

CHAPTER 15

BIODIVERSITY AND ITS CONSERVATION

Syllabus

- **Organisms and environment** : Habitat and niche, population and ecological adaptations; population interactions-mutualism, competition, predation, parasitism, population attributes-growth, birth rate and death rate, age distribution.

Chapter Analysis

List of Topics		2016		2017		2018
		D	OD	D	OD	D/OD
Biodiversity	• Levels of biodiversity	1 Q		1 Q		1 Q
	• Patterns of biodiversity	(1 M)		(3 M)		(3 M)
	• Biodiversity losses	1 Q				
	• Biodiversity hotspots	(5 M)				
Biodiversity conservation	• Methods to conserve biodiversity- In situ and ex-situ conservation		1 Q	1 Q	1 Q	
	• Sacred groves		(2 M)	(3 M)	(3 M)	

- On the basis of above analysis, it can be concluded that important topics from exam point of view are levels of biodiversity, pattern of biodiversity, cause and effect of biodiversity loss, methods to conserve biodiversity (in-situ and ex-situ conservation).



TOPIC-1 Biodiversity and its Patterns

Revision Notes

- **Biodiversity** : It is the diversity (or heterogeneity) of biological organisation ranging from cellular macromolecules to biomes.
- **Edward Wilson** : Popularized the term 'biodiversity' to describe the combined diversity at all levels of biological organization.

Levels of Biodiversity

- Biodiversity has been divided into three hierarchical levels of biological organization.

1. Genetic diversity

- Diversity shown by a single species at genetic level. *e.g.*, *Rauwolfia vomitoria* in Himalaya shows genetic variation in the potency and concentration of the chemical, reserpine.
- India has more than 50,000 different strains of rice and 1,000 varieties of mango.

2. Species diversity

Diversity at species level. *e.g.*, Western Ghats have greater amphibian species than Eastern Ghats.

3. Ecological diversity

Diversity at ecosystem level. *e.g.*, In India, deserts, rain forests, mangroves, coral reefs, wet lands, estuaries & alpine meadows, all can be seen. Whereas the Scandinavian countries (like, Norway, Sweden) have less ecological diversity.

TOPIC - 1

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TOPIC - 2

Conservation of Biodiversity P. 372

Number of Species on Earth (Global Species Diversity)

- According to IUCN or International Union for Conservation of Nature & Natural Resources (2004) more than 1.5 million species have been described so far.
- According to Robert May, global estimate is about 7 million (considering the species are to be discovered in the tropics. *i.e.* only 22% of the total species have been recorded so far).
- Animals are more diverse (above 70%) than plants including plantae and fungi (22%).
- Most species rich taxonomic group among animals are: Insects (70%, *i.e.*, out of every 10 animals, 7 are insects).
- Number of fungi species is more than the combined total of the species of fishes, amphibians, reptiles and mammals.
- Biologists are not sure about total number of prokaryotic species because :
 - (a) Conventional taxonomic methods are not suitable for identifying microbial species.
 - (b) Many species are not culturable under laboratory conditions.
- India has only 2.4% of world's land area, but has 8.1% of the species diversity.
- India is one of the 12 mega diversity countries of the world.
- Nearly 45,000 species of plants and twice as many of animals have been recorded from India.
- Applying May's global estimate, India would have more than 1 lakh plant species and 3 lakh animal species.

Patterns of Biodiversity

- Biodiversity is not uniform throughout the world. It varies with the change in latitude and altitude, it is affected by latitudinal gradients and species-area relationship. Following are the main patterns of biodiversity.

(a) Latitudinal Gradients

- Species diversity decreases from the equator to the poles.
- Tropics (latitudinal range of 23.5° N to 23.5° S) have more species than temperate or polar areas.
 - (i) Colombia (near equator) has about 1400 species of birds
 - (ii) New York (41° N) : 105 species of birds
 - (iii) Greenland (71° N) : 56 species of birds
 - (iv) India (tropical latitudes) : > 1200 species
- Tropical forest region like Ecuador has up to 40 times species of vascular plants as compared to a forest of equal area in a temperate region like the Midwest of USA.
- Tropical Amazonian rain forest (South America) has the greatest biodiversity on earth. It contains :
 - (i) 40,000 species of plants
 - (ii) 3,000 species of fishes
 - (iii) 1,300 species of birds
 - (iv) 427 species of mammals
 - (v) 427 species of amphibians
 - (vi) 378 species of reptiles
 - (vii) 1,25,000 species of invertebrates
- Biodiversity (species richness) is highest in tropics because
 - (i) Tropics had more evolutionary time.
 - (ii) Relatively constant environment (less seasonal).
 - (iii) They receive more solar energy which contributes to greater productivity.

(b) Species - Area Relationship

- According to the study of **Alexander von Humboldt** (German naturalist & geographer) in South American jungles, within a region, species richness increases with increase in explored area, but only up to a limit.
- Relation between species richness and area for a wide variety of taxa (like, angiosperm plants, birds, freshwater fishes) gives a rectangular hyperbola.
- On a logarithmic scale, the relationship is a straight line or linear, described by the equation:
 $\log S = \log C + Z \log A$
 where, S = Species richness, A = Area, C = Y-intercept, Z = slope of the line (regression co-efficient)
- The value of Z lies in the range of 0.1 to 0.2.
- In species-area relationship among the large areas like entire continents, slope of the line is steeper (Z value : 0.6 to 1.2). *e.g.*, for frugivorous birds and mammals in the tropical forests of different continents, the slope is 1.15.

Importance of Species Diversity to the Ecosystem

- For many decades, ecologists believed that communities with more species, generally, tend to be more stable than those with less species.
- A stable community should not show too much variation in productivity from year to year; it must be either resistant or resilient to occasional disturbances (natural or man-made), and it must also be resistant to invasions by alien species.

- **David Tilman** found that plots with more species showed less year-to-year variation in total biomass.
- He also showed that in his experiments, increased diversity contributed to higher productivity.
- A rich biodiversity is not only essential for ecosystem health but imperative for the survival of the human race on this planet.
- Stanford ecologist Paul Ehrlich explained the effect of loss of species through his the 'rivet popper hypothesis'.

Loss of Biodiversity

- IUCN Red List (2004) says that 784 species (338 vertebrates, 359 invertebrates and 87 plants) became extinct in the last 500 years. *e.g.*, Dodo (Mauritius), Quagga (Africa), Thylacine (Australia), Stellar's sea cow (Russia) and 3 subspecies (Bali, Javan, Caspian) of tiger.
- 27 species have disappeared in the last 20 years.
- The extinctions across taxa are not random. Some groups (like amphibians) appear to be more vulnerable to extinction.
- More than 15,500 species are facing threat of extinction.
- 12% birds, 23% mammals, 32% amphibians, 31% gymnosperm species face the threat of extinction.
- On earth there have been five mass extinction of species and at present 'Sixth Extinction' is in progress.
- The current extinction rate is 100 - 1000 times faster than in the pre-human times. If this trend continues, nearly 50% species might be extinct within the next 100 years.

Impacts of Loss of Biodiversity

- (a) Decline in plant production
- (b) Lowered resistance to some environmental perturbations such as drought.
- (c) Increased variability in ecosystem processes such as plant productivity, water use and pest and disease cycles.

Causes of Biodiversity Losses ('The Evil Quartet')

- "The Evil Quartet" is the phrase coined by Jared Diamond to describe the four human induced causes of extinction.

(a) Habitat Loss and Fragmentation

- It is the most important cause. *e.g.*, Tropical rain forests (loss from 14% to 6%).
- Thousands of hectares of rain forests is being lost within hours.
- The Amazon rain forest ('lungs of the planet') is being cut for cultivating soya beans or for conversion of grass lands for cattle.
- When large habitats are broken up into small fragments due to various human activities, mammals and birds requiring large territories and certain animals with migratory habits are badly affected, leading to population declines.

(b) Over-exploitation

- The dependence of humans on nature for food and shelter led to over-exploitation of natural resources.
- **Example :** Many species like Stellar's sea cow, Passenger pigeon, etc became extinct due to over exploitation.
- Many marine fish populations around the world are over harvested, endangering the continued existence of some commercially important species.

(c) Alien Species Invasions

- When alien species are introduced unintentionally or deliberately, some of them turn invasive, and cause decline or extinction of indigenous species.
- These alien species cause decline or extinction of indigenous species.
- **Example : (a)** The Nile Perch introduced in Lake Victoria (East Africa) caused extinction of more than 200 species of cichlid fish.
- (b) Invasive weed species like carrot grass (*Parthenium*), *Lantana* and water hyacinth (*Eichhornia*) caused damage to our native species.
- (c) The illegal introduction of the African Catfish (*Clarias gariepinus*) for aquaculture is posing a threat to the indigenous catfishes (*Clarias batrachus*) in our rivers.

(d) Co-extinction

- When a species becomes extinct, the plant and animal species associated with it also become extinct.
- **Example : (a)** Extinction of the parasites takes place when the host is extinct.
- (b) In co-evolved plant-pollinator mutualism extinction of one leads to the extinction of the other.



Very Short Answer Type Questions

(1 mark each)

Q.1. Write the level of biodiversity represented by mangrove. Give another example falling in the same level. [A] [Outside Delhi Set, Comptt. 2016]

Ans. Mangroves represent the ecological diversity. The same level of biodiversity is also shown by rain forests, coral reefs wetlands, estuaries and alpine meadows, etc.

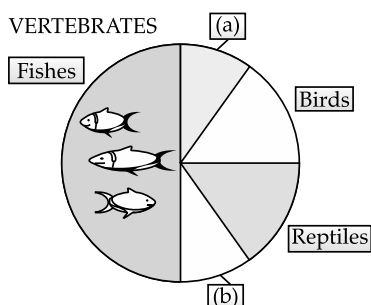
Commonly Made Error

- Students often get confused between different levels of biodiversity.

Answering Tip

- Learn the differences between the three levels of biodiversity in tabular form with examples for better retention and understanding.

Q. 2. Identify 'a' and 'b' in the figure given below representing proportionate number of major vertebrate taxa. [E & A] [Delhi Set-I, II, III, 2014]



Ans. (a) Mammals
(b) Amphibians

[CBSE Marking Scheme, 2014] 1

Answering Tip

- Practice self-explanatory diagrams with proper labelling, arrows and headings.

Q. 3. Name the type of biodiversity represented by the following :

- 50,000 different strains of rice in India.
- Estuaries and alpine meadows in India.

[A] [Delhi Set-I, III, Outside Delhi, 2013]

Ans. (i) Genetic diversity.
(ii) Ecological diversity. $\frac{1}{2} + \frac{1}{2} = 1$

[CBSE Marking Scheme, 2013]

Answering Tip

- Learn the various examples representing species, genetic and ecological diversity.

Q. 4. Name the type of biodiversity represented by the following :

- 1000 varieties of mangoes in India.
- Variations in terms of potency and concentration of reserpine in *Rauwolfia vomitoria* growing in different regions of Himalayas.

[A] [Outside Delhi Set-I, 2013]

Ans. (i) Genetic diversity.
(ii) Genetic diversity. $\frac{1}{2} + \frac{1}{2} = 1$

Q. 5. Why is tropical environment able to support greater species diversity ?

[U] [Outside Delhi Comptt. 2011]

Ans. Tropical environments, unlike temperate ones, are less seasonal, relatively more constant and predictable. Such constant environments promote niche specialization and lead to a greater species diversity. 1

Q. 6. *Eichhornia crassipes* is an alien hydrophyte introduced in India. Mention the problems posed by this plant. [A] [Outside Delhi Comptt. 2010]

Ans. When an alien hydrophyte *Eichhornia crassipes* were introduced unintentionally, they turned invasive and caused decline or extinction of indigenous species. 1

Answering Tip

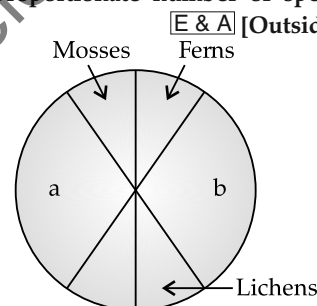
- Learn the concept of water hyacinth instead of rote learning.

Q. 7. The Amazon rain forest is referred to as 'the lungs of the planet'. Mention any one human activity that causes loss of biodiversity in this region.

[A] [Outside Delhi Comptt. 2010]

Ans. The Amazon rain forest is so huge that it is called the lungs of the planet. Cutting down of forest for cultivation of soya beans and its conversion to grasslands for raising beef cattle caused loss of biodiversity in this region. 1

Q. 8. Name the unlabelled areas 'a' & 'b' of the pie chart representing the biodiversity of plants showing their proportionate number of species of major taxa. [E & A] [Outside Delhi, 2009]



Ans. (i) Fungi
(ii) Angiosperms. 1

Q. 9. What does the term genetic diversity refer to ? What is the significance of large genetic diversity in a population ? [U] [Delhi Set, 2007]

Ans. The genetic diversity refers to the variation of genes within a species. The genetic diversity helps the population to adapt into its environment and to respond to natural selection. It also helps in speciation or evolution of new species. 1

Q. 10. Why are mango trees unable to grow in temperate climate? [R] [Outside Delhi Set-I, II, Comptt. 2016]

Ans. Because temperature affects the basal metabolism/physiological function of the plant not adapted to low temperature of temperate climate. Mango trees are not able to grow in temperate below 30 degree, thus cannot grow in temperate climate. 1

[CBSE Marking Scheme, 2016]

Q. 11. An exotic variety of prickly pear introduced in Australia turned out to be invasive. How was it brought under control ?

[A] [Delhi Set-II, Comptt. 2013]

Ans. It was controlled by introducing a cactus – feeding predator (a moth) from its natural habitat. 1

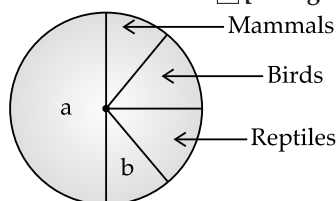
Q. 12. Give an example of a plant which came into India as a contaminant and is a cause of pollen allergy.

[R] [Outside Delhi Set-III, 2014]

Ans. *Parthenium* / Carrot grass. 1
[CBSE Marking Scheme, 2014]

Q. 13. Name the unlabelled areas 'a' & 'b' of the pie chart representing biodiversity of vertebrates showing the proportionate number of species of major taxa.

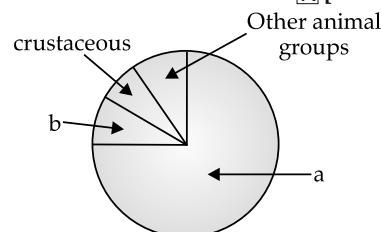
[R] [Foreign Set, 2014]



Ans. (i) Fishes $\frac{1}{2}$
(ii) Amphibians. $\frac{1}{2}$

Q. 14. Name the unlabelled area of the pie chart given alongside representing the global biodiversity of invertebrates showing their proportionate number of species of major taxa.

[R] [Delhi Set, 2009]



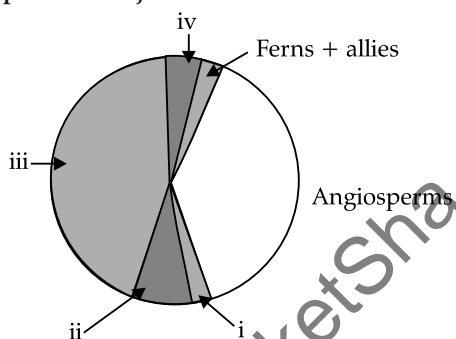
Ans. (i) Insects $\frac{1}{2}$
(ii) Molluscus. $\frac{1}{2}$



Short Answer Type Questions-I

(2 marks each)

Q.1. Identify the areas labelled i, ii, iii and iv in the pie chart given below representing the biodiversity of plants showing their proportionate number of species of major taxa.



[E & A] [Delhi/Outside Delhi, Comptt, Set 1,2,3, 2018]

Ans. i - Lichen, ii - Algae, iii - Fungi, iv - Mosses $\frac{1}{2} \times 4$
[CBSE Marking Scheme, 2018]

[AI] Q.2. Mention the kind of biodiversity of more than a thousand varieties of mangoes in India represent. How is it possible?

[A] [Delhi Set-I, 2016]

Ans. Genetic diversity/single species show high diversity at genetic level. 1

Single species show high diversity at genetic level over its distributional range/different varieties grow in different geographical areas/climatic conditions/breeding/mutations. 1

[CBSE Marking Scheme, 2016]

Detailed Answer :

More than a thousand varieties of mangoes in India represent the genetic diversity because (i) a single species show high diversity at genetic level over its distributional range. (ii) different varieties grow in different geographical regions and climatic condition. This is also possible because of breeding and mutations.

Q. 3. Write what was the percentage of forest cover of India at the beginning and at the end of the twentieth century. How different is it from the one recommended by the National Forest Policy of our country?

[U] [Delhi Set-II, 2014]

Ans. Beginning of 20th century - 30%

End of 20th century - 19.4%

Recommendations were 33% for the plains and 67% for the hills (thus forest cover shrunk substantially) 2

CBSE Marking Scheme, 2014]

Q. 4. What is meant by 'alien species' invasion? Name one plant and one animal alien species that are a threat to our Indian native species.

[R] [Outside Delhi Set-III, 2013]

Ans. 'Alien species' invasion means introducing those that are, firstly, outside their natural distribution area, and, secondly, threatens biological diversity.

Plants : *Lantana camara*

Animals : *Equus caballus* (horse) or, *Canis familiaris* (dog). 2

Answering Tips

- Practice writing all definitions emphasizing on operative terms. Learn the correct spelling of scientific names of both plant and animal alien species, which are threat to our Indian native species.
- Repeated tests will help the students to remember the scientific names.

Q. 5. Where would you expect more species diversity- in tropics or in polar regions? Give reasons in support of your answer.

[U] [Outside Delhi Set-I, 2013]

Ans. Tropics have more species biodiversity than that of the polar regions. The maximum biodiversity

in the tropical regions is due to the following reasons :

- (i) **Prolonged evolutionary time** : The tropics have remained undisturbed in the past and therefore evolved more species diversity.
- (ii) **High productivity** : There is more solar energy available in tropics which contributes directly to more productivity, population sizes and indirectly to greater species diversity. 1+1

Q. 6. Plants that inhabit a rain-forest are not found in a wetland. Explain. [U] [Delhi Set-III, 2016]

Ans. Plants that inhabit rain forest are well adapted to that particular habitat. The climate of rainforest is wet and humid and in this climate, large trees and shrubs are predominantly present. The climate of wetlands, on the other hand, is cool and wet. 2

[CBSE Marking Scheme, 2016]

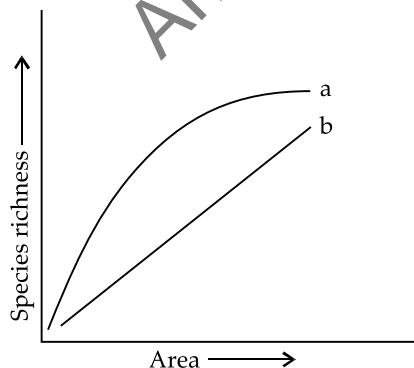
AI Q. 7. Justify with the help of an example where a deliberate attempt by humans has led to the extinction of a particular species.

[A] [Delhi Set-I, 2011]

Ans. The Nile perch introduced into Lake Victoria in East Africa, eventually led to the extinction of an ecologically unique assemblage of more than 200 species of cichlid fish in the lake // Abingdon tortoise in Galapagos islands became, extinct, after goats were introduced due to greater browsing efficiency of goats // Connell's field experiment showed that the competitively superior barnacle *Balanus*, excludes smaller barnacle *Chthamalus* // Over exploitation by man, caused extinction of Stellar's sea cow / Passenger pigeon. 2

[CBSE Marking Scheme, 2011]

AI Q. 8.



The above graph shows Species-Area relationship. Write the equation of the curve 'a' and explain.

[A] [Delhi Set-I, 2011]

Ans. (i) $S = CA^Z$

Within a region, species richness increases with increasing explored area but only up to a limit.

- (ii) Relationship between species richness and area for a wide variety of taxa turns out to be rectangular hyperbola. 2

[CBSE Marking Scheme, 2011]

Answering Tip

- Carefully learn the concept of Species- Area relationship.

Q. 9. With the help of one example, explain how does alien species invasion cause biodiversity loss.

[A] [Outside Delhi Set-I, II, III, 2011]

Ans. When alien species are introduced, some of them become invasive, compete with the native species and cause extinction of indigenous species. **For example :**

- (i) *Parthenium*, *Lantana* and *Eichhornia* are the exotic species of plants that have invaded India and caused environmental damage. They pose threats to the survival of many of our native species.

- (ii) Introduction of African catfish (*Clarias faripepinus*) for aquaculture purposes is posing a threat to our indigenous catfish *Clarias batrachus*. 1 × 2 = 2

Answering Tip

- Stress upon writing scientific names correctly according to Binomial Nomenclature.

Q. 10. List any two causes of biodiversity loss and explain any one of them. [U] [Outside Delhi Comptt. 2011]

Ans. Causes of biodiversity losses :

- (i) Habitat loss and fragmentation.
- (ii) Over-exploitation.
- (iii) Alien species invasions.
- (iv) Co-extinctions. (Any two)

Co-extinctions : When a species becomes extinct, the plant and animal species associated with it in an obligatory way also become extinct. For example, when a host fish species becomes extinct, its unique assemblage of parasites also meets the same fate. Another example is the case of a co-evolved plant pollinator mutualism where extinction of one invariably leads to the extinction of the other. 1 + 1 = 2

Q. 11. How does over-exploitation of beneficial species affect biodiversity ? Explain with the help of one example. [U] [Delhi Comptt. 2011]

Ans. Humans have always depended on nature for food and shelter, but when need turns to 'greed', it leads to over-exploitation of natural resources. Many species extinctions in the last 500 years (Stellar's sea cow, passenger pigeon) were due to over-exploitation by humans.

Presently, many marine fish populations around the world are over harvested, endangering the continued existence of some commercially important species. 1+1=2

Q. 12. In the biosphere, immense biological diversity exists at all levels of biological organisation. Explain any two levels of biodiversity.

[R] [Delhi Set-I, 2010]

Ans. (i) Genetic diversity : A single species might show high diversity at the genetic level over its distributional range. The genetic variation is shown by the medicinal plant *Rauwolfia vomitoria*. 1

(ii) Species diversity : It is the product of both species richness and evenness *i.e.* species richness is weighed by species evenness.

E.g., amphibian species are found more in the western ghats as compared to the eastern ghats. 1

[CBSE Marking Scheme, 2010]

Q. 13. List the features that make a stable biological community. [U] [Outside Delhi Set-I, II, III, 2010]

Ans. The features of a stable community are as follows :

(i) Communities should have greater biodiversity for greater stability.

(ii) It should be able to prevent invasion by alien species.

(iii) It should be able to restore itself in a short period of time.

(iv) Variations should be minimal in the community. $\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2}$

Q. 14. Giving two reasons explain why there is more species biodiversity in tropical latitudes than in temperate ones.

[U] [Outside Delhi, Delhi, 2010]

Ans. (i) Tropical environments, unlike temperate ones, are less seasonal, relatively more constant and predictable. Such constant environments promote niche specialization and lead to a greater species diversity. 1

(ii) There is more solar energy available in the tropics, which contributes to higher productivity; this in turn might contribute indirectly to greater diversity. 1

[CBSE Marking Scheme, 2010]

Q. 15. Why certain regions have been declared as biodiversity 'hot spots' by environmentalists of the world ? Name any two (hotspot) regions of India. [A] [Delhi Comppt. 2010]

Ans. Faced with the conflict between development and conservation, many nations find it unrealistic and economically not feasible to conserve all their biological wealth. Invariably, the number of species waiting to be saved from extinction far exceeds the conservation resources available.

Hence, conservationists have declared certain regions as "hot spots" for maximum protection of these regions which have high levels of species richness and high degree of endemism.

Example, Western Ghats, Sri Lanka and Himalaya. 2

[AI] Q. 16. Evaluate the effect of loss of biodiversity in a region. Mention any four such effects.

[C] [CBSE SQP, 2017-18]

Ans. (i) Decline in plant production/Decline in number of animal species

(ii) Lowered resistance to environmental perturbations such as drought

(iii) Increased variability in certain ecosystem processes such as plant productivity / water use / pest & disease cycles

(iv) Species may become endangered / increased rate of species extinction. $\frac{1}{2} \times 4 = 2$

[CBSE Marking Scheme, 2017]



Short Answer Type Questions-II

(3 marks each)

Q. 1. Explain, giving three reasons, why tropics show greatest levels of species diversity.

[U] [Outside Delhi Set-II, 2014]

Ans. (i) Tropical latitude have remained relatively undisturbed, have a long evolutionary time for species diversification. $\frac{1}{2} + \frac{1}{2}$

(ii) Less seasonal variations, constant and predictable environmental condition, promote niche specialization for greater species diversity. $\frac{1}{2} + \frac{1}{2}$

(iii) More availability of solar energy, contributes to higher productivity. $\frac{1}{2} + \frac{1}{2}$

[CBSE Marking Scheme, 2014]

Detailed Answer :

(i) Speciation is generally a function of time. Unlike temperate regions subjected to frequent glaciations in the past, tropical latitudes have remained relatively undisturbed for millions of years and thus, had a long evolutionary time for species diversification.

(ii) Tropical 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 tropics, which contributes to higher productivity; this in turn might contribute indirectly to greater diversity.

Q. 2. Alien species are highly invasive and are a threat to indigenous species. Substantiate this statement with any three examples.

[A] [CBSE SQP, 2018, Outside Delhi Set-II, 2014]

- Ans.** (i) Nile perch introduced into Lake Victoria in East Africa led to the extinction of Cichlids fish. 1
 (ii) *Parthenium/Lantana/Eichhornia* are invasive plants and pose a threat to indigenous species. 1
 (iii) Introduction of African catfish (*Clarias gariepinus*) to aquaculture is a threat to Indian catfishes. 1

[CBSE Marking Scheme, 2018]

Detailed Answer :

- (i) The Nile perch introduced into Lake Victoria in east Africa led eventually to the extinction of an ecologically unique assemblage of more than 200 species of cichlid fish in the lake. Since, cichlid fish became extinct and so the Nile perch, not finding any food for itself, died too.
 (ii) The environmental damage caused a threat to our native species by invasive weed species like carrot grass (*Parthenium*), Lantana and water hyacinth (*Eichhornia*).
 (ii) The recent illegal introduction of the African catfish *Clarias gariepinus* for aquaculture purposes is posing a threat to the indigenous catfishes in our rivers.

Q. 3. Since the origin of life on the earth, there were five episodes of mass extinction of species.

- (i) How is the 'Sixth Extinction', presently in progress, different from the previous episodes?
 (ii) Who is mainly responsible for the 'Sixth Extinction'?
 (iii) List any four points that can help to overcome this disaster.

[A] [Delhi Set-III, 2014]

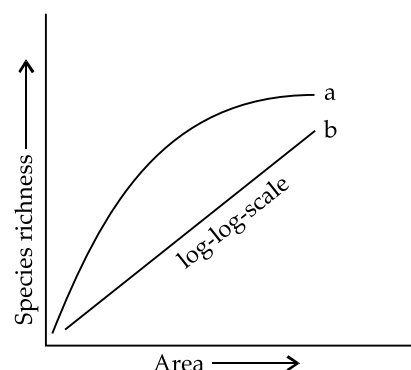
[Outside Delhi Set-II, 2014]

- Ans.** (i) The rates are faster / accelerated / current species extinction rate are estimated to be 100-1000 times faster than in the pre-human times.
 (ii) Human activities.
 (iii) (a) Preventing habitat loss and fragmentation
 (b) Checking over exploitation
 (c) Preventing alien species invasion
 (d) Preventing co-extinction
 (e) Conservation / Preservation of species. 3

[CBSE Marking Scheme, 2014]

[AI] Q. 4. The following graph shows the species-area relationship. Answer the following question as directed.

- (i) Name the naturalist who studied the kind of relationship shown in the graph. Write the observation made by him.
 (ii) Write the situations as discovered by the ecologists when the value of 'Z' (slope of the line) lies



(a) 0.1 and 0.2

(b) 0.6 and 1.2

What does 'Z' stand for ?

(iii) When would the slope of the line 'b' become steeper ? [E & A] [Outside Delhi Set - III, 2014]

Ans. (i) Alexander Von Humboldt. Within a region species richness increased with increasing explored area but only up to a limit.

(ii) (a) The slopes of regression lines are similar / unaffected distribution in an area / normal range.

(b) The slope of regression is steeper when we analyse the species area relationship among very large areas like entire continent. Z (slope of the line) regression co-efficient.

(iii) If species richness is more / 0.62 – 1.2. 3

[CBSE Marking Scheme, 2014]

Q. 5. Taking one example each of habitat loss & fragmentation, explain how are the two responsible for biodiversity loss.

[A] [Outside Delhi Set-I, 2012]

Ans. Habitat loss and fragmentation are two main causes of extinction of plants and animals and therefore loss of biodiversity. One of the important examples of habitat loss is the reduction in area of tropical rain forests. The Amazonian forests commonly called as lungs of planet are cleared for cultivation. This has resulted in extinction of a number of species and thus loss of biodiversity.

Fragmentation of habitat disrupts the interaction amongst species and annihilation of species resulting in the decreased biodiversity. 3

Q. 6. Co-extinction and introduction of alien species too are responsible for the loss of biodiversity.

Explain, how. [U] [Foreign 2017, Set - I, II]

Ans. Co-extinction : When a species becomes extinct, the plant and animal species associated with it in the obligatory way, also becomes extinct

$$\frac{1}{2} \times 3 = 1\frac{1}{2}$$

Introduction of alien species : When alien species are introduced, some of them turn invasive (because of not having their predator there), and hence cause decline / extinction of indigenous species

$$\frac{1}{2} \times 3 = 1\frac{1}{2}$$

[CBSE Marking Scheme, 2017]

Q. 7. Explain the level of biodiversity at genetic, specific and ecological levels with the help of one example for each of the three.

[R] [Outside Delhi Set-III, Comptt. 2016]

Ans. Genetic level : A single species might show high diversity at genetic level, e.g., *Rauwolfia vomitoria*/rice/Mango (any other suitable example)

Specific level : Diversity at species level, e.g. Amphibian species (Any other suitable example)

Ecological level : Diversity at ecosystem level, e.g., Deserts/rain forest/mangroves/ coral reef/ wet lands/estuaries/ alpine meadows/ (Any other suitable example) $1 \times 3 = 3$

[CBSE Marking Scheme, 2016]

Answering Tip

- Understand the differences between level of biodiversity at genetic, species and ecological levels in tabular form with proper example.

Q. 8. (a) "India has greater ecosystem diversity than Norway." Do you agree with the statement ? Give reasons in support of your answer.

(b) Write the difference between genetic biodiversity and species biodiversity that exists at all levels of biological organization.

[A] [Delhi/Outside Delhi, 2018]

Ans. (a) Yes $\frac{1}{2}$
India / tropical region : (i) are less seasonal / more constant / more predictable.
 (ii) promote niche specialisation leading to greater bio-diversity.

(iii) Species diversity increases as we move towards equator.

(iv) More number of species exist.

Norway / temperate region : (i) more seasonal / less constant / less predictable.

(ii) do not promote niche specialisation leading to low bio-diversity.

(iii) Species diversity decreases as we move away from equator.

(iv) Less number of species exist. (Any one)

(b) (i) Genetic diversity : Diversity / variation within a species over its distributional range/ (same explanation with the help of a correct examples)

(ii) Species diversity : Diversity / variation at a species level (same explained with the help of a correct example). [1 + 2 = 3 marks]

[CBSE Marking Scheme, 2018]

Detailed Answer :

(a) Yes, India has greater ecosystem diversity than Norway. It is because India lies primarily in the tropical and sub-tropical zone while Norway lies near the Arctic region. This exposes the India to greater amounts of sunlight and thus greater level of ecosystem diversity.

(b) Difference between genetic diversity and species diversity :

Genetic diversity	Species diversity
It refers to the number of genes and their alleles found in organisms.	It refers to the numbers of species per unit area.
It increases as we move up the biological organization.	It may or may not increase to a greater extent as we move up the biological organization.

2 + 1

? Long Answer Type Question

(5 marks)

Q. 1. (i) Taking one example each of habitat loss and fragmentation, explain how are two responsible for biodiversity loss.

(ii) Explain two different ways of biodiversity conservation.

[A] [Outside Delhi Set-II, 2014]

Ans. (i) Habitat loss—Amazon rain forest destroyed for soya beans cultivation for growing grass land, for grazing cattle / colonisation of Pacific islands—extinction of 2000 species of native birds.

Fragmentation—By human activity—migratory birds and animals are affected.

(ii) Ex situ, Threatened organism are taken out from the natural habitat and placed in special setting with care and protection. e.g., Zoological park / botanical garden / wild safari.

In situ, Threatened organisms are conserved in their natural habitat e.g. National park / Biosphere reserves. 5

[CBSE Marking Scheme, 2014]

Commonly Made Error

- Many students fail to explain the examples correctly. They get confused with the technical terms. Many of them explained the term but could not give correct examples.

Q. 2. (i) Indiscriminate human activities such as alien species invasion, fragmentation and habitat loss have accelerated the loss of biodiversity. Justify by taking one example for each.

(ii) State the importance of (a) IUCN Red data list and (b) Hot spots in conservation of biodiversity.

[U] [Delhi Comptt. - 2017, Set - II]

Ans. (i) Alien species invasion :

When alien species are introduced unintentionally or deliberately for whatever purpose, some of them turn invasive and decline/ extinction of indigenous species **Examples:**

- (a) The introduction of African catfish / *Clarias gariepinus* (for aquaculture purpose) poses a threat to indigenous catfishes in our rivers.
- (b) The Nile perch introduced into lake Victoria in East Africa led to the extinction of more than 200 species of Cichlid fish in the lake.
- (c) Carrot grass / *Parthenium*, *Lantana*, Water hyacinth / *Eichhornia* poses a threat to indigenous species.

Fragmentation :

- (a) When large habitats are broken into small fragments due to various human activities.
- (b) Mammals / birds requiring large territories and certain animals with migratory habits are badly affected.

Habitat Loss : The Amazon rain forest is being cut and cleared for cultivating soyabeans / conversion to grasslands for raising cattle.

- (ii) (a) Provides information regarding extinction of species
- (b) Regions with very high levels of species richness, high degree of endemism / species confined to that region and not found anywhere else are identified which need to be conserved in all priority basis.

3+2



TOPIC-2

Conservation of Biodiversity

Revision Notes

There are three main reasons for conserving the biodiversity which are categorized as follows :

(a) Narrowly Utilitarian Arguments

- Humans derive economic benefits from nature such as food, firewood, fibre, construction material, industrial products (tannins, lubricants, dyes, resins, perfumes) and medicines.
- More than 25% of the drugs are derived from plants.
- 25,000 species of plants have medicinal value.
- Exploring molecular, genetic and species-level diversity for i.e. 'bioprospecting' products of economic importance may enormously benefit nations with rich biodiversity.

(b) Broadly Utilitarian Arguments

- Biodiversity has many ecosystem services.
- Amazon forest produces 20% of total O₂ in the earth's atmosphere by the process of photosynthesis.
- Pollination service takes place through bees, bumblebees, birds and bats.
- Aesthetic pleasures such as walking through thick woods, watching spring flowers in full bloom or waking by hearing a bulbul's song in the morning.
- Other indirect benefits are pest control, climate moderation and flood control.

(c) Ethical Arguments

- Every species has an intrinsic value.
- We have a moral duty to take care for their well-being.

CONSERVATION BIODIVERSITY

Types of Conservation

(a) In situ conservation (on site)

- It is the conservation of genetic resources within natural or human-made ecosystems in which they occur.
- E.g. Protected areas such as National Parks, Sanctuaries, Biosphere reserves, cultural landscapes, national monuments.

(i) National Park

- Strictly reserved for the welfare of the wildlife where private ownership, cultivation, grazing etc are prohibited.
- There are 90 national parks in India.

(ii) Sanctuary

- Here, protection is given only to the animals.

- Collection of timbers, minor forest products and private ownership are allowed so long as they do not harm the animals.
 - There are 448 wildlife sanctuaries in India.
 - (iii) **Biosphere Reserves**
 - Areas of land or coastal environments to conserve ecosystem and genetic resources contained therein.
 - There are 14 biosphere reserves in India.
 - (iv) **Sacred Forests (Sacred Groves)**
 - Sacred groves are highly protected forests because of religious and cultural traditions.
 - Sacred groves in Khasi and Jaintia Hills in Meghalaya
 - Aravalli Hills of Rajasthan
 - Western Ghat regions of Karnataka & Maharashtra
 - Sarguja, Chanda and Bastar areas of Madhya Pradesh.
 - In Meghalaya, the sacred groves are the last refuges for a large number of rare and threatened plants.
 - (v) **Hotspots**
 - These are the richest and the most threatened reservoirs of plant and animal life on earth.
 - There are 34 hotspots in the world.
 - In total all the biodiversity hotspots cover less than 2% of the earth's land area but could reduce the ongoing extinctions by almost 30%.
 - Three main hotspots (Western Ghats and Sri Lanka, Indo-Burma and Himalaya) cover India's biodiversity regions.
 - (b) **Ex situ conservation (off site)**
 - It is the conservation of organisms outside their habitats.
 - In this approach, threatened animals and plants are taken out from their natural habitat and placed in special setting where they can be protected and given special care. *e.g.*, genetic resource centres, zoological parks, botanical gardens, gene banks etc.
 - In recent years, *ex-situ* conservation has advanced by preserving the gametes of threatened species in viable and fertile condition for long periods using cryopreservation techniques, eggs can be fertilised *in-vitro*, and plants can be propagated using tissue culture methods.
 - Seeds of different genetic strains of commercially important plants can be kept for long periods in seed banks.
- International Efforts for Conserving Biodiversity**
- **The Earth Summit (Rio de Janeiro, 1992) - Three objectives :**
 - (a) Conservation of biodiversity
 - (b) Sustainable use of biodiversity
 - (c) Sharing of benefits in the utilization of genetic resources.
 - The World Summit on Sustainable Development (Johannesburg, South Africa, 2002) : 190 countries pledged to reduce the current rate of biodiversity loss.



Very Short Answer Type Questions

(1 mark each)

Q. 1. Why have Western Ghats in India been declared as biological hot spots ?

[R] [Outside Set-III, Comptt. 2015]

Ans. Due to greater species diversity/presence of endemic species. $\frac{1}{2} + \frac{1}{2}$

[CBSE Marking Scheme, 2015]

Q. 2. Write the importance of cryopreservation in conservation of biodiversity. [R]

[Outside Delhi Set-I, 2011]

Ans. Gametes of threatened species / seeds of commercially important strains can be preserved, in viable and fertile condition / for long periods. 1

[CBSE Marking Scheme, 2011]

Detailed Answer :

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

cryopreservation techniques, eggs can be fertilised *in-vitro*, and plants can be propagated using tissue culture methods. 1

Answering Tip

- Learn the meaning of the term 'cryopreservation'- cryo indicates cold or low temperature and preservation of germplasm should be highlighted.

Q. 3. State the use of biodiversity in modern agriculture.

[A] [Outside Delhi, Set, 2011]

Ans. Biodiversity is useful in modern agriculture because it is source of hybrids, GM Crops, biopesticides, biofertilizers, improved variety of plants and also disease resistant plants. 1



Short Answer Type Questions-I

(2 marks each)

Q. 1. Why are sacred groves highly protected ?

[U] [Outside Delhi Set-I, 2016]

Ans. Sacred groves are highly protected because of religious and cultural traditions, refugees for large number of rare and threatened plants, ecologically unique and biodiversity rich regions. 1+1=2

[CBSE Marking Scheme, 2016]

Detailed Answer :

The sacred groves are forest fragments which are regenerated around places of worship. They are highly protected by certain communities because they are of religious importance to the communities. They have a significant role in *in-situ* conservation.

AI Q. 2. List any four techniques where the principle of *ex-situ* conservation of biodiversity has been employed. [U] [Outside Delhi Set-I, 2015]

OR

State how does *ex-situ* conservation help in protecting biodiversity.

[Foreign - 2017, Set - I, II, III]

Ans. Cryopreservation, *in vitro* fertilisation, micro-propagation / tissue culture, sperm bank / seed bank / gene bank $\frac{1}{2} \times 4 = 2$

[CBSE Marking Scheme, 2015]

Detailed Answer :

Four techniques where the principle of *ex-situ* conservation of bio-diversity has been employed are as follows :

- Preservation of the gametes of threatened species (using cryopreservation technique) in viable and fertile condition for long periods.
- In vitro* fertilization of eggs.
- Propagation of plants using tissue culture technique.
- Keeping the seeds of different genetic strains that are commercially important plants for long period in seed bankers.

2

Commonly Made Error

- Students get confused between examples of *in-situ* and *ex-situ* conservation of biodiversity.

Answering Tip

- In -situ* and *ex-situ* method of conservation should be clearly discussed for proper understanding.

Q. 3. Differentiate between *in-situ* and *ex-situ* approaches of conservation of biodiversity.

[U] [Delhi Set-II, 2011]

Ans.

in-situ	ex-situ
Protection of endangered species of plants and animals by protecting the natural habitat/ecosystem.	Protection of endangered species by removing them from the natural habitat and placing under special care.

2

[CBSE Marking Scheme, 2011]

Q. 4. Suggest two practices giving one example of each, that help protect rare or threatened species.

[A] [Outside Delhi 2017, Set - I, II, III]

Ans. (i) In situ conservation, biodiversity hotspot / biosphere reserve / national parks / sanctuaries / Ramsar sites / sacred groves

(Any one) $\frac{1}{2} + \frac{1}{2}$

(ii) Ex situ conservation, Zoological parks / botanical garden / wild life safari parks / cryopreservation techniques / Tissue culture / seed bank / pollen banks. (Any one) $\frac{1}{2} + \frac{1}{2}$

[CBSE Marking Scheme, 2017]



Short Answer Type Questions-II

(3 marks each)

Q. 1. Why should biodiversity be conserved ? Explain giving three reasons.

[U] [Outside Delhi Set, II, Comptt., 2016]

Ans. Narrowly utilitarian : Humans derive direct economic benefits from nature (or explained with example).

Broadly utilitarian : Provides many ecosystem services such as provide oxygen (through photosynthesis), prevents pollution, provides aesthetic pleasure.

Ethical : We share this planet with millions of other organisms and every species has intrinsic value and it is our moral duty to conserve them and pass on the legacy to future generation.

$\frac{1}{2} \times 6 = 3$

[CBSE Marking Scheme, 2016]

AI Q. 2. Narrowly utilitarian arguments are put forth in support of biodiversity conservation. Explain the other two arguments that are put forth in support of the same cause.

[A] [Foreign Set-I, 2016]

Ans. Broadly utilitarian arguments : Biodiversity plays an important role in maintaining sustaining supply of good & ecological services. 1

The different ecosystem services provided are : purifies air, cycling of nutrients, habitat for wildlife, pollinating crops, aesthetic pleasure. $\frac{1}{2} \times 2 = 1$

Ethical reasons :

It is our philosophical/spiritual & moral duty to ensure well being of all living beings for utilization of future generations. $\frac{1}{2} \times 2 = 1$

[CBSE Marking Scheme, 2016]

Q. 3. Many plant and animal species are on the verge of their extinction because of loss of forest land by indiscriminate use by the humans. As biology student what method would you suggest along with its advantages that can protect such threatened species from getting extinct ?

[C] [Delhi Set-I, 2015]

Ans. As a biology student, I would suggest the following method that can protect these threatened species from becoming extinct:

Ex situ conservation : The threatened species of plants and animals are taken out of their habitats and are kept in special setting such as zoological parks, botanical gardens and wildlife sanctuaries.

In the present scenario, the gametes of endangered species can be preserved by methods like cryopreservation and can be fertilised *in vitro* followed by propagation through tissue culture methods. Similarly, seeds can be preserved in seed banks. This type of conservation method is an off-site conservation method. 3

[CBSE Marking Scheme, 2015]

Answering Tip

- Advise students to read the questions carefully and answer the questions part-by-part.

Q. 4. There are many animals that have become extinct in the wild but continue to be maintained in Zoological parks.

(i) What type of biodiversity conservation is observed in this case ?

(ii) Explain any other two ways that help in this type of conservation. [A] [Delhi Set-III, 2014]

Ans. (i) It is an example of *ex-situ* conservation (off-site conservation). In this approach, threatened plants and animals are taken out of their natural habitat and placed into suitable settings and given special care.

(ii) Cryopreservation and tissue culture are two ways that help in *ex-situ* conservation.

In cryopreservation, gametes of threatened species are preserved in viable and fertile conditions at subzero temperatures, which helps in preserving these cells for longer periods. In tissue culture, plants are propagated from a small mass of tissue called callus. 3

[CBSE Marking Scheme, 2014]

Q. 5. (i) Why is there a need to conserve biodiversity ?

(ii) Name and explain any two ways that are responsible for the loss of biodiversity.

[A] [Delhi Set-II, III, 2014]

[Delhi - Set - I, II, III - 2017]

Ans. (i) (a) To continue to get the products of human consumption.

(b) Plays a major role in many ecosystem services that nature provides and that is invaluable.

(c) Moral duty to pass on biological legacy in good order to future generations.

(ii) (a) **Habitat loss and fragmentation :** large habitats when broken lead to loss of habitat for animals needing large territories (are badly affected) – population decline.

(b) **Over exploitation :** leading to extinction of many, especially commercially important species.

(c) **Alien species invasion :** alien species when introduced may turn invasive causing decline and extinction of indigenous species // explain with an example.

(d) **Co-extinction :** when one species become extinct, any other organism intimately associated also becomes extinct. 3

[CBSE Marking Scheme, 2014]

Answering Tip

- Always write the answer pointwise and each point must reflect a separate idea. Do not repeat the same point in different words.

Q. 6. The sacred groves of Aravalli Hills and Ooty botanical garden both aim at biodiversity conservation. How do they differ in their approached ? Explain.

[A] [Outside Delhi Set-I,II, Comptt. 2013]

Ans. Sacred groves are the areas of Aravalli Hills where forest patches around places of worship are held in high esteem by tribals. All the trees and wildlife are given protection by tribals. Not a single branch is allowed to be cut from these forests. As a result, many endemic species that are rare or have become extinct elsewhere can be seen to flourish here. Thus they help to conserve rare and threatened species of plants and animals. Ooty botanical garden conserves threatened and endangered species through *ex-situ* conservation technologies, involving seed bank, tissue culture facilities etc. 3

Q. 7. (i) What are the two types of desirable approaches to conserve biodiversity ? Explain with examples bringing out the difference between the two types.

(ii) What is the association between the bumblebee and its favourite orchid *Ophrys* ? How would extinction or change of one affect the other ?

[U] [Delhi Set-II, 2012]

Ans. (i) The two types of desirable approaches to conserve biodiversity are *in-situ* and *ex-situ* conservation.

Difference between in-situ and ex-situ conservation of biodiversity : Refer: SAQ-I/ Q.3

(ii) Commensalism is the type of association seen between the bumble bee and the orchid *Ophrys*. In this type of association, one species is benefitted and the other is neither harmed nor benefitted. Extinction of bumble bee will definitely affect the orchid flower because these bees are the means of pollination for the flower and if they get extinct then the pollination percentage will be reduced. $1\frac{1}{2} + 1\frac{1}{2} = 3$

Commonly Made Error

- In situ and Ex situ modes of conservation were mixed up.
- Some students write general points. Many of them discuss the importance of biodiversity and the consequences of loss of biodiversity.

Answering Tip

- Understand the topics *In situ* and *Ex situ* separately with relevant examples.

Q. 8. 'In-situ' conservation can help endangered / threatened species. Justify the statement.

[A] [Delhi - 2017, Set - I, II, III]

Ans. Threatened organisms are conserved in their natural habitat / ecosystem, and such regions are legally protected $1 + 1$

As hotspots / biosphere reserves / national parks / sanctuaries / sacred groves / ramsar sites

(Any two names) $\frac{1}{2} + \frac{1}{2}$

[CBSE Marking Scheme, 2017]

Detailed Answer :

In-situ conservation is the conservation of genetic resources within natural or human made ecosystems in which they occur. *e.g.*, Protected areas such as National Parks, sanctuaries, biosphere reserves, cultural landscape, national monuments etc.

Q. 9. Explain the 'Ex-situ conservation' of Biodiversity. How is the in-situ conservation different from it ?

[U] [Delhi/Outside Delhi, Comptt, Set 1,2,3, 2018]

Ans. Ex-situ - 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, by keeping the gametes of threatened species preserved in viable and fertile condition for long time $\frac{1}{2} + \frac{1}{2}$

Zoological parks / botanical gardens / wildlife safari parks / cryopreservation / eggs can be fertilised *in vitro* / tissue culture method / seed banks (Any correct example explained) 1

In-situ conservation: Organisms are given protection in their natural habitat in which biodiversity is protected at all levels 1

[CBSE Marking Scheme, 2018]

Answering Tip

- Learn the differences point wise and in a tabular form along with examples for better understanding and retention.

? Long Answer Type Questions

(5 marks each)

[AI] Q. 1. (i) Why should we conserve biodiversity ? How can we do it ? **[C] [KVS]**

(ii) Explain the importance of biodiversity hot spots and sacred groves. **[Delhi Set-I, 2016]**

Ans. (i) (a) • **Narrowly utilitarian** - related examples like derive economic benefits from nature: food (cereals, pulses, fruits) / firewood / fibre / construction materials / industrial products (tannins, lubricants, dyes, resins, perfumes) / product of medicinal importance / drugs.

• **Broadly utilitarian** - 20% of total O_2 from Amazon forests / pollination / aesthetic pleasures.

• **Ethical** - millions of species (plants, animals, microbes) share this planet / we need to realise that every species has an intrinsic value / we have a moral duty to care for their well-being and pass on our biological legacy to future generations.

(b) • *In situ* conservation / biosphere reserves / national parks / sanctuaries / sacred groves.

- *Ex situ* conservation / zoological parks / botanical gardens / wild life safari parks / cryopreservation / seed banks / tissue culture (eggs *in vitro*) 3

(ii) Hot spots : Regions with high level of species richness, high degree of endemism.

Sacred groves : Tracts of forest containing tree / wild life were venerated and given total protection / to protect a large number of rare, and threatened plants. 2

[CBSE Marking Scheme, 2016]

Detailed Answer :

(i) We should conserve bio-diversity because of the following reasons :

- (a)** Humans derive countless economic benefits from nature like
- Food (cereals, pulses, fruits)
 - Wood, fibre, construction material, industrial products (tannins, lubricants, dyes, resins, perfumes)

- Products of medicinal importance
- (b) Biodiversity plays a major role in many ecosystem services that nature provides such as production of oxygen and pollination.
- (c) It is our moral duty to care for well being and pass on our biological legacy in good order to future generations.

We can conserve biodiversity by following ways :

- (a) **In situ** conservation : It is the conservation of genetic resources within natural or human-made ecosystems in which they occur. e.g., protected areas such as national parks, sanctuaries, biosphere reserves, cultural


landscapes, natural monuments.

- (b) **Ex situ** conservation (off site) : It is the conservation of organisms outside their habitats, e.g., genetic resource centres, zoological parks, botanical gardens, gene banks, etc.
- (ii) Biodiversity hotspots and sacred groves are the regions that are rich in biodiversity. A system with greater biodiversity is more stable and has greater productivity. Hence, biodiversity is related with overall health of our ecosystem and the survival of human race on the earth.

3 + 2

Know the Terms

- **Exotic species** : They are known as alien species that are introduced into a habitat by humans.
- **Biosphere reserve** : A reserve area for multiple use of land but having many zones.
- **Red list** : A catalogue highlighting the challenged taxons that are on the verge of global extinction.
- **WCU** : World Conservation Union (formerly called IUCN).
- **IUCN** : International Union for Conservation of Nature and Natural resource.
- **Biodiversity** : It is the variety of living forms present in various ecosystems.
- **Genetic diversity** : Diversity shown by a single species at genetic level.
- **Species diversity** : Diversity at the species level.
- **Ecological diversity** : Diversity at the ecosystem level.
- **Hotspots** : These are the areas or regions of high endemism and very high levels of species richness.
- **Extinct species** : Species that no longer exist on earth.
- **In situ conservation (on site)** : It is the conservation of genetic resources within natural or human-made ecosystems in which they occur.
- **Ex situ conservation (off site)** : It is the conservation of organisms outside their habitats.

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