Conservation of Biological Diversity
(Biodiversity Conservation)
(NOTES)

Definition: Biodiversity is defined as the variety and variability among <u>all groups of living organisms</u> and the <u>ecosystem</u> in which they live.

Significance of biodiversity

1. Biodiversity protects the fresh air, clean water and productive land.

2. It is also important for forestry, fisheries and agriculture, which depend on rich water variety of various biological resources available in nature.

3. Loss of biodiversity exerts heavy economic and social costs for any country.

4. It is very important for human life; we depend on plants, microorganisms and earth's animals for our food, medicine and industrial products.

Biodiversity is usually considered at 3 different levels

1. Genetic diversity
2. Species diversity
3. Ecosystem diversity

(1) Genetic diversity: <u>Genes</u> are the basic unit of hereditary information, transmitted from one generation to the other. Within <u>individual species</u>, there are a number of <u>varieties</u>, which are slightly different from one another. These differences are due to difference in the <u>combination of genes</u>.

Example: all rice varieties belong to the species "*Oryza sativa*"; but there are thousands of <u>wild</u> and <u>cultivated</u> varieties of rice, which shows <u>variations</u> at the <u>genetic level</u> and are different in their colour, size, shape, nutrient content of the plant.

(2) Species diversity: A <u>discrete group of organisms</u> of the <u>same kinds</u> is known as **species**. <u>Species diversity</u> is the <u>diversity between different species</u>. The sum

of varieties of all the living organisms at the species level is known as <u>species diversity</u>.

Example: There are more than 20 million organisms on the earth,which have been identified and given names. Apple, mango, grapes, wheat, rice, etc. are <u>examples</u> of <u>plant species</u>.

(3) Ecosystem diversity: It is a set of <u>biotic components</u> [*such as plants, animals and micro organisms*] interacting with one another and with <u>abiotic components</u>[*such as soil, air, water, etc*.]. The diversity at the ecological or <u>habitat level</u> is known as "<u>ecosystem diversity</u>". *A large region with different ecosystems can be considered as* **ecosystem diversity**. The ecosystem also shows variation with respect to <u>physical parameters</u> like moisture, temperature, altitude, precipitation, etc.

Example: <u>Forest ecosystem</u> is supposed to have mainly dominance of trees. But, while considering a <u>tropical rain forest</u>, a <u>tropical deciduous forest</u> and a <u>temperature forest</u>, variations observed are numerous due to variations in the physical factors.

Biogeographical classification of India

India is a <u>mega diversity country</u> having different types of <u>climate</u> and <u>topography</u> in different parts of the country. These variations have induced much <u>variability in flora and fauna</u>. India occupies <u>10th position</u> among the <u>plant-rich</u> countries of the world.

It is a very important to know and study the <u>distribution</u>, <u>elevation</u> and <u>environmental relationship </u>of plants and animals in time and space.

Biogeography: It comprising of <u>photo-geography</u> and <u>zoo-geography</u>, which deals with aspects of plants and animals, respectively. In order to know about the distribution and environmental interaction of<u> flora</u> and <u>fauna</u> of our country, it has been classified into 10 <u>bio-geographical zones</u>. Each of these zones has its own <u>climate</u> and <u>soil topography</u>(*shape and features of the earth*) and biodiversity.

Global biodiversity

Following the 1992 "**earth summit**" at Rio de Janeiro (Brazil) , it became evident that there is a growing need to know about the huge number of species, which are still unknown on this earth.

Roughly 1.5 million species are known till today, which is perhaps 15% of the actual number of the total earth-biodiversity. It has, therefore, been rightly recognized as an emergency task in order to plan its conservation and practical utilization.

Terrestrial biodiversity of the earth is best described as "biomass", which is the largest ecological unit present in different geographic areas.

Example: Tropical rain-forests are inhabited by millions of species of plants, birds, amphibians, insects and mammals. They are the earth's **largest** store house of biodiversity. About 50-80% of global biodiversity lies in these rain-forests.3,000 plants, identified by national cancer research institute [NCRI], are marvellous sources of cancer fighting chemicals.

Very recently extract from one of the creeping wines in the rain forests at Cameroon has proved effective in the inhibition of replication of 'AIDS' virus.

Tropical forests have much less biodiversity, but there is much better documentation of the species at global level, representing about 170,000 of flowering plants, 30,000 of vertebrates and about 250,000 of other groups of species.

Biological diversity at national level

Every country is characterised by its own biodiversity depending mainly on its climate.

1. India has a rich biological diversity of flora and fauna, representing about 6% of the global biodiversity.

2. India ranks **10th** among the plant-rich countries of the world, **11th** in term of number of endemic species of high vertebrates and **6th** among the centres of diversity and origin of agricultural crops

Local biodiversity

Biodiversity at <u>regional level</u> is better understood by categorizing <u>species-richness</u> into <u>four types</u>.

Point richness: It refers to the <u>number of species</u> that can be found <u>at a single point</u> in a given space.

1. **Alpha (α) richness:** It refers to the <u>number of species</u> that can be found in a <u>small homogeneous area</u>.

2. **Beta (β) richness:** It refers to the rate of change of species-composition <u>across different habitats</u>.

3. **Gamma (γ) richness:** It refers to the rate of change of species-composition across large <u>landscrape gradients</u>.

Alpha (α) richness: It is strongly correlated with <u>physical variables</u> of the environment.

Beta (β) richness: It means that the <u>cumulative</u> number of species increases as more heterogeneous habitats are taken into consideration.

Example: the <u>ant</u> species found in local species region of <u>North pole</u> is merely 10. As we keep on moving towards the <u>equator</u>, more and more habitats are added and, accordingly, the number of species of ants increases so much so that it reaches as high as 2000 on the equatorial region.

India as a mega diversity nation

India has a rich and varied heritage of biodiversity, encompassing a wide spectrum of habitats from <u>tropical rain forests</u> to <u>alpine vegetation</u> and from <u>temperate</u> to <u>coastal wetlands</u>.

India is one of the 12 <u>mega biodiversity</u> countries in the world. In 2000, government of India recorded 47,000 species of plants and 81,000 species of animals, which is about 7% and 6.5%, of global <u>flora</u> and <u>fauna</u>, respectively.

Endemism: Species, which are <u>restricted only to a particular</u> area, are known as <u>endemic species</u>. India shows a good number of endemic species; it is

recorded that about 62% of <u>amphibians</u> and 50% of <u>lizards</u> are <u>endemic to India</u>.

Centre of origin: A large number of species are known to have <u>originated in India</u>. India has been the centre of origin of <u>166 species</u> of <u>crop plants</u> and 320 species of <u>wild species</u> or of wild relative of cultivated crops.

Nearly 5,000 species of <u>flowering plants</u> have their origin in India.

Marine biodiversity: There exists a rich biodiversity along 7,500 km long <u>coastline</u> of our country, carrying <u>mangroves</u>, <u>estuaries</u>, <u>coral reefs</u>, <u>back-water</u>, etc.

The marine biodiversity is rich in <u>moleskins</u>, <u>crustaceans</u> [crabs], <u>polychquetus</u> and <u>corals</u>, several species of <u>mangrove plants</u> and <u>sea grasses</u>[marine algae] are also found in our country.

India's forest cover of 64.01 million hectares and has a <u>rich biodiversity</u> of plants in the Trans-Himalayan, North-West, central and Eastern Himalayan forest, coasts, deserts, Gangetic plain, Nicobar and Lakshadweep island.

Conservations of biodiversity

<u>Biodiversity conservation</u> is the <u>protection</u>, <u>preservation</u>, <u>management</u>, or <u>restoration</u> of **wildlife** and **natural resources** such as <u>forests</u>, <u>water bodies</u>, etc. Survival of many species and habitats, which are <u>threatened</u> due to <u>human activities</u>, can be ensured through the <u>conservation of biodiversity</u>. There is an urgent need, not only to <u>manage</u> and <u>conserve</u> the **biotic wealth**, but also to restore the <u>degraded ecosystems</u>.

Humans have been directly or indirectly dependent on biodiversity for their sustenance to a considerable extent. However, increasing <u>population pressure</u> and <u>developmental activities</u> have led to large scale depletion of the <u>natural resources</u>.

Biodiversity conservation is meant for management of human activities in the environment so that it does not lead to habitat destruction and loss of biodiversity. The conservation of biodiversity is carried out:

1. To <u>preserve</u> and <u>protect</u> the species in their habitat.

2. To maintain essential ecological process so that there is no ecological imbalance created.

3. To use the species and ecosystem sustainably without exploiting them.

4. To preserve flora and fauna, natural parks, sanctuaries, biosphere reverses, etc. are created.

5. To conserve the <u>genetic biodiversity</u> by establishing the zoological gardens (zoos), botanical gardens, nurseries, etc.

6. To ensure proper planning of land use and other natural resources so as to conserve the biodiversity.

7. To prohibit the hunting, poaching of animals, fishing etc., beyond the productive capacity of ecosystem.

8. To ensure biodiversity maintenance by enforcing the acts, laws of legislative controls such as <u>India forests act</u>, <u>endangered species act</u>, etc.,

9. To create <u>public awareness</u> about sustainable use of the species without affecting the biodiversity.

10. To delineate the particular areas as "<u>reserved</u>" so that no activity is permitted in that zone. **Example**: reserve forests.

11. To conserve the biodiversity with regard to plants and animals,a number of measures are now being taken the world over.

Types of conservation: Conservation can broadly be divided into two types:

1. In-situ conservation
2. Ex-situ conservation

BIODIVERSITY CONSERVATION	
In-Situ Conservation	**Ex-Situ Conservation**
1. Protected areas	**1.** Seed banks, Gene banks
➤ National parks	**2.** Long term captive breeding
➤ Sanctuaries	**3.** Animal translocations
➤ Biosphere reserves	**4.** Tissue culture banks
2. Sacred forests and lakes	**5.** Cryopreservation of gametes and embryos
	6. Botanical gardens
	7. Zoological gardens (Zoos)

[1] In-situ conservation

In-situ conservation is <u>on site conservation</u> or the *conservation of genetic resources in natural populations of plant or animal species*, such as forest genetic resources in natural populations of tree species.

<u>*In-situ conservation*</u> *is the process of protecting an <u>endangered</u> plant or animal species in its <u>natural habitat</u>, either by protecting or cleaning up the habitat itself, or by defending the species from predators.*

It is applied to conservation of <u>agricultural biodiversity</u> in agro-forestry by farmers, especially those using unconventional farming practices. In-situ conservation is done by declaring the particular area as <u>protected area</u>.

The role of protected areas in maintaining biodiversity

A <u>protected area</u> is a geographically defined area that is designated or regulated and managed to achieve specific conservation objectives. It may be set aside for the protection of biological diversity, and of natural and associated cultural resources and is managed through legal or other effective means. This includes <u>national parks</u> and <u>nature reserves</u>, <u>sustainable use reserves</u>, <u>wilderness areas</u> and <u>heritage sites</u>.

<u>Protected areas</u> (PAs) have been widely used as a <u>conservation tool</u> in order to maintain a representative sample of <u>unaltered species</u> and <u>eco-systems</u> for the future, and to limit the potential for environmental degradation through human mismanagement of resources.

At present, approximately 8,500 PAs exist throughout the world in 169 countries. This covers about 750 million hectares of marine and terrestrial ecosystems, which amounts to 5.2 % of the Earth's land surface.

The World Conservation Union, <u>International Union of Conservation of Nature</u> (IUCN), has a key role in promoting the establishment of protected areas throughout the world. Since 1948, IUCN has developed standards and guidelines for PAs management. Protected areas have been established following the categories defined by the IUCN.

Strict protection categories (**categories I – III**) have mostly been applied in the *developing countries*, whereas **categories V and VI** are the most commonly used in the *developed world*).

Category I: Strict Protection Sometimes called strict nature reserve/wilderness areas.

These are protected areas managed mainly for science or wilderness protection. These are generally smaller areas where the preservation of important natural values with minimum human disturbance.

Category II: Ecosystem Conservation and Tourism Sometimes called national parks.

These are generally larger areas with a range of outstanding features and ecosystems that people may visit for education, recreation, and inspiration as long as they do not threaten the area's values.

Category III: Conservation of Natural Features Sometimes called natural monuments.

These are similar to National Parks, but usually smaller areas protecting a single spectacular *natural feature or **historic site***.

Category IV: Conservation through Active Management Sometimes called habitat and wildlife (species) management areas.

These are areas managed to protect and utilise wildlife species.

Category V: Landscape/Seascape Conservation and Recreation Sometimes called protected landscapes/seascapes.

Category VI: Sustainable Use of Natural Ecosystems Sometimes called managed resource protected areas.

Protected areas are managed mainly for the sustainable use of natural ecosystems.

In the past, it was assumed that the best way to preserve biodiversity was to conserve it through protected areas by reducing human activities or

completely excluding humans. Population growth and poverty were seen as main causes of environmental degradation; people were regarded as a problem from which the <u>environment needed protection</u>. Accordingly, protected areas and parks were fenced off from local people, traditional practices were prohibited, and people were held under penalties of fines or imprisonments for utilising park resources. However, there are very controversial scientific and social problems with this approach, which was characterized by serious conflicts between local communities and the state.

This, therefore, led to a transformation in thinking and the recognition that:

1. Local people understand their environment and have extensive knowledge of the resources within their local environment

2. The exclusion of local people from protected areas may actually lead to impoverishment of their biological diversity, with both ecological and social costs

3. Traditional practices enable people to live with nature in a mutually beneficial way. For example, instead of banning hunting altogether, a series of regulations could be put in place to regulate hunting, e.g. prohibitions on killing juveniles, or pregnant females.

4. Many communities still do not see wildlife and the environment as their own property because they are not involved in decision-making process and have little responsibility in conservation projects.

5. Revenues earned from PAs have not always been passed on to communities

PAs management has taken on a more holistic approach to assessing biodiversity and environmental protection - it has to be effective in linking conservation with human needs. PAs management must take into account the local people's realities, that is, policy formulation must be based on a more realistic understanding of the social and political dimensions of natural resources management.

In India, following three types of natural habitats are being maintained:

1. National parks

2. Wildlife sanctuaries

3. Biosphere reserves

India has over 600 underlined protected areas, which includes over 90 national parks, over 500 animal sanctuaries and 15 biosphere reserves.

(1) National parks

A national park is an area which is strictly reserved for the betterment of the wildlife and where activities like forestry and grazing on cultivated area are not permitted. In these parks, even private ownership rights are not allowed.

Their boundaries are well marked and circumscribed. They are usually small reserves spreading in an area of 100 to 500 sq. km. In national parks, the emphasis is given on the preservation of a single plant or animal species.

List of some major national parks of India

S. No.	Name	State	Year of establish-ment	Area (km^2)
1.	**Corbett** National Park	Uttarakhand	1921	1318.5
2.	**Dudhwa** National Park	Uttar Pradesh	1977	490.29
3.	**Gir** National Park	Gujarat	1965	258.71
4.	**Kanha** National Park	Madhya Pradesh	1955	940
5.	**KangerGhati** National Park (Kanger Valley)	Chhattisgarh	1982	200
6.	**Kaziranga** National Park	Assam	1974	471.71
7.	**Nanda Devi** National Park	Uttarakhand	1982	630.33
8.	**Sariska** National Park	Rajasthan	1955	866
9.	**Silent Valley** National Park	Kerala	1980	237
10.	**Sundarbans** National Park	West Bengal	1984	1330.12

(2) Wildlife sanctuaries

A sanctuary is a protected area, which is reserved for the conservation of only animals in which the human activities (*like harvesting of timber, collecting minor forest products, and private ownership rig*hts) are allowed as long as they do not

interfere with the <u>well-being of animals</u>. Boundaries of sanctuaries are not well defined and <u>controlled biotic-interference</u> is permitted, e.g., *tourist activity*.

List of some major wildlife sanctuaries of India

S. No.	Name	State	Year of establish-ment	Area (km^2)
1.	**Ghana** Bird Sanctuary	Rajasthan	1982	28.73
2.	**Hazaribag** Wildlife Sanctuary	Jharkhand	1954	183.89
3.	**Mudumalai** Wildlife Sanctuary	Tamil Nadu	1940	321.55
4.	**Jaldapara** Wildlife Sanctuary	West Bengal	2012	216
5.	**Mount Abu** Wildlife Sanctuary	Rajasthan	1960	288.84
6.	**Annamalai** Wildlife Sanctuary (Indira Gandhi Wildlife Sanctuary and National Park)	Tamil Nadu	1989	117.10

(3) Biosphere reserves

It is a special category of <u>protected areas</u>, where human population also forms a part of the system. They are <u>large protected area</u> of usually more than 5000 sq.km. A biosphere reserves has 3 parts, viz. <u>core zone</u>, <u>buffer zone</u> and <u>transition zone</u>.

1. **Core zone** is the inner zone; this is undisturbed and legally protected area.

2. **Buffer zone** lies between the core and transition zone. Some research and educational activities are permitted here.

3. **Transition zone** is the outermost part of biosphere reserves. Here, <u>cropping</u>, <u>forestry</u>, <u>recreation</u>, <u>fishery</u> and <u>other activities</u> are allowed.

The main functions of biodiversity reserves are:

1. Conservation: To ensure the conservation of ecosystem, species and genetic resources

2. Development: To promote economic development, while maintaining cultural, social and ecological identity

3. Scientific Research: To provide support for research related to monitoring and education, local, national and global issues.

Biosphere reserves serve in some ways as 'living laboratories' for testing out and demonstrating integrated management of land, water and biodiversity.

List of some major biosphere reserves of India

S. No.	Name	State	Year of establishment	Area (km^2)
1	Nanda Devi	Uttarakhand	1982	5,860.69
2	Manas	Assam	1990	2837
3	Gulf of Mannar	Tamil Nadu	1980	10,500
4	Great Nicobar	Andaman and Nicobar Islands	1989	885
5	Panchmarhi	Madhya Pradesh	1999	4,926.28

Uses of in-situ conservation

1. The flora and fauna live in natural habitats without human interference.

2. The life cycles of the organisms and their evolution progresses in a natural way

3. In-situ conservation provides the required green cover and its associated benefits to our environment.

4. It is less expensive and easy to manage.

5. The interests of the indigenous people are also protected.

[2] Ex-situ conservation

Ex-situ conservation is the *preservation of components of biological diversity outside their natural habitats*. This involves conservation of genetic resources, as well as wild and cultivated species, and draws on a diverse body of techniques and facilities. Such strategies include establishment of botanical gardens, zoos, conservation strands and gene, pollen seed, seedling, tissue culture and DNA banks. Methods of ex-situ conservation are as follows:

1. Seed gene bank: These are cold storages where seeds are kept under controlled temperature and humidity for storage and this is easiest way to store the germ plasma of plants at low temperature. Seeds preserved under

controlled conditions (minus temperature) remain viable for long durations of time.

2. Gene bank: Genetic variability also is preserved by gene bank under normal growing conditions. These are cold storages where germplasm is kept under controlled temperature and humidity for storage; this is an important way of preserving the genetic resources.

3. Cryopreservation: This is the newest application of technology for preservation of biotic parts. This type of conservation is done in liquid nitrogen at very low temperature (-196°C). The metabolic activities of the organisms are suspended under low temperature, which are later used for research purposes.

4. Tissue culture bank: Cryopreservation of disease free meristems is very helpful. Long term culture of excised roots and shoots are maintained. Meristem culture is very popular in plant propagation as it's a virus and disease free method of multiplication.

5. Long term captive breeding: The method involves capture, maintenance and captive breeding on long term basis of individuals of the endangered species, which have lost their habitat permanently or certain highly unfavourable conditions are present in their habitat.

6. Botanical gardens: A botanical garden is a place where flowers, fruits and vegetables are grown. The botanical gardens provide beauty and calm environment. Most of them have started keeping exotic plants for educational and research purposes.

7. Animal Translocation: Release of animals in a new locality, which come from anywhere else

Translocation is carried in following cases:

1. When a species, on which an animal is dependent, becomes rare
2. When a species is endemic or restricted to a particular area
3. Due to habit destruction and unfavourable environment conditions
4. Increase in population in an area

8. Zoological gardens or zoos: In zoos, wild animals are maintained in captivity and conservation of wild animals (rare, endangered species). The oldest zoo, the Schonbrumm Zoo, which exists today also, was established in VIENNA in 1759.

In India, the 1st zoo came into existence at BARRACKPORE in 1800. In world, there are about 800 zoos. Such zoos have about 3000 species of vertebrates. Some zoos have undertaken captive breeding programmes.

Uses of ex-situ preservation

1. It is useful for declining population of species.

2. Endangered animals on the verge of extinction are successfully bred.

3. Threatened species are bred in captivity and then released in the natural habitats.

4. Ex-situ centres offer the possibilities of observing wild animals, which is otherwise not possible.

5. It is extremely useful for conducting research and scientific work on different species.

Threats to biodiversity

Extinction or **elimination:** A species in a natural habitat may face <u>extinction</u> or <u>elimination</u> as per natural process of evolution.

During evolution, different species have died out or lost of species in the past, following a slow processes. However, the <u>process of extinction</u> has been particularly fast in the recent years of human civilization due to anthropogenic activities. If the present trend continues we would lose 1/3rd to 2/3rd of our current biodiversity by the middle of <u>21st century</u>.

*Some of the major causes and issues related to **threats to biodiversity** are:*

Loss of habitats

1. Habitat degradation is an important cause of known extinction. As deforestation precedes in tropical forests this becomes the cause of mass extinctions caused by human activity.

2. Billions of hectares of forests and grasslands have been cleared for conservations into agricultural lands, or into settlement area or for development projects.

3. The unique rich biodiversity of the wetlands, estuaries and mangroves are under the most serious threat today.

4. Sometimes the loss of habitat proceeds in instatements so that the habitat is divided into small and scattered patches, a phenomenon known as habitat fragmentation.

5. There are many wild life species such as bears and large cats that required large territories to manage to survive. They get badly threaten; so, they breed in the interiors of the forests. Due to habitat fragmentation, many song birds are vanishing.

6. The wetlands have been destroyed due to draining, filling and pollution, resulting in a huge biodiversity loss.

7. Marine biodiversity is also under serious threat due to large scale destruction of the fragile breeding and feeding grounds of our oceanic fish and other species.

Poaching:

Hunting is a passion for some people and for others it is need for getting food. Poaching is another threat to wild life. *Catching of animals without their knowledge is called* "**poaching**"; so, human beings, at places, act as hunter and poachers. These two activities also result in the destruction of habitat and animals, due to which the species may disappear from their own areas.

Smuggling of <u>wildlife items</u> like *fuss*, *hides*, *horns, etc* of animals and herbal products, worth millions of dollars per year, is also <u>great threat</u> to <u>species survival</u>. The developing natures in Asia, Latin America and Africa are the richest sources of biodiversity and have enormous wealth of wildlife.

The trading of such wild life products is highly profit-making for the poachers, who hunt the wildlife species smuggle them to other countries. <u>National parks</u> and <u>sanctuaries</u> have been developed to protect animals and birds from such dangers of hunters and poachers.

Endangered and endemic species of India

The growing human population and other influences combine to eliminate some wild animals and plants; hence, there is a raising concern for preserving wild species all over the world. Natural causes of <u>wild species destruction</u> include <u>evolutionary replacement</u> and <u>mass extinction</u>. The direct threats are over-harvesting of animals and plants for food or various industrial and commercial products.

Extinct species: A species is said to be extinct when it is not seen in the world for 50 years at abstract.

Example: dodo, passenger pigeon

The Zoological Survey of India (**ZSI**) reported that cheetah, pink headed duck and mountain quail have already become extinct from India.

1. A species is said to be **endangered** when its number has been reduced to a <u>critical level</u>.

2. A species is said to **vulnerable** if its population is facing <u>continuous decline</u> due to <u>over exploitation</u> (or) <u>habitat destruction</u>.

3. The species which are not <u>endangered</u> (or) <u>vulnerable</u> at present but are <u>at risk</u> are categorized as **rare species**.

The examples of direct threats to biological resources are <u>habitat destruction</u>, <u>introduction of exotic species</u>, <u>diseases</u>, <u>environmental pollution</u> and <u>genetic assimilation</u> (*environmentally induced genetic and phenotypic changes in*

species). The international union for conservation of nature and natural resources (**IUCN**) publishes a periodical the "**RED DATA BOOK**" which includes the list of underlined endangered species of plants and animals; some of the examples are given below:

Reptiles: garial, green seat rile, python

Birds: great Indian bustard peacock, great Indian hornbills

Carnivores: leopard, striped hyena, Indian lion, gold cat, desert cat, red panda

Plants: orchids, medicinal plants like *Ravioli serpentica*, sandal wood tree (*Santalum album*).

Endemic species of India

Endemic species are plants and animals that exist only in one geographic region. The species can be endemic to large or small areas of the earth; some are **endemic** to a particular continent, some to part of a continent, and others may be endemic to a single island.

India has two **biodiversity hotspots** and thus posses a large number of endemic species. *Out of about 47000 species of plants in our country, 7000 are endemic.* Some of the important endemic floras include orchids and species like *Sepia himalayan*, *Ovarian lardier*, *Nepenthes khans land*, etc.

A large number, out of total 81000 species of animals in our country, is endemic to Western Ghats; they are particularly rich in amphibians and reptiles. Different species of monitor lizards, recticultured pythons and Indian surrender are some important endemic species of our country.

Hotspots of biodiversity

A biodiversity hotspot is a biogeographic region that is both a significant reservoir of biodiversity and is threatened with destruction.

The term biodiversity hotspot specifically refers to 36 biologically rich areas around the world that have lost at least 70 percent of their original habitat.

The British biologist **Norman Myers** coined the term "biodiversity hotspot" in 1988 as a biogeographic region characterized both by exceptional levels of plant endemism and by serious levels of habitat loss. In 1990, Myers proclaimed eight hotspots, including four Mediterranean-type ecosystems.

Conservation International (CI) adopted hotspots of Myers as its institutional blueprint in 1989; and in 1996, the organization made the decision to undertake a re-assessment of the hotspots concept. Three years later, an extensive global review was undertaken, which introduced quantitative thresholds for the designation of biodiversity hotspots.

Conservation International (CI) is an American non-profit environmental organization. CI headquarter is situated in Arlington, Virginia (USA). Its goal is to protect nature as a source of food, fresh water, livelihoods and a stable climate.

According to CI, to qualify as a hotspot, a region must meet two strict criteria:

(1) The hotspot must contain at least 1,500 species of vascular plants *(> 0.5% of the world's total number of species*) as endemics.

(2) The hotspot must have lost at least 70% of its original habitat.

In 1999, CI identified 25 biodiversity hotspots in the book ***"Hotspots: Earth's Biologically Richest and Most Endangered Terrestrial Eco-regions".***

The natural habitat in these biodiversity hotspots amounts to just 1.4% of the land surface of the planet, yet it supports nearly 60 percent of the world's plants, birds, mammals, reptiles, and amphibians. Collectively, these areas hold as endemics about 44% of the world's plants and 35% of terrestrial vertebrates in an area that formerly covered only 11.8% of the planet's land surface. In 2005, CI published an updated titled ***"Hotspots Revisited: Earth's Biologically Richest and Most Endangered Terrestrial Eco-regions".***

Biodiversity hot spots are a method to identify those regions of the world where attention is needed to address biodiversity loss and to guide investments in conservation. The CI adopted hotspots of Myers as its

institutional blueprint in 1989, and in 1999, the organization undertook an extensive global review, which introduced quantitative thresholds for the designation of biodiversity hotspots. A reworking of the hotspots analysis in 2004 resulted in the system in place today.

New hotspots: Only 25 hotspots were mentioned in the original proposal. Later on new biodiversity hotspots were periodically added based on scientific assessments of new regions. For example, the Forests of East Australia are the latest hotspot to have been added after research showed that the area fulfilled all criteria. Changing circumstances such as sustained habitat loss or the discovery of new species may mean that areas previously not considered as biodiversity hotspots could qualify in a future re-assessment.

Currently, **36** biodiversity hotspots have been identified, most of which occur in tropical forests. They represent just 2.3% of earth's land surface, but between them they contain around 50% of the world's endemic plant species and 42% of all terrestrial vertebrates. Overall, Hotspots have lost around 86% of their original habitat and additionally are considered to be significantly threatened by extinctions induced by climate change.

Current biodiversity hotspots in the world

North and Central America

1. California Floristic Province •8•

2. Madrean Pine-oak Woodlands •26•

3. Mesoamerica •2•

North American Coastal Plain

4. Atlantic Coastal Plain & Gulf Coastal Plain•36•

The Caribbean

5. Caribbean Islands •3•

South America

6. Atlantic Forest •4•

7. Cerrado •6•

8. Chilean Winter Rainfall-Valdivian Forests •7•

9. Tumbes-Chocó-Magdalena •5•

10. Tropical Andes •1•

Europe

    11. Mediterranean Basin •14•

Africa

    12. Cape Floristic Region •12•

    13. Coastal Forests of Eastern Africa •10•

    14. Eastern Afromontane •28•

    15. Guinean Forests of West Africa •11•

    16. Horn of Africa •29•

    17. Madagascar & the Indian Ocean Islands •9•

    18. Maputaland-Pondoland-Albany •27•

    19. Succulent Karoo •13•

Central Asia

    20. Mountains of Central Asia •31•

South Asia

    21. Eastern Himalaya, Nepal, India •32•
    22. Indo-Burma(Eastern Himalayas)•19•
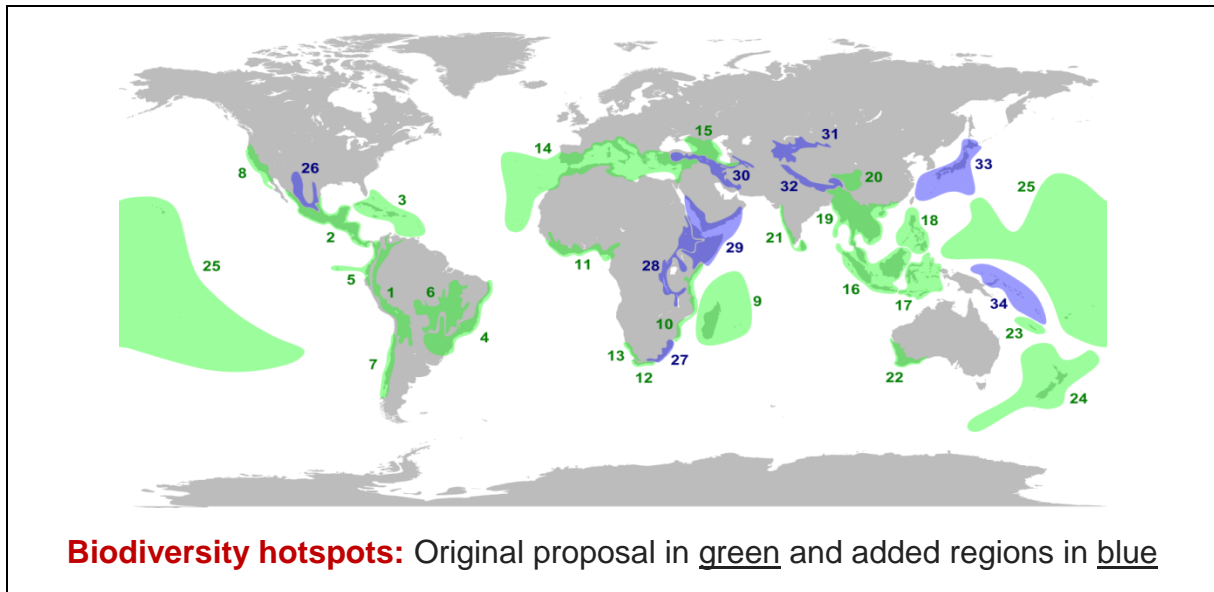   **23.**Western Ghatsof India& Sri Lanka •21•

South East Asia and Asia-Pacific

    24. East Melanesian Islands •34•
    25. New Caledonia •23•
    26. New Zealand •24•
    27. Philippines •18•
    28. Polynesia-Micronesia •25•
    29. Eastern Australian temperate forests •35•
    30. Southwest Australia •22•
    31. Sundaland & Nicobar islands of India •16•
    32. Wallacea •17•

East Asia

    33. Japan •33•
    34. Mountains of Southwest China •20•

West Asia

    35. Caucasus •15•

    36. Irano-Anatolian •30•

Biodiversity hotspots: Original proposal in <u>green</u> and added regions in <u>blue</u>

<u>Criteria</u>: To qualify as a hotspot, a region must meet two criteria:

1. It must contain at least 1,500 species of vascular plants (> 0.5% of the world's total) as endemics.

2. It has to have lost ≥ 70% of its original native habitat.

Characteristic features of hotspots

1. Hotspots are of global importance and are the hosts of priceless gift of nature.

2. They are very rich in <u>biodiversity</u>, <u>genetic</u> diversity, <u>species</u> diversity (or a combination of all).

3. Being the habitats of <u>endemic</u> and <u>endangered</u> species. They are having a high level of <u>endemism</u> and are under <u>threat</u> of habitat destruction that again leads to <u>extinction</u> of species.

Out of 36 **hotspots** of biodiversity in the world, two are present in India, namely, the <u>Eastern Himalayas</u> and <u>Western Ghats</u>.

Salient features of Indian hotspots

(1) Eastern Himalayas: They display on ultra-varied topography that <u>forest species diversity</u> and <u>endemism</u>.

1. They are numerous deep and semi-isolated valleys in <u>Sikkim</u>, which are extremely rich in <u>endemic</u> plant species.

2. The forest cover in Eastern Himalayas has dominated to about 1/3rd of its original cover.

3. Certain species like *Sepia himalayas*, a parasitize organism, was sighted only twice in this region in the last 70 years.

(2) Western Ghats: It extends along a 17,000 km strip of forests in Maharashtra, Karnataka, Tamil Nadu and Kerala. It has 40% of the total <u>endemic</u> plant species 62% <u>amphibians</u> and 50% <u>lizards</u> are endemic to Western Ghats.

The hotspots are characterized by <u>endemism</u>. Interestingly, a few species are common to both the hotspots in India.

Some common plants include *Lernstroemia japonica*, *Rhode drum* and *hyponym*.