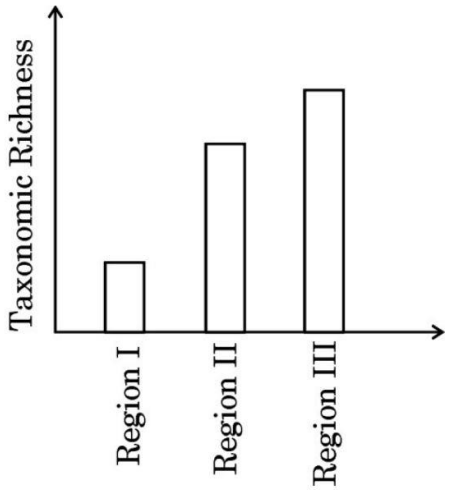
Biodiversity and its Conservation

1. Case-based questions. Each question has 3 sub-questions with internal choice in one sub-question. (2024)

Read the following passage and answer the questions that follow. 4 total land area whereas its share of the global species diversity is an impressive 8·1 per cent ! However, in these estimates of species, prokaryotes do not figure anywhere.

Biologists are always keen on collecting data with respect to species diversity observed in different regions of the world. The data collected based on the survey conducted for species richness of groups of mammals in three different regions of the world is shown in the bar graph given below :



(a) Why is the species richness maximum in Region III in the bar graph ?

Ans. This region is less seasonal with constant and more predictable environment / More solar energy so higher productivity and higher diversity / it represent tropical lattitudes which remain relatively undisturbed for millions of years and had a long evolutionary time for species diversification.

OR

(a) Why is the species richness minimum in Region I in the bar graph ?

Ans. Region I represent temperate region subjected to frequent glaciation and get lesser evolutionary time for species diversification / has more seasonal with less constant and less predictable environment which lead to lower specie diversification / have lower solar energy available which reduces productivity and inturn contributes to lesser diversity.

(b) Plants and animals do not have uniform diversity in the world but show rather uneven distribution. Mention what this kind of diversity is referred to as.

Ans. Latitudinal gradient in diversity

(c) Why is it that prokaryotes do not have an estimated number of their species diversity as seen in plants and animals ? Explain.

Ans. Conventional taxonomic methods are not suitable for identifying microbial species, and many species are not culturable under laboratory conditions.

Previous Years' CBSE Board Questions

13.1 Biodiversity

MCQ

1. The IUCN Red Data List (2004) in the last 500 years documents the extinction of nearly 784 species including

(a) 330 invertebrates (b) 338 invertebrates

(c) 359 invertebrates (d) 362 invertebrates. **(2023)**

2. Human settlement often leads to habitat loss which leads to fragmentation, forming smaller patches of habitats. Select the statements that describe how a small patch differs from a large patch of the same habitat.

(i) Invasive species will never be seen here.

(ii) Population of large animals decreases.

(iii) Biodiversity decreases.

(iv) Competition from surrounding habitats increases.

(a) (ii), (iii) and (iv) only (b) (ii) and (iv) only

(c) (i) and (iii) only (d) (i), (ii) and (iii) only

(2023)

3. It is observed that the species diversity decreases as we

(a) move away from equator to poles

(b) move towards equator from poles

(c) move along the equator

(d) move from deserts to rainforests. **(2020)**

4. Species-area relationship is represented on a log scale as

(a) hyperbola

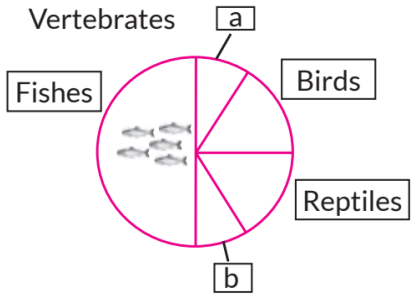
(b) rectangular hyperbola

(c) linear

(d) inverted. **(2020)**

VSA (1 mark)

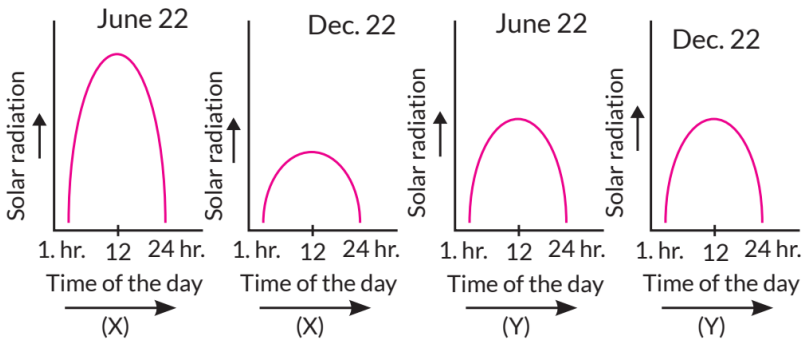
5. Identify 'a' and 'b' in the figure given below representing proportionate number of major vertebrate taxa.



(Delhi 2014)

SA I (2 marks)

6. The graphs (X) and (Y) below depict the diurnal variations in the solar radiations in the month of June (Summer) and in December (Winters):



(i) Which of the two graphs depicts tropical region and temperate regions respectively?

(ii) Which of the two region (X) or (Y) will show high biological diversity and why? **(Term II, 2021-22)**

7. Substantiate with the help of one example that in an ecosystem mutualists (i) tend to co-evolve and (ii) are also one of the major causes of biodiversity loss. **(Delhi 2019)**

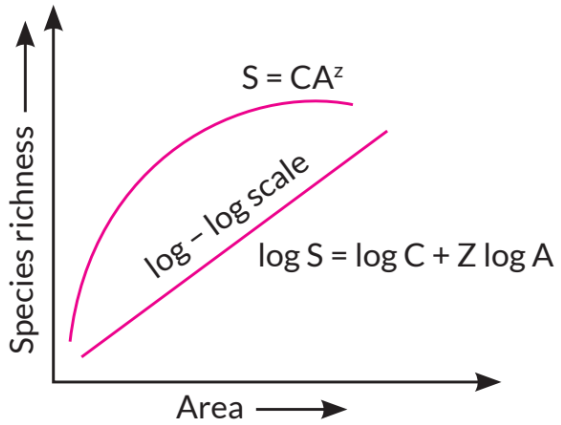
8. List four causes of biodiversity loss. **(Delhi 2014C)**

SA II (3 marks)

9. Explain the concept of "co-extinction" by taking two examples. **(Term II, 2021-22)**

10. (a) Write the inference drawn by Alexander von Humboldt after his extensive explorations of South American jungle.

(b) Study the graph given below:



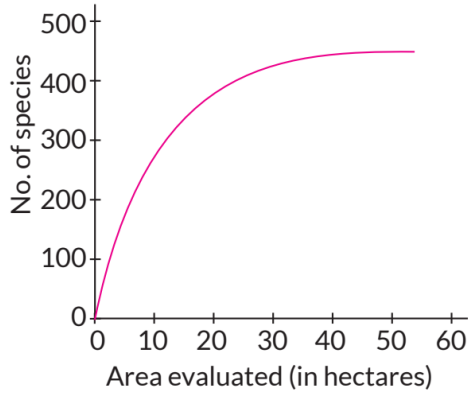
As per Alexander von Humboldt, what do the symbols S, A, Z and C in the graph stand for, in respect of a species and area relationship?
(Term II, 2021-22)

11. How have the following factors affected the biodiversity of an area? Explain.

(a) Habitat loss and fragmentation

(b) Over-exploitation **(Term II, 2021-22 C)**

12. The graph given below shows species-area relationship of a certain region.



(i) Study the graph and explain what it represents.

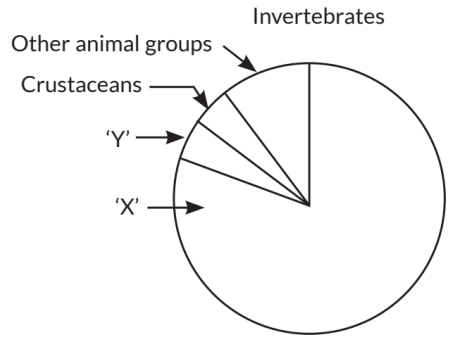
(ii) After a while, a small area was taken for constructing a road which divided the region into two. Write the impact this construction would have on species richness of the region.

(Term II, 2021-22)

13. How did Dr. David Tilman relate experimentally, the stability of a community and its species richness? Explain.

(Term II, 2021–22)

14. Study the pie chart given below, representing the global diversity: proportionate number of species of major taxa and answer the following questions based on it.



(a) Identify 'X' and 'Y' in the given pie chart.

(b) Which one of the two, 'X' or 'Y', is the most species rich taxonomic group and by what percentage? **(Term II, 2021-22 C)**

15. What are the consequences of loss of biodiversity in a region? Explain.

(Term II, 2021–22)

16. Given below is an equation describing the Species-Area relationship between species richness and area for a wide variety of taxa as angiosperm plants, birds, bats etc.

$$S = CA^Z$$

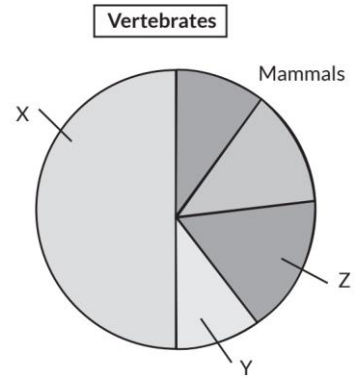
(i) Give a graphical representation of the given equation showing Species-Area relationship.

(ii) What does 'S' represent in the given equation?

(iii) What is the value of 'Z' (regression coefficient) for frugivorous birds and mammals in the tropical forests of different continents?

(Term II, 2021-22)

17. Given below is a 'pie chart' representing the global biodiversity: proportionate number of species of major taxa.

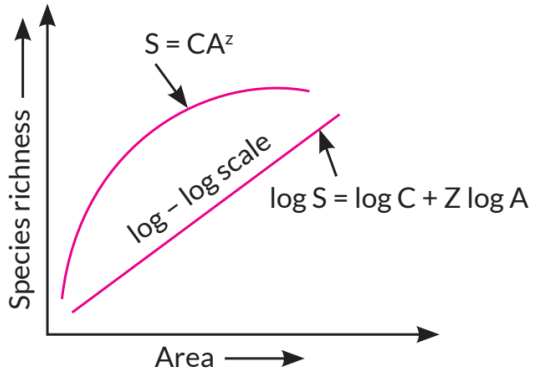


(i) Identify (X) and (Y) in the given 'pie chart'.

(ii) "Extinction of species across taxa are not random." Which group amongst the vertebrates is more vulnerable to extinction?

(iii) Give one example each of recent extinctions of species in Russia, Mauritius and Australia. **(Term II, 2021-22)**

18. Study the graphical representation of Species richness-Area relationship given below and answer the questions that follow:



(a) What do S, C, Zand A represent in the given graph?

(b) What will be the range value of 'Z line' if we analyse the species-area relationship among very large areas like entire continent?
(2021 C)

19. Alien species invasion has been a threat to biodiversity. Justify with the help of a suitable example. List any other three causes responsible for such a loss.
(2020)

20. Tigers inhabit forests. Over the past many decades, the tiger population was on the decline in our country. A project 'Save Tiger' was launched in 1973 to conserve this precious species. It is heartening to see in the last couple of decades that there has been a gradual increase in the tiger population in our country.

Answer the questions:

(a) Mention one major cause responsible for the decline in tiger population.

(b) Write one main effort of the biodiversity conservationists that must have helped in the increase in tiger population.

(c) State how it is possible to count the number of tigers in a forest area.
(2020 C)

21. Name and describe any three causes of biodiversity losses.
(Delhi 2017)

22. The following graph shows the species-area relationship. Answer the following questions as directed.

(a) Name the naturalist who studied the kind of relationship shown in the graph. Write the observation made by him.

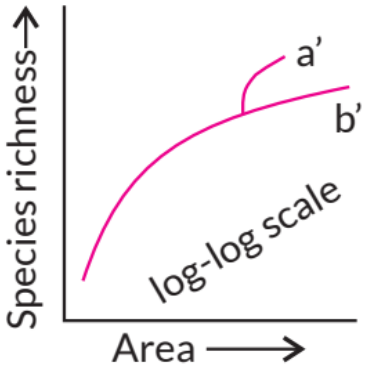
(b) Write the situation as discovered by the ecologists when the value of 'Z' (slope of the line) lies between.

(i) 0.1 and 0.2

(ii) 0.6 and 1.2

What does 'Z' stand for?

(c) When would the slope of the line 'b' become steeper?



23. Since the origin of life on Earth, there were five episodes of mass extinction of species.

(a) How is the 'Sixth Extinction', presently in progress, different from the previous episodes?

(b) Who is mainly responsible for the 'Sixth Extinction'?

(c) List any four points that can help to overcome this disaster.
(AI 2014)

24. Explain giving three reasons, why tropics show greatest levels of species diversity? **(AI 2014)**

25. Name and explain any two ways that are responsible for the loss of biodiversity. **(3/5, Foreign 2014)**

LA (5 marks)

26. (a) According to ecologists, tropical regions in the world account for greater biological diversity. Justify.

(b) Why are habitat loss and alien species invasion considered as the causes of biodiversity loss? Explain with the help of an example of each.
(2020)

13.2 Biodiversity Conservation

MCQ

27. One of the ex-situ conservation methods for endangered species is

(a) biosphere reserves

(b) National parks

(c) cryopreservation

(d) wildlife sanctuaries.

(2020)

SA I (2 marks)

28. How are 'in-situ' and 'ex-situ' approaches of bio-diversity conservations different from each other?
(Term II, 2021-22)

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

(AI 2017)

30. Why are sacred groves highly protected?
(AI 2016)

31. List any four techniques where the principle of ex-situ conservation of biodiversity has been employed.
(AI 2015)

32. Why is there a need to conserve biodiversity?
(2/5, Foreign 2014)

SA II (3 marks)

33. "Biodiversity plays a major role in many ecosystem services that nature provides."

(a) Describe any two broadly utilitarian arguments to justify the given statement.

(b) State one ethical reason of conserving biodiversity.
(2023)

34. (a) Enlist two criteria that are used to identify a region for maximum protection as 'Biodiversity hotspot.

(b) Name any two "hotspot" regions in our country.
(Term II, 2021-22)

35. (a) Explain the concept of endemism.

(b) Name four regions in and around our country that are considered hotspots.
(2020)

36. Explain any three ways other than zoological parks, botanical gardens and wildlife sanctuaries by which threatened species of plants and animals are being conserved 'ex-situ'. **(2020)**

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

(Delhi 2017)

38. 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 a biology student what method would you suggest along with its advantages that can protect such threatened species from getting extinct? **(Delhi 2015)**

39. Compare narrowly utilitarian and broadly utilitarian approaches to conserve biodiversity, with the help of suitable examples.
(Foreign 2015)

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

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

(b) Explain any other two ways which help in this type of conservation.
(Delhi 2014)

LA (5 marks)

41. There is a great concern all over the world to conserve biodiversity for maintaining ecological balance in nature. Explain giving three reasons. Write different ways that have helped in increasing tiger population in our country.
(2020)

42. (a) Why should we conserve biodiversity? How can we do it?

(b) Explain the importance of biodiversity hotspots and sacred groves.
(Delhi 2016)

43. (a) Explain the narrowly utilitarian, broadly utilitarian and ethical arguments in favour of conservation of biodiversity.

(b) How is designation of certain areas as hotspots a step towards biodiversity conservation? Name any two hotspots in India.
(Delhi 2014C)

CBSE Sample Questions

13.1 Biodiversity

MCQ

1. Assertion: A community with more species is more stable than that with less species.

Reason: More the number of species, lesser the variation in the total biomass production year after year.

(a) Both assertion and reason are true, and reason is the correct explanation of assertion.

(b) Both assertion and reason are true, but reason is not the correct explanation of assertion.

(c) Assertion is true but reason is false.

(d) Both assertion and reason are false.

(2020-21)

VSA (1 mark)

2. Value of Z (regression coefficient) is considered for measuring the species richness of an area. If the value of Z is 0.7 for area A, and 0.15 for area B, which area has higher species richness and a steeper slope?

(Term II, 2021-22)

3. Which of the three forests- Temperate, Mangroves and Tropical Evergreen is more vulnerable to invasion by outside animals and plants?

(2020-21)

SA I (2 marks)

4. The tropical regions are likely to have more biological diversity than the temperate ones. Give two reasons to justify the statement.
(2020-21)

SA II (3 marks)

5. (a) There was loss of biodiversity in an ecosystem due to a new construction project in that area. What would be its impact on the ecosystem? State any three.

(b) List any three major causes of loss of biodiversity.

(2022-23)

6. (a) 'The Evil Quartet' describes the rates of species extinction due to human activities. Explain how the population of organisms is affected by fragmentation of the habitats.

(b) Introduction of alien species has led to environmental damage and decline of indigenous species. Give any one example of how it has affected the indigenous species.

(c) Could the extinction of Steller's Sea cow and passenger pigeon be saved by man? Give reasons to support your answer.

(Term II, 2021-22)

13.2 Biodiversity Conservation

MCQ

7. Which of the following is an example of ex situ conservation?

(a) Sacred Groves (b) National Park

(c) Biosphere Reserve (d) Seed Bank

(2022-23)

SA I (2 marks)

8. The image shown below is of a sacred grove found in India. Explain how has human involvement helped in the preservation of these biodiversity rich regions.

(Term II, 2021-22)

9. Explain how advanced ex-situ conservation techniques assist in preserving threatened species of plants and animals.

(2020-21)

Detailed SOLUTIONS

Previous Years' CBSE Board Questions

1. (c) : A Red Data Book or Red List is a catalogue of taxa facing risk of extinction. Red Data Book or Red List documents the extinction of 784 species (including 338 vertebrates, 359 invertebrates and 87 plants) in the last 500 years.

2. (c)

3. (a) : When we move away from equator to poles then the species diversity decreases.

4. (b)

5. (a) Mammals

(b) Amphibians

6. Graphs Y represents tropical region whereas graph X represents temperate region.

(ii) The tropical region (Y) will show high biological diversity. This is because tropical regions are less seasonal, relative move constant and predictable. Such constant environments promote niche specialisation and lead to greater species diversity.

7. (i) Ecosystem mutualists often tend to coevolve, like the flower and its pollinator species which are tightly linked with one another. For example, fig species can be pollinated only by its partner wasp species and by no other species.

(ii) Ecosystem mutualist results in co-extinction elimination of one species invariably leads to the extinction of the other.

8. The four causes of biodiversity loss are –

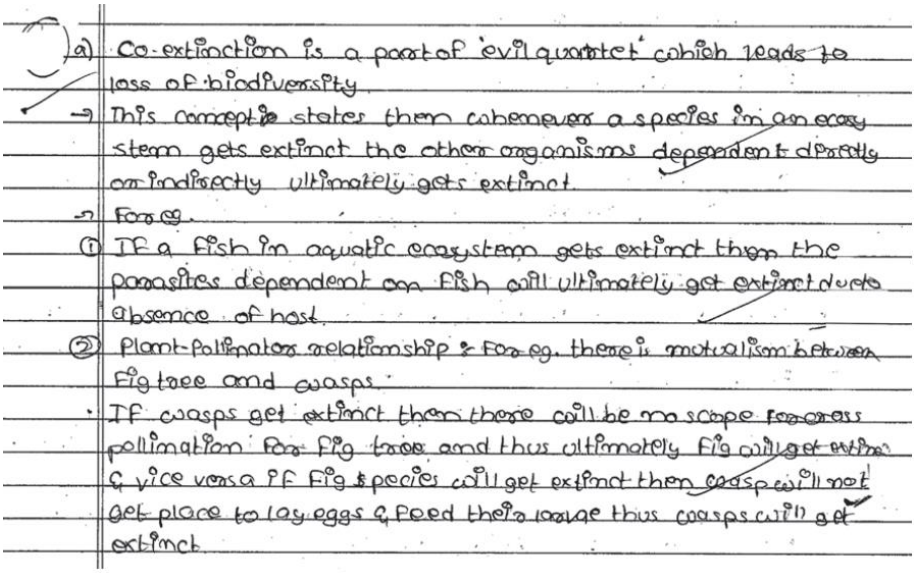
(i) Habitat loss and fragmentation

(ii) Over-exploitation

(iii) Alien species invasions

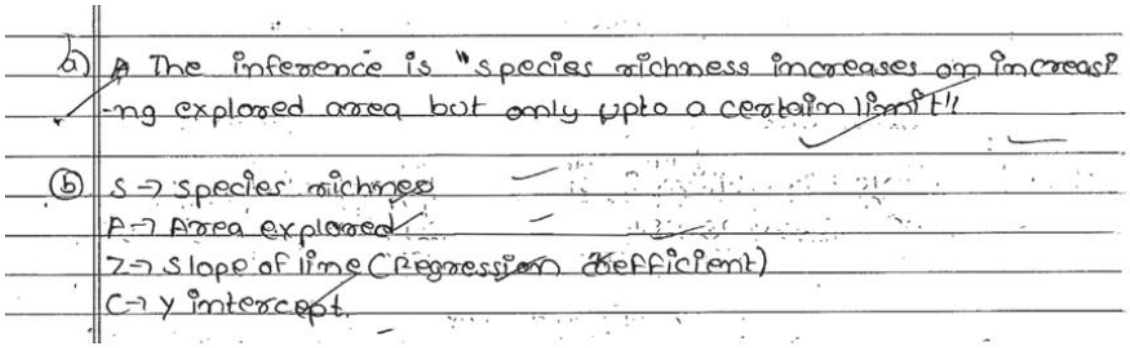
(iv) Co-extinctions.

9.



[Topper's Answer, 2022]

10.



[Topper's Answer, 2022]

11. (a) Habitat loss and fragmentation - Over-population, urbanisation and industrialisation require additional land every year. It can come through destruction or fragmentation of natural habitats through filling wetlands, ploughing grasslands, cutting down trees, burning a forest and clearing some area of vegetation. Loss of habitat results in annihilation of species of endemic plants, microorganisms and forcing out of animals which in alien lands die out after some time. Migrating animals would go astray and get killed.

(b) Over-exploitation - Excessive exploitation of a species, whether a plant or an animal, reduces size of its population so, that it becomes vulnerable to extinction. Due to over-exploitation by humans, Dodo, three subspecies of tiger and Steller's sea cow have become extinct in the last 500 years.

12. (i) The graph represents the species-area relationship. It states that within a region, species richness increases with increasing explored area but only upto a certain limit. It can be represented by:

$S = CA^Z$

where S = Species richness

A = Area

Z = Slope of the line (regression coefficient)

C = Y - intercept

The relationship between species richness and area turned out to be rectangular hyperbola for a wide variety of taxa.

(ii) If the region is divided into two for road contruction, there could be negative impact on species richness. The degradation of habitat threatens the survival of many species. Leading to decline in species richness. When a species become extinct, the plant and animal species associated with it in an obligatory way also become extinct.

13. Dr. David Tilman's long term ecosystem experiment showed that a community with more species, tends to be more stable than those with less species. A stable community does not show much variation in productivity from year to year and is resistant or resilient to occasional disturbances (natural or man made) and it also shows resistant to invasions by alien species. Dr. David Tilman used outdoor plots to give experimental evidence of a stable community. He 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.

14. (a) X-Insects, Y-Molluscs

(b) Insects (X) are the most species-rich taxonomic group, making up more than 70 percent of the total.

15. The loss of biodiversity in a region may lead to:

(i) Decline in ecosystems' productivity (the amount of food energy that is converted into the biomass).

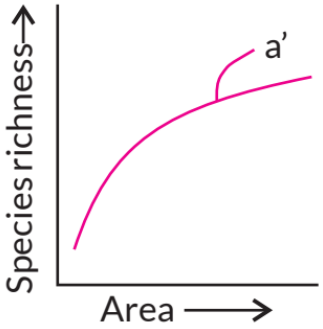
(ii) Lowered resistance to environmental perturbations such as drought.

(iii) Increased variability in certain ecosystem processes such as plant productivity, water use and pest and disease cycle.

(iv) Extinction of plants and animals due to habitat loss, fragmentation and biodiversity loss.

(v) Excessive exploitation of a species whether plant or animal reduces size of its population so that it becomes vulnerable to extinction.

(i) The graphical representation of species area relationship is as follows:



(ii) S represents species richness.

(iii) For frugivorous birds and mammals in the tropical forest of different continents, the value of Z is found to be 1.15.

17. (i) X is fishes and Y is amphibians.

(ii) Amphibians (Y) appear to be more vulnerable to extinction.

(iii) Russia-Steller's Sea cow; Mauritius-Dodo;-Australia-Thylacine.

18. (a) S = Species richness, C = Y-intercept, Z = Slope of the line (regression coefficient), A = Area

(b) If we analyse the species area relationship among very large area like the entire continents, we will find that the slope of the line will be much steeper, i.e., the values of Z lies in the range of 0.6 to 1.2.

19. Non-native or alien species are often introduced by man unintentionally or deliberately for whatever purpose. They often become invasive and drive away the local species. For example, water hyacinth (Eichhornia crassipes) was introduced in Indian waters due to its aesthetic value but, turned out to be a problematic species. It clogged water bodies including wetlands at many places resulting in death of several aquatic plants and animals. The three other major causes of biodiversity loss are:

(i) Habitat loss and fragmentation. Loss of habitat results in annihilation of species of endemic plants, microorganisms and forcing out of animals which in alien lands die out after some time. Migrating animals would go astray and get killed.

(ii) Over-exploitation-Excessive exploitation of a species, whether a plant or an animal, reduces size of its population so, that it becomes vulnerable to extinction.

Due to over-exploitation by humans, Dodo, three subspecies of tiger and Steller's sea cow have become extinct in the last 500 years.

(iii) Co-extinction - When a species become extinct, the plant and animal species associated with it in an obligatory way also become extinct.

20. (a) Over exploitation; tigers are being hunted for their skin.

(b) Biodiversity conservationist must have aware the people about the importance of tiger being the apex species and also by making them understand to refuse to by tiger parts and items prepared from tiger derivatives.

(c) The tiger census in our national parks and tiger reserves is often based on pug marks and fecal pellets.

21. The three major causes of biodiversity loss are:

(i) Habitat loss and fragmentation - Over-population, urbanisation and industrialisation require additional land every year. It can come through destruction or fragmentation of natural habitats through filling wetlands, ploughing grasslands, cutting down trees, burning a forest and clearing some area of vegetation. Loss of habitat results in annihilation of species of endemic plants, microorganisms and forcing out of animals which in alien lands die out after some time. Migrating animals would go astray and get killed.

(ii) Over- exploitation - Excessive exploitation of a species, whether a plant or an animal, reduces size of its population so, that it becomes vulnerable to extinction. Due to over-exploitation by humans, Dodo, three subspecies of tiger and Steller's sea cow have become extinct in the last 500 years.

(iii) Alien species invasions - Non-native or alien species are often introduced by man for their economic and other uses. They often become invasive and drive away the local species. For example, water hyacinth (Eichhornia crassipes) was introduced in Indian waters due to its aesthetic value but turned out to be a problematic species. It clogged water bodies including wetlands at many places resulting in death of several aquatic plants and animals.

22. (a) Alexander von Humboldt studied species-area relationship. He observed that within a region, the species richness increases with increasing area but upto a certain limit.

(b) (i) Ecologists have discovered that the value of Z lies in the range of 0.1-0.2 regardless of taxonomic group or region, i.e., whether it is plants in Britain, birds in California or molluscs in New York the slopes of the regression line are similar.

(ii) When the species-area relationship is considered for a very large area like a whole continent, regression coefficient Z or slope of the line become steeper with Z values in the range of 0.6-1.2.

(c) Slope of line b, would become steeper when the value of Z ranges from 0.6 to 1.2 as for mammals of tropical forests of different continents, the slope is found to be 1.15.

23. (a) Sixth extinction, i.e., the current species extinction is 100 - 1000 times faster than extinctions in pre-human times.

(b) Human activities like settlements, hunting, over-exploitation and habitat destruction are mainly responsible for 'Sixth Extinction.

(c) This disaster can be overcome by the following ways:

(i) Planting large number of trees on road sides and where space is available

(ii) Avoid introduction of invasive alien species

(iii) Conserving biodiversity by maintaining National parks, zoos, etc

(iv) Deforestation and fragmentation of forested areas should be stopped

24. The reasons for more species biodiversity in tropical latitudes than in temperate ones are:

(i) Temperate region was subjected to frequent glaciations in the past, while 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) High productivity: There is more solar energy available in the tropics, which contributes to higher productivity; this in turn might contribute indirectly to greater diversity.

25. Refer to answer 21.

26. Refer to answer 24.

(b) Loss of habitat results in annihilation of plants, microorganisms and forcing out of animals which in alien lands die out after sometime due to unfavourable conditions. Fragmentation of habitats results in disruption of complex interactions among species and animals requiring large territories are badly affected. E.g., mammals and birds.

Alien species often become invasive and drive away the local species. They have proved harmful in both aquatic and terrestrial ecosystems. E.g., water hyacinth was introduced in Indian waters to reduce pollution. It clogged water bodies at many places resulting in death of several plants and animals.

27. (c) : Biosphere reserve, Wildlife sanctuary and National park are in-situ methods of biodiversity conservation.

28.

	In situ conservation	Ex situ conservation
1.	This is approach of conservation of endangered plants & animals in their own natural habitat.	This is approach of conservation of endangered plants & animals outside their habitat in human places which are maintained by humans.
2.	It is relatively cheaper method	It is relatively costlier method
3.	It cannot protect flora & fauna from biotic & abiotic factors.	It protects flora & fauna from abiotic & biotic factors.
4.	eg: National parks, wildlife sanctuaries, Biosphere reserves	eg: Zoological parks, botanical gardens, seed banks, cryopreservation

[Topper's Answer, 2022]

29. Two methods which are practiced to protect threatened or rare species are:

(i) In-situ conservation: It is the conservation of endangered plant or animal species in its natural habitat, either by protecting the habitat itself, or by defending the species from predators.

Examples: Hotspots, National parks, sanctuaries, biosphere reserves, etc.

(ii) Ex-situ conservation: It is the conservation of selected rare plants or animals in places outside their natural homes.

Examples: Offsite collections, gene banks, botanical gardens, zoological parks, etc.

30. 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.

Examples: Jaintia and Khasi hills in Meghalaya.

31. Four techniques where principles for ex-situ biodiversity conservation have been employed are:

(i) In vitro fertilisation – Egg is fertilised in vitro conditions.

(ii) Cryopreservation – Cells, embryos, tissues are preserved at – 196°C.

(iii) Seed banks – Storing viable seeds at low temperature, and germinating them to obtain fresh seeds.

(iv) Tissue culture – Production of large number of plants through callus culture, pollen grain culture, embryoids, etc.

32. Conservation of biodiversity is the protection, uplift and scientific management of biodiversity so as to maintain it at its optimum level and derive sustainable benefits for the present as well as future strategies. The maintenance of a high level of biodiversity is important for the stability of ecosystem. The main reasons to conserve the biological diversity can be grouped in three categories:

– Narrowly utilitarian (useful products for humans like food, fibres, drugs and medicines, etc.)

– Broadly utilitarian (ecosystem services like provision of pollination, climate regulation, flood and erosion control, ecological balance through nutrient cycling, microbial waste treatment, biological pest control, aesthetic and cultural values).

– Ethical utilitarian (every living species has an intrinsic value though it may not have any direct economic value, and also, every species has the right to live).

33. (a) The broadly utilitarian argument says that biodiversity plays a major role in many ecosystem services of nature.

For example :

(i) Oxygen: Through their photosynthetic activity plants are replenishing oxygen of the atmosphere. Amazon rain forest is estimated to contribute 20% of it.

(ii) Pollination: Bees, bumble bees, butterflies, moths, beetles, birds and bats are engaged in pollination of plants which is essential for formation of fruits and seeds.

(b) Human beings share the biosphere with over a million species of plants, animals and microbes. They have evolved just as we have evolved. Every living species has an intrinsic value though it may not have any direct economic value. 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 on the rich biological legacy to future generations.

34. (a) The two criteria that are used to identify a region for maximum protection as 'Biodiversity Hotspots' are:

(i) High degree of endemism

(ii) High levels of species richness

(b) Two "hotspot" regions in our country are:

(i) Indo-Burma (North-East India)

(ii) Himalayas

35. (a) Endemism is the ecological state of a species being unique to a defined geographical location such as an island, nation, country or other defined zone. E.g., the Tasmanian Devil is the largest carnivorous marsupial in the world and found only on the Australian island state of Tasmania.

(b) Western Ghats and Sri Lanka, Indo-Burma, Himalayas and Sundaland are hotspots in India.

36. Some ex-situ conservation strategies are:

(i) Seed banks: Seeds are of two types - orthodox seeds and recalcitrant seeds. Orthodox seeds can tolerate reduction in moisture content (upto 5%), anaerobic conditions and low temperature (-10°C to -20°C), e.g., cereals, legumes.

Recalcitrant seeds get killed on reduction of moisture and exposure to low temperature, e.g., tea, cocoa, etc.

(ii) Orchards : Plants with recalcitrant seeds are grown in orchards where all possible strains and varieties are maintained.

(iii) Tissue culture: It is carried out through callus formation, embryoids, pollen grains culture, etc. for those plants that are either seedless or where clone is to be maintained. The method is useful in maintaining a large number of genotypes in small area, rapid multiplication of endangered species and hybrid rescue.

37. 'In-situ' conservation helps endangered and threatened species by protecting them in their natural habitats along with their ecosystem and its biodiversity. For example, National parks are the areas maintained by the government for better conservation of wildlife. It is a place where cultivation, grazing, forestry and habitat manipulation are restricted.

Sanctuaries are places where wild animals can take refuge without being hunted. Activities like collection of forest products, private ownership land, tilling of land, etc., are allowed but animal hunting is prohibited.

Biosphere reserves are meant for preserving genetic diversity in representative ecosystems of various natural biomes and unique biological communities by protecting wild populations, traditional life style of tribals and domesticated plant/animal genetic resources.

38. Conservation of biodiversity is protection, uplift and scientific management of biodiversity so as to maintain it at its optimum level and derive sustainable

benefits for the present as well as future generations. There are two types of conservation strategies - in - situ (on site) and ex-situ (offsite).

In-situ conservation is conservation and protection of the whole ecosystem and its biodiversity at all levels in their natural habitat in order to protect the threatened species. It involves hotspots and protected areas. Hotspots are areas of high endemism and high level of species richness. Protected areas are ecological/biogeographical areas where biological diversity along with natural and cultural resources is protected, maintained and managed through legal or other effective measures. Protected areas include national parks, sanctuaries and biosphere reserves.

Ex-situ conservation is conservation of threatened plants and animals in places outside their natural homes under full protection and supervision. It includes offsite collections and gene banks.

39. There are a number of reasons to conserve biodiversity which can be grouped as:

(a) Narrowly utilitarian: Human derive a major part of their requirement from organisms. Their direct benefits are countless, e.g., (i) Food cereals: Pulses, fruits, vegetables, milk, egg, meat comes from plants and animals. (ii) Fats and oils are obtained from plants and animal. (iii) Firewood as a source of energy for cooking and heating. (iv) Fibres, e.g., cotton, flax silk, wool. (v) Industrial products like tannins, lubricant dyes, resins, and perfumes. (vi) Drugs: Nearly 25% of drugs being used by us are directly coming from plants.

(b) Broadly utilitarian : Biodiversity is fundamental to ecosystem services of nature. For example :

(i) Oxygen: Through their photosynthetic activity plants are replenishing oxygen of the atmosphere. Amazon rainforest is estimated to contribute 20% of it.

(ii) Pollination: Bees, bumble- bees, butterflies, moths, beetles, birds and bats are engaged in pollination of plants which is essential for formation of fruits and seeds.

(iii) Climate regulation: Forest and oceanic systems regulate global climate.

(iv) Aquifers: Plant cover is essential for retention of rain water, its percolation and storage in aquifers and reservoirs.

(v) Flood and erosion control: Plant cover protects the soil from wind and water erosion. Run off of rain water is reduced so that flood water is rarely formed.

(vi) Nutrient cycling: It is essential for continued availability of nutrients to plants without which there would be no photosynthetic activity.

40. (a) Zoological parks represent ex-situ conservation.

(b) Ex-situ conservation, is conservation of endangered plants and animals outside their natural homes. It includes tissue culture and cryopreservation.

(i) Tissue culture is carried out through callus formation, embryoids, pollen grain culture and shoot tip culture for those plants which are either seedless, variable seed progeny or where clone is to be maintained. The method is useful in maintaining a large number of genotypes in small area, rapid multiplication of even endangered species and for hybrid rescue. Shoot tip culture maintains virus free plants. It is used for international exchange of germplasm in vegetatively multiplied cultivars, e.g., banana, potato.

(ii) Cryopreservation is ex-situ conservation technique in which tissues, organs, embryos, seeds, etc. are stored at very low temperature of -196°C. At this temperature the living material can be stored indefinitely in compact, low maintenance refrigeration units. It can be revived through special technique when required. In order to prevent extinction, endangered organisms are being cryopreserved so that they can be revived to help in conservation.

41. Biodiversity is very important for maintaining ecological balance. Biodiversity is fundamental to ecosystem services of nature.

(i) Photosynthetic activity of producers replenishes oxygen in the atmosphere.

(ii) Forests and oceanic systems regulate global climate. Plants cover is essential for retention of rain water, its percolation and storage in aquifers and reservoirs.

(iii) Different species present on earth play important role in ecological food chains bringing balance in species population. Disturbance in any species population may disturb the entire food chain thereby creating ecological disbalance.

Different ways that have helped in increasing tiger population in our country are :

(i) Protected tiger and its habitat

(ii) Reduced human tiger conflict

(iii) Conducted scientific research on tigers to help inform conservation strategies

(iv) Promoted tiger-friendly policies

(v) Monitored tiger numbers, population trends and threats to tigers and their habitats.

42. (a) The reasons for conserving biodiversity can be grouped into three categories:

(i) The narrowly utilitarian argument says that humans derive many economic benefits from nature such as food, firewood, construction material, industrial products, medicines, etc. This can be done by 'bioprospecting' (exploring molecular, genetic and species-level diversity for products of economic importance).

(ii) The broadly utilitarian argument says that biodiversity plays a major role in many ecosystem services that nature provides. e.g., the Amazon forest produces 20% of the total oxygen in the earth's atmosphere.

(iii) The ethical argument says that we owe it to the millions of species with whom we share this planet to conserve biodiversity.

Biodiversity can be conserved by two methods:

(i) In-situ conservation: The conservation of the whole ecosystem in its natural habitat is called in-situ conservation. e.g., biodiversity hotspots, sacred grooves, biosphere reserves, etc.

(ii) Ex-situ conservation: The conservation of threatened animals and plants in a specially created environment outside of their natural habitat is called ex-situ conservation. eg., zoological Parks, botanical gardens, etc.

(b) Importance of hotspots are as follows:

(i) Maintaining genetic diversity of all present species and varieties.

(ii) Maintaining viable populations of native species, subspecies and varieties.

(iii) Maintaining resilience in species/habitats/ecosystems to adapt to environmental changes.

(iv) Maintaining the various types of communities/ecosystems/habitats both in number and distribution.

(v) Checking human aided introduction of alien/exotic species.

Sacred forests or sacred groves are forest patches around places of worship which are held in high esteem by tribal communities. They are the most undisturbed forest patches (island of pristine forests) which are often surrounded by highly degraded landscapes. They are found in several parts of India, e.g., Karnataka, Maharashtra, Rajasthan (Aravalli), Madhya Pradesh (Surguja, Chanada and Bastar), Kerala, Meghalaya. Temples built by tribals are found surrounded by deodar forests in Kumaon region, Jaintia and Khasi hills in Meghalaya. Not a single branch is allowed to be cut from these forests. As a result, many endemic species which are rare or have become extinct elsewhere can be seen to flourish here. Bishnois of Rajasthan protect Prosopis cineraria and Black

Buck religiously. Some water bodies are also held sacred in certain places. e.g., Khecheopalri in Sikkim. Their aquatic flora and fauna are naturally preserved.

43. (a) Refer to answer 42 (a).

(b) 'Biodiversity hotspots' are the regions of very high levels of species richness and high degree of endemism. This earns them a step towards biodiversity conservation. Himalayas and Western Ghats are two hotspots in India.

CBSE Sample Questions

1. (a)

2. Area A will have more species richness and a steeper slope.

3. Tropical evergreen forest is more vulnerable to invasion by outside animals and plants.

4. The tropical regions are likely to have more biological diversity than the temperate ones. Some possible reasons are:

(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 which in turn might contribute indirectly to greater diversity.

5. (a) Impacts of loss of biodiversity on the ecosystem:

(i) Decline in plant production

(ii) Lowered resistance to environmental perturbations such as drought.

(iii) Increased variability in certain ecosystem processes such as plant productivity, water use, pest and disease cycles.

(b) Causes of biodiversity loss are:

(i) Habitat loss and fragmentation

(ii) Over-exploitation

(iii) Alien invasive species

6. (a) When a large habitat is broken into small fragments due to various activities, mammals and birds requiring large territories and certain animals with migratory habitats are badly affected, leading to population decline.

(b) Alien-species invasion-Nile perch introduced in Lake Victoria eventually led to the extinction of an ecologically unique assemblage of more than 200 species of Cichild fish.

(c) Yes; humans have overexploited natural resources for their 'greed' rather than 'need' leading to extinction of these animals. Sustainable harvesting could have prevented extinction of Steller's sea cow and passenger pigeon or even more exitincted animals.

7. (d): Ex-situ conservation refers to offsite conservation. Seeds of different genetic strains of commercially important plants can be kept for long periods in seed banks.

8. India's history of religious and cultural traditions emphasised the protection of nature. In many cultures, tracts of forest are set aside, all the trees and wildlife within are venerated and given total protection. Sacred groves in many states are the last refuges for a large number of rare and threatened plants.

9. Advanced techniques are being used now for ex-situ conservation. Gametes of threatened species can be preserved in viable and fertile condition for long periods using cryopreservation techniques. Eggs can thus, be fertilised in vitro.

In plants, the explants can be propagated using tissue culture methods and can be kept for long periods in seed banks.