

Biodiversity and its conservation

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Introduction

Bio means “life” and diversity means “variety”. Hence, biodiversity refers wide variety of life on the earth.

Definition:

“Biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes biological diversity within species and ecosystems”.

OR - Biodiversity may be defined as the sum total of species richness, i.e., the number of species of plants, animals and microorganisms occurring in a given region, country, continent of the entire globe.

History of Biodiversity

The term ‘diversity’ is not new, rather has a long history, but ‘biological diversity’ came into use in scientific literature only in the 1980s.

Robert E. Jenkins and **Thomas Lovejoy** in 1980 first used the term biological diversity.

SIGNIFICANCE OF BIODIVERSITY:

- Biodiversity protects the fresh air, clean water and productive land.
- It is also important for forestry, fisheries and agriculture, which depend on rich water variety of various biological resources available in nature.
- Loss of biodiversity has series economic and social costs for any country.
- It is very important for human life; we depend on plants, microorganisms, earth’s animals for our food, medicine and industrial products.

Biological diversity is usually considered at three different levels –

- a) Genetic diversity i.e. at genetic level
- b) Species diversity i.e. at the level of species
- c) Ecosystem diversity i.e. at the level of ecosystem.

Genetic diversity (Diversity of genes within a species). Genetic diversity refers to the variation of genes among the population and the individuals of the same species.

Genetic variations represent the differences in the sequence of bases in nucleotides, which constitutes the genetic code. Genetic variations are due to gene mutations, and in an organism with sexual reproduction, these can spread by crossing-over and recombination. Genetic diversity provides the raw materials for adaptation to changing environment and for the natural selection to act upon. If a species has more genetic variability, it can adapt better off to the changed environment.

Species	No. of genes
Mycoplasma	450-700
Bacteria (E. coli)	4000
Fruit-fly	13,000
Rice	32,000 - 50,000
Human beings	35,000 - 45,000

Species diversity (Diversity among species). It refers to the variety of species within a region, i.e. the number of species per unit area at the site (species richness). An estimated 1.7 million species have been described to date.

Ecosystem diversity (Diversity at the level of community/ecosystem). The diversity at the ecological (or) habitual level is known as “eco-system diversity”.

For instance, the tropical south India with rich species diversity will have altogether different structure compared to the desert ecosystem, which has far less number of plant and animal species. Likewise, the marine ecosystem although has many types of fishes, yet it differs from the freshwater ecosystem of rivers and lakes in terms of its characteristics. So such variations at ecosystem level are termed as ecosystem diversity.

Ecological use three different terms for various practical measures of biodiversity:

- **Alpha diversity.** It refers to diversity within a particular area, community or ecosystem, and is measured by counting the number of species within the ecosystem.
- **Beta diversity.** It refers to species diversity between ecosystems and is measured by comparing the number of species that are unique to each of the ecosystems.
- **Gamma diversity.** It is a measure of overall diversity for different ecosystems within a region.

BIOGEOGRAPHIC CLASSIFICATION OF INDIA

Our country can be conveniently divided into ten major regions, based on the geography, climate and pattern of vegetation seen and the communities of mammals, birds, reptiles, amphibian, insects and other invertebrates that live in them. Each of these regions contains a variety of ecosystems such as forests, grasslands, lakes, rivers, wetlands, mountains and hills, which have specific plant and animal species.

India's Biogeographic Zones

1. The cold mountainous snow covered Trans Himalayan region of Ladakh.
2. The Himalayan ranges and valleys of Kashmir, Himachal Pradesh, Uttarakhand, Assam and other North Eastern States.
3. The Terai, the lowland where the Himalayan rivers flow into the plains.
4. The Gangetic and Brahmaputra plains.
5. The Thar Desert of Rajasthan.
6. The semi arid grassland region of the Deccan plateau Gujarat, Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu.
7. The Northeast States of India,
8. The Western Ghats in Maharashtra, Karnataka and Kerala.
9. The Andaman and Nicobar Islands.
10. The long western and eastern coastal belt with sandy beaches, forests and mangroves.

Table 1. Biogeographical classification of India.

BIOGEOGRAPHICAL ZONE	BIOTIC PROVINCE	TOTAL AREA
Trans Himalayas	Upper region	186200
Himalayas	North west Himalayas	6900
	West Himalayas	720000
	Central Himalayas	123000
	East Himalayas	83000
Desert	Kutch	45000
	Thar	180000
	Ladakh	NA
Semi arid	Central India	107600
	Gujarat-Rajwara	400400
Western Ghats	Malabar coast	59700
	Western Ghats mountain	99300
Deccan Peninsula	South Deccan plateau	378000
	Central plateau	341000
	Eastern plateau	198000
	Choate Nagpur	217000
	Central highlands	287000
Gang tic plan	Upper Gang tic plain	206400
	Lower Gang tic plain	153000
North east India	Brahmaputra valley	65200
	North eastern hills	1062000
Islands	Andaman islands	6397
	Nicobar islands	1930
	Lakshadweep islands	180
Coasts	West coast	6500
	East coast	6500

VALUE OF BIODIVERSITY

Food, clothes, housing, energy, medicines are all resources that are directly (or) indirectly linked to the biological variety present in the biosphere. An agricultural community, biodiversity is used to grow their crops to suit the environment.

The environmental multiple uses of biodiversity values has been classified by MC Nectyetal in 1990 as follows.

CONSUMPTIVE USE VALUE

These are directly used values where the biodiversity products are harvested and consumed directly. The direct utilisation of timber, food, fuelwood, fodder by local communities.

Example:-food, drug, fuel etc.

Food:- A large number of wild plants are consumed by human beings as food.

Drugs:-Around 70% of modern medicines are derived for plant and plant extracts.

Example:-

- The wonderful drug penicillin used as an antibiotic. It is derived from a fungus called “pencilinium”.
- life saving drugs like ‘quinine’ comes from the cinchona tree (used to treat malaria).
- “Vin blast in” and “Vin Christine” two anticancer drugs have obtained from “periwinkle” plant, which possesses anti-cancer alkaloids.
- Morphine (painkiller) is all of plant origin.
- The purple tree leaves, trunk and roots are used as effective medicines for curing diseases like fever, cough, stomach-ache and skin diseases.
- “Caffeine” is obtained from fox grove, which is an effective cure for heart stimulation.

Fuel:-our forest has been used since ago for fuel wood. The forest fossil fuel like coal, petroleum and natural gas are also the products of the fossilized biodiversity.

PRODUCTIVE USE VALUES

Biodiversity products have obtained a commercial value. These products are marketed and sold. These products may be derived from the animals and plants.

Table 2. Animal and animal products.

ANIMALS	ANIMAL PRODUCER
Silk worm	Silk
Sheep	Wool
Musk deer	Musk
Elephant	Tusk
Lac insects	Lac

Many industries are dependent upon the productive use values of biodiversity.

Example:- paper and pulp industry, plywood, silk industry, textile industry, leather industry, pearl industry.

Social values

These are the values associated with the social life customs, religion and spiritual aspects of the people. The consumptive and productive value of biodiversity is closely linked to social concerns in traditional communities. 'Ecosystem people' value biodiversity as a part of their livelihood as well as through cultural and religious sentiments.

Many of the plants are considered holy and sacred in our country.

Example:-

Holy plants:- Tulsa, penal, lotus etc.,

The tribal people are very closely linked with the wild life in the forest.

Examples:- cow, snake, bull, peacock, rat etc.,

Ethical and moral value or Existence value

Ethical values related to biodiversity conservation are based on the importance of protecting all forms of life. All forms of life have the right to exist on earth.

Our rich heritage teaches us to worship plant, animals, river and mountains. The ethical values mean that a speck may or may not be used, but its existence in nature gives us pleasure.

Example:-

- The river Gangs is considered as Holy River.
- Tulsa, veggie some of the trees worshipped by the people.

Thus there is an ethical value (or) existence value attached to each species.

Aesthetic value

Knowledge and an appreciation of the presence of biodiversity for its own sake is another reason to preserve it. Quite apart from killing wildlife for food, it is important as a tourist attraction. Biodiversity is a beautiful and wonderful aspect of nature. Sit in a forest and listen to the birds. Watch a spider weave its complex web. Observe a fish feeding. It is magnificent and fascinating.

Symbols from wild species such as the lion of Hinduism, the elephant of Buddhism and deities such as Lord Ganesh, and the vehicles of several deities that are animals, have been venerated for thousands of years.

Option values

Keeping future possibilities open for their use is called option value. It is impossible to predict which of our species or traditional varieties of crops and domestic animals will be of great use in the future.

BIODIVERSITY AT GLOBAL, NATIONAL AND LOCAL LEVELS

GLOBAL BIODIVERSITY

There are at present 1.8 million species known and documented by scientists in the world. However, scientists have estimated that the number of species of plants and animals on earth could vary from 1.5 to 20 billion! Thus, the majority of species are yet to be discovered.

Roughly 1.5 million species are known till today which is perhaps 15% or may be just 2% of the actual number mapping the biodiversity has therefore been rightly recognized as an emergency task in order to plan its conservation and practical utilisation in audacious.

Terrestrial biodiversity of the earth is best described as “biomass” which are the largest ecological unit present in different geographic areas and are named after the dominant vegetarian.

Example:- Tropical rain forest savages, desert tundra etc.,

Teeming millions of species of plants, birds, amphibians, insects as well as mammals inhabit the tropical rain forests. They are the earth’s largest storehouse of biodiversity. About 50-80% of global biodiversity lies in these rainforests. 3000 plants identified by national cancer research institute [NCRI] are sources of cancer fighting chemicals.

BIOLOGICAL DIVERSITY TO NATIONAL LEVEL

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

- India has a rich biological diversity of flora and fauna overall 6% of the global are found in India.
- 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 regional level is better understood by categorizing species richness into four types.

1) Point richness:-

It refers to the number of species that can be found at a single point in a given space.

2) Alpha (α) richness:-

It refers the number of species found in a small homogeneous area.

3) Beta (β) richness:-

It refers to the change of rate of species in composition across different habitats.

4) Gamma (γ) richness:-

It refers to the rate of change across large landscape gradients.

α richness is strongly correlated with physical environmental variables.

β richness means that the cumulative number of species increases as more heterogeneous habitats are taken into consideration.

For example:-the ant species found in local species region of North Pole is merely 10. As we kept on moving towards the equator and add more and more habitats. The number of species of ants reaches as high as 2000 on the equatorial region.

INDIA AS A MEGADIVERSITY NATION

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

India is one of the 12-mega diversity countries in the world. Government of India 2000 records 47000 species of plants and 81000 species of animals, which is about 7% and 6.5% respectively of global flora and fauna.

Centre of origin:-

A large number of species are known to have originated in India. India has been the centre of origin of 166 species of crop plants and 320 species of wild species of wild relative of cultivated crops.

Nearly 5000 species of flowering plants had their origin in India.

HOT SPOTS OF BIODIVERSITY

Areas which exhibit high species richness as well as high species endemism are termed as “hot spots of biodiversity”. The term was introduced by **Norman Myers**, a British Ecologist, developed the concept of hot spots in **1988** to designate priority areas for *in situ* conservation.

Biodiversity is distributed heterogeneously across the Earth. Some areas are full with biological variations (e.g. tropical forests) others are virtually devoid of life (e.g. some deserts and Polar regions) and most fall somewhere in between. The regions where a large number of species are found are described as mega centres of biodiversity or mega diversity zone.

There are 25 such hot spots of biodiversity on a global level out of which two are present in India, namely the eastern Himalayas and Western Ghats.

HOT SPOTS

- 1) Tropical Andes
- 2) Mesoamerican forest
- 3) Caribbean
- 4) Brazil's Antarctic forests
- 5) Enasco Darien of panama
- 6) Western Ecuador
- 7) Brazil's corrode
- 8) Central Chile
- 9) California floristic province
- 10) Madagascar
- 11) Eastern arc and coastal
- 12) Western African forest
- 13) Cape holistic province
- 14) Succulent kaloc
- 15) Mediterranean basin
- 16) Caucused
- 17) Sunderland
- 18) Wallace
- 19) Philippians
- 20) **Indo Burma eastern Himalayas**
- 21) South central china
- 22) South Western Australia
- 23) **Western Ghats Sri Lanka**
- 24) New Zealand
- 25) New Caledonia

The India hotspots are not only rich in floral wealth and endemic species of plants but also reptiles, amphibians, swallow tailed butterflies and some mammals.

The eastern Himalayan hot spot extends to the north-eastern India, and Bhutan. The temperate forests are found at altitudes of 1780 to 3500 meters. Many deep and semi-isolated valleys

found in this region are exceptionally rich in endemic plant species. Besides being an active centre of evolution and rich diversity of flowering plants, the numerous primitive angiosperm families (e.g. Magnoliaceae and Winteraceae) and primitive genera of plants like Magnolia and Betula are found in eastern Himalayas.

The Western Ghat region lies parallel to the western coast of Indian peninsula for almost 1600 km, in Maharashtra, Karnataka, Tamil Nadu and Kerala. In the Western Ghats region, the forests at low elevation (500 m above mean sea level) are mostly evergreen, while those found at 500-1500 meter height are generally semi evergreen forests. The Agastiyamalai hills and the Silent Valley, the new Amambalam.

Reserve, are the two main centres of diversity.

THREATS TO BIODIVERSITY

Important factors leading to extinction (or) eliminations of species and consequent loss of biodiversity are:

Habitat loss and fragmentation, introduction of non-native species, overexploitation, soil, water and atmospheric pollution, and intensive agriculture and forestry.

Habitat Loss and Fragmentation

The destruction of habitats is the primary reason for the loss of biodiversity. When people cut down trees, fill a wetland, plough a grassland or burn a forest, the natural habitat of a species is changed or destroyed. These changes can kill or force out many plants, animals, and microorganisms, as well as disrupt complex interactions among the species.

A forest patch surrounded by croplands, orchards, plantations, or urban areas is an example of fragmented habitats. With the fragmentation of a large forest tract, species occupying deeper parts of forests are the first to disappear. Overexploitation of a particular species reduces the size of its population to an extent that it becomes vulnerable to extinction.

Disturbance and Pollution

Communities are affected by natural disturbances, such as fire, tree fall, and defoliation by insects. Man-made disturbances differ from natural disturbances in intensity, rate and spatial extent.

Introduction of Exotic Species

New species entering a geographical region are called exotic or alien species. Introduction of such invasive species may cause disappearance of native species through changed biotic interactions. Invasive species are considered second only to habitat destruction as a major cause of extinction of species. Exotic species are having large impact especially in island ecosystems, which harbour much of the world's threatened biodiversity. A few examples are:

(1) *Parthenium hysterophorus* (Congress grass- a tropical American weed) has invaded many of the vacant areas in cities, towns and villages in India leading to removal of the local plants and the dependent animals.

(2) Nile perch, an exotic predatory fish introduced into Lake Victoria (South Africa) threatens the entire ecosystem of the lake by eliminating several native species of the small Cichlid fish species that were endemic to this freshwater aquatic system.

(3) Water hyacinth clogs rivers and lakes and threatens the survival of many aquatic species in lakes and river flood plains in several tropical countries including India.

(4) *Lantana camara* has invaded many forest lands in different parts of India, and strongly competes with the native species.

Extinction of Species

Extinction is a natural process. Species have disappeared and new ones have evolved to take their place over the long geological history of the earth. It is useful to distinguish three types of extinction processes.

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

This loss of species, which occurred in the geological past at a very slow rate, is called natural or background extinction.

Mass extinction: There have been several periods in the earth's geological history when large number of species became extinct because of catastrophes. Mass extinctions occurred in millions of years.

Anthropogenic extinction: An increasing number of species is disappearing from the face of the earth due to human activities. This man-made mass extinction represents a very severe depletion of biodiversity, particularly because it is occurring within a short period of time.

The World Conservation Monitoring Centre has recorded that 533 animal (mostly vertebrates) and 384 plant species (mostly flowering plants) have become extinct since the year 1600. More species have gone extinct from the islands than from the mainland or the oceans.

The current rate of extinction is 1000 to 10000 times higher than the background rate of extinction. Some interesting observations about the current loss of species are:

(1) From ten high-diversity localities in tropical forests covering 300,000 km², some 17,000 endemic plant species and 350,000 endemic animal species could be lost in near future.

(2) The tropical forests alone are losing roughly 14000-40000 species per year (or 2-5 species per hour).

(3) The earth may lose up to 50% of the species by the end of the 21st century, if the current rate of loss continues.

Susceptibility to extinction

The characteristics of species particularly susceptible to extinction are large body size (Bengal tiger, lion and elephant); small population size and low reproductive rate (Blue whale and Giant panda). Feeding at high trophic levels in the food chain (Bengal tiger and Bald eagle), fixed

migratory routes and habit (Blue whale and Whooping crane) and localized and narrow range of distribution (woodland caribou; many island species) also make the species susceptible to extinction.

The IUCN Red List Categories

The (International Union for Conservation of Nature) IUCN Red List is a catalogue of taxa (species) that are facing the risk of extinction. It is important to understand that the Red List aims to impart information about the urgency and scale of conservation problems to the public and policy makers. The uses of the Red Lists are:

- (1) Developing awareness about the importance of threatened biodiversity;
- (2) Identification and documentation of endangered species;
- (3) Providing a global index of the decline of biodiversity;
- (4) Defining conservation priorities at the local level and guiding conservation action.

To highlight the legal status of rare species for the purpose of conservation, the International Union for Conservation of Nature and Natural Resources (IUCN) has established the following five main conservation categories:

- **Extinct species** that are no longer known to exist in the wild. Searches of localities where they were once found and of other possible sites have failed to detect the species.
- **Endangered species** that have a high likelihood of going extinct in the near future.
- **Vulnerable species** that may become endangered in the near future because populations of the species are decreasing in size throughout its range.
- **Rare species** that have small total numbers of individuals often due to limited geographical ranges or low population densities.
- **Insufficiently known species** that probably belong to one of the conservation categories but are not sufficiently well known to be assigned to a specific category.

The species, which are threatened with extinction, are included in Vulnerable, Endangered, or Critically Endangered category.

The IUCN **Red List** System was initiated in 1963 and since then evaluation of the conservation, status of species and subspecies is continuing on a global scale. The 2000 **IUCN Red List** is the most comprehensive inventory of the global conservation status of plant and animal species. It uses a set of criteria, relevant to all species and all regions of the world, to evaluate the extinction risk of species and subspecies. The 2000 Red List contains assessments of more than 18,000 species, 11,000 of which are threatened. The Red List also provides information to international agreements such as the Convention on Biological Diversity and the Convention on International Trade in Endangered Species of Wild Fauna and Flora.

STATUS OF THREATENED SPECIES

There are 11,046 species (5,485 animals, and 5,611 plants) listed as threatened (Critically Endangered, Endangered, or Vulnerable) on the 2000 Red List. Of these, 1,939 are listed as

Critically Endangered (925 animals, and 1,014 plants). The percentages of threatened species of Angiosperms and four vertebrate groups categorized as Critically Endangered, Endangered, and Vulnerable and at Lower Risk are shown in **Figure 1** of the species evaluated for risk in these major groups, 17-22% are critically endangered, and 34-51% are vulnerable. According to the Red List, in India, 44 plant species are critically endangered, 113 endangered and 87 vulnerable. Amongst animals, 18 are critically endangered, 54 endangered and 143 vulnerable. Some examples of threatened species in India are given in **Table 3**.

Table 3. Examples of Threatened Species in India.

Category	Plants	Animals
Critically Endangered	<i>Berberis nilghiriensis</i>	<i>Sus salvanius</i> (Pigmy hog)
Endangered	<i>Bentinckia nicobarica</i>	<i>Ailurus fulgens</i> (Red Panda)
Vulnerable	<i>Cupressus cashmeriana</i>	<i>Antilope cervicapra</i> (Black buck)

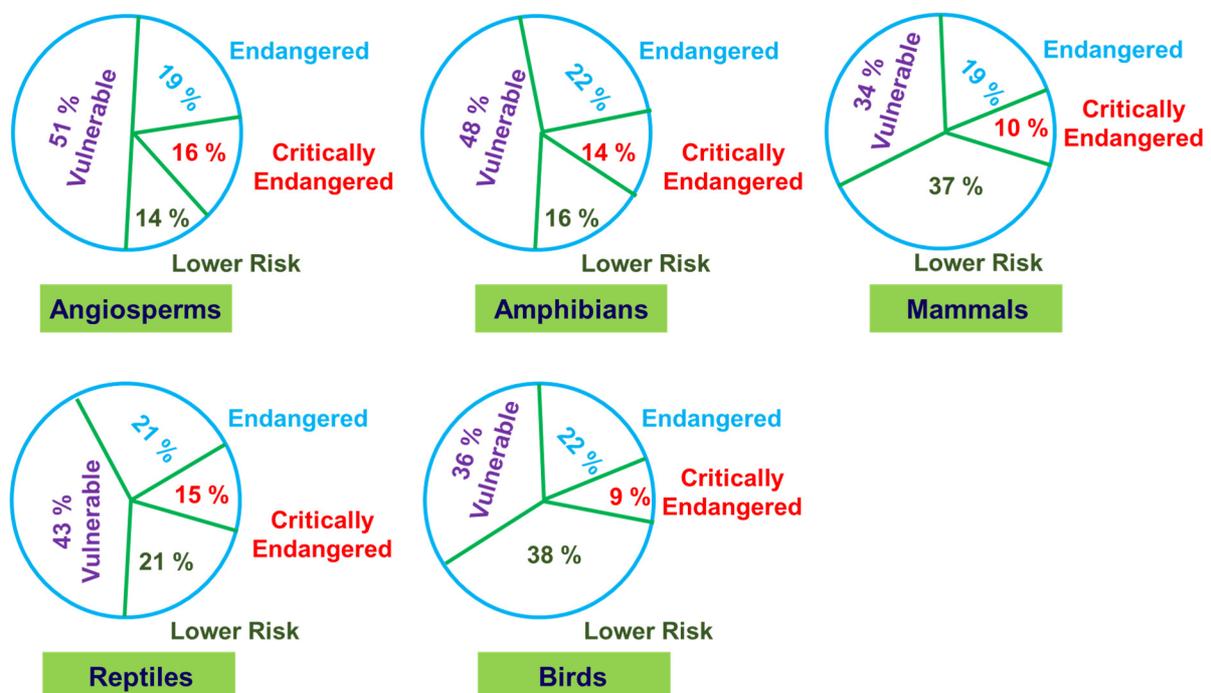


Figure 1. The percentage of threatened angiosperms, amphibians, reptiles, birds and mammals categorized as Critically Endangered, Endangered, Vulnerable and at Lower risk

Poaching

Hunting is a passion for some people and for others is necessary 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 will help in the destruction of habitat and animals may disappear from their own areas.

Smuggling of wild life items like furs, hides, horns tusks like specimen and herbal products worth millions of dollars per year. The developing nations 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 poaches who guest hunt there profit wild life and smuggling it to other countries to protect animals from each such dangers of hunters and poachers, the concept of protecting animals in an area called “sanctuary”.

MAN WILD CONFLICTS

The need to protect and preserve our wildlife sometimes we come across conflicting situations when wild life starts causing immense damage and dangerous to man and under such conditions it becomes very difficult for the forest department to specify the affected villages and gain local support for wild life conservation.

CAUSES OF MAN ANIMAL CONFLICTS

- 1) Dwindling habitats of tigers, elephants, rhinos and bears due to shrinking forest cover compels them to move outside the forest and attack the field.
- 2) Human encroachment into the forest area includes a conflict between man and the wildlife.
- 3) Injured animals have a tendency to attack man usually the female wildlife attacks the human if she feels that her newborn cubs are in danger.
- 4) Earlier, forest departments used to cultivate sugarcane, paddy, and coconut trees in the sanctuaries. When the favourite food of elephants, were not available, they feed them to the elephants. But, now due to lack of such practices the wild animals move out of the forest for searching foods.
- 5) Often the villagers put electric wiring around their crop fields. The elephant get injured, suffering pain and star violence.
- 6) The cost compensation paid by the government for the damage caused by the wild animals is not enough. Therefore, the organised formers get revengefully and kill the wild animals.

Example: - a farmer in Mysore gets compensation of RS 400/- per quintal but the marketed price is RS 2400/- per quintal.

- 7) Garbage near human settlement (or) food crops near forest areas attracts wild animals.

REMEDICAL MEASURES

1. Adequate crop and cattle compensation schemes must be started, along with sustainable cash compensation for loss of human life.
2. Solar powered fencing should be provided along with electric current proof trenches to prevent the animals from staying into fields.
3. Cropping pattern should be changed near the forest borders and adequate fodder, fruit and water should be made available for the elephants with in forest zones.
4. Wild life corridors should be provided for mass migration of big animals during unfavourable periods.
5. The development and constructional work in and around forest region must be stopped.

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 wild species destruction include evolutionary replacement and mass extinction. The direct threats are over harvesting of animals and plants for food or various industrial and commercial products.

The examples of direct threats to biological resources are habitual destruction to the introduction of exotic species and diseases, pollution of the environment and genetic assimilation. The international union for conservation of nature and natural resources publishes the “RED DATA BORK” which includes the list of endangering species of plants and animals.

REPTILES: - garial, green seat rile, python

BIRDS: - great Indian bustard peacock, great Indian hornbills

CARNIVOROUS: - leopard, striped hyena, Indian lion mammals, gold cat, desert cat, red panda

PLANTS: - orchids, medicine plants like ravioli serpentina sandal wood tree sanctorum.

The zoological survey of India reported that cheetah, pink-headed duck and mountain quail have already become extinct from India.

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

Example: - dodo, passenger pigeon

A species is said to be endangered when its number has been reduced to a critical level. A species is said to vulnerable if its population is facing continuous decline due to over exploitation (or) habitat destruction.

A species, which are not endangered (or) vulnerable at present but are at a risk are categorized as rare species.

ENDEMIC SPECIES OF INDIA

India has two biodiversity hot spots and thus passers 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”.

A large number out of total 81000 species of animals in our country is endemic the Western Ghats are particularly rich in amphibians and reptiles. Different species of monitor lizards’ recti cultured pythons and Indian surrender are some important endemic species of our country.

CONSERVATION OF BIODIVERSITY

Biodiversity knows no political boundaries and its conservation is therefore a collective responsibility of all nations. The historic Convention on Biological Diversity ('The Earth Summit') held in **Rio de Janeiro** in **1992**, called upon all nations to take appropriate measures for conservation of biodiversity and sustainable utilisation of its benefits.

We know that ecosystems are undergoing change due to pollution, invasive species, overexploitation by humans, and climate change. Most people are beginning to recognize that diversity at all levels - gene pool, species and biotic community is important and needs to be conserved.

Conservation of biodiversity is important to:

- ❖ Prevent the loss of genetic diversity of a species,
- ❖ Save a species from becoming extinct, and
- ❖ Protect ecosystems damage and degradation.

How do we conserve Biodiversity?

There are two basic strategies of biodiversity conservation, *in situ* and *ex situ* (off site).

In situ (on-site) Conservation Strategies

Conservation of a species is best done by protecting its habitat along with all the other species that live in it in nature. This is known as *in-situ* conservation, which is conserving a species in its own environment by creating National Parks and Wildlife Sanctuaries.

In situ conservation means the conservation of ecosystem and natural habitat and maintenance and recovery of viable population of species in the natural surrounding where they have developed their distinctive characteristics.

Biodiversity at all its levels, genetic species and as intact ecosystems, can be best preserved *in-situ* by setting aside an adequate representation of wilderness as '**Protected Areas**'. In the past National Parks and Sanctuaries in India were notified to preserve major wildlife species such as tigers, lions, elephants, and deer. The objective of these areas should be expanded to the preservation of relatively intact natural ecosystems, where biological diversity – from microscopic unicellular plants and animals, to the giant trees and major mammals – can all be preserved.

Wildlife Sanctuaries and National Parks of India:

There are 589 Protected Areas in India of which 89 are National Parks and 500 are Wildlife Sanctuaries. They include a variety of ecosystems and habitats. Some have been created in order to protect highly endangered species of wild plants and animals found nowhere else in the world.

The **Great Himalayan National Park** is the largest sanctuary in this ecosystem and is one of the last homes of the beautiful snow leopard. **Dachigam (national park) Sanctuary** is the only place where the rare Hangul or Kashmir stag is found. There are several Sanctuaries in the

Terai region, **Kaziranga National Park** is the most famous which has elephant, wild buffalo, gaur, wild boar, swamp deer, and hog deer, in large numbers, as well as tiger and leopard. Its bird life is extremely rich and includes ducks, geese, pelicans and storks. The **Manas Sanctuary**, in addition to the above Terai species, also includes the rare golden langur and the very rare pygmy hog, the smallest wild boar in the world.

In the sal forests of Madhya Pradesh, there are several Protected Areas. **Kanha** offers a wonderful opportunity to observe wild tigers. It is the only Protected Area in which a subspecies of the Barasingha is found.

Bharatpur is one of the most famous water bird sanctuaries in the world. Thousands of ducks, geese, herons, and other wading birds can be seen here.

In the Thar desert, the wild life is protected in the **Desert National Park**. Here large numbers of black buck, neelgai and chinkara can be seen.

In Gujarat, the **Gir Sanctuary** protects the last population of the majestic Asiatic lion. This thorn and deciduous forest is also the home of large herds of chital, sambhar, and nilgai.

The Sanctuaries of the Western Ghats such as **Bhimashankar**, **Koyana**, **Chandoli** and **Radhanagari** preserve this rich flora in Maharashtra, **Bandipur**, **Bhadra**, **Dandeli**, **Nagarhole**, etc. in Karnataka, and **Eravikulam**, **Perambikulam**, **Periyar**, **Silent Valley**, in Kerala.

***Ex-situ* conservation**

In this approach, threatened animals and plants are taken out from their natural habitat and placed in a carefully controlled situation where they can be protected and given special care. Zoological parks, botanical gardens and wildlife safari parks serve this purpose. There are many animals that have become extinct in the wild but continue to be maintained in zoological parks. In recent years *ex-situ*, conservation has advanced beyond keeping threatened species in enclosures.

In India, successful *ex situ* conservation programs have been done for all our three species of crocodiles. Another recent success has been the breeding of the very rare pygmy hog in Gauhati zoo. Delhi zoo has successfully bred the rare Manipur brow antlered deer.