Biomes

- A biome is composed of broad ecological communities (of plants and animals) that occur in widely separated areas characterised by similar climatic, topographic and edaphic conditions.

- Though a number of conditions characterise a particular biome, climate is the major condition which maintains a biome.

Terrestrial biomes

- There are several types of terrestrial biomes

1. Tropical moist forests
2. Tropical seasonal forests
3. Coniferous forests (Taiga)
4. Grasslands
5. Deserts
6. Tundra
7. Temperate rainforest
8. Temperate deciduous forest

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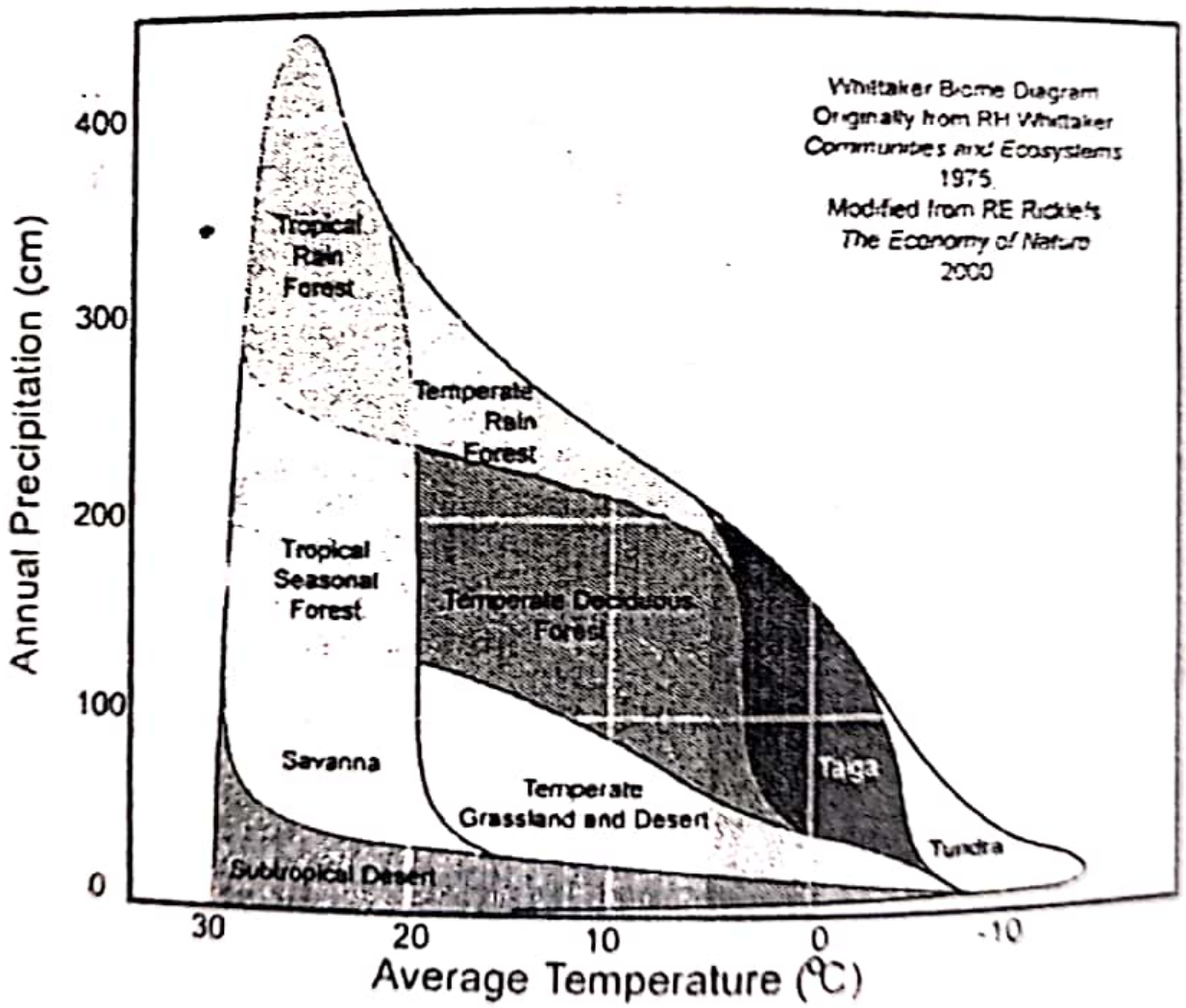


Tropical moist forests (TMF)

- TMF are forests that are characterised by *uniform annual temperature* and *high amount of rainfall* (> 2,000 mm annually).

- There are several kinds of TMF. E.g. Cloud forest, tropical rainforest, wet evergreen forest etc. Nevertheless, they share a number of common attributes.

Environmental conditions

- Tropical rainforests receive *plenty rainfall* throughout the year (> 2000 mm annually).

- They experience *warm to hot temperatures* year-round.

- Average humidity of tropical rainforests is between 77 and 88 %.

- Cloud forests are usually located on mountainous areas where *fog* and *mist* make their vegetation wet all the year.

- The soils of TMF are usually old, thin, acidic, and nutrient-poor.

Vegetation

- Tropical rainforests harbour high number of plant species. E.g. a total of 100-300 tree species occur within an area of 1 ha in some forests.

- It has different kinds of growth forms: trees, shrubs, climbers, herbs, ferns, epiphytes etc.

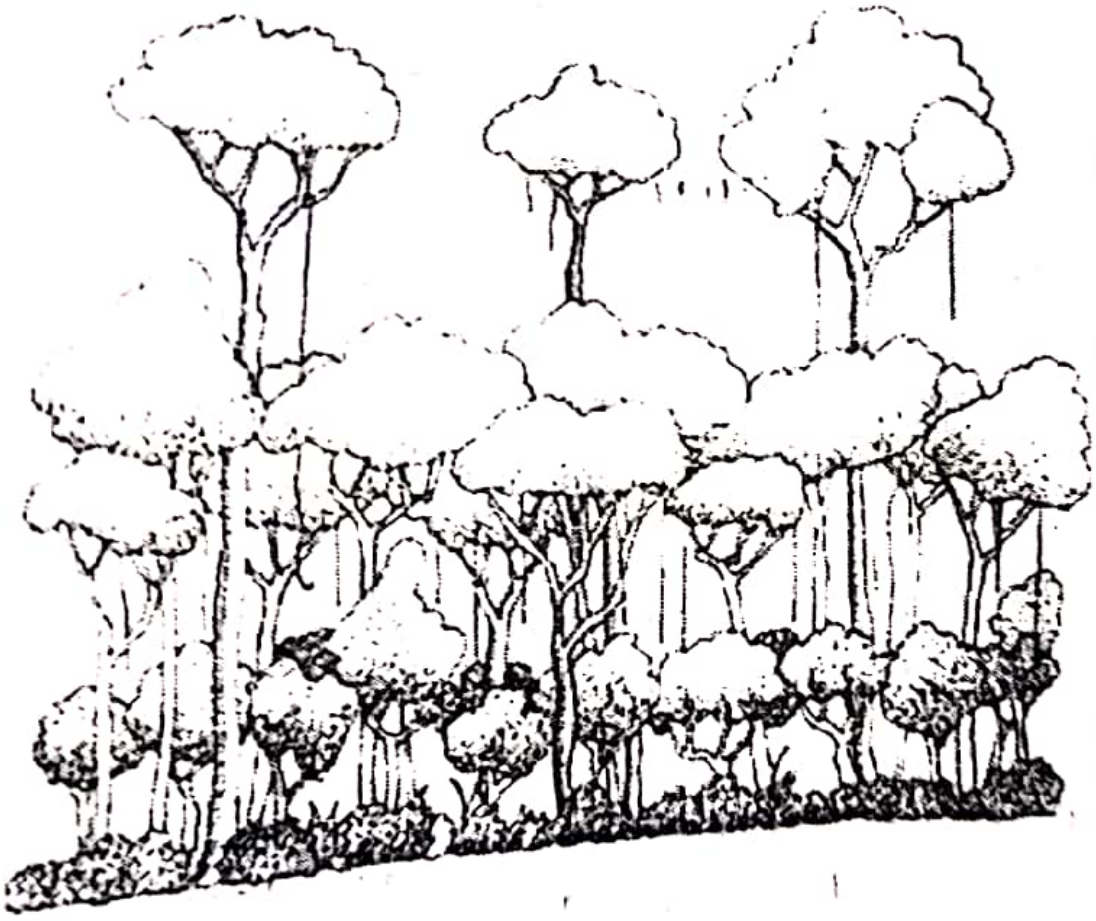
- About 70 % of plants in tropical rainforests are trees.

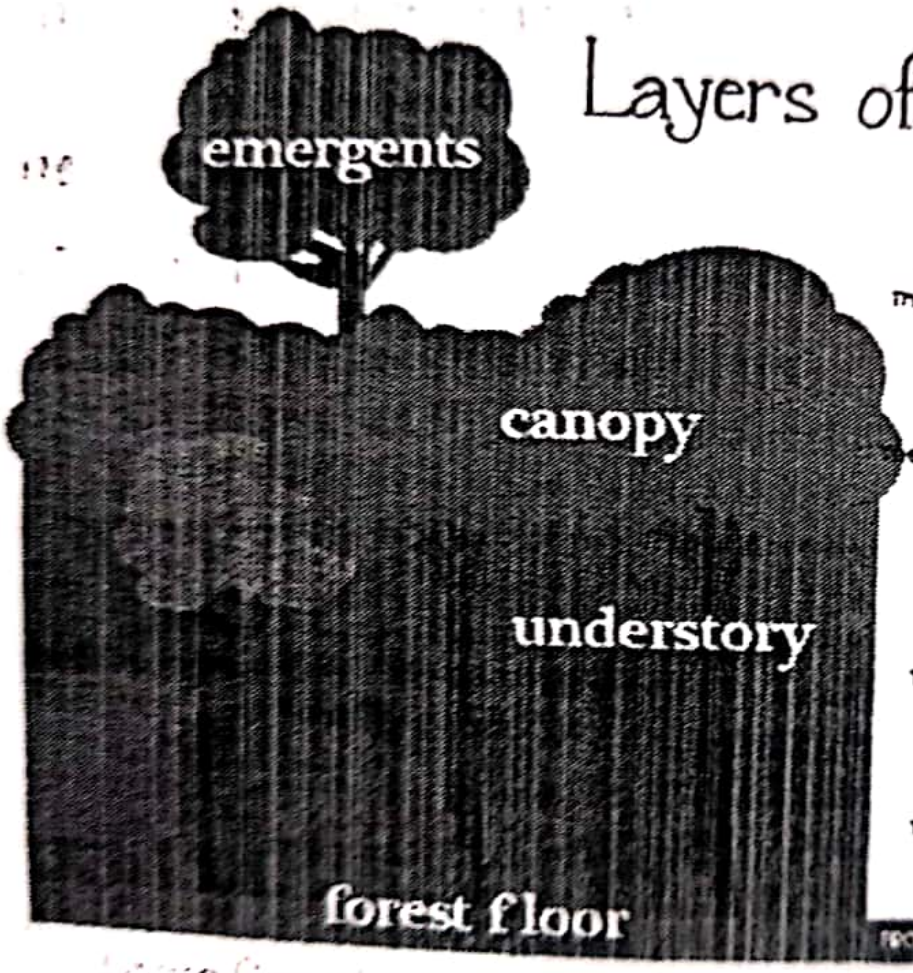
- Trees of tropical rainforest have straight trunks (stems) which branch high above the ground (≥ 30 m).

- Many trees have thin and smooth bark since they do not suffer from desiccation or freezing temperatures.

- Does this feature of trees affect diversity of other growth forms?

- Tropical rainforest vegetation is stratified vertically into layers:





Layers of the Rainforest

EMERGENTS

Giant trees that stick out above the canopy
they are much taller than average canopy trees
Many birds and insects live here

CANOPY

The upper layer of the trees (leaves & upper limbs)
that form the cover over the lower layers
Put of all, this layer is home to many
insects, birds, reptiles, and mammals

UNDERSTORY

The cool, dark environment that is between
the canopy & the ground.

FOREST FLOOR

The ground layer of the rainforest, teeming
with insect life and host to the
biggest animals of the rainforest

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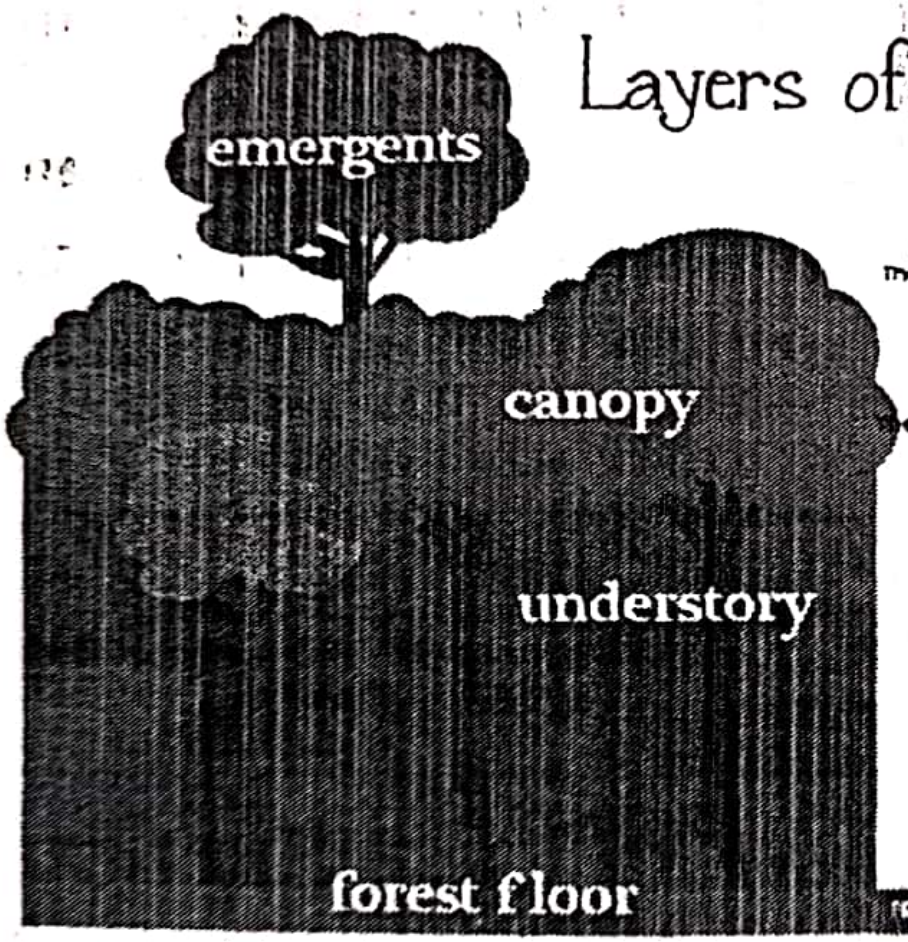
Layers of the Rainforest



EMERGENTS

Giant trees that stick out above the canopy. They are much taller than average canopy trees. Many birds and insects live here.

CANOPY

The upper level of the trees (leaves & upper limbs) that form the cover over the lower layers. Full of life, this layer is home to many insects, birds, reptiles, and mammals.

UNDERSTORY

The cool, dark environment that is between the canopy & the ground.

FOREST FLOOR

The ground layer of the rainforest, teeming with insect life and host to the biggest animals of the rainforest.

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Emergent layer

- This layer is made up of very tall, widely spaced trees which project above the canopy layer. They have mushroom-shaped crowns.

- The trees receive the highest sunlight intensity.

- Are there any ecological consequences of this?

Canopy layer

- The crowns of some tall trees (10-30 m tall) become broad and irregular, and form a tight, continuous canopy.

- The crowns are often densely covered with other plants such as epiphytes or mistletoes. They are also tied together with climbers (lianas).

- There are two types of canopy layer: upper and lower canopies.

- Upper canopy occurs between 20-30 m above ground and lower canopy is about 10-20 m above ground.

Understorey layer

- This is a layer of shrubs, herbs, and tree seedlings and saplings below the canopy.

- This layer is a dark place as it receives only about 2-15 % of the sunlight that reaches the canopy. It is also very humid.

- Plants in this layer are usually adapted to growing in low light intensity.

- Inadequate sunlight in the understorey results in slow growth of saplings although they are able to grow rapidly to become tall trees when gaps are created in the canopy.

Forest floor layer

- The forest floor receives less than 2 % of the sunlight. Thus, only plants adapted to very low light and humid environment are found in this part of the forest. E.g. ferns.

- The forest floor is occupied by a thin layer of litter (fallen leaves, seeds, fruits, branches).

Fauna

- Many different kinds of animal species occur in tropical rainforests.

- It has been estimated that the canopy of these forests contain millions of insect species throughout the tropics.

- Tropical rainforests also serve as a home to a wide variety of mammals, birds, reptiles and amphibians.

Nutrient cycling in tropical rainforests

- Majority of nutrients (about 90 %) in tropical rainforests are kept in the bodies of living organisms.

- Dead plants and animals undergo rapid decay, thus ensuring that nutrients contained in the organisms are returned into the soil for plant growth.

- Soil in tropical rainforests is less fertile. Why????

Plant adaptations in TMF

- Buttress roots
- Stilt roots
- Red leaves
- Lianas and epiphytes
- Leaf angling
- Leaf drip tips

Animal adaptations in TMF

- Camouflage to avoid predators. E.g. walking stick insects camouflage themselves to appear like a tree branch.

- The use of night-time or day-time mode of life.

- Poison

Threats to the Tropical Rainforest

- Logging
- Slash and burn agriculture
- Mining operations
- Infrastructure development such as roads, industries schools etc.
- Flooding of forests due to hydroelectric projects.

Tropical seasonal forests (TSF)

- TSF are forests that are characterised by distinct wet and dry seasons.

- Temperatures are hot throughout the year.

Environmental conditions

- The climate in this forest biome is seasonal, alternating between wet and dry seasons.

- The dry season is often more prolonged than the wet season.

- Rainfall is therefore not uniform throughout the year. Rainfall amounts range from 815 to 1800 mm annually.

- Temperatures are hot throughout the year. Mean annual temperature is > 24°C.

Vegetation

- Several plant growth forms exist in the tropical seasonal forest. These include trees, shrubs, climbers, herbs, ferns, epiphytes etc.

- Some of the trees are deciduous at the onset of the dry season. Depending on the level of deciduousness, TSF can be classified as semi-deciduous (semi-evergreen) or deciduous.

- Tropical seasonal forest has also got vertical stratification just as in the TRF.

- Trees of this biome are spatially farther apart than those in rainforests or TMF.

- What is the ecological significance of this???

- Because trees in this biome are not close to one another, more sunlight penetrates through to the undersotrey and floor layers.

- Tropical seasonal forests turn brown and dormant in the dry season, although they become green in the wet season.

Fauna

- Animals in the tropical seasonal forest adapt to the dry condition of the dry season to survive.

- Some of the adaptations are:

- A lot of animals are nocturnal and gather their food in the cooler night, thereby conserving water.

- Nocturnal animals have very high night vision which enables them to search for food at night.

Coniferous forests (Taiga)

- Coniferous forests consist mostly of conifers, which are trees that bear cones instead of flowers. They occur in temperate areas.

Environmental conditions

- Precipitation in this biome is low; usually between 300-900 mm per year. A few areas may receive up to 2000 mm.

- In the northern boreal forests (taiga), winters are long, cold and dry, while summers are short, and moderately warm and moist.

- In taiga, decay of organic matter is inhibited by cold temperature and very wet soil during growing season, and as a result acid is produced from fallen needle-like leaves and sphagnum moss.

- Temperature in coniferous forests is extremely low in winter period; -54°C to -1°C.

- During summer, temperature increases but it is even still colder than tropical weather; 4°C to 21°C.

- Soils of this biome are usually sandy.

- The above-mentioned environmental conditions make soil moisture and nutrients limited in coniferous forests. Productivity is therefore limited.

Vegetation

- Taiga biome vegetation is dominated by trees that produce needle-like leaves (with thick waxy coating) instead of true leaves.

- Because they bear needle-like leaves throughout the year, they tend to be evergreen year-round.

- By these adaptations, conifers are able to survive in the harsh conditions of cold and dryness.

- Examples of dominant conifer trees in taiga biome are pine, hemlock, spruce, cedar and fir.

- Generally, coniferous forests consist of 2 layers: an overstory and understory. Nevertheless, in some coniferous forests, there may be a shrub layer that occurs between the two main layers mentioned above.

- The understory of coniferous forests is generally dominated by grasses and herbaceous perennials.

- Other growth forms such as mosses, lichens and ferns occur on tree branches and forest floor.

Fauna

- Animals in Coniferous forests have to deal with the harsh environmental conditions in this biome. Consequently, the biome supports only a few animal species.

- Amphibians and reptiles are scarce, but birds, insects and mammals are common.

- During winter, some of the animals hibernate while others migrate to warmer climates.

Examples,

Many ground squirrels hibernate during cold winters, sleeping in a burrow system until there is warm weather.

Wood warbler birds migrate to warmer habitats during winter.

Grasslands (Tropical savannas)

- A savanna biome is predominantly made up of grasses scattered with many shrubs and a few trees.

- Savannas occupy about 2/5 of Africa and 2/3 of Ghana. They also occur in large areas of Australia, India and South America.

Environmental conditions

- Inadequate rainfall; 500-1270 mm per year
- Very high daily and seasonal temperatures
- Frequent bush fires
- Compact soils

- Savanna climate has two distinct seasons; a long dry season and a short wet season.

Vegetation

- Savanna vegetation is dominated by tall, perennial grasses which can grow to the height of 10 m or even above.

- There are many shrubs scattered throughout the grassland vegetation.

- Trees are also scattered in savanna vegetation but they are fewer than shrubs.

- Trees and shrubs of savanna biome are drought-tolerant and fire-resistant.

- In some areas, trees of savanna biome may form open canopies.

- The wet season is the main period for growth and flowering of the herbaceous species in the savanna biome.

- The dry season and build up to the wet season are important periods of growth and flowering in the woody species.

Fauna

- Animal assemblages in the savanna biome consist of many wild herbivores most of which are ungulates. E.g. gazelles, oryx, lions, zebras, buffalo, rhinoceros, elephant, warthog, giraffes.

- Other animals such as frogs, reptiles, birds and invertebrates such as ants and termites are found in some savanna vegetation.

West African Savanna vegetation

- In West Africa three savanna zones are usually distinguished on the basis of precipitation differences.

- These are Sahel, the Sudan and the Guinea savanna.

- The Sahel savanna is the driest, followed by the Sudan savanna and then the Guinea savanna.

Derived savannas

- Savannas along the border between the climatic Guinea savanna and forest zones are commonly called 'derived' savannas.

- They were converted from forest by human clearing, cultivation and subsequent regular burning.

Savanna vegetation in Ghana

- Savanna vegetation occupies about 2/3 of Ghana.
- There are two types of savanna ecosystem in Ghana: the Guinea and Sudan Savannas.

Guinea savanna

- It occupies an area of about 148, 542 km^2
- It receives higher amounts of rainfall than the Sudan savanna.
- The vegetation has broad-leaved trees some of which are also found in the Seasonal (dry) semi-deciduous forest subtype.