopy by the host trees. Epiphytes are plants living perched on, but not necessarily deriving sustenance from the host plants.

The lowland humid forests of the tropics occupy less than a third of tropical land areas. According to Norman Myers wet lowland rainforests are found in areas receiving not less than 100 mm of precipitation in any month for two out of three years, with mean annual temperatures of more than 24° C. Further, typical lowland rain forests are found at elevations below 1300 metres. In south east Asia lowland forests are usually below 750 m. Forests on wet mountain slopes of the tropics are called submonatane rain forests and montane rain forests (Ambawela, Horton Plains, the upper slopes of the Adams Peak Wilderness and the upper parts of the Knuckles Range in Sri Lanka). More than

overall rainfall values absence of seasonality is an important feature for development of luxuriant lowland rain forests.

Besides warm tropical rain forests, there are also subtropical rain forests in Southern China, the eastern coast of Australia and in Mexico. The lowland humid forests are the home of a wide diversity of plants and animals and it is regarded as the richest biome on earth. Although covering only 5-6% of the surface of the globe, the rain forests contain about half the number of the earth's total animal and plant species. Taxonomists believe that there are many more plant and animal species that can be collected and described as new to science from the tropical rain forests. It is difficult to give an exact estimate of the present cover of natural rain forests but these forests are being cleared at the rate of some 11000 km² per annum and there is growing concern at the rapid dwindling of these biologically interesting forests. The number of trees per hectare of rain forests ranged from 368 (Cameroon) to 740 (Andalau Forest Reserve, Borneo). As regards species number the following may be quoted: 251 species on a 2 hectare plot in the Buket-Lagon Forest Reserve in Malaya and 219 species of trees with a diameter at breast height of 10 cm in a valley bottom forest at Andalau, Borneo. It is generally agreed that some of the richest forests are in Southeast Asia. The wet rain forests of Malaya have 9 genera and over 155 species of trees belonging to the Family Dipterocarpaceae. In Sri Lanka this family is represented by 7 genera and over 45 species.

Nearly all the dipterocarp species found in Sri Lanka are endemic to the island. In Malaya there are 127 endemic species. Thus the lowland rain forests of south and southeast Asia are often called dipterocarp forests.

Floristic Composition of Rain Forests in Sri Lanka

The tropical rainforest is genetically, floristically structurally and functionally complex and dynamic with numerous feed back loops regulating its functioning. Like other forest formations and plant communities the mosaic of communities forming the rain forests have diverse floristic composition, complex structure and development. In Sri Lanka the lowland rain forests are dominated by canopy tree species belonging to the families Bombacaceae (Katumoda), Clusiaceae (Na) and Dipterocarpaceae (Dun, Bu-Hora, Beraliya, Nawada etc.). An appendix gives a list of the more common species found at Gilimale, Kanneliya, and Sinharaja. Madol (Garcinia hermonii Clusiaceae) and Athuketiya (Xylopia chamionii, Annonaceae) are common understorey trees in Sri Lanka. Puswel (Entada ceylanica), Bambara wel (Dalbergia championii) Uncaria elliptica, Calamus ovoides (wewel) are some of the woody climbers of our rain forest. Freycinetia walkeri. Leucocodon reticulatum are some interesting root climbers seen in the rain forests of Sri Lanka. In some parts of the forests large numbers of the treelet Agrostistachys hookeri are very common in the understorey. The shrubs found within the forest are mainly members of the family Loganiaceae (Gaertnera vaginans)

Melastomaceae (Memecylon spp.) and Rubiaceae (Urophyllum ellipticum, Psychotria spp. etc.). The ground vegetation on the floor of the rain forest is very poorly developed. Ferns (Lindsaea caudata, Polystichum walkeri, Idiopteris hookerana) and the dicot (Acranthera ceylanica) are usually seen. The microhabitats within the forest (rock boulders, rocky streams, stream banks, boles and leaves of trees, fallen and decaying logs) support a wide variety of bryophytes, ferns and flowering plants. Root parasites and wood rotting fungi are also encountered.

Some aspects of nutrient cycling in rain forests

Rain forests are usually found on nutrient poor soils classified as lateritic soils or ultisols (yellow brown). The large standing biomass appears to function and maintain itself on limited availability of soil nutrients. Some studies (Jordan et al. 1981) indicate that the main inputs of nutrients into natural rain forests come from rain. Many tree species and other life forms exhibit structural and physiological adaptations for efficient procuring and recycling of nutrients within the forest ecosystems. Monitoring runoff water and stream water flowing out of forest water sheds show that losses of nutrients from natural forest systems are minimal.

As mentioned before luxuriant rain forest of giant trees and many other life forms appear to successfully grow and support themselves on soils of low fertility. The multilayered structure

of the canopy have leaves of moderate size and relatively long periods of physiological activity. Many of the tree species have tough leathery leaves like mediterranean sclerophylls. Some authors have described them as pachyphylls (thick leaves). Many of the tropical trees produce large amounts of secondary metabolites (phenolic compounds, alkaloids etc.) and these render them unpalatable to herbivores & insects. With age these leaves growing in a humid environment get covered with epiphyllous bryophytes and many microorganisms. These phyllosphere organisms have been shown to scavenge nutrients intercepted by the canopy. The longevity of the evergreen leaves and the associated epiphyllous organisms partly contribute to the retention, release and overall conservation and recycling of nutrients. Within the individual trees there is also redistribution and retranslocation of some key nutrients like potassium from older leaves to new flush and growing parts. Leaves and other litter (small branches, prematurely shed parts etc.) falling on the forest floor may decompose slowly due to the presence of inhibitory metabolites like coumarins and other compounds. This too contributes to the slow release of nutrients. Besides foliar structure and chemical composition, the root biology of rain forest trees also augument the efficient retention, release and recycling of nutrients in rain forests. The tree species generally possess shallow feeding root systems. Usually a dense root mat is formed over the soils and the roots are in close contact with the fallen leaf litter. Mycorrhizal associations are widespread and are active in direct transfer to nutrients from litter to feeder roots. The

superficial mats of roots immediately below the litter function as efficient sites of exchange and absorption. Through-fall water containing small amounts of dissolved ions also serve as a source of supply of nutrients to the root mats. Ectotrophic mycorrhizae are found on the roots of Dipterocarpaceae. Most of the other tree families have endotrophic vesicular arbuscular mycorrihzas. Species of Psychotria and other rubiaceous shrubs growing in rain forests have leaf spots or nodules containing nitrogen fixing actinomycetes. Saprophytic and symbiotic microbes thus paly an important role in the maintenance of the fertility and nutrient balance of rain forest ecosystems. Besides plants and microbes; animals like earth-worms, millipedes, termites are also essential for nutrient cycling and water percolation.

Some studies on the partitioning of nutrients between living parts of the forest, litter, humus and mineral components of the soil show that over 90% of the nutrients are found within the biomass. Fluxes of nutrients between different compartments of the complex rainforest ecosystem as well as flows into an out of the ecosystem indicate that internal cycling is relatively efficient and the trees are adapted to it. Output from natural rain forest ecosystems are usually low. Overall balance of input versus output for some nutrients like, K, Ca and Mg for a case study in the Amazon Basin shows an apparent gain of 14 kg ha^{-1} yr^{-1} *for two years of study (Jordan et al 1981). From such studies, it is concluded that the rain forest ecosystem is generally more dependent on rainfall and internal cycling for its nutrients than on the soil on which it is growing*

List of common rainforest species in Sri Lanka

1. Canopy Trees

Dipterocarpus hispidus Bu Hora

Shorea trapezifolia (Doona trapezifolia) Yakhalu Dun

Shorea congestiflora Thiniya-Dun

Shorea megistophylla Beraliya

Mesua nagassarium Na

Cullenia ceylanica Katumoda

Cyllenia rosayroana Katumoda

2. Understorey trees and treelets

Garcinia hermonii Madol

Xylopia championii Athuketiya

Agrostistachys hookeri Beru

Schumachaeria castanaefolia Kekiriwara (disturbed sites)

3. Lianas & Root Climbers

Dalbergia championii Bambara wel

Entada ceylanica Puswel

Uncaria elliptica disturbed sites

Calamus ovoides Wewel

Cissus acuminata disturbed sites

Freycinetia walkeri (Climbing Pandan)

Ficus diversiformis (Climbing Pandan)

Piper spp. (wild pepper)

Leucocodon reticulatum

4. *Shrubs*

Urophyllum ellipticum (coffee family)

Gaertnera rosea (disturbed sites)

Memecylon rostratum Gal-pinibaru, Kuretiya (?)

5. *Ground Herbs and Terrestrial Ferns*

Acranthera ceylanica (rosette plant)

Lindasaea caudata (fern)

Polystichum walkerae (fern)