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Endemism: Species which are restricted only to a particular area are known as endemic. India shows a good number of endemic species. About 62% of amphibians and 50% of lizards are endemic to India. Western ghats are the site of maximum endemism.

Center of origin: A large number of species are known to have originated in India. Nearly 5000 species of flowering plants had their origin in India. From agro-diversity point of view also our country is quite rich. India has been the center of origin of 166 species of crop plants and 320 species of wild relatives of cultivated crops, thereby providing a broad spectrum of diversity of traits for our crop plants.

Marine diversity: Along 7500 km long coastline of our country in the mangroves, estuaries, coral reefs, back waters etc. there exists a

Indian subcontinent has about 62% endemic flora restricted mainly to Himalayas, Khasi Hills and Western ghats, Eg - *Sapria himalayana*, *Uvaria lurida*, etc.

8. HOT SPOTS OF BIODIVERSITY

Areas which exhibit high species richness as well as high species endemism are termed as hot spots of biodiversity.

Biodiversity and its Conservation

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(a) *Eastern Himalayas*: They display an ultra-varied topography that fosters species diversity and endemism. There are numerous deep and semi-isolated valleys in Sikkim which are extremely rich in endemic plant species. In an area of 7298 Km² of Sikkim about 4250 plant species are found of which 60% are endemic.

The forest cover of Eastern Himalayas has dwindled to about 1/3rd of its original cover. Certain species like *Sapria himalayana*, a parasitic angiosperm was sighted only twice in this region in the last 70 years.

Recent studies have shown that North East India along with its contiguous regions of Burma and Chinese provinces of Yunnan and Schezwan is an active center of organic evolution and is considered to be the cradle of flowering plants. Out of the world's recorded flora 30% are endemic to India of which 35,000 are in the Himalayas.

(b) *Western Ghats*: It extends along a 17,000 Km² strip of forests in Maharashtra, Karnataka, Tamil Nadu and Kerala and has 40% of the total endemic plant species. 62% amphibians and 50% lizards are endemic to Western Ghats.

Forest tracts upto 500 m elevation covering 20% of the forest expanse are evergreen while those in 500-1500 m range are semi-evergreen. The major centers of diversity are *Agastyamalai Hills* and *Silent Valley—the New Amambalam Reserve Basin*. It is reported that only 6.8% of the original forests are existing today while the rest has been deforested or degraded, which raises a serious cause of alarm, because it means we have already lost a huge proportion of the biodiversity.

■ THREATS TO BIODIVERSITY 2823

Extinction or elimination of a species is a natural process of evolution. In the geologic period the earth has experienced mass extinctions. During evolution, species have died out and have been replaced by others. However, the rate of loss of species in geologic past has been a slow process, keeping in view the vast span of time going back to 444 million years. The process of extinction has become particularly fast in the recent years of human civilization. In this century, the human impact

Let us consider threats to biodiversity.

(a) ■ LOSS OF HABITAT *CBES*

died → Destruction and loss of natural habitat is the single largest cause of biodiversity loss. Billions of hectares of forests and grasslands have been cleared over the past 10,000 years for conversion into agriculture lands, pastures, settlement areas or development projects. These natural forests and grasslands were the natural homes of thousands of species which perished due to loss of their natural habitat. Severe damage has been caused to wetlands thinking them to be useless ecosystems. The unique rich biodiversity of the wetlands, estuaries and mangroves are under the most serious threat today. The wetlands are destroyed due to draining, filling and pollution thereby causing huge biodiversity loss.

Sometimes the loss of habitat is in instalments so that the habitat is divided into small and scattered patches, a phenomenon known as habitat fragmentation. There are many wild life species such as bears and large cats that require large territories to subsist. They get badly threatened as they breed only in the interiors of the forests. Due to habitat fragmentation many song birds are vanishing.

Indian context There has been a rapid disappearance of tropical forests in our country also, at a rate of about 0.6% per year. With the current rate of loss of forest habitat, it is estimated that 20-25% of the global flora would be lost within a few years. 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, as a result of human intervention.

(b) ■ POACHING *CBES*

ex wildlife
Illegal trade of wildlife products by killing prohibited endangered animals i.e. poaching is another threat to wildlife. Despite international ban on trade in products from endangered species, smuggling of wildlife items like furs, hides, horns, tusks, live specimens and herbal products

worth millions of dollars per year continues. The developing nations in Asia, Latin America and Africa are the richest source of biodiversity and have enormous wealth of wildlife. The rich countries in Europe and North America and some affluent countries in Asia like Japan, Taiwan and Hong Kong are the major importers of the wild life products or wild life itself.

The trading of such wild life products is highly profit making for the poachers who just hunt these prohibited wild life and smuggle it to other countries mediated through a mafia. The cost of elephant tusks can go upto \$ 100 per kg; the leopard fur coat is sold at \$ 100,000 in Japan while bird catchers can fetch upto \$ 10,000 for a rare hyacinth macaw, a beautiful coloured bird, from Brazil. The worse part of the story is that for every live animal that actually gets into the market, about 50 additional animals are caught and killed.

If you are fond of rare plants, fish or birds, please make sure that you are not going for the endangered species or the wild-caught species. Doing so will help in checking further decline of these species. Also do not purchase furcoat, purse or bag, or items made of crocodile skin or python skin. You will certainly help in preserving biodiversity by doing so.

(c) ■ **MAN-WILDLIFE CONFLICTS** *CBES*

We have discussed about the need to preserve and protect our wildlife. However, sometimes we come across conflicting situations when wildlife starts causing immense damage and danger to man and under such conditions it becomes very difficult for the forest department to pacify the affected villagers and gain local support for wild-life conservation.

Instances of man animal conflicts keep on coming to lime light from several states in our country. In Sambalpur, Orissa 195 humans were killed in the last 5 years by elephants. In retaliation the villagers killed 98 elephants and badly injured 30 elephants. Several instances of killing of elephants in the border regions of Kote-Chamarajanagar belt in Mysore have been reported recently. The man-elephant conflict in this region has arisen because of the massive damage done by the elephants to the farmer's cotton and sugarcane crops. The agonized villagers electrocute the elephants and sometimes hide explosives in the sugarcane fields, which explode as the elephants intrude into their fields. In fact, more killings are done by locals than by poachers. Recently, in early 2004, a man-eating tiger was reported to kill 16 Nepalese people and one 4-year old child inside the Royal Chitwan

the border region
National Parks in our country
men were killed by leopards in Powan
were killed during 19 attacks since January by
Sanjay Gandhi National Park, Mumbai which has
among the local residents.

Causes of Man-animal conflicts: The root causes of these conflicts are discussed below:

(i) Dwindling habitats of tigers, elephants, rhinos and bears due to shrinking forest cover compels them to move outside the forest and attack the field or sometimes even humans. Human encroachment into the forest areas raises a conflict between man and the wildlife, perhaps because it is an issue of survival of both.

(ii) Usually the ill, weak and injured animals have a tendency to attack man. Also, the female tigress attacks the human if she feels that her newborn cubs are in danger. But the biggest problem is that if human-flesh is tasted once then the tiger does not eat any other animal. At the same time, it is very difficult to trace and cull the man-eating tiger and in the process many innocent tigers are also killed.

(iii) Earlier, forest departments used to cultivate paddy, sugarcane etc. within the sanctuaries when the favourite staple food of elephants i.e. bamboo leaves were not available. Now due to lack of such practices the animals move out of the forest in search of food. It may be noted that, One adult elephant needs 2 quintals of green fodder and 150 kg of clean water daily and if it is not available, the animal strays out.

(iv) Very often the villagers put electric wiring around their ripe crop fields. The elephants get injured, suffer in pain and turn violent.

(v) Earlier there used to be wild-life corridors through which the wild animals used to migrate seasonally in groups to other areas. Due to development of human settlements in these corridors, the path of wildlife has been disrupted and the animals attack the settlements.

(vi) The cash compensation paid by the government in lieu of the damage caused to the farmers crop is not enough. In Mysore, a farmer gets a compensation of Rs. 400/- per quintal of expected yield while the market price is Rs. 2400/- per quintal. The agonized farmer therefore gets revengeful and kills the wild animals.

Remedial Measures to Curb the Conflict

(i) Tiger Conservation Project (TCP) has made provisions for making available vehicles, tranquillizer guns, binoculars and radio sets etc. to tactfully deal with any imminent danger.

(ii) Adequate crop compensation and cattle compensation scheme must be started, along with substantial cash compensation for loss of human life.

(iii) Solar powered fencing should be provided along with electric current proof trenches to prevent the animals from straying into fields.

(iv) Cropping pattern should be changed near the forest borders and adequate fodder, fruit and water should be made available for the elephants within forest zones.

(v) Wild life corridors should be provided for mass migration of big animals during unfavorable periods. About 300 km² area is required for elephant corridors for their seasonal migration.

(vi) In Similipal Sanctuary, Orissa there is a ritual of wild animal hunting during the months of April-May for which forest is burnt to flush out the animals. Due to massive hunting by people, there is a decline in prey of tigers and they start coming out of the forest in search of prey. Now there is WWF-TCP initiative to curb this ritual of "Akhand Shikar" in Orissa.

■ ENDANGERED SPECIES OF INDIA ebs

The International Union for Conservation of Nature and Natural Resources (IUCN) publishes the Red Data Book which includes the list of endangered species of plants and animals. The red data symbolizes the warning signal for those species which are endangered and if not protected are likely to become extinct in near future.

In India, nearly 450 plant species have been identified in the categories of endangered, threatened or rare. Existence of about 150 mammals and 150 species of birds is estimated to be threatened while an unknown number of species of insects are endangered. It may not be of direct relevance here to give a complete list of endangered flora and fauna of our country. However, a few species of endangered reptiles, birds, mammals and plants are given below:

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|--------------|---|---|
| (a) Reptiles | : | Gharial, green sea turtle, tortoise, python |
| (b) Birds | : | Great Indian bustard, Peacock, Pelican,
Great Indian Hornbill, Siberian White
Crane |

- (c) Carnivorous Mammals : Indian wolf, red fox, Sloth bear, red panda, tiger, leopard, striped hyena, Indian lion, golden cat, desert cat, dugong
- (d) Primates : Hoolock gibbon, lion-tailed macaque, Nilgiri langur, Capped monkey, golden monkey
- (e) Plants : A large number of species of orchids, Rhododendrons, medicinal plants like *Rauvolfia serpentina*, the sandal wood tree *Santalum*, *Cycas beddomei* etc.

The Zoological Survey of India reported that Cheetah, Pink headed duck and mountain quail have already become extinct from India.

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- ★ (A species is said to be extinct when it is not seen in the wild for 50 years at a stretch e.g. Dodo, passenger pigeon.)
 - ★ (A species is said to be endangered when its number has been reduced to a critical level or whose habitats, have been drastically reduced and if such a species is not protected and conserved, it is in immediate danger of extinction.)
 - ★ (A species is said to be in vulnerable category if its population is facing continuous decline due to overexploitation or habitat destruction. Such a species is still abundant, but under a serious threat of becoming endangered if causal factors are not checked.)
 - ★ (Species which are not endangered or vulnerable at present, but are at a risk are categorized as rare species. These taxa are usually localized within restricted areas i.e. they are usually endemic. Sometimes they are thinly scattered over a more extensive area.)

These may come as short que.

■ ENDEMIC SPECIES OF INDIA

India has two biodiversity hot spots and thus possesses a large number of endemic species. Out of about 47,000 species of plants in our country 7000 are endemic. Thus, Indian subcontinent has about 62% endemic flora, restricted mainly to Himalayas, Khasi Hills and Western Ghats. Some of the important endemic flora include orchids and species like *Sapria himalayana*, *Uvaria lurida*, *Nepenthes khasiana*, *Pedicularis perroter* etc. Some endemic plant species are shown in Plate V.

A large number out of a total of 81,000 species of animals in our country is endemic. The western ghats are particularly rich in amphibians (frogs, toads etc.) and reptiles (lizards, crocodiles etc.). About 62% amphibians and 50% lizards are endemic to Western Ghats. Different species of monitor lizards (*Varanus*), reticulated python and Indian Salamander and Viviparous toad *Nectophrynne* are some important endemic species of our country.

■ CONSERVATION OF BIODIVERSITY

The enormous value of biodiversity due to their genetic, commercial, medical, aesthetic, ecological and optional importance emphasizes the need to conserve biodiversity. Gradually we are coming to realize that wildlife is not just 'a game to be hunted', rather it is a 'gift of nature' to be nurtured and enjoyed. A number of measures are now being taken the world over to conserve biodiversity including plants and wildlife.

There are two approaches of biodiversity conservation:

(a) In situ conservation (within habitat): This is achieved by protection of wild flora and fauna in nature itself. e.g. Biosphere Reserves, National Parks, Sanctuaries, Reserve Forests etc.

(b) Ex situ conservation (outside habitats) This is done by establishment of gene banks, seed banks, zoos, botanical gardens, culture collections etc.

(a) In Situ Conservation

At present we have 7 major Biosphere reserves, 80 National Parks, 420 wild-life sanctuaries and 120 Botanical gardens in our country covering 4% of the geographic area.

The *Biosphere Reserves* conserve some representative ecosystems as a whole for long-term in situ conservation. In India we have Nanda Devi (U.P.), Nokrek (Meghalaya), Manas (Assam), Sunderbans (West Bengal), Gulf of Mannar (Tamil Nadu), Nilgiri (Karnataka, Kerala, Tamil Nadu), Great Nicobars and Similipal (Orissa) biosphere Reserves. Within the Biosphere reserves we may have one or more National Parks. For example, Nilgiri Biosphere Reserve has two National Parks viz. Bandipur and Nagarhole National Park.

A **National Park** is an area dedicated for the conservation of wildlife along with its environment. It is also meant for enjoyment through tourism but without impairing the environment. Grazing of domestic animals, all private rights and forestry activities are prohibited within a National Park. Each National Park usually aims at conservation specifically of some particular species of wildlife along with its environment. National Parks of our country are enlisted in

Table 4.5. Some important National parks in India

Name of National Park	State	Important Wildlife
Kaziranga	Assam	One horned Rhino
Gir National Park	Gujarat	Indian Lion
Dachigam	J & K	Hangul
Bandipur	Karnataka	Elephant
Periyar	Kerala	Elephant, Tiger
Kanha	M.P.	Tiger
Corbett	U.P.	Tiger
Dudwa	U.P.	Tiger
Ranthambore	Rajasthan	Tiger
Sariska	Rajasthan	Tiger

Wildlife sanctuaries are also protected areas where killing, hunting, shooting or capturing of wildlife is prohibited except under the control of highest authority. However, private ownership rights are permissible and forestry operations are also permitted to an extent that they do not affect the wildlife adversely.

Some major wildlife sanctuaries of our country are shown in Table 4.6.

Table 4.6. Some Important Wildlife Sanctuaries of India

Name of Sanctuary	State	Major Wild Life
Ghana Bird Sanctuary	Rajasthan	300 species of birds (including migratory)
Hazaribagh Sanctuary	Bihar	Tiger, Leopard
Sultanpur Bird Sanctuary	Haryana	Migratory birds
Nal Sarovar Bird Sanctuary	Gujarat	Water birds
Abohar Wildlife Sanctuary	Punjab	Black buck
Mudamalai Wildlife Sanctuary	Tamil Nadu	Tiger, elephant, Leopard
Vedanthangal Bird Sanctuary	Tamil Nadu	Water birds
Jaldapara Wild Life Sanctuary	W. Bengal	Rhinoceros, elephant, Tiger
Wild Ass Sanctuary	Gujarat	Wild ass, wolf, nilgai, chinkara

For plants, there is one gene sanctuary for Citrus (Lemon family) and one for pitcher plant (an insect eating plant) in Northeast India. For the protection and conservation of certain animals, there have been specific projects in our country e.g. Project Tiger, Gir Lion Project, Crocodile Breeding Project, Project Elephant, Snow Leopard Project etc.

(b)
✶ Ex situ Conservation: This type of conservation is mainly done for conservation of crop varieties, the wild relatives of crops and all the local varieties with the main objective of conserving the total genetic variability of the crop species for future crop improvement or afforestation programmes. In India, we have the following important **gene bank/seed bank** facilities:

just one heading
✶ (i) National Bureau of Plant Genetic Resources (NBPGR) is located in New Delhi. Here agricultural and horticultural crops and their wild relatives are preserved by **cryo-preservation** of seeds, pollen etc. by using liquid nitrogen at a temperature as low as -196°C . Varieties of rice, pearl millet, Brassica, turnip, radish, tomato, onion, carrot, chilli, tobacco, poppy etc. have been preserved successfully in liquid nitrogen for several years without losing seed viability.

(ii) National Bureau of Animal Genetic Resources (NBAGR) located at Karnal, Haryana. It preserves the semen of domesticated bovine animals.

(iii) National Facility for Plant Tissue Culture Repository (NFPTCR) for the development of a facility of conservation of varieties of crop plants/trees by tissue culture. This facility has been created within the NBPGR.

The G-15 countries have also resolved to set up a network of gene banks to facilitate the conservation of various varieties of aromatic and medicinal plants for which India is the networking co-ordinator country.