

**AS-3026 (A)**  
**B.A. LL.B/ B.COM. LL.B. (Third Semester) Examination, 2013**  
**Environmental Studies**

**Time allowed : Three hours**  
**Maximum Marks : 80**

**Model answer**

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**Section : A**  
(Objective Answer Type Question)

**15 x 2 = 30**

Note : Attempt all questions. Each question carries 2 marks

**Q1) Objective questions**

**A) Multiple choice questions**

(i) Those species whose population may extinct any time is called-

- (a) Endangered species (b) Endemic species (c) All of the above (d) None

Ans : Endangered species

(ii) The place or area where plants and animals live is called as –

- (a) Habitat (b) Biota (c) Protected area (d) None

Ans : (a) Habitat

(iii) All the plants, animals and microorganism of the earth form

- (a) Ecosystem (b) Succession (c) Biodiversity (d) None

Ans : (c) Biodiversity

(iv) Biosphere extends up to following kilometre from earth surface

- (a) 10 km (b) 15 km (c) 25 km (d) None

Ans : (b) 15 km

(v) Term Ecosystem was coined by

- (a) Transley (b) Odum (c) Clements (d) None

Ans : (a) Transley

**B) Fill in the blanks**

(vi) The conditions under which an organism live is called environment .

(vii) Species whose population is sharply declined and it may extinct any time is called endangered species .

(viii) Troposphere extends up to a height of 8 km near poles.

(ix) The species whose population is confined to a particular area is called endemic species .

(x) Smallest unit of biosphere is ecosystem .

**(C) Define the following terms**

**(xi) Ecology**

Ecology is the study of organisms in relation to their environment. According to Kendeigh (1961), ecology is the study of animals and plants in their relations to each other and to their environment. The term Ecology is derived from two Greek words, namely Oikos and Logos. Oikos means home or habitation and Logos means study.

**(xii) Environment**

Environment can be defined as the sum total of materials and forces surrounding the living organism. It is the sum total of conditions that surrounds us at a given point at space and time. Gisbert defined environment as “anything immediately surrounding an object and exerting a direct influence on it”.

**(xiii) Trophic level**

Each food chain contains many steps like producers, herbivores, primary carnivores and so on. Each step of the food chain is called trophic level. The number of trophic levels in a food chain is normally restricted to 4 or 5.

**(xiv) Ecological pyramid**

Ecological pyramid is the graphical representation of the number, biomass and energy of the successive trophic levels of an ecosystem. In the ecological pyramid, the producer forms the base and the final consumer occupies the apex.

**(xv) Alpha diversity**

Alpha diversity ( $\alpha$ -diversity) is the biodiversity within a particular area, community or ecosystem. It refers to the number of species that can be found in a small homogenous area. This is expressed as the Species richness and abundance of an area, and it can be measured by counting the number of taxa within a particular area or ecosystem (eg. families, genera, species).

**Section : B**

**5 x 4 = 20**

(Short Answer Type Question)

Note : Attempt any five questions. Each question carries 4 marks

**Q2. Write short note on following (any five )**

**(a) Biological diversity**

Biodiversity refers as the variety and variability among all groups of living organisms and the ecosystem complex. According to the Convention of Biological Diversity (1992), Biodiversity refers as the variability among living organisms from all sources including inter alia, terrestrial, marine and other aquatic ecosystem and the ecological complexes in which they are a part.

There are three level of biodiversity :-

- (i) ***Species diversity*** – This includes variability within a community. It is express as the Species Richness and abundance. Wilson (1992) estimated 10-52 million species in the world. Among these, 1.5 million of living and another 3,00,000 fossils are described till date.
- (ii) ***Genetic diversity*** – This includes variability within a species. Eg. Rice (*Oryza sativa*) is considered to be of one species, but there are more than 1000 varieties of wild and cultivated rice. These are called genetic variation.
- (iii) ***Ecosystem diversity*** – This includes variability within an ecosystem. Eg. Variation within ecological niche, trophic level, food chain and food web etc.

Biodiversity of an area may be measured by following three ways-

- (i) ***Alpha diversity*** – It refers to the number of species that can be found in a small homogenous area. It is expressed as the Species Richness and abundance.
- (ii) ***Beta diversity*** – It refers to the rate of change in species composition across different habitats. Eg. Moss species richness
- (iii) ***Gamma diversity*** – It refers to the rate of change across large landscape gradients.

**(b) Structural component of Ecosystem**

The structure of an ecosystem is formed of two components, namely abiotic and biotic factors-

(i) **Abiotic factors** :-

The abiotic factors of an ecosystem include the non-living substances of the environment. Eg. water, soil, air, light, temperature, minerals, climate, pressure etc.

(iii) Biotic factors :-

The biotic factors include the living organisms of the environment. They are classified into three types –

1. Producers – The organisms which carry out photosynthesis constitutes the producers of an ecosystem. Eg. Plants and algae.
2. Consumers – Consumers are organisms which eat other organisms. The consumers are again sub-divided into –primary, secondary and tertiary consumers based on the position in the trophic level. Eg. Tiger, lion etc.
3. Decomposers-The decomposers are organisms that break up the dead bodies of plants and their waste products. Eg. Certain fungi and bacteria.

(c) Wind energy

When warmed air over sun-heated land rises, leaving a vacuum, cooler surrounding air rushes in, to fill the vacuum. This movement of rushing air is known as wind. The cyclones, hurricanes and tornadoes are the examples of strong wind. The blowing air possesses kinetic energy, called wind energy. When harnessed, wind energy can be converted to mechanical energy for useful work such as pumping water, grinding grain and milling lumber. Use of wind turbines can convert wind energy to electrical energy. Modern wind energy systems consist of three basic components-(a) tower, (b) rotor, and (c) generator.

Although wind energy is a relatively clean means of generating electricity, they also possess bad impact on environment. The wind turbine results noise pollution. Wind turbines in some areas are responsible for killing birds that are accidentally caught in the rotor blades.

(d) Food Chain

The biotic factors of the ecosystem are linked together by food. For example the producers form the food for the herbivores. The herbivores form the food for the carnivores. This sequence of eater being eaten is called food chain.

**Types of food chain**

**(a) On the basis of habitat:**

(i) **Terrestrial** : This type of food chain operate at grassland, forest, agricultural land etc which belong to terrestrial habitat. Eg: In Indian pasture following type of food chain operates

*Cynodon dactylon* (Grass)→*Melanoplus differentialis* (grasshopper)→*Bufo melanostictus* (toad)→*Zamenis mucosus* (snake)→ *Pavo cristatus* (Peacock)

(ii) **Aquatic** : This type of food chain operate in water bodies. Eg.: Following type of food chain operate in Indian river:

*Scenedesmus boligues* (phytoplankton)→*Brachionus falcatus* (zooplankton)→*Amblypharyngodon* sp. (small fish)→*Wallago attu* (large fish)→ *Homo sapien* (man)

**(b) On the basis of ecosystem:**

(i) **Grazing food chain:** Cattle and rodents are the main grazers in grassland, while zooplanktons are the main grazers in a pond or lake. Up to 50% of the net primary production is grazed on by these animals in their respective ecosystems and the remaining 50% goes to the decomposer organisms as dead organic matter. Therefore, in these ecosystems, the food chain is herbivore based and herbivores are considered important consumers. This is called as grazing food chain.

(ii) **Detritus or decomposer food chain:** In a forest ecosystem, the dominant primary consumers are insects, which usually consume less than 10% of the net primary production. The rest 90% is consumed later as dead plant material by the small detritus feeding animals such as earthworms and microorganisms like bacteria etc. This is called as detritus food chain.

(iii) **Parasitic food chain:** This type of food chain operates in every ecosystem. This involves host parasite-hyperparasite links.

**(e) Mineral resource**

Minerals are the elements and compounds which could be extracted profitably. It is broadly defined as elements, chemicals compounds, minerals or rock concentrated in a form that can be extracted to obtain a sustainable commodity.

The human today use a wide variety of minerals, many in large quantities to sustain his industry based civilization. Modern society depends on the availability of mineral resources, which can be considered as a non-renewable source of energy.

Minerals are generally classified into three groups on the basis of their use- (i) Metallic minerals or ores or rocks or mineral deposits are those from which metals are extracted

profitably. The important metals are gold, silver, platinum, copper, lead, iron etc., (ii) Mineral fuels are coal, petroleum and natural gas, and (iii) Non-metallic minerals are sulphur, salt, asbestos etc.

According to geological survey of India, there are fifty important mineral and 400 major sites where these minerals occur. Minerals resources can be conserved by – (i) Reduce, Reuse and Recycle, (ii) Finding new substitute and (iii) By the use of alternative sources of energy.

***(f) Lithosphere***

Lithosphere comprises the solid components of earth like soil and rock. It has several layers namely crust, mantle, outer core and inner core.

- (i) Crust:- It is the outermost solid zone that contains soil on its surface. Soil with soil air, water and mineral nutrients supports a large biotic community. Organisms get food, shelter, hiding space and anchorage from soil. It is 8 to 40 km in thickness.
- (ii) Mantle:- Mantle is present below the crust of earth and unlike crust, it is in a molten stage. This zone contains most metals in molten condition which come out of the earth during volcanic eruption. It has a thickness of 2900 to 3000 km.
- (iii) Core :- It is the central fluid which comprises metals like nickel, iron etc. The outer core has a thickness of 2000 km and the inner core of 2500 to 2800 km thickness.

***(g) Forest resource***

Forest is a biotic community, predominantly of trees, shrubs or other woody vegetation with a closed canopy. As per the estimation of scientists, there should be 33% of land under forests.

The most significant service of forest to human being is the intake of carbon dioxide and release of oxygen in order to maintain atmosphere equilibrium. It has an important role in conservation of essential characteristics of soil. It affects the degree of rainfall in a region. Forest prevents droughts, floods and soil erosion. It absorbs heat and protects us from severe radiation. It also acts as natural habitats of wildlife, both plants and animals. Beside this, forests are the major sources of woods, foods and pharmaceuticals. In fact, forest saves our lives along with other resources.

Due to population explosion, deforestation and developmental activities like agriculture, mining, roads construction etc are going on that result in reduction of forest cover.

Forest resource can be preserved by in-situ and ex-situ conservation. In in-situ conservation, more number of protected areas (national park, wildlife sanctuary, conservation reserve and community reserve) and other reserve areas (like biosphere reserve, tiger reserve, elephant reserve etc.) should be declared. For this strict forest laws and wildlife law should be implemented. People also should be aware about the importance of the forest resource. More number of Botanical Garden, Zoos/ safari parks, cryopreservation etc. should be facilitated as part of ex-situ conservation.

***(h) Solar energy***

Solar energy is the biggest non-conventional source of energy. The simple and commonest mode of solar energy utilization is solar thermal conversion.

Efforts are being made for solar refrigeration, air conditioning etc. Solar photovoltaic panels, cookers, heaters and solar battery adopted, since we get effective sunshine for 250-300 useful days in a year. In India, SPV programmes began in mid-seventies and by 1990, the indigenous fabrication of solar cells and modules was started. The SPV systems installation in India by 2000 are home lighting system, rural radio telephones, solar lanterns, street light systems and water pumping systems. This SPV systems are now more reliable and economical than many other technologies for many consumer product applications.

The most important factor is that it is pollution free clean, eco-friendly and renewable energy resource. Of course, the high cost of its collection, conversion and storage has limited its exploitation.

**Section : C**

**2 x 15 = 30**

(Long Answer Type Question)

Note : Attempt any two questions. Each question carries 15 marks

**Q3. Define hydrosphere. State the properties of water. What is the significance of hydrosphere?**

**Ans :** The hydrosphere consists of all bodies of water like oceans, seas, lakes, rivers, streams, ground water, glaciers, polar ice caps, atmospheric moisture, precipitation etc. Living things pervade throughout the hydrosphere. Earth is unique to possess it. Oceans, the largest



reservoir, contain over 97% of total global water. Glaciers and the polar ice caps contain just over 2% in the form of solid water. Hence, about 1% of the total resources are available as fresh water of which 0.28% is ground water and 0.72% is surface water.

### **Properties of water**

The hydrosphere consists of all bodies of water. Water has been remaining indispensable for our sustenance because of its several unique and fascinating properties which are as follows -

- It is a universal solvent being capable of dissolving many substances.
- With high specific and latent heat, it is capable of storing and transferring more heat.
- Aquatic animals can swim inside water due to special density and structure of water.
- Due to property called surface tension, mosquitoes walk on water surface.
- Water can rise into plants due to high surface tension.
- It helps aquatic creature to live inside by absorbing good amount of oxygen.
- It helps ship to float in the sea due to buoyancy.
- Its transparency allows submerged plants to have photosynthesis.
- Its ability to transform radiant energy into heat energy is used to capture solar energy.
- It freezes at  $0^{\circ}\text{C}$  and boiled  $100^{\circ}\text{C}$  under normal pressure. It can remain in 3 states.

### **Significance of hydrosphere**

The existence of hydrosphere in the earth has initiated life cycle in it. Therefore, hydrosphere is an indispensable sphere for the living organisms. The important functions of water found in hydrosphere are as follows –

- Water accounts 50-90% of the weight of living organisms.
- Water is necessary in domestic use of drinking, cooking cleaning etc.
- Water is necessary in industrial use for cooling, cleaning, processing etc.
- It is necessary for plant growth and irrigation in agriculture.
- Energy from hydro-electricity generation is possible from water reservoir.
- Water is necessary in ponds, seas and oceans for fisheries and aquaculture.
- It is necessary in seas and oceans for navigation and tidal energy.
- Water has an important role in waste disposal through canals and drainage.
- Ice made from water is used in transportation of perishable goods.

**Q4. What do you mean by ecological succession? Mention causes and stages of ecological succession along with an example.**

**Ans :** The communities in any area are not stable. They are changing into other forms of communities from time to time. Thus in a particular area, one community may be replaced by another community or by a series of communities. This process of development of new communities is called ecological succession. It can be defined as an orderly and progressive replacement of one community by another till the development of a stable community in that area. Ecological succession has following significance in the community-

- Ecological succession creates a stable community in the fluctuating physical environment. The stable or climax community has the ability to buffer and control the physical forces like water, temperature etc.
- It plays an important role in the slow dispersal of animals.

**Causes of ecological succession**

Generally there are three types of cause of ecological succession which are as follows –

***(a) Initial or initiating causes :***

These are climatic as well as biotic. The former includes factors, such as erosion and deposits, wind fire etc. caused by lightning or volcanic activity and the latter includes the various activities of organisms. These causes produce the bare area or destroy the existing populations in an area.

***(b) Ecesis or continuing cause :***

These are the processes as migration, ecesis, aggregation, competition etc. which cause successive waves of populations as result of changes, chiefly in the edaphic features of the area.

***(c) Stabilising causes :***

These cause the stabilisation of the community. According to Clements, climate of the area is the chief cause of stabilisation; other factors are of secondary value.

## Stages of Ecological Succession

### **General process**

#### (a) Nudation :

This is the development of a bare area without any form of life. The causes of nudation may be topographic, climatic and biotic.

#### (b) Invasion :

This is the successful establishment of a species in a bare area. The whole process is completed in three successive stages which is as follows –

- (i) Migration- Here seeds or spores of the species reach the bare area with the help of air, water etc.
- (ii) Ecesis – After reaching to new area, the process of successful establishment of the species, as a result of adjustment with the conditions prevailing there is known as ecesis.
- (iii) Aggregation – As a result of reproduction, the individuals of the species increase in number and they come close to each other. This process is known as aggregation.

#### (c) Competition –

After aggregation of a large number of individuals of the species at the limited place, there develops competition (inter-as well as intra-specific) mainly for space and nutrition. Individuals of a species affect each other's life in various ways and this is called coactions.

#### (d) Reaction –

The mechanism of the modification of the environment through the influence of living organisms on it is known as reaction. As a result, the pioneer stage converts into a number of developmental stages, called seral stage.

#### (e) Stabilization –

Finally, the seral stage becomes more or less stable for a longer period of time and it can maintain itself in equilibrium with the climate of the area. This stage is called climax stage.

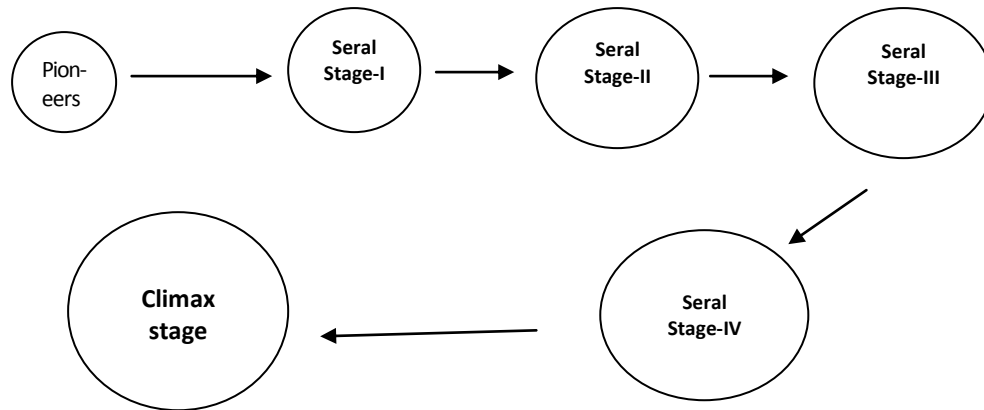


Fig-Stages of ecological succession

### Theories

There are three main concepts regarding climax formation. These are as follows -

- (a) *Mono-climax Theory* – This concept was proposed by Clemants. According to this concept, each climatic or geographical region has only one climax community.
- (b) *Poly-climax Theory* – This theory was proposed by Transley. It says that each area is occupied by many climax communities. They are controlled by soil moisture, soil nutrients, and several other factors. This theory argues that climate is only one of the several characters. As there are several environmental factors, many climax communities are established.
- (c) *Climax Pattern Theory* – This theory was proposed by Whittaker (1953). According to this theory, the climax community of an area is determined by the total factors of the area in which it exists. According to him, nine major factors are involved. They are the genetic structure of each species, climate, soil, site, biotic factors, fire, wind the availability of species and the chances of dispersal.

### Example

For example, a pond community can be transformed into a marshy land community, if the pond is gradually filled with sand and mud. The marshy land in the course of time may give rise to a grassland community or a forest community according to the environmental factors prevailing there.

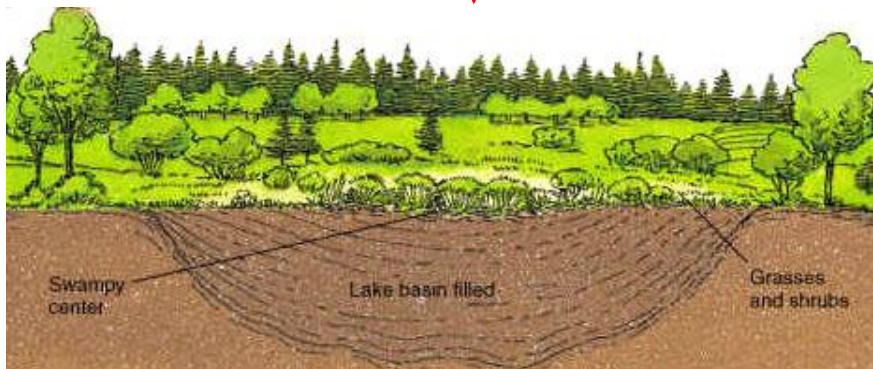
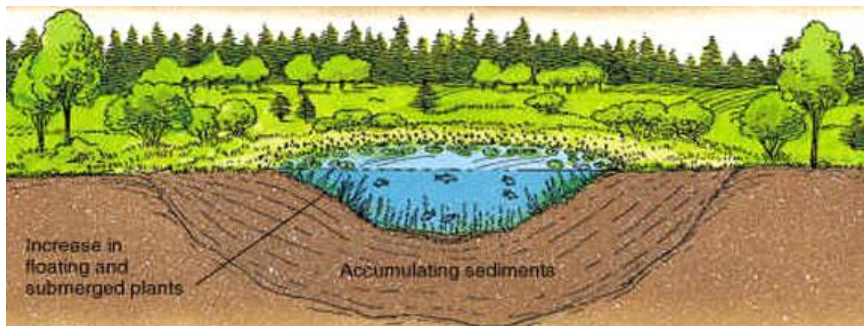
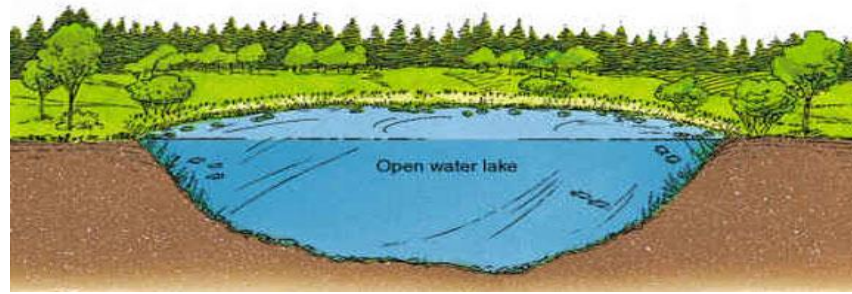


Fig-Aquatic ecosystem showing stages of ecological succession

**Q5. Define Biodiversity Hot Spot. How many hot spots are there in the world? Brief about the number of hot spot found in India with suitable examples. .**

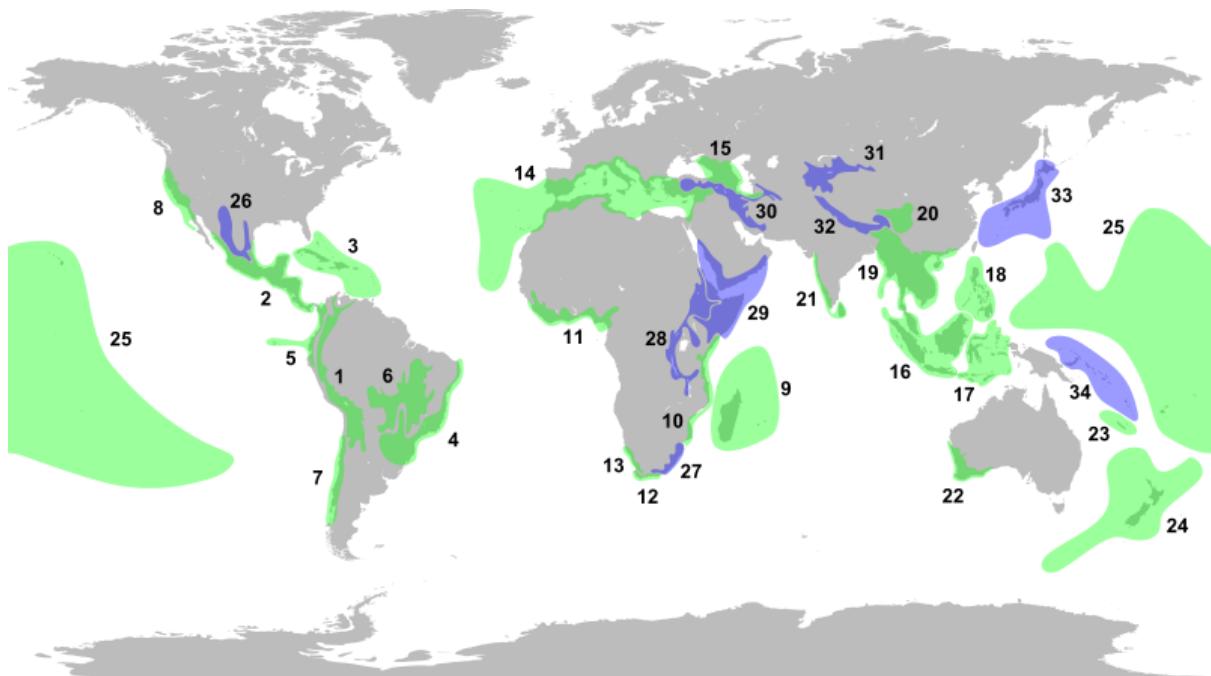
Ans : A biodiversity hot spot is a biogeographical region with a significant reservoir of biodiversity that is under threat from humans. According to Myers (2000), hot spot must meet two strict criteria:

1. It must contain at least 0.5% or 1,500 species of vascular plants as endemics, and
2. It has to have lost at least 70% of its primary vegetation.

The concept of biodiversity hotspots was originated by Norman Myers in two articles in “The Environmentalist” (1988) and 1990 revised after thorough analysis by Myers and others in “Hotspots: Earth’s Biologically Richest and Most Endangered Terrestrial Eco-regions. The United Nations designated 2011-2020 as the United Nations Decade on Biodiversity.

### Number of Hot Spot of the world

Around the world, at least 25 areas qualify under this definition, with nine others possible candidates. These sites support nearly 60% of the world's plant, bird, mammal, reptile, and amphibian species, with a very high share of endemic species.



1. The Tropical Andes
2. Mesoamerica
3. The Caribbean Islands
4. The Atlantic Forest
5. Tumbes-Chocó-Magdalena
6. The Cerrado
7. Chilean Winter Rainfall-Valdivian Forests

8. The California Floristic Province
9. Madagascar and the Indian Ocean Islands
10. The Coastal Forests of Eastern Africa
11. The Guinean Forests of West Africa
12. The Cape Floristic Region
13. The Succulent Karoo
14. The Mediterranean Basin
15. The Caucasus
16. Sundaland
17. Wallacea
18. The Philippines
19. Indo-Burma
20. The Mountains of Southwest China
21. Western Ghat and Sri Lanka
22. Southwest Australia
23. New Caledonia
24. New Zealand
25. Polynesia and Micronesia

An additional nine hotspots have since been added -

26. The Madrean Pine-Oak Woodlands
27. Maputaland-Pondoland-Albany
28. The Eastern Afromontane
29. The Horn of Africa
30. The Irano-Anatolian
31. The Mountains of Central Asia
32. Eastern Himalaya
33. Japan
34. East Melanesian Islands.

### **Hot spots of India**

India is part of three Biodiversity Hot Spot of the world. Details of these hot spots are given below :-

#### ***(a) Eastern Himalaya***

The Eastern Himalayas is the region encompassing Bhutan, northeastern India, and southern, central, and eastern Nepal. The Himalayan mountain system is the world's highest, and home to the world's highest peaks, which include Mount Everest

There are an estimated 10,000 species of plants in the Himalayas, of which one-third are endemic and found nowhere else in the world.

The Himalayas are home to over 300 species of mammals, 977 birds, 176 reptiles, 105 amphibians and 269 freshwater fish. Among this nearly 163 species categorised as globally threatened which includes 45 mammals, 50 birds, 17 reptiles, 12 amphibians and 3 invertebrate.

#### ***(b) Indo-Burma***

The Indo-Burma region spread out from the southern part of China's Yunnan province, North-Eastern India south of Brahmaputra river, Eastern Bangladesh, Myanmar, Malaysia, Lao People's Democratic Republic, Cambodia, Thailand and Vietnam. This region is spread over 2 million sq. km of tropical Asia.

It is estimated that there are about 13,500 plant species in this hotspot, with over half of them endemic. Almost 1,300 bird species exist in this region.

#### ***(c) Western Ghat and Sri Lanka***

The region shows high species diversity as well as high levels of endemism. Nearly 77% of the amphibians and 62% of the reptile species found here are found nowhere else. Sri Lanka, which lies to the south of India, is also a country rich in species diversity. It has been connected with India through several past glaciations events by a land bridge almost 140 km wide.



The vegetation in this hotspot originally extended over 190,000 square km. Today, it has been reduced to just 43,000 sq. km. In Sri Lanka, only 1.5% of the original forest cover still remains.

There are over 6000 vascular plants belonging to over 2500 genera in this hotspot, of which over 3000 are endemic. The region also harbours over 450 bird species, about 140 mammalian species, 260 reptiles and 175 amphibians. Over 60% of the reptiles and amphibians are completely endemic to the hotspot.