BIODIVERSITY & CONSERVATION

Biodiversity

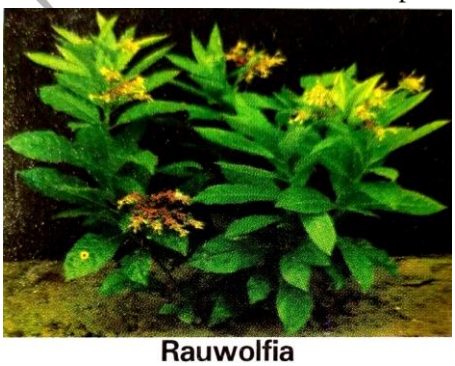
Biodiversity is the totality of genes species and ecosystems of a region. The occurrence of different kinds of organisms on a site is determined by environmental conditions of the site and range of tolerance of species. The living world has enormous biodiversity which differs from place to place.

In our biosphere immense diversity (or heterogeneity) exists not only at the species level but at all levels of biological Organisation ranging from macromolecules within cells to biomes. Biodiversity is the term popularised by the sociobiologist **Edward Wilson** to describe the combined diversity at all the levels of biological Organisation. There are more than 20,000 species of ants, 3,00,000 species of beetles, 28,000 species of fishes and nearly 20,000 species of orchids.

Broadly speaking, there are three levels of biodiversity :

(i) Genetic diversity
(ii) Species diversity
(iii) Community and ecosystem diversity

(i) Genetic diversity (Intraspecific diversity): is the variation of genes within the species. The difference could be at the level off alleles, genes or at the level of chromosomes. Intraspecific diversity may occur between individuals within single population of species (interpopulation diversity) or between different population of same species (interpopulation diversity).Medicinal plant *Rauwolfia vomitoria* growing in different Himalayan ranges show differences in the potency and concentration of active chemical called reserpine due to genetic diversity. India has more than 50,000 genetically diverse varieties of rice and 1000 varieties of mango. A species with more genetic diversity can from ecotypes (it is genetically distinct geographical variants of a population which is adapted to specific environment condition, they have phenotypically and physiologically different but can interbreed and spread over larger area.

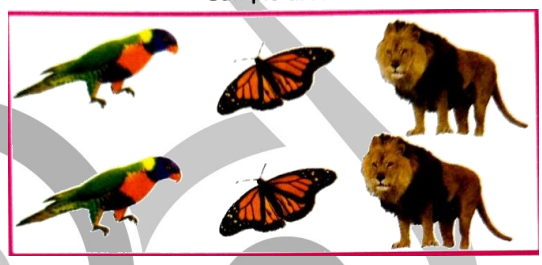


Rauwolfia

(ii) Species diversity (interspecific diversity) : Species diversity is the variety in the number and richness of the species of a region. The number of species per unit area is called **species richness.** Number of individuals of different species represent **species evenness** or **species equitability**. Species diversity is product of both species richness and evenness or equitability.

Sample area 1

Sample area 2



Sample area 3 shows the maximum diversity as species of taxonomically different groups occur in almost equal abundance.

Example: Biotic communities (A – E) consist of species designated with numbers (1 – 7). Individual densities of these species are given (as individuals per square meter) in the table. Which of the following communities is least susceptible to mass pest infection?

	Biotic Communities				
Species	**A**	**B**	**C**	**D**	**E**
1	82	50	2	0	0
2	10	30	25	2	65
3	4	10	20	3	20
4	4	10	20	40	10
5	0	0	18	50	3
6	0	0	5	5	2
7	0	0	10	0	0

Answer – C

(iii) Community / Ecosystem diversity / Ecological diversity. It is three types :-

i. **Alpha diversity** (Intra- community diversity) :Refers to the diversity of organisms sharing same community habitat. This diversity depends on species richness and species evenness.

ii. **Beta diversity** (Inter-community diversity): It is rate of replacement of species along gradient of habitat or communities.

iii. **Gamma diversity**: It is diversity of the habitat over the landscape / geographical areas. Ecosystem diversity describes number of niches tropic levels, food webs and recycling of nutrients operating in an ecosystem. Diverse communities are more productive and stable under unfavourable conditions.

Ecosystem diversity is quite high in India because of the occurrence of a large number of ecosystem like deserts, rainforests, deciduous forests, mangroves, coral reefs, wetlands, estuaries and alpha meadows. It is quite low in small countries like Nor way (Scandinavian country).

It has taken millions of years of evolution, to accumulate this rich diversity in nature, but we could lose all the wealth in less than two centuries if the present rates of species losses continue. Biodiversity and its conservation are

now vital environment issues of international concern as more and more people around the world begin to realise the critical importance of biodiversity for our survival are well-being on this planet.

Biogeographical regions of India :

India can be categorised into 10 biogeographical region Each biozone has several habitat, biotic communities an ecosystems.

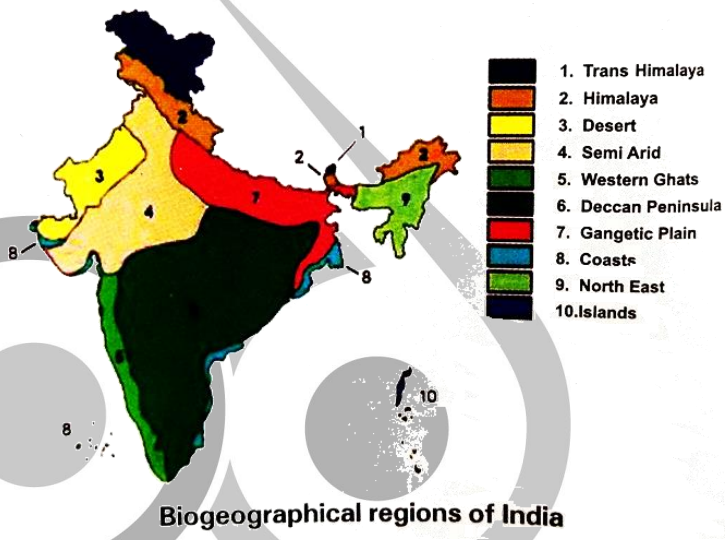
Trans-Himalaya represents a cold desert which occurs is parts of J&K, Himachal Ladakh and Sikkim.

Western ghats and North-East accounting for 4% and 5.2% are most biodiversity rich-zones of India.

Western Ghats have a greater amphibian species diversity than Eastern Ghats.

The largest biogeographical region is Deccan Peninsula Which Occupy 42% land mass.

Mangroves vegetation is found in swamps along the coast e.g. Sunderbans (it is the largest mangroves forest of the world).



Biogeographical regions of India

How many species are there on earth and how many in

According to the IUCN (2004), the total number of plant and animal species described so far is slightly more than .5 million, but there are many species yet to be discovered and described. Estimates vary widely and many of them are only educated guesses.

Projects like Global Biodiversity Information Facility and Species – 2000 are working to describe large number of species before they go extinct.

How do ecologist estimate the total number of species present in the world?

For many taxonomic groups, species inventories are more complete in temperate than in tropical Countries . Considering that an overwhelmingly large proportion of the species waiting to be discovered are in the tropics, biologists make a statistical comparison of the temperate-tropical species richness of an exhaustively studied group of in sects and correlate this ratio to other groups of animals and plants.

On this basis, ecologists have calculated the total number of species on earth to be 20 to 50 million, but a more conservative and scientifically correct estimate made by **Robert May** places the global species diversity at about 7 million.

More than 70% of all the species recorded on earth are animals, while plants (including algae, fungi, bryophytes, gymnosperms & angiosperms) accounts for no more than 22% of the total.

Among animals insects are the most species rich taxonomic groups (70% of the total), that means out of every ten animals on this planet, 7 are insects.

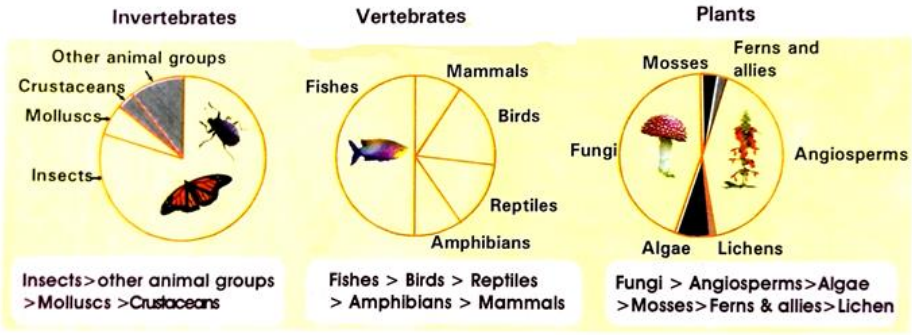
The species diversity of plants (22 percent) is much less than that of animals (72%). The reason for this is plant are fixed. They require fewer evolutionary adaptations to obtain optimum amounts of raw materials and sunlight and mechanism to ward off the effect of herbivory. Therefore, they have lesser diversity. Animals are mobile. A number of them will converge on a single piece of vegetation. They must avoid competition by developing niche specialisation. A single piece of vegetation will be, therefore, allowing evolution of several hundred animal species.

Similarly, a herbivore species may provide food to several types of carnivore species. This results in higher diversity among animals.

The number of fungi species in the world is more than combined total of the species of fishes, amphibian, reptiles and mammals.

It should be noted that these estimates do not give any figures for prokaryotes. Biologists are not sure about how many prokaryotes species there might be. The problem is that conventional taxonomic methods are not suitable for identifying microbial species and many species are simply not culturable under laboratory conditions. If we accept biochemical or molecular criteria for delineating species for this group, then their diversity alone might run into millions.

Out of these, the number of known species in India is roughly 8.1% of the total though India has only 2.4% of the world's land area. That is why 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.



If May's global estimates are correct only 22% of the total species have been recorded so far. Applying this proportion to India's diversity figures, it is estimated that there are probably more than 1,00,000 plant species and more than described. We are nor be able to complete the inventory of the biological wealth of our country because lack of the immense trained manpower (taxonomists) and the time required to complete the job. The situation appears more hopeless when we realise that a large fraction of these species faces the threat of becoming extinct even before we discover them. Nature's biological library is burning even before we catalogued the titles of all the books stocked there.

Gradients / Patterns of biodiversity

i. **Latitudinal gradients**: The diversity of plants and animals is not uniform throughout the world but shows a rather uneven distribution. There are interesting patterns in diversity, the most well known being the latitudinal gradient in diversity. In general, species diversity decreases as we move away from the equator towards the poles. Mostly tropics (Latitudinal range of 23.5^{o} N to 23.5^{o} S) have more species than temperate or polar region. Colombia located near equator has nearly 1400 species to birds.

   New york at 41^{o} N has 105 species.

   Greenland at 71^{o} N only 56 species of birds.

   India with much of its land area in the tropical latitudes, has more than 1200 species of birds.

A forest in a tropical region like Equador has up to 10 times as many species of vascular plants as a forest of equal area in a temperate region like the Midwest of the USA.

The largely tropical Amazonian rain forest in South America has greatest biodiversity on earth. It is home to more than 40,000 species of plants, 3,000 of fishes, 1300 of birds, 427 of mammals, 427 of amphibians, 378 of reptiles and of more than 1,25,000 invertebrates and it is believed that there might be at least two million insect species waiting to be discovered and named in these forests.

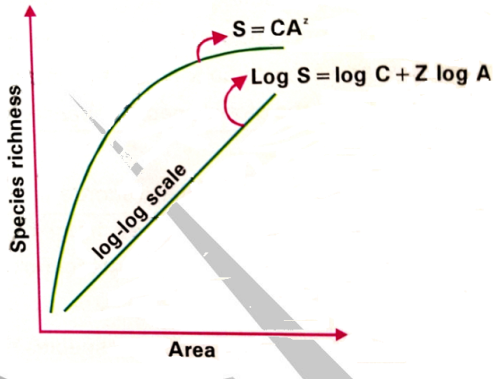
Ecologist and evolutionary biologists have proposed various hypothesis to account for greater biological diversity in tropical regions. Some important ones are :

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

(b) 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.

(c) There is more solar energy available in the tropics, which contributes to higher productivity that in turn contribute indirectly to greater diversity.

ii. Species area relationship : German naturalist and geographer Alexander von Humboldt while exploring South American jungles, observed that within a region, species richness and area for a wide variety of taxa (angiosperm, birds bats, freshwater fishes turns out to be a rectangular hyperbole.



On a logarithmic scale, the relationship is a straight line described by the equation

Log S = log C + Z log A

Where

S = species richness A= area

Z = slope of the line (regression coefficient)

C = Y- intercept

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

But, if we analyse the species area relationship among very large area like the entire continents, we will find that the slope of the line to be much steeper (Z values in the range of 0.6 to 1.2)

For example, frugivorous (fruit-eating) birds and mammals in the tropical forest of different continents will have slope to be 1.15.

Importance of species diversity (Biodiversity)

i. **Stability :** Biodiversity is essential for stability of an ecosystem. Communities with more species tend to be more stable than those with less species.

ii. **Productivity :** Ecosystem with higher biodiversity are more productive than ecosystem withlower biodiversity. Experiments of David Tilman have confirmed that increased diversity contributes to higher productivity. A stable community should not show too much variation in productivity from year of year. This has been confirmed by David Tilman's long term ecosystem experiments using outdoor plots. Tilman found that plots with more species showed less year to year variation in total biomass. Increased biodiversity contributed to higher productivity.

iii. **Resilience :** It must be either resistant or resilient to occasional disturbances (natural or man- made), and it must also resistant to invasions by alien species.

iv. **Ecosystem health :** Rich biodiversity is not only essential for ecosystem health but is also imperative (essential) for the very survival of the human race on this planet. No Spaces occurs in isolation. Rather all the species are interlinked through various types of relationships. Killing or disappearance of even a few species may have destablising effect.

There are no direct answers to some questions (Such as would Western Ghats ecosystems be less functional if one of its tree frog species is lost forever? How is our quality of life affected if, say, instead of 20,000 we have only 15,000 species of ants on earth?) but we can develop a proper perspective through an analogy –the 'rivet popper hypothesis' used by Stanford ecologist Paul Ehrlich. 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 effect 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 plane.

Cause of biodiversity loss:

There are four major causes – the **'evil quartet'** (sobriquet) leading to extinction of species and consequent loss of biodiversity are :

i. **Habitat loss and fragmentation** : This is the most important cause driving animals and plants to extinction. The most dramatic examples of habitat loss come from tropical rain forests. Once covering more than 14 percent of the earth's land surface, thee rain forests now cover no more than 6 percent. They are being destroyed fast. By the time you finish reading this chapter, 1000 more hectares of rain forest would have been lost. The Amazon rain forest (it is so huge that it is called the 'lings of the planet') harbouring probably millions of species is being cut and cleared for cultivating soya beans or for conversion to grasslands for raising beef cattle. Besides total loss, the degradation of many species. When large habitats are broken up into small fragments due to various human activites, mammals and birds requiring large territories and certain animals with migratory habits are badly affected, leading to population declines. A habitat may become fragmented when roads and habitations intrude into forest. Changes in microclimate (temperature, wind and humidity) near the forest edge may reduce appropriate habitat for many species. Increasing habitat edge opens up opportunities for parasites and predators.

ii. **Over-exploitation** : Exploitation of a particular species reduces the size of its population to an extent that it becomes vulnerable to extinction. Humans have always depended on nature for food and shelter, but when need turns to greed. It leads to overexploitation of natural resources. Many species extinction in the last 500 years (Stellar's sea cow, Passenger pigeon) were due to over exploitation. Many marine fish populations are harvested on large scale which can endanger many commercially important species.

Passenger pigeon

Nepenthes, Psilotum, Rauwolfia and Aconitum – all are prone to over – exploitation.

iii. **Alien species invasions :** New species entering a geographical region are called **Exotic or Alien Species.** It is second major reason of extinction. Introduction of invasive species may cause disappearance of native species through changed biotic interactions e.g.

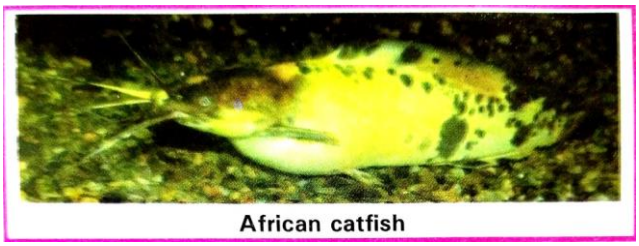
a. Eichhornia (Water hyacinth) threatens many aquatic species.

b. Lantana camera has invaded many forest lands as weed, e.g. UP, M.P.

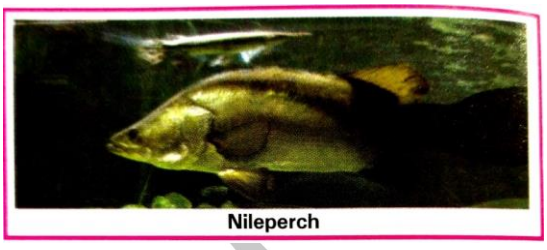
c. Parthenium (carrot grass) has pushed out several herbs and shrubs from open places.

Parthenium *Lantana*

d. African catfish, Clarias gariepinus has been illegally introduced for aquaculture in India. It is threatening native catfish of Indian rivers.


African catfish

e. Nile perch (exotic predatory fish) introduced into lake victoria (East Africa) eliminated several native species of the small cichild fish species (more than 200 species)


Nileperch

f. Aggressive African bees introduced into Brazil now occupy much of western hemisphere.
g. Introduction of Goat in Galapagos islands.
h. Introduction of Rabbit in Australia.
i. Eupatorium reduced population of Tectona grandis in North East.

iv. **Co-extinction :** Certain obligatory Mutualistic relationship exist in nature, e.g. Pronuba and Yucca. Extinction of one will automatically cause extinction of the other e.g. when a host fish species becomes extinct, its unique assemblage of parasites also meets the same fate. In case of a coevolved plant-pollinator mutualism, extinction of one will lead to extinction of the other.

Extinction

It is total elimination or dying out of species from earth.

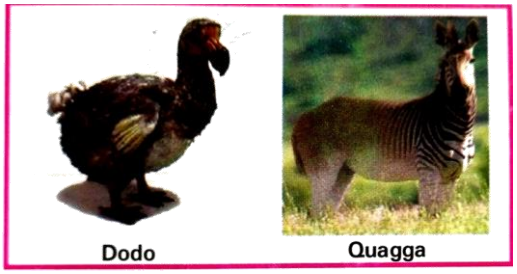
Natural extinction : With the change in environmental conditions, some species disappears and others which are more adapted to changed conditions, take their place.

Mass extinction : When large number of species became extinct because of catastrophes.

Anthropogenic extinction : An increasing number of species are disappearing from earth due to human activities called anthropogenic extinction.

The colonisation of tropical Pacific islands by humans is said to have led to the extinction of more than 2,000 species of native birds. The IUCN Red List (2004) documents the extinction of 784 species (including 338 vertebrates, 359 invertebrates and 87 plants) in the last 500 years.

Some Examples of recent extinctions include the Dodo (Raphus cucullatus) of Mauritius, Quagga (Africa), Thylacine or Tasmanian Wolf (Thylacinus cynocephalus) of Australia, Steller, s Sea Cow (Russia) and three subspecies of Tiger (Bali, Javan and Caspian).


Dodo Quagga

In the last twenty years, 27 species have become extinct, Amphibians seem to be at higher risk of extinction. More than 15,500 species worldwide are threatened. Presently, all over the world, 12% of all amphibian species and 31% of all gymnosperms are facing the threat of extinction.

There is greater vulnerability of amphibians to extinction as compared to
Other animal group because wetlands are being filled up at many places
For creation of land for human habitation and other activites.

During the long period (>3 billion years) since the origin ad diversification of life on earth there were five episodes of mass extinction of species. Present **Sixth Extinction** in progress is different from the previous episodes in the rates (the current species extinction rates are estimated to be 100 to 1000 times faster than the pre-human times) and our activities are responsible for the faster rates, Ecologists warn that if the present trends continue, nearly half of all the species on earth might be wiped out within the next 100 years

In general, loss of biodiversity in a region may lead to

(a) Decline in plant production,

(b) Lowered resistance to environmental perturbations such as drought

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

The IUCN List Categories

Red list is a catalogue of taxa that are facing risk of extinction. World Conservation Union, WCU (formerly the international Union for Conservation of Nature and Natural Resources (IUCN), Morges-Switzerland) has maintained record of threatened species (T) which are likely to become extinct, in the form of Red Data Book. It has **Pink Pages** for **critically endangered species.**

Red list has 8 categories. Four criteria have been used for this categorisation – distribution, population science, natural habitat and importance.

The **uses** of this Red list are :

i. Developing awareness about threatened biodiversity.

ii. Identification and documentation of endangered species.

iii. Providing Global Index of the decline of diversity.

iv. Defining conservation priorties at local level.

Species threatened with extinctions are placed in vulnerable, endangered or critically endangered categories.

Black buck

Extinct — A Taxon is Extinct when there is no reasonable doubt that the last individual has died

Extinct in the wild — A Taxon is Extinct in the wild when exhaustive surveys, in known and / or expected habitats, have failed to record an individual.

Category	Plants	Animals
Critically Endangered	Berberis Nilghiriensis	Sus Slavanius (Pigmy hog)
Endangered	Bentinckia Nicobarica	Ailurus Fulgens (Red Panda)
Vulnerable	Cupressus Cashmeriana	Antelope Cervicapra (Black buck)

Berberis

Critically Endangered — A Taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the **near future.**

Endangered — A taxon is Endangered when it is not Critically Endangered, but is facing a very high risk of extinction in the wild in the near future.

Vulnerable — A taxon is lower risk when it has been evaluated and does not satisfy the criteria for Critically Endangered, Endangered or Vulnerable

Bentinckia

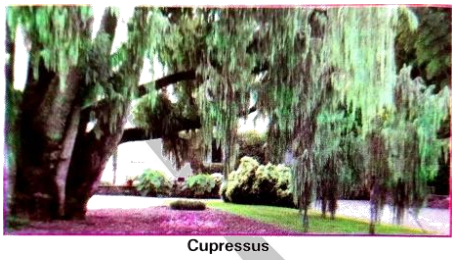
Lower Risk — A taxon is lower risk when it has been evaluated and does not satisfy the criteria for Critically Endangered, Endangered or Vulnerable


Red Panda


Pigmy hog

Data Deficient A Taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction.

Not Evaluated A Taxon is not evaluated when it has not yet been assessed against the above criteria.


Cupressus

Endangered Species (E)

(a) Asiatic Wild Ass - Asinus heminuskhur
(b) Snow Leopard - Panthera uncial
(c) Red Panda - Ailurus fulgens
(d) Musk Deer - Moschus moschiferus
(e) Great Indian Bustard- Ardeotis nigriceps

Great Indian plant species of India. Rauwolfia serpentina, Santalum album, Cycas beddomei.

Why should we conserve biodiversity?

There are many reasons for conservation of biodiversity & are equally important & can be grouped into 3 categories : narrowly utilitarian broadly utilitarian & ethical.

1. **Narrowly utilitarian :** Humans derive countless direct benefits from nature :

i. Food : cereals, pulses, fruits.
ii. Firewood.
iii. Fibres : cotton, flax, silk and wool.
iv. Construction material
v. Industrial products : tannins, lubricants, dyes, resins, perfumes and
vi. Products of medicinal in=importance.

More than 25% of the drugs sold in the market worldwide are derived from plants and 25,000 species of plants contribute to traditional medicines used by native peoples around the world.

(i) Morphine (Papaver somniferum) – Analgesic
(ii) Quinine (Cinchona ledgeriana) – Malaria control
(iii) Taxol (New tree – Taxus brevifolia, Taxus baccata) – Anticancer drug
(iv) Reserpine (Roots of Rauwolfia vomitoria) – High Blood pressure, schizophrenia
(v) Vasaca (leaves of Adhatoda vesica) – Bronchitis
(vi) Liquorice (Roots of Glycyrrhiza glabra) – Bronchitis

Many more medicinally useful plants are in tropical rain forests waiting to be explored.

With increasing resources put into 'bioprospecting' (exploring molecular, genetic and species- levels diversity for products of economic importance), nations endowed with rich biodiversity can expect to reap enormous benefits.

2. Broadly utilitarian : Biodiversity plays a major role in many ecosystem services that nature provides.

Oxygen : Through photosynthetic activity, plants are releasing oxygen in the atmosphere. Fast dwindling Amazon rain forest is estimated to contribute 20% of it.

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. If human's were to do the same. The cost would be 117 billion dollars.

Aesthetic value: There are intangible benefits that we drive from nature : It provides a lot of pleasure and excitement to listen to bird songs, walking through thick woods, watching spring flowers in full bloom.

In addition to all these, biodiversity is also required for climate regulation, flood and erosion control, nutrient cycling and biological pest control.

3. **Ethical :** Human being share the biosphere with over a million species of plants and animals and microbes. Every living species has an intrinsic value through it may not have any direct economic value. It is therefore our moral and ethical duty not to destroy them and pass this rich biological legacy to future generation.

Methods to conserve biodiversity

Biodiversity needs to be conserved at all levels. Ecosystems are undergoing changes due to pollution, invasive species, over exploitation by humans and climate change. Most efficient and effective mechanism for conserving biodiversity is to prevent further destruction or degradation. There are two basic strategies of biodiversity conservation : - In situ (on site) : save the entire forest to save the tiger. – Ex situ (off site) ; when there are situations where an animal or plant is endangered or threatened and needs urgent measures to save it from extinction, ex situ (off site) conservation is the desirable approach.

In situ conservation strategies

The in situ strategies emphasise protection of total ecosystem. Two alternate methods are used to save biodiversity i.e. hot spots and protected areas.

1. Protected areas

National Parks

Sanctuaries

Biosphere reserves

These are managed through legal and other means. World Conservation Monitoring Centre has recognized 37,000 protected areas around the world. India has 538 (90 National parks, < 450 wild life sanctuaries and many sacred groves) protected areas.

Benefits of protected areas –

(i) Maintaining viable populations of all species.

(ii) Maintaining number and distribution of communities and habitats.

(iii) Preventing alien species introduction.

(iv) Making species / habitat shifting possible in response to environmental changes.

(a) National Parks : These are areas reserved for wild life. Plantations, cultivation, grazing, felling of trees and habitat manipulation are not allowed. India has 90 National Parks, Uttaranchal (earlier named as Hailey National Park) was National Park to be established in India. Yellowstone in US and Royal near Sydney-Australia are world known for their beauty and recreational value.

(b) Sanctuaries : Tracts of land where animals are protected from all types of exploitation and habitat disturbance. Private ownership is permitted. Collection of minor forest products, harvesting of timber and wood, tilling of land and other creativities are allowed provided they do not interfere with animal welfare. Presently India has 448 sanctuaries covering 3.2% area.

(c) Biosphere Reserves : There are special category of protected areas wherein people are an integral component of system. These are representative examples of natural biomes and contain unique biological communities. They have been set up under MAB programme of UNESCO. There are 408 biosphere reserves in 94 countries. There are 14 biosphere reserves in India also notified as National Parks.

First biosphere reserve of India is Nilgiri.

Each biosphere reserve has :

(a) **Core / Natural zone :** No human activity is permitted

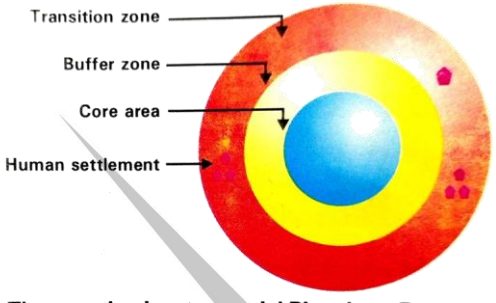
(b) **Buffer zone :** Limited human activity permitted.

(c) **Manipulation / Transition zone :** All type of human activities which do not disturb ecology, are permitted. It has different part like forestry, agriculture, tourism and restoration region.

The main functions of biosphere reserve are conservation, development, scientific research monitoring ad education.

MAB Programme

Man and biosphere programme is an international biological programme of UNESCO (United Nations Educational Scientific and cultural Organisation) which was launched in 1971 but was introduced in India in 1986.



The zonation in a terrestrial Biosphere Reserve

Sacred forest (sacred groves) and sacred lakes : A traditional strategy of biodiversity protection is in the form of **Sacred forest.** These are forest patches of varying dimensions protected by tribal communities due to religious sanctity also called islands of pristine forests. In India, sacred forest are located in serval Parts. Such sacred groves are found in Khasi and Jaintia Hills in Meghalaya, Aravalli Hills of Rajasthan, Western Ghat regions of Karnataka and Maharashtra and the Sarguja, Chanda and Baster area of Madhya Pradesh. Not a single branch is allowed to cut from these forests and they are serving as refuge for a number of rare, endangered and endemic taxa. In Meghalaya, the sacred groves are last refuge for a number of rare, endangered and refuges for a large number of rare and threatened plants.

Sacred lakes

Similarly, several water bodies, e.g., Khecheopalri lake in Sikkim, Pushkar lake in Rajasthan have been declared sacred by the people, leading to protection of aquatic flora and fauna.

2. Hot Spots of Biodiversity

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. On a global basis, this problem has been addressed by eminent conservationists. They identified for maximum protection certain 'biodiversity hotspots' regions.

Norman Myers developed he hot spots concept in 1988 for in situ conservation. Hot spots are richest and most threatened reservoirs of plant and animal life on earth.

The key criteria for hot spot determination are :

(i) High degree of endemism (that is, species confined to that region & hot found anywhere else).

(ii) Accelerated

(iii) High Level of species richness.

Initially 25 biodiversity hot spots were identified globally, but subsequently 9 more have been added to the list, bringing total number of biodiversity hot spots in the world to 34.

India has three hot spots:

i. Western Ghats and Sri Lanka

ii. Indo- Burma

iii. Himalayas

Although all the biodiversity hot spots put together cover less than 2 percent of the earth lands area, but number of species is extremely high and strict protection of these hotspots could reduce the mass extinctions by almost 30%.

Eastern Himalayas are an active centre of evolution and has rich diversity of flowering plant and a number of endemic species. Further, numerous primitive angiosperm genera- Magnolia, Betula are found in Eastern Himalayas.

Western ghats are spread over 1600 km in Maharashtra, Karnataka, Tamilnadu and Kerala to Sri Lanks. It is rich in amphibians and reptiles. The Agasthyamalai hills, Silent Valley, Amambalam Reserve are main centres of diversity.

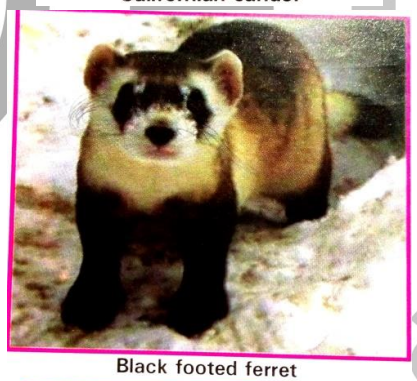
Ex-situ conservation strategies

In this approach threatened animals and plants are taken out from their natural habitats and placed in special care. Ex situ conservation includes offsite collections and gene banks.

1. **Offsite collection :** These are live collections of wild and domesticated species in botanical gardens, zoo/ zoological parks, wildlife safari parks, arboreta etc. There are more than 1500 botanical gardens and arboreta in world containing more than 80,000 species.

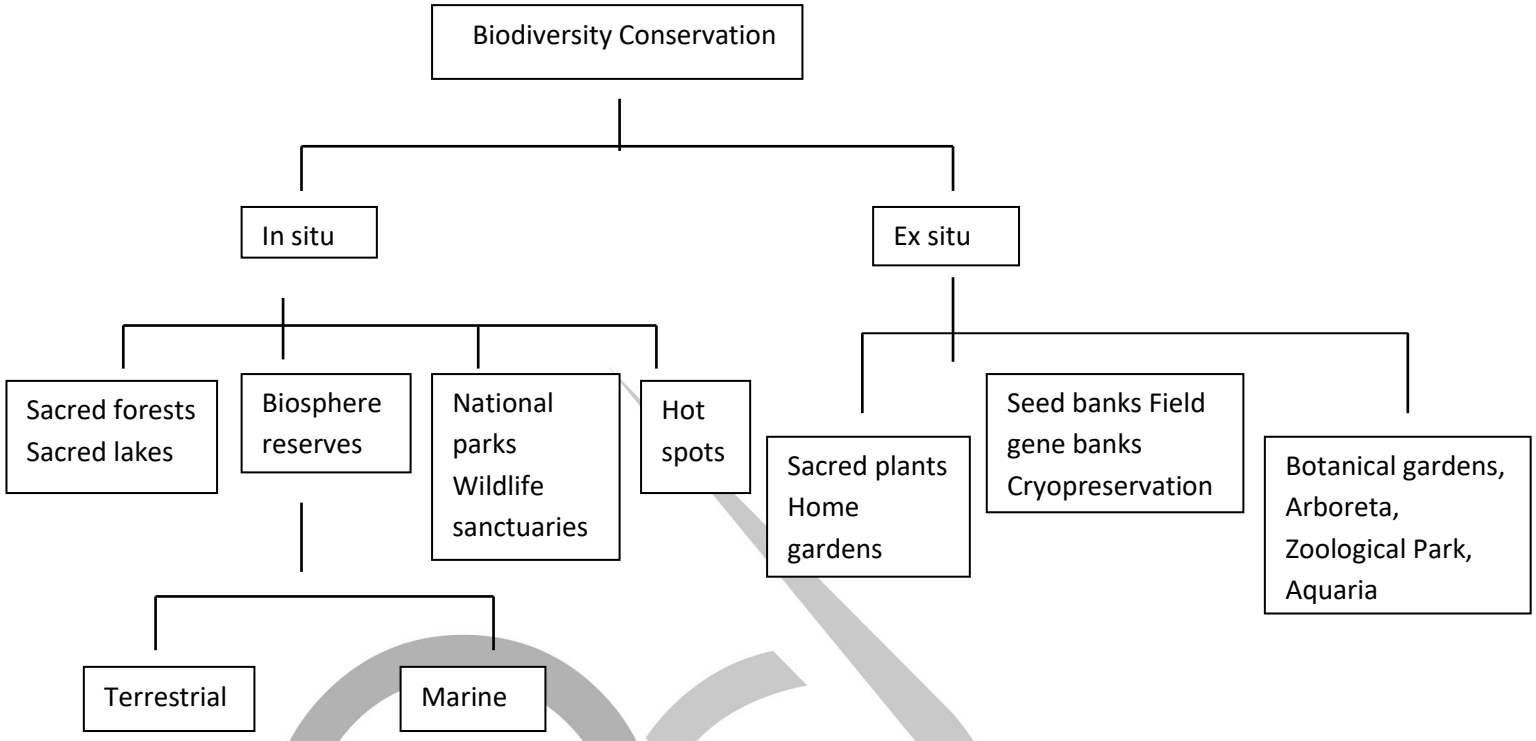
The number of zoo/zoological parks is more than 800 most of them have well managed captive breeding programmes. By this method, Californian Candor and Black Footed Ferret have been saved from extinction. Ginkgo tree (Ginkgo bilobo) has been saved by selective breeding followed by bringing it into trade of nature lovers.

Californian candor



Black footed ferret

2. **Gene Banks/ Seed banks :** In recent years ex situ conservation has advanced beyond keeping threatened species in enclosures. Now 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. Seeds of different genetic strains of commercially important plants can be kept for long periods in seed banks. The National Bureau of Plant Animal and Fish Genetic Resources has a number of programmes to collect and conserve the germplasm of plant and animals, field gene banks for in-vitro conservation.
3. **Sacred plants** Ocimum sanctum (Tulsi), Elaeocarpus floribundus Rudraksh (Ficus religiosa (Peepal).



International efforts for conserving biodiversity

Biodiversity knowns no political boundaries and its conservation is therefore a collective responsibility of all nations.

Historic convention on biological diversity (The Earth Summit) held in 1992 at Rio de Jeneiro, Brazil resulted into **Convention on Biodiversity** which came into force on December – 29, 1993. The convention has 3 key objectives.

(i) All nations to take appropriate measures for conservation of Biological Diversity

(ii) Sustainable use of Biodiversity

(iii) Fair and Equitable sharing of benefits arising out of the utilization of genetic resources.

Agenda 21

A product of earth summit is blue print for encouraging sustainable development of diversity through social economic and environmental measures in 21st century.

World Summit

A World Summit followed by Earth Summit was held in 2002 in Johannesberg, South Africa. 190 countries attending the Summit pledged to significantly reduce the current rate biodiversity loss at global, regional and local levels by 2010.

CU (IUCN) and WWF support Worldwide projects to promote conservation and development of biosphere preserves.

Earth summit 2012

In 2012, the United Nations Conference on Sustainable Development Was also held in Rio, and is also commonly called Rio + 20 or Rio Earth Summit 2012. It was held from20 to 22 June.

The Issues addressed included:

System scrutiny of patterns of production particularly the production of toxic components, such as lead in gasoline, or poisonous waste including radioactive chemicals.

- Alternative sources of energy to replace the use of fossil fuel which are linked to global climate change

- new reliance on public transportation systems in order to reduce vehicle emissions, congestion in cities and the health problems caused by polluted air and smoke
- the growing scarcity of water

List of protected areas of India

Protected Wild life	Protected Areas
Snow Leopard (Panthera uncia)	Khangchendonga ; National park (Gangtok)
Lion (Panthera leo persica)	Gir National park, Junagarh (Gujarat)
Elephant (Elephas maximum)	Manas Sanctuary, Barpeta (Assam) Periya Sanctuary, Kerala Kaziranga national park, sibsagar, Jorhat (Assam) Palamau Sanctuary, Daltonganj (Bihar) Similipal Sanctuary, Mayurbhanj (Orissa) Now a National Park
Rhino (Rhinoceros unicomis)	Kaziranga National park, Sibsagar, Jorhat (Assam) Jaldapara Sanctuary (Bengal) Manas Sanctuary, Barpeta (Assam)
	Corbett National park, Nainital (Uttaranchal) Harzibeg Sanctuary, Hazaribeg (Jharkhand) Ranthambore National park (Rajasthan) Kanha National pak (M.P.) Sunderbans Tiger Reserve, 24 parganas (West Bengal)

Important wildlife projects of India:

Musk deer

Project tiger (Panthera tigris) – started in 1973 to check depletion in population of Tiger, presently applicable to 23 National Parks (Initially 17)

Lion project (Panthera leo persica), e.g., Gir National Park, Junagarh (Gujrat).

Snow Leopard Project (Panthera uncia). Throughout Himalayas e.g., Khangchendzonga National Park (Gangtok)

Musk deer project (Moschus Moschiferus) – Kedarnath Sanctuary (Uttaranchal), Manali Sanctuary (H.P.) and Shikari Devi Sanctuary (H.P.)

Remembers:

i. First man made sanctuary is Ranganathitto bird sanctuary, Mysore (Karnataka).
ii. Chilka lake in Orissa is a breeding place for flamingoes.
iii. Asiatic Wild Ass is given protection in wild Ass Sanctuary (Rann of Kutuch, Gujarat).
iv. Brazil – highest biodiversity.
v. Pitcher plant is found in rain forest of North east India.
vi. One- horned rhinoceros is specific to Kaziranga sanctuary.
vii. Red in IUCN list indicate threatened species or species under various degrees of extinction risk.
viii. Low diversity man-made ecosystem that has high productivity – crop field (e.g. wheat , paddy, sugarcane).

ix. Productivity and diversity of natural community remain constant over a time period of hundred years in climax community.
x. CITES : Convention of International Trade in Endangered Species of Wild Fauna and Flora.
xi. IBWL : Indian Board of Wildlife.
xii. 3rd December – World Conservation Day.
xiii. 29th December – International Day for Biological Diversity.
xiv. Biodiversity Bill- 2002.
xv. Wildlife (Protection) Act 1972 and 1991.
xvi. Forest (Conservation) Act 1980.
xvii. 21st March – World Forest Day.
xviii. 22nd April – World Earth Day.
xix. 5th June – World Environment Day.
xx. 3rd October – World Animal Day.
xxi. First week of October (Monday) – Wildlife week.
xxii. WWF – The World wildlife Fund for Nature.
xxiii. IBP – International Biological Programme.
xxiv. UNDP – United Nation Development Programme.
xxv. IUCN – International Union for Conservation of a true and Natural Resources.
xxvi. Keibul Lamjao National park (Manipur) – Only floaring national park (Lake Loketak) where the dancing deer has been conserved.

EXERCISE - 1

1. Bio – diversity is determined by
   (a) Number of individuals in an area
   (b) Species richness
   (c) Evenness
   (d) Both (b) and (c)
2. Alpha diversity is biodiversity present
   (a) Within community
   (b) Between communities
   (c) Ranges of community
   (d) All of the above
3. The replacement of species along a gradient of habitats/communities is called
   (a) $\alpha -$ diversity
   (b) $\beta -$ diversity
   (c) $\gamma -$ diversity
   (d) $\omega -$diversity
4. Genetic diversity is related to
   (a) Types of species within a community
   (b) Types of communities in an area
   (c) Gene based diversity
   (d) Diversity and evolution of species.
5. A species spread over a large tract with varied environmental conditions will have
   (a) Higher genetic diversity
   (b) Uniform gene pool
   (c) Little genetic diversity
   (d) Both (b) and (c)
6. Ladakh is present in biogeographical region called
   (a) Himalayas
   (b) Semi – arid
   (c) Trans – Himalayas
   (d) North – east
7. In "rivet popper hypothesis" and analogy given by Paul Ehrlich what "rivets" stand for?
   (a) Population
   (b) Ecosystem
   (c) Species
   (d) Community
8. Diversity of habitats over the total geographical area is
   (a) $\alpha -$ diversity
   (b) $\beta -$ diversity
   (c) $\gamma -$ diversity
   (d) $\delta -$ diversity
9. The active chemical drug reserpine is obtained from
   (a) Datura
   (b) Rauwolfia
   (c) Atropa
   (d) Papaver
10. Percentage Number of animal species out of the total known organisms is
    (a) 53
    (b) 60
    (c) 70
    (d) 80
11. Robert May places the global species diversity a^+ about
    (a) 20 – 50 million
    (b) 1. 7 million
    (c) 7 million
    (d) 10 million
12. Out of all the species recorded on earth, animals are more than_____% and plants like (algae, fungi bryophytes, gymnosperms and angiosperms) accounts for only _____% of the total
    (a) 80% and 20%
    (b) 70% and 22%
    (c) 70% and 30%
    (d) 75% and 25%
13. Total number of plant species and animal species recorded from India respectively are
    (a) 40000 and 80000
    (b) 50000 and 70000
    (c) 45000 and 90000
    (d) 40000 and 60000
14. According to may's global estimates, total species recorded are only ____of the total species existing in nature.
    (a) 50%
    (b) 20%
    (c) 40%
    (d) 22%
15. Species diversity decreases with
    (a) Increase in latitude and decrease in altitude.
    (b) Decrease in latitude and increase in altitude.
    (c) Decrease in both latitude and altitude
    (d) Increase in both latitude and altitude
16. Which of the following groups of vertebrates show maximum species diversity
    (a) Mammals
    (b) Birds

(c) Reptiles
(d) Fishes

17. Tropical regions show greater biological diversity because
(a) These latitudes have remained relatively undisturbed
(b) Constant environment promotes niche specialization
(c) More solar energy is available
(d) All of these

18. Alexander von Humboldt explained species – area relationship by the equation
(a) Log C = Log S + Z log A
(b) Log A = Log S + Log C
(c) Log S = Log C + z Log A
(d) Log S = Log C + Log A

19. Which of the following statements is not correct for a stable community?
(a) There is not much variation in productivity from year to year.
(b) It is resistant or resilient to occasional disturbances
(c) It shows decreased productivity
(d) It is resistant to invasion by alien species

20. Tilman's long term ecosystem experiments provided evidence that
(a) Ecosystems with more diversity showed less year to year variations in total biomass
(b) Species richness increased with increasing explored area
(c) Species diversity decreases with increase in latitude
(d) Both (a) and (b)

21. Various forms of life should be conserved as they
(a) Will be lost otherwise
(b) Have economic values
(c) Contain diverse genetic resources
(d) Are important for humans

22. Decrease in species diversity in tropical equntries is mainly due to
(a) Urbanisation
(b) Pollution
(c) Deforestation
(d) Soil erosion

23. A Introduction of Nile perch in Lake Victoria of East Africa resulted in
(a) Excessive growth of water weeds
(b) Elimination of water weeds
(c) Elimination of many species of chichlid fish
(d) Excessive growth of chichlid fish

24. A weed which has invaded many forest lands of India is
(a) Parthenium
(b) Eichhornia
(c) Lantana
(d) Chenopodium

25. Which of the following species have become extinct recently because of over – exploitation?
(a) Dodo
(b) Quagga
(c) Stellar's sea cow
(d) Thylacine

26. Loss of biodiversity in a region lead to
(a) Decline in plant production
(b) Lowered resistance to environmental disturbances
(c) Increased variability in plant productivity
(d) All of these

27. According to IUCN red list 2004, in last 500 years, the number of species which have become extinct are
(a) 338 vertebrates, 300 in vertebrates and 87 plants
(b) 350 vertebrates, 359 invertebrates and 87 plants
(c) 338 vertebrates, 359 invertebrates and 97 plants
(d) 338 vertebrates, 359 invertebrates and 87 plants

28. Match the following

Column – A	Column – B
a. Amazon Rain Forest	i. Anthropogenic
b. Evil Quartet	ii. Alien species
c. Quagga	iii. Lake Victoria
d. Clarias	iv. Lungs of the planet
e. Sixth Extinction	v. Sobriquet
f. Nile perch	vi. Extinct

(a) a – iv, b – v, c – vi, d – ii, e – I, f – iii
(b) a – I, b – v, c – iii, d – ii, e – iv, f – vi
(c) a – v, b – iv, c – vi, d – iii, e – ii, f – I
(d) a – iv, b – I, c – v, d – vi, e – iii, f – ii

29. Wild life is conserved
(a) In situ
(b) Ex situ
(c) Both (a) and (b)
(d) Selective hunting of predators.

30. Which one of endangered species?
(a) Pinus
(b) Chrysanthemum
(c) Rauwolfia
(d) Both (b) and (c)

31. Organisation responsible for maintaining Red Data Book/Red list is
(a) IUCN
(b) WWF
(c) CITES
(d) IBWL

32. Red list contains information about
(a) Red coloured flowers
(b) Endangered plants and animals
(c) Extinct animals only
(d) Extinct plants only

33. Status of Red Panda is
(a) Critically endangered
(b) Endangered
(c) Vulnerable
(d) Extinct

34. Number of protected areas around the world is
(a) 17000
(b) 37000
(c) 1700
(d) 3700

35. Number of categories recongised by Red List is
(a) 4
(b) 5
(c) 6
(d) 8

36. Number of wildlife sanctuaries and National Parks set up in India respectively are
(a) 513 & 90
(b) 448& 90
(c) 294 & 80
(d) 316 & 85

37. Which one of the following is not the broadly utilitarian reason for the conservation of biodiversity?
(a) Providing oxygen
(b) Pollination
(c) Source of medicines
(d) Aesthetic value

38. Bioprospecting is study of diversity of economically important organisms at
(a) Molecular level
(b) Genetic level
(c) Species level
(d) All of these

39. Plant species, which contribute to the traditional medicines used by native peoples around the world are about
(a) 2500
(b) 25000
(c) 2000
(d) 22000

40. Narrowly utilitarians benefits of biodiversity refer to
(a) Food
(b) Firewood
(c) Fibre
(d) Ali direct economic benefits from living organisms

41. In which zone of biosphere reserves is limited human activity allowed?
(a) Core zone
(b) Buffer zone
(c) Manipulation zone
(d) Restoration zone

42. The most effective method of conservation of biodiversity over a large area is
(a) Tissue culture
(b) Botanical Eardens
(c) Wild life sanctuaries
(d) Biosphere reserves

43. Biodiversity bill was passed in
(a) 1992
(b) 1996
(c) 2002
(d) 2000

44. Which is hot spot of biodiversity in India?
(a) Aravalli Hills
(b) Eastern Ghats
(c) Western Ghats
(d) Indogangetic plains

45. Which does not occur in biodiversity hot spots?
(a) Species richness
(b) Lesser interspecific competition
(c) Endemism
(d) Acceleration species loss

46. Tiger is not resident in the National Park
(a) Sunderbans
(b) Ghir
(c) Jim Corbett
(d) Ranthambore

47. Indian Rhinoceros is natural inhabitant of which state?

(a) Assam
(b) Uttarakhand
(c) Uttar Pradesh
(d) Himachal Pradesh

48. Which of the following is not a ex – situ method of conservation of endangered species?
(a) cryopreservation
(b) Tissue culture
(c) Sacred groves
(d) Botanical Gardens

49. For reducing the current rate of biodiversity loss at global, regional and local level, a convention was held in 2002 which was named as
(a) Earth summit
(b) World summit on sustainable development
(c) Forest conservation programme
(d) MAB programme

50. Which one of the expanded forms of the following acronyms is incorrect?
(a) WCU – World Conservation Union
(b) IUCN – International Union for Conservation of Nature and Natural Resources
(c) MAB – Man and Biology
(d) All are correct

51. Gene bank is collection of
(a) Frozen germplasm
(b) Spores
(c) Seeds
(d) All of these

52. Biosphere reserves differ from National Parks and Wild life Sanctuaries
(a) In the absence of human interference
(b) In people being integral part
(c) In plants given more importance
(d) Having living organisms from different parts of the world and protected here

53. Which one is odd combination of habitat and particular animal?
(a) Sunderbans – Bengal Tiger
(b) Periyar – Elephant
(c) Rann of Kutch – Wild Ass
(d) Kerala – Snow Leopard

54. Which of the following about biodiversity hot spots is correct?
a. The total number of biodiversity hot spots in the world presently is 34
b. Three of these hotspots – Western Ghats and Srilanka, Indo – Burma and Himalaya – cover out country's. exceptionally high biodiversity regions.
c. The biodiversity hot spots cover less than 2% of the earth's land area
d. The hot spots are regions of accelerated habitat loss
e. The hot spots harbor a very high number species
(a) a, b, c
(b) a, b, c, d
(c) b, c, d, e
(d) a, b, c, d, e

55. Venue and year of Earth Summit and Conservation of bioversity was
(a) South Africa 2002
(b) Rio de Jeneiro 1992
(c) Johannesburg 2004
(d) Ramsar 1974

56. In 2002, in the world summit on sustainable development, in South Africa, how many countries pledged their commitment to achieve significant reduction in the current rate of biodiversity loss at global, regional and local levels?
(a) 200 countries
(b) 150 countries
(c) 190 countries
(d) 290 countries

EXERCISE - 2

1. Occurrence of different kinds of organism on a site is determined by
   (a) Environmental conditions of a site
   (b) Alpha diversity
   (c) Range of tolerance of species
   (d) Both (a) and (c)
2. In India, we find mangoes with different flavours, colours, fibre – content, sugar content and even shelf life. The large variation is on account of
   (a) Species diversity
   (b) Induced mutations
   (c) Genetic diversity
   (d) Hybridization
3. Species diversity
   (a) Depends on species richness
   (b) Depends on species evenness
   (c) Is also called interspecific diversity
   (d) All
4. Largest biogeographical region of India is
   (a) Western ghats
   (b) Deccan peninsula
   (c) North east region
   (d) Sunderbans
5. Which of these does not cover our country's sex ceptionally high biodiversity region?
   (a) Arravali Hills
   (b) Western Ghats and Sri Lanka
   (c) Indo – Burma
   (d) Himalaya
6. Discovery of new species has recently picked up due to project
   (a) Species 2000
   (b) Global diversity information facility
   (c) Agenda 21
   (d) Both a and b
7. Number of plant species reported in India are
   (a) 45,000
   (b) 40,000
   (c) 90,000
   (d) 50,0001
8. Maximum productivity is found in
   (a) Grassland
   (b) Tropical rain forest
   (c) Ocean
   (d) None of these
9. The larges tropical Amazonian rain forest is in
   (a) North America
   (b) South America
   (c) India
   (d) Pakistan
10. On a logarithmic scale, space area relationship is
    (a) A straight line
    (b) Described by equation log S = log C + Z log A
    (c) Described by equation log C = log S + Z log Z
    (d) Both (a) and (b)
11. Rivet popper hypothesis proposed by Paul Ehlrich is for
    (a) The effect of decrease in biodiversity on the ecosystem
    (b) The effect of increase in biodiversity on the cosystem
    (c) Alien species invasions
    (d) Over exploitation
12. American water plant that has become a trouble some water weed in India is
    (a) Cyperus rotundus
    (b) Eichhornia crassipes
    (c) Trape latifolia
    (d) Trapa Bispinosa
13. Evil quartet or major four causes, leads to extinction of species. One of the reason is
    (a) Habitat loss and fragmentation
    (b) Reducing over exploitation
    (c) Ecosystem health
    (d) Resilience
14. Dodo, an extinct flightless bird, belonged to
    (a) Mauritius
    (b) Lakshadweep
    (c) Canada
    (d) Iceland
15. If the Bengal tiger becomes extinct
    (a) Hyaenas and wolves will become scarce
    (b) The wild areas will be safe for man and domestic animals
    (c) Its gene pool will be lost for ever
    (d) The population of beautiful animals will get stabilized

16. Organization responsible for maintaining Red Data Book/ Red List is
(a) IUCN
(b) CITES
(c) WWF
(d) IBWL

17. World Conservation Union maintains
(a) Red data book
(b) Red list
(c) Yellow list
(d) Both a and b

18. The species very near to extinction if conservational measures are not prompt are called as
(a) Threatened species
(b) Rare species
(c) Endangered
(d) Vulnerable

19. A threatened specfies category includes only
(a) Only endangered species
(b) Only vulnerable species
(c) Endangered and rare species
(d) Endangered, vulnerable and critically endangered species

20. Which group of vertebrates comprises the highest number of endangered species?
(a) Amphibians
(b) Reptiles
(c) Birds
(d) Mammals

21. Which of the following is not related to narrow utilization?
(a) Products of medicinal importance
(b) Pollination
(c) Construction material
(d) Availability of food

22. There are _____sanctuaries in india and covering _____area (respectively)
(a) 448, 3.2%
(b) 548, 3.2%
(c) 538, 4.2%
(d) 90, 3.2%

23. All types of human activity like forestry, agriculture, tourism, are permitted in which zone of biosphere reserve?
(a) Buffer zone
(b) Manipulation zone
(c) Transition zone
(d) Both (b) and (c)

24. MAB is
(a) Man and botany
(b) Man and biosphere
(c) Man and biotic community
(d) Man, antibiotic and bacteria

25. In your opinion, which is the most effective way to conserve the plant diversity of an area?
(a) By creating biosphere reserve
(b) By creating botanical gardens
(c) By developing seed bank.
(d) By tissue culture method

26. Which one of the following pairs of geographical areas show maximum biodiversity in out country?
(a) Sunderbans and Rann of Kutch
(b) Eastern ghats and west Bengal
(c) Eastern Himalaya and western ghat
(d) Kerala and Punjab

27. Ecological hot spots present in india are
(a) One
(b) Two
(c) Three
(d) Four

28. Which one of the following is not included under in – situ conservation?
(a) National park
(b) Sanctuary
(c) Botanical garden
(d) Biosphere reserve

29. World summit was held in
(a) Rio de Jeneiro, Brazil
(b) Johannesberg, S. Africa
(c) Morges, Switzerland
(d) New York

30. Ranthambore National Park is situated in
(a) Maharashtra
(b) Rajasthan
(c) Gujarat
(d) U.P.

31. Which one is correctly matched?
(a) Gir – Lion
(b) Kaziranga – Musk Deer
(c) Sunderbans – Rhino
(d) Jaipur – Elephant

32. Ranganathitto Sanctuary (Mysore) is known for population of

(a) Bison
(b) Tiger
(c) Goats
(d) Birds

33. Kaziranga is associated with
(a) Rhinoceros
(b) Tigers
(c) Birds
(d) Lions

34. Biological diversity day is
(a) 5 June
(b) 21 March
(c) 3 October
(d) 29 December

35. A: Beta diversity is a community diversity.
R: It is the number of organisms sharing the same habitat.

36. A: Red data book categorise all the plant species occurring on the earth.
R: Blue whale, black buck and snow leopard are only animals mentioned in red data book.

37. A: In situ conservation means conservation of organism in their natural habitat in which they naturally occur.
R: Zoo is an in situ conserved area.

Section – II

38. Match the living organism in column I with their approximate variety of species in column II

Column I	Column II
a. Ants	p. 28,000
b. Beetles	q. 20,000
c. Fishes	r. 3,00,000
d. Orchids	

(a) a – r, b – p, c – q, d – q
(b) a – q, b – r, c – q, d – p
(c) a – q, b – r, c – p, d – q
(d) a – p, b – r, c – p, d – q

39. According to the IUCN (2004), the total number of plants and animal species described so far is
(a) Slightly more than 2.5 million
(b) Slightly more than 1.5 million
(c) Approximately equal to 1.5 lac
(d) Slightly more than 2.5 lac

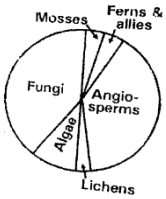
40. "Considering that an overwhelmingly large proportion of species waiting to be discovered are in _____. biologists make a statistical comparison of temperate – tropical species richness of an exhaustively studied group of ____and extrapolate this ratio to other groups of ___and to come up with a gross estimate of total number of species on earth".
Which is correct fill – up of the paragraph is sequence?
(a) Tropics, birds, plants, animals
(b) Temperate, insects plants, animals
(c) Temperate, reptiles, animals, plants
(d) Tropics, insects, animals, plants

41. Which is FALSE with respect to Earth's biodiversity?
a. More than 70% of all species recorded are animals
b. Plants comprise no more than 22% of total
c. About 50% of all species recorded are animals
d. India's share of global species diversity is about 2.4%
(a) a, b & c
(b) both c & d
(c) a, c & d
(d) a, b, c & d

42. Which is correct representation of proportionate number of species of major taxa of plants?

(a) 

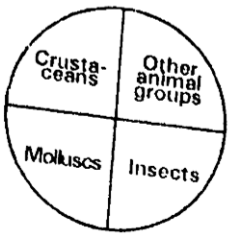
(b) 

(c) 

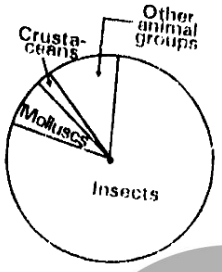
(d) None of these

43. Scientifically sound estimate made by Robert May places the global species diversity at about
(a) 7 million
(b) 17 million
(c) 3 million
(d) 12 million

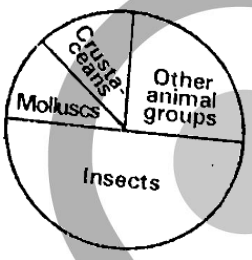
44. Which of the following is correct representation of proportionate number of invertebrates?



(a)



(b)



(c)

(d) None of these

45. Match the areas in column I with approximate species harboured by that area in column II

Column – I	Column – II
a. Indian area in tropical latitude	p. 10 times as many species of vascular plants as in a temperate regions
b. Amazonian rain forest in South America	q. >1200 species of brids
c. Forest in tropical area like Equador	r. Greatest biodiversity on earth

(a) a – r, b – p, c – q
(b) a – p, b – r, c – q
(c) a – q, b – p, c – r
(d) a – q, b – r, c – p

46. What is so special about tropics that might account for their greater biological diversity?
(a) They have remained relatively undisturbed for millions of years
(b) Their environments are less seasonal, relatively more constant and predictable
(c) There is more solar energy available
(d) All of these

47. As per IUCN Red List (2004) documents, match the 784 extincted species in last 500 years in column I with their number in column II

Column I	Column II
a. Vertebrates	p. 359
b. Invertebrates	q. 87
c. Plants	r. 338

(a) a – q, b – r, c – p
(b) a – r, b – p, c – q
(c) a – p, b – q, c – r
(d) a – q, b – p, c – r

48. Match species of recent extinctions in column I with the country to which they belonged in column II

Column I	Column II
a. Dodo	p. Australia
b. Quagga	q. Russia
c. Thylacine	r. Africa
d. Steller's Sea Cow	s. Mauritius

(a) a – s, b – r, c – p, d – q
(b) a – r, b – p, c – q, d – s
(c) a – p, b – s, c – r, d – q
(d) a – q, b – s, c – r, d – p

49. On analyzing species – area relationships among very large areas like entire continents, it s found that for frugivorous (fruit – eating) brids and mammals in tropical forests of different continents, the slope is tropical forests of different continents, the slope is
(a) 1.50
(b) 0.6
(c) 1.15
(d) 0.75

50. For exact stability of a biological community, it must
(a) Not show too much variation in productivity from year to year
(b) Be either resistant of resilient to occasional disturbances (natural or man – made)
(c) Be resistant to invasions by alien species
(d) All of these

51. Rich biodiversity is essential for
(a) Ecosystem health
(b) Survival of human race on the planet
(c) Quality of life
(d) All of these

52. As per present analysis of records match th species in column I with their percentage facing the threat of extinction worldwide in column II

Column I	Column II
a. All bird species	p. 31
b. All mammal species	q. 12
c. All amphibian species	r. 23
d. All gymnosperm species	s. 32

(a) a – s, b – r, c – p, d – q
(b) a – r, b – p, c – q, d – s
(c) a – q, b – r, c – s, d – p
(d) a – q, b – s, c – r, d – p

53. Loss of biodiversity in a region may lead to
a. Decline in plant production
b. Enhanced resistance to environment perturbations such as drought
c. Increased variability in plant productivity
d. Decreased variability in pest & productivity
(a) both a & b
(b) a only
(c) both a & c
(d) a, b & d

54. Which is incorrect with respect to habitat loss coming from tropical rain forests?
(a) Rain forests area has reduced from 14% to 6% of earth's land surface
(b) Amazon rain forest is being cut and cleared for cultivating soya beans
(c) Amazon rain forest is being cut and cleared for raising beef cattle
(d) Rain forests area has reduced from 24% to 14% of earth's land surface

55. How many species of plants contribute to traditional medicines used by native peoples around to world?
(a) 35,000
(b) 15,000
(c) 45,000
(d) 25,000

56. Which is incorrect with respect to broadly utilitarian argument in favour of biodiversity?
(a) Amazon forest produces, through photosynthesis, 20% of the total oxygen in atmosphere
(b) Pollination, without which plants cannot give us fruits or seeds
(c) The aesthetic pleasures of walking through thick woods
(d) Amazon forest produces, through photosynthesis, 12% of the total oxygen in atmosphere

57. Kaziranga National Park is protected area for
(a) Rhinoceros and Elephas
(b) Tigers and Rhinoceros
(c) Birds and Rhinoceros
(d) Lions and Tigers

58. Which of the following is an approach for ex – situ conservation of threatened species?
(a) These are placed in zoological parks, botanical gardens and wildlife safari parks
(b) Gametes of these can be preserved in viable and fertile condition for long periods
(c) Seeds of different genetics strains can be kept for long periods is seed banks
(d) All of these

59. The historic convention on biological diversity ("The Earth Summit") was held in 1992 in
(a) London
(b) Rio de Jeneiro
(c) New York
(d) Johannesburg

60. In the World Summit on Sustainable Development held in 2002 in South Africa, many countries pledged their commitment to achieve a significant reduction in the current rate of biodiversity loss at global, regional and local levels by
(a) 2010
(b) 2009
(c) 2012
(d) 2008

61. A: Alien species invasion is one of the important causes of biodiversity loss.
R: Introduction of African Catfish in the aquatic ecosystems has threatened indigenous catfishes in rivers.

62. A: Botanical gradens and zoological parks provide ex – situ conservation to plants and animals.
R: Botanical gardens and zoological park provides special settings for protection and care which is not possible in their natural habitats.

63. A: Sacred groves and hot spots are means of ex – situ conservation.

R: Religious traditions of india emphasis protection of nature.

64. A: Tropics show very high species richness.
R: Environment of tropics is relatively constant and receives more sunlight.
Exemplar

65. Which of the following countries has the highest biodiversity?
(a) Brazil
(b) South Africa
(c) Russia
(d) India

66. Which of the following is not a cause for loss of biodiversity?
(a) Destruction of habitat
(b) Invasion by alien species
(c) Keeping animals in zoological parks
(d) Over – exploitation of natural resources

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

68. Where among following will you find pitcher plant?
(a) Rain forest of North – East India
(b) Sunderbans
(c) Thar Desert
(d) Western Ghats

69. Which one of the following is not a major characteristic feature of biodiversity hot spots?
(a) Large number of species
(b) Abundance endemic species
(c) Large number of exotic species
(d) Destruction of habitat

70. Match the column I with column – II

Column – I	Column – II
i. Food	a. Jute
ii. Medicines	b. Wood
iii. Fuel	c. Reserpine
iv. Fibre	d. Fig

(a) I – d, ii – c, iii – b, iv – a
(b) I – d, ii – a, iii – b, iv – c
(c) I – b, ii – c, iii – d, iv – a
(d) I – c, ii – d, iii – a, iv – b

71. Nepenthes, psilotum, Rauwolfia & Aconitum are all
(a) Ornamental plants
(b) Phylogenic link species
(c) Prone to over exploitation
(d) Exclusively present in he Eastern Himalayas.

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

73. Amongst the animal groups given below, which one has the highest percentage of endangered species?
(a) Insects
(b) Mammals
(c) Amphibians
(d) Reptiles

74. Which is an endangered plants species of India?
(a) Rauwolfia serpentine
(b) Santalum album (Sandal wood)
(c) Cycas beddonei
(d) All of the

75. In India Lantana, Eichhornia & African catfish are all
(a) Endangered species
(b) Key stone species.
(c) Mammals found
(d) Neither threatened nor indigenous

76. The extinction of passenger pigeon was due to:
(a) Increased number of predatory birds.
(b) Over exploitation by humans.
(c) Non – availability of the food
(d) Bird flu virus infection.

77. Which of the following statements is correct?
(a) Parthenium is an endemic species of our country
(b) African catfish is not a threat to indigenous catfishes.
(c) Steller's sea cow is an extinct animal.
(d) Lantana is popularly known as carrot grass.

78. Among the ecosystem mentioned below, where can one find maximum biodiversity?
(a) Savanna
(b) Desert
(c) Coral reefs
(d) Alpine meadows

79. Which of the following forests is known as the 'lungs of the planet Earth'?

(a) Tiaga forest
(b) Tundra forest
(c) Amazon rain forest
(d) Rain forests of North East India

80. The active chemical drug reserpine is obtained from:
(a) Datura
(b) Rauwolfia
(c) Atropa
(d) Papaver

81. Which of the following group of plants exhibit more species diversity?
(a) Angiosperms
(b) Algae
(c) Bryophytes
(d) Fungi

82. Which of the below mentioned regions exhibit less seasonal variations?
(a) Tropics
(b) Temperate
(c) Alpines
(d) Both (a) & (b)

83. The historic convention on Biological Diversity held in Rio de Jeneiro in 1992 is known as:
(a) CITES Convention
(b) The Earth Summit
(c) UNDP
(d) MAB Programme

84. i. In vitro fertilisation
ii. Cryo preservation and
iii. Tissue culture
All the above techniques are
(a) In situ conservation methods.
(b) Ex situ conservation methods.
(c) Require ultra modern equipment & large. space.
(d) Methods of conservation of extinct organisms.

85. Which characteristic make a community stable?
(a) Habitat
(b) Diversity
(c) Climatic conditions
(d) All of these

86. Mass extinction of species in the past has mainly occurred because of
(a) Human activities
(b) Large scale natural calamities
(c) Large scale predation
(d) Out break of diseases

87. Which of the following accounts for greater ecological diversity of India?
(a) Different climates
(b) Habitat diversity
(c) Variable altitudes
(d) All of these

88. Man made ecosystem show very low diversity but still have high productivity because of
(a) Proper maintainance & protection by human
(b) Less competition
(c) Less genetic diversity
(d) C_4 genetic diversity

89. Red in IUCN (2004), red list indicates
(a) Threatened species
(b) Endemic species
(c) Protected species
(d) Red colour of pages

90. Protection of biodiversity hot spots alone can reduce the current rate of extinction upto 30% because these regions have
(a) High of species diversity
(b) High degree of endemism
(c) Large populations of plants and animals
(d) Both (a) & (b)

91. An endemic species differs from exotic species in
(a)Being an introduced species
(b) Being confined to a specific region only
(c) Being widely distributed
(d) Being confined to islands only

92. Ecological diversity differs from species diversity because it refers to
(a) Diversity at different levels in ecological hierarchy
(b) Variety of species found in an area
(c) High diversity at genetic level
(d) All of these

93. Genetic variation in a medicinal plant Rauwolfia vomitoria is important for us, because it results in
(a) Variation in potency and concentration of reserpine
(b) In the development of new species
(c) Wider distribution
(d) Better adaptations

94. Frugivorous means

(a) Flower eating
(b) Fruit eating
(c) Plant sap sucking
(d) Nectar sucking

95. The expanded from of IUCN is
(a) Institute of universal conservation of nature
(b) International union of conservation of nature
(c) International union of conservation of nature and natural resources
(d) Institute of universal council for nature

96. Presently occurring species extinction is different from earlier mass extinction because presently occurring extinction is
(a) Anthropogenic while mass extinction was climatic
(b) Climatic while mass extinction was anthropogenic
(c) Slower while mass extinction was faster
(d) Of plants only while mass extinction was of both plants and animals

97. Of the four major causes for the loss of bio – diversity, which is the major cause of loss of bio – diversity
(a) Alien species invasion
(b) Habitat loss and fragmentation
(c) Over exploitation
(d) Co – extinction

98. Loss of one species may lead to the extinction of another if
(a) Two species are showing competition for a common resource
(b) Second species is associated with lost one in an obligatory way
(c) Species are showing facultative mutualism
(d) All of these

99. In an species – are curve, if a very large area is considered then slop of the line
(a) Is not much steeper
(b) Is irregular
(c) Is much steeper
(d) Remains same as that of smaller area

100. Conventional methods are not suitable for the assement of biodiversity of bacteria because
(a) Bacteria show asexual reproduction only
(b) These donot have fixed characteristics
(c) Many bacteria cannot be cultured so their characteristics cannot be studied
(d) Their size is very small

101. A species is considered threatened, if in nature it is having
(a) Large populations
(b) Small populations
(c) Under the effect of causal factors which decreases its population size
(d) Both (b) & (c)

102. Amphibians show greater vulnerability to extinction as compared to other animal groups because
(a) Their main habitat wetlands are being filled up at many places
(b) Sufficient food not available
(c) Higher rate of biotic potential
(d) Can live in both land and water

103. Scientists extrapolate total number of species on earth by
(a) Statistical comparison of temperate – tropical species richness of a studied group
(b) Studying certain regions and then providing approximate species – richness of earth
(c) Actual study of diversity of all regions
(d) All of these

104. What are the two major causes, other than anthropogenic, for the loss of biodiversity?
(a) Frequent fires and habitat destruction
(b) Background and mass extinction
(c) Pest attack and less fertily of soil
(d) Habitat destruction and new introductions

105. Endangered species are those which have higher risk of extinction in
(a) Wild in the near future
(b) Wild in the immediate future
(c) The captivity
(d) Wild in the medium term future

106. Sacred groves are
(a) Important for biodiversity conservation
(b) Patches of forests with religious sanctity
(c) Forests which have large number of rare and threatened plants
(d) All of these

107. There is more solar energy available in the tropics than in temperate regions because
(a) Of more biodiversity
(b) Tropical forest trap more solar energy
(c) Longer day at equator
(d) Nights are longer than days

108. Invasion by an alien species reduces the species diversity of an area because
(a) Natural pest and predators of the alien species may not be present
(b) Competition with native plants for water and minerals may eliminate less vigorous native species
(c) Alien species by their vigorous growth may make conditions unfavourable for the growth of native species
(d) All of these

109. Loss of biodiversity at individual level can be prevented by
(a) Recycling waste paper
(b) Judicious use of economically important plants and animals
(c) Generating awareness among the public for importance of biodiversity
(d) All of these

110. Species diversity decreases as we move away from equator towards the poles because
(a) Temperature increases with increase in latitude
(b) Temperature decreases with increase in latitude
(c) Higher temperature and humidity favours species diversity
(d) Both (b) & (c)

111. Invasion by an alien species reduces the species diversity of an area
(a) By showing vigorous growth in the absence of natural pests and predators
(b) By harming local species
(c) By making conditions unfavourable for the growth of local native plants
(d) All of these

112. At present the conflict between humans and wild life has greatly increased because
(a) Of increase in the exploitation of natural resources due to increase in human population
(b) "need has turned to greed"
(c) Of imbalance created in the ecosystem due to alien species introductions
(d) All of these

ANSWER KEY

EXERCISE – 1

Ques.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Ans.	d	a	b	c	a	c	c	c	b	d
Ques.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
Ans.	c	b	c	d	d	d	d	c	c	a
Ques.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.
Ans.	c	c	c	c	c	d	d	a	c	c
Ques.	31.	32.	33.	34.	35.	36.	37.	38.	39.	40.
Ans.	a	b	b	b	d	b	c	d	b	d
Ques.	41.	42.	43.	44.	45.	46.	47.	48.	49.	50.
Ans.	b	d	c	c	b	b	a	c	b	c
Ques.	51.	52.	53.	54.	55.	56.				
Ans.	d	b	d	d	b	c				

EXERCISE – 2

Ques.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Ans.	d	c	d	b	a	d	a	b	b	d
Ques.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
Ans.	a	b	a	a	c	a	d	c	d	a
Ques.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.
Ans.	b	a	d	b	a	c	c	c	b	b
Ques.	31.	32.	33.	34.	35.	36.	37.	38.	39.	40.
Ans.	a	d	a	d	c	d	c	c	b	d
Ques.	41.	42.	43.	44.	45.	46.	47.	48.	49.	50.
Ans.	b	c	a	b	d	d	b	a	c	d
Ques.	51.	52.	53.	54.	55.	56.	57.	58.	59.	60.
Ans.	d	c	c	d	d	d	a	c	b	a
Ques.	61.	62.	63.	64.	65.	66.	67.	68.	69.	70.
Ans.	b	a	d	a	a	c	b	a	c	a
Ques.	71.	72.	73.	74.	75.	76.	77.	78.	79.	80.
Ans.	c	c	c	d	d	b	c	c	c	b
Ques.	81.	82.	83.	84.	85.	86.	87.	88.	89.	90.
Ans.	d	a	b	b	b	b	d	a	a	d
Ques.	91.	92.	93.	94.	95.	96.	97.	98.	99.	100.
Ans.	b	a	a	b	c	a	b	b	c	c
Ques.	101.	102.	103.	104.	105.	106.	107.	108.	109.	110.
Ans.	d	a	a	b	a	d	c	d	d	d
Ques.	111.	112.								
Ans.	d	d								