Biodiversity and Conservation

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Biodiversity and Conservation

INTRODUCTION

- Biological diversity or biodiversity refers to the different life forms and habitats found in a defined area. UNEP (1992) defines it "as the variety and variability of all animals, plants and micro-organisms and the ecological complexes of which they are a part".
- The convention on Biological Diversity defines biodiversity as "The variability among living organisms from all sources including, interalia terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems".
- **The term biodiversity was coined by W.G. Rosen (1985).**

Definition

Biodiversity: It is defined as the totality of genes, species and ecosystems of a given region.

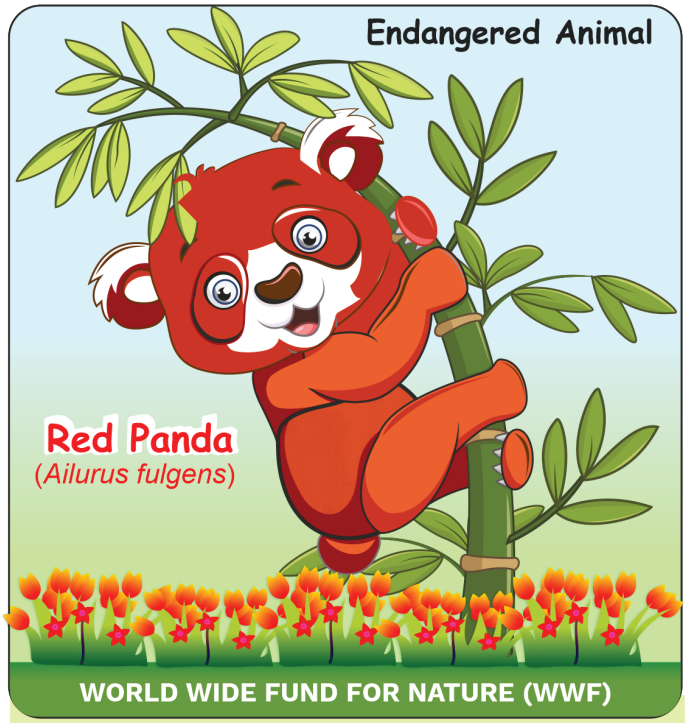
Gray Matter Alert!!!

Norman Myers introduced the concept of biodiversity.

Amazon rainforest is the major carbon sinks contained within Brazil, with 60% of the rainforest, followed by Peru with 13%, Colombia with 10%, and with minor amounts in Bolivia, Ecuador, French, Guiana, Guyana, Suriname, and Venezuela.

BIODIVERSITY

- **The term biodiversity was popularised by Edward Wilson.**
- Diversity is present at all levels of biological organisation ranging from the micro-molecules within the cells to biomass.
- Biodiversity in one way is more applicable to all living organisms, plants, animals and microorganisms which have not been cultivated and domesticated.



Red Panda is facing a high risk of extinction in the wild.

It is a small arboreal mammal found in the forests of Sikkim, Western Arunachal Pradesh, Darjeeling district of West Bengal and parts of Meghalaya.

It is also the state animal of Sikkim.

Importance of Biodiversity

- All the organisms are important links in the food chains operating in different habitats. If any of

Definition

Green Data Book : It consists of rare plants growing in protected areas like botanical gardens.

Rack Your Brain

The Amazon rainforest is referred as the 'lungs of the planet'. Mention any one human activity which causes loss of biodiversity in this region.

Definition

Bioprospecting: Exploring molecular, genetic and species-level diversity for products of economic importance.

Previous Year's Question

The breeding place of Flamingo (Hansawar) in India is most likely:
(1) Sambhar lake
(2) Chilka lake
(3) Rann of Kachchh
(4) Ghana vihar

the links is removed then the whole ecosystem faces the consequences.

- It acts as a source of gene pool or gene bank for various breeding programs. For example, one of the rice species resistant to the rice pest ***Nilaparvata lugens*** (Brown planthopper) was discovered from the wildlife gene pool and cultivated. This way serious damage due to this pest was prevented.
- Drugs have been developed from the raw materials obtained from plants and other organisms.
- Biodiversity is of great ecological, economic and aesthetic value.

LEVELS OF BIODIVERSITY

- Genetic diversity
- Species diversity
- Ecological or Ecosystem diversity

Genetic Diversity

- Greater the genetic diversity among organisms of a species, more sustenance it has against environmental perturbations.

FIG. RICE (50,000 GENETICALLY DIFFERENT STRAINS OF RICE ARE FOUND IN INDIA)

Previous Year's Question

Animal species should be protected because they are:
(1) Lovely creatures
(2) Useful to humans
(3) To be studied by zoologists
(4) Man cannot recreate a lost species

Definition

Genetic diversity : It refers the presence of diverse genes in a particular species.

Rack Your Brain

Why are genetically uniform populations highly prone to diseases?

- The genetically uniform populations are highly prone to diseases and harsh environment.
- The genetic variation shown by ***Rauwolfia vomitoria*** (poison devil's-pepper) is in terms of potency and concentration of the chemical **reserpine**.
- There are more than 50,000 genetically different strains of rice and 1000 varieties of mango in India.

Species Diversity

- The two important measures of species diversity are: species richness and species evenness.

Species Richness

- It refers to the number of different species per unit area in an ecological community. Here neither abundance nor distribution of species is taken into account.
- For example, if an area has birds, amphibians, herbivores, insects, small carnivores, reptiles and plants of various types then it is species rich.

Species Evenness

- It is the relative abundance with which each species is represented in an area. This aspect focuses on how many members of different species are present in an area.
- For example if in an area number of wolves, foxes and wild dogs is 1000, 90 and 700 respectively then the area is uneven in species richness.
- But if the same species are in 1000,950 and 970 respectively then it is relatively even in species richness.
- The number and variety of individuals determine the level of diversity in an ecosystem.
- **The Western Ghats have a greater diversity of amphibian species than the Eastern Ghats. Approximately 181 amphibian species are recorded in the Western Ghats** (Subramanian et al. 2013)

FIG. MANGO (1000 VARIETIES OF MANGO ARE FOUND IN INDIA)

Definition

Species Diversity: Variety of species belonging to a genus or different genera within a given region.

Previous Year's Question

In India, we find mangoes with different flavours, colours, fibre content, sugar content and even shelf life. The large variation is on account of:

(1) Species diversity
(2) Induced mutations
(3) Genetic diversity
(4) Hybridization

Ecological Diversity

- Ecological diversity is related to species diversity and genetic diversity.
- India has greater ecosystem diversity than a Scandinavian country like Norway; India has several ecosystems or biomes like rain forests, deserts, wetlands, mangroves, coral reefs, estuaries and alpine meadows.

Definition

Ecological or ecosystem diversity: Variation in ecosystems within a geographical location of a given area.

GLOBAL BIODIVERSITY

- According to **IUCN** (2004), the total number of plant and animal species described is over 1.5 million.
- The species inventories for taxonomic groups in temperate countries or regions are more complete than those in tropical countries or regions.
- **Robert May**, has put the global species diversity at about seven million by his conservative and scientific estimate.
- Till now, from all the recorded species more than 70% are animals and of this 70% are insects.
- Plants account for about 22% which include algae, fungi, bryophytes, gymnosperms and angiosperms.

Gray Matter Alert!!!

International Union for Conservation of Nature and Natural Resources (IUCN) has headquarters at Morgis, Switzerland. It maintains a red data book about threatened species.

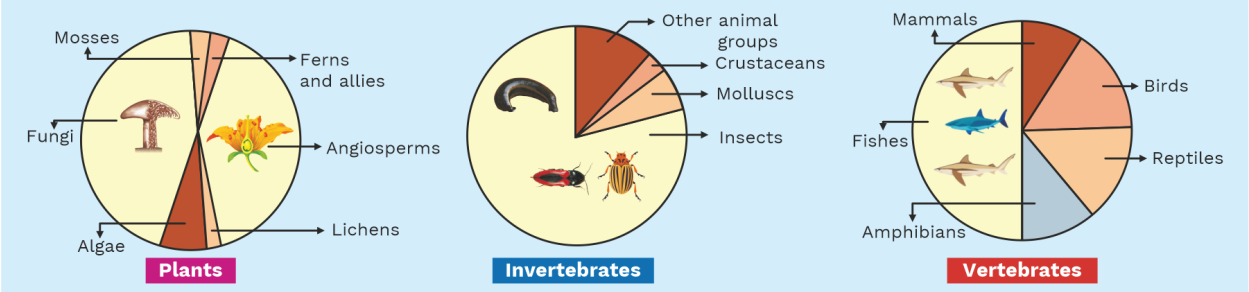


FIG. REPRESENTATION OF GLOBAL BIODIVERSITY OF MAJOR TAXA OF PLANTS, INVERTEBRATES AND VERTEBRATES

- On the globe, the species of fungi are more than the combined numbers of fish, amphibians, reptiles and mammals.
- **These estimates do not give any figures prokaryotes for the following reasons:**

Rack Your Brain

Why is genetic variation important in plant *Rauwolfia vomitoria*?

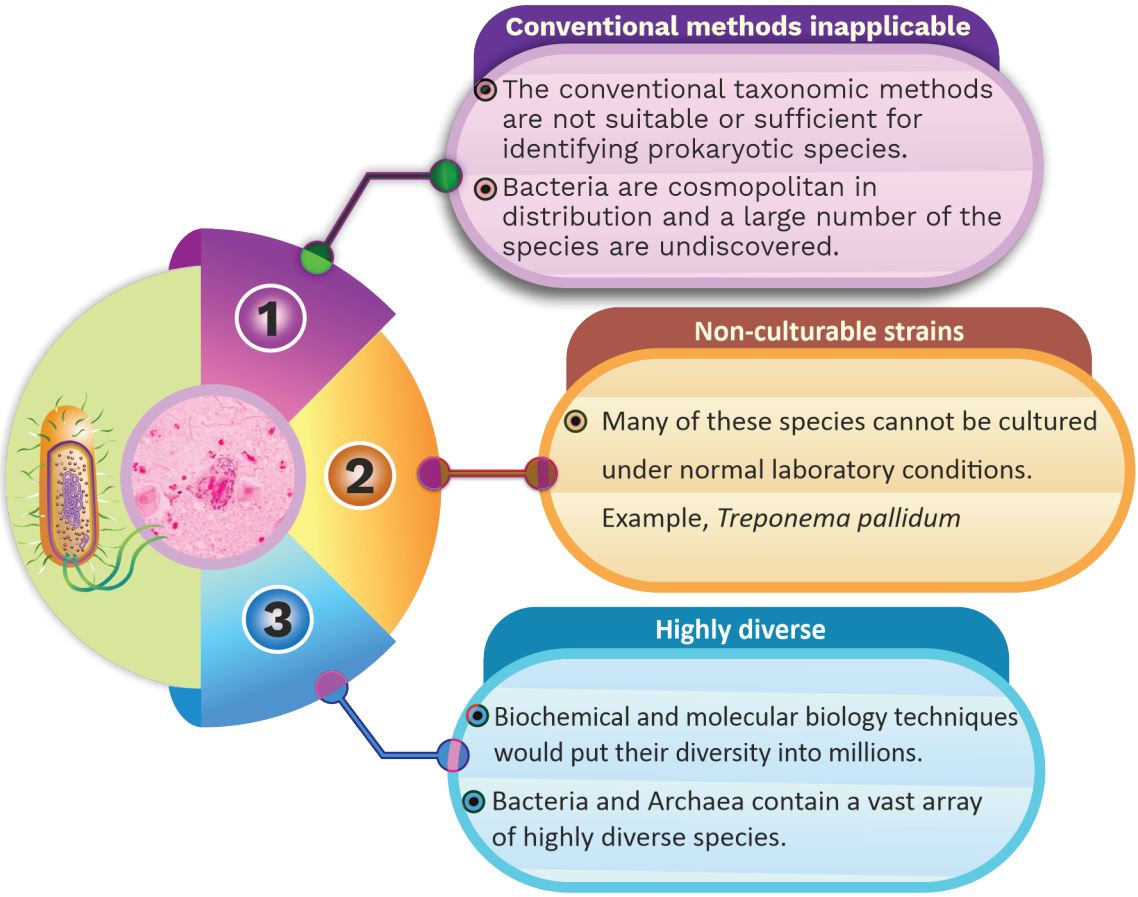


FIG. CONCERNS IN ESTIMATING PROKARYOTIC SPECIES

Biodiversity in India

- **India** is one of the **12 mega biodiverse countries** of the world.
- The 12 mega biodiverse countries are - United States of America, Mexico, Colombia, Ecuador, Peru, Venezuela, Brazil, Democratic Republic of Congo, South Africa, Madagascar, India, Malaysia, Indonesia, Philippines, Papua New Guinea, China, and Australia.
- India has only 2.4% of the land area of the world but it has 8.1% of the global species biodiversity.
- There are about 4500 species of plants and 90,000 – 1,00,000 species of animals. Many species are yet to be discovered and named.

Rack Your Brain

Why are the conventional methods not suitable for the assessment of biodiversity of bacteria?

Rack Your Brain

What accounts for the greater ecological diversity of India?

- Only 22% of the total species have been recorded so far according to Robert May's global estimate. India probably has more than 1,00,000 plants and 3,00,000 animals species at to be discovered and described.

PATTERNS OF BIODIVERSITY

- Biodiversity in the world varies with change in altitude and latitude.
- Favourable environmental conditions favour speciation and thus makes it possible for a larger number of species to exist, i.e., biodiversity is more in such areas than in others.

Latitudinal Gradients

- There is a decrease in species diversity from equator towards poles.
- The tropics (between 23.5°N to 23.5°S) has more species than polar and temperate regions.
- For example, Columbia near equator, has about 1400 species of birds, while New York (41°N) has 100 species, Greenland (71°N) has about 56 species while India (in the equator region) has 1200 species.
- The number of species of vascular plants in tropics is about ten times more of that of temperate forests.
- The Amazonian rainforest in South America has the greatest biodiversity on earth; it harbours about 40000 species of plants, 1,25,000 species of invertebrates, 3000 of fishes, 427 of amphibians, 378 of reptiles, 1300 of birds and 427 of mammals.

Note : India is the only country in the world with native populations of both lions and tigers.

- **Three hypotheses proposed to explain the difference in biodiversity between tropical and temperate regions:**

Rack Your Brain

Why are tropical regions more biodiverse than the temperate regions?

Definition

Blue Book: It consists of list of endangered species (red list species) that show overall stabilization of the species. The blue book is generated by United Nations Environment Programme (UNEP).

Rack Your Brain

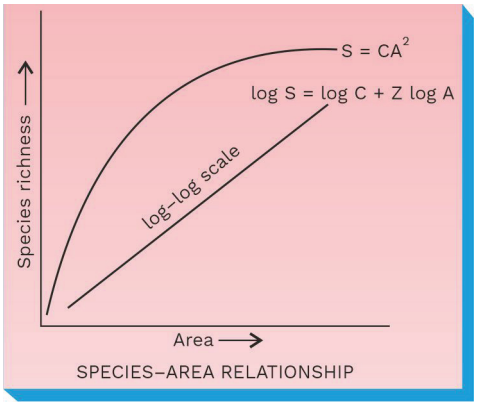
Which of the following countries has highest biodiversity?

(1) Brazil (2) South Africa
(3) Russia (4) India

Factors or Phenomenon	Tropical Regions	Temperate Regions
Speciation	The tropical latitudes had remained undisturbed and got long evolutionary time for species diversification. Hence, had evolved more species diversity.	Temperate regions were affected by frequent glaciations in the past. Thus, had less time for species diversification.
Climatic Conditions	Tropical environments are less seasonal, relatively more constant and predictable; such constant environments have promoted niche specialisation and greater species diversity. Like the average daily temperature lies between 20°C to 25°C and is warm throughout the year.	In temperate region environments are more seasonal, relatively less constant and less predictable. Like During summers the average temperature in a temperate deciduous forest is 21°C and in winters is 10° C and below.
Solar Radiation	There is more solar radiation available in the tropical region and thus increasing the productivity and indirectly to greater species diversity.	There is comparatively less solar radiation available in the temperate region; this contributes to less productivity and hence lesser species diversity.

Species-Area Relationship

- **Alexander Von Humboldt** has observed that within a region, species richness increased with increasing explored area, but only upto a limit.
- The relationship between species richness and area for a number of taxa like angiospermic plants, freshwater fishes and birds is found to be a rectangular hyperbola.
- On a log scale, the relationship becomes linear (straight line) and is described by the equation.
  - log S = log C + Z log A,



Where,
- S = Species richness
- Z = Slope of the line (regression coefficient)
- A = Area and C = Y–intercept

- Ecologists have found out that the value of **Z-line** ranges between 0.1 and 0.2 irrespective of the taxonomic group or the region.
- But this analysis in very large areas like a continent, shows the slope to be much steeper and the Z value ranges between 0.6 and 1.2.
- The Z value for frugivorous birds and mammals in the tropical forests is found to be 1.15.
- The species-area relationship has played an important role in understanding the species distribution in a habitat in the past and it predicts the future as well due to anthropogenic effect on biodiversity.

Note: Ecologists usually construct the species-area relationship for a single-type of organism e.g., all non-vascular plants or for all organisms which belong to a particular trophic level such as all herbivores in an area of observation.

Previous Year's Question

The soil erosion can be prevented by—
(1) Over grazing
(2) Deforestation
(3) Afforestation
(4) None of these

Rack Your Brain

Where among the following will you find pitcher plant in India?
(1) Rain forest of North-East region
(2) Sunderbans
(3) Thar Desert
(4) Western Ghats

IMPORTANCE OF SPECIES DIVERSITY TO THE ECOSYSTEM

- Ecologists believe that communities with more species tend to be more stable than those with less species.
- A stable community has the following attributes.
  - It shall not show too much of variations in the year-to-year productivity.
  - It must be either resistant or resilient to seasonal disturbances.
  - It must be resistant also to invasion by alien species.
- **David Tilman** had shown through his ecology experiments using outdoor plots, the following features:

- The plots with more species showed less year-to-year variation in the total biomass, plots with increased diversity showed higher productivity.
- Species richness and diversity are essential for ecosystem's health as well as survival of human race on the earth.

Note: The 'rivet popper hypothesis' was used by Stanford ecologist Paul Ehrlich to explain that in an ecosystem some species are more important than the other species for its proper fucntioning. Just like in an airplane (ecosystem) all parts are joined together using thousands of rivets (species). If every passenger travelling in it starts popping a rivet to take home (causing a species to become extinct), it may not affect flight safety (proper functioning of the ecosystem) initially, but as more and more rivets are removed, the plane becomes dangerously weak over a period of time. Furthermore, which rivet is removed may also be critical. Loss of rivets on the wings (key species) that drive major ecosystem functions is obviously a more serious threat to flight safety than loss of a few rivets on the seats or windows inside the plant.

LOSS OF BIODIVERSITY

Brief Account

- The colonisation of tropical Pacific Islands by human beings has led to the extinction of more than two thousand species of native birds.
- **IUCN Red List (2004)** documents the extinction of 784 species in the last 500 year that includes 359 invertebrates, 338 vertebrates and 87 plants.
- Some of the animals that have become extinct in recent times are given below:
  - Steller's sea cow (Russia)
  - Dodo (Mauritius)
  - Thylacine (Australia)
  - *Quagga* (Africa)

Rack Your Brain

What does 'Red' indicate in the IUCN Red list?

Definition

Keystone species: A species which makes up a small proportion of the total biomass of a community yet has a huge impact on the community organisation and survival.

Previous Year's Question

Which animal should be protected?
(1) Harmless
(2) Economically useful
(3) Likely to perish
(4) Ferocious

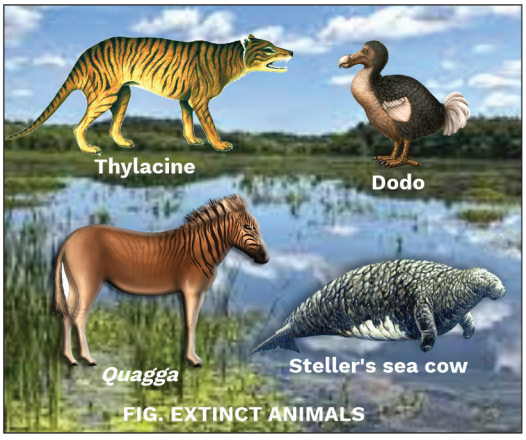


FIG. EXTINCT ANIMALS

- Three sub-species (Bali, Javan, Caspian) of tiger.

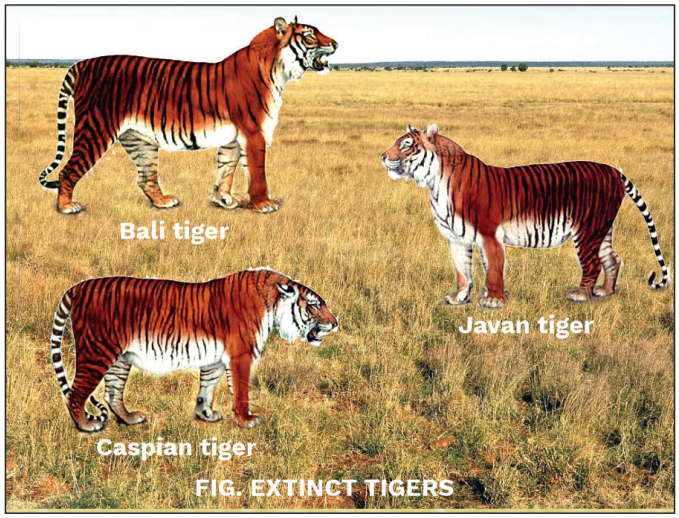


FIG. EXTINCT TIGERS

- 27 species have become extinct in the last twenty years alone.
- Amphibians are more vulnerable to extinction.
- At present the percentage of threat of extinction among organisms is given below:
  - 31% of gymnosperms
  - 32% of amphibians
  - 12% of bird species
  - 23% of mammals
- There have been five episodes of mass extinction since the origin of life, but current rate of extinction is 100–1000 times faster due to human activities.
- Loss of biodiversity in a region can lead to the following:
  - Decrease in plant production.
  - Lowered resistance to environmental perturbation.
  - Increased variability in ecosystem processes like water use, pest or disease cycles, plant productivity, etc.

Previous Year's Question

Wildlife is destroyed most when:
(1) There is lack of proper care
(2) Mass scale hunting for foreign trade
(3) Its habitat is destroyed
(4) Natural calamity

Definition

Exotic or alien species: Those species which are introduced into an ecosystem knowingly or unknowingly and gradually they become threat to the indigenous species.

Previous Year's Questions

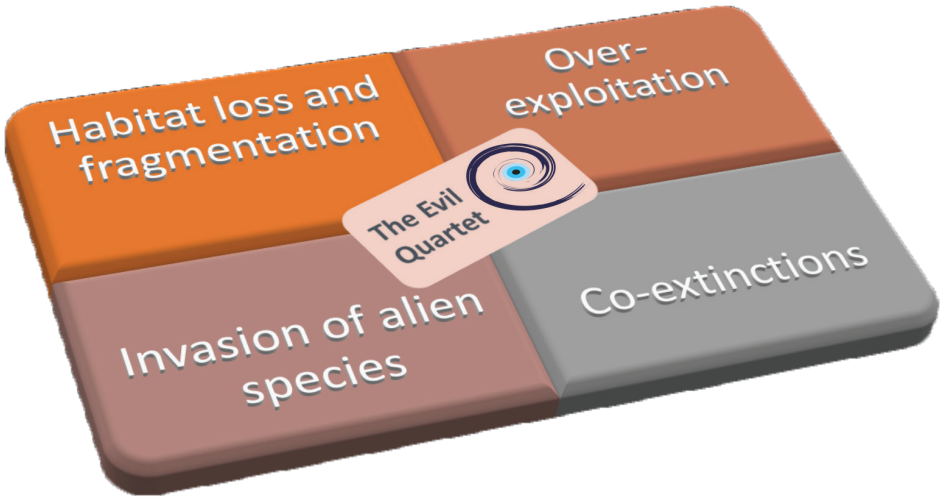
Red Data Book deals with—
(1) Plants showing phototropism
(2) Endemic plants
(3) Plants on the verge of extinction
(4) Plants that are extinct

Rack Your Brain

What is the difference between exotic and endemic species?

CAUSES FOR LOSS OF BIODIVERSITY

- The four major causes are described as '**The Evil Quartet'**. These are:



Habitat Loss and Fragmentation

- It is the most important or primary cause for extinction of species .
- The tropical rainforest initially covered 14% of the land surface of earth, but presently they cover only 6% of the land surface.
- The **Amazon forests**, called as the '**lungs of the planet'**, are cleared for cultivation of soyabean or conversion into grasslands for raising beef-cattle.
- Total loss of a habitat deprives many animals and plants their homes and they face extinction.
- Degradation of habitats by pollution threatens the survival of many species.
- When a large habitat becomes fragmented, animals requiring large territories and those with certain migratory habits are adversely affected and their populations start decreasing.

FIG. HABITAT FRAGMENTATION

Over-Exploitation

- When nature is over-exploited by man for the natural resources, many species become extinct, e.g., **Stellar's sea cow, passenger pigeon,** many marine fishes, etc.

Rack Your Brain

What is common to the following plants: *Psilotum, Nepenthes*, *Rauwoljia* and *Aconitum*?

(1) All are ornamental plants
(2) All are phylogenic link species
(3) All are prone to over exploitation
(4) All are exclusively present in the Eastern Himalayas.

Invasion of Alien Species

- The alien species become invasive, compete with the native species and causes extinction of the indigenous species.
- A few examples are given below:
  - Introduction of **Nile Perch** into Lake Victoria (East Africa) caused the extinction of the endemic, ecologically unique species of **Cichild fish**.
  - Exotic species like ***Parthenium***, ***Lantana*** and ***Eichhornia*** which had been introduced in India and caused environment damage, they pose threat to the survival of many of our native species.
  - ***Parthenium*** (**carrot grass**) entered India due to poor quarantine while importing massive amount of wheat from USA. Livestock do not feed on it as it causes allergy and fever. It is an invasive weed that competes with grass and other weeds that the cattle feed on.
  - ***Lantana*** was brought to India by British as an ornamental plant. But it is toxic to livestock and humans moreover, it grows quickly suppressing the growth of other useful plants for grazing animals.

FIG. LANTANA

  - ***Eichhornia*** is an aquatic free floating plant, introduced in India for its beautiful flowers and leaves. It grows rapidly covers the water surface, drains oxygen and leads to suffocation

FIG. CICHILD FISH

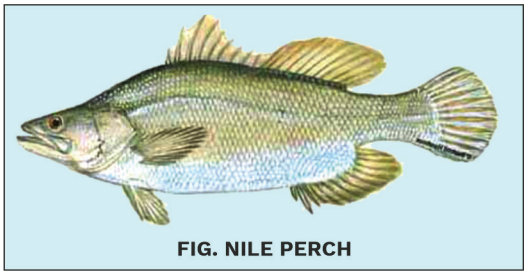


FIG. NILE PERCH

FIG. PARTHENIUM

Rack Your Brain

Which of the following is not an invasive alien species in India and why?

(1) *Eichhornia* (2) *Parthenium*
(3) *Cynodon* (4) *Lantana*

and death of fish and other aquatic animals. It suppresses the growth of other aquatic plants too.

FIG. EICHHORNIA

- Introduction of **African catfish** (*Clarias gariepinus*) for aquaculture purposes, is posing threat to our **indigenous catfish** (*Clarias bactrachus*). It is also known as walking fish (an air breathing catfish).

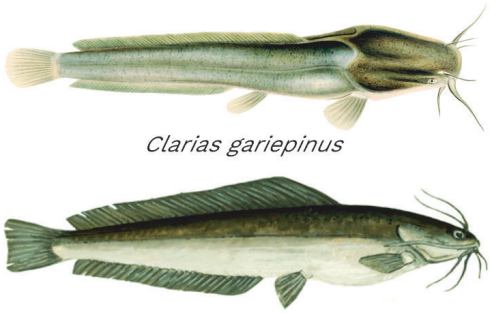
Co-Extinctions

- Co-extinction is phenomenon in which, when a host species becomes extinct, the plant and animal species associated with it in an obligatory manner, also become extinct.
- For example, if a species of fish becomes extinct, all those parasites unique or specific to that species also face extinction.
- Similarly, a co-evolved plant-pollinator mutualism show co-extinction where extinction of one species invariably leads to extinction of the other.

- When the passenger pigeon (*Ectopistes migratorius*) got extinct, its parasitic lice is believed to be extinct .
- A louse restricted to the black-footed ferret (*Mustela nigripes*) will get extinct if the black-footed ferret becomes extinct.

Rack Your Brain

What is common with *Eichhornia, Lantana* and *Parthenium* with reference to threat to our biodiversity?



Clarias gariepinus

Clarias bactrachus

FIG. SPECIES OF CATFISH

Previous Year's Questions

When a threatened species needs urgent measures to save from its extinction which will be the most desirable approach?

(1) *Ex situ* conservation
(2) *In situ* conservation
(3) Cryopreservation
(4) Tissue culture

MASS EXTINCTION

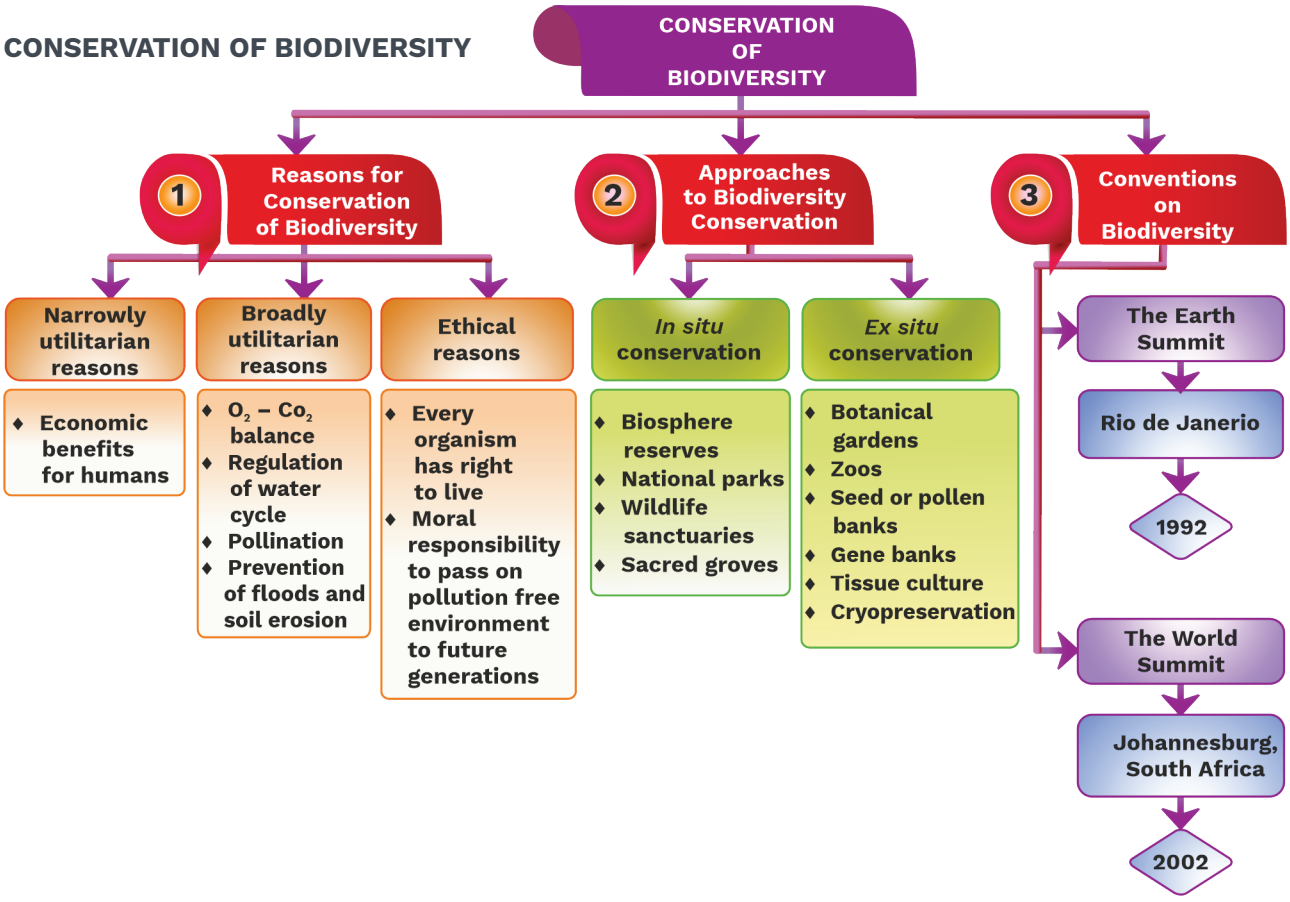
Mass extinction in ecology refers to an extinction of species at a faster rate in short geological period of time. At present sixth mass extinction is going on which is referred to as the **Anthropocene extinction**.

In the past five extinctions have occurred:

- **Ordovician-silurian Extinction** (440 million years ago)-small marine animals got extinct.
- **Devonian Extinction** (365 million years ago)- Extinction of tropical marine species.
- **Permian-triassic Extinction** (250 million years ago)- Largest mass extinction that wiped out numerous species including vertebrates.
- **Triassic-jurassic Extinction** (210 million years ago)- Numerous species of vertebrates died paving the way for the dinosaurs to flourish.
- **Cretaceous-tertiary Extinction** or K-T extinction (65 million years ago)- Non-avian dinosaurs, other animals and many plants got extinct.

***(K is used to depict Cretaceous period)**

CONSERVATION OF BIODIVERSITY



REASONS FOR CONSERVING BIODIVERSITY

- The reasons for conserving biodiversity can be grouped into three categories:
  - Narrowly utilitarian
  - Broadly utilitarian
  - Ethical

Narrowly Utilitarian Reasons

- These are obvious reasons which focus on present day needs.
- Human beings derive a number of economic benefits like food, fibre, firewood, industrial products (resigns, gums, dyes, tannin, etc.) and medicinal products.
- More than 25% of the drugs are derived from plants and about 25000 species of plants are used by native people as traditional medicine.

Broadly Utilitarian Reasons

- Biodiversity plays a major role in providing various ecosystem services, which cannot be given a price-tag and these focus on well-being of our planet for future generations, they are:
  - Production of oxygen.
  - Pollination of flower, without which fruits or seeds are not produced
  - Aesthetic pleasure like bird watching, watching spring flower, walking through the thick forest, waking up to bulbul's song, etc.

Ethical Reasons

- Every species has an intrinsic value, even if it is not of any economic value to us.
- We have a moral duty to care for their well-being and pass on the biological legacy in a proper form to our future generations.

In Situ Strategies

- *In situ* conservation means 'on-site conservation'. Here, the plant or animal species are protected

Previous Year's Question

Bandipur and Karnataka is the site of Project..... .
(1) Elephant
(2) Hangul
(3) Tiger
(4) Peacock

Definition

Rare species: Species with a small population in the world, e.g., Amur Leopard, Elephant Shrew, Pangolin, etc.

Previous Year's Question

In a National Park, protection is provided to:
(1) Entire ecosystem
(2) Flora and fauna
(3) Fauna only
(4) Floral only

Definition

In situ conservation: Protecting the endangered species of plants and animals in their natural habitat.

in their natural habitat. This is carried on by two methods:

- **By protecting or cleaning up the habitat itself.**
- **By defending the species from predators.**

Biosphere Reserves

- Protected area for wildlife. It has 3 zones:
  - Core zone – No human activity is permitted in this zone.
  - Buffer zone – Limited human activity is allowed in this zone.
  - Manipulation zone – A large number of human activities are allowed in this zone.

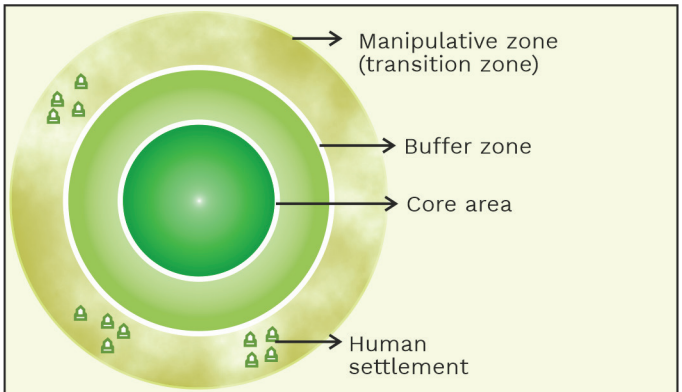


FIG. DIAGRAMMATIC REPRESENTATION OF ZONES IN A BIOSPHERE RESERVE

Objectives of Biosphere Reserve

- To conserve the diversity and integrity of biotic communities.
- To provide areas for ecological and environmental research.
- To provide facilities for educational training.

Number of Biosphere Reserves

- There are currently 714 biosphere reserves in 129 countries.
- In India there are **14 biosphere** reserves.

Rack Your Brain

What is meant by endemism?

Definition

Biosphere reserves: These are a kind of protected areas of land and coastal environments having unique biodiversity.

Rack Your Brain

How much area of earth's land surface is covered by biodiversity hotspots?

BIODIVERSITY HOTSPOTS

- Extremely rich in species with high degree of endemism.
- Biodiversity hotspots have been identified for maximum protection to the endemic and endangered species.
- At present biodiversity hotspots cover more than 15.7% area on the earth.

Criteria for an Area to be Labelled as 'Hotspot'

- It must contain 1,500 species of vascular plants or > 0.5 percent of the world's total as endemics.
- It has lost one third or 75% of its primary vegetation.

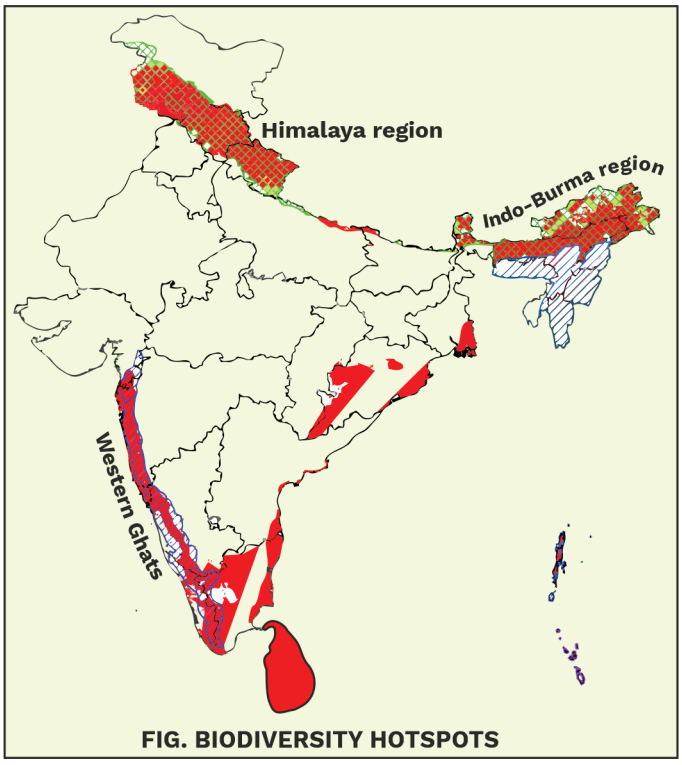


FIG. BIODIVERSITY HOTSPOTS

Number of 'Hotspots'

- There are **34 hotspots** on the globe.
- Three are in India-
  - Western Ghats
  - Indo-Burma Region

Definition

Biodiversity hotspots. These areas are extremely rich in species, which have high endemism and are under constant threat of extinction due to human inhabitation.

Previous Year's Question

Which one is hotspot of biodiversity?
(1) Eastern Ghats
(2) Western Ghats
(3) Aravalli Hills
(4) Indogangetic Plain

Rack Your Brain

Which one of the following is not a characteristic feature of biodiversity hot spots?
(1) Large number of species
(2) Abundance of endemic species
(3) Mostly located in the polar regions
(4) Mostly located in the tropics

- Himalayan region.

NATIONAL PARKS AND WILDLIFE SANCTUARIES

- India has (according to September 2002 list) **90 National Parks** and **448 Wildlife Sanctuaries.**
- **Jim Corbett National Park:**
  - It is the first to be established in India, in the Nainital district of Uttarakhand.
  - It was established in the year 1936 and here **Project Tiger was launched in 1973**.
  - It spans over 520 square kilometres and comprises of hills, marshy areas, riverine belts, grasslands and large lake.

Rack Your Brain

Name any two conventional methods of *ex situ* conservation.

Gray Matter Alert!!!

Willam Hornday coined the term wildlife in his book 'Our Vanishing Wildlife'.

National Park	State	Animal Protected
Jim Corbett National Park	Uttarakhand	Tiger
Rajaji National Park	Uttarakhand	Tiger
Kanha National Park	M.P.	Tiger
Sunderbans National Park	West Bengal	Tiger
Bandipur National Park	Mysore (Karnataka)	Tiger, Elephant
Ranthambhor National Park	Rajasthan	Tiger
Desert National Park	Rajasthan	Tiger
Keolado National Park	Bharatpur (Rajasthan)	Great Indian Bustard, Black Buck

Scared Forests

- These are the undisturbed forests without any human intervention and have a special religious importance to a particular culture.
- The area is usually dedicated to a local deity.
- **In India these sacred groves were brought under the Wildlife protection Act, in 2002**
- Such forests include a number of rare, endangered and endemic species.

Definition

Sacred forests: These are the forest patches protected by tribal communities, due to religious sanctity accorded to the forest patches.

Sacred Groves in India

- Khasi and Jaintia hills in Meghalaya.
- Western Ghat regions of Karnataka and Maharashtra.
- Aravalli Hills of Rajasthan.
- Sarguja, Chanda and Bastar areas of Madhya Pradesh.

EX SITU CONSERVATION

- Botanical gardens, zoological parks and arboretum are the conventional methods of *ex situ* conservation.
- Cryopreservation is a method of conservation by storage of live cells, tissues and other biological sample at ultra low temperatures for a very long period; gametes of threatened species can be preserved in viable and fertile condition for long periods using this technique.
- Plants are propagated using tissue culture method (micropropagation).
- Seeds of many different genetic strains of commercially important plants are kept viable for long periods in seed banks.
- India has today 122 botanical gardens and 275 zoos (zoos, deer parks, aquaria and safari parks).

Definition

Ex situ conservation:
Protecting the endangered species of plants or animals by removing them from the unsafe or threatened habitat and placing under human care.

Definition

Cryopreservation:
It is the storage of live cells, tissues and other biological samples at extremely low temperature (like at –196°C) either by very rapid cooling or by gradual cooling and simultaneous dehydration at low temperatures.

DIFFERENCE BETWEEN IN SITU CONSERVATION AND EX SITU CONSERVATION

IN SITU CONSERVATION	EX SITU CONSERVATION
• It is the process of protecting the endangered species of plant or animal in the natural habitat, either by protecting or cleaning up the habitat itself or by defending the species from predators. • It helps in recovering populations in the surrounding where they have developed their distinctive features e.g., national parks, biosphere reserves, wildlife sanctuaries.	• It is the process of protecting the endangered species of plant or animal by removing it from the unsafe or threatened habitat and placing under the care of humans. • It helps in recovering populations or preventing their extinction under simulated conditions that closely resemble their natural habitats (botanical gardens, zoos, seed) or pollen, seeds, genes are preserved in pollen banks, gene banks, etc.

ENDEMISM

- **When a native species is found in a particular geographical area, this state is called endemism**.
- Endemic species are not found naturally in any other geographical area.

CONVENTIONS ON BIODIVERSITY

The Earth Summit

- This is the historic convention on Biological Diversity held in **Rio de Janeiro in 1992**.
- It called upon all the nations to take appropriate measures for:
  - Conservation of biodiversity and
  - sustainable utilisation of the benefits from biodiversity.

The World Summit on Sustainable Development

- This was held in 2002, in Johannesburg, South Africa.
- 190 countries signed their commitment to achieve a significant reduction in the current rate of biodiversity loss at global, regional and local levels by 2010.

MAN AND THE BIOSPHERE PROGRAMME

In 1986, United Nations Educational Scientific and Cultural Organisation (UNESCO) started MAB Programme. It promotes innovative approches towards environment, impact of interference of man in biosphere and effect of pollution on biotic and abiotic environments. It develops strategies for conservation of environment for the present and time to come.

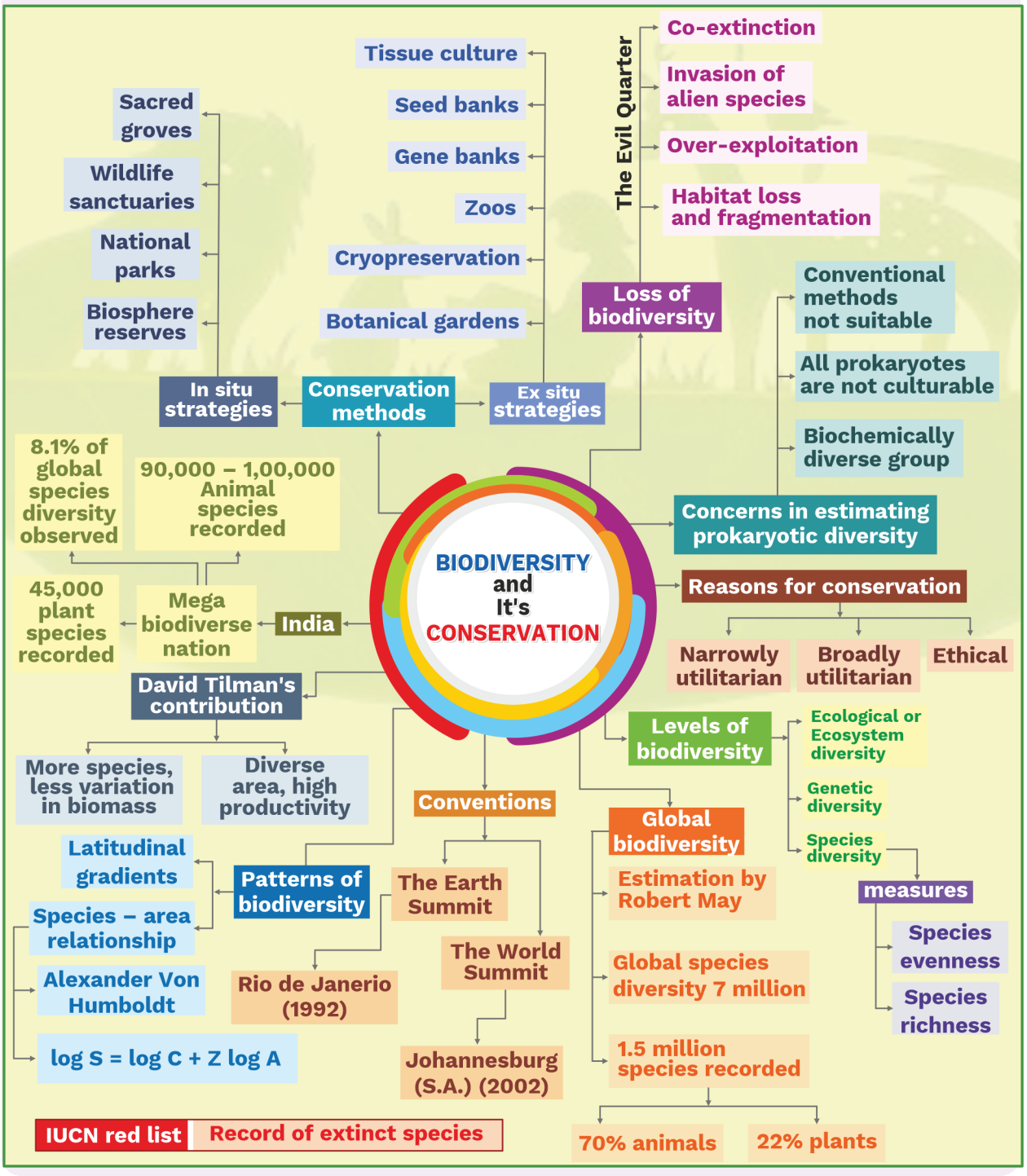
Previous Year's Question

Which country hosted the first World Earth Summit on conservation of environment:
(1) India (2) Brazil
(3) Peru (4) Spain

Previous Year's Question

The species of animals protected in Kaziranga sanctuary is:
(1) *Macaca mullata*
(2) *Panthera tigris*
(3) *Panthera leo*
(4) *Rhinoceros unicornis*

Summary


BIODIVERSITY and It's CONSERVATION
Conservation methods
In situ strategies
Ex situ strategies
Sacred groves
Wildlife sanctuaries
National parks
Biosphere reserves
Tissue culture
Seed banks
Gene banks
Zoos
Cryopreservation
Botanical gardens
Loss of biodiversity
The Evil Quarter
Co-extinction
Invasion of alien species
Over-exploitation
Habitat loss and fragmentation
Conventional methods not suitable
All prokaryotes are not culturable
Biochemically diverse group
Concerns in estimating prokaryotic diversity
Reasons for conservation
Narrowly utilitarian
Broadly utilitarian
Ethical
Levels of biodiversity
Ecological or Ecosystem diversity
Genetic diversity
Species diversity
measures
Species evenness
Species richness
Global biodiversity
Estimation by Robert May
Global species diversity 7 million
1.5 million species recorded
70% animals
22% plants
Conventions
The Earth Summit
Rio de Janerio (1992)
The World Summit
Johannesburg (S.A.) (2002)
Patterns of biodiversity
Latitudinal gradients
Species – area relationship
Alexander Von Humboldt
log S = log C + Z log A
David Tilman's contribution
More species, less variation in biomass
Diverse area, high productivity
India
Mega biodiverse nation
45,000 plant species recorded
8.1% of global species diversity observed
90,000 – 1,00,000 Animal species recorded
IUCN red list
Record of extinct species

Solved Exercise

Q1 **Forest control drought through**
(1) These have lots of water plants
(2) Increasing rainfall
(3) Retention of water and prevention of soil erosion
(4) Functions as water shed

A1 **(3)**

Roots of forest vegetation hold the soil particles and thus, prevent soil erosion and also the water is held between the layers of the soil.

Q2 **Which of the following allow scientific research?**
(1) Biosphere reserves
(2) National parks
(3) Botanical gardens
(4) All the above

A2 **(4)**

Government allows the students and research scholars to do scientific research in biosphere reserves, national parks and botanical gardens with due permission.

Q3 **Which one of the following is known as 'lungs of the planet'?**
(1) The Amazon rainforest
(2) Sundarbans
(3) Daintree rainforest
(4) Xishuangbanna

A3 **(1)**

The Amazonia forests are vast and are extended to 10 nations. In Brazil 60% of the forest lies and the rest in other nations. So are called lungs of the planet.

Q4 **Total number of biodiversity hotspots in the world is**
(1) 25
(2) 34
(3) 14
(4) 448

A4 **(2)**

There are total 34 biodiversity hotspots in the world.

Q5 **Conservation in ecology means:**
(1) Protection of natural resources
(2) Management of natural resources
(3) Proper and sustained use of natural resources
(4) All the above

A5 **(4)**

Conservation in ecology means protection, management, proper and sustained use of natural resources.

Q6 **Overgrazing causes:**
(1) Negative pollution
(2) Removal of weeds
(3) Reduction in crop yield
(4) Soil erosion

A6 **(4)**

Overgrazing causes soil erosion as while grazing the cattle uproot the grasses and small plants.

Q7 **Earth Summit at Rio de Janeiro was related to:**
(1) Conservation of biodiversity
(2) Survey of natural resources
(3) Conservation of environment
(4) Conservation of biodiversity and sustainable utilisation of natural resources.

A7 **(4)**

Earth Summit was held in 1992 at Rio de Janeiro. It was related to conservation of biodiversity and sustainable utilisation of natural resources.

Q8 **When 'need' turns to 'greed', it leads to:**
(1) Habitat loss and fragmentation
(2) Alien species invasions
(3) Co-extinctions
(4) Over-exploitation

A8 **(4)**

Many species got extinct in the last 500 years due to over exploitation by human.

Q9 **IUCN denotes:**
(1) Indian Union for Cultural Natural Resources
(2) International Union for Caretaker Nations
(3) Industrial Union for Capital and Natural Resources
(4) International Union for Conservation of Nature and Natural Resources

A9 **(4)**

International Union for Conservation of Nature and Natural Resources, located at Gland, Switzerland.

Q10 **Indian Government enacted the 'Wildlife Protection Act' in:**
(1) 1972
(2) 1952
(3) 1982
(4) 1992

A10 **(1)**

Enacted on 9 September 1972 the 'Wildlife Protection Act' to protect animals and plants.