

Topic: Phytogeography

Phytogeography (from Greek phytón = "plant" and geographía = "geography" meaning also distribution) or botanical geography is the branch of biogeography that is concerned with the geographic distribution of plant species and their influence on the earth's surface. Phytogeography is concerned with all aspects of plant distribution, from the controls on the distribution of individual species ranges (at both large and small scales, see species distribution) to the factors that govern the composition of entire communities and floras.

Major Divisions of Phytogeography:

There are two major divisions of Phytogeography:

- (i) Descriptive or Static Phytogeography
- (ii) Interpretive or Dynamic Phytogeography

Descriptive Phytogeography: This deals with the actual description of floristic or vegetational groups found in different parts of the world. Early plant geographers described floras and attempted to divide earth into floristic and botanical zones.

Interpretive or Dynamic Phytogeography: This deals with the dynamics of migration and evolution of plants and floras. It explains the reasons for varied distribution of plant species in different parts of the world. It is a borderline science involving synthesis and integration of data and concepts from several specialized disciplines like ecology, physiology, genetics, taxonomy, evolution, palaeontology and geology. Good (1931), Mason (1936), Cain (1944) and some others have pointed out the factors involved in the distribution of plants.

Distribution:

On the basis of area of the earth surface occupied by the plants, the various taxa are categorized as under:

1. Wides.
2. Endemics.
3. Discontinuous species.

1. Wides:

Plants widely distributed over the earth in definite climatic zones and the different continents are referred to as wides. Cosmopolitan is applied for wides but, in fact, no plant is cosmopolitan in real sense of the term. *Taraxacum officinale* and *Chaenopodium album* are the common examples of the wides. Plants of tropical regions are called Pantropical. The plants of very cold climate may not only be found in the arctic regions but also in alpine zone of mountains in tropical and subtropical regions. These are called arctic-alpine plants.

2. Endemics: A taxon whose distribution is confined to a given area is said to be endemic to that area. The taxon may be of any rank, although it is usually at a family level or below, and its range of distribution may be wide, spanning an entire continent, or very narrow covering only a few square metres. The concept of endemism is important because in the past the formulation of biogeographic regions was based on it.

3. Discontinuous Distribution: When plants occur at two or more distant places of the world which are separated by overland's or oceans hundreds or thousands of kilometres apart. Such a distribution is called discontinuous or disjunct distribution. Three genera *Nothofagus*, *Jovellona* and *Adensonia* for example are found in parts of South America, South Africa and Australia which are -parated by vast oceans.

Botanical Zones of India /Phytogeographical Zones of India

India has been divided into the following botanical zones by D. Chatterjee (1962)-

(1) Western Himalayas, (2) Eastern Himalayas, (3) Indus plain, (4) Gangetic plain, (5) Central India, (6) Deccan, (7) Western coasts of Malabar, (8) Assam, and (9) Bay Islands of Andaman and Nicobar

1. Western Himalayas

Mountain ranges at the north-west of India are named as Western Himalayas. This is north most botanical region in India. This botanical zone includes Kashmir, Northern part of Punjab and Kumaon ranges of Uttranchal. The annual rainfall in this region is 100-200 cm. This region is wet in the southern ranges and slightly dry in the higher ranges in the North. At high altitudes, snowfall occurs during the winters. This zone lies in the sub-tropical belt. However, temperate and alpine zones are found higher altitudes. Thus there are three climatic zones in this phytogeographic region. They are:

1. Subtropical zone 2. Temperate zone 3. Alpine zone.

1. Subtropical Zone

This zone occurs at the low altitudes of western Himalayas up to the height of 1500 metres. It occurs in the foothills of the Himalayas and the adjoining areas. Here the summer is very dry but winter is very cool with occasional ground frosts. But there is no snow deposit on the ground. The vegetation consists of subtropical dry evergreen forest and subtropical moist deciduous forests. Sal tree (*Shorea robusta*) is dominant in these forests. *Salmalia malabaricum* and *Acacia catachu* are common associates of Sal. Swamp forests are seen near the banks of rivers and streams. *Ficus*, *Dalbergia*, *Syzygium*, etc. are common in these forests. Dry thorn forest is seen in the rocky slopes and areas disturbed by overgrazing. *Euphorbia*, *Acacia*, etc. are found in these areas. At the height of 800-1500 metres, pine forest is seen in many places. *Pinus roxburghii* (Cheer pine) is dominant in these forests. *Quercus*, *Syzygium*, etc. are common associates of pine. Ground vegetation is very thin. It has *Andropogon*, *Indigofera*, etc.

2. Temperate Zone- This zone lies at the elevation between 1500 m and 3000 m. The climate is wet between the altitudes of 1500 and 1800 m and is drier at higher altitude. Rainfall is low but land is humid due to water coming from the melting of snow. Moist temperate forests are seen at low elevations (1500-1800 m). White oak (*Quercus incana*), green oak (*Quercus dilatata*), brown oak (*Quercus semecarpifolia*), *Cedrus*, *Pinus*, etc. are common in these forests. Conifers are abundant at higher elevations. Herbs, ferns and grasses form the ground vegetation.

3. Alpine Zone- High mountain range where there is high snow fall is called alpine zone. In the western Himalayas, it extends from 3000m to 5000 m elevation. The rainfall is very scanty and climate is very cool and dry. Wind velocity is very high Winter is very cold but summer is pleasant. Sub-alpine forests are found up to the elevation of 3650m. Trees cannot grow above this height. These forests contain *Abies*, *Pinus*, *Pyrus*, *Quercus*, etc. Height of these trees is low in these forests. Just above the sub-alpine forests, there are alpine shrub lands. *Juniperus*, *Salix*, *Rhododendron*, *Rheum*, *Polygonum*, *Sedum*, etc. are common in these areas. These plants are very small in size. Just above the shrub lands, alpine meadows are there. These are flat areas. They accommodate many herbaceous plants which can form cushion of green beds on the soil surface. *Potentilla*, *Corydalis*, *Saxifraga*, *Primula*, etc. are common in the meadows. Alpine stony deserts are found in between the alpine meadow and snowline. These areas are covered with stones and rocks. Lichens and xerophytic herbs are rich in these areas. Plants like *Saxifraga*, *Gentiana*, etc. are growing in these areas.

2. Eastern Himalayas

The north east botanical zone is named as Eastern Himalayas. This botanical province includes the Himalayas and adjoining areas in Sikkim, Bhutan, north border of Assam, Darjeeling and Arunachal Pradesh. The annual rainfall is slightly higher than that in the Western Himalayas. The climate is warmer and wetter than in western Himalayas. Snowfall is very low. This zone lies in the sub-tropical belt. Because of heavy rainfall and warm climate, sub tropical forests are found at lower altitudes. Temperate and alpine zones are found at higher altitudes.

1. Subtropical Zone- Subtropical zone refers to moderately warm region. This zone occurs at low altitudes of eastern Himalayas upto the height of 1800 metres. It occurs in the foothills of the Himalayas and in the adjoining areas. Rainfall is heavy and the number of rainy days is more compared to the Western Himalayas. Ground frost and snowfall are rare. Winter is less cool. The vegetation consists of evergreen forests, mixed deciduous forests and subtropical moist deciduous forests.

2. Temperate Zone- This zone lies at the elevation between 1800 m and 3800 m. Puri (1960) divided this zone into lower temperate zone and upper temperate zone. The lower temperate zone extends from the elevation of 900 m to 2800m. This area is occupied by broad-leaved evergreen trees and deciduous trees occur here and there. Canopy is closed. Important trees are *Quercus*, *Lithocarpus*, *Prunus*, *Pyrus*, *Castanopsis*, *Mahonia*, *Symplocos*, *Cinnamomum*, etc. The upper temperate zone is found at the elevations between 2800m and 3800m. Mixed coniferous forests occur in this zone. Conifers such as *Abies*, *Pinus*, *Picea*, *Larix*, *Cryptomeria*, *Cupressus*, *Juniperus* and *Taxus* form dominant vegetation. Broad leaved trees (*Acer*, *Quercus*, *Betula*, *Magnolia* and *Listea*) are common associates of conifers. Ground cover is formed by shrubs, ferns and grasses.

3. Alpine Zone- Region with frequent snowfall is called alpine zone. In the eastern Himalayas, alpine zone extends from 3800m to 4800 m elevation. The rain fall is very low and climate is very cool and dry. Wind velocity is very high. Winter is very cold but summer is pleasant. Sub-alpine forests are found up to the elevation of 4200m. Trees cannot grow above this height. These forests contain *Abies*, *Juniperus*, *Rhododendron*, *Pyrus*, *Polygonum*, etc. Just above the sub-alpine forests, there are alpine shrub lands. *Juniperus*, *Salix*, *Rhodo dendron*, *Rheum*, etc. form thick vegetation. Small shrubs, herbs and herbaceous plants form the ground vegetation.

3. Indus Plain

The large plain of land in which ancient Indus Valley civilization is observed is known as Indus plain. It is located in the north-west of India. It includes Punjab, Haryana, Delhi, Rajasthan and north part of Gujarat. Some parts of this plain is now in Pakistan. The annual rainfall is less than 70 cm. In some parts, it is as low as 10-15cm. The climate is very dry and hot in the summer and cold in the winter. Soils in most regions are saline. Southern part of this zone had become deserts. Dry deciduous forests and tropical thorn forests make up the natural vegetation of Indus plain. Deciduous forests are found in Aravalli ranges, Cutch and riverine lowlands. Trees like *Grewia*, *Butea*, *Mangifera*, *Acacia*, *Balanites*, *Zyzyphus*, *Nyctanthes*, *Carissa*, etc. are dominant in the forests. Climbers like *Tragia*, *Rivea* and *Vitis* are seen in these forests. Grasses and seasonal herbs form the ground vegetation. Tropical thorn forests are found in arid lowlands and deserts. Trees like *Acacia modesta*, *Prosopis*, *Dichrostachys*, *Salvadora* and *Tamarix* form dominant vegetation. The shrubs include *Zyzyphus*, *Lycium*, *Capparis*, *Opuntia*, *Euphorbia*, *Calotropis*, etc. Xerophytic herbs like *Tribulus*, *Solanum*, *Argemone*, etc. form ground vegetation.

4. Gangetic Plain

The large plain through which the river Ganges and its tributaries flow is known as It includes Uttar Pradesh, Bihar, West Bengal, Chhattisgarh, Jharkhand and northern part of Orissa. Annual rainfall ranges from 50cm to 150cm. The climate is warm during the summer and less cool during the winter. There is a

gradual transition of dry deciduous forest to moist deciduous forest towards the east. This zone is divided into three subzones. They are the Western Gangetic plain, Eastern Gangetic plain and Sundarbans.

1. Western Gangetic Plain- It occupies the western half of the Gangetic plain. It is also called Upper Gangetic plain. The annual rainfall is 50-110 cm. The climate is very dry and hot in the summer and cold in the winter. This area has dry deciduous forests. Small trees, thorny shrubs and bushes form dominant vegetation. Vegetation includes *Acacia*, *Jatropha*, *Caparis*, *Aegle marmelose*, *Melia*, *Phoenix*, *Mangifera*, *Zyzyphus*, etc. Climbers like *Tinospora cordifolia*, *Cocculus villosus* and *Hemidesmus indicus* are seen in these forests. Grasses and seasonal herbs form the ground vegetation. Sal forests occur at the foothills of mountain ranges.

2. Eastern Gangetic Plain- It occupies the eastern half of the Gangetic plain, except the coastal region. It is also called Lower Gangetic Plain. It extends from Allahabad to Orissa. The climate is more humid because of high rainfall(150-250cm). This area has moist deciduous forests. Trees like *Shorea*, *Diospyros*, *Artocarpus*, *Pterospermum*, *Bombax*, *Casuarina*, *Eugenia*, etc, are dominant in these forests. Bamboos, Coconut palms, Areca nut palms, Palmyra palms and Phoenix are so common.

3. Sundarbans- The mangrove forest at the river mouth of the Ganges is called Sundarbans. It covers the coastal region of West Bengal and Orissa. It covers 1500sq.km area. This area is swampy. Mangrove plants such as *Rhizophora*, *Bruguiera*, *Ceriops*, *Heritiera*, *Avicennia*, *Sonneratia*, etc. are dominant in this forest.

5. Central India

This botanical zone includes Madhya Pradesh, eastern part of Gujarat and western part of Orissa. It lies between the Aravalli ranges (in the north-west) and Satpura ranges (in the south). The areas are mostly hilly. Some areas are at the elevation of 500-700 m height from the sea level. Eg. Vindhyas. The average annual rainfall is 100-170 cm. Sal forest and mixed deciduous forest form natural vegetation. But, thorny vegetation is common in some areas. *Hardwickia binata*, *Acacia catchu*, *Lannea cormandalica*, etc. are common associates of Sal tree. Mixed deciduous forests are seen in Vindhyas and other areas where the annual rainfall is Madhuca indica, etc. are very common in these forests. Bamboos, epiphytes, climbers and 150-200 cm. *Tectona grandis*, *Terminalia tomentosa*, *Dalbergia paniculata*, *Bombax ceba*, grasses are abundant. The thorny vegetation has Prosopis, Acacia, Zizyphus, Mimusops, teak, etc.

6. Deccan

The Peninsular India is also known as Deccan Plateau. It includes Tamil Nadu, Karnataka, Andhra Pradesh and southern regions of Madhya Pradesh and Orissa. The average rainfall is about 100 cm per year. The climate is dry except at hill stations. Soils fertile enough for agriculture. Tropical moist evergreen forests occur at the elevations above 1000 m. *Pterospermum*, *Emblica*, *Dillenia*, *Kydia*, *Rhus*, *Xylia*, *Terminalia*, *Woodfordia*, *Crotalaria*, *Berberis*, *Commelina*, *Leucas*, etc. are common in these forests. Tropical dry evergreen forests occur in regions between Tirunelveli and Nellore (AP).

Some spiny xerophytic species are found along with the broad leafed plants. Climbers are abundant but bamboos are rare. Trees like *Manilkara*, *Terminalia*, *Acacia*, *Ixora*, *Syzygium*, etc. are common in these forests. Tropical moist deciduous forests are seen in some regions. Teak forests are found in many hill tracts. Red sandal (*Pterocarpus santalinus*) forest is seen in Cuddapah.

7. Western Coast of Malabar

This botanical zone consists of the Western Ghats and west coast of India. It lies between the Satpura range of Gujarat and Kovalam (Kerala). It includes Kerala Goa, southern of Gujarat and western parts of Karnataka and Maharashtra. The climate is warm and humid having annual rainfall over 400 cm. The climate is tropical on the coasts and temperate in the hills. Tropical moist evergreen forests are found in Western Ghats, North Kanara, Anamala Coorg and Mysore plateau. The annual rainfall is 250 cm or above. The climate is warm and humid. In the top storey, trees grow up to 50m height and form closed canopy. Shrubs, herbs, climbers and epiphytes are abundant. Trees like *Dipterocarpus*, *Hopea*, *Syzygium*, *Myristica* *Terminalia*, etc. are dominant in these forests. Tropical semi-evergreen forests are found in some regions of the Western Ghats. Trees like *Terminalia*, *Calophyllum*, *Hopea*, *Xylia*, etc. are dominant in these forests. Climbers and bamboos are seen in many places. Tropical moist deciduous forests are distributed in Wyanad, Kanara, Coorg, Cochin and Travancore. Trees like *Tectona*, *Terminalia*, *Pterocarpus*, *Xylia*, *Santalum*, etc. form dominant vegetation. Trees remain leafless for 2-4 months. Climbers, herbs and grasses are common. Subtropical mixed deciduous forests are distributed at the elevations between 700m and 1600 m. They are found in Nilgris and Palni hills. *Syzygium*, *Actinodaphne*, *Terminalia*, *Rhododendron*, etc. are common in these forests. Deciduous trees are dominant in Coorg. Temperate evergreen forests are distributed at the elevations above 1200 found in the Nilgris, Palni hills and Anamalai ranges. Trees grow up to 20m height and form closed canopy. The temperate forests are often called Sholas. Mangrove vegetation is found in the coastal regions.

8. Assam

This botanical zone consists of Assam, Nagaland, Mizoram, Tripura, Manipur and Meghalaya It has so many hills interspaced with plains and rivers. Rainfall is frequent and it usually exceeds 205cm in a year. In some regions the annu rainfall is even as high as 1000cm (eg. Cherapunji). The climate is warm and humid. So, this zone has dense vegetation. Tropical moist evergreen forests are found up to the elevation of 1200m. They occur in lowlands, foothills and plains. Climbers and epiphytes are very common. Broad leafed trees like *Dipterocarpus*, *Artocarpus*, *Altingia*, *Cinnamomum*, *Magnolia*, *Syzygium*, *Bambusa*, *Ca pus*, *Magnolia*, etc. are common in these forests. Some conifers are found here and there. Tropical semi-evergreen forests and tropical deciduous forests are found in Garo hills Assam valley and North Cachar. Pine forests are found at the elevations between 1200m and 1700m height. The climate is subtropical. Broad leaved trees (*Pinus*, *Quercus*, *Lithocarpus*, *Pentapenex*, *Indula*, etc) are abundant in these forests. Ground flora is rich in grasses and Wet temperate forests are found in the regions at 1700m altitude. Trees grow up to 23m herbs. height. *Betula*, *Caprinus*, *Rhododendron*, *Magnolia*, Pines, etc grow in these forests. Shrubs and bamboos form ground vegetation.

9. Islands of Andaman and Nicobar

The islands of Andaman and Nicobar make up this botanical zone. These islands are located in the tropical belt. So, the climate is warm and humid. The coastal zones of these islands have sandy shores. Tropical forests of Nicobar are dominated by *Ptychophis*, *Sterculia*, *Symploca*, *Trichospermum*, *Garcinia*, *Ficus*, etc. The under story is formed by *Ixora*, *Hedyotis*, *Lesianthus*, *Zyzyphus*, *Dinochola*, *Salix*, etc. Climbers are abundant. Ground vegetation is formed of grasses and herbs. Tropical moist evergreen forests, tropical semi-evergreen forests and deciduous forests are found in Andaman. *Dipterocarpus* and *Cannarium* are dominant in the moist evergreen forests. *Dipterocarpus*, *Sterculia*, *Albizzia*, *Calophyllum*, *Bombax*, *Dillenia*, *Myristica*, etc are common in tropical semi-evergreen forests. *Pterocarpus*, *Terminalia*, *Cannarium*, *Murraya*, *Diospyros*, etc. are common in the tropical deciduous forests. Bamboos and shrubs are abundant in these forests.