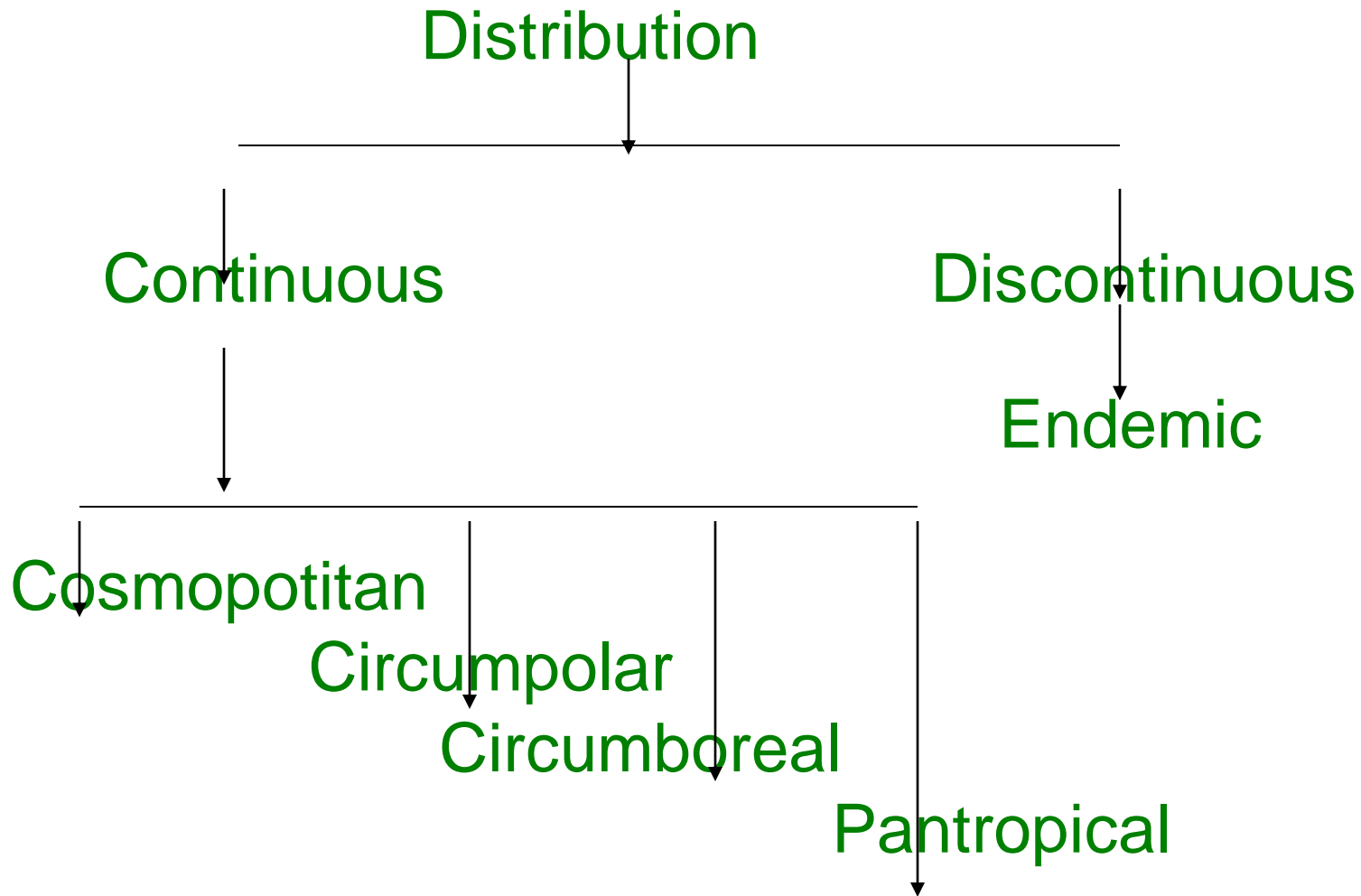


# Biogeography

- *bios* = life; *geo* = earth; *graphein* = to write.
- Aspects of distribution of an organism:
  - Geographic range, extent where the organism normally occurs
  - Geologic range, distribution in the time – past and present; and
  - Ecological distribution, or the major biotic communities.

# Patterns of Distribution



# Continuous Distribution

- 1. Cosmopolitan Distribution:** - Distributed throughout the world in all climatic zones. *Chenopodium album, Urtica dioica, Poa annua*
- 2. Circumpolar Distribution:-** *Saxiphraga oppositaefolia*, distributed in a belt around north pole.
- 3. Circumboreal Distribution:-** Distributed in a near continuous belt in temperate region of northern and/or southern hemisphere. *Alnus, Acer* etc.
- 4. Pantropical Distribution:-** *Bauhinia, Dalbergia, Ocimum, Cassia, Eugenia, Phyllanthus* distributed throughout the tropical belt.

# Discontinuous Distribution

- A taxon distributed in two or more widely separated geographical areas

# Discontinuous Distribution

<b>Discontinuity</b>	<b>Distribution</b>	<b>Examples</b>
<b>Arctic-alpine</b>	<b>Arctic region and high altitudes</b>	<b><i>Saxifraga, Silene</i></b>
<b>Mediterranean</b>	<b>Around Mediterranean sea in Europe and Africa</b>	<b><i>Olea, Cistus, Ceratonia</i></b>
<b>Tropical</b>	<b>In two or more parts of tropics</b>	<b><i>Pandanus, Coffea arabica, Viola abyssinica, Nepenthes, Anona, Agathis, Adansonia digitata</i></b>
<b>Antarctic</b>	<b>South America, New Zealand and Some Islands</b>	
<b>Intercontinental</b>	<b>Several places within the same continent</b>	<b><i>Drosera, Rubia, Erica, Daboecia</i></b>

# Two reasons

- (a) Range has become discontinuous because **individuals simply disappeared** from the intervening areas, and
- (b) The range of species was **never contiguous** but **propagules** (seed, spores, vegetatively reproducing organs) from the original area reached distant sites.

# Endemic Distribution

**Endemism:** Confinement of plant species, genus or a family to a certain restricted area.

- Endemics are taxa of very restricted distribution in small areas.
- India:-
  - **60% indigenous dicots**
  - **20% indigenous monocots**

# Endemic taxa

- Found in some isolation areas are perhaps the remnants of their ancient stock.
- Environmental or geological changes may lead to the occurrence of taxa in disjunct areas

<i>Tribulus rajasthanensis</i>	- Rajasthan/Gujrat
<i>Hopea andamamica</i>	- Amdamans
<i>Cryptomeria japonica</i>	- Japan
<i>Eucalyptus</i>	- Australia
<i>Rumex punjabensis</i>	- Punjab
<i>Cycas beddome</i>	- Cuddapah (AP)
<i>Dipterocarpus santalinus</i>	- Cuddapah (AP)



# (A) Nature of endemism

- Restricted in occurrence to a particular region, mountain or island.
- In the course of climatic or geological changes, distribution of the taxon may have been reduced.

## **(B) Neo-endemism**

Closely related spp. in same or adjacent areas developed due to following.

- ❖ Mutation
- ❖ Chromosomal rearrangement
- ❖ Polyploidy

## **(C) Holo-endemism**

•The phase of endemic species which lies between its origin, spread and perhaps subsequent loss due to extinction.

## (D) Paleo- endemism

- Ancient endemics, which represent remnants of older species, that usually occur in geologically old land masses.
  - They are taxonomically isolated components, which have no closely related species.

- “**Progressive, expanding or neoendemics**” - young species, whose distribution is narrow in the beginning and it is likely to grow in its area in course of time.
- “**Retrogressive endemics**” - species on account of their gradual dwindling gets restricted to a small region
- “**Relic endemics**” - Some species which had extensive distribution in the past, but are narrowly distributed today. This change may be due to geographical and climatic changes.
- “**Local endemics**” - Even among endemics some are restricted to a very localized spot.
- “**Pseudo endemics**” - Sometimes, a few mutants appear which do not compete successfully, and therefore disappear quickly.

# Phytogeography

- Study of present and past geographical **distribution of plants** on the earth.
- Study of present and past areas and the elucidation of **origin and history of development of floras**.

# Phytogeography of India

- **Peculiar physiographic, climate and biotic features.**
- **Subcontinent stretches out between tropical and subtropical belts.**
- **Climate is chiefly modified by oceans and mountains.**

## **Three distinct seasons**

- **Cold winter**
- **Hot summer**
- **Monsoon**

# Vegetation of India

- Champion and Seth recognized 16 major types of forests in India.
- Edaphic and biotic factors have been taken into account for recognizing subgroups.

**(A) Moist Tropical Forests**

**(B) Dry Tropical Forest**

**(C) Montane Subtropical Forest**

**(D) Montane Temperate Forests**

**(E) Sub Alpine Forests**

# Grassland Vegetation

- **Natural grasslands (as climax formation) are not present, but occur only during succession.**
- **Three types of grasslands**
  - 1. Xerophilous** that occur in dry regions of north west India under **semi-arid conditions**.
  - 2. Mesophilous** which are extensive grass flats or savannas and occur in **moist deciduous forests of Uttar Pradesh**.
  - 3. Hygrophilous** which are called **wet savannas**.



# Grassland Types in India

## 1. Sehima-Dicanthium type

- Whole of peninsular India – Southern Parts of Maharashtra, Madhya Pradesh, Orissa, Andhra Pradesh, Tamil Nadu, Karnataka, South West Bengal.

## 2. Dicanthium-Cenchrus-Lasiurus type

- Subtropical arid and semi-arid regions – North Gujrat, Rajasthan, Western UP, Punjab & Haryana

## 3. Phragmites-Saccharum-Imperata type

- Gangetic plains, Brahmaputra valley, extending west ward to plains of Panjab.

#### **4. Thameda-Arundinella type**

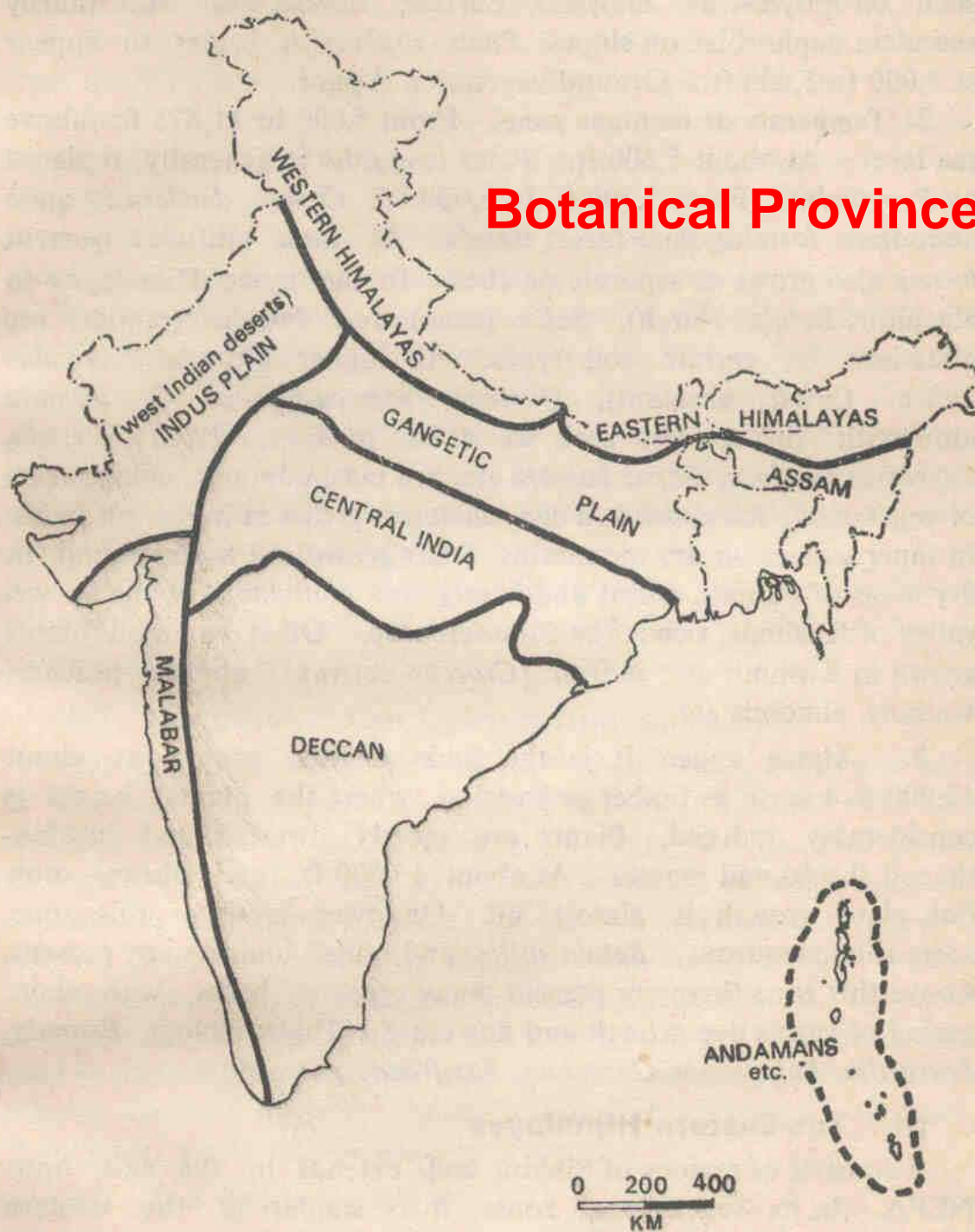
- Entire Northern and NE mountain tracts in Manipur, Assam, WB, UP, Punjab, Himachal Pradesh, J&K.

#### **5. Temperate-Alpine type**

- High hills of Northern mountain belt in J&K, Himachal Pradesh, Punjab, UP, West Bengal & Assam



# Botanical Provinces of India





# Botanical Provinces of India

- Floristic regions

## 1. Western Himalayas

- Extends from Kumaon to Kashmir and has annual rainfall up to 2000 mm.
- Altitudinally three zones of vegetation corresponding to three climatic belts.

### a) Submontane zone:-

- Extends up to 1500 meters altitude and comprises mostly Siwalik ranges.
- Forests are tropical and subtropical.
- *Shorea robusta*, *Dalbergia sissoo*, *Ficus glomerata*, *Eugenia jambolana*, *Acacia catechu*, *Zizyphus*, thorny succulent *Euphorbias* on the slopes.

## **b) Temperate zone**

- Montane temperate forest up to 3500 meters.
- *Quercus, Acer, Ulmus, Rhododendron, Betula, Salix, Populus, Prunus, Fraxinus, Pinus, Cedrus, Picea and Taxus.*

## **c) Alpine zone**

- Above 3500 meters up to about 4500 meters (Snow line).
- Vegetation is alpine forest and scrub merging into meadows.
- *Abies, Betula, Juniperus and bushy Rhododendron.*
- Herbs near the snowline include *Primula, Potentilla, Polygonum, Geranium, etc.*

## 2. Eastern Himalayas

- North Eastern region characterized by more rainfall, less snow and higher temperature.
- Three zones:

### a. Tropical zone

- Up to about 1800 meters.
- Tropical semi-evergreen or moist deciduous forests.
- *Shorea robusta*, *Acacia catechu*, *Dalbergia sissoo*, *Terminalia*, *Albizza*, *Cedrela*, *Dendrocalamus* etc.

## **b. Temperate zone**

- Extends between 1800 to 3800 meters.
- Typical montane temperate forests dominated by *Oaks, Michelia, Quercus, Pyrus, Symplocus, Eugenia* etc., at lower levels;
- Conifers such as *Abies, Pinus Larix, Tsuga* and *Juniperus* and also *Salix, Rhododendron Arundinaria* etc, at higher levels

## **c. Alpine zone**

- Beyond the temperate zone,
- Up to 4500 meters altitude.
- Alpine vegetation
- *Juniperus* and *Rhododendron*



# 3. Indus Plains

- Arid and semi arid regions of Punjab, Rajasthan, Kutch, parts of Gujarat and Delhi.
- Rainfall is less than 700 mm.
- Tropical thorn forest in semi arid region
- Typical desert in the arid region.
- Xerophytes, *Acacia nilotica*, *A. Senegal*, *A. leucophloea*, *Anogeissus pendula*, *Salvadora*, *Capparis*, *Albizzia*, *Grewia*, and *Calotropis*.

# 4. Gangetic Plains

- Extends over Uttar Pradesh, Bihar, Bengal and parts of Orissa.
- Moderate amount of rainfall and most fertile soils.
- Vegetation chiefly of tropical moist and deciduous and dry deciduous forest type.
- *Dalbergia sissoo*, *Acacia nilotica*, *Saccharum munja*, *Butea monosperma*, *Madhuca indica*, *Terminalia arjuna*, *Buchanania lanzan*, *Diospyros melanoxylon*, *Cordia myxa*, *Azadirachta indica*, *Xanthium*, *Cassia*, *Amaranthus* etc.
- In Gangetic delta (South Bengal) mangrove vegetation is common.

## 5. Central India

- Madhya Pradesh, parts of Orissa and Gujarat.
- Rainfall 1500-2000 mm
- Vegetation thorny, mixed deciduous and teak type.
- *Tectona grandis*, *Madhuca indica*, *Diospyros*, *Butea*, *Dalbergia*, *Terminalia*, *Carissa*, *Zizyphus*, *Acacia*, *Mangifera* etc.
- Forests in many areas have been degraded to a grassland vegetation due to heavy grazing, burning and other biotic interferences.

# 6. Malabar (West Coast)

- Western coast - from Gujarat to Kanya Kumari
- Heavy rainfall
- Forests
  - tropical evergreen towards extreme west,
  - semi-evergreen towards interior
  - subtropical or montane temperate evergreen forests in Nilgiris and
  - mangroves near Maharashtra and Kerala coast.
- *Dipterocarpus indicus*, *Sterculia alata*, *Cedrela toona*, *Tectona grandis*, *Dalbergia latifolia*, bamboos
- Nilgiris- Shola forests- *Eurya japonica*, *Michelia nilagirica*

# 7. Deccan Plateau

- Extends all over peninsular India, that is, Andhra Pradesh, Tamil Nadu and Karnataka.
- Rainfall up to 1000 mm.
- Central hilly plateau has tropical dry deciduous forests of *Boswellia serrata*, *Tectona grandis* and *Hardwickia binata*
- Low eastern dry Coromandal coast has tropical dry evergreen forests of *Santalum album*, *Cedrela toona* and plants like *Acacia*, *Prosopis*, *Euphorbia*, *Capparis*, *Phyllanthus*

# 8. Assam

- Characterized by heavy rainfall (2000-10000 mm).
- Dense evergreen forest or sub-tropical.
- Evergreen forests - *Dipterocarpus macrocarpa*, *Mesua ferrea*, *Shorea robusta*, *Ficus elastica*, *Bambusa pallida*, *Dendrocalamus hamiltonii*, epiphytes and orchids.
- In the northern cooler region, wet hill forest include *Alnus*, *Betula*, *Rhododendron*, *Magnolia* etc.
- Hilly tracts also have pine forests of *Pinus khasiya* and *P. insularis*.

## 9. Andamans

- Varied type of vegetation:
  - mangroves at its coast and
  - evergreen forests of tall trees in the interior.
- *Rhizophora*, *Mimusops*,  
*Calophyllum*, *Lagerstroemia* etc.

# Dispersal Dynamics

- Spread of individuals away from their home sites.
- Dispersal movements are usually slow, and cover relatively short distances in the life time of an individual.
- Range expansion of the species into a new habitat or area.



# Manner and Means of Dispersal

- Active process of transportation of disseminules from place to place. Implies not only dispersal but also a successful growth and establishment.
- Methods of dispersal
  1. Wind
  2. Water and ice
  3. Animals
  4. Mechanical means
  5. Human agency

# Anemochory (Dispersal by wind)

- Various adaptations such as lightness, winged shape, hairyness.
- Fruits of *Holoptelia*, *Hiptage*, *Acer*, *Shorea* etc. are provided with wings.
- In many Compositae, the calyx is modified into hair like structure known as pappus.
- Seeds of *Calotropis*, *Holarrhena* and *Gossipium* are provided with either one or two tufts of hair or all over their body.

# Hydrochory (Dispersal by water)

- Earliest mode of dispersal as the primitive plants were aquatic.
- In *Cocos nucifera*, *Lodoicea schelliarum*, pericarp is modified as floating organs.
- Testa is buoyant in *Iris*, *Lamna*
- *Trapa*, *Eichhornia*, *Salvinia*, *Azolla* etc. are floating plants which are carried as a whole by flowing streams.

# Zoochory (Dispersal by animals)

❖ Most effective means of dispersal

Three ways;

1. Swallowing them, passing them through and out of the digestive tract.
2. Carrying them attached to their outer surface and
3. Carrying them in mud adhering to their feet.

❖ Birds

❖ Grazing animals

❖ Hooks, spines, bristles, stiff hairs.

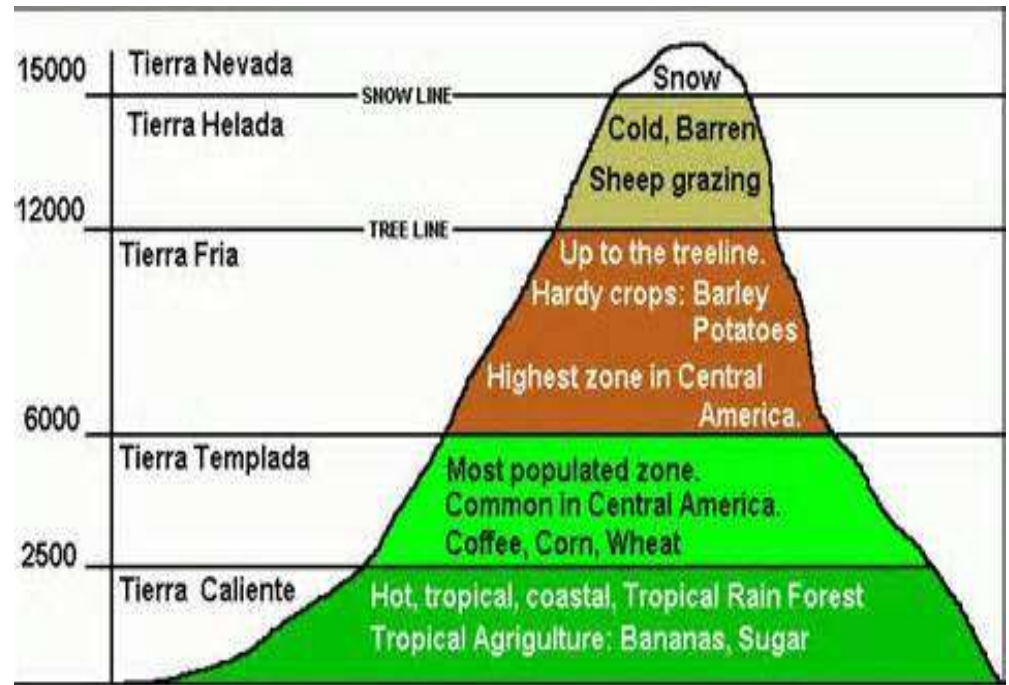
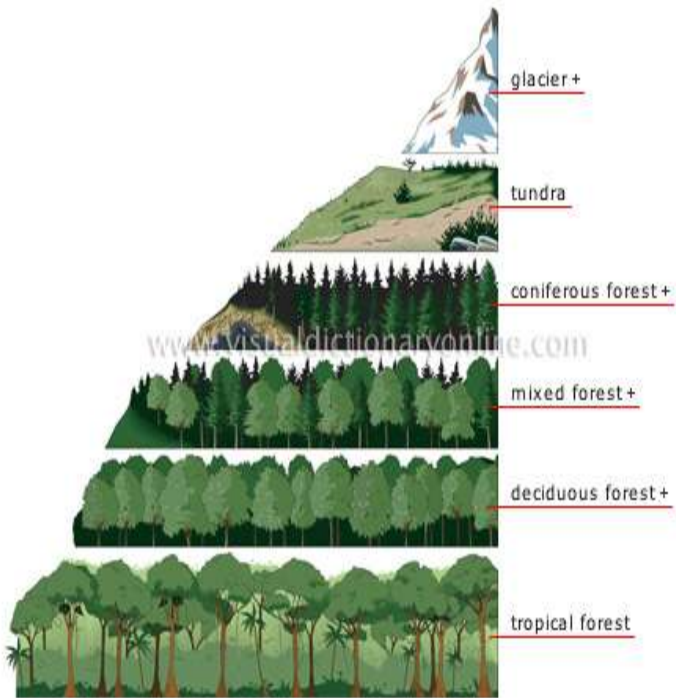
❖ *Tribulus, Xanthium, Achyranthus, Martynia, Aristida etc*

# Barriers to Dispersal

- **Feature of the physical or biological agency that restricts or prevents dispersal of plants is a barrier. Barriers are always relative and a barrier for one species may well be main dispersal route for another.**
- **Water might be barrier for a terrestrial species but normally is not for a aquatic species.**
- **Three classes or barriers:**
  1. **Physiographic or physical barriers such as land, water, elevation, soil;**
  2. **Climatic barriers such as temperature, humidity, rainfall, sunlight etc., and**
  3. **Biotic or biological barriers such as lack of food and the presence of enemies or effective competitors.**

## Different kinds of barriers:

1. **Topographic barriers:** -Physical factors as high and extensive mountain ranges.
2. **Climatic barriers:**- Extremes of temperature and moisture.
3. **Vegetation as barrier:**- . Plants serve as food and a means of shelter for animals. Thus depending upon their selective food habits, animals remain confined to areas with vegetation of their choice.
4. **Extensive water bodies:** - Effective physical barriers to distribution of amphibians, reptiles and mammals.
5. **Land masses:**- Barriers to the dispersal of marine life.



## ALTITUDINAL ZONATION

# Zoogeographic Regions of World

- I. **Palaeartic region:-** Largest region includes whole of Europe, northern China, Japan, erstwhile USSR, northern part of Africa and Persia etc.
- II. **Ethiopian region:-** Includes whole of Africa and Arabia, Madagascar and Mauritius. Divided into east African, west African, south African and Malagasy sub regions.
- III. **Oriental region: -**
  - Includes all the tropical parts of Asia, like India, Sri Lanka, south China, Malaysia, and Malayan islands.
  - Climatic conditions of this region are much varied.
  - Desert in the north of Indian sub-region.
  - Tropical in southern portion of India and Sri Lanka.
  - Temperate in Bhutan. .
  - Major part occupied by luxuriant forest vegetation.



## **Faunal characteristics(Oriental Region):**

- a) Fishes-** Freshwater fishes are more common,
- b) Amphibians-** Represented by nine families. (tree frogs), true frogs, salamanders.
- c) Reptiles-** 35 families, true vipers, pit vipers, sea snakes, turtles, freshwater snakes, tree snakes, Pythons, crocodiles, water lizards, geckos, some iguanas.
- d) Aves-** 71 families, babblers, sunbirds, king crows, woodpeckers, barbets, cuckoos, kingfishers, pigeons, doves, fowls, peacocks etc.
- e) Mammals-** 35 families, hedgehogs, shrews, flying lemurs, old world monkeys, cats, bear, dogs.

# IV. Australian region

- Include the whole of Australia, New Zealand, New Guinea, and adjoining islands, particularly those of Pacific Ocean.
- Fauna is represented by 134 families of terrestrial vertebrates, of which 30 are specific to the region including 8 families of mammals, 17 of birds, 3 of reptiles, and 2 of amphibians. Kangaroos, Wombats, Tuatara, Bandicoots, Marsupial. Birds of Paradise,.

## **V. Neotropical region:**

- Comprises southern Mexico, Central and South America, West Indies, and Galapagos island. Tropical region with luxuriant forests.

## **VI. Neoarctic region:**

- Greenland and North America up to the center of Mexico.

**Thank you**