PHYTOGEOGRAPHY

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Meaning of Phytogeography

- Actual description of floristic or vegetation groups found in different parts of the world
- Campbell (1926), Plant geography is to discover the similarities and diversities in the plants and floras of the present and past found in widely separated parts of the earth
- The Study of distribution of plant species in their habitats and elucidation of origin and history of development of floras
- The branch of botany that deals with the geographical distribution of plants.
- Phytogeography (from Greek, Phyto = Plant and “Geography” meaning also distribution) – Distribution of plant species

MAJOR DIVISIONS OF PHYTOGEOGRAPHY

- Descriptive Phytogeography - Pattern of distribution of present day plants. Actual description of floristic or vegetational groups found in different parts of the world
- Interpretive Phytogeography – Analyses about the actual causes, methods and conditions of the distribution of plants in the world - Good (1931) Mason (1936), Cain (1944)
- Dynamic Phytogeography - Dynamics of migration and evolution of plants and floras, borderline science involving synthesis and integration of data and concepts from several specialized disciplines like ecology, physiology, genetics, taxonomy, evolution, paleontology and geology.

CONTINUOUS VARIATION

- A variation that has no limit on the value that can occur within a population/inside a population **or** Variation in phenotypic traits such as body weight or height in which a series of types are distributed on a continuum rather than grouped into discrete categories
- Continuous variations are formed due to chance segregation of genes during gamete formation, crossing over and chance combination during fertilization
- For any species a characteristic that changes gradually over a range of values shows continuous variation

  e.g. Person's height and weight
- The variations fluctuate around an average or mean of species, They are already present in the population
- They can increase adaptability of the race but cannot form new species, Graphically, continuous variation gives a smooth bell shaped curve

The factors responsible for distribution of plants and animals in India are:

- **Climate** – India's climate is of monsoon type
- Varying amount of rainfall there are various types of vegetation all over the country
- **Soil** – Determines the type of plants,
- Type of plants found further determines the animals
- Soil type is different in various areas due to physical features like mountain, plateau, coastal area, island and desert
- **Precipitation** – The amount of rainfall determines the type of vegetation.
- In India rainfall amount varies place to place
- **Bio Reserve** - Natural forest preserved to protect various species of birds, animals and plants

Different types of Vegetation in India are

1.Tropical evergreen forest

- Dense, multilayered, and harbour many types of plants and animals,
- Receives rainfall 200 cm annual rainfall e.g. Ebony, Mahogany, Rosewood, Rubber and Cinchona
- Found in Andaman and Nicobar islands, the Western Ghats, Assam region in north-east

2.Tropical deciduous forest

- Trees of this forest type shed their leaves of about six to eight weeks in dry summer
- Receives rainfall 200 cm and 70 cm e.g. Sal, Shisham, Sandalwood, Khair, Jusum, Arjun, Mulberry
- Found in Eastern part of the North East States, Foot Hills of the Himalayas, Jharkhand West Orissa, Chhattisgarh and Eastern slopes of the Western Ghats

3. Thorn forest and shrubs

- A dense, scrub like vegetation characteristic of dry subtropical and warm temperate areas
- Vegetation consists of stunted trees with thorny bushes
- A seasonal rainfall averaging 250 – 500 mm
- Trees like Babul, Kikar, Khair, Plums, Cactus and Dates
- Semi-arid regions like Rajasthan, Gujarat, Chhattisgarh, Madhya Pradesh, Uttar Pradesh, Haryana and dry areas of the Deccan Plateau

4. Mountain Forest

- Forests on land with an elevation of 2500 m above sea level or higher, irrespective of slope, or on land with an elevation of 300 - 2500 m and a slope with sharp changes in elevation within a short distance
- At 1000 – 2000 m wet temperate vegetation is found, e.g. Chestnut And Pines
- At altitude 3000 – 4000 m Alpine vegetation is found, e.g. Silver firs, Junipers, Pines, Rhododendrons and Birches
- At more high altitude shrubs and scrubs are found
- Foot hills of the Himalayas, Vindhyas, Western Ghats of Sholas in the Nilgiris, Anaimalai and Palani Hills (Karnataka, Kerala and Tamil Nadu, at elevations over 1000 meters)

5. Mangrove Forest

- A tropical tree or shrub that grows in swampy areas and has tangled roots located above ground
- Pichavaram in Tamil Nadu - India's Largest Mangrove Forests
- Bhitarkanika Mangrove Forest – Odisa, by the Bay of Bengal,
- Sundarbans Mangrove forest – Delta of the Ganges, Brahmaputra in West Bengal, Gulf of Kutch in Gujarat
- Found in Andaman and Nicobar Islands

Discontinuous Variation

- When plants occur at two or more distant places of the world which are separated by overland's or oceans hundreds or thousands of kilometers apart. Such a distribution is called discontinuous or disjunct distribution **or** A species distributed in two or more widely separated geographical areas is called discontinuous distribution.
- These variations appear occasionally or mutation, e.g. person's blood group or the colour of a species of bird
- Discontinuous variations are produced by change in genome or genes
- Characteristics that are determined by various alleles at a single locus show discontinuous variation. For example garden peas are either wrinkled or smooth
- It is unpredictable,
- Gives new variations though similar variations might have occurred previously

The significant phytogeographical causes for discontinuous distribution are as follows:

- Species might have evolved at more than one place and they failed to migrate outside their original habitats because of barriers
- Species which were once widely distributed in the past disappeared from certain areas and are now surviving in some distant pockets
- The climate may also be a factor for discontinuity in distribution of species
- Plants having specific climatic requirements are found in widely separated areas with similar environmental conditions e.g. Plants of arctic regions are also found in alpine zone of high mountains in tropics and subtropics
- Salix and Silen species show discontinuous distribution in arctic-alpine regions

Continental Drift Theory

- Gradual movement of the continents across the earth surface through geological time - proposed by Alfred Wegener in 1912
- Deals with the distribution of the oceans and the continents
- All the continents were one single continental mass (called a Super Continent) – Pangaea and a Mega Ocean surrounded this supercontinent
- Mega Ocean is otherwise – Panthalassa
- Supercontinent, Pangaea, began to split some two hundred million years back
- Pangaea first split into 2 big continental masses known as Gondwanaland - Southern Region Laurasis – Northern region
- Later, Gondwanaland and Laurasia continued to break into several smaller continents that exist today

Endemism

- A species being unique to a defined geographical location, such as an island, country or other defined zone, or habitat type
- A taxon whose distribution is confined to a given area is said to be endemic to that area
- India is home to more than 50,000 species of plants, including a variety of endemics
- More than 3000 Indian plant species officially documented as possessing into eight main floristic regions e.g. Western Himalayas, Eastern Himalayas, Assam, Indus plain, Ganges plain, the Deccan, Malabar and Andaman Islands
- **Definition Endemism -**A species found naturally in only one geographic area is termed endemic or isolated geographical areas, such as islands, lakes or mountain ranges, often have many endemic species
- Concept of Endemic distribution of plants - A.P. de Candolle (1813)

- Engler (1882) suggested two categories of endemic forms: Palaeoendemics - Ancient forms and indigenous or native forms
- This definition requires that the region that the species is endemic to, be defined as, such as
- A “Site endemic” (e.g. Found only in Western Ghats)
- A “National endemic” (e.g. found only in India)
- A “Geographical range endemic” (e.g. found in the Himalayan region, which however covers several Himalayan countries and therefore is not a national endemic).
- Or a political region endemic (e.g. found in countries of Asia)
- Maximum endemic plants are found in the Himalayas and South India. Indo-Gangetic plains have a very small number of endemic species

Characters of Endemism

- Localized in distribution because of their Narrow Ecological Amplitude and are unable to invade in fresh areas.
- Lack potentially to migrate because of saturate genomes.
- Real endemics never migrate while neoendemics have the potential to migrate.
- Dispersal propagates are not able to sustain during migration to other area. It may be due to physical barriers.

Factors responsible for Endemism

- Production of endemics are Natural crossing among the closely related plants growing under favourable conditions and mutations
- Endemism is found in isolated e.g. islands, isolated areas etc
- Wuff 85% of Flora found in the particular islands such as Hawaii islands and 72% of New Zealand is endemic
- Mountains also have more endemic species as they are isolated e.g. 70% species of Himalayas is endemic

Endemic species of India:

Rhododendron (Ericaceae), *Beaumontia grandiflora* (Apocynaceae), *Eleusine coracana* (Poaceae), *Caryota urena* (Arecaceae), *Aegle marmelos* (Rutaceae), Crotolaria juncea (Fabaceae), *Ficus religiosa* (Moraceae) and *Seasamum indicum* (Pedaliaceae). The other species belong to families like Rubiaceae (6 genera). Rosaceae, Asteraceae, Primulaceae, Acanthaceae etc.

Age and Area Hypothesis

- On the basis of his extensive studies of geographical distribution of certain plant species in tropics - J.W. Willis (1915)
- Willis postulated - Species which evolved earlier occupy greater areas than those which appeared later in the evolutionary sequence
- Frequency of a species over an area is directly proportional to its age in scale of evolution and age of species is directly related with the area of its distribution
- A small area of distribution of a species will indicate its relative young age e.g. Impatines, Primula, Gentiana, Rhododendron
- Willis has also pointed out that the majority of endemics are found to be members of large and successful genera

Thank You