CHAPTER 15

BIODIVERSITY AND CONSERVATION

Topics Discussed

1. Introduction

Our planet Earth if visited by an alien from a distant galaxy,the enormous diversity of life that it would encounter would amaze and baffle it. The rich variety of living organisms with which they share this planet never ceases to astonish and fascinate even humans. The occurrence of biodiversity is inherent in different types of environmental conditions in different parts of area on earth and the presence of different life forms adapted to these different environmental conditions. There are more than 300000 species of beetles, 28000 species of fishes, 20000 species of ants and nearby 20000 species of orchids which the common man would find hard to believe. Biodiversity is not uniform. In certain regions it is low, in some moderate, while in some places it is tremendous. The significance of such a tremendous diversity are studied by ecologists and evolutionary biologists.

Objectives

At the end of this chapter, you will be able to:

- To understand the concept and importance of biodiversity.
- To know about the various patterns of biodiversity.
- To learn about endangered species, their conservation and various conservation reserves.

2. Biodiversity

The term biodiversity was coined by , popularized by sociobiologist **Edward Wilson** who described biodiversity as the combined diversity (or heterogeneity) at all the levels of biological organization right from macromolecules within the cells, genes, species, ecosystems and biomes.

2.1 Hierarchical Levels of Biodiversity

- **Genetic diversity**

At the genetic level, a single species might show high diversity over its distributional range. Measure of variety in genetic information contained in the organisms is **Genetic diversity**. Eg.10-150 genes in virus, 450-700 genes in mycoplasma, 32000-50000 genes in ***Oryza sativa***. Genetic diversity occurs in the differences of alleles, entire genes and chromosomal structures within a species. Genetic diversity gives the population a chance to adapt to environmental changes occurring. Examples- it leads to variation in potency and concentration of the active chemical (reserpine) present in medicinal plant ***Rauwolfia vomitoria*** growing in Himalayan ranges. More than 1000 varieties of mango, 50000 different strains of rice occur in India due to genetic variations.

- **Species diversity**

It is the variety of species within a region. For example, **Western Ghats** have greater amphibian species diversity as compared to Eastern Ghats. The number of species per unit area is **species richness**, number of individuals of different species represent **species evenness** or **species equitability**. Species diversity is the product of species richness and species evenness.

- **Ecological diversity**

It is diversity at level of communities and ecosystem. The variety of ecosystems indicate diversity in the number of niches, trophic levels, food webs, nutrient cycles and ecological processes sustaining energy flow. For example, in **India**, ecosystem diversity is **high** due to presences of large number of ecosystems like **deserts, rain forests, mangroves, coral reefs, wetlands, estuaries, and alpine meadows.** It is **low** in small countries like Norway.

2.2 Types of Ecological Diversity

- **Alpha Diversity:** It is a local diversity within a community.
- **Beta Diversity:** It is diversity between two communities.

- **Gamma Diversity:** It is regional diversity, represents the total richness of the species found in all habitats within a region or landscape.

Try It Yourself

1. Edward Wilson popularized the term biodiversity to describe the combined heterogeneity at all levels of biological organization. (True/False)
2. Western Ghats have greater amphibian species diversity compared to Eastern Ghats. (True/False)
3. Ecosystem diversity is _____ in Norway. (High/Low)
4. What is alpha diversity, beta diversity and gamma diversity?

3. Species Present on the Earth and in India

The earth offers a wide array of ecosystems and thus ecological niches. Consequently, a vast diversity of organisms which have adapted to these varied environments thrive on the planet. India in general possesses a rich biodiversity when compared to many other countries.

3.1 Species Present on The Earth

According to the International Union of Conservation of Nature (IUCN, 2004), the total number of plant and animal species described is slightly more than 1.5 million, but there is no clear idea of species yet to be discovered. By comparing species richness between tropical and temperate areas scientists estimate the number of species present in tropics. Scientists have calculated that the total number of species in the world ranges from 20 to 50 million on this basis. The number of global species diversity is about 7 million according to Robert May and his conservative and scientific studies.

Interesting aspects about the earth's biodiversity based on the currently available species inventories:

- Number of animal species is more than 70%.
- Nearly 22% account for the total plants (including algae, fungi, bryophytes, gymnosperms and angiosperms).
- Among animals, insects are the most species-rich taxonomic group, more than 70% of the total animal species. It means, 7 insects are present out of every 10 animals on this planet.

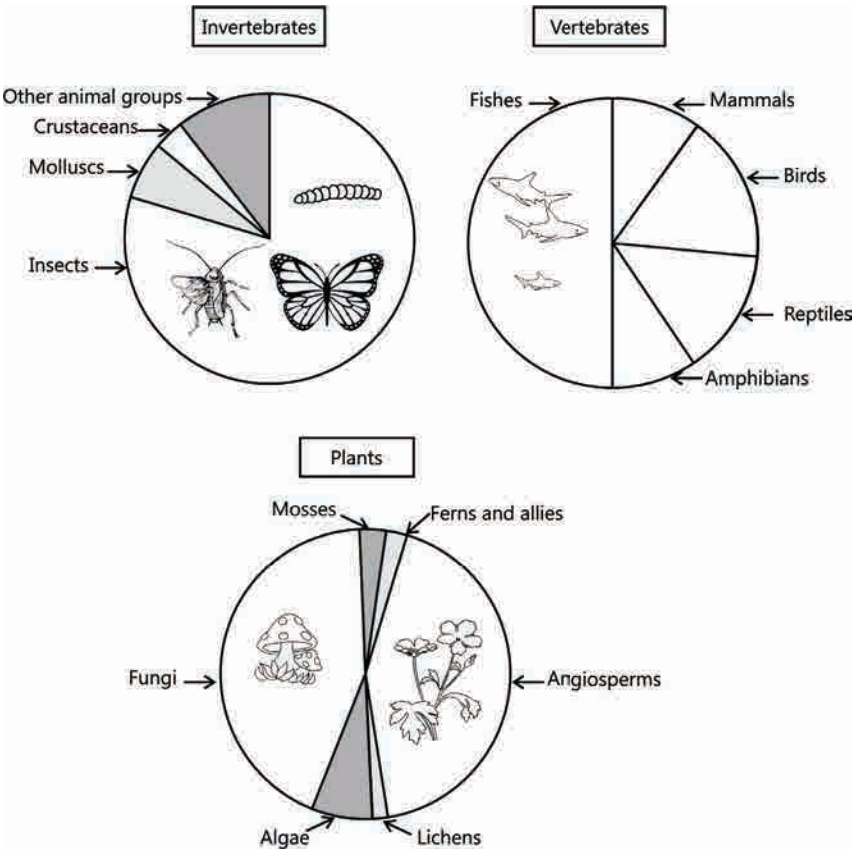


Figure 15.1: A representation of species diversity

Did You Know

- **Plants have achieved lesser diversification than animals due to reasons like-**
  - Animals have nervous system to receive stimuli and respond against them.
  - Plants are immobile. They are fixed and require fewer evolutionary adaptations in order to obtain their requirement of water, minerals and sunlight.
  - They are subjected to more constant environment to avoid competition. All this has resulted in higher species diversity among animals than plants.
- **Reasons of enormous diversification of insects-**

  A thick and strong chitinous cuticle covers the whole body of insects as an exoskeleton. It provides strengths and protection to the body and prevents loss of water. Due to their protective exoskeleton, the insects are, today the most successful animals of nature. These are widespread and can be observed everywhere on land, in water, and even in air.
- Number of fungi species (72000) in the world is more than the combined total of the species of fishes (28000), amphibians (4780), reptiles (7150) and mammals (4650).

3.2 Biodiversity in India

India with only 2.4% of the world's land area possesses 8.1% species diversity of the world due to varying physical conditions and species grouping. It is because India is one of the 12 mega diversity countries of the world. There are nearly 45000 species of plants and twice as many animal species. We estimate that there are probably more than 100000 plant species and more than 300000 animal species yet to be discovered and described according to May's global estimates, only 22% of the total species have been recorded so far. Applying this proportion to India's diversity figures, we will require a large trained manpower of taxonomists and lot of time to complete the inventory of the biological wealth of our country. However, a very large number of species that are yet to be discovered may be facing the threat of becoming extinct even before we discover them.

4. Patterns of Biodiversity

The diversity of plants and animals is not uniform throughout the world but shows a rather uneven distribution. Different patterns in diversity are latitudinal, altitudinal, geographical, topographical, humidity gradients but most common is the latitudinal gradient in diversity.

4.1 Latitudinal Gradients

The biodiversity decreases as we move from low to high latitude i.e. from the equator to the poles. In other words the biodiversity is maximum in tropical regions, moderate in temperate area and minimum in the arctic region (latitudinal range of 23.5° N to 23.5° S).

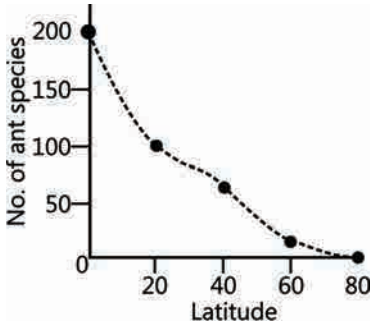


Figure 15.2: A graph representing latitude gradients

Various examples of high diversity in tropical regions:

- About 1400 species of birds are found in Colombia located near the equator (tropical region). About 105 species in New York (41° N) in temperate area and about 56 species of birds Greenland (71° N) in arctic area.
- Most of the land area of our country lies in tropics so India has more than 1200 species of birds.
- A tropical region forest like equator has 10 times more species of vascular plants as compared to temperate region forest of equal area like midwest of the USA.
- Tropical Amazonian rain forest (South America) has the greatest biodiversity on earth. At least 2 million insect species are yet to be discovered and named in these rain forest.

Table 15.1: Biodiversity in Amazonian rain forest

Taxa	Number of species
Plant species	More than 40000
Mammals	427
Birds	1300
Reptiles	378
Amphibians	427
Fishes	3000
Invertebrates	More than 125000

Why Biodiversity is rich in tropics?

Various hypothesis proposed by Ecologists and evolutionary biologists explain the cause of high diversity in tropics; important ones are as follows:

- Speciation is a function of time. Most of the species in the past are killed in temperate areas due to frequent glaciations. Species continue to flourish and evolve undisturbed for millions of years in tropics.
- In tropical areas, environments unlike temperate ones, are less seasonal due to favorable conditions such as warm temperatures and high humidity, relatively more constant and predictable. Such constant and favorable environment has helped tropical organisms to gain more niche specialization and lead to a greater species diversity.
- As they are near to equator, the tropical areas receive more solar energy over the year. Hence more productive that can support a wider range of species in tropical communities.

4.2 Species-Area Relationships

While exploring the South American jungles, German naturalist and geographer Alexander von Humboldt, found that within a region species richness increased with increasing explored area but only up to a limit. The relationship between species richness and area turned out to be a rectangular hyperbola for a wide variety of organisms like angiosperm plants, birds, bats and freshwater fishes.

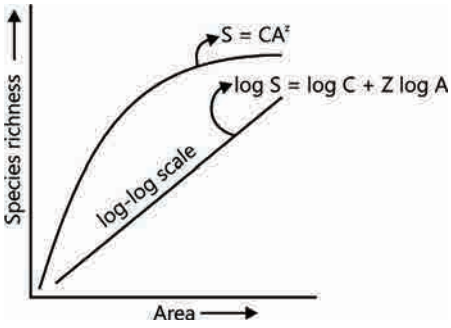


Figure 15.3: A graph representing species area relationship

On a logarithmic scale, the relationship is a straight line described by the equation.

$S = CA^Z$

$\log S = \log C + Z \log A$

Where,

S = Species richness

A = Area

Z = Slope of the line (regression coefficient)

C = Y-intercept

Significance of slope of regression (Z) in a species-area relationship

Slope of regression or regression coefficient of species-area relationship indicates that species richness decreases with the decreases in area. The value of slope of regression (Z) of species-area relationships lies in the range of 0.1 to 0.2 when analysis is done among small areas like plants in Britain, birds in California or molluscs in New York state. However, if the species-area relationship is conducted for very large areas like the entire continent, the slope of the line is much steep with value of Z in the range of 0.6 to 1.2. For example, it is 1.15 for frugivorous (fruit-eating) birds and mammals in the tropical forests of different continents. Thus more is steepness of the slope of line, larger the explored area.

TRY IT YOURSELF

1. New York temperate area has 56 species of birds. (True/False).
2. Tropical biomes unlike temperate ones, are more seasonal, relatively less constant and predictable. (True/False).
3. Slope of regression (Z) is _____ for frugivorous birds and mammals in tropical forests of different continents. (Write the number)
4. Why is biodiversity rich in tropics?
5. Value of slope of regression (Z) of species-area relationship lies in the range of _____ molluscs in New York State.
6. Colombia located near the equator has about _____ species of birds.

5. The Importance of Species Diversity to the Ecosystem

The functioning of the ecosystem is based on the number of species in a community because rich biodiversity is important for stability, productivity, resilience, alternative pathways and health of ecosystems.

5.1 Stability

Ecologists, consider that with more species, communities tend to be more stable than those with less species. What exactly is stability for a biological community? Let us discuss it.

- Too much variation in productivity from year to year is not shown in stable community.
- It must be resistant to occasional natural as well as man-made disturbances.
- It must be resistant to invasions by alien species.

David Tilaman's long-term ecosystem experiments using outdoor plots confirmed that these attributes are linked to species richness in a community. He found that

- Less year-to-year variation in total biomass was seen in plots with more species.
- Higher productivity was due to increased diversity.

Now it is clear that species diversity is important for productivity, stability and resilience.

5.2 Ecosystem Health

If a few species become extinct it is often believed that little harm would occur to ecosystem. There should not be much difference if one of the tree frog species is lost forever from Western Ghats ecosystems or number of ant species is reduced from 20000 to 15000. However, rich biodiversity is important for ecosystem health but also for survival of human race on earth. Since large number of species have higher number of niches, more interactions and more inter-relationships. Paul Ehrlich through Rivet popper hypothesis explained the effect of reduction in biodiversity. In an airplane (ecosystem) all parts are joined together using thousands of rivets (species). If every passenger travelling in it starts popping a rivet to take home (causing a species to become extinct), it may not affect flight safety (proper functioning of the ecosystem) initially, but as more and more rivets are removed, the plane becomes dangerously weak over a period of time. Which rivet is removed may also be critical. Loss of rivets on the wings (key species that drive major ecosystem functions) is obviously is more serious threat to flight safety than loss of a few rivets on the seats or windows inside the plane.

KNOWLEDGE BUILDER

Deliberate eradication of species which are harmful to human beings like HIV, small pox virus, Plasmodium etc. can be taught of. Such pathogens are not part of any food chain or food webs, nor have role in bio control. They are neither producer nor decomposers of any ecosystem. Hence, their extinction would not affect the functioning of ecosystems in any way. Poliovirus is about to get eradicated. Efforts are continued to make this world free form diseases like TB, AIDS, malaria hepatitis, Diphtheria, Tetanus etc.

6. Loss of Biodiversity

It is doubtful if any new species are being added (through speciation) into the earth's treasury of species, there is no doubt there is continuing losses. The biological wealth is declining rapidly of our planet. Complete loss of genetic information happens due to complete disappearance or extinction of a species.

6.1 Types of Extinction

- Natural extinction: Some species disappear and others, which are more adapted to changed conditions, take their place with the change in environmental conditions. This loss of species which occurred in the geological past at a very slow rate, is natural extinction.
- Mass extinction: Due to catastrophes, the dying of or extermination of a large number of species. There were five episodes of mass extinction of species during the long period (> 3 billion years) since the origin and diversification of life on earth.
- Anthropogenic extinction: It is extermination of species caused directly or indirectly by human activities like habitat destruction, over-exploitation, hunting, pollution etc.
    - More than 2000 species of native birds are extinct due to colonization of tropical pacific islands by humans.
    - The IUCN Red list (2004) documents the extinction of 784 species in the last 500 years. It includes 338 vertebrates, 359 invertebrates and 87 plants, Some examples of important recent extinctions include the Dodo (Mauritius), Quagga (Africa), Thylacine (Australia), Steller's sea cow (Russia), and three subspecies (Bali, Javan, Caspian) of tiger. In the last 20 years, 27 species become extinct.
    - Extinction across taxa are not random. For example, some groups like amphibians appear to be more vulnerable to extinction.

  Presently some 15500 species world-wide are facing the threat of extinction. They include:

- 12 percent of all bird species
- 23 percent of all mammal species
- 31 percent of all gymnosperm species
- 32 percent of all amphibian species
- Anthropogenic extinction is causing a sixth extinction of species. It is 100 – 1000 times faster than the rate of natural extinctions. If the present trends continue ecologists warn that, nearly half of all the species on earth might be wiped out within the next 100 years.

6.2 Results of Loss of Biodiversity

Loss of biodiversity in a region may lead to

- Decline in plant production or productivity.
- Reduced resistance to environmental perturbations like drought.
- Increased variability of ecosystem processes like productivity, water use, and pest and disease cycles.

TRY IT YOURSELF

1. Rich biodiversity is not essential for ecosystem health but required for survival of human race on earth. (True/False)
2. _____ put forth the rivet popper hypothesis.
3. Loss of species which occurred in the geological past at a _____ Rate, is called natural extinction. (very slow/fast)

6.3 Causes of Loss of Biodiversity

The world is facing increased rates of species extinctions, due to human activities. There are four major causes of biodiversity losses, called as 'The Evil Quarter'.

- **Habitat loss and fragmentation:** Most important cause driving animals and plants to extinction.
    - The natural habitat of a species is changed or destroyed when people cut down trees, fill a wetland, plough a grassland or burn a forest. These changes can kill or force out many plants, animals and microorganisms as well as disrupt complex interactions among the species. The most dramatic examples of habitat loss come from tropical rain forests. These forests once occupied 14% of the earth's land area, today they occur on only 6% of land area. By the time you finish reading this chapter, 1000 more hectares of rain forest would have been lost. The Amazon rain forest ('Lungs of the planet') harboring probably millions of species is being cut and cleared for cultivating soya beans or for conversion to grasslands for raising beef cattle.
    - The degradation of many habitats by pollution besides total loss, also threatens the survival of many species. Pollution may reduce and eliminate populations of sensitive species. For example, pesticide linked decline of fish-eating birds and falcons. Another major cause of mortality of many species, such as ducks, swans is lead poisoning. Species diversity drastically reduces eutrophication (nutrient enrichment) of water bodies.
    - In habitat fragmentation large habitats are broken into small fragments due to various human activities like human settlements, building of roads, digging of canals etc. Forest patches having croplands, orchards, plantations and urban settlements on their outskirts are examples of fragmented habitats. Animals requiring large territories (e.g. mammals, birds) and migrating animals are badly affected, leading to population declines.
- **Over-exploitation:** Humans have always dependent on nature for food and shelter, but when 'need' turns to 'greed', it leads to over-exploitation of natural resources. It means, beyond the degree of their renewability, biological systems should not be exploited. Overexploitation of a particular species reduces size of its population to an extent so that it becomes vulnerable to extinction. Due to overexploitation by humans dodo, staller's sea cow and passenger pigeon have become extinct in the last 500 years. Some commercially important species are marine fishes are likely to become endangered because marine fish populations are being overharvested all over the world.

- **Alien species invasions:** New species entering a geographical region are called exotic or alien or non-native species. Disappearance of native or indigenous species through changed biotic interactions occur when alien species are introduced unintentionally or deliberately for whatever purpose.

A few examples of exotic species are as follows:

- Nile perch, a large predator fish was introduced into Lake Victoria of East Africa. Nile perch killed and eliminated ecologically unique assemblage of over 200 species of cichlid fish that were endemic to this freshwater aquatic system.
- Carrot grass (*Parthenium*) is a weed found in India as a contaminant with imported wheat. Many herbs and shrubs are exterminated and it has occupied all open areas.
- *Lantana* is a straggling shrub of tropical America which got introduced in India accidentally. Today it has become a serious weed which as replaced many species in forests.
- Water hyacinth (*Eichhornia*) was introduced by Europeans in India. It has clogged water bodies including wetlands at many placed resulting in death of several aquatic plants and animals.
- The recent illegal introduction of the African catfish *Clarias gariepinus* for aquaculture purposes is posing a threat to the indigenous catfishes in out rivers.
    - **Co-extinctions:** There are many obligate associations amongst different species in ecosystems. When one of them becomes extinct, the plant and animal species associated with it in an obligatory way also become extinct. For example, coevolved plant-pollinator mutualism will result in extinction of one partner if the other is eliminated in nature. If the host fish become extinct, all the parasite exclusively found on it will also become extinct.

Did You Know

Exotic species have the maximum harmful impact on island ecosystems because of the small size and small number of species. Therefore, islands harbor much of the world's threatened biodiversity.

6.4 Red Data List/Red List

The IUCN Red List or Red Data List is an inventory of the global conservation status of biological species. IUCN aims to review the status of each species every 5 to 10 years. The list also is a means to convey the necessity of urgency in implementing conservation plans.

6.5 Endangered Species of India

Mammals:

Black buck *Antelope cervicapra* (V) (a graceful antelope, native to India possessing two spirally twisted horns in males. It is a state animal Punjab Asian Lion) (*Panthera leo Perscia*) (E); Golden langur *Presbytis geei;* Pigmy Hog (*Sus salvanius*) (CR); Lion Tailed Macaque (E) – *Macaca sitenus* (E) Snow leopard

(*Panthera uncia*) (E) Lesser or Red Panda (*Ailurus fulgens*) (E) Giant Panda (*Ailuropoda metanoleuca*) (E). Tibetan Antelope (Chiru/Shahtoosh) (E). One horned rhinoceros (*Rhinoceros unicomis*) (E). Kashmiri stag (Hangul) – *Cervus elaphus hangulu* (E).

Musk deer (*Muschus moschatus*): it is hunted for musk a soft powdery reddish brown odorous, substance, secreted in musk bag under the skin near reproductive organ of the male.

Blue whale Sibbaldus (*Balaenoptera*), Gangetic Dolphin (*Plantanista gangeticus*) (E), Indian elephant (*Elephas indicus*) Panther / Leopard (*Panthera pardus*) (E), Himalayan Brown Bear (*Selenarctos thibetans*) (E), Indian wild Ass (E), Nilgai (*Boselaphustrago camelus*), Chinkara (Gazelle):*Gazella gazelle, Sambhar*: *Crevus unicolor*, Chital (*Axis axis*).

Reptiles

Gharial: *Gavialis gangeticus* (E), Turtle: *Dermochelys coricacea* (E), Crocodile : *Crocodylus* (E), Python : *Python moluras*

Birds

Siberian Crane: *Grus* (E), Great Indian Bustard: Choriotis (*Ardeotis nigriceps*) (E)

Extinct animals from India

Passenger pigeon: *Ectopistes migratorius* (Ex), Dodo – *Raphus cucullatus* (Ex), Cheetah – *Acinonyx jubatus* (Ex).

Plants

Bentinckia nicobarica (E), *Berberis nilghireiensis* (CR), Acontium (E), *Cupessus cashmeriana* (V), *Cypripedium orchid* (E), *Nepenthes* (Pitcher plant) (E), *Rauwolfia serpentina*, *Podophyllum*, *Dioscorea* (Yam plant), *Gingkobiloba*, *Osmunda*, *Colchicum*, *Sapria*.

Note-

Extinct (EX) – No known individuals remaining.

Critically endangered (CR) – Extremely high risk of extinction in the wild.

Endangered (E) – High risk of extinction in the wild.

Vulnerable (V) – High risk of endangerment in the wild.

7. Biodiversity Conservation

Millions of years of evolution has resulted in this diversity in nature. If the present rates of species losses continue we could lose all that wealth in less than two centuries. Biodiversity and its conservation are important environmental issues of international concerns as it is of critical importance for our survival and well-being on this planet.

Due to several factors like pollution, invasive species, over-exploitation by humans, climate change etc. ecosystems are undergoing changes. Diversity at all levels-genetic, species and ecological is important and needs to be conserved.

7.1 Why Should We Conserve Biodiversity?

There are many reasons (all equally important). They can be grouped into three categories: narrowly utilitarian, broadly utilitarian, and ethical.

- **Narrowly utilitarian (Direct or economic uses):** Humans derive countless direct economic benefits from nature.
    - **Food:** All the food we eat comes from plants and animals e.g., cereals, pulses, fruits, eggs, meats etc.
    - **Firewood:** It is used as source of energy for cooking and heating.
    - **Fibre:** Jute, flax, hemp, cotton, coir are the source of natural fibers.
    - **Construction material:** Wood is used as timber in construction work, furniture, sports goods, musical instruments etc.
    - **Industrial products:** Tannins, lubricants, dyes, resins, perfumes, paper, and rubber are some of the industrial products obtained from plants.
    - **Drugs:** More than 25% of the drugs currently sold in the market worldwide are derived from a mere 120 species of plants. About 25000 species of plants contribute to the traditional medicines used by native peoples around the world. Many more medicinally useful plants especially in tropical rain forests, waiting to be explored.

  Bio prospecting or exploring molecular, genetic and species-level diversity for products of economic importance is going on vigorously. Nations with rich biodiversity are expected to reap enormous benefits.

KNOWLEDGE BUILDER

1. 3000 species of plants have edible parts out of which 150 are commercially exploited.
2. The Anticancer drug Taxol has been obtained from bark of Taxusbaccata (yew plant).
3. Leaves of Lawsoniainermis provides us with henna.

- **Broadly utilitarian (Ecosystem services):** Biodiversity plays a major role in many ecosystem services that nature provides.
    - **Oxygen:** Plants are replenishing O_2 of the atmosphere due to their photosynthetic activity. Amazon rain forest is estimated to produce 20% of it.
    - **Pollination:** A number of organisms like bees, bumblebees, birds, bats and few other animals are involved in pollination of plants which is essential for formation of fruits and seeds. If humans are made to do this duty, the cost would be many billions of dollars.
    - **Aesthetic pleasure:** Biodiversity has a lot of aesthetic and attraction value. It provides a lot of pleasures of walking through thick woods, fresh oxygen rich air, watching flowers in full bloom, hearing the voices of various birds or waking up to a bulbul's song in the mornings.

- **Flood and Erosion control:** Plant roots hold the soil particles, moving wind and water and thus prevent soil erosion. Plants also increases the porosity of soil and thereby allow water to percolate down into the soil and then in the water table. It helps conservation of water by retaining water and preventing run off of rain water. Litter and humus of plants act as a sponge retaining most of the rain water. As the soil is porous, the retained water downwardly and stored as underground water.

- **Ethical:** There are millions of plant, animal and microbial species who evolved just as we have evolved and are sharing the planet with us. No organisms is useless. Every species has an intrinsic value, though it may not be of direct use to us. It is therefore, our moral and ethical duty not to destroy them. Instead we should take care of their wellbeing so to pass the rich biological legacy to future generations.

TRY IT YOURSELF

1. Classity under narrowly and broadly utilitarian services of biodiversity for the benefits given in following.

   (A) Taxol, (B) Gaseous composition, (C) Timber, (D) Flood control, (E) Quinine, (F) control of soil erosion, (G) Traditional medicines, (H) Perfumes, (I) Pollinators, (J) Food, (K) Watching springs flowers in full bloom

2. Amazon forest is estimated to produce, through photosynthesis _____ percent of the total oxygen in the earth's atmosphere.

3. The _____ argument for conserving biodiversity relates to what we owe to millions of plants, animal and microbe species with whom we share this planet.

7.2 How to Conserve Biodiversity

There are two basic strategies of biodiversity conservation, in-situ (on site) and ex-situ (off site).

- **In-situ conservation:** protection of whole natural ecosystem is emphasized in in-situ strategies, leading to biodiversity protected at all levels. It means we save the entire forest to save the tiger. Invariably, the number of species waiting to be saved from extinction far exceeds the conservation resources available. On a global basis, this problem has been addressed by eminent conservationists. In-situ conservation are of two types: hot spots and protected areas.

- **Hot spots**

The richest and the most threatened reservoirs of plant and animal life on earth are the hot spots.

The key criteria for determining a hot spot are:

- Very high levels of species richness.
- High degree of endemism (species confined to that region and not found anywhere else).
- Degree of threat, which is measured in terms of habitat loss.

Initially 25 hot spots were identified globally. The number is raised to 34 with area of less than 2% of earth's land. Extremely high and strict protection of these hot spots could reduce the ongoing mass extinctions by almost 30%.

- **Biodiversity hot spots in India:**
    - **Western Ghats and Sri Lanka:** Occurring along the western coast of India through Maharashtra, Karnataka, Tamil Nadu and Kerala extending over to Sri Lanka. Southern Western Ghats are known as Malabar. The Agasthymalai hills, the Silent Valley and the new Amambalam Reserve, are the major centres of diversity.
    - **Indo-Burma:** Extending from Bhutan to Myanmar covering most of the North-Eastern India.
    - **Himalaya:** One of the richest hot spot of biodiversity.
- **Protected areas**

Areas of land and/or sea, especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources are protected areas. These are managed through legal of other effective means. World Conservation Center has recognized nearly 37000 protected areas.

India has 14 biosphere reserves, 90 national parks and 448 wildlife sanctuaries covering 4.7% of the land surface, as against 10% internationally suggested norm.

- **National parks:**

  These are maintained by government and reserved for betterment of wildlife (both flora and fauna). Grazing, felling of trees, habitat manipulation and cultivation are not allowed. The idea of National park was formulated by George Catlin. First National park in India was Jim Corbett National Park (1935) in Uttarakhand.

- **Sanctuaries:**

  These are tracts of land with or without lakes where animals (fauna) are protected from all types of exploitation and habitat disturbance. Collection of forest products, harvesting of timber, tilling of land, etc. are allowed. Conservation is species oriented

  e.g. pitcher plant, great Indian Bustard.

- **Biosphere reserves:**

  These are a special category of protected areas of land and/or coastal environments, wherein tribal people are an integral component of the system. These are representative example of natural biomes and contain unique biological communities. Creation of Biosphere Reserve is a new approach for conservation of Biodiversity of an area. There are 14 biosphere reserves in India. A biosphere reserve consists of core, buffer and transition zones. An undisturbed and legally protected ecosystem is the natural or core zone. The buffer zone surrounds the core area, and is managed to accommodate a greater research and educational activities. The transition zone, the outermost part of the Biosphere Reserve, is an area of active cooperation between reserve management and the local people, wherein activities like settlements, cropping, forestry, recreation and other economic uses continues in harmony with conservation goals.

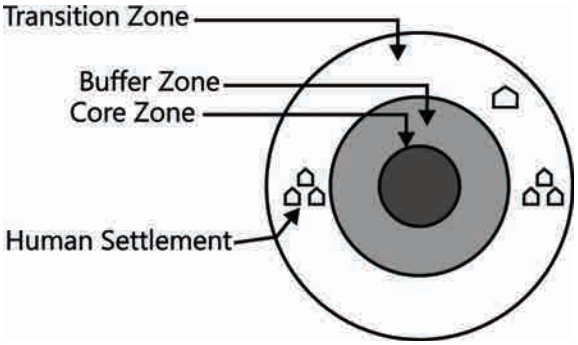


Figure 15.4: Zonation in terrestrial biosphere

The main functions of biosphere reserves are:

- Conservation
- Development
- Scientific research, monitoring and education

Biosphere reserves are nominated by national governments and remain under the sovereign jurisdiction of the states where they are located. Their status is internationally recognized. There are 651 biosphere reserves in 120 countries, including 15 Trans boundary sites. They are distributed as follows:

- 67 in 28 countries in Africa
- 28 in 11 countries in the Arab States
- 137 in 24 countries in Asia and the Pacific
- 297 in 36 countries in Europe and North America
- 122 in 21 countries in Latin America and the Caribbean.

List of Bioreserves in India are:

- Nilgiri
- Nanda Devi
- Nokrek
- Manas
- Sunderban
- Gulf of Mannar
- Great Nicobar
- Similipal
- Dibru-Saikhova

- Dehang-Dibang
- Pachmarhi
- Khangchendzonga
- Agasthyamalai
- Achanakmar- Amarkantak
- Kachchh
- Cold Desert
- Seshachalam
- Panna

- **Sacred groves**

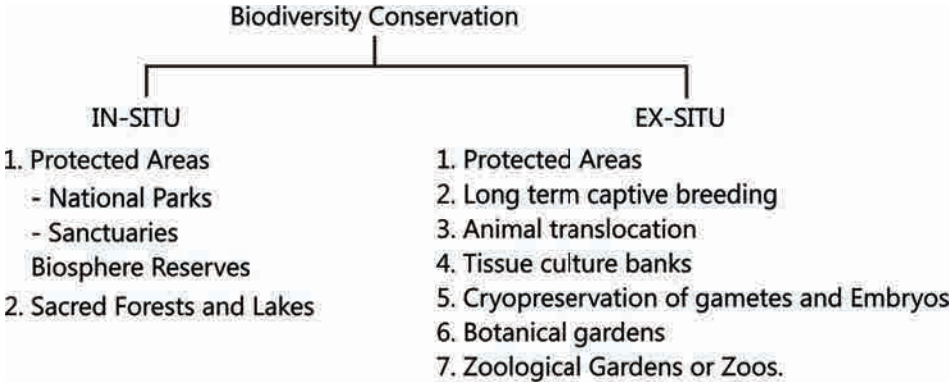
  A sacred grove or sacred woods are any grove of trees of special religious importance to a particular culture. Sacred groves feature in various cultures throughout the world. In many cultures, tracts of forest were set aside, and all the trees and wildlife within were venerated and given total protection. These are found in several parts of India.

  - Khasi and Jaintia Hills in Meghalaya
  - Aravalli Hills of Rajasthan
  - Western Ghat regions of Karnataka and Maharashtra
  - Sarguja, Chanda and Bastar areas of Madhya Pradesh
  - The sacred groves are the last refuges for a large number of rare and threatened plants in Meghalaya.

- **Ex-situ conservation**

  Threatened animals and plants are taken out from their natural habitat and placed in special setting where they can be protected and given special care is Ex-situ conversation. Ex-situ conservation is the desirable approach if an animal or plant is endangered or threatened and needs urgent measures to save it from extinction.

  In recent years ex-situ conservation has advanced beyond keeping threatened species in enclosures. Using cryopreservation techniques, now gametes of threatened species can be preserved in viable and fertile condition for long periods, eggs can be fertilized in-vitro, and plants can be propagated using tissue culture methods. Seeds of different genetic strains of commercially important plants can be kept for long periods in seeds banks.Strategies including establishment of botanical gardens, zoos, conservation strands and gene, pollen seed, seedling, tissue culture and DNA banks are also included in Ex-situ conservation.



Flowchart 15.1: Biodiversity conservation methods

Knowledge Builder

1. Concept of hot spots was developed by Norman Myers. Nearly 25% of plant species and 20% of human population living are included in Hot spot.
2. The Jim Corbett National Park was the first National Park established in India.
3. The concept of Biosphere reserves was launched in 1975 as a part of UNESCO's Man and Biosphere Programme (MAB)

Biodiversity knows no political boundaries and its conservation is a collective responsibility of all nations. The historic convention on Biological Diversity ('The Earth summit') held in Riode Janerio in 1992, called upon all nations to take appropriate measures for conservation of biodiversity and sustainable utilization of its benefits. In a follow-up, the World summit on sustainable development held in 2002 in Johannesburg, South Africa, 190 countries pledged their commitment to achieve by 2010, a significant reduction in the current rate of biodiversity loss at global, regional and local levels.

Try It Yourself

1. Initially 25 biodiversity hotspots were identified but subsequently _____ more have been added to the list.
2. India has _____ biosphere reserves, _____ national parks and _____ Wildlife sanctuaries.
3. Mass extinction is the extermination of a large number of species due to catastrophes. (True/False)
4. Anthropogenic extinction is faster than the rate of natural extinctions.(True/False)

DID YOU KNOW

- Population characteristics for susceptibility to extinction are-
- Large body size e.g. Lion, Rhinoceros.
- Small population size and low reproductive rate e.g.Ghat panda and Blue whale.
- High trophic level in food chain e.g. Bengal tiger, bald Eagle.
- Fixed habitat and migratory routes e.g. Blue whale, whooping crane
- Some laws-
    - Biodiversity Bill - 2002
    - Wild life (protection) Act, 1972, amended in 1991
    - Forest Conservation Act, 1980
- 1st National Park established in India -Jim Corbett national park (Uttarakhand); Tiger protection.
- In Kerala, Silent valley is a tropical evergreen forest declared as National reserve forest.
- International organizations concerned with biodiversity conservation - IUCN and WWF (World Wild Fund for Nature).

7.3 Conservation Projects in India

Table 15.2: Some special projects for endangered animal species

Name of Project	Details
1. Tiger project	There are now tiger reserves (mainly Sunderban, Corbett, Periyar and Ranthambore NP) to save tigers. It was launched on 1st April, 1973. Nagarjuna Sagar is largest Tiger Reserve in India.
2. Lion project (Gir Lion project)	Asian lion is found in Gir forest of Gujrat. It was started in 1972.
3. Crocodile breeding project	It was initially started in Orissa to save crocodiles in 1975. There are three species of crocodiles in India (i) Salt water (*Crocodylus posrosus*) (ii) Fresh water muggar (*Crocodylus palustris*) (iii) Gharial (*Gavialls gangeticus*)
4. Rhino Conservation project	It was started in Assam in 1987. Dudhwa National Park (Lakhimpur Kheri UP) was selected for the rhino reintroduction project.
5. Snow leopard project	There are 12 snow-leopard reserves throughout the Himalayas.
6. Hangul project	It was started in 1790 Dachiagam Sanctuary, Sri Nagar (Kashmir) to protect hangul or Kashmiri stag (*Cervusel ephushangul*)
7. Brow-antler deer project	It was started in Manipur since 1977 to protect brow-antler deer (Cervuseldieldi)
8. Musk deer project	It was started at Kedarnath Sanctuary Uttarakhand to protect musk-deer (*Moschus moschiferus*). Shikari Devi Sanctuary in Himachal Pradesh is also carrying this project
9. Elephant project	It has been recently started (1991) to protect elephants
10. Yak Project Research Centre	It is an Arunachal Pradesh
11. River Dolphin Project	Vikramshila (Bihar)
12. Lion Tailed Macaque Project	Silent valley National Park, Kerala
13. Great India Bustard Project	Desert National park (Raj) and Great India Bustard sanctuary (Maharashtra).

Summary

- Biodiversity is the sum total of diversity that exists at all levels of biological organization.
- Protecting diversity at all levels is the main aim of conservation.
- Nearly 6 million waiting to be discovered and named and more than 1.5 million species have been recorded.
- More than 70 percent of named species are animals of which 70% are insects.
- All vertebrate species combined fungi has more species.
- One of the 12 mega diversity countries of world is India with 45000 species of plants and twice as many species of animals.
- Species diversity is highest in the tropics and decreases towards the poles.
- Greater productivity and species richness in tropics is due to constant environment and more sunlight.
- Species richness is a function of area and species area relationship, generally a rectangular hyperbolic function.
- Communities with high diversity tend to be less variable, more productive and resistant to biological invasions.
- Mass extinctions have occurred in the past but present rates are 100 to 1000 times higher largely due to human activities.
- Nearly 700 species became extinct in recent times and more than 15500 species (of which > 650 are from India) currently face threat of extinction.
- The main causes of extinction are Habitat loss and fragmentation, over-exploitations, biological invasions and co-extinctions.
- Biodiversity needs to be conserved for narrowly utilitarian, broadly utilitarian and ethical reasons.
- Direct benefits of biodiversity are food, fire, firewood, pharmaceuticals etc.
- Indirect benefits of biodiversity are through ecosystem services like pollination, pest control, climate moderation and flood control.
- We have a moral responsibility to take good care of earth's biodiversity and pass it on in good order to our next generation.
- Biodiversity conservation may be in-situ as well as ex-situ.
- In-situ conservation is where endangered species are protected in their natural habitat.
- 34 biodiversity hotspots have been proposed for intensive conservation efforts in the world.
- Western Ghats and Sri Lanka, Himalaya and Indo-Burma cover India's biodiversity rich regions.
- India's in-situ conservation efforts are reflected in its 14 biosphere reserves, 90 national parks 448 wildlife sanctuaries and many sacred groves.
- Protective maintenance of threatened species in zoological parks, botanical gardens, in vitro fertilization, tissue culture propagation and cryopreservation of gametes are included in ex-situ conservation.

EXERCISE

Objective Questions

Q.1 Which of the following taxon shows maximum species diversity?

(A) Fishes (B) Beetles (C) Ants (D) Orchids

Q.2 The variation shown by the medicinal plant *Rauwolfia vomitoria* growing in different Himalayan ranges represents

(A) Genetic diversity (B) Species diversity

(C) Ecological diversity (D) Community diversity

Q.3 Read the following statements

(1) India has a greater ecosystem diversity than Norway

(2) According to the IUCN (2004), the total number of plant and animal species described so far is slightly more than 15 million.

(A) Both (1) and (2) are correct (B) Only (2) is correct

(C) Both (1) and (2) are incorrect (D) Only (1) is correct

Q.4 More conservative and scientifically sound estimate made by Robert May places the global species diversity at about

(A) 1.5 million (B) 7 million (C) 1.7 million (D) 17 million

Q.5 Species diversity of plants on earth is

(A) 2.5 % (B) 22 % (C) 7.1 % (D) 32 %

Q.6 Insects are the most numerous with estimate of

(A) 7 out of 10 invertebrates (B) 4 out of 10 invertebrates

(C) 7 out of 10 animals (D) 4 out of 10 animals

Q.7 Which of the following is not an in situ technique?

(A) Cryopreservation (B) National parks

(C) Sanctuaries (D) Sacred forests

Q.8 Which of the following group represents minimum species diversity among vertebrates?

(A) Birds (B) Mammals (C) Reptiles (D) Amphibians

Q.9 In global biodiversity of plants, the

(A) Angiosperms represent maximum number

(B) Algae represent the minimum number

(C) Fungi represent the minimum number

(D) Mosses represent the maximum number

Q.10 Conventional taxonomic methods are not suitable for identifying

(A) Amphibian species (B) Insect species

(C) Microbial species (D) Gymnospermic species

Q.11 India has _____% of the world's land area. Its share of the global species diversity is an impressive _____%

(A) 8.1, 2.4 (B) 22, 12 (C) 12, 22 (D) 2.4, 8.1

Q.12 What is the approximate ratio of animals and plants species in our country ?

(A) 3 : 1 (B) 2 : 1 (C) 1 : 3 (D) 1 : 2

Q.13 Read the following statements :

(1) Tropics harbor more species than temperate or polar areas.

(2) Colombia located near the equator has nearly 1400 species of birds.

(3) India has less than 105 species of birds.

(A) 1 and 2 are incorrect (B) 2 and 3 are incorrect

(C) 1 and C are incorrect (D) Only 3 is incorrect

Q.14 Amazonian rain forest in South America is home to more than $\underline{\quad A \quad}$ species of plants and $\underline{\quad B \quad}$ species of fishes

(A) A – 3000, B – 40000 (B) A – 1500. B – 2500

(C) A – 40000, B – 3000 (D) A – 427, B – 378

Q.15 Select incorrect statement w.r.t greater biological diversity in tropics

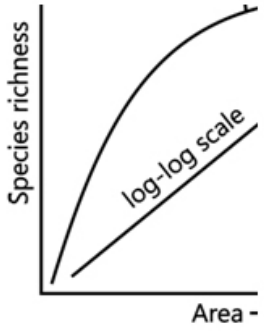
(1) Tropical latitudes have remained relatively undisturbed for millions of years and thus had a long evolutionary time for species diversification.

(2) Tropical environments are more seasonal and less predictable than temperate.

(3) There is more solar energy available which contributes to higher productivity.

(A) 1 and 2 (B) only 2 (C) 2 and 3 (D) only 1

Q.16 Relationship between species richness (S) and area (A) represented in the following graph is described by the equation.



(A) Log S = log A + Z log C (B) Log S = log C + Z log A

(C) Log C = log A + S log A (D) Log C = log S + Z log A

Q.17 Species are relationships among very large areas like the entire continents the Z values in the range of

(A) 0.1 to 0.2 (B) 1.15 (C) 0.3 to 0.6 (D) 0.6 to 1.2

Q.18 Which of the following statement is wrong?

(A) A stable community should show much variation in productivity from year to year

(B) According to Tilman's long term ecosystem experiments increased diversity contributed to higher productivity

(C) Stable community must be resistant to occasional disturbances

(D) Rich biodiversity is essential for ecosystem health but imperative for the very survival of the human race on this planet.

Q.19 Which of the following ecologist gave 'rivet popper' hypothesis?

(A) David Tilman (B) Alexander Von Humboldt

(C) Robert May (D) Paul Ehrlich

Q.20 According to rivet popper hypothesis key species are represented by

(A) Air plane (B) Rivets on the windows

(C) Rivets on the wings (D) Both B and C

Q.21 Colonization of tropical pacific islands by humans have resulted in extinction of more than _____ Species of native birds.

(A) 2000 (B) 7000 (C) 784 (D) 75000

Q.22 Match the column I with Column II

Column I	Column II
a. Thylacine	(i) Russia
b. Dodo	(ii) Mauritius
c. Quagga	(iii) Australia
d. Steller's sea cow	(iv) Africa

(A) a (ii), b (iii) c (i), d (iv) (B) a (iv), b (i), c (ii), d (iii)

(C) a (iii), b (iv), c (ii), d (i) (D) a (iii), b (ii), c (iv), d (i)

Q.23 IUCN Red List (2004) documents the extinction of A species in the last B years.

(A) A – 500, B – 300 (B) A – 784, B – 500

(C) A – 645, B – 500 (D) A – 984, B – 300

Q.24 Loss of biodiversity in a region may lead to all the following, except

(A) Decline in plant production

(B) Lowered resistance to environment perturbations

(C) Increased variability in certain ecosystem processes

(D) Increased endemism

Q.25 The sixth extinction presently in progress is estimated to be _____ times faster from the previous episodes.

(A) 10 – 50 (B) 50 – 100 (C) 100 – 1000 (D) 1000 – 10000

Q.26 Presently A % of all mammal species and B % of all gymnosperm species in the world face threat of extinction.

(A) A – 32, B – 12 (B) A – 22, B – 31 (C) A – 23, B – 31 (D) A – 31, B – 23

Q.27 The Evil Quartet represents the major causes of

(A) Soli pollution

(B) Inbreeding depression

(C) Biodiversity losses

(D) Air pollution

Q.28 Which of the following is the most important cause driving animals and plants to extinction?

(A) Alien species invasions

(B) Co-extinctions

(C) Habitat loss and fragmentation

(D) Over-exploitation

Q.29 Read the following statements

(1) Today tropical rain forests occur on 6% of land.

(2) Today Amazon rain forest is being cut and cleared for cultivating soya beans.

(A) Only 1 is correct

(B) Both 1 and 2 are correct

(C) Both 1 and 2 are incorrect

(D) Only 2 is correct

Q.30 Which of the following organisms are badly affected when large habitats are broken up into small fragments due to various human activities?

(A) Mammals requiring small territories

(B) Planktons showing diapause

(C) Animals with migratory habits

(D) Birds requiring small territories.

Q.31 Which of the following species have been extinct due to over-exploitation by humans in the last 500 years?

(A) Water hyacinth and *Quagga*

(B) *Parthenium* and *Lantana*

(C) Steller's sea cow, passenger pigeon

(D) African catfish and *Pistia*

Q.32 A weed, which has invaded many forest lands of India is

(A) *Clarias gariepinus*

(B) *Lantana*

(C) *Pistia*

(D) Water hyacinth

Q.33 Extinction of more than 200 species of cichlid fish in Lake Victoria was due to introduction of

(A) African catfish

(B) Nile perch

(C) *Clariasgariepinus*

(D) Lantana

Q.34 When a host fish species becomes extinct, its unique assemblage of parasites also meets the same fate. It is an example of

(A) Co-extinction

(B) Alien species invasion

(C) Over-exploitation

(D) Habitat loss

Q.35 More than _____ % of the drugs currently sold in the market worldwide are derived from plants.

(A) 70 (B) 25 (C) 90 (D) 55

Q.36 Bio-prospecting is exploring molecular, genetic and species level diversity for products of

(A) Ecosystem services (B) Economic benefits

(C) Aesthetic pleasures (D) Both A and C

Q.37 The fast dwindling A forest is estimated to produce B percent of the total oxygen in earth's atmosphere

(A) A – Siberian, B – 30 (B) A – Temperate, B – 20

(C) A – Alpine, B – 15 (D) A – Amazon, B – 20

Q.38 Read the following statements

(1) Pollination is broadly utilitarian services of biodiversity

(2) Philosophically or spiritually, we need to realize that every species has an intrinsic value.

(A) Only 1 is correct (B) Both 1 and 2 are incorrect

(C) Only 2 is correct (D) Both 1 and 2 are correct

Q.39 How many biodiversity hotspots have been identified in the world?

(A) 30 (B) 3 (C) 34 (D) 20

Q.40 Which one of the following is not hot spot of biodiversity in our country?

(A) Western Ghats and Sri Lanka (B) Indo-Burma

(C) Madagascar (D) Himalaya

Q.41 Strict protection of biodiversity hotspots could reduce ongoing mass extinctions by almost

(A) 30 % (B) 15 % (C) 10 % (D) 5 %

Q.42 When we conserve and protect the whole ecosystem, its biodiversity at all levels is protected. This approach includes all of the following, except

(A) Biosphere reserves (B) Seed bank

(C) National parks (D) Sanctuaries

Q.43 Which of the following is not concerned with in-situ conservation of diversity?

(A) Wildlife sanctuaries (B) Zoological parks

(C) Biosphere reserves (D) National parks

Q.44 Mark the correct match

(A) Wildlife sanctuaries in India - 90

(B) Sacred groves - On-site conservation

(C) Western ghat - Rajasthan and M.P

(D) National park in India - 448

Q.45 In which of the following method threatened animals are taken out from natural habitat and placed in special setting?

(A) Zoological park (B) Botanical garden

(C) Biosphere reserves (D) Both A and B

Q.46 Gametes of threatened species can be preserved in viable and fertile condition for long periods using

(A) Wildlife safari parks (B) On-site conservation

(C) Cryopreservation (D) Botanical gardens

Q.47 Which of the following is correct match w.r.t biodiversity rich region?

(A) National parks - 95

(B) Wildlife sanctuaries - 448

(C) Biosphere reserves - 24

(D) Zoological parks - 25

Q.48 Select incorrect match

(A) Aravalli hills - Gujrat

(B) Khasi and Jaintia hills - Meghalaya

(C) Sarguja - Madhya Pradesh

(D) Western Ghats - Karnataka, Maharashtra

Q.49 How many countries pledged their commitment to achieve by 2010, a significant reduction in the current rate of biodiversity loss at global, regional and local levels in the World summit held in 2002?

(A) 119 (B) 121 (C) 190 (D) 195

Q.50 The historic convention on biological diversity held in

(A) Johannesburg (B) Rio De Janeiro

(C) Washington (D) California

Q.51 Select the correct statement about biodiversity

(A) The desert areas of Rajasthan and Gujrat have a very high level of desert animal species as well as numerous rare animals

(B) Large scale planting of BT cotton has no adverse effect on biodiversity

(C) Western Ghats have a very high degree of species richness and endemism

(D) Conventional taxonomic methods are more suitable for identifying microbial species

Q.52 Which one of the following shows maximum genetic diversity in India?

(A) Mango (B) Groundnut (C) Rice (D) Maize

Q.53 Total number of all plant and animal species in a given region is known as the regions

(A) Biota (B) Flora (C) Fauna (D) Diversity

Q.54 Biodiversity of a geographical region represents

(A) Genetic diversity present in the dominant species of the region

(B) Species endemic to the region

(C) Endangered species found in the region

(D) The diversity in the organisms living in the region

Q.55 The highest number of plant species in the world is represented by

(A) Algae (B) Lichens (C) Fungi (D) Mosses

Q.56 Which one of the following have the highest number of animal species in nature?

(A) Mammals (B) Molluscs (C) Insects (D) Birds

Q.57 Which sample area shows maximum diversity?

(A) Birds - 4
Insects - 4
Elephant - 4

(B) Crow - 8
Pigeon - 8
Cuckoo - 8
Myana - 8

(C) Pigeon - 10
Crow - 3
Insect - 7

(D) Butter fly - 20
Banana fly - 20
Lizards - 20

Q.58 Which of the following is an in-situ method?

(A) Captive breeding
(B) Cryopreservation
(C) National parks
(D) Tissue culture banks

Q.59 India covers the world land area of _____ and contributes the global diversity of _____

(A) 4 %, 8 %
(B) 8.1 %, 2.4
(C) 2.4 %, 8.1 %
(D) 8 %, 4 %

Q.60 Degree of biodiversity increases from

(A) Equator to poles
(B) Poles to equator
(C) Low latitude to high latitude
(D) Low altitude to high altitude

Q.61 Lion is more susceptible to extinction due to which one of the following population characteristics?

(A) Large body size
(B) Small population size
(C) Low reproductive rate
(D) Fixed habitat

Q.62 What is the major causes of diminishing wildlife number?

(A) Felling of trees
(B) Paucity of drinking water
(C) Cannibalism
(D) Habitat destruction

Q.63 Biodiversity Bill was introduced in India in

(A) 2002 (B) 1972 (C) 1991 (D) 1980

Q.64 The most important human activity, leading to the extinction of wildlife, is

(A) Pollution of air and water

(B) Hunting for valuable wildlife products

(C) Introduction of alien species

(D) Alteration and destruction of the natural habitats

Q.65 Diversification in plant life appeared

(A) Due to long periods of evolutionary changes

(B) Due to abrupt mutations

(C) Suddenly on earth due to more seasonal variations

(D) By seed dispersal

Q.66 Which one of the following areas in India, is a hotspot of biodiversity?

(A) Sundarbans (B) Western Ghats (C) Eastern Ghats (D) Gangetic plain

Q.67 Which one of the following is not observed in biodiversity hotspots?

(A) Species richness (B) Endemism

(C) Accelerated species loss (D) Lesser inter-specific competition

Q.68 Total how many hot spots are distinguished over earth surface?

(A) 25 (B) 27 (C) 31 (D) 34

Q.69 How many biodiversity hotspots are in India?

(A) Two (B) Three (C) Four (D) One

Q.70 Viable material of endangered species can be preserved by

(A) Gene bank (B) Gene library (C) Herbarium (D) Gene pool

Q.71 Choose the odd one out w.r.t in-situ conservation

(A) Wild life sanctuaries (B) National parks

(C) Biosphere reserves (D) Zoological parks

Q.72 Sacred groves are especially useful in

(A) Generating environmental awareness (B) Preventing soil erosion

(C) Year-round flow of water in rivers (D) Conserving rare and threatened species

Q.73 In your opinion, which is the most effective in-situ strategies to conserve the plant diversity of an area?

(A) By tissue culture method (B) By creating biosphere reserve

(C) By creating botanical garden (D) By developing seed bank

Q.74 Which one of the following is not included under in-situ conservation?

(A) National park, Sacred grooves (B) Sanctuary, National parks

(C) Botanical garden, Wildlife Safaris (D) Biosphere reserve, Sanctuary

Q.75 Mark the odd one (w.r.t national parks)

(A) Cultivation on land is not permitted (B) Meant for protection of both flora and fauna

(C) Forest products are not harvested (D) Grazing is allowed

Q.76 Which one of the following is an example of ex-situ conservation?

(A) National park (B) Wildlife sanctuary

(C) Seed bank (D) Sacred groves

Q.77 Which of the following is narrowly utilitarian aspect to conserve biodiversity?

(A) Pollination (B) Aesthetic value

(C) Air purification (D) Medicinal value

Q.78 World summit on Sustainable development (2002) was held in

(A) South Africa (B) Brazil (C) Sweden (D) Argentina

Q.79 Which of the following statement for biosphere reserve is incorrect?

(A) They are meant for preserving genetic diversity in representative ecosystems

(B) They are also notified as National parks

(C) Transition zone is legally protected area without utilizing their resources

(D) Protected areas for with multipurpose activities in peripheral zone.

Q.80 What is number of hotspots, biosphere reserves, national parks and wildlife sanctuaries in India respectively?

(i) – 14 (ii) – 90 (iii) – 3 (iv) – 448

(A) (i), (ii), (iii), (iv) (B) (iii), (i), (ii), (iv)

(C) (iv), (iii), (ii), (i) (D) (ii), (iii), (iv), (i)

Q.81 Which of the following countries has the highest biodiversity?

(A) Brazil (B) South Africa (C) Russia (D) India

Q.82 Which of the following is not a cause for loss of biodiversity?

(A) Destruction of habitat (B) Invasion by alien species

(C) Keeping animals in zoological parks (D) Over-exploitation of natural resources.

Q.83 Which of the following is not an invasive alien species in the Indian context?

(A) Lantana (B) Cynodon (C) Parthenium (D) Eichhomia

Q.84 Where among the following will you find pitcher plant?

(A) Rainforest of North EastIndia (B) Sundarbans

(C) Thar Desert (D) Western Ghats

Q.85 Which one of the following is not a major characteristic feature of biodiversity hot spots?

(A) Large number of species (B) Abundance of endemic species

(C) Large number of exotic species (D) Destruction of habitat.

Q.86 Match the animals in column A with their location in column B:

Column A	Column B
Dodo	Africa
Quagga	Russia
Thylacine	Mauritius
Steller's Sea cow	Australia

(A) (i)- (a), (ii)- (c), (iii)-(b), (iv)-(d) (B) (i)- (d), (ii)- (c), (iii)-(a), (iv)-(b)

(C) (i)- (c), (ii)- (a), (iii)-(b), (iv)-(d) (D) (i)- (c), (ii)- (a), (iii)-(d), (iv)- (b)

Q.87 What is common to the following plants: *Nepenthes*, *Psilotum*, *Rauwolfia* and *Aconitum*?

(A) All are ornamental plants

(B) All are phylogenic link species

(C) All are prone to over-exploitation

(D) All are exclusively present in the Eastern Himalayas.

Q.88 The one-homed rhinoceros is specific to which of the following sanctuary:

(A) Bhitar Kanika (B) Bandipur (B) Kaziranga (D) Corbett Park

Q.89 Amongst the animal groups given below, which one has the highest percentage of endangered species?

(A) Insects (B) Mammals (C) Amphibians (D) Reptiles

Q. 90 Which one of the following is an endangered plant species of India?

(A) *Rauwolfia serpentina* (B) *Santalum album*

(C) *Cycas beddomei* (D) All the above

Q.91 What is common to Lantana, Eichhornia and African Catfish?

(A) All are endangered species of India

(B) All of keystone species

(C) All are mammals found in India

(D) All the species are neither threatened nor indigenous species of India.

Q.92 The extinction of passenger pigeon was due to:

(A) Increased number of predatory birds (B) Over-exploitation by humans

(C) Non-availability of food (D) Bird flu virus infection.

Q.93 Which of the following statements is correct?

(A) *Parthenium* is an endemic species of our country

(B) African catfish is not a threat to indigenous catfishes

(C) Steller's Sea cow is an extinct animal

(D) *Lantana* is popularly known as Carrot Grass

Q.94 Among the ecosystems mentioned below, where can one find maximum biodiversity?

(A) Mangroves (B) Desert (C) Coral reefs (D) Alpine meadows

Q.95 Which of the following forests is known as the "lungs of the planet earth"?

(A) Taiga forest (B) Tundra forest

(C) Amazon rainforest (D) Rainforests of North East India

Q.96 The active chemical drug reserpine is obtained from :

(A) *Datura* (B) *Rauwolfia* (C) *Atropa* (D) *Papaver*

Q.97 Which of the following group of plants exhibit more species diversity?

(A) Angiosperms (B) Algae (C) Bryophytes (D) Fungi

Q.98 Which of the below mentioned regions exhibit less seasonal variations?

(A) Tropics (B) Temperates. (C) Alpines (D) Both (A) and (B)

Q.99 The historic convention of Biological Diversity held in Rio de Janeiro in 1992 is known as :

(A) CITES Convention (B) The Earth Summit

(C) G-16 Summit (D) MAB Programme.

Q.100 What is common to the techniques?

(i) In vitro fertilization (ii) Cryopreservation and (iii) Tissue culture

(A) All are in-situ conservation methods

(B) All are ex-situ conservation methods

(C) All require ultra modem equipment and large space

(D) All are methods of conservation of extinct organisms.

Previous Years' Questions

Q.1 Tiger is not a resident in which one of the following national park? ***[CBSE Prelims 2009]***

(A) Gir (B) Jim Corbett (C) Ranthambhor (D) Sunderbans

Q.2 The Indian Rhinoceros is a natural inhabitant of which one of the following Indian states?

[CBSE Main PMT 2010]

(A) Uttarakhand (B) Uttar Pradesh (C) Himachal Pradesh (D) Assam

Q.3 Which one of the following is an example of ex-situ conservation? ***[CBSE Prelims 2010]***

(A) National park (B) Wildlife sanctuary

(C) Seed bank (D) Sacred groves

Q.4 A renewable exhaustible natural resource in ***[CBSE Prelims 2010]***

(A) Forest (B) Coal (C) Petroleum (D) Minerals

Q.5 Which one is famous for hosting thousands of migratory birds coming from Siberia in winter? ***[HP PMT 2010]***

(A) Kanha National Park, Balaghat, M.P.

(B) Keoladeo National Park, Bharatpur, Rajasthan

(C) Kaziranga National Park, Assam

(D) Corbett National Park, Nainital, Uttarakhand.

Q.6 The second trophic level in the lake is ***[HP PMT 2010]***

(A) Phytoplankton (B) Zooplankton (C) Benthos (D) Fishes

Q.7 Who gave the "Rivet Popper hypothesis"? ***[HP PMT 2010; 2011]***

(A) E.P. Odum (B) Ram Deo Misra

(C) Paul Ehrlich (D) A. Tansley

Q.8 'Evil Quartet' is related with ***[HP PMT 2010; 2011]***

(A) Loss of biodiversity (B) Loss of alien species

(C) Loss of standing crop (D) Loss of climax community

Q.9 How many hot spots have been identified in the world? ***[HP PMT 2010]***

(A) 10 (B) 34 (C) 20 (D) 25

Q.10 Which one of the following expanded forms of the following acronyms is correct? ***[CBSE Prelims 2011]***

(A) IPCC = International Panel for Climate Change

(B) UNEP = United Nations Environmental Policy

(C) EPA = Environmental Pollution Agency

(D) IUCN = International Union for Conservation of Nature and Natural Resources

Q.11 Which one of the following have the highest number of species in nature ***[CBSE Prelims 2011]***

(A) Fungi (B) Insects (C) Birds (D) Angiosperms

Q.12 Biodiversity of a geographical area represents ***[CBSE Main PMT 2011]***

(A) Endangered species found in the region

(B) The diversity in the organisms living in the region

(C) Genetic diversity in the dominant species of the region

(D) Species endemic to the region

Q.13 Brow antlered deer is found in ***[Chandigarh CET 2011]***

(A) Kaziranga National park (B) Corbett National Park

(C) Keibul Lamjao National Park (D) Bandipur National Park

Q.14 The only Floating National Park in the world is ***[Chandigarh CET 2011]***

(A) Keibul Lamjao National Park (B) Keoladeo Ghana National Park

(C) Chilka Lake Sanctuary (D) Nal Sarovar Sanctuary

Q.15 Sacred groves are found in ***[Chandigarh CET 2011]***

(A) Meghalaya (B) Punjab

(C) Jammu and Kashmir (D) Bihar

Q.16 Who have recently tried to put price tags on nature's life support services ***[HP PMT 2011]***

(A) Robert Constanza and his colleagues

(B) Nile Perch and his colleagues

(C) Herbert Boyer and his colleagues

(D) Ram Deo Mishra and his colleagues

Q.17 India now has ***[HP PMT 2011]***

(A) 10 Biosphere reserves, 50 National parks, and 400 Wildlife sanctuaries

(B) 14 Biosphere reserves, 50 National parks, and 400 Wildlife sanctuaries

(C) 10 Biosphere reserves, 90 National parks, and 448 Wildlife sanctuaries

(D) 14 Biosphere reserves, 90 National parks, and 448 Wildlife sanctuaries

Q.18 Chipko movement was first led by ***[Orissa JEE 2011]***

(A) Sundarlal Bahuguna (B) Rajiv Gandhi

(C) Ramdev Mishra (D) Indira Gandhi

Q.19 5th June is celebrated as ***[Orissa JEE 2011]***

(A) World Typhoid day (B) World AIDS day

(C) World Environmental Day (D) World Tobacco day

Q.20 The "World Intellectual Property day" is observed on ***[Karnataka CET 2011]***

(A) February 29th (B) June, 30th (C) April 26th (D) September, 5th

Q.21 The highest number of species in the world is represented by ***[CBSE Prelims 2012]***

(A) Mosses (B) Algae (C) Lichens (D) Fungi

Q.22 Which one of the following areas in India is a hotspot of biodiversity? ***[CBSE Prelims 2012]***

(A) Gangetic Plain (B) Sunderbans

(C) Western Ghats (D) Eastern Ghats

Q.23 Select the correct statement about biodiversity ***[CBSE Main PMT 2012]***

(A) Western Ghats have a high degree of species richness and endemism

(B) Conservation of biodiversity is just a fad pursued by the developed countries

(C) The desert areas of Rajasthan and Gujarat have a very high level of desert animal species as well as numerous animals

(D) large scale planting of Bt cotton has no adverse effect on biodiversity

Q.24 Sacred groves are specially useful in: ***[CBSE Main PMT 2012]***

(A) Year round flow of water in rivers (B) Conserving rare and threatened species

(C) Generating environmental awareness (D) Preventing soil erosion

Q.25 Kaziranga wild life sanctuary is home for ***[Chandigarh CET 2012]***

(A) Golden langur (B) Water birds (C) Rhino (D) Porcupine

Q.26 Which region on the planet earth is rich in species diversity? ***[HP PMT 2012]***

(A) North pole (B) Temperate region

(C) Tropical region (D) South pole

Q.27 Arrange the following in ascending order based on their numbers in India ***[HP PMT 2012]***

(a) Biosphere reserves (b) Hot spots

(c) National parks (d) Wild life sanctuaries

(A) b a c d (B) b c d a (C) a b c d (D) d c b a

Q.28 Which one of the following is not used for ex-situ plant conservation? ***[NEET 2013]***

(A) Shifting cultivation (B) Botanical Gardens

(C) Field gene banks (D) Seed banks

Q.29 The organization which publishes the Red List species is ***[AIPMT 2014]***

(A) WWF (B) ICFRE (C) IUCN (D) UNEP

Q.30 A species facing extremely high risk of extinction in the immediate future is called ***[AIPMT 2014]***

(A) Extinct (B) Vulnerable (C) Endemic (D) Critically endangered

ANSWER KEY

Objective Questions

Q.1 B	**Q.2** A	**Q.3** D	**Q.4** B	**Q.5** B	**Q.6** C
Q.7 A	**Q.8** B	**Q.9** A	**Q.10** C	**Q.11** D	**Q.12** B
Q.13 D	**Q.14** C	**Q.15** B	**Q.16** B	**Q.17** D	**Q.18** A
Q.19 D	**Q.20** C	**Q.21** A	**Q.22** D	**Q.23** B	**Q.24** D
Q.25 C	**Q.26** C	**Q.27** C	**Q.28** C	**Q.29** B	**Q.30** C
Q.31 C	**Q.32** B	**Q.33** B	**Q.34** A	**Q.35** B	**Q.36** B
Q.37 D	**Q.38** D	**Q.39** C	**Q.40** C	**Q.41** A	**Q.42** B
Q.43 B	**Q.44** B	**Q.45** A	**Q.46** C	**Q.47** B	**Q.48** A
Q.49 C	**Q.50** B	**Q.51** C	**Q.52** C	**Q.53** D	**Q.54** D
Q.55 C	**Q.56** C	**Q.57** A	**Q.58** C	**Q.59** C	**Q.60** B
Q.61 A	**Q.62** D	**Q.63** A	**Q.64** D	**Q.65** A	**Q.66** B
Q.67 D	**Q.68** D	**Q.69** B	**Q.70** A	**Q.71** D	**Q.72** D
Q.73 B	**Q.74** C	**Q.75** D	**Q.76** B	**Q.77** D	**Q.78** A
Q.79 C	**Q.80** B	**Q.81** A	**Q.82** C	**Q.83** B	**Q.84** A
Q.85 C	**Q.86** D	**Q.87** C	**Q.88** C	**Q.89** C	**Q.90** D
Q.91 D	**Q.92** B	**Q.93** B	**Q.94** C	**Q.95** C	**Q.96** B
Q.97 D	**Q.98** A	**Q.99** B	**Q.100** B		

Previous Years' Questions

Q.1 A	**Q.2** D	**Q.3** C	**Q.4** A	**Q.5** B	**Q.6** B
Q.7 C	**Q.8** A	**Q.9** B	**Q.10** D	**Q.11** B	**Q.12** B
Q.13 C	**Q.14** A	**Q.15** A	**Q.16** A	**Q.17** D	**Q.18** A
Q.19 C	**Q.20** C	**Q.21** D	**Q.22** C	**Q.23** A	**Q.24** B
Q.25 C	**Q.26** C	**Q.27** A	**Q.28** A	**Q.29** C	**Q.30** D