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Biodiversity conservation, threats and their global impact

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Introduction

Biodiversity means variation in different species found within the world. The word biodiversity is commonly used by scientist, environmental organizations, industrialist and economist. The term biodiversity was discovered by W.G. Rosen in 1985. According to Rio Convention on Biodiversity, 1992 (Article-2), it can be defined as: "Biological diversity means the variability among living organisms from all sources, including, interalias, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within the species, between species and ecosystem". The different groups of biodiversity are classified as: grassland biodiversity, wetland biodiversity, agrobiodiversity, desert biodiversity, microbial diversity, genetic biodiversity, and species biodiversity.

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The concept of biodiversity (synonyms with biological diversity) has been known to man ever since he began to minutely observe the living being around him. The term biological diversity was used by Robert E. Jenkins and Thomas Lovejoy in 1980. The word biodiversity itself may have been coined by W. G. Rosen in 1985. The term biodiversity was used as the title for a symposium organized by national Research council in Washington in 1986. At about that time, as people became more aware of the extinction crisis, biodiversity emerged as a significant issue. It was given concrete expression in the World Resources Institute (WRI), World Bank (WB), International Union of Nature and Natural Resources (IUCN) and World Wide Fund for Nature (WWF) publications concerned with conservation of world's biological diversity. However, biodiversity did not became a familiar term to general public until the United Nations Conference on the Environmental and Development (UNCED) held at Rio de Janerio (Brazil) in 1992. The Conference laid immense stress on

the biological diversity of our earth planet and the need to preserve it for posterity. It defined the biodiversity: *'Biodiversity 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 diversity within species, between species and of ecosystems.'* This is the single legally accepted definition of biodiversity adopted by the UN convention on Biological Diversity.

The most straight forward definition of biodiversity is the variation of life at all levels of biological organization. It includes diversity of forms right from the molecular unit to the individual organism, and then on to the population, community, ecosystem, landscape and biosphere levels. *In the simplest sense, 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.* Broadly speaking, the term biodiversity includes genetic diversity, species diversity, ecosystem diversity and habit diversity.

Grassland biodiversity: Those areas that contain flowers and non-woody plants. Grasslands have high nutrient rich soil, support perennial grasses and various types of shrubs. In the soil, mites, insect, nematodes, termites survive well. In the savanna, grazing animals like antelope, gazelles, zebra and rhinoceros but other animals such as monkey, porcupine and hedgehogs are also found (Freedman, 2009).

Wetland biodiversity: Wetlands are shallow lakes, water meadows, marshes and bogs. These are rich in animal diversity, amphibians (*e.g.* leopard, frogs), reptiles (alligator), birds (gees, muskrat). The plants diversity classified in submerged plants (bladderworts), floating leaved plants (water lilies), and floating plants (water hyacinth), emergent plants (common reed, shrubs and trees)

Agrobiodiversity: Agrobiodiversity is component of variety of animals and plants and microorganisms. It includes diverse crops, livestock, pests, parasites, predators (Qualset*et al.*, 1995).

Biodiversity: Desert ecosystem characterized by very low low rainfall (less than 50 cm), aridity and low vegetation. The animals in desrt biodiversity include insect, snake, lizards, birds and rodents and in plants contain cactus, with having small and thick leaves and extensive root systems (Rechtman 2007).

Microbial diversity: Microbial diversity is important aspect in the field of biotechnology; it denotes the species of bacteria, archea, eukarya. Microbes like bacteria and fungus play significant role in soil fertility.

Genetic diversity: Genetic diversity is diversity among same species with having variation in gene level. This diversity arises due to mutation in genes in response of environmental changes. The variety of common wheat (*Triticumaestivam*) is grown, but there can be different species of wheat on the bases of colour, size, nutrient content and grain quality.

Species diversity: This diversity is also named as community diversity. This diversity

is the variety of species found within an area (Newmark, 2013). Species diversity measured at the single species (alpha diversity), regional (gamma diversity), intermediate alpha and gamma (beta diversity). Species are important component of diversity and each species play a vital role in the ecosystem. The number of the species is greater in that area will represent greater species diversity.

Importance of Biodiversity

Biodiversity is importance for the survival of the living creature on earth. It not supports only human life but also maintain ecosystem channels.

1) **Ecological balance**: The biodiversity helps in the nitrogen, carbon, sulphur, oxygen and water cycle. The interaction among different communities and organisms play a key role in the stabilization of ecosystem. The species diversity change affects the functioning of ecosystem.
2) **Raw material source:** The rich biodiversity provides variety of different raw materials for manufacturing industries. Essential oils, gum and resins, tans and dyes, fibers, bamboos, saw dust, bidi leaves, lac, silk and honey are important raw material bases for small, cottage and large industries.
3) **Ecotourism:** Biodiversity is a source of recreational activities. The biodiversity is also important as economical sources such as national parks, wildlife sanctuaries, biosphere reserves etc. Boating, fishing, nature watching, and photography are other opportunism in ecotourism growth
4) **Climate change**: Forest diversity (herb, shrub and tree) absorb greenhouse gases like carbon dioxide, methane, nitrous oxide which helps in the regulation of climate change. Some other pollutant gases such as sulphur dioxide, ozone, chlorinated gases are also sequestering by forest biomass.
5) **Aesthetic value**: The aesthetic value is also important because it is related with cultural and natural beauty of plants. The people pay money for visit spiritual and religious plants.

Biodiversity on Earth:

There are 80,000 species of edible plants known on Earth, but 90% of the world's food comes from a mere 20 of these species. Edible plant species, both those we know of and those we don't, offer a tremendous resource of possibilities that could greatly add to the security of our food. How many of these have high potential for commercial exploitation and for feeding the hungry? Certainly a great many. Breeding cultivars with their wild counterparts can also confer resistance to diseases and increase crop yield. Medicines originating from wild species, including penicillin, aspirin, taxol, and quinine, have saved millions of lives and alleviated tremendous suffering. 40% of all prescriptions are for medicines that originated from plants and animals. No one knows how many more cures await discovery, hidden in Earth's poorly studied species.

Types of biodiversity

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. There are about 1.7 million known species of living forms on the earth. Each one stores an immense amount of genetic information. For example, the number of genes is ~35,000 in *Homo sapiens*. Genetic variation within species constitutes distinct populations of the same species or genetic variation within population or varieties. 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. Other kinds of genetic diversity can be seen at all levels of organization, including the amount of DNA per cell, chromosome structure and their number. 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. The amount of genetic variation is the basis of the evolution of new life forms (speciation). It has a key role in the maintenance of biodiversity at species levels.

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. Species are the primary focus of evolutionary mechanisms and therefore the origin and evolution of species are principle agents in maintenance of global biodiversity.

Ecosystem diversity (Diversity at the level of community/ecosystem).

In an ecosystem there may exist different landforms, each of which supports different but specific vegetation's. Ecosystem diversity in contrast to genetic and specific diversity is difficult to assess quantitatively since the boundaries of the communities, which constitute the various sub-ecosystems are elusive. Ecosystem diversity could best have understood if one studies the communities in various ecological niches within the given ecosystem; each ecosystem is associated with defined species complexes. These complexes are related to composition and structure of the ecosystem.

Habitat diversity

It involves more than just the kind of communities and species- it depends on the spatial arrangement of habitats across a large and on the fluxes of energy, nutrients, disturbances and organisms across the area. 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 texa within the ecosystem (usually species).

Beta diversity It refers to species diversity between ecosystems and is measured by comparing the number of taxa that are unique to each of the ecosystems.

Gamma diversity It is a measure of overall diversity for different ecosystems within a region. Species diversity in natural habitats is a high in warm areas and decreases with increasing latitude and altitude. On land, diversity is higher in areas of higher rainfall

and lower in drier areas. Tropical moist forests undoubtedly, are the richer areas. These comprise only 7% of the world surface area, but contain over 90% of all species. In India we are endowed with a rich diversity of biogeographically distinct regions due to varying physical conditions and species groupings.

Ecological role of biodiversity

All species provide some kind of function to an ecosystem. They can capture and store energy, produce organic material, decompose organic material, help to recycle water and nutrients throughout the ecosystem, control erosion or pests, fix atmospheric gases, and help regulate climate. These physiologically processes are important for ecosystem function and human survival. Diverse is the ecosystem better able to withstand environmental stress and consequently is more productive. The loss of a species is thus likely to decrease the ability of the system to maintain itself or to recover from damage or disturbance. Just like a species with high genetic diversity, an ecosystem with high biodiversity may have a greater chance of adapting to environmental change. In other words, the more species comprising an ecosystem, the more stable the ecosystem is likely to be.

Economic role of biodiversity

For all humans, biodiversity is first a resource for daily life. One important part of biodiversity is crop diversity, which is also called agro biodiversity. Most people see biodiversity as a reservoir of resources to be drawn upon for the manufacture of food, pharmaceutical, and cosmetic products. Some of the important economic commodities that biodiversity supplies to humankind are:

Modern agriculture: Biodiversity is used as a source of material for breeding improved varieties, and as bio pesticides, bio fertilizers *etc*.

Food: Crops, livestock, forestry and fish. Mangroves and coral reefs in coastal zone support fisheries.

Medical drugs

Wild plant species have been used for medicinal purposes since before the beginning of recorded history. For example, quinine comes from the cinchona tree (used to treat malaria), digitalis from the foxglove plant (chronic heart trouble), and morphine from the poppy plant (pain relief). According to the National Cancer Institute, over 70% of the promising anticancer drugs come from plants in the tropical rainforests. It is estimated that of the 2,50,000 known plants species, only 5,000 have been investigated for possible medical applications.

Industry: Fibbers are used for clothing, wood for shelter, energy and various other uses. Biodiversity may be a source of energy (such as biomass). Other industrial products are oils, fragrances, dyes paper, waxes, rubber, latexes, resins, poisons, and cork, which all can be derived from various plant species. Supplies from animal origin include wool, silk, fur, leather, lubricants and waxes. Animals may also be used as a mode of transport.

Aesthetic and cultural benefits

Biodiversity has great aesthetic value. Examples of aesthetic value include eco-

tourism, bird watching, wildlife, gardening, etc. Eco-tourism is a source of economical wealth for many areas, such as many parks and forests, where wild nature and animals are a source of beauty and joy for many people. Biodiversity is also part of many cultural and religious beliefs. In many Indian villages and towns, plants like *Ocimumsanctum* (Tulsi), *Ficusreligiosa* (Pipal), and *Prosopis cineraria* (Khejri) and various other trees are considered sacred and worshipped by the people. Several birds, animals and even snake have been considered sacred. Also, we recognize several animals as symbols of national and heritage.

Scientific role of biodiversity

Biodiversity is important because each species can give scientists some clue as to how the life evolved and will continue to evolve on Earth. In addition, biodiversity helps scientists understand how life functions and the role of each species in sustaining ecosystems. From above it is clear that the survival and well being of the present day human population, depends on several substances obtained from plants and animals. The nutritional needs of mankind are also met by wild and domesticated animal and plant species. Indeed, the biodiversity in wild and domesticated form is the source for most of humanity's food, medicine, clothing and housing, much of the cultural diversity, and most of the intellectual and spiritual inspiration. It is, without doubt, the very basis of man's being. It is believed that $1/4^{th}$ of the known biodiversity, which might be useful to mankind in one way or the other, is in serious risk of extinction. This calls for an integrated approach for conserving global biodiversity.

The threatened biodiversity

The loss of biological diversity is a global crisis. There is hardly any region on the Earth that is not facing ecological catastrophes. Of the 1.7 million species known to inhibit the Earth (human are just one of them), one third to one fourth is likely to extinct within the next few decades. Biological extinction has been a natural phenomenon in geological history. But the rate of extinction was perhaps one species every 1000 years. But man's intervention has speeded up extinction rates all the more. Between 1600 and 1500, the rate of extinction went up to one species every 10 years. It is estimated that about 50 species are being driven to extinction every year, bulk of them in tropical forest, due to human interference.

Listing of threatened biodiversity

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. These categories were named as **Red list categories**. The IUCN Red List is the catalogue of texa that are facing the risk of extinction. This list aims to impart information about the urgency and scale of conservation problems to the public, environmentalists and policy makers. On the global level, the IUCN published **Red Data Book,** name given to the book dealing with threatened pants and animals of any region.

The IUCN, now known as World Conservation Union (WCU), in 2001 recognized nine Red List Categories as Extinct (Ex), Extinct in wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Least Concern (LC), Data Deficient (DD) and Not Evaluated (NE). The main purpose of the IUCN RED List is to catalogue and highlight those texa that are facing a higher risk of global extinction (i.e. those listed Critically Endangered, Endangered and Vulnerable.

Reasons for extinction of Biodiversity

Destruction of habitat

The natural habitat may be destroyed by man for his settlement, grazing grounds, agriculture, mining, industries, highway construction, drainage, dam building, *etc*. as a consequence of this, the species must adapt to the changes, move elsewhere or may succumb to predation, starvation or disease and eventually die. This is the most pervasive threat to birds, mammals and plants affecting 89% of all threatened birds, 83% of the threatened animals assessed. In our country, several rare butterfly species are facing extinction with the uncannily swift habitat destruction of the Western Ghats. Of the 370 butterfly species available in the Ghats, up to 70 are at the brink of extinction.

Hunting

From time immemorial, man has hunted for food. Commercially, wild animals are hunted for their products such as hide and skin, tusk, antlers, fur meat, pharmaceuticals, perfumes, cosmetics and decoration purposes. For example, in India, rhino is hunted for its horns, tigers for bones and skin, musk deer for musk (have medicinal value), elephant for ivory, gharial and crocodile for their skin, and jackal for thriving fur trade in Kashmir. One of the most publicized commercial hunts in that of whale. The whalebone or 'baleen' is used to make combs and other products. Poaching of the Indian tiger has been risen because of the increasing demand from pharmaceutical industries, which consume the bones of 100 tigers per year. Such huge demand has been mat by poachers from India. Even the Project tiger Programme failed to check poaching and resultantly the tigers have been almost disappeared from Ranthambore and Keoladeo national parks. Smuggling of tiger bones and skins is a lucrative business. Hunting for sport is also a factor for loss of wild animals.

Over exploitation

This is one of the main cause of the loss of not only economic species but also biological ciriosities like the insectivorous and primitive species and other taxa needed for teaching or laboratory (like *Nepenthes, Gnetum, Psilotum,* etc.). commercial exploitation of wild plants has invariably causes their overuse and eventual destruction. This has been true in case of Indian wild mango trees, which were turned into plywood as of the whales that were hunted for tallow. Plants of medicinal value like *Podophyllum hexandrum, Coptisteeta, Aconitum, Disocoreadeltoidea, Rauwolfiaserpentine, Paphiopedilumdruryi, etc*., and horticultural plants like orchids and rhododendrons come under the over-exploited category. Faunal losses have been mainly because of over-exploitation. For instance, excessive harvesting of marine organisms such as fish, mollusks, sea cows and sea turtles has resulted in extinction of these animals.

Collection for zoo and research

Animals and plants are collected throughout the world for zoo and biological laboratories for study and research in science and medicine. For example, primates such as monkey and chimpanzees are sacrificed for research as they have anatomical, genetic and physiological similarities to human being.

Introduction of exotic species

Native species are subjected to competition for food and space due to competition for food and space due to introduction of exotic species. For example, introduction of goats and rabbits in the Pacific and Indian regions has resulted in destruction of habitats of several plants, birds and reptiles.

Control of pest and predators

Predator and pest control measures, generally kill predators that are a component of balanced ecosystem and may also indiscriminately poison non-target species.

Pollution

The water pollution especially injurious to the biotic components of estuary and coastal ecosystem. Toxic wastes entering the water bodies disturb the food chain, and so to the aquatic ecosystems. Insecticides, pesticides, sulphur dioxide, nitrogen oxides, acid rain, ozone depletion and global warming too, affect adversely the plant and animal species. The impact of coastal pollution is also very important, it is seen that coral reefs are being threatened by pollution from industrialization along the coast, oil transport and offshore mining. Noise pollution is also the cause of wildlife extinction. According to a study Arctic whales are seen on the verge of extinction as a result of increasing noise of ships, particularly ice breakers and tankers.

Radiation effect on biodiversity

Radiation coming from solar rays like UV-B is harmful for living organisms on earth. There may be somatic and genetic damage changes. UV-B radiation affects on crop, aquatic and terrestrial organisms, human, microorganisms and plants. Thinning of ozone layer in stratosphere leads to radiation hazards on earth. Terrestrial and aquatic both organisms seriously exposed with eyes and skin diseases. Planktons (Phytoplankton and Zooplankton) are threatened due to over exposure of UV radiation. Planktons are

source of food in aquatic ecosystem, food chain in aquatic ecosystem.

Urban sprawl and biodiversity

Rapid rate of urbanization reduces forest land cover which ultimately leads to lower species richness at local and regional level. Urban developments are often responsible for introduce of exotic species like Parthenium spp. Parthenium is toxic weed with having allelopathic nature which reduce the growth of nearby plants and affects biodiversity. Construction of roads, river valley projects, industrialization and railway network expansion in forest areas disturb the forest ecosystem. Human settlement promotes the developments of exotic species due to high disturbance. The demand of food raw materials and recreational activities increases the pressure on ecosystems.

Global worming

Climate change affects the living organisms (plants and animals) respiration, photosynthetic activity, metabolic rate, and reproduction cycle and water consumption. Behaviour changes like reproduction cycle, nesting, and feeding habits are suspected to alter. Rise in temperature makes many biological communities habitat defragmented. The climate change effects rainfall patters, species diversity, and plants growth. Rise in temperature and CO_2 concentration is harmful for coral reef diversity.

Deforestation

One of the main causes for the loss of wildlife is population explosion and the resultant deforestation. Deforestation mainly results from population settlement, shifting cultivation, development projects, demand for fuel wood, demand of wood as a raw material for many industries such as paper and pulp, match, veneer and plywood, furniture etc. In the Country, the current rate of deforestation is 13,000 sq. km annually. If this rate of deforestation continues, one can imagine the ultimate fate of our forest and biological richness. It is presumed that in coming years, the global loss of biodiversity from deforestation alone would be 100 species every day.

Other factors: Other ecological factors that may also contribute to the extinction of wildlife are as follows:

i. Distribution range – The smaller the range of distribution, the greater the threat of extinction.

ii. Degree of specialization – The more specialized an organism is, the more vulnerable it isto extinction.

iii. Position of the organism in the food chain – The higher the position of the organism is in food chain, the more susceptibility it becomes.

iv. Reproductive rate – Large organisms tend to produce fewer offspring at widely spaced intervals.

v. Outbreaks of diseases – it is also one of the major causes for the decline in wildlife species.

vi. Loss of gene flow – The individuals of plant and animal life may decline to the significant levels as a result of loss of gene flow.

vii. Substitution – During the process of evolution an existing species may be replaced

by ecologically another one. In developing counties like India, the development policies and projects have rarely been sensitive to the need for biodiversity conservation, and that of the local communities. The government's failure to remove poverty and curb middle-class consumerism has led conditions in which sensible natural resources management assumes low priority.

Biodiversity conservation

A) In-situ Conservation

This type of conservation includes conservation of plant and animals in their native ecosystems or in manmade ecosystem where they naturally occur. This type of conservation applies only to wild fauna and flora and not to the domesticated animals and plants because conservation is possible by protection of population in nature. *In situ* conservation aims at either enhancement of existing populations or creation of self-supported new populations via reintroductions and translocations, using sampled or propagated material. In-situ conservation includes a system of protected areas of different categories, e.g., National Park, Sanctuaries, Biosphere Reserves, Cultural Landscapes, and National Monument *etc*. According to the World Conservation Union, protected area is defined as: "An area of land and/or sea specially. dedicated to the protection and maintenance of biological diversity and of natural and associated cultural resources and managed through legal or other effective mean.

B) Ex-situ Conservation

Ex-situ conservation means conservation of species (sample of genetic diversity), particularly of endangered species away from their natural habitat. It is done through establishment of 'gene banks', which include genetic resource centres, botanical gardens, cultural collection and zoos etc. *Ex situ* conservation needs biologically effective, financially realistic and easy-to-use guidelines that can be applied to a wide range of situations. The development of such guidelines must take into consideration basic issues of conservation biology. Traditionally, the germplasm sampled for *ex situ* collection is supposed to represent potential adaptive variation within a species.

C) Wild Life Conservation in India

The shocking death of many tigers and lions due to a mysterious disease in our sanctuaries has brought wildlife conservation policies and their implementation into public focus. India has a wide variety of wildlife, many of them endangered, ranging from the snow leopard in the Himalayas to the giant Malabar squirrel in the rain forests of Kerala. Wildlife conservation has been very much in forefront of government policy and India is a signatory to the Convention on International Trade in Endangered Species (CITES).

Enforcement of wildlife protection is done under the Wildlife Protection Act, 1972. The Indian Board for Wildlife (IBWL) is the apex advisory body in the field of wildlife conservation in the country and is headed by the Prime Minister. Indian wildlife is protected in 107 zoos, 49 deer parks, 16 safari parks, 6 snake parks, 24 breeding

centres and 6 aquariums, besides of course 95 national parks and 500 sanctuaries. Forest staff looks after anti-poaching activities, habitat management and improvement. Besides, there are also projects for the flagship species like Project Tiger and Project Elephant where the habitats are maintained according to the requirements of the flagships species like tiger or elephant.

What are some methods to conserve biodiversity?

Biodiversity banking places a monetary value on biodiversity. One example is the Australian Native Vegetation Management Framework. Gene banks are collections of specimens and genetic material. Some banks intend to reintroduce banked species to the ecosystem (e.g. via tree nurseries). Reducing and better targeting of pesticides allows more species to survive in agricultural and urbanized areas. Location-specific approaches are less useful for protecting migratory species. One approach is to create wildlife corridors that correspond to the animals' movements. National and other boundaries can complicate corridor creation.

Strategies for Protection of Biodiversity at the Landscape Level

Two major strategies for conservation of biodiversity at the landscape level of analysis have emerged over the last 20 years. One strategy promoted by Conservation International, International Union for the Conservation of Nature and some other international conservation organizations, is to focus on “world hotspots of biodiversity” defined as areas with larger numbers of species and high species diversity.

Some Wild Life Projects In India

1) Project Tiger: 50 years ago, there were over 40,000 tigers in India. But poaching and destruction of habitat had reduced the number to just 1827 by 1972, making them an endangered species. To protect the tigers from extinction, the Government of India started "Project Tiger" on April 1st, 1973. Due to the success of the project the tiger population has now grown to over 4,000.
2) Lion Project: In Gir forest of Gujarat started in 1972.
3) Yak Research Centre 9 In Arunachal Pradesh
4) Crocodile Breeding Project Started in 1975.
5) Himalayan Musk Deer Project AtKedarnath in Uttar Pradesh.
6) Project Elephant Started in 1991
7) Snow Leopard Project at 12 reserves throughout the Himalayas. Project Hanghul at Dachigan sanctuary, Jammu and Kashmir, started in 1970.
8) Project Hanghul at Dachigan sanctuary, Jammu and Kashmir, started in 1970.
9) Rhino conservation Project at Dudhwal National Park.
10) Manipur Brow Antlered Deer Project at Keibul Lamjoa, since 1977.

Floral and Faunal diversity

India accounts about 2.4 % of world’s total geographical area, India occupies 6.7 % of the faunal diversity of the world. In faunal diversity 96,423 insect species (Table 2) India holds about 29,105 species of algae, bryophytes, pteridophytes, gymnosperms. It

occupies 9.13 % of the world's floral diversity in these groups (Table 1).

Plant group		Number of species described	
	World (estimated)	India	Percentage in India
Algae	40,800	7,244	17.75
Bryophytes	14,500	2,504	17.27
Pteridophytes	12,000	1,267	10.56
Gymnosperms	650	74	11.38
Angiosperms	250,000	17,926	7.17
Total	317,950	29,015	9.13

Source: BSI (2013) **Table 1:** Floral diversity of India

Taxonomic group	Number of species		
	World	India	Percentage in India
Protista (Protozoa)	31,250	3500	11.20
Animalia	1,53,122`	13,033	8.51
Mesozoa	71	10	14.08
Porifera	5000	500	10.00
Cnidaria	10,105	1042	10.31
Ctenophora	100	12	12.00
Platyhelminthes	17,511	1,650	9.42
Rotifera	2500	330	13.20
Gastrotricha	3000	100	3.33
Kinorhyncha	100	10	10.00
Nematoda	30,028	2902	9.66
Acanthocephala	800	229	28.63
Sipuncula	145	35	24.14
Mollusca	66,535	5169	7.77
Echiura	127	43	33.86
Annelida	17,000	1000	5.88
Onychophora	100	1	1.00
Arthopoda	11,81,398	74,175	6.28
Crustacea	60,000	3549	5.91
Insecta	10,20,007	63,423	6.22
Arachnida	73,451	5850	7.96
Pycnogonida	600	17	2.83
Chilopoda	8000	101	1.26
Diplopoda	73,451	5850	7.96
Symphyla	120	4	3.33
Merostomata	4	2	50.00
Phoronida	11	3	27.27
Bryozoa (Ectoprocta)	4000	200	5.00
Entoprocta	60	10	16.67
Brachiopoda	300	3	1.00
Chaetognatha	111	30	27.03
Tardigrada	514	30	5.84
Echinodermata	6600	779	11.80
Hemichordata	120	12	10.00
Chordata	64,669	5,665	8.76
Protochordata	2106	119	5.65
Pisces	32,120	3,022	9.41
Amphibia	6771	342	5.05
Reptilia	9230	526	5.70
Aves	9026	1,233	13.66
Mammalia	5416	423	7.81
Total (Animalia)	13,99,189	92,873	6.64
Grand total (Protista+Animalia)	14,30,439	96,373	6.74

Source: ZSI (2014) **Table. 2: Faunal diversity of India**

Forest

The forests in India are spread over an area of 692,027 km^2, covering 21.05% of the geographical area of the country. There are 16 major forest types and 251 sub-types (FSI 2011). According to National Forest Policy (1952) about 33 percent of geographical area should be under forest cover. However, the present situation not fulfilled the criteria. The forest cover of India is 21.05 percent which is much below the average of 30.4 percent of the world. The areas of different types of forest found in India are shown in Table 3.

Class	Area $(Km)^2$	Percent of geographical area
Forest cover		
a) Very Dense forest	83,471	2.54
b) Moderately Dense Forest	3,20,736	9.76
c) Open forest	2,87,820	8.75
Total Forest Cover	6,92,027	21.05
Scrub	42,176	1.28
Total geographical area	3,2,87,263	100.00

Table. 3: Forest cover of India

Protected areas

The conservation of wide range of diversity is necessary for ecological balance. National Parks, Sanctuaries, Biosphere reserves and other protected areas have been established. At present in India, 103 National parks, 536 wildlife Sanctuaries, 67 conservation reserves and 26 community reserves (Table 4)

	Number	Area (Km^2)	% Geographical area of India
National Parks (NPs)	103	40500.13	1.23
Wildlife Sanctuaries	536	118005.33	3.59
Conservation Reserves	67	2349.38	0.07
Community Reserves	26	46.93	0.001

Source: www.wiienvis.nic.in/Database/Protected-Area-854.aspx.Wiienvis.nic.in /Database/ html /pages /forest cover map.html

Table. 4: Protected areas of India (As on 14 June, 2016)

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