Quadrant II – Transcript and Related Materials

Programme: Bachelor of Science (Third Year)

Subject: Botany

Course Code: BOC110

Course Title: Plant Ecology and Phytogeography

Unit: 9

Module Name: Terrestrial Biome - Tropical

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INTRODUCTION

Various types of ecosystems have developed due to the interaction of climate with parent rock material, the available flora and fauna. These ecosystems are broadly classified as terrestrial and aquatic. The major types of terrestrial ecosystems are forests, grasslands, savanna, deserts and the tundra.

A biome is a large community unit characterized by the kinds of plants and animals present. In each biome the kind of climax vegetation is uniform—grasses, conifers, deciduous trees—but the particular species of plant may vary in different parts of the biome. The kind of climax vegetation depends upon the physical environment and the two together determine the kind of animals present. The factors that influence the types of biomes are temperature and precipitation.

Further, there is usually no sharp line of demarcation between adjacent biomes; instead, each blend with the next through a fairly broad transition region termed as ecotone.

TERRESTRIAL BIOME – TROPICAL

The tropical biomes are close to the equator, creating biomes unique to their areas. Tropical biomes receive more sunlight than any other biomes on Earth. They also have high temperatures year-round.

There are 3 major types of tropical biomes:

1. Tropical Forests
2. Savanna (Grassland)
3. Hot Desert

1. Tropical Forest

i. Tropical rainforest
ii. Tropical seasonal forests
iii. Subtropical rainforests
iv. Rainforests of India
   (a) Moist tropical forests
   (b) Montane subtropical forests
   (c) Montane wet temperate forests

i. Tropical rainforest

Tropical rainforests occur near the equator in Central and South America, Central and Western Africa (Congo, Zambesi river), Southeast Asia (parts of India and Malaysia), Malaya, Borneo, New Guinea and Northwest Australia. Tropical rainforests are among the most diverse communities on earth. Both temperature and humidity are high and constant. The annual rainfall which exceeds 200 to 1000 cm is generally evenly distributed throughout the year.

The flora is highly diversified: a square mile may contain 300 different species of trees, a diversity unparalleled in any other biome. The extremely dense vegetation of the tropical rainforests remains vertically stratified with tall trees often covered with vines, creepers, lianas, epiphytic orchids and bromeliads. Under the tall trees is a continuous evergreen carpet, the canopy layer, some 25 to 35 meters tall. The lowest layer is an understory of trees, shrubs, herbs like ferns and palms, all of which become dense where there is a break in the canopy. Nearly all plants are evergreen, and those that do lose their leaves entirely do so at irregular intervals with no apparent regard to the climatic regime. The leaves of most plant are of moderate size, leathery and dark green in colour. Their roots are often shallow and have swollen bases or flying buttresses.

Soils of tropical rainforests are red latosols, and they may be exceedingly thick. The high rate of leaching makes these soils virtually useless for agriculture purposes, but if they are left undisturbed the extremely rapid cycling of

nutrients within the litter layer (due to decomposition) can compensate for the natural poverty of the soil. It is the nature of the soil, both its potential for high leaching as well as its chemical composition that promotes a rock-like quality when exposed to air, that largely has prevented western style agriculture from being applied to the tropical forests (Kormondy, 1976).

Invertebrate density and abundance are very high in tropical rainforests, but while vertebrates are diverse, they are not as abundant as in many other communities. The common invertebrates of these forests are worms, snails, millipedes, centipedes, scorpions, isopods, spiders, insects, planarians and leeches. Among insects, heteropterans, orthopterans, blattids, mantids, phasmids, bees, termites and ants are most common. The common vertebrates of tropical rainforests are the arboreal amphibian *Rhacophorus malabaricus*; aquatic reptiles, chameleons, agamids, geckoes, and many species of snakes; many species of birds, social birds being predominant; and a variety of mammals. Nocturnal and arboreal habits are most common in many mammals such as insectivores, leopards, jungle cats, anteaters, giant flying squirrels, monkeys and sloths. But in New Guinea and Northern Queensland, where monkeys are absent, there are arboreal kangaroos (*Dendrolagus* sp.), despite the fact that the basic anatomy of the kangaroo is not particularly well-suited to arboreal life. Further, in the foot hills of the forest zone of peninsular India covered with dense tropical vegetation, the tiger (*Panthera tigris*), the elephant (*Elephas maximus*), samber deer (*Rusa unicolor*), muntjac (*Muntiacus muntjak*), the gaur (*Bibos gaurus*), the chital or spotted deer (*Axis axis*), and the swamp deer (*Rucervus duraucelli*) are the major ground dwelling mammals.

ii. Tropical seasonal forests

Tropical seasonal forests occur in region whose total annual rainfall is very high, but segregated into pronounced wet and dry periods. Tropical seasonal forests are found in Southeast Asia, Central and South America, Northern Australia, Western Africa and the tropical islands of the Pacific as well as India and Southeast Asia. In exceedingly wet tropical seasonal forests, commonly known as monsoon forests, the annual precipitation may be several times higher than that of the tropical rainforests (exceeds 900-1600 mm). Trees may reach heights over 40 m, but are more commonly 20- 30m high. Stratification is of a relatively simple type with a single understory tree layer, canopy is deciduous and understory is evergreen. Teak is often a major large tree in the best-known

tropical seasonal forests, those of India (Central India) and Southeast Asia. Bamboo is also an important climax shrub in these areas although in other areas it is important only in earlier stages of the succession.

iii. Subtropical rainforests

In regions of fairly high rainfall but where temperature differences between winter and summer are less marked, as in Florida (USA), the broad-leaved evergreen subtropical biome is found. The vegetation includes mahogany, gumbo limbo, bays, palms, oaks, magnolias, tamarinds, all laden with epiphytes (of pineapple and orchid families), ferns, vines and strangler fig (*Ficus aureus*). This stratification is simpler, with only one understory tree horizon. All these plants tend to be evergreen, but may lose their leaves during the dry season. Animal life of subtropical forest is very similar to that of tropical rainforests.

iv. Rainforests of India.

In India, patches of rainforests are found in Kerala, Assam and the Gandhamardan hills of Orissa. The biota includes mosses, ferns, epiphytes, orchids, lianas and vines, herbs, shrubs and fungi, *Dipterocarpus* spp., Golden Langur, Lion- tailed Macaque, Slender Loris, Giant Squirrel, Civets and Flying Squirrel. The rainforests of India are of following three types:

(a) Moist tropical forests: They include the southern tropical wet evergreen forests found in Assam and West Bengal, the northern semievergreen forests of Assam and Orissa, and the southern tropical semievergreen forests of Andamans.

(b) Montane subtropical forests: They include the northern subtropical broad-leaved wet hill forests of Assam and West Bengal, the southern subtropical broad-leaved hill forests of Orissa and Kerala and the subtropical pine forests of UP, Himachal Pradesh, Assam, Manipur, etc. The *Chir* forests of UP and HP are also example of this type of forests.

(c) Montane wet temperate forests: They include the forests of Kodaikanal and Udagamandalam in Tamil Nadu and Kerala, the northern wet temperate forest of the north-eastern region and West Bengal and the Himalayan moist temperate forests.

2. Savanna (Grassland)

Savannas are tropical grassland with scattered, drought resistant trees which generally do not exceed above ten meters in height and do not form a canopy. Thus, a savanna is an intermediate between a forest and a grassland. Savannas constitute extensive areas in Eastern Africa, which support the richest diversity of grazing mammals in the world, and also occur in Australia, South America and Asia. The climate is generally characterized by a rainy (May through October) and dry (November through April) season; in the llanos of Venezuela, for example, nearly 90 per cent of the annual rainfall of 130 cm falls during the rainy season.

The latosol soils of savannas are nutrient poor owing a heavy leaching. Quite widely distributed in savannas are soils called laterite which when dried harden to rock-like consistency thereby precluding their use in western style agriculture (Kormandy, 1976). Although climate and soil are significant regulating factors in this biome, the controlling factor appears to be fire, which gives grass and certain species of trees a powerful advantage over other tree species. As a result of this latter factor, species diversity is quite low in comparison to adjacent tropical forests ; in some situations a single species of both grass and tree may be dominant over large areas. The trees of savannas are resistant to desiccation, and may be either deciduous or evergreen. Their leaves are often hard and drought-resistant. Grasses are the most conspicuous plants, and may reach heights of 1½–2m. Gigantism of certain animal groups in these tropical savannas is as pronounced as it is in the boreal forest including such giants as many antelopes, giraffes, elephants, buffalo and lions (Clapham, Jr., 1973). In addition, a rich insectan fauna especially those with strong mandibles capable of mastication are conspicuous in this biome. Grasshoppers and termites are encountered in large numbers.

Savannas of India.

The savannas of India are dominated by grasses and sal trees and the consumers are cattle, rodents, insects, jackals, hyaenas, etc. They are classified into the following types:

(a) High savanna: It occurs in the Brahmaputra valley and constitutes open stands of low branching trees which are usually 2 to 3 metres tall, such as *Syzigium cerasoideum* and *Emblica officinalis*. Its common grasses are *Imperata*, *Saccharum spontaneum*, *Ophiurus* and *Vetiveria*.

(b) Moist sal savanna: It occurs in the Gangetic plain and consists of open forests of sal (*Shorea robusta*) having tall grasses. Its common grasses are *Imperata cylindrica*, *Themeda arundinacea*, *Cymbopogon nardus, Erianthus* and *Apluda*.

(c) Low alluvial savanna woodlands: It occurs in the Gangetic plain and on riverine flats. The soil of this savanna is sandy and alluvial and contains patches of clay in depressions. The common trees of this region are *Dalbergia sissoo*, *Butea monosperma*, *Albizia, Adina cordifolia* and *Zizyphus procerum*, *Arundinella*, *Themeda gigantea* and *Erianthus* sp.

(d) Dry savanna: This region is found in Punjab, Haryana, Bihar, Orissa and eastern Tamil Nadu. It is characterized by trees which stand far apart, singly or in small groups such as *Acacia lenticularis*, *Emblica officinalis*, *Gardenia turgida*, *Crotalaria hirta* and *Pterocarpus marsupium*. The common and abundant grasses of this region are *Themeda triandra*, *T. quadrivalves*, *Apluda mutica* and *Arundinella setosa*

(e) Saline alkalina scrub savanna: It occurs throughout the Indo-Gangetic Plain. The common tree of this region are the *Phoenix sylvestris, Acacia sp., Tamarix sp., Calotropis procera, C. giganta* and *Kochia indica*.

3. Hot Desert

Deserts are the biomes formed in the driest of environments. Temperatures are very high. Major hot deserts of the world are situated near the tropics of cancer and Capricorn, with a rainfall of less than 10 mm. The most important hot deserts of world is the Sahara-Arabia-Gobi desert complex extending from Africa to Central Asia and contains highly irregular and very insignificant rainfall, and low humidity due to excessive evaporation. Fairly extensive hot deserts also occur in India (Sind-Rajasthan deserts), South America (Chile), North America ad Australia. The cold deserts occur at high elevations where the temperatures are low and rainfall scanty as the air losses all its moisture content as it ascends higher and higher. Cold deserts occur in Ladakh regions of Himalayas, Tibet, and

Bolivia Arctic. In the hot desert plant population includes mostly succulent type (e.g., cactus, palo verde trees, creosote bush, etc.).

Low abnormal precipitation coupled with soil and air temperatures that are extremely high by day and drop abruptly by night, low humidity, and high insolation are the major desiccating environmental factors to which desert vegetation and animals have adapted.

Desert plants which tend to be shrubs are adapted to drought conditions through reduced leaf size and the dropping of leaves in dry conditions, both reducing water loss via evapotranspiration. The roots of most desert plants remain well developed and occur in the top meter of the soil to take maximum possible advantage of any rainfall. Further, the root hairs on many desert plants are ephemeral, drying back under drought conditions and thereby reducing potential water loss by osmosis. Yet other species are short lived annuals that complete their life cycles during the short-moist period. In most hot deserts, there occur plants such as cacti, water storing succulents such as acacias, euphorbias, cacti, prickly pears, etc., which are adapted by their protoplasmic colloids, which enable the accumulation of substantial water reserves, as well as by a reduced leaf surface, which obviates water loss via evapotranspiration.

The animals present in the desert are reptiles, insects and burrowing rodents. All these animals possess special morphological, physiological and ethological adaptations for deserts. In general, large animals are very uncommon except mule deer and some species of gazelle and all animals have cursorial, fossorial and/or saltatorial adaptations. Some desert animals are nicely adapted for high extremes of temperature. For example, the lethal temperature of different species of insects found to be following—for the canal spider *Galeodes granti* it is 50°C, for the *Gryllus domesticus* it is 40°C and for the forficulid *Labidura riparia* it is 38°C (Cloudsely-Thompson, 1962). Diurnal rhythms are perhaps the best method of avoiding the heat. While some desert plants close their petals at night, many blossom only at night. Some insects such as tenebrionid bettle *Akis spinosa* remain active during the day, and the centipede *Scolopendra clavipes* restricts its activities to night time.

Further, certain reptiles and certain insects are well adapted for survival in deserts because of their thick, impervious integuments and the fact they excrete dry waste matter. A few species of mammals have become secondarily adapted to the desert by excreting very concentrated urine. They avoid the sun by remaining in their burrows during the day. Kangaroo rat and pocket mouse, both

are able to live without drinking water by extracting the moisture from the seeds and succulent cactus they eat. The camel and the desert birds (ostrich, etc.) must have an occasional drink of water but can go for long periods of time using the water stored in the body. Most insects of deserts are herbivores and as a correlation the number of small insectivorous lizards found in the desert is usually high.