

Biodiversity and Conservation

EXAM DRILL

ANSWERS

1. (a) : Biodiversity decreases from the equator towards the poles. Tropics have more species than temperate or polar areas.

2. (b)

OR

(a) : A more conservative and scientifically sound estimate about the total number of species present on earth, was made by Robert May.

3. (c) : Restoration region is degraded area which is selected for restoration to nearly natural form.

4. (a)

5. (a)

6. (d) : On a logarithmic scale, the relationship is a straight line described by equation, $\log S = \log C + Z \log A$.

7. All are exclusively present in the Eastern Himalayas.

8. Endemic species are those which are restricted to certain area.

9. Dodo -Mauritius

Quagga - Africa

10. K-T boundary extinction occurred during Cretaceous and tertiary period leading to extinction of dinosaurs and several other contemporary life forms.

11. (i) *Berberis nilghiriensis*

(ii) Red panda (*Ailurus fulgens*)

12. (b)

13. (a) : Ivory-billed woodpecker is considered as a critically endangered species as its population is facing a extremely high risk of extinction in near future.

14. (c) : A wildlife sanctuary is a protected area which is meant for the conservation of only fauna. Human activities like harvesting of timber, collection of minor forest products and private ownership rights are allowed as long as they do not interfere with the well-being of animals.

15. (i) (c)

(ii) (a) : Mosses and ferns grow in shady and humid places or wet places and need water for fertilisation. They also require high temperature and dry conditions and thus only a few of them survive. Hence, they are few in numbers.

(iii) Mammals

(iv) (d)

(v) (d)

16. (i) (a)

(ii) (c)

(iii) (d) : According to ecologists, the value of Z , i.e., regression coefficient lies in the range of 0.1 to 0.2 regardless of the taxonomic group or the region.

(iv) (d)

(v) (b) : For frugivorous or fruit eating birds in the tropical forests of different continent the slope is found to be 1.15.

17. Ethical argument says that every living species has an intrinsic value though it may not have any direct economic value to us. It is therefore, our moral and ethical duty not to destroy them. Instead we should take care of their well being so as to pass the rich biological legacy to our future generations.

18. The Rivet Popper Hypothesis was proposed by Paul Ehrlich. The hypothesis suggests the importance of species richness in the maintenance of the ecosystem. The rivets of an aeroplane were compared with species in an ecosystem. If the passengers start to pop the rivets from the wings of the aeroplane, the aeroplane will not be able to perform its flight. In the similar way, if the species present in an ecosystem are reduced, the ecosystem will collapse.

19. Biodiversity is defined as the occurrence of different types of ecosystem, different species of organisms with the whole range of their variants and genes adapted to different environment along with their processes and interactions. The term biodiversity was coined by W.G. Rosen in 1985.

20. Sacred groves are forest patches around places of worship, held in high esteem by tribal communities. They are most undisturbed forest patches which are often surrounded by highly degraded landscapes. Not a single branch is allowed to be cut from these forests and as a result, many endemic species which are rare or have become extinct elsewhere can be seen to flourish here. E.g., Jaintia and Khasi hills in Meghalaya.

OR

Co-extinction means that when a species become extinct, the plant and animal species associated with it in an obligatory relation also become extinct. For example, the case of a co-evolved plant-pollinator mutualism like in *Pronuba yuccaselles* and *Yucca* where extinction of one invariably leads to the extinction of the other.

21. Narrow utilitarian arguments for conserving biodiversity states that humans derive countless direct economic benefits from nature such as food, firewood, fibre, construction material, industrial products and products of medicinal importance.

22. The main functions of biosphere reserve are:

- (i) Conservation – To ensure the conservation of landscapes, ecosystems, species and genetic resources.
- (ii) Development – To promote economic development which is socially and ecologically sustainable.
- (iii) Scientific research, monitoring and education
- (iv) Restoration – Biosphere reserves help in restoration of degraded ecosystems and habitats.

23. (i) MAB – Man and Biosphere programme

(ii) IUCN – International Union for the Conservation of Nature and Natural Resources

(iii) WWF – World Wide Fund

(iv) UNCED – United Nations Conference on Environment and Development.

24. Cryopreservation in liquid nitrogen at a temperature of -196°C , is particularly useful methodology for conserving vegetatively propagated crops like potato. Cryopreservation is the storage of material at ultra-low temperature either by very rapid cooling (used for storing seeds) or by gradual cooling and simultaneous dehydration at low temperature (used for tissue culture). The material can be stored for a long period of time in compact, low maintenance refrigeration units.

25. Excessive exploitation of a species, whether a plant or animal, reduces size of its population and the population becomes vulnerable to extinction. Dodo have become extinct in the last 500 years due to overexploitation by humans.

26. Offsite collections are live collections of wild and domesticated species in botanical gardens, zoological parks, wildlife safari parks, arboreta, etc. Many botanical gardens and arboreta have seed banks, tissue culture facilities and other *ex-situ* technologies. Zoological parks have well managed captive breeding programmes due to which many animals that have become extinct in the wild continue to be maintained in zoological parks. Therefore, offsite collections help in conservation of biodiversity.

27. Amazon rainforest is a tropical rainforest. According to scientists, the reasons for its species richness may be the following:

(i) Speciation which is a function of time and unlike temperate regions, tropics have remained relatively undisturbed for millions of years and thus had long evolutionary time for species diversification.

(ii) Tropical environments are more constant, predictable and less seasonal. Such constant environment promotes niche specialisation and lead to greater diversity.

(iii) More solar energy is available in tropics which promotes higher productivity and increases biodiversity.

28. (a) India has been divided into ten biogeographic regions:

1. Trans-Himalayas, 2. Himalayas, 3. Desert, 4. Semi-arid, 5. Western ghats, 6. Deccan peninsula, 7. Gangetic plains, 8. Northeast, 9. Coasts, 10. Islands.

The most biodiversity rich regions are Western ghats (are a 4.0%) and North-east (area 5.2%).

(b) If Robert May's proposal for discovery of new species is accepted, then it is estimated that in India there are probably more than 1,00,000 plant species and more than 3,00,000 animal species that are yet to be discovered and described.

29. Excessive use of pesticides has polluted both ground water and surface water bodies. Many sensitive species have disappeared. Pesticide biomagnification with the rise in trophic level has resulted in drastic decline in the population of fish eating birds and falcons. Run off from fertilisers rich fields causes nutrient enrichment of water bodies called eutrophication. Sewage and other organic remains also result in eutrophication. Lead and other types of heavy metals poured into water bodies lead to mortality of many animals. In this way, pollution leads to loss of biodiversity.

Impacts of loss of biodiversity are as follows :

- (i) Decline in plant and animal production
- (ii) Environmental perturbations such as drought
- (iii) Increased variability in ecosystem processes such as plant productivity, water use and pest and disease cycles.

30. There have been several periods in the earth's geological history when large number of species became extinct because of catastrophes. These are called mass extinctions. These extinctions occurred in millions of years. Environmental catastrophes have lead to sudden extinction of large number of species inhabiting a large geographical area. K-T boundary extinction occurred during cretaceous and tertiary period led to extinction of dinosaurs and several other contemporary life forms. During pleistocene Woolly Mammoth, Mastodon, Giant Sloth and many other mammals species become extinct. Pleistocene extinctions are believed to be due to advance and retreat of ice sheets coupled with over-exploitation

by hunters. K–T boundary extinctions are connected with deposits of iridium which is otherwise rare on earth. The other types of extinction are natural or background extinction and anthropogenic extinctions.

OR

The uses of the red lists are as follows:

- (i) Developing awareness about the importance of threatened biodiversity.
- (ii) Identification and documentation of endangered species.
- (iii) Providing a global index of the decline of biodiversity.
- (iv) Defining conservation priorities at the local level and guiding conservation action.

The world conservation union (formerly known as International Union for the Conservation of Nature and Natural Resources (IUCN) has recognised Red list categories of species: (i) Extinct, (ii) Extinct in the wild, (iii) Critically endangered, (iv) Endangered, (v) Vulnerable, (vi) Near threatened, (vii) Least concern, (viii) Data deficit.

31. (a) According to IUCN (2004), the total numbers of plant and animal species described so far are more than 1.5 million. According to Robert May, global estimate is about 7 million (considering that only 22% of the total species have been recorded so far). More than 70% of all the species recorded are animals while plants comprise no more than 22% of the total. Insects are the most species rich taxonomic group in animal kingdom, making more than 70% of the total animals. Number of fungi species is more than the combined total of the species of fishes, amphibians, reptiles and mammals.

(b) The reasons for high tropical diversity are:

- (i) Tropical latitudes have remained undisturbed for millions of years allowing species to flourish unlike temperate areas that have undergone frequent glaciations.
- (ii) Favourable environment and relatively constant and predictable climate promoted more niche specialisation and thus more diversity.
- (iii) Higher productivity due to more solar energy available in the tropics is related to greater diversity.
- (iv) Reduced competition due to favourable environment and high resource availability, resulted in more diversity.

OR

There are four major causes *i.e.*, the evil quartet of biodiversity loss: (i) Habitat loss and fragmentation (ii) Over exploitation (iii) Alien species invasion and (iv) Co-extinction.

(i) Habitat loss and fragmentation – The destruction of habitats is the primary reason for the loss of biodiversity. When people cut down trees, fill a wetland, plough a grassland or burn a forest, the natural habitat of species is changed or destroyed. These changes can kill or force

out many plants, animals and microorganisms, as well as disrupt complex interactions among the species. Habitat destruction resulting from expansion of human population, urbanisation and industrialisation is the primary cause of loss of biodiversity.

(ii) Over exploitation – Increasing human population has escalated the use of natural resources. Over exploitation of resources also occurs when a commercial market develops for previously unexploited species. Many species are likely to become endangered or vulnerable to extinction due to over exploitation. Dodo, passenger pigeon, three subspecies of tiger and Steller's sea cow have become extinct in the last 500 years due to over exploitation by humans.

(iii) Alien species invasion – New species entering a geographical region are called exotic or alien species. Introduction of such invasive species may cause disappearance of native species through changed biotic interactions. Exotic species are having large impact especially in island ecosystems, which harbour much of the world's threatened biodiversity.

Nile perch, an exotic predatory fish introduced into lake victoria (East Africa) threatens the entire ecosystem of the lake by eliminating several native species of the small cichlid fish that were endemic to this freshwater aquatic system.

(iv) Co-extinction – Co-extinctions occur in organisms sharing certain obligatory mutualistic relationships in nature. Extinction of one will automatically cause extinction of the other *e.g.*, *Pronuba yuccaselles* and *Yucca*.

32. India is one of the 12 megadiversity countries of the world having 8.1% of total global species diversity. There are about 45,000 species of plants and about 90,000-1,00,000 species of animals. Applying Robert May's global estimate only 22% of the total species have been recorded. India has probably more than 1,00,000 species of plants and 3,00,000 species of animals to be discovered and described.

In India, we are endowed with a rich diversity of the ten biogeographically distinct regions due to hanging physical conditions and species groupings. A large number of species that are found in these zones are endemic (only found locally) exclusive to India. About 33% of the flowering plants recorded in India are endemic to one country. Indian region is also notable for endemic fauna.

For example, out of the recorded vertebrates, 53% freshwater fishes, 60% amphibians, 36% reptiles and 10% mammalian fauna are endemic. A very high number of amphibian species are endemic to western ghats. The endemic species are concentrated mainly in north-east, western ghats, north-west Himalaya and Andaman and Nicobar Islands.

OR

(a) Sacred forests (sacred groves) is a traditional strategy for the protection of biodiversity that has been in practiced in India and some other Asian countries. These are forest patches of varying dimensions protected by tribal communities due to religious sanctity. The sacred forests represent islands of pristine forests (most undisturbed forests without any human impact) and have been free from all disturbances; though these are frequently surrounded by highly degraded landscapes. In India, sacred forests are located in several parts, e.g., Karnataka, Maharashtra, Kerala, Meghalaya, etc. and are serving a refugia for a number of rare, endangered and endemic taxa. Similarly, several water bodies (e.g., Khecheopalri lake in Sikkim) have been declared sacred by the people leading to protection of aquatic flora and fauna.

(b) Difference between National parks and Sanctuaries are as follows:

S.No.	National Park	Sanctuary
(i)	It is meant for protection of both flora and fauna.	It is meant for protection of only fauna.
(ii)	Cultivation of land is not permitted.	Cultivation of land is permitted.
(iii)	Private ownership not permitted.	Private ownership is permitted.
(iv)	Grazing is not allowed.	Grazing is allowed.
(v)	Boundary is well demarcated.	Boundary is not well demarcated.

33. Ex-situ conservation strategies include offsite collections and gene banks. It is the conservation of selected rare plants/ animals in places outside their natural homes.

The *ex situ* conservation includes:

(i) Seed banks - They are institutes that maintain stocks of viable seeds (seed banks).

Seed banks are of two types, orthodox and recalcitrant. Orthodox seeds are those seeds which can tolerate reduction in moisture content (upto 5%), anaerobic conditions and long temperature of -10°C to -20°C or even lower for prolonged periods, e.g., cereals, legumes. At intervals the seeds are allowed to germinate from plants and develop fresh seeds for storage.

Recalcitrant seeds are those which get killed on reduction of moisture and exposure to low temperature, e.g., tea, cocoa, jackfruit, coconut. They can be stored for shorter duration after treatment with fungicides in rooms having humid air and normal oxygen.

(ii) Tissue culture – It is carried out through callus formation, embryoids, pollen grain culture and shoot tip culture for those

plants which are either seedless, have recalcitrant seeds, non viable seed progeny or where clone is to be maintained. This method is useful in maintaining a large number of genotypes in small area, rapid multiplication of even endangered species and for hybrid rescue.

OR

(a) Earth Summit at Rio de Janeiro (1992), Brazil promoted Convention on Biological Diversity (CBD) which was signed by 152 nations. Its recommendations came into effect on 29th Dec 1993. India became a party to this Convention on Biological Diversity in May, 1994. The various commitments were (i) Adoption of ways and means to conserve biodiversity. (ii) Managing biodiversity for sustainable use. (iii) Ensuring equitable sharing of benefits from biological diversity including utilisation of genetic resources. Agenda 21, a product of Earth Summit, is a blue print for encouraging sustainable development of diversity through social, economic and environment measures in the 21st century.

A second World Summit was held in 2002 in Johannesburg, South Africa, 1990. Countries attending the Summit pledged to significantly reduce the current rate of biodiversity loss at global, regional and local levels by 2010. An Earth Summit (Rio + 20) was again held in 2012 in Rio de Janeiro to chalk out new strategies for sustainable development.

(b) The uses of biodiversity are:

(i) Source of food and improved varieties : Biodiversity is of great use to modern agriculture in three ways; source of new crops, as a source material for breeding improved varieties, and as a source of new biodegradable pesticides.

(ii) Drugs and Medicines : Biodiversity is a rich source of substances with therapeutic properties. Several important pharmaceuticals have originated as plant based substances. Examples of plant derived substances developed into valuable drugs are : Morphine (*Papaver somniferum*), used as an analgesic and Quinine (*Cinchona sp.*) used for treatment of fever.

(iii) Aesthetic and cultural benefits : Biodiversity has also great aesthetic value. Examples : Bird watching, wildlife, pet keeping, gardening, etc. Throughout human history, people have related biodiversity to the very existence of human race through cultural and religious beliefs.

(iv) Ecosystem services : Biodiversity is essential for the maintenance and sustainable utilisation of goods and services from ecological systems as well as from the individual species. These services include maintenance of gaseous composition of the atmosphere, climate control by forests and oceanic systems, natural pest control, pollination of plants by insects and birds, formation and protection of soil, and purification of water and nutrient cycling, etc.

