CHAPTER › 15

Biodiversity and Conservation

NEET KEY NOTES

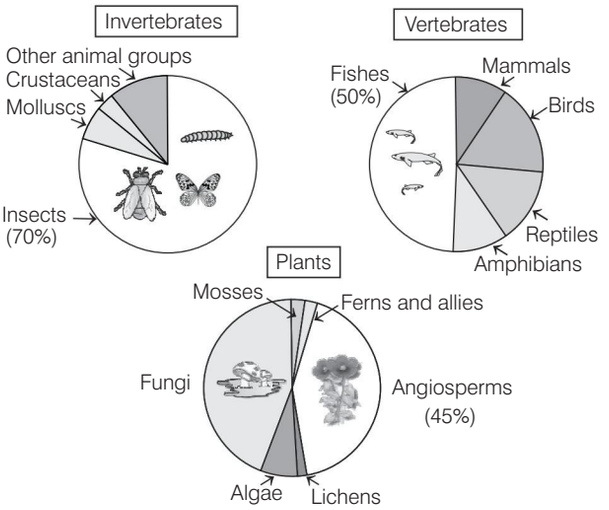
- Since life on earth evolved around 3.8 billion years ago, there have been diversification of all kinds of organisms in their effort to survive. Eventhough, there must be more than 7 million types of species, only 1.5 million have been recorded.

Biodiversity

- Biodiversity is the term popularised by **Edward Wilson** to describe the sum total of the diversity of biological organisation at all the levels. The three most important levels of biodiversity are, genetic diversity, species diversity and ecological diversity.
- **Genetic diversity** shows high diversity at gene (and chromosomal) level.
  - The genetic variation (in terms of allelic forms of the same gene) expressed by the medicinal plant *Rauwolfia vomitoria* growing in different Himalayan ranges is in terms of the potency and concentration of the active chemical (reserpine) that the plant produces.
  - India has more than 50000 genetically different strains of rice and 1000 varieties of mango.
- **Species diversity** is the measure of the varieties of species and their abundant presence within a region, e.g. Western Ghats have more amphibians than Eastern Ghats. **Species richness** and **species evenness** are the two important measures of species diversity.
- **Ecological diversity** refers to the diversity at ecosystem level. It makes communities more productive and stable, e.g. India has a greater ecosystem diversity (in terms of variety of habitats in deserts, rainforests, mangroves, coral reefs, wetlands, estuaries and alpine meadows) than a Scandinavian country like Norway.

How Many Species are There on Earth and How Many in India?

- According to the **IUCN** 2004, more than 1.5 million species have been recorded in the world, but we have no idea of how many species are yet to be discovered and described. A sound estimate of global species diversity of about 7 million was given by **Robert May**.
- More than 70% of all the species recorded are animals, while plants comprise no more than 22%. Out of total animals recorded, 70% are insects (i.e. out of every 10 animals on this planet, 7 are insects).



Representing global biodiversity : proportionate number of species of major taxa of plants, invertebrates and vertebrates

- The number of fungi species is more than all the vertebrate species of fishes, amphibians, reptiles and mammals combined in the world and it is interesting to know that the diversity of microbial species alone might run into millions.
- **Indian biodiversity** India is one of the 12 megadiverse countries of the world. Though India has only 2.4% of the world's land are but it shares an impressive 8.1% of the world's species diversity.
- There are about 45,000 species of plants and twice as many of animals have been recorded in India.
- India probably has more than 1,00,000 species of plants and 3,00,000 species of animals yet to be discovered and described. If we apply Robert May's global estimate then only 22% of species of the world have been recorded.

Patterns of Bioidiversity

- The diversity of plants and animals, throughout the world, is not evenly distributed and shows some interesting patterns of distribution.
- The patterns of biodiversity are, latitudinal gradients and species-area relationships.

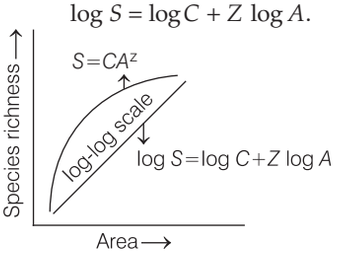
1. Latitudinal Gradients

- It means that species diversity decreases as we move away from the equator and towards the poles (low to high latitude).
- Generally, tropics (latitudinal range of 23.5°N to 23.5°S) have more species than temperate or polar areas, e.g. Colombia near the equator has nearly 1, 400 species of birds. India has more than 1,200 speices, while New York at 91°N has 105 species and Greenland at 71°C has 56 species.
- The largely tropical Amazonian rainforest in South America has the greatest biodiversity on the earth using more than 40,000 species of plants, 3,000 of fishes, 1,300 of birds, 427 of mammals, 427 of amphibians, 378 of reptiles and of more than 1,25,000 invertebrates.
- Some hypothesis proposed by scientists to explain the rich biodiversity in tropical regions are
  - The temperate regions were subjected to frequent glaciations in the past, whereas tropical latitudes have remained relatively undisturbed for millions of years.
  - Tropical environments are less seasonal, relatively more constant and predictable. This promotes niche specialisation and leads to a greater species diversity.
  - Availability of more solar energy in the tropics, contributes to higher productivity, this in turn might contribute indirectly to greater diversity.

2. Species-Area Relationships

- German naturalist and geographer **Alexander von Humboldt** observed that within a region, species richness increased with the increasing available area, but only up to a limit.
- The relation between species richness and area, for a wide variety of taxa (angiosperm plants, birds, bats, freshwater fishes) turns out to be a rectangular hyperbola.
- On a logarithmic scale, the relationship is a straight line described by the equation;

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



Where, S = Species richness, A = Area, Z = Slope of the line (regression coefficient) and C = y-Intercept.

- Ecologists have discovered that the value of Z lies in the range of 0.1 to 0.2, when analysis is done in small areas regardless of the taxonomic group or area. But the species-area relationships among very large areas (continents), will give a much steeper slope and Z values in the range of 0.6 to 1.2, e.g. for frugivorous birds and mammals in the tropical forests, the slope is found to be 1.15. Thus, it can be said that the larger the area, the steeper is the slope.

Importance of Species Diversity to the Ecosystem

- **Stability** Communities with more species diversity, generally, tend to be more stable than those with less species. This is because such communities are more resistant or resilient to occasional distrubances (natural or man-made) and invasions by alien species.
- These communities do not show much variation in productivity from year to year.
- **David Tilman** discovered that increased diversity contributed to higher productivity and also proved that species richness is the key to the well-being of any ecosystem. It is also essential for the survival of man on this planet earth.
- **Ecosystem health** Ecologist **Paul Ehrlich** gave an analogy, **Rivet Popper hypothesis**, to help understand the effect of loss of species biodiversity. He compared each species with a rivet in the body of an airplane.
  - This hypothesis explain that ecosystem is an airplane and the species are the rivets joining all the parts together.
  - If every passenger travelling in the airplane starts taking rivets home (causing a species to become extinct), initially it may not affect flight safety but as more and more rivets are removed, over a period of time the plane becomes weak and poses threat to flight safety. However, if rivets on wings (keystone) species are removed, it would pose a more serious threat to flight safety.

Loss of Biodiversity

- **International Union for Conservation of Nature** (IUCN) documents **Red List** (2004), which lists **extinct** and **endangered** species of the earth in the Red Data Book.
- Red list has the following categories of species,
  - **Extinct** (no living member; extinct in the wild known to survive only in cultivation)
  - **Critically endangered** (extremely high risk)
  - **Endangered** (very high risk of extinction)
  - **Vulnerable** (high risk of extinction in medium term future)
  - **Threatened** (liable to become extinct in the absence of protective measures)
  - **Low Risk**, **Data deficient** and **not evaluated**.
- It documents the extinction of 784 species (including 338 vertebrates, 359 invertebrates and 87 plants) in the last 500 years.
- Some examples of recent extinctions include Dodo (Mauritius), Quagga (Africa), Thylacine (Australia), Steller's Sea Cow (Russia) and three subspecies of tiger (Bali, Javan, Caspian). The last 20 years alone have witnessed the disappearance of 27 species.
- Presently, 12.1% of all birds species, 23% of all mammal species, 32% of all amphibian species and 31% of all gymnosperms (more than 15,500 species world-wide) are facing the threat of extinction.
- There have been five episodes of natural mass extinction (due to natural calamities) of species since the origin of life on the earth. The anthropogenic (man made) cause of mass extinction, i.e. sixth extinction is far more serious than the natural one. Ecologists warn that if present trends continue, nearly half of the species on earth might be wiped out within the next 100 years.
- The loss of biodiversity in a region may lead to
  - Decline in plant production.
  - Lowered resistance to environmental perturbations like drought, etc.
  - Negative impact on ecosystem processes such as plant productivity, water use pest and disease cycles.

Causes of Biodiversity Loss

Habitat loss and fragmentation, overexploitation, alien species invasion, coextinction are the four (Evil Quartet) major causes of loss of biodiversity.

- **Habitat loss and fragmentation** occurs due to population explosion, that has destroyed forest land, which leads to the loss of habitat of several species, e.g. once covering more than 14 % of the earth's land surface, the Amazonian rainforests ('lungs of the planet') now cover less than 6 % as they are being cut and cleared for cultivation of soybeans or conversion into grasslands for raising beef cattle. This has caused loss of habitat for lots of species and has put tremendous pressure on the ecosystem.
- **Overexploitation** Uncontrolled or overuse of resources by humans leads to overexploitation of natural resources. Many species extinctions in the last 500 years such as that of Steller's sea cow, passenger pigeon, etc., were due to the overexploitation by humans.
  Currently, many marine fish populations are being over harvested, endangering the continued existence of some commercially important species.
- **Alien species invasions** When alien species are introduced unintentionally or deliberately in a habitat, some of them turn invasive and can cause decline or extinction of indigenous species, e.g. the Nile perch introduced into lake Victoria (East Africa) cause extinction of cichlid fishes, invasive weed species like carrot grass (*Parthenium*), *Lantana* and water hyacinth (*Eichhornia*) also can cause environment damage threaten the existence of native species. African catfish called, *Clarias gariepinus* is posing a threat to the indigenous catfishes in our rivers.
- **Coextinctions** When a species becomes extinct, the plant and animal species associated with it, in an obligatory way, also become extinct, e.g. when a host fish species becomes extinct, its parasites also vanish.

Biodiversity Conservation

- Biodiversity needs to be conserved and maintained because humans derive lots of benefits from nature and are dependent on it for survival.
- They directly or indirectly derive economic benefits from nature like food products, firewood, fibre, construction material, industrial products and products of medicinal importance (about 2,500 plants used in traditional medicines).
- They also explore molecular, genetic and species level diversity (bioprospecting) for products of economic importance. These are called **narrowly utilitarian aspects of conserving biodiversity**.
- Ecosystem services (atmosphere's O_2, pollination, water cycles, aesthetic pleasures) are **broadly utilitarian aspects of biodiversity conservation**.
- The Amazon forest is estimated to produce, through photosynthesis, 20% of the total oxygen in the earth's atmosphere.
- The **ethical aspect of conserving biodiversity** relates to our moral obligation to conserve the planet that we share with millions of plants, animals and microbial species.
  - We need to realise that every species has an intrinsic value, even if it may not be of current or any economic value to us.
  - We have a moral duty to care for their well-being and pass on our biological legacy in good order to future generations.

How do We Conserve Biodiversity?

- Conservation of biodiversity means offering protection, implementing judicious and minimal use and rebuilding the damaged units. There are two basic approaches in the conservation of biodiveristy, i.e. *in situ* conservation and *ex situ* conservation.

In Situ (on-site) Conservation

- It involves protection of threatened or endangered species of animals or plants in their natural habitat.
- For maximum protection, certain regions like **hotspots**, have been identified. These are the regions of high levels of species richness and high degree of **endemism**, i.e. contain species are confined only to particular region and not found anywhere else.
- There are 34 hotspots in the world. Three of these hotspots are in India and are Western Ghats and Sri Lanka Indo-Burma and Eastern Himalaya cover our country's exceptionally high biodiversity regions.
- ***In situ*** method includes **biosphere reserves**, **national parks** and **sanctuaries**. India has 14 biosphere reserves, 90 national parks, 448 wildlife sanctuaries and many **sacred groves** (forest patches of religious importance).
- Sacred groves are found in Khasi and Jaintia Hills in Meghalaya, Aravalli Hills of Rajasthan, Western Ghat regions of Karnataka, Maharashtra. The Sarguja, Chanda and Bastar areas of Madhya Pradesh.

Ex Situ (off-site) Conservation

- It is the approach in which threatened animals and plants are taken out from their natural habitat and placed in special settings, where they can be protected and given special care. Zoological parks, botanical gardens and wildlife safari parks are used for *ex situ* conservation.
- Scientific technology has enabled advancement of *ex situ* conservation in following ways
  - **Cryopreservation** of gametes of threatened species involves preserving them in viable and fertile conditions for long periods at very low temperatures (–196°C in liquid nitrogen).
  - **In *vitro* fertilisation** to propagate endangered species. Offspring can be produced by using preserved sperm to fertilise the eggs in *in vitro* and then implanting in female animals.
  - **Tissue culture** can be used to propagate endangered plants species.
  - In **seed banks**, seeds of different genetic strains of commercially important plants can be kept for long periods, under specific conditions.
- The historic **Convention on Biological Diversity** (**The Earth Summit**) held in Rio de Janeiro in 1992, called **upon all the nations** to take appropriate measures for conservation of biodiversity and sustainable utilisation of its benefits.
- The **World Summit on Sustainable Development** held in 2002 in Johannesburg, Sourth Africa, saw 190 countries pledge their commitment to achieve by 2010, a significant reduction in the current rate of biodiversity loss at global, regional and local levels.

Mastering NCERT

MULTIPLE CHOICE QUESTIONS

TOPIC 1 ~ *Biodiversity : Levels and Patterns*

1 Three levels of biodiversity are
(a) genetic diversity, species diversity and ecological diversity
(b) species diversity, ecological diversity and habitat diversity
(c) geographical diversity, genetic diversity and habitat diversity
(d) ecological diversity, species diversity and community diversity

2 Genetic diversity is the measure of
(a) varieties of the species and their relative abundance present within a region
(b) variation in the genetic information contained in the organisms
(c) diversity of the genes at community and ecosystem levels
(d) All of the above

3 The medicinal plant, *Rauwolfia vomitoria*, growing in Himalayan ranges shows variation in terms of the potency and concentration of the chemical (reserpine), that it produces. It is an example of
(a) species diversity
(b) ecological diversity
(c) genetic diversity
(d) None of the above

4 The Western Ghats have a greater amphibians diversity than the Eastern Ghats. It is an example of
(a) species diversity
(b) genetic diversity
(c) ecological diversity
(d) None of the above

5 Ecological diversity exists at community level and is of three types. Select the correctly matched option for ecological diversity.

(a) Alpha diversity – Diversity between communities
(b) Beta diversity – Diversity of organisms within same community
(c) Gamma diversity – Diversity of organisms over the entire geographical area
(d) None of the above

6 As estimated by Robert May, what is the total number of species present on earth?

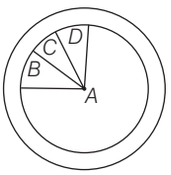
(a) 3 million (b) 5 million (c) 7 million (d) 9 million

7 Which one of the following has the highest number of species in nature?

(a) Angiosperms (b) Fungi
(c) Insects (d) Birds

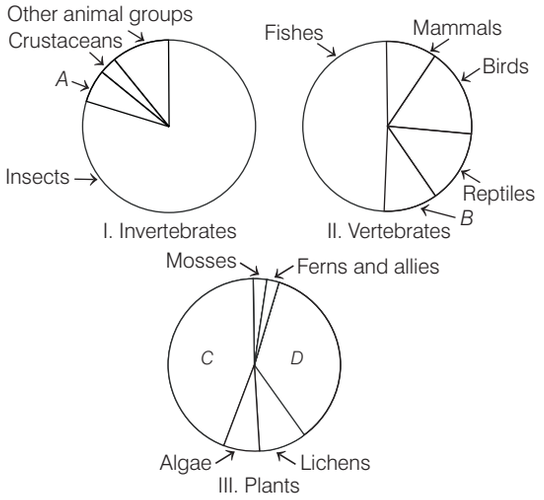
8 Given below is the representation of the extent of global diversity of invertebrates. What groups the four portions (*A*-*D*) represent, respectively?

CBSE-AIPMT 2014



	A	B	C	D
(a)	Insects	Crustaceans	Other animal groups	Molluscs
(b)	Crustaceans	Insects	Molluscs	Other animal groups
(c)	Molluscs	Other animal groups	Crustaceans	Insects
(d)	Insects	Molluscs	Crustaceans	Other animal groups

9 Given below are pie diagrams I, II and III related to the proportionate number of species of major taxa of invertebrates, vertebrates and plants, respectively. Critically study and fill in the blanks *A, B, C* and *D*.



(a) A–Molluscs, B–Amphibians, C–Angiosperms, D–Gymnosperms
(b) A–Molluscs, B–Amphibians, C–Fungi, D–Angiosperms
(c) A–Turtles, B– Amphibians, C–Fungi, D–Angiosperms
(d) A–Hexapoda, B–Amphibians, C–Fungi, D–Angiosperms

10 Which of the following represents maximum number of species among global biodiversity? ***NEET 2013***

(a) Algae (b) Lichens
(c) Fungi (d) Mosses and ferns

11 India is one of the 'twelve' megadiversity countries with …… of genetic resources of the world.

(a) 12.1% (b) 18.1%
(c) 38.1% (d) 8.1%

12 Biodiversity is affected by

(a) latitudinal gradients and species-area relationship
(b) species-area relationship and longitudinal gradients
(c) Both (a) and (b)
(d) latitudinal and longitudinal gradients

13 From equator towards the poles biodiversity

(a) decreases (b) increases
(c) remains same (d) first decreases then increases

14

I. Higher latitude (Poles) —Biodiversity increases→ Lower latitude (Equator)

II. Higher latitude (Poles) —Biodiversity decreases→ Lower latitude (Equator)

III. Higher altitude (Mountain top) —Biodiversity increases→ Lower altitude (Sea level)

IV. Higher altitude (Mountain top) —Biodiversity decreases→ Lower altitude (Sea level)

Which of the matches above is/are correct?

(a) I and III (b) I and II
(c) II and III (d) III and IV

15 Tropics (23.5°N to 23.5°S) have ..... species as compared to temperate or polar regions. The most appropriate word to fill the blank is

(a) less (b) equal
(c) more (d) None of these

16 Arrange the following places in increasing order of biodiversities of species of birds and select the right option.

(a) Colombia →New York → Greenland → India
(b) Greenland→ New York → India → Colombia
(c) New York → India → Colombia → Greenland
(d) India → Colombia → Greenland → New York

17 How many times the tropical areas have vascular plants than the temperate areas have?

(a) 10 (b) 50
(c) 3 (d) 65

18 The country, whose tropical rainforests possess the greatest biodiversity on earth is
(a) New York
(b) South America
(c) India
(d) England

19 Given below are three statements (I-III) each with one or two blanks. Select the option, which correctly fill up to blanks.

Ecologists and evolutionary biologists have proposed various hypotheses; some important ones are

I. Speciation is generally a function of time, unlike ...*A*... regions subjected to frequent glaciations in the past. ...*B*... have remained relatively undisturbed for millions of years and thus, had a long evolutionary time for species diversification.

II. ...*C*... environments, unlike temperate ones, are less seasonal, relatively more constant and predictable. Such constant environments promote niche specialisation and lead to a greater species diversity.

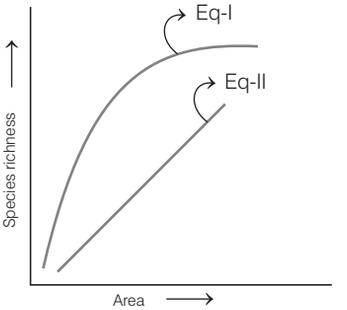
III. There is more solar energy available in the ...*D*..., which contributes to higher productivity; this in turn might contribute indirectly to greater diversity.

Choose the correct option for *A, B, C* and *D*.
(a) A–tropics, B–Tropical latitudes, C–Temperate, D–Arctic tundra
(b) A–temperate, B–Tropical latitudes, C–Tropics, D–chapparral
(c) A–tropical, B–Tropical latitudes, C–Tropics, D–chapparral
(d) A–temperate, B–Tropical latitudes, C–Tropical, D–tropics

20 Alexander von Humboldt described for the first time
(a) ecological biodiveristy ***NEET 2017***
(b) law of limiting factor
(c) species-area relationships
(d) population growth equation

21 Alexander von Humboldt observed that, within a region species richness…… with increasing explored area. The most appropriate word to fill the blank is
(a) increased
(b) decreased
(c) increased up to a limit
(d) decreased up to a limit

22 The great German naturalist and geographer Alexander von Humboldt observed that within a region species richness increased with increasing explored area, but only up to a limit. In fact, relation between species richness and area for a wide variety of taxa (angiosperm plants, birds, bats, freshwater fishes) turns out to be rectangular hyperbola. Now find out correct equations shown in the graph.



Species-area relationship

(a) I - $S = CA^Z$; II- $\log S = \log C + Z \log A$
(b) I - $\log S = \log C + Z \log A$; II - S- CA^Z
(c) I-$S = CA^Z + \log C$; II- $\log S = \log C + Z \log A$
(d) I - $S = CA^Z + \log A$; II - $\log S = \log C + Z \log A$

23 The relationship between the species richness and the area for a wide variety of taxa appears as
(a) straight line (b) sigmoid curve
(c) rectangular hyperbola (d) None of these

24 On a logarithmic scale, the species-area relationship is a straight line described by the equation
(a) $\log S = \frac{\log C}{\log A}$ (b) $Z \log A = \frac{\log C}{\log S}$
(c) $\log S = \log C + Z \log A$ (d) $\log S = \log C - Z \log A$

25 In the species-area relationship, 'S' represents
(a) species richness (b) slope of the line
(c) specific area (d) special species

26 In the species-area relationship, 'Z' represents
(a) regression coefficient
(b) enzymatic coefficient
(c) multiplication coefficient
(d) None of the above

27 The value of 'Z' lies in the range of ..... regardless of the taxonomic group or the region. The most appropriate value to fill the blank is
(a) 0.5 to 0.7 (b) 0.3 to 0.7
(c) 0.2 to 0.3 (d) 0.1 to 0.2

28 For frugivorous birds and mammals in the tropical forests of different continents, Z(slope of the line/regression coefficient) is found to be
(a) 1.15 (b) 0.1
(c) 0.5 (d) 0

29 If $\log A = 4$, $Z = 0.3$ and $\log C = 0.8$, find the value of $\log$ 'S'?
(a) 3.76 (b) 100
(c) 4.24 (d) 2

TOPIC 2 ~ *Importance and Loss of Biodiversity*

30 Communities with more species tend to be more stable than those with less species. This was confirmed by
(a) Alexander von Humboldt
(b) David Tilman
(c) Paul Ehrlich
(d) Edward Wilson

31 Which of the following hypothesis suggests that ecosystems are like aeroplanes where flight safety (ecosystem functioning) may or may not be compromised, depending upon which species are being lost?
(a) Gaia hypothesis
(b) Gause-exclusion hypothesis
(c) Qudum's hypothesis
(d) Rivet popper hypothesis

32 The organisation, which publishes the Red List of species is ***CBSE-AIPMT 2014***
(a) ICFRE (b) IUCN (c) UNEP (d) WWF

33 *Antilope cervicapra* (blackbuck) is categorised by IUCN as
(a) critically endangered (b) endangered
(c) vulnerable (d) extinct in the wild

34 A species facing extremely high risk of extinction in the immediate future is called ***CBSE-AIPMT 2014***
(a) vulnerable (b) endemic
(c) critically endangered (d) extinct

35 In natural extinction of species
(a) gradual replacement of existing species takes place
(b) human activities play an active part
(c) catastrophes, earthquakes and other natural calamities are involved
(d) None of the above

36 Anthropogenic extinction is called
(a) fifth mass extinction (b) fourth mass extinction
(c) sixth mass extinction (d) seventh mass extinction

37 The term 'The Evil Quartet' is related with
(a) Four major causes of forest loss
(b) Four major causes of population explosion
(c) Four major causes of air pollution
(d) Four major causes of biodiversity losses

38 Which of the following is responsible for biodiversity loss?
(a) Habitat loss and fragmentation
(b) Alien species invasions
(c) Coextinctions
(d) All of the above

39 Which of the following is the most important cause for animals and plants being driven to extinction?
(a) Drought and floods ***NEET 2019, 16***
(b) Economic exploitation
(c) Alien species invasion
(d) Habitat loss and fragmentation

40 Many species like Steller's sea cow and passenger pigeon have been driven to the brink of extinction. Which of the following describes this situation?
(a) Overexploitation by humans
(b) Pollution
(c) Habitat loss
(d) Competition from introduced species

41 Water hyacinth *(Eichhornia crassipes)* was introduced in Indian water to reduce pollution. It is an example of
(a) disturbance and degradation
(b) coextinctions
(c) alien species invasions
(d) overexploitation

42 Decline in the population of Indian native fishes due to introduction of *Clarias gariepinus* in river Yamuna can be categoriesd as ***NEET (Odisha) 2019***
(a) coextinction
(b) habitat fragmentation
(c) overexploitation
(d) alien species invasion

43 If any extinction of a mutualistic pollinator takes place, what would be its effect on the plants where it pollinates?
(a) Decreased pollination
(b) No effect because substitute pollinator is available
(c) The plant would not be pollinated
(d) None of the above

TOPIC 3 ~ *Conservation of Biodiversity*

44 The reasons behind conserving biodiversity can be grouped into categories, which include

I. broadly utilitarian
II. narrowly utilitarian
III. no utilitarian
IV. ethical utilitarian

Choose the correct option.

(a) I, II, III and IV (b) II, III and IV
(c) I, II and IV (d) I, III and IV

45 More than 25% of the drugs are derive from the plants. What benefit does this describe?

(a) Aesthetic value
(b) Ethical value
(c) Indirect economic value
(d) Direct economic value

46 Exploration of molecular, genetic and species level diversity for novel products of economic importance is known as ***NEET (Odisha) 2019***

(a) biopiracy (b) bioenergetics
(c) bioremediation (d) bioprospecting

47 What is the sustainable use of resources?

(a) Protected strips of the land that allows organisms to migrate from one wilderness area to another
(b) A law that makes it illegal to do harm to the species that are listed as endangered or threatened
(c) The ability to use natural resources in a way that helps people to protect the ecosystem
(d) The study of the methods which help to protect biodiversity

48 Conservation in the natural habitat is

(a) *in situ* (b) *ex situ*
(c) zoo (d) botanical garden

49 Western Ghats have a large number of plant and animal species that are not found anywhere else. Which of the following terms will you use to notify such species? ***NEET (Odisha) 2019***

(a) Endemic (b) Vulnerable
(c) Threatened (d) Keystone

50 How many hotspots of biodiversity in the world have been identified till date by Norman Myers? ***NEET 2016***

(a) 17 (b) 25
(c) 34 (d) 43

51 Which one of the following areas in India, is a hotspot of biodiversity? ***CBSE-AIPMT 2012***

(a) Eastern Ghats (b) Gangetic plain
(c) Sunderbans (d) Western Ghats

52 Conservation of hotspots are best described as

(a) conserving islands that are experiencing high rates of extinction
(b) conserving areas where native species are being replaced with introduced species
(c) conserving areas where the people are active supporters of the biological diversity
(d) conserving areas with the large members of endemic species that are disappearing rapidly

53 What is the approximate percentage of the earth covered by terrestrial hotspots?

(a) 1.5% (less than 2%) (b) 2.5%
(c) 3.5% (d) 4.5%

54 *In situ* strategies include

I. national parks II. wildlife sanctuaries
III. biosphere reserves IV. sacred groves

Choose the correct option.

(a) I and II (b) II, III and IV
(c) I, II and III (d) I, II, III and IV

55 The numbers of national parks, biosphere and wildlife sanctuaries of India, respectively are

(a) 90, 14, 448 (b) 158, 62, 10
(c) 58, 412, 10 (d) 96, 412, 10

56 Which one of the following is not a method of *in situ* conservation of biodiversity?

(a) Wildlife sanctuary
(b) Botanical garden
(c) Sacred grove
(d) Biosphere reserve

57 Which of the following national parks is home to the famous musk deer or hangul? ***NEET 2016***

(a) Keibul Lamjao National Park, Manipur
(b) Bandhavgarh National Park, Madhya Pradesh
(c) Eaglenest Wildlife Sanctuary, Arunachal Pradesh
(d) Dachigam National Park, Jammu and Kashmir

58 Biosphere reserves differ from the national parks and wildlife sanctuaries because in the former

(a) human beings are not allowed to enter
(b) people are an integral part of the ecosystem
(c) plants are paid greater attention than the animals
(d) living organisms are brought from all over the world and preserved for posterity

59 In your opinion, which is the most effective way to conserve genetic diversity of the plant of an area?

(a) By tissue culture method
(b) By creating biosphere reserve
(c) By creating botanical garden
(d) By developing seed bank

60 Core zone, buffer zone and manipulation zone are found in
(a) national park (b) sanctuary
(c) tiger reserve (d) biosphere reserve

61 The region of biosphere reserve, which is legally protected and where no human activity is allowed is known as ***NEET 2019***
(a) core zone (b) buffer zone
(c) transition zone (d) restoration zone

62 Sacred groves in India are related with
(a) aesthetic pleasure
(b) the place where threatened species are protected
(c) the place where only artificial plant breeding is allowed
(d) forest patches around the places of worship

63 Sacred groves in India are found in
(a) Jaintia hills of Karnataka
(b) Western Ghat regions of Tamil Nadu
(c) Aravalli hills of Meghalaya
(d) Bastar areas of Madhya Pradesh

64 *Ex situ* strategies include
I. zoological parks
II. seed/pollen banks
III. gene bank and tissue cultures
IV. botanical garden
Choose the correct option.
(a) II, III and IV (b) I, II and III
(c) I, II and IV (d) I, II, III and IV

65 Which one of the following is not used for *ex situ* plant conservation? ***NEET 2013***
(a) Field gene banks
(b) Seed banks
(c) Shifting cultivation
(d) Botanical gardens

66 All of the following are included in *ex situ* conservation except ***NEET 2019***
(a) botanical gardens
(b) sacred groves
(c) wildilfe safari parks
(d) seed banks

67 Which one of the following is related to *ex situ* conservation of threatened animals and plants ? ***NEET 2019***
(a) Wildflife safari parks (b) Biodiversity hotspots
(c) Amazon rainforest (d) Himalayan region

68 One of the most important function of botanical gardens is that
(a) one can observe tropical plants there
(b) they allow *ex situ* conservation of the germplasm
(c) they provide the natural habitat for wildlife
(d) they provide a beautiful area for recreation

69 Cryopreservation of gametes of threatened species in viable and fertile condition can be referred to as ***CBSE-AIPMT 2015***
(a) *in situ* conservation of biodiversity
(b) advanced *ex situ* conservation of biodiversity
(c) *in situ* conservation by sacred groves
(d) *in situ* cryopreservation of biodiversity

70 In which one of the following, both pairs have correct combination? ***CBSE-AIPMT 2015***
(a) *In situ* conservation/National park
Ex situ conservation/Botanical garden
(b) *In situ* conservation/Cryopreservation
Ex situ conservation/Wildlife sanctuary
(c) *In situ* conservation/Seed bank
Ex situ conservation/National park
(d) *In situ* conservation/Tissue culture
Ex situ conservation/Sacred groves

71 The Earth Summit held in Rio de Janeiro in 1992 was called ***NEET 2019***
(a) for conservation of biodiversity and sustainable utilisation of its benefits
(b) to assess threat posed to native species by invasive weed species
(c) for immediate steps to discontinue the use of CFCs that were damaging the ozone layer
(d) to reduce CO_2 emissions and global warming

72 Where was the World Summit on Sustainable development held ?
(a) South Africa (b) USA
(c) South Korea (d) UK

NEET

SPECIAL TYPES QUESTIONS

I. Assertion and Reason

■ **Direction** (Q. No. 73-81) *In each of the following questions, a statement of Assertion (A) is given followed by corresponding statement of Reason (R). Of the statements, mark the correct answer as*

(a) If both A and R are true and R is the correct explanation of A

(b) If both A and R are true, but R is not the correct explanation of A

(c) If A is true, but R is false

(d) If A is false, but R is true

73 **Assertion** (A) Community with more species tends to be more stable than those with less species.

Reason (R) More the number of species, less will be year to year variation in total biomass.

74 **Assertion** (A) Species with low genetic variability are usually at a great risk of extinction.

Reason (R) Low genetic variability increases vulnerability to diseases, environmental changes and predators.

75 **Assertion** (A) Tropical latitudes have greater biological diversity than temperate latitudes.

Reason (R) Tropical regions remain relatively undisturbed for millions of years.

76 **Assertion** (A) The great Indian bustard is a critically endangered bird found in India.

Reason (R) It is vulnerable to extinction in the future.

77 **Assertion** (A) The presently occurring species extinction is different from the earlier mass extinction.

Reason (R) Present species extinction is due to natural causes, whereas the earlier extinction was due to the man-made causes.

78 **Assertion** (A) In case, a species becomes extinct, the plant and animal species associated within an obligatory way also become extinct.

Reason (R) When a host fish species becomes extinct, its unique assemblage of parasites also become extinct.

79 **Assertion** (A) If the species-area relationships are analysed among very large areas like the entire continents, the value of Z, i.e. slope of line lies in the range of 0.1 to 0.2.

Reason (R) Larger is the explored area more is the steepness of slope of line.

80 **Assertion** (A) Keystone species are not relevant to biodiversity conservation.

Reason (R) Keystone species have a significant impact on community structure and characteristics.

81 **Assertion** (A) IUCN prepares and maintains a Red Data Book since 1963.

Reason (R) It is catalogue which provides an awareness about the degree of threat to the biodiversity.

II. Statement Based Questions

82 Select the correct statement about biodiversity.

CBSE-AIPMT 2012

(a) The desert areas of Rajasthan and Gujarat 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) Conservation of biodiversity is just a fad pursued by the developed countries

83 Which of the following statements is false?

(a) Species diversity provides stability to the ecosystem

(b) Communities with more species tend to be more stable than those with less species

(c) Ecosystems with higher biodiversity are more productive than the ecosystems with lower biodiversity

(d) Biodiversity is not essential for the maintenance and health of ecosystems

84 Which of the following statement is the incorrect explanations about higher diversity in tropical areas in comparison to the temperate areas?

(a) There are less seasonal variations in tropics

(b) Less solar energy is available in tropics

(c) Rate of extinction is low in tropics

(d) Resource availability is higher in tropics

85 Which of the following statements shows an example of alien species invading a new ecosystem resulting in biodiversity losses?

(a) Introduction of Nile perch into lake Victoria in East Africa

(b) Introduction of water hyacinth into India

(c) Introduction of African catfish into Indian rivers

(d) All of the above

86 Which of the following statements is true ?

(a) The IUCN Red list (2004) documents the extinction of 784 species (including 338 vertebrates, 359 invertebrates and 87 plants) in last 500 years

(b) There are more than 20,000 species of ants, 3,00,000 species of beetles, 28, 000 species of fishes and nearly 20,000 species of orchids

(c) More than 70% of all the species recorded are animals, while plants comprise no more than 22% of the total

(d) All of the above

87 Select the statement that is in support of ethical arguments for biodiversity conservation.

(a) Every species has an intrinsic value even though economically it is not valuable

(b) Several benefits are derived from biodiversity such as food, furniture, medicines, etc.

(c) Pollination, photosynthesis, carbon cycle, etc., are the ecological processes which maintains the balance of nature

(d) All of the above

88 Identify the incorrect statement.

(a) In wildlife sanctuaries protection is only given to animal life

(b) National parks protects both the flora and fauna

(c) MAB programme of UNESCO protects the sacred groves as a site of biodiversity conservation

(d) Ramsar sites are integral part of watersheds are very rich in biodiversity and a component of *in situ* conservation

89 Which of the following statements are correct?

I. Alpha diversity represents number of species in a given habitat.

II. Genetic diversity are the variation of the genes within species.

III. Beta diversity is the diversity of the habitat in the whole region.

IV. Species diversity is the product of the species richness and evenness.

Choose the correct option.

(a) I, II and III (b) I and II

(c) I, II, III and IV (d) I, II and IV

90 Which of the following statements are correct about Amazon rainforest?

I. It is called lungs of the planet.

II. It harbours probably millions of the species.

III. It is the largest tropical rainforest in South America and has greatest biodiversity on earth.

IV. They are being cut and cleared for cultivating soybeans or for the conversion to grasslands for raising beef cattle.

Choose the correct option.

(a) II, III and IV (b) I, II and III

(c) I and II (d) I, II, III and IV

91 The impacts of loss of biodiversity may lead to

I. lowered resistance to environmental perturbation.

II. decrease in plant production.

III. increased variability in ecosystem processes like water use, pest/disease cycle, plants productivity.

IV. increase in plant production.

Select the option containing correct statements.

(a) I and II

(b) I and IV

(c) I and III

(d) I, II and III

92 Which of the following statements are correct about narrowly utilitarian arguments for conserving biodiversity?

I. Ecosystem services like photosynthesis.

II. Industrial products like dyes and lubricants.

III. Watching spring flowers in full bloom.

IV. The aesthetic pleasure of walking through thick woods.

V. Fibre, firewood and construction material.

VI. Products of medicinal importance.

Choose the correct option.

(a) I, II and III

(b) II, V and VI

(c) IV, V and VI

(d) I, III and VI

93 Select the correct statement (s).

I. India has more than 50,000 genetically different strains of rice.

II. India has 1000 varieties of mango.

III. At ecosystem level, India, with its deserts, rainforests mangroves, etc., has a greater diversity than a Scandinavian country like Norway.

IV. The tropical rainforest initially covered 14% of the land surface of earth, but now they cover only 6% of the land area.

(a) I and II

(b) I, II and III

(c) II, III and IV

(d) I, II, III and IV

94 Wildlife conservation aims at

I. maintaining the ecological process.

II. to enrich the wildlife diversity with exotic species.

III. preventing migration of the species.

IV. maintaining the diversity of life.

Select the option containing correct statements.

(a) I and II

(b) II and III

(c) III and IV

(d) I and IV

95 Read the following statements.

I. Species diversity increases as we move away from the equator towards the poles.

II. Stellar's sea cow and passenger pigeon got extinct due to overexploitation by man.

III. *Lantana* and *Eichhornia* are invasive weed in India.

IV. The historic convention on biological diversity was held in 1992.

Choose the option containing correct statements.

AIIMS 2018

(a) I and II (b) I, II and IV
(c) I, III and IV (d) II, III and IV

III. Matching Type Questions

96 Match the following columns.

	Column I		Column II
A.	Species diversity	1.	influences biotic interactions and stability of the community.
B.	Genetic diversity	2.	is the variety of forms in the ecosystem.
C.	Ecological diversity	3.	influences adaptability and distribution of a species in diverse habitats.
D.	Biodiversity	4.	is the occurrence of different types in different ecosystems, species of organism with the whole range of their variants and genes.

Codes

	A	B	C	D
(a)	1	3	2	4
(b)	2	1	4	3
(c)	4	2	3	1
(d)	3	4	2	1

97 Match the following columns.

	Column I		Column II
A.	Rivet popper hypothesis	1.	Paul Ehrlich
B.	Communities with more species	2.	Edward Wilson
C.	Communities with less species	3.	Less stable
D.	Term biodiversity	4.	More stable

Codes

	A	B	C	D
(a)	2	4	3	1
(b)	1	4	3	2
(c)	1	3	4	2
(d)	1	4	2	3

98 Match the following columns.

	Column I (Organisms)		Column II (Estimations)
A.	Plants	1.	1,25,000
B.	Fish	2.	427
C.	Birds	3.	1,300
D.	Mammals	4.	378
E.	Reptiles	5.	40,000
F.	Invertebrates	6.	3,000

Codes

	A	B	C	D	E	F
(a)	5	6	3	2	4	1
(b)	6	3	4	1	2	5
(c)	3	4	2	1	6	5
(d)	6	5	4	2	1	3

99 Match the following columns.

	Column I		Column II
A.	Dodo	1.	*Rauwolfia*
B.	Reserpine	2.	Mauritius
C.	Nile Perch in lake Victoria	3.	Habitat destruction
D.	Main cause for biodiversity loss	4.	Alien species

Codes

	A	B	C	D
(a)	4	2	1	3
(b)	2	1	4	3
(c)	2	4	3	1
(d)	3	2	1	4

100 Match the following columns.

	Column I		Column II
A.	Hotspots	1.	Areas maintained by government for the betterment of wildlife.
B.	Protected areas	2.	Areas of high endemism and high level of species richness.
C.	National parks	3.	Biogeographical areas where biological diversity along with natural and cultural resources is protected, maintained and managed.
D.	Biosphere reserves	4.	Multipurpose protected areas, which are meant for preserving genetic diversity in the ecosystem of various natural biomass and unique biological communities.

Codes

	A	B	C	D		A	B	C	D
(a)	1	2	3	4	(b)	3	1	2	4
(c)	2	3	1	4	(d)	4	2	3	1

101 Match the following columns.

	Column I		Column II
A.	Rhinoceros	1.	Bharatpur
B.	Tiger project in Karnataka	2.	Tropical evergreen forest
C.	Assemblage protection	3.	Kaziranga
D.	Silent valley	4.	National park
		5.	Bandipur

Codes

	A	B	C	D
(a)	5	3	1	4
(b)	2	4	3	1
(c)	4	3	1	2
(d)	3	5	1	2

102 Match the Column I (terms of IUCN's Red list) and Column II (description).

	Column I		Column II
A.	Threatened species	1.	Thinly scaltered or localised population with less number of individuals, highly sensitive to pests/pathogens/alien invasion.
B.	Endangered	2.	Species facing very high risk of extinction in the wild
C.	Extinct	3.	Moving towards extinction if not allowed to realise their biotic potential and protection against human exploitation, alien species, scarcity of food, etc.
D.	Rare	4.	No living individual exists.

Codes

	A	B	C	D		A	B	C	D
(a)	3	2	4	1	(b)	1	2	3	4
(c)	4	3	2	1	(d)	2	1	4	3

NCERT & NCERT Exemplar

MULTIPLE CHOICE QUESTIONS

NCERT

103 The important levels of biodiversity are
(a) genetic biodiversity (b) species biodiversity
(c) ecological biodiversity (d) All of these

104 Which among the following hypothesis explains richness of tropical forests in terms of species biodiversity?
(a) David Tilman's hypothesis
(b) Species-area relationship by Alexander von Humboldt
(c) Rivet popper hypothesis
(d) None of the above

NCERT Exemplar

105 Which of the following countries has the highest biodiversity?
(a) South America (b) South Africa
(c) Russia (d) India

106 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) Overexploitation of natural resources

107 Which of the following is not an invasive alien species in the Indian context?
(a) *Lantana* (b) *Cynodon*
(c) *Parthenium* (d) *Eichhornia*

108 Where among the following will you find pitcher plant?
(a) Rainforest of North-East India
(b) Sunderbans
(c) Thar desert
(d) Western Ghats

109 Which one of the following is not a major characteristic feature of biodiversity hotspots?
(a) Large number of species
(b) Abundance of endemic species
(c) Mostly located in the tropics
(d) Mostly located in the polar regions

110 Match the animals given in Column I with their location in Column II.

	Column I		Column II
A.	Dodo	1.	Africa
B.	Quagga	2.	Russia
C.	Thylacine	3.	Mauritius
D.	Stellar's sea cow	4.	Australia

Codes

	A	B	C	D
(a)	1	3	2	4
(b)	4	3	1	2
(c)	3	1	2	4
(d)	3	1	4	2

111 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 overexploitation
(d) All are exclusively present in the Eastern Himalayas

112 The one-horned rhinoceros is specific to which of the following sanctuary?
(a) Bhitar Kanika (b) Bandipur
(c) Kaziranga (d) Corbett park

113 Amongst the animal groups given below, which one appears to be more vulnerable to extinction?
(a) Insects (b) Mammals
(c) Amphibians (d) Reptiles

114 Which one of the following is an endangered plant species of India?
(a) *Rauwolfia serpentina*
(b) *Santalum album* (sandal wood)
(c) *Cycas beddomei*
(d) All of the above

115 What is common to *Lantana*, *Eichhornia* and African catfish?
(a) All are endangered species of India
(b) All are key stone species
(c) All mammals are found in India
(d) All the species are neither threatened nor indigenous species of India

116 The extinction of passenger pigeon was due to
(a) increased number of predatory birds
(b) overexploitation by humans
(c) non-availability of the food
(d) bird flu virus infection

117 Which one 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

118 Among the ecosystems mentioned below, where can one find maximum biodiversity?
(a) Mangroves (b) Desert
(c) Coral reefs (d) Alpine meadows

119 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

120 The active chemical drug reserpine is obtained from
(a) *Datura* (b) *Rauwolfia*
(c) *Atropa* (d) *Papaver*

121 Which of the following groups exhibits more species diversity?
(a) Gymnosperms (b) Algae
(c) Bryophytes (d) Fungi

122 Which of the below mentioned regions exhibit less seasonal variations?
(a) Tropics (b) Temperates
(c) Alpines (d) Both (a) and (b)

123 The historic convention on 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

124 What is common to the techniques given below?
I. *In vitro* fertilisation. II. Cryopreservation.
III. Tissue culture.
(a) All are *in situ* conservation methods
(b) All are *ex situ* conservation methods
(c) All require ultra modern equipment and large space
(d) All methods are of conservation of extinct organisms

Answers

Mastering NCERT with MCQs

1 (a)	2 (b)	3 (c)	4 (a)	5 (c)	6 (c)	7 (c)	8 (d)	9 (b)	10 (c)	11 (d)	12 (a)	13 (a)	14 (a)	15 (c)
16 (b)	17 (a)	18 (b)	19 (d)	20 (c)	21 (a)	22 (a)	23 (c)	24 (c)	25 (a)	26 (a)	27 (d)	28 (a)	29 (d)	30 (b)
31 (d)	32 (b)	33 (c)	34 (c)	35 (a)	36 (c)	37 (d)	38 (d)	39 (d)	40 (a)	41 (c)	42 (d)	43 (c)	44 (c)	45 (c)
46 (d)	47 (c)	48 (a)	49 (a)	50 (c)	51 (d)	52 (d)	53 (a)	54 (d)	55 (a)	56 (b)	57 (d)	58 (b)	59 (b)	60 (d)
61 (a)	62 (d)	63 (d)	64 (d)	65 (c)	66 (b)	67 (a)	68 (b)	69 (b)	70 (a)	71 (a)	72 (a)			

NEET Special Types Questions

73 (a)	74 (a)	75 (a)	76 (c)	77 (c)	78 (a)	79 (d)	80 (d)	81 (a)	82 (c)	83 (d)	84 (b)	85 (d)	86 (d)	87 (a)
88 (c)	89 (d)	90 (d)	91 (d)	92 (b)	93 (d)	94 (d)	95 (d)	96 (d)	97 (b)	98 (a)	99 (b)	100 (c)	101 (d)	102 (a)

NCERT & NCERT Exemplar Questions

103 (d)	104 (b)	105 (a)	106 (c)	107 (b)	108 (a)	109 (d)	110 (d)	111 (c)	112 (c)	113 (c)	114 (d)	115 (d)	116 (b)	117 (c)
118 (c)	119 (c)	120 (b)	121 (d)	122 (a)	123 (b)	124 (b)								

Answers & Explanations

2 (*b*) Genetic diversity is the variation in genetic information present in the organisms. It is the diversity in number and types of genes as well as the chromosomes present in different species, their variation in the organism and their alleles in the same species. It helps in speciation through evolution of the existing species.

4 (*a*) The Western Ghats have a greater amphibian species diversity than the Eastern Ghats. Thus, it is an example of species diversity which is defined as the diversity at the species level and is indicated by the variety and richness of the species of a region.

5 (*c*) Option (c) contains the correctly matched pair for ecological diversity. Rest of the options are incorrectly matched and can be corrected as

- Alpha diversity occurs within the same community.
- Beta diversity exists between different communities.

7 (*c*) Insects have the highest number of species in nature, making up more than 70% of the total. That means out of every 10 animals on this planet, 7 are insects.

10 (*c*) From the fungi, mosses, ferns, algae and lichens, the maximum number of species among the global biodiversity is represented by fungi.

14 (*a*) Option (a) shows the correct match.

Biodiversity is not uniform throughout the world because it is affected by many factors.

It increases from poles to equator, i.e. from higher to lower latitude and *vice-versa*.

It also increases from higher altitude to lower altitude, i.e. from mountain top to sea level and *vice-versa*.

16 (*b*) Colombia, India, New York and Greenland have 1400, 1200, 105 and 56 species of birds, respectively. Thus, places with increasing order of biodiversities of species of birds would be

Greenland $\rightarrow$ New York $\rightarrow$ India $\rightarrow$ Colombia

17 (*a*) A forest in a tropical region like Ecuador has up to 10 times as many species of vascular plants as a forest of equal area in a temperate region like the midwest of the USA.

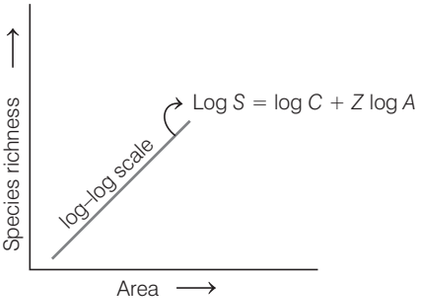
18 (*b*) The tropical Amazonian rainforests in South America possess the greatest biodiversity on earth with more than 40,000 species of plants, 3,000 of fishes, 1300 birds, 427 of mammals, 427 of amphibians, 378 of reptiles and more than 1, 25,000 invertebrates.

21 (*a*) Alexander von Humboldt was a German naturalist and geographer who described species-area relationship for the first time. He did extensive explorations in the wilderness of South American forests and observed that within a region, species richness increases with increasing explored area, but up to a certain limit.

23 (*c*) The relationship between the species richness and the area for a wide variety of taxa (angiosperm plants, birds, bats, freshwater fishes) appears as a rectangular hyperbola.

24 (*c*) On a logarithmic scale, the species-area relationship is a straight line described by the equation

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



27 (*d*) Ecologists have discovered that the value of Z lies in the range of 0.1 to 0.2, regardless of the taxonomic group or the region whether it is the plants in Britain, birds in California or molluscs in New York state, the slopes of the regression line are amazingly similar.

29 (*d*) Given, $\log A = 4$, $Z = 0.3$ and $\log C = 0.8$

Putting these values in equation, $\log S = \log C + Z \log A$, i.e. species-area relationship equation, we will get the value of $\log S$.

Thus, $\log S = 0.8 + 0.3 \times 4 = 0.8 + 1.2 = 2.0$

31 (*d*) Rivet popper hypothesis suggests that the ecosystems are like aeroplanes, where flight safety (ecosystem fuctioning) may or may not be compromised.

This hypothesis assumes the ecosystem to be an aeroplane and the species to be rivets joining all the parts together.

If every passenger starts popping a rivet to take home (resulting in species extinction), it may not affect flight safety initially (proper ecosystem functioning), but with time as more and more rivets are removed, the plane will become dangerously weak over a period of time specially if key rivets (keystone species) are removed.

32 (*b*) IUCN, i.e. the International Union for Conservation of Nature, publishes the Red List of threatened species or Red Data list and assesses the status of conservation of species.

It is an international organisation founded in October, 1948. Its headquarter is in Switzerland.

34 (*c*) According to IUCN's Red List for wild species, critically endangered are those species that are facing a very high risk of extinction in the world in near future. There are currently 2,129 animals and 1,821 plants, which have been recorded in this category.

35 (*a*) In natural extinction, the existing species are gradually replaced with better, adapted species due to the evolutionary progress, changes in environment, predators, etc.

For other options, human activities play an important part in anthropogenic extinction, while natural calamities are involved in mass extinctions.

39 (*d*) Habitat loss and fragmentation serves as the most important cause for animals and plants being driven to extinction. Due to habitat loss and fragmentation, tropical rainforests which cover 14% of the earth's land surface, rainforest has shrunk to 6% in the last few years.

On the other hand, droughts and floods, economic exploitation and alien species invasion affect only a small part of a population at a time.

40 (*a*) Many species like Steller's sea cow and passenger pigeon have been driven to the brink of extinction. This is due to overexploitation of a species by humans, which reduces the size of its population and it becomes vulnerable to extinction. Many marine fishes like whales population is also declining around the world because of overharvesting.

42 (*d*) Decline in the population of Indian native fishes due to introduction of *Clarias gariepinus* in river Yamuna can be categorised as alien species invasions. It is posing a threat to the indigenous catfishes in our rivers and is causing a loss of biodiversity.

43 (*c*) If a pollinator in mutualistic relationship becomes extinct, the pollen grains of the associated plant would not be pollinated and gradually it will also become extinct.

44 (*c*) The reasons behind conserving biodiversity are correctly indicated by option (c). These can be grouped into three categories, i.e. narrowly utilitarian, due to direct economic benefits from nature, broadly utilitarian provides many ecosystem services like pure air, pollination, etc., and ethical utilitarian argues that every living being (plant, animal or microbes) has a right to exist.

46 (*d*) Exploration of molecular, genetic and species level diversity for novel products of economic importance is known as bioprospecting.

As for the other options,

- Biopiracy refers to the illegal use of bioresources.
- Bioremediation is the use of living organisms to clean up any contamination or pollution from the environment.
- Bioenergetic deals with energy metabolism in living organisms.

47 (*c*) Sustainable use of resources is the ability to use natural resources such as forests and wildlife, water, soil, etc., in a way that helps people to protect the ecosystem. These resources are for future generations.

49 (*a*) Endemic species are those species which are confined to a particular region and are not found anywhere else, e.g. species of Western Ghats.

51 (*d*) Western Ghats is a hotspot of biodiversity in India. Hotspots are areas that are extremely rich in species diversity in its natural habitat, have high endemism and are under constant threat. In India, three hotspots are found extending into neighbouring countries. The Western Ghats/Sri Lanka, the Indo-Burma region and the Himalayas.

52 (*d*) Conservation of hotspots are best defined as conserving areas with the large members of endemic species which are disappearing rapidly. Eminent conservationists identified these areas (regions) with very high levels of species richness and high degree of endemism (i.e. species confined to that region and not found anywhere else) for maximum protection. Initially, the number of biodiversity hotspots were 25, but now it has increased up to 34.

54 (*d*) *In situ* strategy is the conservation and the protection of living resources in their natural habitat, where they occur. It includes, national parks, biosphere reserves, wildlife sanctuaries and sacred groves, etc.

56 (*b*) Botonical garden is not a method of *in situ* conservation of biodiversity. It is a type of *ex situ* or off site conservation in which rare plants are conserved in places outside their natural habitat.

Rest all are methods of *in situ* conservation of biodiversity.

57 (*d*) Dachigam National Park, situated at Jammu and Kashmir is home to the famous musk deer or hangul.

For other options

- At Keibul Lamjao National Park, Manipur, brown deer (Sangai) is protected.
- At Bandhavgarh National Park, Madhya Pradesh, tiger is protected.
- Eaglenest Wildlife Sanctuary, Arunachal Pradesh, protects elephants and red panda.

58 (*b*) Biosphere reserves differ from the national parks and wildlife sanctuaries in that people are an integral part. But it is not the case in national parks and wildlife sanctuaries, where flora and fauna are separately conserved.

59 (*b*) Biosphere reserve comes under *in situ* conservation method. Hence, it is the most effective way among the four, for preserving genetic diversity of the plants by protecting wild population, traditional and domesticated plant genetic resources.

60 (*d*) Core zone, buffer zone and manipulation zone are found in biosphere reserves. Biosphere reserves are the special category of protected areas of land and/or coastal environments wherein people are an integral component of the ecosystem. These zones represent specified areas which have been zoned for particular activities.

61 (*a*) The core zone of biosphere reserves comprises an undisturbed and legally protected ecosystem, where no human activity is allowed.

For other options,

- Buffer zone surrounds the core area where limited human activities are allowed.
- Transition or manipulation zone is the outermost area of the biosphere reserve, where active cooperation between reserve management and the local people occurs.

62 (*d*) Sacred groves are forest patches around the places of worship, which are held in high esteem by tribal communities. These are found in several parts of India, e.g. Karnataka, Maharashtra, Rajasthan (Aravalli), Madhya Pradesh (Sarguja, Chanda and Bastar), Kerala, Meghalaya. In Meghalaya, sacred groves are found in Jaintia and Khasi hills.

64 (*d*) *Ex situ* strategy is the conservation of selected threatened plant and animal species in places outside of their natural habitat, where the population is conserved under simulated conditions that closely resemble their natural habitats. It includes botanical gardens, zoological parks, seed / pollen banks, tissue cultures and gene banks, etc.

65 (*c*) Shifting cultivation is not used for *ex situ* plant conservation. It results into deforestation.

On the other hand, botanical gardnes, seed banks and field gene banks are used as *ex situ* methods for conservation of plants.

66 (*b*) Sacred groves is not an *ex situ*, but a mode of *in situ* conservation in which forest fragments of varying size are protected by religious communities. These help to protect the biota of that area on-site.

On the other hand, botanical gardens, seed banks and wildlife safari parks are the examples of *ex situ* conservation in which the biota is protected outside its natural habitat.

67 (*a*) Wildlife safari parks are used for *ex situ* conservation of threatened animals and plants. In such conservation method, organisms taken out from their natural habitat and placed in special settings (wildlife safari park, zoo). Here, they are protected and given special care.

68 (*b*) A botanical garden is the collection of various types of living plants. *Ex situ* conservation means the conservation of plants or animals in the artificial habitats, which are quite similar to the normal habitats of these organisms. In this way, botanical gardens provide *ex situ* conservation of the germplasm.

69 (*b*) Cryopreservation of gametes of thereatened species in viable and fertile condition is done by preservation at –196°C in liquid nitrogen and it is an advanced method for *ex situ* conservation of biodiversity for indefinite period of time. *In situ* conservation occurs at ecosystem level of threatened or endangered species.

70 (*a*) The option with correct combination is (a)

In situ conservation–National park

Ex situ conservation–Botanical garden

Rest of the options are incorrect and can be corrected as

- Wildlife sanctuary, national park and sacred groves are *in situ* method of biodiversity conservation.
- Cryopreservation, seed bank and tissue culture are *ex situ* methods of biodiversity conservation.

71 (*a*) The Earth Summit held in Rio de Janeiro in 1992 was called for the conservation of biodiversity and sustainable utilisation of its benefits.

In this summit, more than 130 nations signed a convention on biodiversity and climatic change. Canada was the key player in the development of this convention.

72 (*a*) The world summit on sustainable development was held in 2002 in Johannesburg, South Africa.

73 (*a*) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Communities with more Species tends to be more stable than those with less species. Such communities are able to resist occasional disturbances. A stable community does not show too much variation in productivity from year to year and is resistant to invasions by alien species.

David Tilman's long term experiments showed that with more species, less will be year to year variation in total biomass.

74 (*a*) Both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

Species which lack genetic variability are more prone to extinction. This is because they are not equipped with traits, which help them to adapt and evolve in changing conditions of environment. Thus, occurrence of new disease or change in climate, new predators or any other change can easily threaten their numbers.

75 (*a*) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Tropical latitudes have greater biological diversity than temperate latitudes, because unlike temperate regions which were subjected to frequent glaciations in the past, tropical regions remained undisturbed for millions of years, where species continued to flourish. Also tropical environments are more constant and there is more solar energy available in tropics which contributes to high productivity.

76 (*c*) Assertion is true and Reason is false. Reason can be corrected as

The species which are facing, extremely high risk of extinction in the future are referred to as critically endangered species.
The great Indian bustard is a well-known bird which is categorised into critically endangered species.
Threatened species are vulnerable to extinction in the future not, critically endangered species.

77 (*c*) Assertion is true, but Reason is false. Reason can be corrected as

The currently occurring species extinction is different from the earlier mass extinction as the present species extinction is due to man-made causes, whereas the earlier extinction was due to the natural causes.

78 (*a*) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

The correct explanation can be given as

When a species become extinct, the plant and animal species associated with it in an obligatory way also become extinct.

This phenomenon is known as coextinction. This occurs because all species are interconnected to each other, i.e. species coextinction is a manifestation of the interconnectivity of organisms in complex ecosystems. For example, when a host species becomes extinct, its unique assemblage of parasites also meets the same fate, i.e. become extinct due to non-availability of food.

79 (*d*) Assertion is false, but Reason is true. Assertion can be corrected as

If the species-area relationship is for very large areas like the entire continent the slope of the line is much steeper with value of *Z* in the range of 0.6-1.2. The value of *Z*, i.e. slope of line (regression coefficient) of species-area relationship is similar and lies in the range of 0.1-0.2 when analysis is done among small areas.

80 (*d*) Assertion is false, but Reason is true. Assertion can be corrected as

Keystone species are the important and relevant component of ecosystem balance and biodiversity conservation. These are species which have a significant and disproportionately large influence on community structure and characteristics.

81 (*a*) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

The IUCN created the Red Data Book since 1963, so as to create awareness about the endangered species. The Red Data Book is a catalogue which provides a record of all endangered plants and animals. It provides information on the population status of various species, i.e. the degree of threat to the biodiversity.

82 (*c*) The statement in option (c) is correct about biodiversity. Rest of the statements are incorrect and can be corrected as

- The desert areas of Rajasthan and Gujarat do not have high level of desert animal species or numerous rare animals.
- Large scale planting of *Bt* cotton has adverse effects on biodiversity.
- Conservation of biodiversity is a practise being pursued by the developed countries for a long time.

83 (*d*) The statement in option (d) is false. It can be corrected as

Biodiversity is very essential for the maintenance and health of ecosystems.

Rest of the statements are true.

84 (*b*) The statement in option (b) is incorrect explanation about higher diversity in tropical areas in comparison to the temperate areas. It can be corrected as

More solar energy is available in tropics. This promotes higher productivity and increased biodiversity.

Rest of the statements are correct.

87 (*a*) Option (a) is in support of ethical arguments for biodiversity conservation. It relates to fact that we share our planet with millions of plants, animals and microbes. Philosophically or spiritually, we need to realise that every species has an intrinsic value, even if it may not be of current or any economic value to us. We have a moral duty to care for their well-being and pass on our biological legacy in good order to the future generation. Other options, although correct, do not support ethical view on biodiversity conservation.

88 (*c*) The statement in option (c) is incorrect and can be corrected as

MAB (Man and Biosphere) programme of UNESCO was initiated in 1975 for creation of biosphere reserves. Rest of the statements are correct.

89 (*d*) Statements I, II and IV are correct, while statement III is incorrect and can be corrected as
Beta diversity is the biodiversity, which appears in a range of communities due to replacement of species with the change in community/habitat because of the presence of different microhabitats, niches, etc., whereas gamma diversity is the diversity of the habitat in the whole region.

91 (*d*) Statements I, II and III are correct and statement IV is incorrect. It can be corrected as

Loss of biodiversity will lead to loss of genes of crops. Therefore, plant production will decrease.

92 (*b*) Statements II, V and VI are correct about narrowly utilitarian arguments for conserving biodiversity.
Statements I, III and IV are incorrect and can be corrected as
Ecosystem services like photosynthesis, watching spring flowers in full bloom and the aesthetic pleasure of walking through thick woods comes under broadly utilitarian arguments.

94 (*d*) Statements I and IV show the correct answer regarding wildlife conservation.

Ecologically managed wildlife provides food, shelter and some commercially useful products. One step towards the wildlife conservation is to preserve the earth's genetic diversity by protecting all threatened species of the plants and animals.

On the other hand, enriching the wildlife with exotic species may endanger the native species. Further, preventing migration of species may hinder the life cycle of such organisms. Thus, statements II and III are not the aims of wildlife conservation.

95 (*d*) Statements II, III and IV are correct, while statement I is incorrect and can be corrected as
Species diversity decreases as we move away from the equator towards the poles.

104 (*b*) Species-area relationship byAlexander von Humboldt, explains richness of tropical forests in terms of species biodiversity. On analysing, species-area relationships among very large areas like an entire continent, Humboldt observed that within a region, species richness increases with increasing explored area.

105 (*a*) Climate of countries at tropical latitude like South America, relatively remained undisturbed, for millions of years, leading to species diversity. Further, tropical environments are less seasonal and are more constant and predictable with greater availability of sunlight. These factors contribute to high species diversification. Therefore, South America has the highest biodiversity.

106 (*c*) Keeping animals in zoological parks is not a cause for loss of biodiversity. It is a strategy of conservation.

Some of the major causes of biodiversity loss are

- Destruction of natural habitat (primary cause).
- Introduction of exotic (alien species) with indigenous species.
- Overexploitation of natural resources.
- Coextinction of species.

107 (*b*) *Cynodon* (doob grass) is not an invasive alien species (in Indian context).

Rest of the three species *Parthenium* (congress or carrot grass), *Eichhornia* (water hyacinth) and *Lantana* are alien species, which are threats to the native species.

108 (*a*) Pitcher plant (*Nepenthes*), an insectivorous plant is found in rainforest of North-East India. These types of plants generally grow in nitrogen deficient soil. For other options,

- Sunderbans is rich in fauna and flora. Mangrove plants are the characteristic of Sunderbans.
- Western Ghats is rich in biodiversity.
- Xerophytes are more common in Thar deserts.

109 (*d*) Option (d) does not represent a major characteristic feature of biodiversity hotspots. There are no biodiversity hotspots in polar regions. Biodiversity hotspots are characterised by large number of flora and fauna, abundance of endemic species. They are mostly found in tropical and temperate regions.

111 (*c*) All of the given plants are prone to overexploitation due to their respective properties. *Nepenthes* (pitcher plant) is an insectivorous plant, *Psilotum* is a pteridophyte and *Aconitum* is a medicinal plant.

112 (*c*) Kaziranga National Park is situated in Golaghat and Nagaon districts of (Assam). One-horned rhinoceros is specific to this park.

For rest of the other options,

- Corbett National Park is situated in Nainital district (Uttarakhand) and is specific for tiger. It is the first National Park of India, which is famous for tigers.
- Bandipur National Park located in Karnataka is also specific for tigers.
- Bhitar Kanika National Park is located in Odisha and is specific for salt water crocodiles.

114 (*d*) All of mentioned plants are endangered plant species of India. *Rauwolfia serpentina* (sarpgandha), *Santalum album* (sandal wood) and *Cycas beddomei,* all are facing the threat of extinction as these are being overexploited due to their medicinal and commercial importance.

115 (*d*) All the three mentioned species are neither threatened nor indigenous species of India. *Lantana*, *Eichhornia* (water hyacinth) and African catfish (*Clarias gariepinus*) are all alien (exotic) species, which are invasive and have a harmful impact resulting in the extinction of the indigenous species.

117 (*c*) The statement in option (c) is correct.

Rest of the statements are incorrect and can be corrected as

- *Parthenium* is an exotic weed, which grows rapidly and adversely affects the native species.
- African catfish is also an alien species, which adversely affects the growth of indigenous catfishes our local species.
- *Lantana camara*, another alien species, also strongly competes with native species. *Parthenium* is popularly known as carrot grass, not *Lantana*.

118 (*c*) Coral reefs are the most productive ecosystem (2000 - 6000 kcal/m^2/y) and form the most diverse part of coastal region, providing a home to fish, molluscs, crustaceans, sponges, cnidarians, etc.

119 (*c*) Amazon rainforest is popularly called the 'lungs of the planet earth' because its diversified vegetation continuously recycles carbon dioxide into oxygen, contributing about 20% of the earth's oxygen.

120 (*b*) *Rauwolfia vomitoria* is the source of the active chemical drug reserpine, which is prescribed in hypertension and acts as a tranquiliser.

For other options.

- *Datura* is a plant with hallucinogenic properties.
- The compound belladonna is obtained from *Atropa belladonna.*
- The compound opium is obtained from *Papaver somniferum*.

121 (*d*) Fungi refers to the group of eukaryotic heteromorphic organisms with diverse forms, sizes, physiology and mode of reproduction. They exhibit more species diversity. In terms of species diversity, fungi is followed by algae, bryophytes and then ferns and allies.

122 (*a*) The tropical region exhibits less seasonal variations, i.e. remain undisturbed and hence exhibits high species diversity.

As for the other options

- The temperate regions are more seasonal, but less constant and exhibit less species diversity.
- Also, alpines show low temperature and high altitudes and thus exhibit less diversity.

123 (*b*) The historic convention on biological diversity held in Rio de Janeiro (Brazil) in 1992 is known as the Earth Summit (Ist).

The explanation for other options is

- CITES (Convention on International Trade in Endangered Species of wild flora and fauna) has helped in restricting poaching, i.e. illegal capturing of wild animals and loss of rare species.
- MAB stands for Man and Biosphere Programme, which undertakes the establishment and maintenance of biosphere reserves.

124 *(b)* All the three mentioned techniques are *ex situ* conservation methods. At present, gametes of threatened species can be preserved under viable conditions for longer duration by cryopreservation, i.e. storage at very low temperature −196°C in liquid nitrogen.

Fertilisation can be achieved in laboratory *in vitro* and various plant species can be improved or propagated by tissue culture method, a plant breeding principle.