WILDLIFE OF INDIA

The term wild life includes both animals and plants which form part of any habitat in nature. The animals and plants included in the wild life are non-domesticated and are found wild in nature.

In the words of the late Prime Minister Pandit Jawaharlal Nehru, "*wild life refers to the magnificent animals and the beautiful birds of our jungles that brighten our lives. But life would become dull and colorless if we did not have these animals and birds to look at and to play with. We must try to preserve the wild life and their habitats.*"

Some wild animals are so characteristic that they become the symbols of their home countries. For example, tiger is associated with India, white bear with Russia, giant panda with China, kangaroo with Australia, Kiwi with New Zealand.

History of Wildlife in India

Man has been interested in the wild animals since the dawn of civilization. He hunted them for food and clothing, observed them for joy, heard the sweet notes of the birds for pleasure. In India, the idea of preservation of wild life has been an integral idea of Indian culture and religion since ancient times.

The Vedas include hymns in praise of animals and plants. Indian mythology includes references to animal-like gods such as monkey-headed Hanuman, elephant-headed Ganesh, boar-headed Varahavatar, lion-headed Narsimhavathar, fish-headed Matshyavathar, turtle-headed koormavathar, snake-like sheshnag etc. In ancient India, the hermitages of holy sages were the environments in which hunting was fully prohibited, and if this was not followed there used to be severe punishments.

The condition of our wild life started deteriorating under Mughal rulers and then under British Empire, when the mad slaughter of wild animals became the fashion.

- Babar killed thousands of rhinoceros which were abundant in northern India,

- Colonel Pollock shot a Rhino or a buffalo almost every day for breakfast,

- Madhya Pradesh raja held the world record for killing highest number of tigers.

The vanishing wild life

The animals were subject to extinction due to natural causes before the arrival of man about 2 million years ago for example extinction of dinosaurs, large cephalopods and brachiopods. The tempo of extinction of wild life is at its peak since last 2 to 3 centuries due to the thoughtless action of man.

With the growing human population, agriculture and urbanization man has thoroughly exploited wild life and their habitats. Man has cut down forests, polluted water as a result of which many species of animals and plants have vanished and the others which are living today are on the border of extinction.

According to one estimate, the number of wild life species disappeared during last 4 centuries is as follows,

- 17th century- 7 species extinct
- 18th century- 11 species extinct
- 19th century- 27 species extinct
- 20th century- 67 species extinct

Causes of destruction

The ways and means of extinction of wild life by man fall into two categories: direct destruction and indirect destruction.

Direct destruction: by hunting, capturing; for amusement, meat, fur, feathers, etc.

In North America, 60 million heads of bison were hunted to feed Trans-American railways. Only the tongue of the animal was consumed and the rest of the body was left to rot.

Predators like lion (*Panthera leo*), tiger (*Panthera tigris*), Leopard (*Panthera pardus*), white bear (*Ursus*) etc are hunted down, trapped or poisoned because they occasionally eat livestock.

60,000 to 70,000 blue whales (*Balaenopterus musculus*) and many other whale species are killed every year for fat used in cosmetic and soap industry.

Millions of fur bearing animals are killed every for the use of their fur in industry.

Man is responsible for the extinction of hunting leopard (*Acinonyx*), migrating dove (*Ectopistus migratorius*), Dodo (*Rephus*) and many others.

Other direct causes for the reduction of many animal species are for medicines, superstitions, supply of live animals for zoos and laboratories, trophies and stuffed animals.

Indirect destruction: by deforestation, destruction of habitats, desertification, pollution, insecticides

Importance of wild life

Wild life is a danger to the human life, they are a nuisance to the farmers because they destroy crops, the domestic livestock is denied grazing in the wild life reserves and the hunters are denied shooting for recreation. Even then the conservation of the wild life becomes necessary and is of great importance due to many values to mankind.

Ecological value: For millions of years the humans and the wild life have evolved together on the planet earth. All the life on earth is interlinked through food chains and forms the ecosystem. Destruction of wild life may upset the ecological balance resulting in severe consequences. Thus, protection of every species of animal is of great importance to maintain the quality of life and the survival of man himself. By rendering the planet uninhabitable for animals, we will not be able to avoid extension of ourselves.

Commercial value: Wild life forma an important natural resource. Like coal and petroleum even wild life is a non-renewable resource.

- Wild life may attract tourists from other countries and earn foreign currency.

- The fresh water fish and other aquatic life forms provide large amount of food for people.

- The wild life of dry land mainly contributes to the food of primitive people.

- The entire fur industry is supported by fur-bearing animals.

- The trade of live or dead animals earns foreign currency. For example, an Indian Rhino may fetch some lakhs of Indian rupees.

- Similarly, the ivory of elephant, glands of musk deer, horns of Rhinos, antlers of deer fetch good price in international market.

Game value: Wild life has its worth even as games. In Australian and European countries millions of people hunt or fish for recreation and spend billions of dollars on the animal sports.

Scientific value: Scientific studies of various wild animals are of direct value to humans.

- The study of sea urchins helped in understanding the human embryology.

- The study of desert toad has helped in the early determination of pregnancy.

- The study of Rhesus monkey helped in the knowledge of blood groups.

- The study of Antlers of deer helped in determining the degree of radioactive contamination of natural environments.

- The study of Armadillos helped in development of vaccine for leprosy.

Aesthetic value: There is a great worldwide aesthetic value of wild life because of their sheer beauty and appeal to human spirit. A world without melodious birds, graceful beasts and rapturous forests would be a poor place for humans to live in.

Without wild life the country side looks dead, monotonous and static like a picture on the postcard. People feel pleasure, satisfaction and happiness in the presence of wild life.

Ethical value: Generally, people think that they do not have the right to kill animals rather it is the duty of the people to protect and conserve the wild life. In fact, every religion preaches respect and reverence for life.

Important wild animals of India

1. Indian Crocodile (*Crocodylus porosus*)

2. Indian Lion (*Panthera leo*)

3. Indian Tiger (*Panthera tigris*)

4. Indian Rhino (*Rhinoceros unicornis*)

5. Bison (*Bison bonasus*)

6. Indian elephant (*Elephas maximus*)

7. Great Indian Bustard (*Ardeotis nigriceps*)

8. Hornbill (*Ocyceros griseus*)

9. Common peafowl (*Pavo cristatus*)

10. Wild buffalo (*Babalus bubalis*)

11. Musk deer (*Moschus moschiferous*)

12. Bear (*Ursus americanus*)

Wild life organizations

In recent years man has interfered with nature as never before. He has destroyed forests, drained swamps, polluted water which ultimately led to the extinction of many animals and plants. In the

beginning of this century, there was a realization about importance environment for the quality of life and survival of human.

- IUCN (International Union for Conservation of Nature and Natural Resources)

- WWF (World Wild life Fund)

- IBWL (Indian Board of Wild Life)

- BNHS (Bombay Natural History Society)

- WPSI (Wild Life Preservation society)

Wild life institute of India

To train people and expand the activities in wild life, government of India has established wild life institute of India at Dehradun. The institute is engaged in management and extension of wild life.

It runs several courses at post graduate level along with diploma and other short term courses in specialised fields. As a result of training by this institute a number of trained persons are now engaged in conservation and extension of wild life in India.

Methods of wild life conservation

The most commonly adopted methods for conservation of wild life are as follows:

Habitat management: This includes ecological study of habits and habitats of wild life species, protection, preservation and improvement of habitats. Census and statistical data regarding the species which are conservation are done.

Establishment of parks, reserves and sanctuaries: the establishment of national parks, wild life reserves and wild life sanctuaries may serve many purposes like:

- Conserve species in wild state

- Provide scientific, educational and recreational opportunities

- Earn revenue by attracting tourists

Breeding in captivity: The animals are bred in captivity to overcome the danger of predation or to save the wild life from natural disasters. Tree species like Ginko have survived only in captivity. Mountain Gorilla is protected in the national park. It is evident that many other species of wild life are protected in the national parks.

Reintroduction: Several animal species and plant species which were almost extinct in certain areas were allowed to reproduce and flourish in suitable places similar to original ones. Later these were reintroduced in several parks and saved.

Mass education: for any conservation programme to be successful there is a need for education to people to achieve their participation. The methods adopted to educate people are:

- Celebration of wild life week every year

- Publicity through media

- Holding essay competitions, lectures and seminars

- Setting up clubs in educational institutes

- Publication of wild life books and journals

- Establishment of natural history museum

Promulgation of laws: All countries have promulgated laws for protection and conservation of wild life. In India, central legislation act was enacted in 1972 called as Wildlife Protection Act. Killing, hunting and capturing of wild life without prior permission from suitable authority is punishable under this law. In 1976, 42[nd]amendment of Indian constitution, protection of wild life has been included in the concurrent list.

Problems of protection of wild life India

The management of wild life is beset with several problems in India. The most important of the problems are the people living near the forest area. Government is hard pressed with increasing human population, superstitions and illiteracy among people.

Due to these reasons the government is bound to take up projects to educate these people. In addition to these, cultivation of cash crops like tea, coffee, rubber, eucalyptus has disturbed the normal ecological set up of wild life.

REMOTE SENSING

Remote sensing is measurement or acquisition of information about some property of an object or phenomena through object that is not in physical proximity to the object being studied. Basic principle is that different objects, based on their physical, chemical and structural properties emit different energies in the electromagnetic spectrum that is intercepted and used in decision making.

Active remote sensing – when the body is artificially illuminated and the reflected light is measured e.g. RADAR and LIDAR

Passive remote sensing – when the natural light emitted by the object is measured through microwave sensing

Remote sensing techniques play an important role in crop identification, acreage and production estimation, disease and stress detection, soil and water resources etc. Remote sensing applications have become very important for making macroeconomic decisions related to food security, poverty alleviation and sustainable development in the country.

The use of remote sensing for national development started in India comparatively earlier than other developing countries. The first experiment that used remote sensing was on coconut root–wilt disease in Kerala using colour-infrared aerial photography in late 1960s. Another early programme was Agriculture Resources Inventory & Survey Experiment (ARISE) in 1975. After that many other programmes were started such as Experimental Studies on Crop Discrimination in 1970s; Estimation of area & production of major crops at State level in 1980s, Launch of FASAL in 1990s etc.

- National Remote Sensing Agencies (NRSA) was established in 1975 primarily for providing operational aerial survey services.

- Launch of two experimental earth observation satellites Bhaskara I and II (1979, 1981) provided the necessary experience in handling a total remote sensing system on an experimental level. These satellites carried cameras and SAMIR (Satellite Microwave Radiometer).

- India received a tremendous boost with the launch of Indian Remote Sensing Satellite-1A (IRS 1A) in March 1988. This carried two cameras LISS-I and LISS-II. A series of IRS satellites were launched in 1990s. Today, IRS system is the largest constellation of remote sensing satellites for civilian use in operation today in the world, with 12 operational satellites.

- In 1990s, concept of Forecasting Agricultural output using Space, Agro-meteorology and Land based observation (FASAL) developed. Its main objective was to collect Monsoon data through remote sensing, economic data and monitoring of crops when growing.

- To provide real-time information about the prevalence and severity of droughts at district and sub-district level in 13 key agricultural states, the ISRO's National Remote Sensing Centre, Hyderabad launched a National Agricultural Drought Assessment and Monitoring System (NADAMS). It prepared fortnightly reports on droughts by using advanced wide-field sensors of satellites like Resourcesat-1, IRS 1C and IRS 1D.

At present, the government is preparing to deploy satellites to digitally map each farmland in the country, data from which will be used to provide tailor-made crop insurance cover to farmers. The idea is to digitally map all of India's farming plots using GPS readings and offer farmers yield-based insurance products, which will cover their individual risks. At present, crop insurance mainly covers the loans taken by a farmer and not his farming activities.

Autonomous farming

Autonomous Farming refers to the use of machine for seeding, crop sensing, harvesting, weeding and other follow-up operations by using remote sensing and GIS. Seeding is done by an attached seeding drill controlled by GPS. Crop growth, soil moisture and weeds are continuously noted via the remote sensing appliances. Autonomous & coordinated harvesting and grain collection machinery. The automation of agriculture is still in research level in many developed countries (US, Australia).

Major Applications of Remote sensing in Agriculture

Some of the specific applications are as follows:

- **Agriculture:**

  1. Crop identification
  2. Crop acreage estimation
  3. Crop condition assessment and stress detection
  4. Soil moisture detection
  5. Soil nutrient and problem detection; soil mapping
  6. Irrigation monitoring and management; management of droughts
  7. Land cover and degradation mapping
  8. Identify pest and disease infestation

Problems:

  1. Small size of plots
  2. Intercropping and mixed cropping
  3. Different harvest dates for different fields
  4. Cloud cover during monsoons

- **Wildlife conservation**
  1. Mapping wildlife corridors

2. Habitat suitability Mapping
3. Prediction Analysis
4. Change Detection Analysis
5. Mapping Required Resources for Wildlife
6. Real time tracking
7. Population Mapping
8. Web Portal of particular Wildlife

GIS can be used for mapping the endangered species in the particular area. Remote sensing techniques will help in understanding the environmental factors responsible for the extinction of species.

BIODIVERSITY AND CONSERVATION

The term biodiversity was coined as a contraction of biological diversity by E.O. Wilson in 1985. Biodiversity may be defined as the variety and variability of living organisms and the ecological complexes in which they exist. In other words, biodiversity is the occurrence of different types of ecosystems, different species of organisms with the whole range of their variants and genes adapted to different climates, environments along with their interactions and processes.

Biodiversity includes the genetic variability (for which different varieties of species have appeared in the course of evolution) and diversity of life forms such as plants, animal microbes, etc. living in a wide range of ecosystems.

There are three interrelated hierarchical levels of biodiversity namely, genetic diversity, species diversity and community or ecosystem diversity.

1. Genetic diversity:

It describes the variation in the number and types of genes as well as chromosomes present in different species. The magnitude of variation in genes of a species increases with increase in size and environmental parameters of the habitat.

Genetic diversity is the total number of genetic characteristics in the genetic makeup of a species.

A single species might show high diversity at the genetic level. India has more than 50,000 genetically different strains of rice, and 1,000 varieties of mango.

Genetic diversity allows species to adapt to changing environments. This diversity aims to ensure that some species survive drastic changes and thus carry on desirable genes.

The genetic variation arises by gene and chromosome mutation in individuals and in sexually reproducing organisms and it is spread in the population by recombination of genetic materials during cell division after sexual reproduction. Genetic diversity has the following importance:

(i) It helps in speciation or evolution of new species;

(ii) It is useful in adaptation to changes in environmental conditions;

(iii) It is important for agricultural productivity and development.

2. Species diversity:

It describes the variety in the number and richness of the species with in a region. The species richness may be defined as the number of species per unit area. The richness of a species tells about the extent of biodiversity of a site and provides a means for comparing different sites.

The species richness depends largely on climatic conditions. The number of individuals of different species with in a region represents species evenness or species equitability. The product species richness and species evenness give species diversity of a region. When a species is confined entirely to a particular area, it is termed as endemic species.

It is the ratio of one species population over total number of organisms across all species in the given biome. 'Zero' would be infinite diversity, and 'one' represents only one species present.

For example, the Western Ghats have a greater amphibian species diversity than the Eastern Ghats. There are more than 200000 species in India of which several are confined to India (endemic).

Endemism is the ecological state of a species being unique to a defined geographic location, such as an island, nation, country or other defined zone, or habitat type; organisms that are indigenous to a place are not endemic to it if they are also found elsewhere. A particular type of animal or plant may be endemic to a zone, a state or a country. The extreme opposite of endemism is **cosmopolitan distribution**.

Species differ from one another, markedly in their genetic makeup, do not inter-breed in nature. Closely-related species however have in common much of their hereditary characteristics. For instance, about 98.4% of the genes of humans and chimpanzees are the same.

According to the IUCN (2004), the total number of plant and animal species described so far is slightly more than 1.5 million, but we have no clear idea of how many species are yet to be discovered and described. A large proportion of the species waiting to be discovered are in the tropics. Estimates place the global species diversity at about 7 million.

More than 70% of all the species recorded are animals, while plants (including algae, fungi, bryophytes, gymnosperms and angiosperms) comprise no more than 22% of the total.

Among animals, insects are the most species-rich taxonomic group, making up more than 70% of the total. That means, out of every 10 animals on this planet, 7 are insects.

3. Ecosystem diversity:

It describes the assemblage and Interaction of species living together and the physical environment a given area. It relates varieties of habitats, biotic communities ecological processes in biosphere. It also tells about the diversity within the ecosystem. It is referred as Land escape diversity because it includes placement and size of various ecosystems.

For example, the landscapes like grass lands, deserts, mountains etc. show ecosystem diversity. The ecosystem diversity is due to diversity of niches, trophic levels and ecological processes like nutrient cycling, food webs, energy flow, role of dominant species and various related biotic interactions. Such type of diversity can generate more productive and stable ecosystems or communities capable of tolerating various types of stresses e.g. drought, flood etc.

According to Whittaker (1965), the community diversities are of three types:

(i) α-Diversity:

It tells the species diversity in a given community. It depends upon species richness and evenness.

(ii) β-Diversity:

It is a comparison of diversity between ecosystems, usually measured as the change in amount of species between the ecosystems.

(iii) γ -Diversity:

It describes diversity of habitat over a total landscape or geographical area.

Keystone species and Foundation Species

Keystone species is a species whose addition to or loss from an ecosystem leads to major changes in occurrence of at least one other species. Certain species in an ecosystem is considered more important in determining the presence of many other species in that ecosystem.

All **top predators** (Tiger, Lion, Crocodile, Elephant) are considered as keystone species because it regulates all other animal population indirectly. Hence top predators are given much consideration in conservation.

If keystone species is lost, it will result in the degradation of whole ecosystem. For example certain plant species (ebony tree, Indian-laurel) exclusively depends upon bats for its pollination. If the bat population is reduced then regeneration of particular plants becomes more difficult.

Foundation species is a dominant primary producer in an ecosystem both in terms of abundance and influence. Example: kelp in kelp forests and corals in coral reefs.

Flagship species

A flagship species is a species chosen to represent an environmental cause, such as an ecosystem in need of conservation. These species are chosen for their vulnerability, attractiveness or distinctiveness in order to engender support and acknowledgement from the public at large. Example: Indian tiger, African elephant, giant panda of China, mountain gorilla of Central Africa, orangutan of Southeast Asia and the leatherback sea turtle.

THREATS TO BIODIVERSITY

Biodiversity is considered as a reservoir of resources to be used for the manufacture of food, medicine, industrial products, etc. But with an increased demand of rapid population growth, biodiversity is gradually depleting. A number of plants" and animal species have already become extinct and many are endangered. The different factors responsible for causing threat to biodiversity are as follows:

1. Habitat destruction: The primary cause of loss of biodiversity is habitat loss or destruction which is resulting due to industrial and commercial activities associated with agriculture, irrigation, construction of dams, mining, fishing etc.

2. Habitat fragmentation: With increased population, the habitats are fragmented into pieces by roads, fields, canals, power lines, towns etc. Isolated fragments of habitats restrict the potential of species for dispersal and colonization. In addition, habitat fragmentation also brings about microclimatic changes in light, temperature, wind etc.

3. Pollution: The most dreaded factor inducing loss of biodiversity is environmental pollution which include air pollution, Water pollution, industrial pollution, pollution due to chemical Pastes, pesticides radioactive materials etc.

4. Over exploitation: Natural resources are over exploited to meet growing rural poverty, intensive technological growth and globalization of economy. All these factors together may be responsible for the extinction of a number of species.

5. Introduction of exotic species: Introduction of exotic/ invasive species due to horticulture, agriculture, European colonisation and accidental transport. It is seen that some exotic species may kill or eat the native species thereby causing its extinction.

6. Diseases: Since animals are more vulnerable to infection, anthropological activities may increase the incidence of diseases in wild species, leading to their extinction.

7. Shifting or Jhum cultivation: Shifting or Jhum cultivation by poor tribal people greatly affects the forest structure which is a store house of biodiversity.

8. Poaching of wild life: A number of wildlife species are becoming extinct due to poaching and hunting.

CONSERVATION OF BIODIVERSITY

Conservation of biodiversity is protection, upliftment and scientific management of biodiversity so as to maintain it at its threshold level and derive sustainable benefits for present and future generation. In other words, conservation of bio-diversity is the proper management of biosphere by human beings in such a way that it gives maximum benefits for present generation and also develops its potential so as to meet the needs of the future generations.

Conservation of biodiversity has three basic objectives:

(a) To maintain essential ecological processes and life supporting systems.

(b) To preserve the diversity of species.

(c) To make sustainable utilisation of species and ecosystems.

Strategies for Conservation of Biodiversity:

(1) All the possible varieties (old or new) of food, forage and timber plants, livestock, agriculture animals and microbes should be conserved.

(2) All economically important organisms in protected areas should be identified and conserved.

(3) Critical habitats for each species should be identified and safeguarded.

(4) Priority should be given to preserving unique ecosystems.

(5) There should be sustainable utilisation of resources.

(6) International trade in wild life should be highly regulated.

(7) Poaching and hunting of wildlife should be prevented as far as practicable.

(8) Care should be taken for the development of reserves and protected areas.

(9) Efforts should be made to reduce the level of pollutants in the environment.

(10) Public awareness should be created regarding biodiversity and its importance for the living organisms.

(11) Priority should be given in wildlife conservation programs to endangered species over vulnerable species and to vulnerable species over rare species.

(12) The habitats of migratory birds should be protected by bilateral and multilateral agreements.

(13) Over exploitation of useful products of wild life should be prevented.

(14) The useful animals, plants and their wild relatives should be protected both in their natural habitat (in-situ) and in zoological botanical gardens (ex-situ)

(15) Efforts should be made for setting up of National parks and wild life sanctuaries to safeguard the genetic diversity and their continuing evolution.

(16) Environmental laws should be strictly followed.

Conservation Methods:

(a) In situ conservation:

The conservation of species in their natural habitat or natural ecosystem is known as in situ conservation. In this process, natural surrounding or ecosystem is protected and maintained so that all the constituent species (known or unknown) are conserved and benefitted. The factors which are detrimental to existence of species concerned are eliminated by suitable mechanisms.

Advantages of in situ conservation are as follows:

(a) Cheap and convenient way.

(b) It offers a way to preserve a large number of organisms simultaneously, known or unknown to us.

(c) Existence in natural ecosystem provides opportunity to the living organisms to adjust to different environmental conditions and to evolve.

The only disadvantage of in situ conservation is that it requires large areas which is often difficult because of growing demand for space. The protection and management of biodiversity through in situ conservation involves certain specific areas known as protected areas which include national parks, Sanctuaries and Biosphere reserves.

1. Protected areas:

Protected areas are biogeographical areas where biological diversity along with natural and cultural resources is protected, maintained and managed through legal and administrative measures. The demarcation of biodiversity in each area is determined on the basis of climatic and physiological conditions.

In these areas, hunting, firewood collection, timber harvesting etc. are prohibited so that the wild plants and animals can grow and multiply freely without any hindrance. Some protected areas are: Cold desert (Ladakh and Spiti), Hot desert (Thar), Saline Swampy area (Sunderban and Rann of Kutch), Tropical moist deciduous forest (Western Ghats and north East) etc. Protected areas include national parks, sanctuaries and biosphere reserves. There are 37,000 protected areas throughout the world. As per World Conservation Monitoring Centre, India has 581 protected areas, national parks and sanctuaries.

2. National parks:

National Park is an area having adequate ecological, faunal, floral, geomorphological, natural or zoological significance. The National Park is declared for the purpose of protecting, propagating or developing wildlife or its environment, like that of a Sanctuary. The difference between a Sanctuary and a National Park mainly lies in the vesting of rights of people living inside. Unlike a Sanctuary, where certain rights can be allowed, in a National Park, no rights are allowed. No grazing of any livestock shall also be permitted inside a National Park while in a Sanctuary, the Chief Wildlife Warden may regulate, control or prohibit it. In addition, while any removal or exploitation of wildlife or forest produce from a Sanctuary requires the recommendation of the State Board for Wildlife, removal etc., from a National Park requires recommendation of the National Board for Wildlife. Some important national Parks of India are:

(i) Biological Park, Nandankanan, Orissa,

(ii) Corbett national Park Nainital, U.P. (First national Park)

(iii) Kaziranga national Park, Jorhat, Assam

3. Sanctuaries:

Sanctuary is an area which is of adequate ecological, faunal, floral, geomorphological, natural or zoological significance. The Sanctuary is declared for the purpose of protecting, propagating or developing wildlife or its environment. Certain rights of people living inside the Sanctuary could be permitted. Further, during the settlement of claims, before finally notifying the Sanctuary, the Collector may, in consultation with the Chief Wildlife Warden, allow the continuation of any right of any person in or over any land within the limits of the Sanctuary.

4. Biosphere reserves:

Biosphere reserves or natural reserves are multipurpose protected areas with boundaries circumscribed by legislation. The main aim of biosphere reserves is to preserve genetic diversity in representative ecosystems by protecting wild animals, traditional life style of inhabitants and domesticated plant/ animal genetic resources. These are scientifically managed allowing only the tourists to visit. These help in the restoration of degraded ecosystem. These maintain cultural, social and ecologically sustainable economic developments. These support education and research in various ecological aspects. Some important biosphere reserves are Simlipal (Orissa), Sunderban (West Bengal), Kanha (M.P) Kaziranga (Assam).

5. Conservation Reserves:

These can be declared by the State Governments in any area owned by the Government, particularly the areas adjacent to National Parks and Sanctuaries and those areas which link one Protected Area with another. Such declaration should be made after having consultations with the local communities. Conservation Reserves are declared for the purpose of protecting landscapes, seascapes, flora and fauna and their habitat. The rights of people living inside a Conservation Reserve are not affected.

6. Community Reserves:

These can be declared by the State Government in any private or community land, not comprised within a National Park, Sanctuary or a Conservation Reserve, where an individual or a community has volunteered to conserve wildlife and its habitat. Community Reserves are declared for the purpose of protecting fauna, flora and traditional or cultural conservation values and practices. As in the case of a Conservation Reserve, the rights of people living inside a Community Reserve are not affected.

(b) Ex-situ conservation:

Ex-situ conservation involves maintenance and breeding of endangered plants and animals under partially or wholly controlled conditions in specific areas like zoo, gardens, nurseries etc. That is, the conservation of selected plants and animals in selected areas outside their natural habitat is known as ex-situ conservation. The stresses on living organisms due to competition for food, water, space etc. can be avoided by ex-situ conservation there by providing conditions necessary for a secure life and breeding. Some important areas under these conservation are:

(i) Seed gene bank, (ii) Field gene bank, (iii) Botanical gardens, and (iv) Zoos.

The strategies for ex-situ conservations are:

(i) Identification of species to be conserved.

(ii) Adoption of Different ex-situ methods of conservation.

(i) Long-term captive breeding and propagation for the species which have lost their habitats permanently.

(ii) Short-term propagation and release of the animals in their natural habitat

(iii) Animal translocation

(iv) Animal reintroduction

(v) Advanced technology in the service of endangered species.

Advantages of ex-situ conservation are:

(a) It gives longer life time and breeding activity to animals.

(b) Genetic techniques can be utilised in the process.

(c) Captivity breed species can again be reintroduced in the wild.

Some disadvantages of this method are:

(a) The favourable conditions may not be maintained always.

(b) New life forms cannot evolve.

(c) This technique involves only few species.

Hot Spots:

Hot spots are the areas with high density of biodiversity or mega diversity which are most threatened at present. There are 16 hot spots in world, out of which two are located in India namely North-East Himalayas and Western Ghats.

The hot spots are determined considering four factors:

(i) Degrees of endemism,

(ii) Degree of expectation,

(iii) Degrees of threat to habitat due to its degradation and fragmentation, and

(iv) Number of Species diversity.