

1.3 BIO-GEOGRAPHICAL CLASSIFICATION OF INDIA

Introduction

Bio-geography is the study of the distribution of species, communities and ecosystems in geographic space and through geological time. Biogeography includes the area, soil, water, climate as well as plants and animals of particular geographical region. Plants contribute much towards the biogeography than animals as plants are stable/non movable.

Biogeographical classification deals with the biodiversity found in different parts of the world. Plants are considered to be more important in the biogeographical classification as they are non movable.

Alfred Russell Wallace, has classified the entire world into six biogeographically regions. They are;

- 1) Neoarctic
- 2) Paleoarctic
- 3) Ethiopian
- 4) Australian
- 5) Neotropical and
- 6) Oriental

India is included in oriental region along with Srilanka, Philippines, Sumatra, Java, Bali and some parts of China.

Special Features of Oriental Region

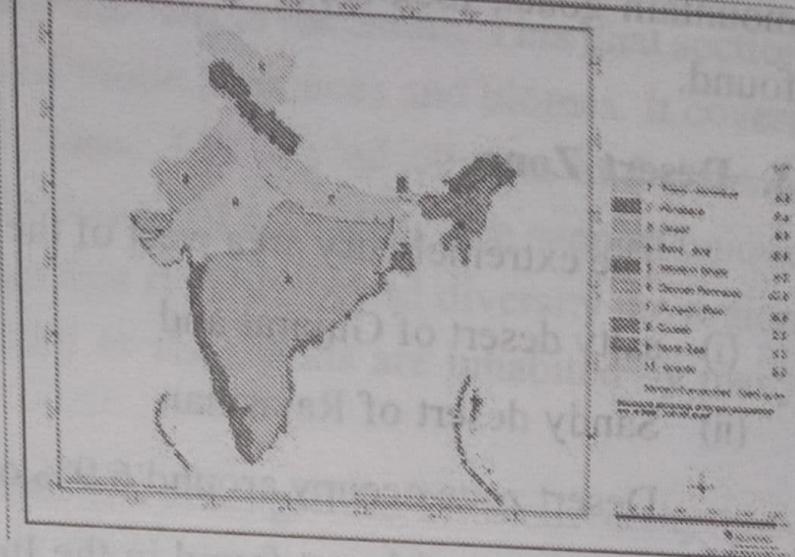
1. Most of the area is covered with thick forest
2. Advanced type of fishes are seen in this region
3. Most of the region has monsoon climate.

BIO-GEOGRAPHICAL CLASSIFICATION OF INDIA

India is the seventh largest country in the world and second largest nation in Asia with an area of 3,287,263 sq. km exhibiting wide range of landscape that are rich in natural resources.

Biogeographers have classified India into Ten Bio-geographic zones. This classification is based on geography climate, soil, pattern of vegetation and communities of invertebrates Amphibians, insects, Reptiles, Birds and mammals.

2. Himalayan zone
3. Desert zone
4. Semiarid zone
5. Western Ghat zone
6. Deccan Plateau zone
7. Gangetic Plain zone
8. North-East zone
9. Costal zone
10. Islands



Bio-geographic Features

1. Trans-Himalayan Zone

The Himalayas consists of the youngest and loftiest mountain chains in the world. The Himalayas have attained a unique feature of its own due to its high altitude, steep gradient and rich temperate flora. The Himalayas are extended to the Tibetan plateau.

The Himalayan region present to the North of the Great Himalayan range are called the trans-Himalayas. It accounts for 5.7% of the India's land mass. The high altitude cold deserts of Ladakh and Lahaul Spiti of Himachal Pradesh are found in this region.

The trans-Himalayan region has very little vegetation. It has the wild sheep and goat community living in this region. Snow leopards are also found. Along with these, migratory black-necked crane is found.

2. Himalayan Zone

The Himalayas form the northern boundaries of India. The entire mountain chain is running from Kashmir in the North-west to Assam in the North-east. The Himalayas cover 7.2% of India's land mars and harbors diverse range of biotic provinces and biomass.

The forests of this zone are very dense with tall evergreen trees and extensive growth of grass. Oak, chestnut, conifer, pine and deodar are the common types of trees found in this region. Vegetation is not found above the snow line.

Several types of animals live in this region. They include wild sheep, mountain goats, Ibex shrew and Tapir. Snow leopard and panda are also found.

3. Desert Zone

The extremely dry area west of the Aravali Hill range consists of

- (i) salty desert of Gujarat and
- (ii) Sandy desert of Rajasthan

Desert zone occupy around 6.9% of India's land mass.

The types of desert found in the India are;

- a) The desert of western Rajasthan
- b) The desert of Gujarat
- c) High-altitude cold desert of Jammu, Kashmir and Himachal Pradesh.

The Indian desert has more diversified fauna. The plants grown here are most xerophytic in nature. Babul, kikar, wild palm grows in these areas.

The endangered bird Bustard is found here. Camels, wild asses, snakes and foxes are found in hot and arid parts of the desert.

4. Semi-Arid Zone

Generally the areas adjoining to the desert are referred as semi-arid zone. In India, the transitional zone between the desert and the dense forest of western Ghats represent the semi-arid zone.

In this semi-arid zone, thorn forest is the natural vegetation. The characteristic feature of the semi-arid zone vegetation is the presence of discontinuous vegetation cover with open area of bare soil and throughout the year one can observe the deficit of soil water.

Thorny shrubs, grasses, bamboos, xerophytic herbs and ephemeral herbs are found here.

Birds, Eagles, Snakes, fox, jackals, buffaloes and leopards etc are the types of animals found in the semi-arid area.

5. Western Ghats

Western Ghats constitute one of the unique biological regions of the world. The Western Ghats are mountain range that runs along the western

covers an extremely diverse range of biotic provinces and biomes. It covers about 5.8% of the India's land mass. The varied climate and diverse topography is responsible for wide variety of habitats which support unique sets of plants and animals. Besides this rich biological diversity the region has high levels of cultural diversity as the forests are inhabited by many indigenous people.

As a result, western Ghats are amongst the 25 biodiversity hot-spots of the world. These western Ghats are known for the high levels of endemism¹. These endemic plants are associated with the evergreen forests of the area.

6. Deccan Plateau Zone

It is a large triangular plateau south of the Narmada valley. Three sides of the plateau are covered by mountains slopes towards east; Satpura Mountains cover the north while western Ghats covers the west side and Eastern Ghats cover the eastern side of the plateau. It covers approximately 15.6% of the country's land mass. The western and Eastren Ghats meet each other at the Nilgiri hills. The western Ghat includes Sahyadri, Nilgiris, Anamalai and Cardamom Hills. Rivers like Mahanadi, Godavari, Krishna and Kaveri originate from Western Ghats and flow eastwards. The Eastern Ghats are broken into small hill ranges by the rivers coming from the Western Ghats. Most of these rivers culminate in the Bay of Bengal. The Godavari is the longest river in the Deccan plateau. The Narmada and Tapi flow westwards and reach the Arabian Sea. The entire zone is covered mostly with deciduous trees.

7. Gangetic Plain Zone

The largest unit of the great plain of India is the Gangetic plain zone. This plain covers the area between the south Himalayas to the tropic of cancer. It covers about 11% of the country's landmass. Ganga is the main river of this plain. River Ganga covers about 72.4mha area and the river Brahmaputra forms the main drainage axes in the major portion.

1. The animals/plants found exclusively in a particular region.

The alluvial sediment thickness is maximum in the plains of Ganga. The physio-geographic scenery varies from arid and semi arid landscapes of Rajasthan plains to the humid and pre humid landscapes of the delta and Assam valley in the east.

This plain supports the highest population densities depending upon purely agro-based economy of these regions. Teak, Sal, Shisham, Mahua and Khair are some of the varieties of trees found in the forests of this plain.

8. North-East Zone

North-east zone consists of the plains and non-Himalayan ranges of northeastern India. It covers about 5.2% of the India land mass. It has several species of orchids, Bamboos, ferns, etc. In this zone, wild relatives of cultivated plants such as banana, mango, citrus and pepper are grown.

9. Coastal Zone

India has over 7,516.4 km of coastline. The west coast and East coast of India varies in their characteristics and structural features. The west coast is narrow with the exception of Gulf of Cambay and Gulf of Kutch. The west coast becomes a bit wider towards extreme south along the south of Sahyadri. The west coast is known for its charming scenic backwaters. In contrast to the west coast, the east coast is broader and it is due to the deposition of soil from the east flowing rivers that has lead to the change in the base levels. In this coast, the characteristic feature is the formation of extensive delta of the rivers-Godavari, Krishna and Kaveri.

Along the estuarine tracts, Mangrove, vegetation is a typical characteristic feature.

Fertile soil cover is present over larger parts of the coastal plains. All along the coast line, coconut trees grow and rice is the main crop of this area.

Along with coconut, rubber is the main vegetation of the coastal area.

The main states found on the coastal area of India are - Gujarat, Maharashtra, Goa, Karnataka, Kerala, West Bengal, Odisha, Andhra Pradesh, Telangana, Tamilnadu and Pudicherry.

10. Islands

Geographically, India has two groups of islands namely the Arabian sea islands and the Bay islands.

Both groups of islands differ significantly in origin and physical characteristics.

The Arabian Sea islands (Laccadive, minicoy etc) are founded by the remnants of the old land mass leading to coral formation. Some of the islands of this area are fringed with coral reefs and many of them are covered with thick forests.

On the other hand, the Bay Islands lay only for about 220km. The Andaman and Nicobar islands in the Bay of Bengal has about 300 big and small islands. Among these, only five islands are inhabited. Tribal people are found only on island of Nicobar. These Islands have a highly diverse set of Biomes and occupy 0.03% of India's biomass.

1.4 BIODIVERSITY

1.4.1 Biodiversity-meaning

The concept of Biodiversity first appeared in 1980. The word "Biodiversity" is shortened form of two words "Biological" and "Diversity". The term biodiversity was coined by W.G. Rosen in 1985.

Biodiversity (GK. Bios=life; diversity=forms) or BIOLOGICAL DIVERSITY can be defined as "the vast array of species of micro organisms, algal, fungi, plants and animals occurring in the earth either in the terrestrial or aquatic habitats and the ecological complexes of which they are a part".

According to the United Nations Earth summit(1992), biodiversity is defined as "the variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystem".

Biodiversity differs from place to place. This is because of environmental conditions of the area as well as ability of an organism's level of tolerance to that area.

Levels of Biodiversity

Biodiversity occurs at different levels. Some of them are;

- 1) Genetic diversity
- 2) Species diversity
- 3) Ecosystems/Community diversity

1. Genetic diversity

Genetic diversity is related to the variations of genes within species. These variations may be due to

- Variants of the same gene
- Variation in the entire gene pool
- Variation in the chromosomal structure.

Because of these genetic differences, formation of sub species, varieties, races, strains etc are observed.

Eg:- Varieties of Mangoes, wheat, Rice, etc.

2. Species diversity

Species diversity is related to variety in the number and richness of the species within a region.

Eg:- The big cats i,e Tiger (*Panthera tigris*)

Lion (*Panthera Leo*) and

Snow leopard (*Panthera uncia*)

belong to the same genus panthera but they all differ at the species level.



3. Ecosystem/ Community diversity

This is related to different types of ecosystems/ habitats. A habitat is the cumulative factor of the climate, vegetation and geography of a region.

Measurement of Biodiversity

Biodiversity is measured by two major components

They are; a) Species richness

b) Species evenness

- a) Species richness refers to the number of species per unit area. As the area considered increases, the number of species found in it also increases due to the availability of more resources. Species richness is the measure of number of species found in a community.
- b) Species evenness refers to the relative abundance with which each species is represented in an area. It measures the proportion of species at a given site.

Eg:- Amphibian species diversity is greater in western Ghats than the Eastern Ghats.

According to conservation international (CI), 1996

1.4.2. Hotspots of Biodiversity in India

Hotspots are those regions of rich biodiversity which have been declared sensitive due to direct or indirect interference of human activities.

The concept of hotspot was first developed by Norman Meyers in 1988.

There are four main criteria for the classification of hotspot. They are

- Rich species diversity
- Number of endemic species
- Degree of threat in terms of habitat loss and
- Degree of exploitation

According to conservation International CI, 1996, a region to be called as hotspot should fulfill the following considerations. They are;

- The region should have at least 1500 species of vascular plant i,e more than 0.5% of the world's total plants.
- The region should have lost greater than or equal to 70% of its original habitat

India has always been on the list of the richest countries in the world for its biodiversity In India, there are approximately

- 350 species of mammals which is about 7.6% of world species
- 1224 species of birds accounting for 2.6% of world species
- 197 species of amphibians which make up 4.4% of world species
- 408 species of reptiles which is about 6.2% of world species
- 2546 species of fishes which makes up 11.7% of world species

- 15000 species of flowering plants which are about 6% of the world species.

India is recognized as one of the **mega-diverse** countries, rich in biodiversity and associated traditional knowledge.

23.39% of geographical area of India is under forest and tree cover. Even though India is just 2.4% of land area of world it accounts for nearly 7% of the recorded species. In 2005 conservation international (CI) published an updated titled book "*Hotspots Revisited: Earth's Biologically Richest and most Endangered Terrestrial Ecoregions*" and gave the list 35 biodiversity hotspots of the world.

These 35 biodiversity hotspots cover 2.3% of the Earths land surface, yet more than 50% of the worlds plant species and 42% of all terrestrial vertebrate species are endemic to these areas.

Out of these 35 hotspots India contains four(04) hotspots. They are,

1. The Himalayas

2. Indo-Burma

3. Western Ghats and Sri Lanka

4. Sundalands

1. **The Himalayas:** It includes the entire Indian Himalayan Region (and that falling in Pakistan, Tibet, Nepal, Bhutan, China and Mayanmar).

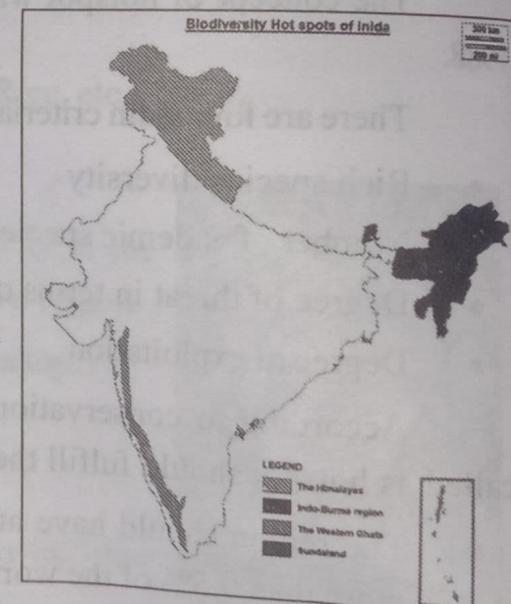
2. **Indo-Burma:** Indo-Burma region includes entire North-Eastern India, except Assam and Andaman group of islands.

3. **Western Ghats and Sri Lanka:** It includes the entire Western Ghats (and Sri Lanka).

4. **Sundalands:** Sundaland consists of Andaman and Nicobar group of Islands (and Indonesia, Malaysia, Singapore, Brunei and Philippines)

1.4.3. Threats to Biodiversity

Man in guise of development has been directly or indirectly involved in the destruction of the environment. So any direct or indirect



human activity that results in destruction and becomes a threat to the survival of organisms can be called as threat to biodiversity.

A list of human activities that are acting as threats to biodiversity are listed, below; They are;

- 1) Extinction
- 2) Genetic and behavioral degradation of taxa
- 3) Habitat destruction
- 4) Habitat degradation and Fragmentation
- 5) Pollution
- 6) Global climate change
- 7) Introduced species
- 8) Disease
- 9) Exploitation

1. Extinction

The most obvious loss of biodiversity is the process of extinction. “When no more individual of a taxonomic group survive, either within a specified part of their range or forever lost across their entire range” can be called as extinction.

Throughout the history of life on this earth, five episodes of mass extinctions have occurred and sixth one is in progress. The sixth one is the fastest as it is anthropogenic i,e involvement of humans is further aiding the extinction of species at a faster rate and faster pace.

2. Genetic and behavioral degradation of Taxa

- The outright loss of population and
- Alteration of population as a result of human activities are responsible for the genetic and behavioral degradation of Taxa

Eg:- Genetic and behavioral degradation of species such as spix's macaw(Cyanopsitta spixii)

3. Habitat Destruction

Human Activities is becoming responsible for the outright loss of habitat resulting in devastating threats to biodiversity.

Conversion of land for **urban** and **agricultural use** are the main causes of habitat destruction.

Habitat destruction of terrestrial ecosystems occurs due to various phenomena such as;

- Deforestation
- Desertification
- Urbanization and
- Artificial burning etc

Habitat destruction of aquatic ecosystems occurs due to various phenomena such as;

- Dam construction/ Wetland filling
- Water flow diversion
- Oil drilling and
- Bottom trawling etc

4. Habitat degradation and Fragmentation

“When some aspect of the natural environment is removed or altered” can be called as habitat degradation.

As a result of human alteration and destruction of habitat, increase in habitat fragmentation of an ecosystem is observed. This has resulted in isolation of habitats to small fragments of their original size. This fragmentation upsets the ecosystem by decreasing the ability of species with large home range or specialist habitats to survive.

5. Pollution

“Contamination of the natural environment” is pollution

Since industrial revolution the input of organic and inorganic substances into the environment by anthropogenic (Human) activities has become a major growing threat to biodiversity.

6. Global climate change

Organisms interact with their environment and any change in environment acts as a key determinant whether an organism thrives or

becomes extinct. So, perhaps the most crucial mechanism of environmental change is **global climate**

Fluctuations such as slight changes in average daily temperature, duration of rainy season, night time temperature, the solar radiation etc can effect any biological organism.

Human activities that affect global climatic change includes;

- Production of air pollutants from source such as fossil fuel combustion and burning of forest.
- Agricultural activities results in reducing available forests from slash and burn agriculture and
- Release of methane-a potent green house gas from livestock.

7. Introduced species.

Introduced species are those species that are found in areas outside of their native range due to direct or indirect human activity. Once successfully introduced into new area these introduced species establish themselves. They become invaders and grow abundantly due to the absence of natural predators in that region and this subsequently results in the loss of biodiversity.

8. Diseases

A special case of threat to biodiversity caused by species introduction is the expansion of pathogens or parasites resulting from human activity. Diseases can result from genetic disorders, pathogens such as viruses, bacteria and other parasites. Coevolution of hosts and pathogens over evolutionary time results in coexistence of both host and pathogens. Due to human activity, when imbalance is produced it results in creating conditions that opens the pathogens to spread. Diseases are often transmitted across different species with the new host species often devastated by the new pathogen. This acts as threat to biodiversity.

9. Exploitation

One of the most direct anthropogenic/manmade made mechanisms for the loss of biodiversity is extraction of organisms from their natural environment.

Humans extract biological organisms from nature for food and other resources. Wide spread exploitation in the form of fishing, hunting and logging of forest is observed. Vertebrate species are especially targeted for food and other economic benefit.

Despites **CITES** (Convention on the International Trade in Endangered Species) endangered animals are still decimated by poaching.

A special class of exploitation is the logging of forests which presents probably the greatest single threat to biodiversity.

1.4.4. Endangered and Endemic species

Endangered species: Endangered species is a species that is very likely to become extinct in the near future either worldwide or in a particular jurisdiction. These species may be at risk due to factors such as

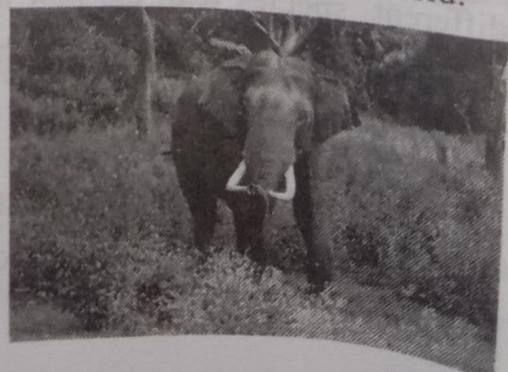
- Habitat loss
- Poaching
- Invasive species
- Diseases
- Human exploitation

Red List of International Union for Conservation of Nature (IUCN) lists the *global conservation status* of many species. The IUCN is the global authority on endangered species determination.

The IUCN compiles information from a network of conservation organizations to rate which species are most endangered and this information is published in the IUCN Red list of Threatened species. The IUCN regional red lists assess the risk of extinction to species in over 100 countries and regions around the world.

Examples for Endangered Species

1. Giant Panda
2. Tiger
3. Asian Elephant
4. Snow Leopard
5. Blue Whale, etc.



Endemic Species: The endemic is derived from Greek. In Greek, “*endemos*” means “dwelling in a place”. Indigenous, Native are the synonyms for the word endemic.

Endemic species are a group of species that are unique to a defined geographic location such as an island nation, country or other defined zone or hebetate type.

Bicoloured frog (***Clinotarsus curtipes***) is endemic to the Western Ghats of India.

