1. Details of Module and its structure

Module Detail	
Subject Name	Geography
Course Name	Geography 02 (Class XI, Semester - 2)
Module Name/Title	Natural Vegetation Concepts – Part 1
Module Id	kegy_20501
Pre-requisites	Basic Knowledge about vegetation, relief, soil, climate
Objectives	After going through this module, the learners will be able to know about: • Definition of Natural Vegetation • Conditions that determine the growth of Natural Vegetation • Factors associated with Relief and Climate that determine the type of natural vegetation found in a region.
Keywords	Natural Vegetation, Relief, Soil, Temperature, Precipitation, Length of Growing Period

2. Development Team

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1. Natural Vegetation

Our earth is also called a blue planet because around 71 % of its surface is covered under water. The earth is also called the green planet since it has green vegetation cover over its land surface and numerous species are present in the oceans, seas and lakes. The presence of plants on the earth's surface holds the key to the existence of other forms of life on earth. The term natural vegetation refers to forests that have grown naturally over long periods of time and have been exposed to little or no human interference. Natural vegetation may have classified as **Primary forests** and **Secondary forests**.

Ecologists have defined Primary forests as those which are made up of native species that have developed naturally with no interference of human activities. These forests have tall trees and very little undergrowth on the ground as the canopy of the trees do not let sun's rays to reach the ground level. In some parts of the world, Primary forests may still be found. The map below shows the regions of the world where Primary forests may still be found.

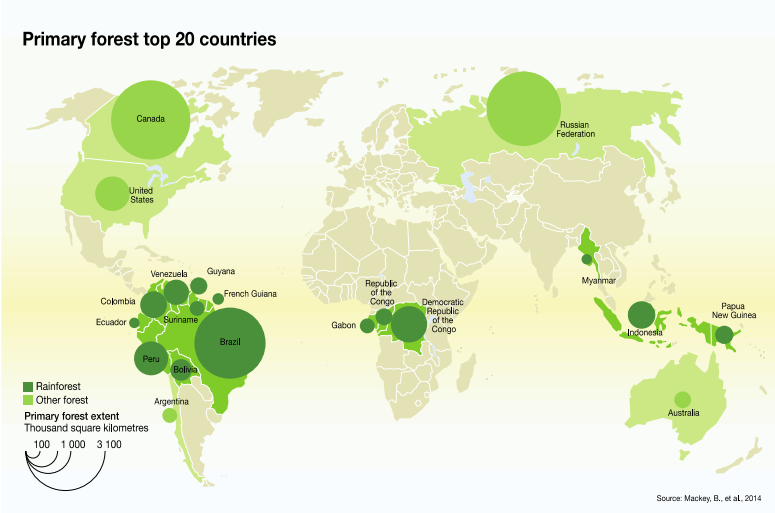

Image 1. Location of Primary Forests

Source: https://grida.no/resources/6951

As contrast to the Primary forests, the Secondary forests on the other hand are those that were once the original form of the forest was altered due to human disturbances and the forest is in the process of growing back to its original form.

For many centuries, the development of human civilization has led to cutting down of forests. Activities related to agriculture, pastoralism as well as setting up of human settlements. Primary forests of South America and Asia have been cleared by indigenous population for centuries as the cleared forests for slash and burn agriculture. In the modern times, in Europe forests have been replaced by pastures over the last two thousand years. Yet, there are some primary forests in Europe that have remained standing throughout historical changes. In the past hundred years North America has lost much of its temperate forests.

Human activities in the form of logging, clearing forest for agricultural purposes are a few of the reasons for the primary forest to degenerate into secondary forests. The diversity of tree species is less in these forests and the canopy of the secondary forest is usually minimal which allows for sunlight to penetrate to the ground surface, thereby allowing undergrowth.
The photograph below shows a jungle trail in a secondary forest. The dense undergrowth may be observed in the photograph.

Image 2. Undergrowth in a Secondary Forest.

Source:https://commons.wikimedia.org/wiki/File:Jungle_trail_in_secondary_forest_... (27757776259).jpg

There are some indicators for you to distinguish between a Primary Forest and a Secondary Forest. A Secondary Forest lacks large trees and appear shredded. Secondary forests also have kinked or curved trunks as a marks of the trees that grew back after being logged down.
Natural vegetation, whether in the form of Primary Forests or Secondary Forests is found in almost every part of the globe.

Did you Know?

In Malaysia the obvious clues of human disturbance in a forest, and that the forest is a secondary forest is the presence of bamboo, wild bananas, wild gingers, and climbing vines that grow over the canopy of logged forest.

Temperate forest's deforestation peaked before 1700, and the area under these forests have steadily declined further over the centuries. Large scale tropical forest logging began in 1800s and it peaked in mid-1900s.

Even though natural vegetation is found all over the surface of the earth, these must be There are three distinct realms over which natural vegetation may be found over the surface of the earth.

Realms of Natural Vegetation: Based on the location, vegetation can be classified into three groups, Terrestrial, Aquatic and Aqua - Terrestrial.

1. Terrestrial Vegetation – Trees and plants that are found over the land surface. Some examples of terrestrial vegetation are, forests, grasslands and deserts. With the help of the images below, the diversity of terrestrial vegetation found in forests, grasslands and deserts may be observed.

i. Forests: A forest has many layers of vegetation. Each layer has a different set of plants. The top layer or the Canopy is formed by the intertwined branches, and crowns of tall trees.

The second layer comprises of understory made of bushes, shrubs and young trees that can survive under the shades of the canopy.

The lowest layer may have ferns, mushroom and tree seedlings.

Image 3. Sal forest in Dehradun showing tall trees with undergrowth.

Source:https://commons.wikimedia.org/wiki/File:Managed_Sal_forest_in_Dehradun.jpg

ii. Grasslands: These are vast areas that are dominated by grasses. Tall woody trees and large shrubs are not present in the grasslands.

Image 4. Grassland in Madhya Pradesh shows long stretch of grasses with stunted trees in the horizon.

Source: https://commons.wikimedia.org/wiki/File:Grasslands_in_India,_Madhy_pradesh.JPG

iii. Desert Vegetation – comprises of plants that have adapted themselves to survive the arid environment, meaning region which has very little rainfall and is dry. The plants in the desert region tend to be tough and wiry with small or no leaves. They are usually water-resistant and store water in succulent stems. These plants have spines which help in controlling water loss through evaporation and also saving the plant from animals from eating it. The deep roots found in desert vegetation tap underground moisture for survival.

Image 5. Shows a dry shrub near Bikaner, Rajasthan, the shrub is an example of Desert Vegetation

Source: https://commons.wikimedia.org/wiki/File:A_shrub_in_desert_of_Bikaner.jpg

2. Aquatic Vegetation – Aquatic vegetation comprises of plants that grow in water bodies. These can be classified into two broad categories like; i. freshwater aquatic plants or plants that grow in rivers, lakes, ponds and ii. marine aquatic plants or plants that grow on the shorelines. Barrier reefs and atolls and plants that are found in the open sea.

Fresh water aquatic plants–these plants may be found to be either fully or partially submerged under water. Some of these plants could be growing on the margins of the water bodies and when the area gets inundated, they can survive under water too.

The photo below shows vegetation growing in a fresh-water lake in India.

Image 6. Vegetation in Pampa Sarovar (Lake)

Source: https://commons.wikimedia.org/wiki/File:Pampa_Sarover.jpg

Marine Aquatic Plants – Plants that grow near the surface of saline water bodies or ice within the reach of sunlight that penetrates through water. With the help of sunlight these plants carry out photosynthesis under water. Algae is one of the most plentiful type of marine plant. The image below shows underwater marine vegetation.

Image 7. Marine Vegetation

Source:https://commons.wikimedia.org/wiki/File:Atoll_research_bulletin_(2007)_(19724804313).jpg

3. Aqua-terrestrial vegetation – This special kind of vegetation includes plants that grow in transitional areas where plants are required to adapt to growing on land as well as getting submerged in water too. Area like the inter tidal zones, wetlands, swamps and marshes promote aqua-terrestrial vegetation. The plants can adapt to conditions of saturated soils and are capable of remaining submerged in water as well as exposed to the air. These plants also have the strength to bear great physical impact of waves, desiccation and sunlight.

Image 8: Vegetation in Pichavaram Mangrove

https://te.wikipedia.org/wiki/దస్త్రం:Pichavaram_Mangrove.jpg

The type of natural vegetation that may be found in any region depends on a variety of geographical factors. These factors can be divided into two broad groups; Relief and Climate. The flowchart presented below represents the various components of relief and climate that play their role in influencing the type of natural vegetation found in a region.

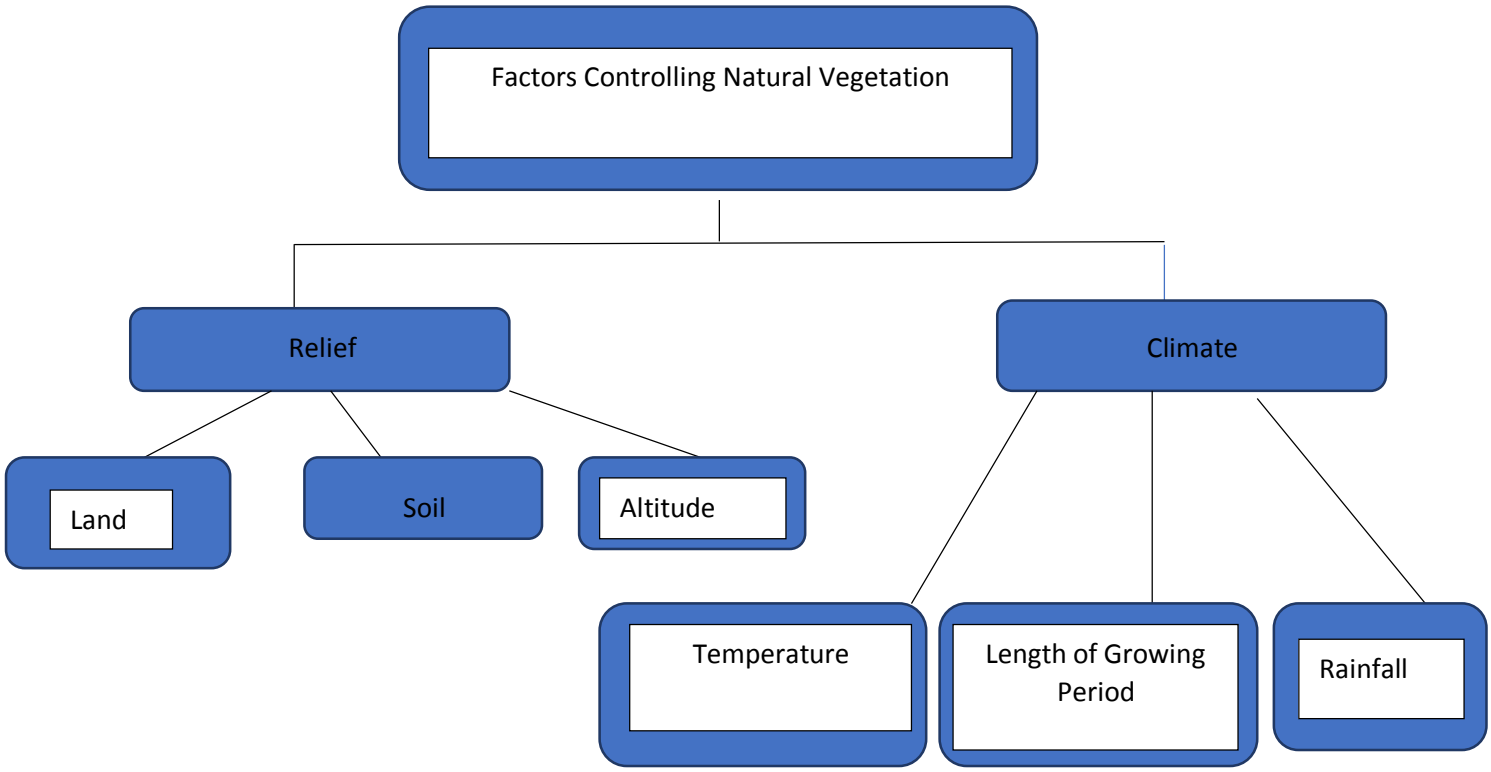

Image: 9. Flowchart showing the factors affecting Natural Vegetation.

1. Relief: The word relief pertains to the landscape of the region. The various components of relief that influence the growth of natural vegetation are:

a. Land: The type of land area determines the type of natural vegetation that may be found over it. Over the mountains, coniferous vegetation may be observed, while on broad leaved trees on the plane lands are a common sight.

b. Soil: The soil type plays an important role in determining the type of vegetation found over an area. Depending on the soil types, whether loamy, silty, clayey or sandy, different vegetation types adapted to such soil conditions. For example, mangrove forests are found in deltaic soils; cactus and xerophytic vegetation in sandy soils, etc.,

c. Altitude: The association of altitude with natural vegetation is very significant. With increase in altitude, the natural vegetation's zone too change and adapt to the colder and rarified air in regions of higher elevation. The diagram below shows the transition from Tropical

forests, Deciduous forest, Coniferous forest, Low herbaceous vegetation and finally Mosses and Lichens at the upper reaches of the hill slope.

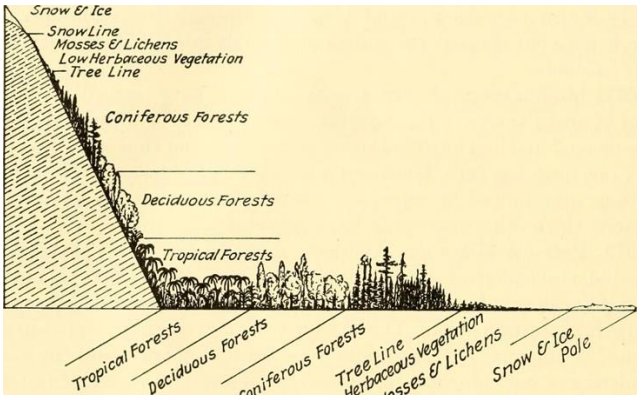

Image 10: Effect of Altitude on Natural Vegetation

Source: https://www.flickr.com/photos/internetarchivebookimages/18009438618/

Apart from the elevation, the 'aspect of slope' too plays an important role in determining the type of natural vegetation found on higher altitudes. It has been observed the world over, that slopes that face the sun are regions that have dense vegetation cover as against the slopes which are on the opposite direction of the sun-facing slope. In the Himalayas, the southern slopes, which receive direct rays of the sun, have luxuriant vegetation on the hill slopes while the north facing slope of the same altitude remains barren and tree-less.

Some more zones: Treeline, Timberline, Forestline

The **tree line** is height at which trees are incapable of growing. It is found at high elevations and high latitudes. Beyond the tree line, trees cannot tolerate the environmental conditions (usually cold temperatures or dryness that hinders their growth).The tree line is sometimes distinguished from a lower **timberline** or **forest line**, which is the line below which trees form a forest with a closed canopy

Other than relief, climatic conditions play an important role in determining the type of natural vegetation found in an area. Detailed discussion on the role of climate is being presented below.

2. Climate –Wladimir Koppen, a Russian-German botanist,meteorologist/climatologist used a vegetation based climatic classification in 1900. With the help of maps, he was able to establish a very strong link between the climatic conditions of a region with the natural vegetation that is found there. Koppen divided terrestrial climates into five major types, denoting them with the help of capital letters A, B, C, D, and E. Each of these climate types except for B is defined

by temperature criteria as Type B climate is determined by moisture content in the air or dryness (rather than coldness).

How did Koppen determine the Moisture Index in Type B Climate?

Aridity is not measured by the amount of precipitation alone but is defined by the relationship between the precipitation input to the soil in which the plants grow and the evaporative losses. Since evaporation is difficult to evaluate and is not a conventional measurement at meteorological stations, Köppen was forced to substitute a formula that identifies aridity in terms of a temperature-precipitation index (that is, evaporation is assumed to be controlled by temperature). Dry climates are divided into arid (BW) and semiarid (BS) subtypes, and each may be differentiated further by adding a third code, for warm (h) or cold (k).

This classification has been replicated at different parts of the world by botanists later.
If one observes the climatic zones of the world delineated according to Koppen's classification along with the map showing zones of natural vegetation across the globe, one finds a strong similarity in their zonation.

The two maps are being presented below for you to observe the similarities in the patterns.

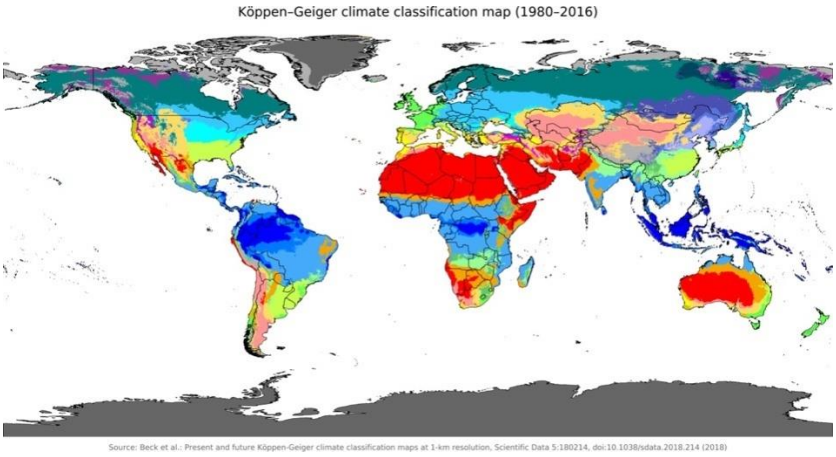

Image 9. Climatic Zones of the World

Source:https://en.m.wikipedia.org/wiki/File:Köppen-Geiger_Climate_Classification_Map.png

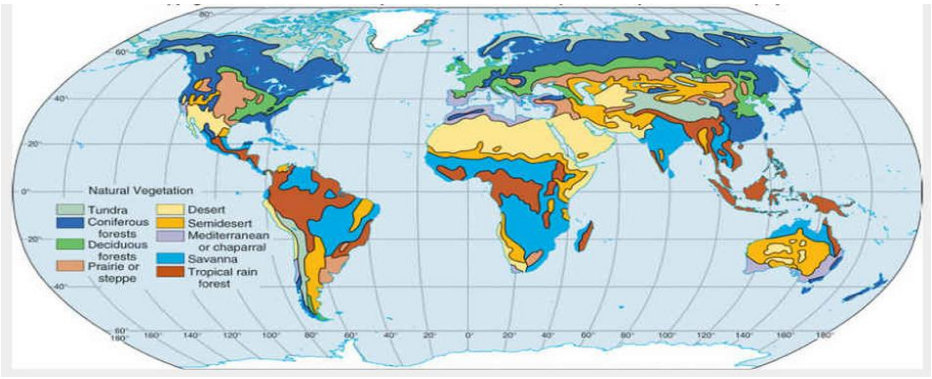

Image 10. Natural Vegetation zones of the world.

Source: https://suelynhomeworkhelper.weebly.com/world-map.html

For instance, it may be observed that in areas of tropical warm climates with abundance of Rainfall; Tropical Rainforests can be found. In the same way, different climatic zones give rise to specific types of natural vegetation. In India too, a similar link may be observed if the of natural vegetation zones are studied in relation to the climatic regime of the place. **The maps of climatic and vegetation zones of India are being presented here to observe the influence of climate on vegetation.**

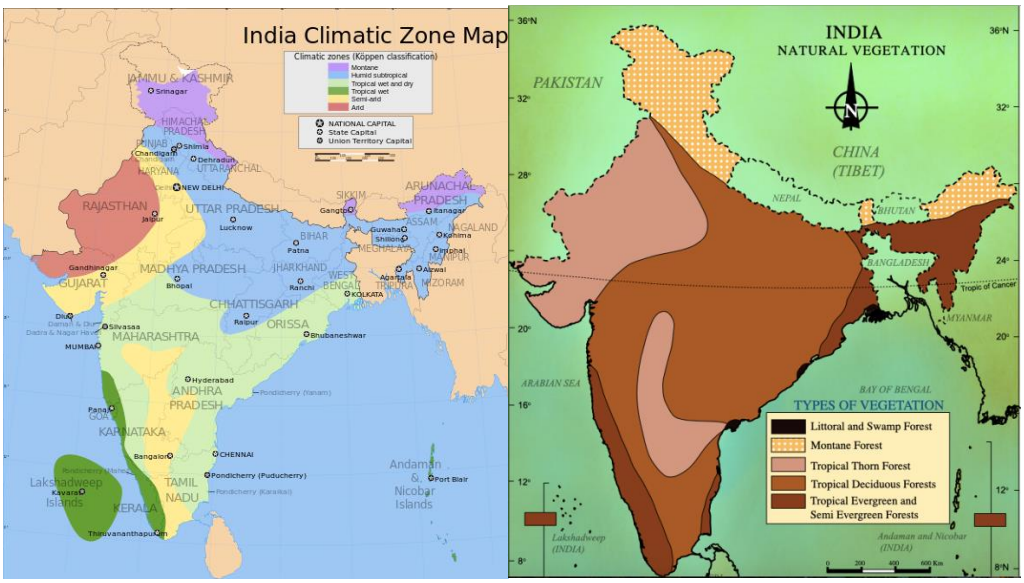

Image 11(a); 11(b) Climatic Zones of India and Natural Vegetation Zones of India.

Source: https://commons.wikimedia.org/wiki/File:India_climatic_zone_map_en.svg

Source: https://nroer.gov.in/5645d28d81fccb60f166681d/file/57cff5f316b51c038dedcadb

It may be observed from the two maps that vegetation zones are controlled by climatic zones. Tropical wet areas have tropical rain forests and in the arid regions, tropical thorn forests may be found. For a clearer understanding of this phenomenon, the aspects of climate that influence the type of vegetation is being now discussed in detail. The different aspects of climate that influence the natural vegetation of a region are:

a. **Temperature**–Temperature plays a critical role in the germination of seeds into plants. Not only germination, but a number of other physiological processes of a plant like respiration and transpiration. Extremely high temperature is usually detrimental for the growth of plants as it may cause stunting and lead to death of plants. Different plants have different levels of endurance of temperature and plants grow well if they receive the optimum temperature required by them. Metabolic activity of plants is very low below 0º C and above 40º C. Plants may be classified into four broad categories on the basis of the thermal regime that suits their growth and reproduction. These categories are;

   i. **Megatherms**– Plants that sustain in high temperature throughout the year. Examples; Equatorial forests and Tropical rain forests
   ii. **Mesotherms** – Plants that sustain in higher temperatures in summer and lower temperatures in winter. Examples; Deciduous Tropical and Sub-tropical forests
   iii. **Microtherm**– Plants that can sustain in extremely low temperatures. Example; Coniferous forests.
   iv. **Hekistotherms**– Plants that can sustain themselves in extremely low temperatures. Example; Cold tolerant plants of the Polar Regions.

The next important aspect that affects the growth of natural vegetation is Rainfall.

Rainfall – Rainfall along with temperature have a strong bearing on the type of natural vegetation found in a region. Distinct community of plants or 'Biomes' develop in accordance to the characteristics of the environment. Areas receiving 200 centimeters or more rainfall per annum have Evergreen rainforests, while Monsoon deciduous forests dominate in areas between 100 and 200 centimeters of rainfall per annum. In areas where the annual average rainfall ranges between 50 to 100 centimeters, vegetation resembling dry deciduous or Tropical savanna with open thorny scrub may be found. In areas where the annual average precipitation measures below 50 centimeters, only dry thorny scrub vegetation exist. The following diagram clearly explains how regimes of temperature and precipitation together contribute to the localisation of particular zones of natural vegetation.

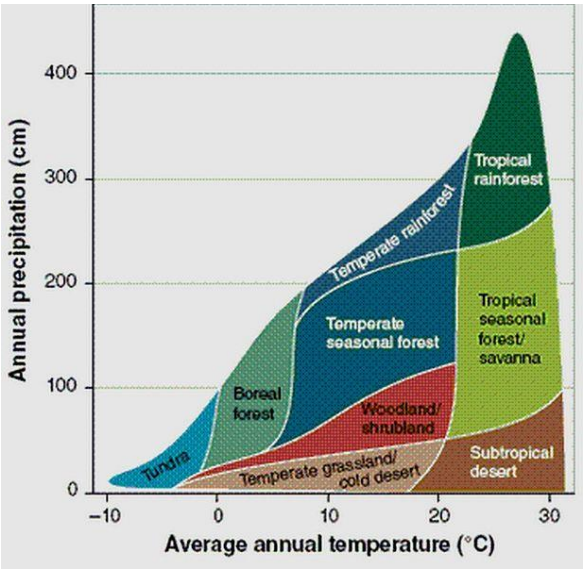

Image :12. Precipitation and Temperature Biomes

Source: https://commons.wikimedia.org/wiki/File:PrecipitationTempBiomes.jpg

Image 12 shows, low temperature and low rainfall regimes are requisite conditions of Tundra type of forests, while on the other extreme high temperature and high rainfall regimes promote the growth and maintenance of Tropical rainforests.

Closely linked with the temperature and rainfall regimes, is the length of growing period available in an area. This is being discussed in the following section.

b. **Length of Growing Period –** the germination of seeds and their growth from a seedling to mature plant, is dependent on the heat and moisture regime. Growing period for plants refers to that period of the year when the temperature and precipitation levels are conducive for plants to grow successfully. The length of growing period varies from place to place. Most plants need a growing period of a minimum of 90 days. In warm tropical regions, the length of the growing period may last throughout the year. In the Tundra region, the length of the growing period may extend from 50 to 60 days only. Owing to the diversity of relief, climate and soil types found in India, the length of growing season also varies from one place to the other. The National Bureau of Soil Survey and Land Use Planning (NBSSLUP) has delineated 20 Agro Ecological Regions of India and measured the length of growing period in those regions. The images below show the map of the Agro-Ecological Regions of India.

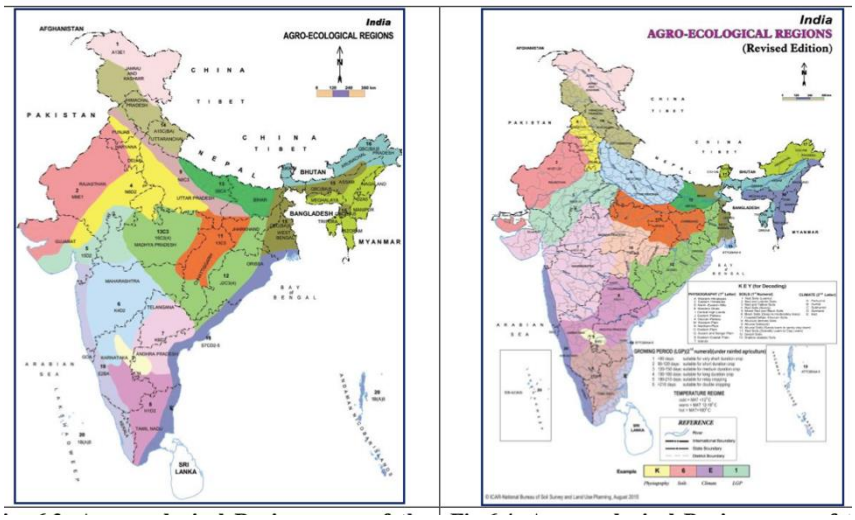

Image 13: Agro-Ecological Regions of India (AER)

Source:https://www.nbsslup.in/assets/uploads/clinks/Delineating%20Agro-Ecological%20Regions.pdf

With the help of the delineation of the AERs, the length of growing was determined. The study indicates that the Arid regions and Semi-arid regions (Ladakh, North Kashmir Himalayas, arid regions of Rajasthan) have less than 90 days. Sub-humid regions (Central Highlands, Northern Karnataka, Tamil Nadu Uplands) between 90 and 150 days; Humid regions (Indo-Gangetic Plains, foothills of Himalayas, Chotanagpur Plateau, Eastern Ghats of Odisha) between 150 and 210 days while the Per-humid regions (Nagaland, Manipur, Meghalaya, Mizoram, Sahyadris of Kerala and Karnataka) have more than 210 days of growing period. All the factors discussed in this module, collectively determine the type of natural vegetation that may be found in a region.