# The Institution of Engineers (India)

## MUZAFFARPUR LOCAL CENTRE

# WORLD ENVIRONMENT DAY

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**WEBINAR**

**ON**

## *"CELEBRATE BIODIVERSITY"*

**5TH JUNE 2020**

THE INSTITUTION OF ENGINEERS (INDIA)

MUZAFFARPUR LOCAL CENTRE

**(FOUNDED 1969)**

**MUZAFFFARPUR INSTITUTE OF TECHNOLOGY**

**MUZAFFARPUR – 842003 (BIHAR),**

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# The Institution of Engineers (India)
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# THE INSTITUTIONOF ENGINEERS(INDIA)

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# 2020

## CONTENTS

# Biodiversity Importance and Climate Change Impacts: A Review

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***Abstract*:** Biodiversity plays a direct role in climate regulation. It is the variability among living organisms, including genetic and structural difference between individual and within and between individual and within and between species..Biodiversity conservation will lead to strengthening of ecosystem resilience and will improve the ability of ecosystem to provide important services during increasing climate pressures.

This review basically focuses on the importance of biodiversity, the consequences faced by the plants, animals, humans and ecosystem owing to the global warming and climate change and the possible mitigation and adaptation strategies in terms of biodiversity conservation which can protect the planet from the consequences of climate change.

***Keywords*:** Biodiversity, climate change, mitigation and adaptation.

## INTRODUCTION BIODIVERSITY AND ITS IMPORTANCE

Biodiversity is the variability among living organisms, including genetic and structural difference between individual and within and between individual and within and between species. The world biodiversity has a total of 1,263,500 species of plants and animals while India has only 51,828 species(table-1) (1). It provides us with all the necessities of life and sustains and nourishes us. Biodiversity plays a direct role in climate regulation. Climate always changes resulting in evolutionary changes in the species. Biodiversity is important in following ways (3);

i). **Soil formation and maintenance of soil quality:** The activities of microbes and animal (bacteria, algae, fungi, millipedes, etc) condition soils, break down organic matter, form soil and prevent soil erosion.

ii). **Maintain air quality:** Plants purify the air and regulate the composition of the atmosphere, by taking in $CO_2$ during photosynthesis and liberating oxygen in the atmosphere.

iii). **Maintain water quality**: Trees and forest soils purify water; prevent siltation of rivers and reservoirs arising due to soil erosion and landslides.

iv). **Pest control**: Conserving biodiversity can control 99% of potential crop pests.

**v). Detoxification and decomposition of wastes**: About 130 billion metric tons of organic waste (including industrial wastes) is processed every year by earth's decomposing organisms.

**vi). Pollination and crop production:** Without plant and animal (bees, butterflies, bats, birds) interactions, no pollination will be possible and hence would lead to decline in crop yield.

**vii). Climate stabilization**: Oceans, soil and vegetation are huge carbon sinks and help reduce the $CO_2$ in atmosphere. In rainforests the surface temperature is maintained by regular rains, while in cold regions the temperature is regulated by forests acting as insulators and windbreaks.

**viii). Prevention and mitigation of natural disasters**: Ecosystem biodiversity (forest, salt marshes, mangrove) prevents erosion, nutrient loss, landslides, floods and impacts of storms.

**ix). Provision of food security**: biodiversity in terms of plants and animals is the ultimate source of food, fiber, fuel and shelter. Biodiversity conservation will lead to strengthening of ecosystem resilience and will improve the ability of ecosystem to provide important services during increasing climate pressures.

## GLOBAL WARMING AND CLIMATE CHANGE: DRIVERS AND IMPACTS

Global warming is the increase in the world's average temperature occurring due to increasing emission of the greenhouse gases (GHGs) which results in an enhanced greenhouse effect. *Climate change* refers to a statistically significant change in either the mean state of the climate or in its variability persisting for decades or longer (17). Climate change results due to both; natural and anthropogenic drivers.

**Natural drivers:** It involves the contribution of plants, animals and humans naturally by processes of respiration, death and decomposition. Earth's climate variability is also caused by changes in the solar radiations, Milankovitch cycle, volcanic eruption, plate tectonics, ocean circulations, earthquakes and so on (18).

**Anthropogenic drivers:** It involves the human activities leading to climate change (table-2)(20). The concentration of $CO_2$ has increased from pre-industrial concentration of 280ppm to 392ppm in 2010. It is all due to the burning of fossil fuel to generate the electricity in power plants, industrialization, deforestation, mechanization of agricultural practices, increasing vehicular transportation (In India, vehicles have increased from 350 million to 40 billion since 1947) (21), land use changes, urbanization, industrialization and the disposal of subsequent waste generated out of it all.

**Impacts:** Millennium Ecosystem Assessment (MEA) predicts climate change to be the principal threat to the biological diversity (2). The average global temperature has increased by 0.6°C since mid 1800s and is predicted to rise by 1.4-5.8°C by the year 2100. The global mean sea level has risen by 10 to 20 cm (8) and may further rise to 88 cm. Thickness of Arctic ice has decreased by about 40%. Many areas are facing problem of water shortage. Alaska's boreal forest has moved about 100 km for every 1°C rise in temperature. Climate change has resulted in extinction of animals like golden toad and Monteverde harlequin frog (8). Many communities have already become climate refugees to evade rising sea level (2).The rainfall is predicted to increase in Southeast Asia and decrease in Central Asia, Australia, New Zealand, Mediterranean region and Africa. Extreme climatic events(heat waves, storms and hurricanes) and tropical vector-borne diseases (malaria, dengue etc) are predicted to increase.

## IMPACTS OF CLIMATE CHANGE ON BIODIVERSITY

**[I] Vegetation:** The vegetation is exhibiting the following changes;

**a). Migration of vegetation towards a higher altitude:** In Nainital, species such as *Berberisasiatica, Taraxacumofficinale, Jasminumofficinale*etc have shifted from 1000 to 2000m height (4).Teak dominated forests are predicted to replace the Sal trees in central India and also the conifers may be replaced by the deciduous types. According to climatologists and palynologists, temperature change of 3°C may lead to forest movement of250 km at a rate of 2.5 km/year which is ten times the rate of natural forest movement(6,7).

**b). Invasive species:** Invasive species (*Lantana camara*, *Parthenium hysterophorous, Ageratumconyzoides*) are a threat to native species being more tolerant to climatic variations (4). **c). Changes in phenologicalbehaviour:** Climate/season affects the normal life cycle (bud, leaf fall, flowering, fruiting, fertilization time and production) of the plant (4). The crops show early flowering and maturation which has shortened their grain fill period and yield. **d). Forest fires** have increased in number due to high temperature conditions.

**f). Increase in the pest attacks:** Due to climate change, pests (Pine wood nematode- *Bursaphelenchusxylophilus*, Pitch canker- *Gibberellacircinata*, Red palm weevil- *Rhynchophorusferrugineus*, virus, aphids, fungi) have increased in number. Variation in temperature and precipitation patterns can result in more frequent droughts and floods making indigenous plants more vulnerable to pests and diseases (rots, blights) (5).

**[II]Animals:** Sensitivity of the species to even a slight change in the climate leads to their extinction as in case of the golden toad. Polar bears are in danger due to reduction in Arctic ice cover. North Atlantic right whale may become extinct, as planktons, its main food have shown decline due to climate change. The sex of sea turtle depends on temperature and more female turtles are produced as a result of high temperature. Some threatened species (frogs, toads, amphibians, tigers and elephants) are vulnerable to the impacts of climate change like sea level changes and longer drier spells. Changes in ocean temperature and acidification may lead to loss of 95% of the living corals of Australia's Great Barrier Reef (2).

**[III] Ecosystem**

**a). Marine and Coastal:** 70% of the Earth's surface is covered by oceans comprising some of the world's most diverse and unique ecosystems (mangroves, coral reefs, sea grass beds)(10). Climate change is leading to sea level rise, increased coastal erosion, flooding, higher storm surges, sea salinity ingress, increased sea-surface temperatures, ocean acidification, coral bleaching, mangroves and millions of climate change refugees. Species composition and distribution will surely be affected by such changes. Indian coastal areas vulnerable to climate change are Sundarbans, Maharashtra, Goa and Gujarat (Rann of Kutch) (15,16). The distribution and composition of the species is bound to be effected.

**b). Island ecosystem:** Islands are the most fragile with rich biodiversity and a high economic importance. 23% of island species are at present endangered (11).Islands have small and endemic species (corals) (11) sensitive to the changing climate. Climate change leads to an increase in the sea level, frequency and intensity of storms, variability in rainfall and intolerably high temperatures affecting the endemic species and hence economic loss in the tourism sector. **c). Inland water ecosystem:** Inland water systems include the fresh water systems and are only 0.01% of the world's water source comprising 0.8% of the Earth's surface, but support 6% of the total species (12).They are rich source of food, income, employment and biodiversity. Changing rainfall patterns will lead to change in the course of the streams affecting breeding and food habits of many species. The ice cover is bound to decrease causing an increase in the number of flood and drought. This would further lead to changes in the phenology, physiology and migration trends of some organisms like migratory birds.

**d). Forest:** Forest area is about one-third of the Earth's surface and comprises two-thirds of all the known terrestrial species. They are also rich biodiversity hotspots. Half of the original forest cover has been cleared up till now. The increased level of $CO_2$ has led to increase in the growth of some forest. Increased temperature (even 1°C) has resulted in significant migration of tree species, increased attack of pest, invasive species and wild fires, hence modifying the composition of forest. Many animals, primates and 9% of all known tree species (woody trees, white spruce) are at risk of extinction(13).

**e). Agriculture:** About one-third of the world's area is under cultivation (2).Climate change leads to variability in rainfall patterns, heat stress, spread of pests and diseases and shortening of the crop cycle and affecting plant growth and production.

**f). Dry lands and Grassland:** They support35%of the world population and comprise of the arid and semi-arid areas, grasslands and savannahs. They have localized species (wild ass, Kutch etc) and have varied crops and livestock. The desertification is expanding and so is the temperature making them drier and intolerable for the threatened species. The risk of wild fire is increasing which could change the species biodiversity. Climate change is a threat to the diverse hotspots (Succulent Karoo, South Africa) (2).

**g). Mountain:** One–third of the Earth's surface is covered by the mountains which supports one-third of the world population. Many species are very specific and endemic to this ecosystem and are rich natural reservoirs of goods. Climate change is leading to the glacier retreat, change in the course of rivers, migration of the tree species northward (13) and subsequent extinction of some species.

**h). Polar ice/Glaciers:** They are diverse ecosystem facing extremes of the cold temperature with the flora (planktons) and fauna (migratory birds, whales) and Arctic people modified to such conditions (2). Climate change has resulted in an increase in the temperature to about 5°C to the normal and has resulted in the melting

of the ice, increase in sea level which is threatening the endemic species (polar bears, walruses, seals, emperor penguins, krill, ringed seal). Studies show a decline in the weight of the polar bears from 325 kg in 1980 to 253 kg in 2004 (14). Biodiversity loss has impacted the fishing and hunting practices by indigenous people (Saamiand Inuit of Canada) posing an implication on their only source of food (2). (ref. table-3)

**[IV] Humans**

Climate change leads toan increase in temperature, melting of the ice and increased extreme events. All the extreme events like floods, droughts, cyclones displace the humans from their home andlead to outbreak of water borne diseases like cholera, typhoid etc;spread oftropical and vector borne diseases like malaria, dengue etc androdent borne diseases like plague. These diseases have shown a persistent increase in the past 50 years. The incident of heat waves has registered an increase throughout the world taking away a heavy toll of the people life every year (5). The increasing sea level rise has already submerged many islands and will soon leave millions of refugees for the world to provide shelter. The sea salinity ingress in the fresh water sources has made land barren and will soon be a threat to the food security.

## PREVENTION OF CLIMATE CHANGE: MITIGATION AND ADAPTATION STRATEGIES

Mitigation deals with the causes of climate change, while adaptation tackles its effects. Global warming mitigation involves reducing the intensity of radiative forcings so as to reduce the effect of global warming and it can be made possible by two aspects; Geo-engineering and Carbon sequestration. Geo- engineering are the proposals to manipulate the earth's climate so as to decrease the impact of global warming from the greenhouse gas emission. It comprises of Sulphur dioxide spraying, artificial trees, cloud seeding ships, iron and limestone fertilization of the oceans and space mirrors (19).

Another technology comprises of the various methods of carbon sequestration called Carbon Capture and Storage (CCS). According to a 2005 IPCC report major point sources of carbon dioxide include coal-fired power stations, natural gas, fossil fuel– based hydrogen, and synthetic fuel. $CO_2$emissions from such sources can be captured and stored in underground geologic formations. CCS technologies are already being widely used in industries producing fertilizers, hydrogen and natural gas processing (21). Carbon sequestration can also be made practically possible by methods of organic farming using natural manures, fertilizers (algae-*Nostoc, Anaebaena,* mycorrhizae) and pesticides and bringing a halt on the application of chemical fertilizers and pesticides and promoting tree plantations and agro- forestry practices (20). Environment Impact Assessment (EIA) of the industrial areas, checking vehicular pollution by the use of biofuels and using the clean technology, reducing over-exploitation of resources (over- fishing, land-use-changes); preventing poaching of rare,

endangered and endemic species; preventing habitat fragmentation. The biodiversity can be conserved by management programmes including ecosystem conservation and restoration. The forest need to be conserved with practices of reforestation and afforestation as they have 80% of the total carbon stored in terrestrial vegetation. The indigenous knowledge can also be used to prevent climate change or adapt to it (2).

Strategies by the United Framework Convention on Climate Change (UNFCCC) focuses on cutting down greenhouse gas emissions to prevent climate change. Kyoto protocol has brought into existence joint implementation, emission trading and Clean Development Mechanism (CDM) to reduce greenhouse gas emission. Like all other countries National Action Plan on Climate Change of India was released in Delhi in 2009 and involves eight missions on solar mission, enhanced energy efficiency, sustainable habitat, water mission, sustaining Himalayan ecosystem, Green India through massive tree plantation, sustainable agriculture and strategic knowledge for climate change by establishing a knowledge platform on climate change (22). Successful implementation of all these plans would surely help reduce global warming and conserve biodiversity.

## CONCLUSION

The increase in the greenhouse gases is leading to climate change at a faster rate and impacts the people and ecosystems. Every change in the ecosystem process works on the principle of Newton's law of motion (Every action has an equal and opposite reaction) which may be damaging or complimentary. Even a small change in the climate can lead to the extinction of some vulnerable and sensitive species. Climate change results in the impact on the biodiversity like change in their distribution pattern, migration of species, invasion of invasive species, change in the phonological behaviour like breeding period, migration time etc, increase in the forest fires and pest attacks. To maintain the balance of ecosystem, interaction between the plants, animals and biodiversity needs to be understood, hence promoting its conservation and protection by designating the hotspots as biosphere reserves, increasing afforestation, reforestation and agroforestry practices. Biodiversity-based adaption and mitigation strategies willenhance the resilience of ecosystems and prevent damage to human and natural ecosystems.

**Table-1: Species biodiversity in India and World**

| Species | Number in India | Number in world |
|---|---|---|
| Mammals | 410 | 4,000 |
| Birds | 1,228 | 10,000 |
| Reptiles | 447 | 10,500 |
| Amphibians | 197 | |
| Fishes | 2,546 | 19,000 |
| Plants | 47,000 | 2,70,000 |

**Table-2: Percent GHGs emissions by various sectors(Smith et al., IPCC, 2007**

| Anthropogenic sectors | Percentage emission |
|---|---|
| Energy supply | 25.9% |
| Industrial sector | 19.4% |
| Forestry (deforestation) | 17.4% |
| Agriculture | 13.5% |
| Transportation | 13.1% |
| Urbanization | 7.9% |
| Waste | 2.8% |

**Table-3: Ecosystem: vulnerability, impacts, mitigation and adaptation with respect to climate change**

| Ecosystem | Polar ice/Glaciers, Marine and Coastal, Inland water, Island, Forest, Dry lands/Grassland, Mountain and Agriculture |
|---|---|
| **Vulnerability** | Climate sensitivity of flora and fauna, low resilience power |

| | |
|---|---|
| **Impacts** | Rising temperature, Melting ice,<br>Sea level rise, Altering stream flow Ocean acidification,<br>Increased extreme events like floods, storms<br>Sea salinity ingress<br>Increased pest attacks and diseases,<br>Wildfires<br>Invasion of invasive species Endemic species like polar bears, penguin, walruses, seals, krill are threatened<br>Changes in phenological, physiological and migration pattern of species.<br>Reduced agricultural yield |
| **Mitigation and Adaptation** | Reducing pollution both industrial and vehicular, Environment impact assessment, CDM, using clean and renewable energy and biofuels<br>Biodiversity conservation:Forest conservation, reforestation, afforestation,agro-forestry, avoiding deforestation, sustainable and efficient management of water resources, ecosystem management and restoration, preventing habitat fragmentation, over-exploitation of resources and land-use-change Agriculture:Organic farming,biological pest control, improving rice farming, no-till practices and in-situ and ex-situ gene preservation.<br>Consideration of suggestion on methods to conserve biodiversity from indigenous people observing climate change |

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# Biodiversity in India

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**"Nature protects if she is protected."**

India is a megadiverse nation and land of around 10% of world's species.Environmental services from species and ecosystems are essential at global, regional and local levels.It also has a rich cultural heritage traced back to thousands of years. Much of Indian biodiversity is intricately related to the socio-cultural practices of the land. Unfortunately, due to population explosion, climate change and lax implementation of environmental policies, several species are facing the threat of extinction. A complete summary on the Biodiversity in India is as below:

**Flora and Fauna of India**

According to the International Union for Conservation of Nature (IUCN): India is a megadiverse country with only 2.4% of the world's land area, accounts for 7-8% of all recorded species, including species of plants and species of animals.

1. There are about **45,000 species of plants**, which is about 7% of world's total. About 33% of these are endemic.
2. There are **15,000 flowering plants**, which is 6% of world's total. Roughly, 1,500 plant species are endangered.
3. There are **91,000 animal species**, representing about 6.5% of world's fauna. These include 60,000 insect species, 2,456 fish species, 1,230 bird species, 372 mammals, over 440 reptiles and 200 amphibians with largest concentration in Western Ghats and 500 molluscs.
4. Livestock diversity is high. There are **400 breeds of sheep, 27 of cattle and 22 of goats** found in India.
5. It has also globally important populations of some of **Asia's rarest animals**, such as the Bengal Fox, Asiatic Cheetah, Marbled Cat, Asiatic Lion, Indian Elephant, Asiatic Wild Ass, Indian Rhinoceros, Markhor, Gaur, Wild Asiatic Water Buffalo etc.

**Classification of Biodiversity in India**

**1. Malayan Biodiversity**

It is along the densely forested areas of the Eastern Himalayas and along the coastal areas.

**2. Ethiopian Biodiversity**
The arid and semi-arid regions of Rajasthan are characterised by this kind of biodiversity.

**3. European Biodiversity**
This kind of biodiversity is found in the areas of upper Himalayas where the climatic characteristics are mostly temperate in nature.

**4. Indian Biodiversity**
The dense forest areas of Indian plain are characterised by this kind of biodiversity.

**Bio Geographic Regions and Provinces of India**
There are 10 biogeographic regions or zones in India which are further divided into 25 biogeographic provinces. These are as follow

**1. Trans Himalaya:** This zone has three provinces Ladakh mountains, Tibetan Plateau, Trans- Himalaya Sikkim.
**2. The Himalaya:** It has four provinces-North-West Himalaya, West Himalaya, Central Himalaya and East Himalaya.
**3. The Indian Desert:** This zone includes two provinces- Thar and Kutch.
**4. The Semi-Arid:** This constitutes two namely-Punjab Gujarat-Rajasthan.
**5. The Western Ghats:** Two provinces namely Malabar plains and Western Ghats Mountains are included in this zone.
**6. The Deccan Plateau:** This zone has five provinces Central Highlands, Chhota Nagpur, Eastern Highlands, Central Plateau and Deccan South.
**7. The Coasts:** Three provinces namely- West coast, East coast and Lakshadweep.
**8. The Gangetic Plains:** This zone has two provinces- Upper Gangetic plains and lower Gangetic plains.
**9. North East India:** Two provinces are included- Brahmaputra valley and North-East hills.
**10. Islands:** This zone includes two provinces-Andaman and Nicobar. It is highly diverse set of biomes.
As we know that India is one of the megadiverse countries in the world, but many plants and animals are facing threats of extinction. The Wildlife Act mentions 253 fauna species as requiring adequate protection and 135 plants as species have been identified as endangered by the Botanical Survey of India.

Threats to species are:

1.Residential and commercial development-Housing and urban areas,Tourism and recreation areas,commercial and industrial areas.

2.Agriculture and aquaculture-annual and perennial non-timber crops, livestock farming and ranching.

3.Biological resource use-Logging and wood harvesting.

4.Pollution-agricultural and forestry effluents.

5.Natural system modification-dams and water management.

6.Transportation service- roads and railways.

7.Climate change and severe weather-storms and flooding.

**Conservation of Biodiversity**

There are two strategies may be adopted to conserve .

**1. On-site Conservation Strategies:**

Here, the plant or animal species are protected in their natural habitat.

**This is carried on by two methods:**

(I ) Either by protecting or cleaning up the habitat itself.

(ii) By defending the species from predators. Here stress is laid upon protection of total ecosystem. This leads to declaration of 'Protected Areas'. For protecting such areas, legal or other effective strategies are used.

**Protected Areas in India includes:**

I. National Parks,

II. Sanctuaries, and

III. Biosphere Reserves.

**I. National Parks:**

A national park is an area which is strictly reserved for the betterment of the wildlife and where activities like forestry, grazing or cultivation are not permitted.

There are about 104 national parks in India covering an area of 40501.13 $km^2$, which is 1.23% of the geographical area of the country (National Wildlife Database, May, 2019)..

**Some National Parks of India:**

1. Kaziranga National Park, District Sibsagar (Assam) – Rhinoceros, elephant, wild buffalo, bison, tiger, leopard, sloth, bear, sambhar, swamp deer, barking deer, wild boar, gibbon, python and birds like pelican, stork and ring-tailed fishing eagles. This is a famous National Park of famous one-horned rhinoceros of India.

2. Sundarbans (Tiger Reserve) 24 Pargana (West Bengal) – Tiger, wild boar, deer, dolphin, eustuarine, crocodile.

3. Hazaribagh National Park, Hazaribagh (Bihar) – Tiger, leopard, hyaena, wild boar, gaur, sambhar, nilgai, chital, sloth, bear, peafowl.

4. Corbett National Park, Nanital (Uttarkhand) – Tiger, elephant, panther, sloth, bear, wild boar, nilgai, sambhar, chital, crocodile, python, king cobra, peafowl, partridge. This is the first National Park of India which is famous for tigers.

5. Gir National Park, District Junagarh (Gujrat) – Asiatic lion, panther, striped hyaena, sambhar, nilgai, chital, 4-horned antelope, chinkara, wild boar, langur, python, crocodile, green pigeon, partridge. This National Park is famous for Asiatic lions.

6. Kanha National Park, Mandla and Balaghat (Madhya Pradesh) – Tiger, panther, chital, chinkara, barking deer, blue bull, deer, langur, wild boar, black buck, nilgai, wild dog, sloth bear, sambhar, crocodile, grey horn bill, egret, peafowl.

7. Tandoba National Park, Chandrapur (Maharashtra) – Tiger, sambhar, sloth bear, bison, chital, chinkara, barking deer, blue bull, four-horned deer, langur, pea-fowl, crocodile.

8. Bandipur National Park, District Mysore (Karnataka) – Elephant, tiger, leopard, sloth bear, wild dog, chital, panther, barking deer, langur, porcupine, gaur, sambhar, malabar squirrel, green pigeon.

9. Desert National Park, Jaisalmer (Rajasthan) – Great Indian Bustard, black buck, chinkara.

**II. Sanctuaries:**

A sanctuary is a protected area which is reserved for the conservation of only animals and human activities like harvesting of timber, collection of minor forest products and private ownership rights are allowed so long as they do not interfere with the well- being of animals. There are about 551 existing wildlife sanctuaries in India covering an area of 119775.80 $km^2$, which is 3.64 % of the geographical area of the country (National Wildlife Database, May, 2019).

**Some important sanctuaries of India are listed below:**

1. Annamalai Sanctuary, Coimbatore (Tamil Nadu) – Elephant, tiger, panther, gaur, sambhar, spotted deer, sloth bear, wild dog, barking deer.

2. Jaldapara Sanctuary, Madarihat (West Bengal) – Rhino, elephant, tiger, leopard, gaur, deer, sambhar, different kinds of birds.

3. Keoladeo Ghana Bird Sanctuary, Bharatpur (Rajasthan) – Siberian crane, storks, egrets, herons, spoon bill, etc. Drier parts of this marshy sanctuary have spotted deer, black buck, sambhar, wild boar, blue bull, python. This sanctuary is famous for birds.

4. Sultanpur Lake Bird Sanctuary, Gurgaon (Haryana) – Crane, saras, spotbill, duck, drake, green pigeon, wild bear, crocodile, phython.

5. Bir Moti Bagh Wildlife Sanctuary, Patiala (Punjab) – Nilgai, wild boar, hog deer, black buck, blue bull, jackal, pea-fowl, partridge, sparrow, myna, pigeon, dove.

6. Shikari Devi Sanctuary, Mandi (Himachal Pradesh) – Black bear, snow leopard, flying fox, barking deer, musk deer, chakor, partridge.

7. Dachigam Sanctuary, Srinagar (Jammu & Kashmir) – Hangul or Kashmir stag, musk deer, snow leopard, black bear, brown bear.

8. Mudumalai Wildlife Sanctuary, Nilgiri (Tamil Nadu) – Elephant, gaur, sambhar, chital, bar-king deer, mouse deer, four horned antelope, langur, giant squirrel, flying squirrel, wild dog, wild cat, civet, sloth bear, porcupine, phython, rat snake, monitor lizard, flying lizard.

9. Nagarjuna Sagar Sanctuary, Guntur, Kamool and Nalgonda (Andhra Pradesh) – Tiger, panther, wild bear, chital, nilgai, sambhar, blackbuck, foz, jackal, wolf, crocodile.

10. Periyar Sanctuary (Kerela) – Elephants, gaur, leopard, sloth, bear, sambhar, bison, black langur, hornbill, egret. It is famous for animals.

11. Chilka Lake Bird Sanctuary, Balagaon (Orissa) – An oasis of birds like water fowls, ducks, cranes, golden plovers, sand pipers, flamingoes.

12. Manas Wildlife Sanctuary, Kamprup (Assam) – Tiger, panther, rhino, gaur, wild buffalo, sambhar, swamp deer, golden langur, wild dog, wild boar.

**III. Biosphere Reserves:**

Under MAB (Man and Biosphere) Programme, UNESCO has established a number of biosphere reserves in the world. The concept of Biosphere Reserves was launched by MAB in 1975 for dealing with the conservation of ecosystems and the genetic resources contained therein. Under MAB programme, UNESCO has studied the impact of human interference and pollution on biotic and abiotic environments and conservation strategies for the present as well as future.

**Definition:**

A biosphere reserve is a specified area iii which multiple use of the land is permitted by dividing it into certain zones, each zone being specified for a particular activity.

**Zones of a Biosphere Reserve:**

**A biosphere reserve is basically divided into three zones:**

**(a) Core Zone:**

It lies at centre where no human activity is allowed. It is legally protected.

**(b) Buffer Zone:**

In this zone limited human activities are allowed. It surrounds core area.

**(c) Manipulative Zone (Transition Zone):**

In this zone multiple human activities are allowed but ecology is not permitted to be disturbed. It is the outermost part of biosphere reserve.

**Biosphere Reserves in India:**

In India, there are 14 biosphere reserves. The first biosphere reserve of the world was established in 1979. The number assigned to a biosphere reserve is based on its date of declaration.

The purpose of declaration of biosphere reserve is to conserve bio-diversity in-situ along with its supporting system. Biosphere reserves with human beings as its integral parts are examples of natural biomes. First biosphere reserve established in India, was Nilgiri Biosphere Reserve (1986).

Nanda Devi Biosphere Reserve was established in 1988.

Date of notification of Nilgiri Biosphere reserve is 01.8.1986 with area of 5520 $km^2$ and cover the states of Kerala, Kamataka and Tamil Nadu. Dibru-Saikhowa Biosphere reserve is present in Dibrugarh and Tinsukia districts of Assam. Sunderbans Biosphere reserve with an area of 9630 $km^2$ covers part of delta of Ganga and Brahmputra river system in West Bengal.

Panchmarhi covers an area of 4926 $km^2$ and lies in Madhya Pradesh. Kanchanjanga Biosphere reserve with an area of 2619 km is present in Sikkim. Manas Biosphere reserve is in Assam. Nokrek Biosphere reserve is in Meghalaya. Nanda Devi Biosphere reserve with an area of 5860 $km^2$ is present in Uttaranchal Gulf of Mannar Biosphere reserve is in Tamil Nadu.

**Significance:**

The concept of Biosphere Reserves is of immense value for conserving the gene-pool resources of flora and fauna in the country and to serve as bench-marks for future studies.

**The concept of Biosphere Reserve has the following objectives:**

(a) To conserve for present and future human race use, the diversity and integrity of biotic communities of plants and animals within natural ecosystems and to safeguard the genetic diversity of species on which their continuing evolution depends.

(b) To provide areas for ecological and environmental research.

(c) To provide facilities for education and training.

(d) To promote economic development.

**Sacred Forests and Sacred Lakes:**

Some forest patches are being protected by tribals due to religious sanctity are called sacred forests. Such forests have been found to be most undisturbed and they are usually surrounded by most degraded land scapes. Such sacred forests in India are present in states like Karnataka, Maharashtra, Kerela and Meghalaya. In Sikkim, Khecheopalri lake is declared sacred lake by people, thus protecting the aquatic flore and fauna.

**2. Other Conservation Strategies:**

Such strategies include establishment of botanical gardens, zoos, conservation strands and gene, pollen, seed, seedling, tissue culture and DNA banks. These facilities not only provide housing and care for endangered species, but also have educational and recreational values for the society.

**Few noteworthy points of ex-situ conservation are:**

**1. Seed Gene Bank or Germplasm Bank:**

This is the easiest way to store the germ plasm of plants at low temperature. The term seed bank also refers to cryogenic laboratory facility in which the seeds of some species can be kept viable for long period. Germplasm can also be preserved by in vitro culturing where cutting of plants and maintained under controlled conditions.

**2. Field Gene Bank:**

Genetic variability can also be preserved by field gene bank under normal growing conditions. The gene banks are used to store living sperms, eggs or embryos.

**3. Cryopreservation:**

This type of in vitro conservation is done at very low temperature i.e., -196°C in liquid nitrogen. This may be done with very rapid cooking (in storing seeds) or by gradual cooling and simultaneous dehydration (in tissue culture). Cryopreservation is highly successful in crops like potato.

**4. Botanical Gardens:**

In more than 1500 botanical gardens and arboreta (botanical gardens where particular shrubs and trees are grum) in world. In such gardens more than 80,000 species are found.Many botanical gardens have the facilities of seed banks, tissue culture and other latest ex-situ technologies.

**5. Zoos:**

In world, there are about 800 zoos. Such zoos have about 3000 species of vertebrates. Some zoos have undertaken captive breeding programmes.

Ref. 1. Union for Conservation of Nature (IUCN)

2.Newspaper Report.

3.UNEP websites.

4.ENVIS Centre on Wildlife & Protected Areas.

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# BIODIVERSITY – ROOT OF VIABILITY OF GLOBAL ECOSYSTEMS

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## PROLOGUE

The great variety of life on the earth has provided over thousands of years for necessity of human beings. Civilization of human beings has been used a support system for the growth and development which has formed by diversity of living creatures. Science has tried to classify and categories variableness in nature for over a century which has led to an understanding of its organization into communities of plants and animals. This information has been helped in utilizing biological wealth of earth for the benefit of humanity and the process of development. This includes better crops, better health care and the use of variety of life forms as raw material for industrial growth which has led to a higher standard of living for the developed world. Therefore it has been produced the modern consumerist society which has a negative effect on the diversity of biological resources.

## NATURE OF KNOWLEDGE

The diversity of life on the earth is considerable; if we use it sustainably, we can go on developing new products for generation to generations and this happens only if we manage biodiversity as a precious resource of nature and prevent species extinction. Biodiversity is a comprehensive umbrella term for the extent of natural variety within the system both in number and frequency. Biodiversity is that part of nature which includes the differences in genes among the individuals of a species, the variety and richness of all the plants and animal species at different scales in space, in the country and in the world. The building blocks of life DNA, genes, and chromosomes determine the distinctiveness of each individual and each species. In other words, the features of biodiversity is the variety of ecosystems such as those that occur in forests, deserts, wetlands, lakes, rivers, mountains and agricultural landscapes in which living creatures including human form a community and interacting with one another with the air, water, and soil around them. It is often understood in terms of the wide variety of plants, animals and microorganisms contain unique sequences of genes which form the ecosystem. It also forms the web of life in which we are an integral part upon which fully dependent. Therefore about 2.1 million species have been identified, mostly small creatures such as insects. As per UNEP measurements there are 9.0 to 52 million species exist on earth but scientists believe that there are actually about 13 million species.

## VIEWPOINT

Biodiversity deals with the degree of natural variety in the biosphere which can be observed at three levels that is genetic variability within a species, species variability within a community and the organization of species in an area into distinctive plant and animal communities constitutes ecosystem diversity. Genetic diversity is the variety of genetic information contained in all of the individual microorganisms, plants and animals occurring within populations of species. For example, every human being is different from all others. Species diversity is the variety of species or the living organisms present in a region which is measured in terms of Species Richness and Species Abundance. If all the species have the same equal abundance that means the

variation is high therefore diversity is high. All species of a community are not equally different in nature. Ecosystem diversity is the variety of habitats, biotic communities and ecological processes in the biosphere. Biodiversity is not only distributed on the Earth which is distributed all over the universe either in water, soil and air. Diversity of life is the richest in the tropical region on the earth and the terrestrial biodiversity tends to be highest near the equator having warm climate and highest primary productivity. Marine biodiversity tends to be the highest along coasts in the Western Pacific, where sea surface temperature is the highest and in the mid-latitudinal band in all the oceans. Biodiversity generally tends to cluster in hotspots which has been increasing through time but will be likely to slow in the future.

## BENEFITS OF BIODIVERSITY

Biodiversity bestow to our material well-being. We obtained different forms of productive materials from biodiversity for example agricultural materials, medicine, food, industrial raw materials, etc.

- About more than 60 wild species have been used to improve the 13 major crops of world by providing genes for pest resistance, enhanced nutrition and improved yield (IUCN, 2012). As we know about 7,000 plant species have been used for human consumption since agriculture began about 12,000 years ago across the globe but most of the people depend mainly on domesticated species for their dietary needs and 200 million depend on wild species for at least part of their food.

- Populations of Asian country are dependent on complex rice-fish agro-ecosystems, where fish and other aquatic animals serve as a source of nutrition to local communities and provide essential services for rice productivity in the flooded fields. Fisheries indirectly support additional food production by providing inputs to the aqua-culture and livestock industries.

- Lower animals like amphibians also play a vital role in ecosystems which are indicators of environmental health and these are 'hopping pharmacies' being used in the search for new medicines.

- Most of the countries use medicinal plants and animals for production of different drugs which are technologically advanced and no side effects, half of the 100 most-prescribed drugs originate from wild species. According to WHO report, nearly 80% of people live in Africa rely on traditional/ayurvedic medicines as main source for their health care need. About more than 70,000 different plant species are used in traditional and modern medicine.

- Micro-organisms have been producing nearly all of our antibiotics for example penicillin. The chemical taxol has been found to kill cancer cells which derived from the Pacific yew. Pit Viper (*Bothrops jararaca*) has been producing ACE inhibitors which are among the most effective medicines known for treating high blood pressure.

- Economic benefits of Biodiversity is multipronged which is illustrated pictorially in Fig. 1.

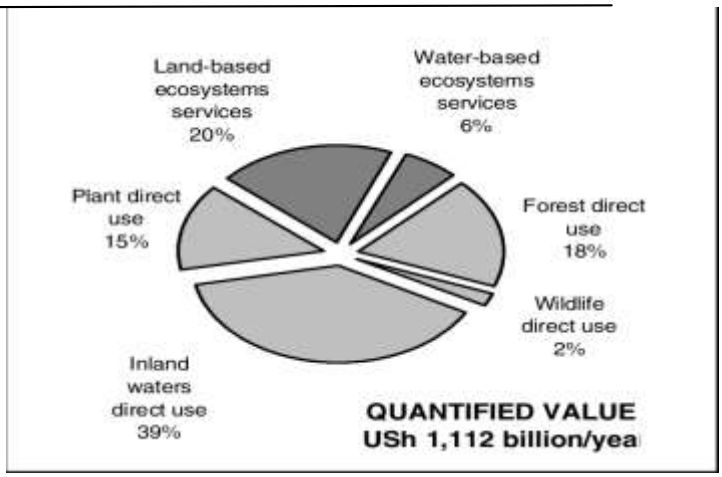


Fig. 1: Economic benefits of Biodiversity

## INTERNATIONAL CONTEXT OF BIODIVERSITY

More ambitious and effective policies to promote biodiversity conservation and sustainable use is urgently needed. The three ultimate objectives of the 1992 UN Convention on Biodiversity (CBD) is:

1. The conservation of biodiversity
2. The sustainable use of its components
3. The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

The CBD adopted a strategic plan in 2002 "*to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the regional, national and global level as a contribution to poverty alleviation and to the benefit of all life on the Earth*". This target was endorsed by the World Summit on Sustainable Development and incorporated as a target under the Millennium Development Goals. It is widely acknowledged that the 2010 biodiversity target was not met. When the importance of this global environment problem was recognized, the United Nations General Assembly declared 2011-20 would be the United Nations Decade on Biodiversity.

The tenth meeting on the CBD in 2010, held in Nagoya, Japan, led to the successful agreement on a revised Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets. In addition, the meeting adopted a Strategy for Resource Mobilization, a consolidated list of guidance to the financial mechanism and an international regime for Access and Benefits Sharing. The eleventh meeting on CBD in Hyderabad, India focused on addressing implementation issues and establishment for an indicator framework to monitor progress on the implementation of the Aichi Biodiversity Targets and the Strategy for Resource Mobilization in October 2012.

## EPILOGUE

Biodiversity is the fundamental to sustaining life, supplying critical ecosystem services such as food provisioning, water purification, flood and drought control, nutrient cycling and climate regulation. These services are essential to support human well-being and economic growth. Yet despite the significant economic, social and cultural values of biodiversity and ecosystem services, biodiversity worldwide is being lost and in some areas, loss is at an accelerated rate. That is why, the main focus of the celebration of the World Environment Day 2020 on 5$^{th}$ June by the Institution of Engineers (India) on BIODIVERSITY is the need of the hour and hopefully, it will steer up the major campaign for environmental issues of ranging from entire botanical to zoological arena across the globe.

# Biodiversity

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**"We should preserve every scrap of biodiversity as priceless while we learn to use it and come to understand what it means to humanity"------ E. O. Wilson**

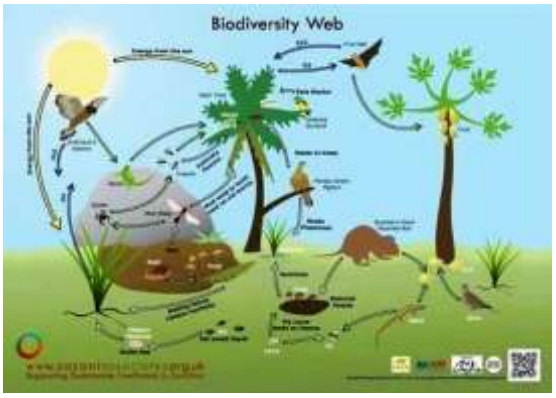
**Introduction**

**World Environment Day** is the most renowned day which has been celebrated every year on 5 June : engaging governments, businesses and citizens to focus their efforts on a pressing environmental issue.


In 2020, the **theme is biodiversity-** a concern that is both urgent and existential. Recent events, from bushfires in Brazil, the United States and Australia to locust infestations across East Africa – and now , a global disease **panademic**- demonstrate the life , in interdependence of humans and the webs of which they exist.

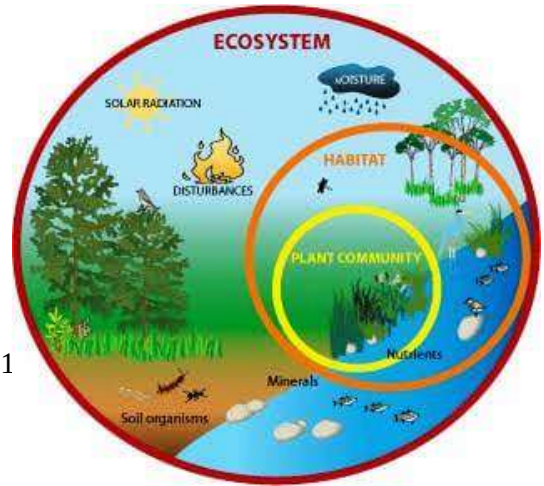
The joint initiatives of India and UN agencies including United Nations Environment Programme (UNEP) may help in conserving biodiversity and finding right solutions to various environmental challenges including illegal trade in wildlife. India has 2.5% of world's land mass , 16% of human and 16% of cattle population, but it has still preserved around 8% of world's biodiversity. Protecting our nature is very important especially in the present context of **Covid-19** as it shields us from various catastrophes including zoonotic diseases, meaning that they are transmitted to people by animals.

**What is Biodiversity ?**




Biodiversity is the foundation that supports all life on land and below water. It affects every aspect of human health , providing clean air and water, nutritious foods , scientific resistance, understanding and medicine sources, natural disease removing and climate change mitigation. Changing or and one element of this web affects the entire life system can produce negative consequences.

Biodiversity includes genetic differences within species, the diversity of species and the variety of ecosystems. It is the result of the interaction of species, including humans, with one another and with the air , water and soil around them. This combination of life forms ecosystems, species and genetic varieties has made Earth a uniquely habitable place.



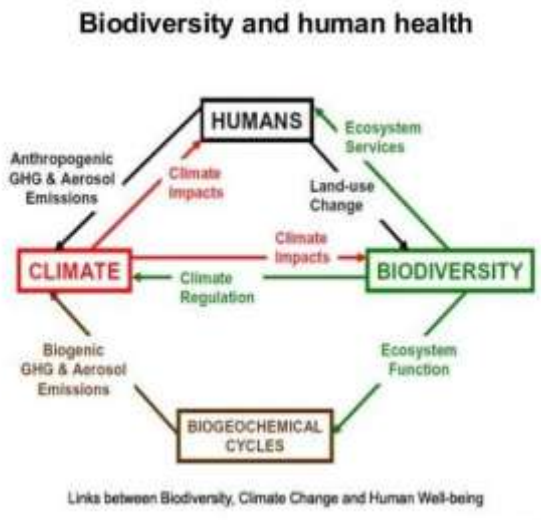

The term Biodiversity was first coined by Walter G .Rosen in the year 1986. The importance of biodiversity was one of the key subjects of the 1992 World Summit held in Rio de Janeiro , Brazil, also known as "**The Earth Summit"** which resulted in the Convention on Biological Diversity (**CBD**) .The agreement on biodiversity was signed by 150 countries. The goals of the CBD are "the conservation of biological diversity, the sustainable

use of its components, and the fair and equitable sharing of the benefits from the use of genetic resources." Nevertheless, human actions have caused huge loss in biodiversity, including the disruption of ecosystem processes, habitat destruction, species extinction and the eroding of genetic diversity within species.

**Why is biodiversity important ?**

Humans can't exist without biodiversity as we use it directly and indirectly in a number of ways. Direct use includes things like food , fibres, medicines and biological control, while indirect uses includes ecosystem services such as atmospheric regulation, nutrient cycling and pollination.

In some countries, medicinal plants and animals provide most of the drugs people use, and even in technologically- advanced countries like USA , half of the 100 most –prescribed drugs originate from wild species. According to WHO report nearly 80%of people live in Africa rely on traditional medicines as main source for their health care need.



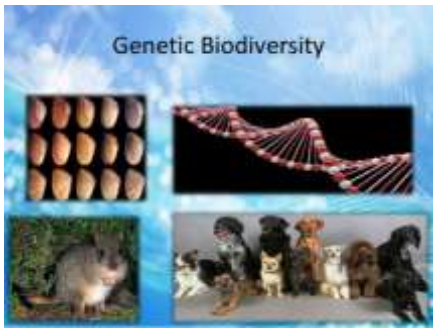

Biodiversity plays an important role in the way ecosystem functions and in the services they provide. Biodiversity plays a major role in mitigating climate change by contributing to long term sequestration of carbon in a number of biomes. It is through biodiversity that sequential balance of Co2 and O2 is maintained. The world now acknowledges that loss of biodiversity contributes to global climate change.

Biological diversity is also essential for preserving ecological processes, such as fixing and recycling of nutrients, soil formation, circulation and cleansing of air and water, global life support, maintain the water balance within ecosystems, watershed protection, maintain stream and river flows throughout the year, erosion control and local flood reduction. Amphibians play a vital role in ecosystems, are indicators of environmental health, and "hopping pharmacies" being used in search of new medicines.

## Types of Biodiversity

There are three types of biodiversity

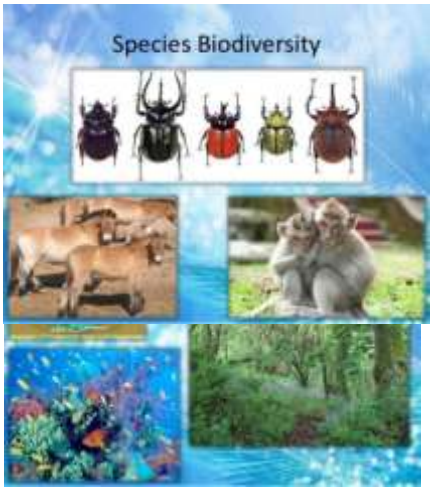
- Genetic Biodiversity




It refers to the variety of genes within a species. Each species is made up of individuals that have their own particular genetic composition. Within a species there may also be discrete populations with distinctive genes.

- **Species Biodiversity**

It is a measure of the diversity within an ecological community that incorporates both species richness ( the number of species in a community) and the evenness of species' abundances. Species diversity is one component of the concept of biodiversity.




- **Ecosystem Biodiversity**

It refers to the variety of ecosystems in a given place. Within any broader landscape there is a mosaic of interconnected ecosystems. To conserve biodiversity, conservation at the landscape

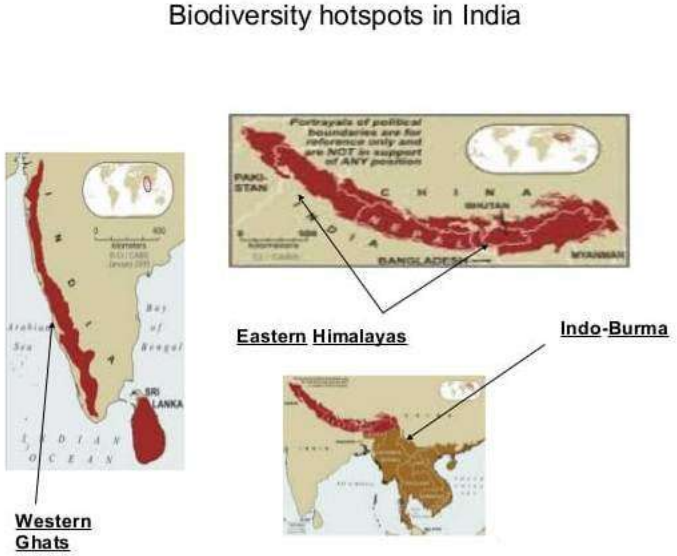
level is critical.

## Threats to Biodiversity

- Urbanization Deforestation
- Agricultural expansion
- Forest fires
- Mining
- Exploitation of water resources
- Construction of Dams
- Waste
- Disposal
- Environmental pollution
- Overgrazing
- Poaching of wildlife


## Biodiversity in India

There are at present 1.8 million species in the world. known and documented by scientists Among the biologically rich nations, India stands among top 10 or 15 countries for its great variety of plants and animals, many of which is not found elsewhere. India has 350 different mammals (rated eight highest in the world) , 1200 species of birds (eighth in the world) , 453 species of reptiles (fifth in the world) and 45000plant species of which most are angiosperms, (fifteenth in the world) . These include especially high species diversity of ferns(1022species) and orchids(10820species) . India has 50000 known species of insects, including 13000 butterflies and moths. It is estimated that the number of unknown species could be several times higher.




It is estimated that 18% of Indian plants are **endemic** to the country and found nowhere in the world. Among amphibians found in India , 62% are unique to this country. Among lizards, of the 153 species recorded , 50% are endemic.

- It has been estimated that that 50000 endemic plants which comprise 205 of global plant life, probably occur in only 18 **hotspots** in the world. Our globally accepted national ' **hotspots'**(a region with high biodiversity with most of species being Endemic)are in the forests of the **North-East** and the **Western Ghats,** which are included in the world's most bio rich areas. The **Andaman and Nicobar Islands** are extremely rich in species and many subspecies of different animals and birds have evolved. Among the endemic species i. e. those species found only in India , a large proportion are concentrated in these three areas.

| India's World Ranking | | Number of species in India |
|---|---|---|
| Mammals | 8th | 350 |
| Birds | 8th | 1200 |
| Reptiles | 5th | 453 |
| Amphibia | 15th | 182 |
| Angiosperms | 15th -20th | 14500 |

**Some salient features of India's Biodiversity**

- One of World's 17 mega diversity countries
- One of Asia's 4 mega diversity countries
- Has 3 hotspots out of 34 hotspots
- Home to world's 60-70% diversity
- 18 biosphere reserves
- Over 515 sanctuaries
- 112 national parks

**Global Biodiversity**

- 17 mega diverse countries
- 10-30 million insects
- 5-10 million bacteria
- 1.5 million fungi
- 1 million mites
- 34 hotspots

## Why conserve biodiversity ?

" I can't imagine anything more important than air, water, soil , energy and **biodiversity.** These are the things that keep us alive "—**David Suzuki**

Human actions, including deforestation, encroachment on wildlife habitats, intensified agriculture, and acceleration of climate change, have pushed nature beyond its limit. It would take 1.6 times of an Earth to meet the demands that humans make of nature each year. If we continue on this path, biodiversity loss will have severe implications for humanity, including the collapse of food and health system.


Biodiversity conservation provides substantial benefits to meet immediate human needs, such as clean, consistent water flows, protection from floods and storms and a stable climate. The loss of biodiversity is dangerous and it's consequences are immediate.

- Restoration of Biodiversity
- Imparting Environmental Education
- Enacting, strengthening and enforcing Legislation
- Population Control
- Reviewing the agriculture practice
- Controlling Urbanization
- Conservation through Biotechnology
- Conserving Biodiversity in protected Habitats-
    - **In situ** conservation:- means the natural or the original place. It includes National parks, Wildlife sanctuaries, Biosphere reserves, etc.
    - **Ex situ conservation** :- plant and animal species are conserved outside their natural habitats, gene banks, zoos, botanical gardens, culture collections, etc.

## Conclusion

Biodiversity is our life. The foods we eat, the air we breathe, the water we drink and the climate that makes our planet habitable all come from nature. For instance each year , marine plants produce more than half of our atmosphere's oxygen, and a mature tree cleans our air, absorbing 22 kilos of carbon dioxide, releasing oxygen in exchange. Despite all the benefits that our nature gives us, we still mistreat it. That is why we need to work on that. That is why we need this protection of biodiversity.

If Biodiversity got lost at this rate then in near future , the survival of human being will be threatened. So, it is our moral duty to conserve Biodiversity as well our Environment.

Long term maintenance of species and their management requires co-operative efforts across entire landscapes. Biodiversity should be dealt with at scale of habitats or ecosystems rather than at species level.

India as a Mega Diversity Nation with 2.4% of the world's area, has over 8% of the world's total biodiversity, making it one of the 17 mega diversity countries in the world. This status is based on the species richness and levels of endemism recorded in a wide range of both plants and animals. This diversity can be attributed to the vast variety of landforms and climates, resulting in habitats ranging from tropical to temperate and from alpine to desert. The India's special geographical position between three distinctive centres of biological evolution and radiation of species is responsible for our rich and varied biodiversity.

The emergence of COVID-19 has underscored the fact that, when we destroy biodiversity, we destroy the system that supports human life. Today , it is estimated that , globally, about one billion cases of illness and millions of deaths occur every year from diseases caused by coronaviruses; and about 75 per cent of all emerging infectious diseases in humans are zoonotic, meaning that they are transmitted to people by animals.

**Nature is sending us a message.**

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## About the Author

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**Post superannuation from HAL he has been Guest Teacher at MCE Motihari, DCE Darbhanga and University Examiner at AKU Patna. He is empanelled as Project Guide for students of Section 'B' exam of AMIE in Branch Mechanical Engineering by IEI. He is Chartered Engineer(Mechanical) by Institution of Engineers(India).**

# Celebrate Biodiversity

Dr. Rajeev Ranjan Kumar

Executive Committee Member (136462-9)

IE (I), Muzaffarpur Local Centre, Muzaffarpur.

We need to learn about it to celebrate the biodiversity, and where we stand? "Biological diversity" means the variability of living organisms from all sources including, but not limited to, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they form part: this includes diversity within species, between species and between ecosystems", Where "Health is a state of full physical, mental and social well-being, not just the absence of illness or disease". Genetic diversity, for example, provides the basis for continued adaptation to evolving environments, and continued crop productivity depends on the diversity of crop species and on the variety of soil invertebrates and microorganisms that sustain soil fertility. Similarly, a shift in species composition and abundance that make up an ecosystem will alter the resources that can be accessed from the system. Biodiversity holds the potential for applied knowledge by discovering how various species have adapted to their diverse environments. In other words, biodiversity holds potential insights for solutions to both current and future biological problems. Experiencing and growing our understanding of biodiversity is changing our beliefs and convictions. By studying other cultures, we have gained profound perspectives regarding our own culture and society. Equally, by researching other animals, we will learn about our physiology. Many of our insights about us could have only come from studying other species.

Significant progress in understanding the human nervous system has come from the research of non-human vertebrates and invertebrates. Biodiversity has often served as an early-warning system with predicted threats to human health before sufficient data were collected to directly detect effects.

There is a close linkage between environmental sustainability and wellbeing. Recognizing the link between human, domestic animal, and wildlife health and the threat disease poses to humans, their food supplies and economies, and the biodiversity that is essential for maintaining a healthy environment and functioning ecosystems that we all need. Abiotic factors (such as population density, and host community and reservoir structure) are essential variables in disease transmission. The epidemiological environment is being shaken up by current global changes (climate change, land-use change, biological invasion). These changes are responsible for new occurrences and distribution of epidemics of infectious diseases; as well as the emergence of new infections through the modification of biotic and abiotic factors. Recent decades have seen an increase in the number of disease epidemics on a global scale, primarily involving infectious virus-type agents (AIDS virus, Ebola virus, Hantavirus, SARS-Corona virus, etc.) and many of which should be sought in domestic or wild animals. Owing to monitoring, these epidemics are not followed by a significant rise in mortality rates (except for AIDS) and public health systems. The population is an important aspect of these latest emergencies. The risks of the emergence of these new diseases, however, concern countries with high biodiversity, and therefore especially those in the intertropical regions. Global and local changes affect all biodiversity components (ecosystems, habitats, communities, populations, genes), and predator prey interactions, hosts and parasites, as well as human cultural diversity. Empirical studies and often-correlative analyzes show that biodiversity is a source of pathogens, but increases in epidemics and emergence risks are associated with decreased biodiversity, which is itself associated with changes in land use (deforestation, agronomic intensification) and therefore favors interfaces between wildlife, domestic animals and humans. The decline in biodiversity also has to do with parasites and pathogens, and this biodiversity loss does not always have positive health effects.

Relationships are founded on a sense of place — for example, with nature, the past, future generations, and those with whom one shares responsibility for preserving the basic character of one's surroundings. To belong to or in a landscape, one must feel connected to its past, natural as well as human. There is a fairly large literature characterizing non-extractive ecosystem services that benefit society directly, such as water pollution and

purification, flood control, pollination, and control of pests. Also, such services characterize the institutional mechanisms needed to generate incentives for their preservation in both biophysical and economic terms. Many developing countries ' economies rely heavier on natural resources, so sectors related to biodiversity contribute a greater share of their GDPs. Until recently, biodiversity uses in the medicinal, agricultural, and industrial sectors depended primarily on various research and development methods. Today, individual plant or microorganism samples can be preserved in culture and screened for possible use in either of these industries with the aid of modern biotechnologies. Biodiversity is the biotechnology industry 's essential "raw material," but the process of examining biodiversity for new applications has only begun in that industry. The basic idea here is that persistent pollution decreases the diversity of system organisms and decreases the functioning of the environment. So it is not easy to separate the restoration of perceived environmental quality and productivity from basic biodiversity issues.

Nature’s beauty and majesty have always influenced human beings: we love perceiving the beauty of nature, and we experience awe and amazement at its immense size (the starry skies) and its complex strength (a hurricane). Plants and animals are beautiful in their intricate and functional design; we are happy to perceive that beauty. We garden; we cut flowers for our homes; we keep in our homes cats, fish, and lots of other animals; we visit zoos; and so on.

Ecotourism is primarily focused on the appreciation of natural beauty by humans. Artists celebrate that beauty in nature-drawn paintings and sculptures. Nature is indeed the primary object of artistic representation and a constant theme of poetry.

Unfortunately, changes in ecosystem resilience or biodiversity and shifts in patterns of the emergence and spread of disease manifest themselves when we fail to recognize this relationship. Therefore, to meet the challenges of global health and biodiversity conservation, it is important to shape some collaborative partnerships between governments, local people, and the private and public sectors. That's going to be the true celebration of biodiversity according to me.

# CELEBRATE BIODIVERSITY

**Prof. Sanjay Kumar Choudhary**
**Head, Dept.of LeatherTechnology**
**M.I.T. Muzaffarpur**

The Theme for this World Environment Day,5th June, 2020 is "CELEBRATING BIODIVERSITY".

## Biodiversity

Biological diversity' or biodiversity is that part of nature which includes the differences in genes among the individuals of a species, the variety and richness of all the plant and animal species at different scales in space, locally, in a region, in the country and the world, and various types of ecosystems, both terrestrial and aquatic, within a defined area.

## Types of Diversity

1. **Genetic Diversity:** Each member of any animal or plant species differs widely from other individuals in its genetic makeup because of the large number of combinations possible in the genes that give every individual a specific characteristic. Thus, for example, e**ach human being is very different from all others. This genetic variability is essential for a healthy breeding population of a species.** If the number of breeding individuals is reduced, the dissimilarity of genetic makeup is reduced and inbreeding occurs. Eventually, this can lead to the extinction of the species. The diversity in wild species forms the 'gene pool' from which our crops and domestic animals have been developed over thousands of years.

2. **Species Diversity: -The number of species of plants and animals that are present in a region constitutes its species diversity.** This diversity is seen both in natural ecosystems and in agricultural ecosystems. Some areas are richer in species than others. Natural undisturbed tropical forests have much greater species richness than plantations developed by the forest department for timber production.
   Thus the value of the natural forest, with all its species richness is much greater than a plantation. Modern intensive agricultural ecosystems have a relatively lower diversity of crops than traditional agro-pastoral farming systems where multiple crops were planted.

3. **Habitat Diversity/ Ecosystem Diversity: -There is a large variety of different ecosystems on earth, which have their own complement of distinctive interlinked species based on the differences in the habitat.** Ecosystem diversity can be described for a specific geographical region, or a political entity such as a country, a State or a taluka.

   Distinctive ecosystems include landscapes such as forests, grasslands, deserts, mountains, etc., as well as aquatic ecosystems such as rivers, lakes, and the sea. Each region also has man-modified areas such as farmland or grazing pastures.
   An ecosystem is referred to as '**Natural'** when it is relatively undisturbed by human activities or '**Modified**' when it is changed to other types of uses, such as farmland or urban areas.
   Most species appear to have a life span extending over several million years. Their adaptability to gradual changes in their habitat and interactions with newly formed species produce groups of interlinked

organisms that continue to evolve together. **Food chains, prey-predator relationships, parasitism** (complete dependence on another species), **commensalism** (a partnership beneficial to both species), etc. are important examples.

## Conservation of Bio-Diversity:

The biodiversity we see today is a result of 3.5 billion years of evolution. Unfortunately, due to human's over-exploitation of natural resources, our unsustainable development and the resulting disturbances to the environment, we are undergoing the sixth extinction crisis on this planet and degrading natural ecosystems at an unprecedented rate. It is estimated that the current species extinction rate is between 1,000 and 10,000 times higher than it would naturally be.

*Biodiversity conservation is about saving life on Earth in all its forms and keeping natural ecosystems functioning and healthy*. Conservation biology as a scientific discipline has grown enormously over the past few decades and has increased our awareness and understanding of the great extent to which humans depend on natural ecosystems and biodiversity.

Conservation of biodiversity means ensuring that natural landscapes, with their array of ecosystems, are maintained, and that species, populations, genes, and the complex interactions between them, persist into the future.

Biodiversity conservation relies on a number of disciplines working together, including Ecology and other Biological Sciences, Physical Sciences, Mathematics, and the Social Sciences Such as Economics, Law, Public Policy and Psychology.

# Importance of Biodiversity

Biodiversity and its maintenance are very important for sustaining life on earth. Few of the reasons explaining the importance of biodiversity are:

### Ecological Stability

Every species has a specific role in an ecosystem. They capture and store energy and also produce and decompose organic matter. The ecosystem supports the services without which humans cannot survive. A diverse ecosystem is more productive and can withstand environmental stress.

### Economic Importance

Biodiversity is a reservoir of resources for the manufacture of food, cosmetic products and pharmaceuticals.

Crops livestock, fishery, and forests are a rich source of food.

Wild plants such as Cinchona and Foxglove plant are used for medicinal purposes.

Wood, fibers, perfumes, lubricants, rubber, resins, poison and cork are all derived from different plant species.

The national parks and sanctuaries are a source of tourism. They are a source of beauty and joy for many people.

**Ethical Importance**

All the species have a right to exist. Humans should not cause their voluntary extinction. Biodiversity preserves different cultures and spiritual heritage. Therefore, it is very important to conserve biodiversity.

Biodiversity in India

India is one of the most diverse nations in the world. It ranks ninth in terms of plant species richness. Two of the world's 25 biodiversity hotspots are found in India. It is the origin of important crop species such as pigeon pea, eggplant, cucumber, cotton and sesame. India is also a center of various domesticated species such as millets, cereals, legumes, vegetables, medicinal and aromatic crops, etc.

India is equally diverse in its faunal wealth. There are about 91000 animal species found here.

However, diversity is depleting at a drastic rate and various programmes on biodiversity conservation are being launched to conserve nature.

# STATUS OF BIODIVERSITY IN INDIA: ISSUES AND CHALLENGES

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**ABSTRACT**
India is a country of rich biological diversity, has over 91,200 species of animals and 45,500 species of plants in its ten bio-geographic regions. Besides, it is recognized as one of the eight Vavilovian centres of origin and diversity of crop plants, having more than 300 wild ancestors and close relatives of cultivated plants, which are still evolving under natural conditions. India is also a vast repository of traditional knowledge associated with biological resources. India ranks among the top ten species-rich nations and shows high endemism. India has four global biodiversity hot spots. The varied edaphic, climatic and topographic conditions and years of geological stability have resulted in a wide range of ecosystems and habitats in India. Unfortunately, as elsewhere on earth, Indian biodiversity is also threatened with destruction due to population pressures and ill-conceived developmental activities. The Government of India has become aware of the situation and has created wildlife sanctuaries, national parks and biosphere reserves for in-situ conservation of biodiversity and scientific organisations (gene banks) for ex-situ conservation.
Keywords: Biodiversity, India

## INTRODUCTION

India is situated north of the equator between 66oE to 98oE and 8oN to 36oN. It is bordered by Nepal, China and Bhutan in the north; Bangladesh and Myanmar in the east; the Bay of Bengal in the south east; the Indian Ocean in the south; the Arabian Sea in the west; and Pakistan in the north-west. The varied edaphic, climatic and topographic conditions have resulted in a wide range of ecosystems and habitats such as forests, grasslands, wetlands, coastal and marine ecosystems, and deserts. The mountainous region covers an area close to 100 mha, arid and semi-arid zones are spread over 30 mha and the coastline is about 8000 km long. India is a country of vast biodiversity. It has diverse biogeographical and climatic conditions, ranging from the cold and high Himalayas in the north to the hot and humid peninsula in the south, and from the wet, green, north-eastern forest to the dry north-western desert. Vegetation ranges from the wet evergreen forest of the Western Ghats and the north-eastern hills to the dry deciduous forest of Central India and the thorny forest of the Thar Desert. About 61.5% of flora in India is endemic. There are about 3,000 endemic species in the Himalayas and the Khasi Hills of north-eastern India and 2,000 in the Deccan Peninsula in the south. The richest area from the biodiversity point of view lies in the Silent Valley of Kerala in the Western Ghats and the north-eastern hills of Assam and Meghalaya.

### The Biodiversity of India

### Animal Diversity

There are about 91,200 species of animals in India, from tiny protozoans to large mammals. Among the 397 species of mammals, nearly 30 are endemic, of which 19 are primates. Among the 458 species of birds, 42 are endemic. The reptile fauna comprises over 245 species of snakes, 171 species of lizards, 41 species of turtles and 3 species of crocodiles. The amphibian fauna comprises 248 species of salamanders, caecilians, frogs and toads. There is a high degree of endemism in this group and out of
153 endemics, 84 occur in the Western Ghats and 20 in the north-east (Table-3). The Indian fauna has been enriched by the migration of birds from Siberia and other parts of Europe, and animals from Nepal, Burma, Bhutan, Malaysia and Bangladesh.

**Table 3: Animal diversity in India**

| Group | World | India | (%) in India |
|---|---|---|---|
| | (number of species) | (number of species) | |
| Mammals | 4629 | 397 | 8.58 |
| Birds | 8,400 | 458 | 5.45 |
| Reptiles | 5817 | 460 | 7.91 |
| Amphibians | 5150 | 248 | 4.81 |
| Fishes | 23,400 | 5749 | 24.56 |
| Insects | 867391 | 61151 | 7.04 |
| Molluscs | 66535 | 5072 | 7.62 |

Source: National Biodiversity Action Plan, 2011

The Erosion of Biodiversity in India The loss of biodiversity and the extinction of species in India are alarming. Because of intense population pressure and ill-conceived developmental activities more and more species are becoming endangered and are at risk of becoming extinct. The hunting leopard (Acinonyx jubatus) is already extinct. The last three hunting leopards were shot dead in 1947 in Bastar. As per the IUCN Red List, 2008, India has 43 globally threatened faunal species, which is approximately 4.9% of the world's total number of threatened faunal species.

Other wildlife species of India which are at risk are the Himalayan quail and Himalayan newt from the Western Himalayas, the white-winged wood duck and Garo Hills tree toad from North-East India, the coconut crab from the Andaman and Nicobar Islands, the Himalayan dragonfly from the Himalayas, the forest owlet from the Satpura Hills, and the Malabar tree toad and the Nilgiri tahr from the Western Ghats. It is estimated that the Western Ghats, considered to be the biological treasure of India, have more than 6,000 species of flowering and non-flowering plants. More than 700 species of flowering plants of the Western Ghats have become rare. The Western Ghats are home to some of the world's rare animals and birds species, such as the lion-tailed macaque (Mancaca silenus), the Nilgiri langur (Presbytis johni), Nilgiri tahr (Hemitrogus hylocrius), grizzled giant squirrel (Ratufa macroura), Malabar giant squirrel (Ratufa indica), flying squirrel (Petaurista candidulus), Malabar pied hornbill (Beceros bicornis) and the great Indian hornbill (Beceros spp.)

endemic to the Western Ghats and are not found in the world anywhere else. They are highly endangered and face the threat of extinction. The Botanical Survey of India has compiled three volumes of the Red Book of Indian Plants, which identify 622 threatened plant species, including 132 highly endangered species which are facing extinction. Another twenty-four plant species are possibly already extinct, not having been sighted since the turn of the century.

**Conclusion**

In ancient India, biodiversity conservation was synonymous with the preservation of big cats and large mammals. But, now there is an urgent need to give attention to smaller animals like the musk deer, fish, frogs, turtles, butterflies and earthworms. In addition, higher plants, particularly trees and medicinal herbs, orchids, agricultural and non-agricultural micro-organisms, blue-green algae and marine organisms, also need protection. Mere legal sanctions will also not help. It is essential for the conservation of biodiversity in India that there has to be a mass awakening among people and support from government and non-government organisations. A realisation of the importance of biodiversity for human survival and welfare has to be built up systematically among the people, showing what it means to the present generation and, more importantly, to future generations. Biodiversity conservation does not mean only propagation of the given species in a limited protected area in national parks and wildlife sanctuaries. It also requires the rehabilitation of given species in a second home - ecologically similar habitats still available elsewhere in the biosphere. It is extremely risky to have the sole surviving population of an endangered species in only one area. A single catastrophic event could lead to its extinction. Therefore, the concept of biodiversity conservation should be in totality, involving plants, animals,

man and also the micro-organisms on which they live and on which they depend for their very survival.

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***CELEBRATE BIODIVERSITY***

***Krishan Kanhai,AMIE***

## Definition

"Biodiversity is the variation among living organisms from different sources including terrestrial, marine and desert ecosy stems, and the ecological complexes of which they are a part."

What is Biodiversity?

Biodiversity describes the richness and variety of life on earth. It is the most complex and important feature of our planet. Without biodiversity, life would not sustain.

The term biodiversity was coined in 1985. It is important in natural as well as artificial ecosystems. It deals with nature's variety is biosphere. It refers to variabilities among plants, animals and microorganism species.

Biodiversity includes the number of different organisms and their relative frequencies in an ecosystem. It also reflects the organisation of organisms at different levels.

Biodiversity holds ecological and economic significance. It provides us with nourishment, housing, fuel, clothing and several other resources. It also extracts monetary benefits through tourism. Therefore, it is very important to have a good knowledge of biodiversity for a sustainable livelihood.

**Types of Biodiversity**

There are the following three different types of biodiversity:

Genetic Biodiversity

Species Biodiversity

Ecological Biodiversity

**Species diversity**

Species diversity refers to the variety of different types of species found in a particular area. It is the biodiversity at the most basic level. It includes all the species ranging from plants to different microorganism.

No two individuals of the same species are exactly similar. For example, humans show a lot of diversity among themselves.

**Genetic diversity**

It refers to the variations among the genetic resources of the organisms. Every individual of a particular species differs from each other in their genetic constitution. That is why every human looks different from each other. Similarly, there are different varieties in the same species of rice, wheat, maize, barley, etc.

**Ecological diversity**

An ecosystem is a collection of living and non-living organisms and their interaction with each other. Ecological biodiversity refers to the variations in the plant and animal species living together and connected by food chains and food webs.

It is the diversity observed among the different ecosystems in a region. Diversity in different ecosystems like deserts, rainforests, mangroves, etc., include ecological diversity.

**Importance Of Biodiversity**

Biodiversity and its maintenance are very important for sustaining life on earth. Few of the reasons explaining the importance of biodiversity are:

**Ecological Stability**

Every species has a specific role in an ecosystem. They capture and store energy and also produce and decompose organic matter. The ecosystem supports the services without which humans cannot survive. A diverse ecosystem is more productive and can withstand environmental stress.

**Economic Importance**

Biodiversity is a reservoir of resources for the manufacture of food, cosmetic products and pharmaceuticals.

Crops livestock, fishery, and forests are a rich source of food.

Wild plants such as Cinchona and Foxglove plant are used for medicinal purposes.

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India is equally diverse in its faunal wealth. There are about 91000 animal species found here.

However, diversity is depleting at a drastic rate and various programmes on biodiversity conservation are being launched to conserve nature.

***CELEBRATE BIODIVERSITY***

***Prabhat Ranjan Bhardwaj,AMIE***
***Lecturer,G.P. VAISHALI***

## What is Biodiversity?

Biodiversity or Biological diversity is a term that describes the variety of living beings on earth. In short, it is described as a degree of variation of life. Biological diversity encompasses microorganisms, plants, animals, and ecosystems such as coral reefs, forests, rainforests, deserts, etc.

Biodiversity also refers to the number or abundance of different species living within a particular region. It represents the wealth of biological resources available to us. It's all about sustaining the natural area made up of a community of plants, animals, and other living things that is begin reduced at a steady rate as we plan human activities that are being reduced by habitat destruction.

The United Nations designated 2011–2020 as the United Nations Decade on Biodiversity. In biodiversity, each species, no matter how big or small has an important role to play in the ecosystem. Various plant and animal species depend on each other for what each offer and these diverse species ensure natural sustainability for all life forms. Healthy and solid biodiversity can recover from a variety of disasters.

Biodiversity has three essential elements:

Genetic diversity,

Ecosystem diversity and

Species diversity

Recently a new aspect has also been added- 'molecular diversity'.

Biodiversity is unevenly distributed. It varies globally and within regions. The various factors that influence biodiversity include -temperature, altitude, precipitation, soils, and their relation with other species. For instance, ocean biodiversity is 25 times lesser than terrestrial diversity. Biodiversity also increases its form as it moves from the poles towards the tropics.

Biodiversity is the result of 3.5 billion years of evolution. It has been subject to periods of extinction. The latest and most destructive stage of extinction is Holocene extinction, which has occurred due to the impact of human beings on the environment.

**Why is Biodiversity Important?**

Biodiversity has a number of functions on the Earth. These are as follows:

Maintaining the balance of the ecosystem: Recycling and storage of nutrients, combating pollution, and stabilizing climate, protecting water resources, forming and protecting soil, and maintaining eco-balance.

Provision of biological resources: Provision of medicines and pharmaceuticals, food for the human population and animals, ornamental plants, wood products, breeding stock, and diversity of species, ecosystems, and genes.

Social benefits: Recreation and tourism, cultural value and education, and research.

The role of biodiversity in the following areas will help make clear the importance of biodiversity in human life:

Biodiversity and food: 80% of the human food supply comes from 20 kinds of plants. But humans use 40,000 species for food, clothing, and shelter. Biodiversity provides for a variety of foods for the planet.

Biodiversity and human health: The shortage of drinking water is expected to create a major global crisis. Biodiversity also plays an important role in drug discovery and medicinal resources. Medicines from nature account for usage by 80% of the world's population.

Biodiversity and industry: Biological sources provide many industrial materials. These include fiber, oil, dyes, rubber, water, timber, paper, and food.

Biodiversity and culture: Biodiversity enhances recreational activities like bird watching, fishing, trekking, etc. It inspires musicians and artists.

**Biodiversity_Plants :Reason for Loss of Biodiversity**

The earth's biodiversity is in grave danger. In the present era, human beings are the most dangerous cause of the destruction of the earth's biodiversity. In 2006, the terms threatened, endangered, or rare were used to describe the status of many species. The "evil quartet" identified by Jared Diamond is overkill, habitat destruction,

secondary extinctions, and introduced species. Factors identified by Edward Wilson are described by the acronym- HIPPO standing for habitat destruction, climate change, invasive species, pollution, human overpopulation, and over-harvesting.
Habitat destruction is a major cause of biodiversity loss. Habitat loss is caused by deforestation, overpopulation, pollution, and global warming. Species that are physically large and those living in forests or oceans are more affected by habitat reduction.
Some experts estimate that around 30% of all species on earth will be extinct by 2050. According to the International Union for Conservation of Nature (IUCN), globally about one-third of all known species are threatened with extinction. Even it is estimated that 25% of all mammals will be extinct within 20 years.

Even if a small element of an ecosystem breaks down, the whole system's balance is threatened. Freshwater ecosystems are nowadays the most threatened ecosystems. Invasive species refer to those that would normally remain constrained from an ecosystem because of the presence of natural barriers. Since these barriers are no longer existing, invasive species invade the ecosystem, destroying native species. Human activities have been the major cause of encouraging invasive species.

Species can also be threatened by genetic pollution- uncontrolled hybridization and gene swamping. For instance, abundant species can interbreed with rare species thus causing swamping of the gene pool. Overexploitation is caused by activities such as overfishing, overhunting, excessive logging and illegal trade of wildlife. Over 25% of global fisheries are being overfished at unsustainable levels.

Global warming is also becoming a major cause of loss of biodiversity. For example, if the present rate of global warming continues, coral reefs which are biodiversity hotspots will disappear in 20-40 years. 10% of all species might become extinct by 2015 if global warming continues.

Thus we can see that biodiversity which is crucial for the well being of life on earth, is coming under the threat of many factors related to human activities. There is an urgent need to take action to protect the magnificent biodiversity of our planet. We must create economic policies in order to maintain the Earth's biodiversity and take appropriate measures to protect habitats and species.
The genetic, species and ecosystem variability of flora and fauna on earth are known as Biodiversity. For painting what exactly is Biodiversity, we need a large canvas beyond imagination. Such is the volume of the subject. But, the actual meaning and terms are still not clear.
Keeping it very simple and to the point, the term 'Biodiversity' comprises of two words. The first word is Bio, and the other one is Diversity. Bio means the forms of life and Diversity means mixture or variety. So, when both the words combine they form a definition like this 'Biodiversity means various and mixed forms of life on earth.' The variety of life forms on earth includes plants and animals and their natural habitat.
Facts about Biodiversity:
Digging into the term 'Biodiversity' more generously makes us realize that we have over 10,000 species of birds on earth. The amazing number blows everyone's mind. Insects have a different counting, and their species are in millions. Plants are also a part of this biological system, and hence there are more than 20,000 species of plants.

Even after so many species of plants, animals and insects have specified there are still over millions of species which are not known by anyone. These species cannot be counted under any head as they don't pursue an identity. The actual picture says that earth is home to almost 50 million species or even more than that. These facts do not conclude the point because one or the other day there may be many new species evolving.
Importance of Biodiversity:
Biodiversity is essential for survival. The importance of Biodiversity not only related to plants, animals and natural habitat. But it also provides us so many natural products such as fibre and timber and the fresh water to carry out our daily lives. Therefore we need to understand the importance of Biodiversity.

1. The natural and organic resources:

In the happiness of living our lives, we often forget that Biodiversity is a part of nature. We should protect it no matter whatever be the limitations. Mother Nature has provided us with enough resources which are the Biological Resources. These include wood, medicines, food, etc., which are direct blessings of Biological System or by-product of the Biological Systems. Herbs and plants play a vital role in producing medicines. They may get their final touch from the pharmaceutical companies, but the original source is plants which are again a part of Biodiversity.

2. Biodiversity provides fibres:

It is important to know that wool, jute, palms, etc., use to produce various types of fibres after processing which are again part of the Biological Systems. So, if biodiversity does not persist how people will have access to these fibres? Flax plants use for the production of linen, which is extensively using for making clothes. Similarly, Corchorus plants and Agave plants are using for the production of Jute and sisal respectively. These fibres are no doubt essential for the cloth industry. Therefore it becomes our duty to maintain the Biodiversity.

3. Powerful benefits of Biodiversity:

People may not be aware of the importance, but there are many spiritual benefits of biodiversity. Our folk dances, mythology, and history have a deep link with the Biodiversity in one or the other way. Everyone enjoys or experience the Biodiversity in a different format. Biological diversity also contributes to attracting tourists, especially flora and fauna, which is a rare phenomenon in cities. Therefore it is our ethical duty to preserve Biodiversity.

Preserve Biodiversity:

There are different ways in which we can preserve our Biological environment. Biodiversity should be protected by following these ways.

i. People should stop the process of hunting and poaching the animals. They are a part of Biodiversity.

ii. Protection of endangered species and their surroundings.

iii. We need to curb pollution for protecting Biodiversity.

iv. The explosive growth of population is a threat to Biodiversity. So, to maintain the biological balance, we need to have the population growth under control. Otherwise, people will be exploiting natural resources unethically for survival.

Conclusion:

All steps must be taken to protect biodiversity. Things may seem difficult in the initial stages but practicing them will lead to genuine results. Creating awareness on environmental issues and the negative impact of the loss of biodiversity will let people understand the inevitable need for biodiversity conservation.It is our responsibility to protect the endangered species of plant and animals. If one wants to reach their destination, then it is imperative to take the first step. Without taking a step forward, things will never change on their own. To make a better tomorrow, we need to take steps for preserving our very own Biodiversity.

## ***CELEBRATE BIODIVERSITY***

***Rahul Kumar,AMIE***
***Lecturer,G.P. VAISHALI***

When you are a biology student biodiversity is one of the most important words you can learn. Not only that but it also becomes your lives calling to maintain it. But let's not get ahead of ourselves before we can understand why it is important, we need to understand what it is.

What is Biodiversity?

This term refers to the many different life forms that inhabit the earth at this moment, this includes bacteria, plants, animals and humans and it also refers to their shared environment. Life has manifested itself in many different forms we do not know why exactly but we are certain that they all exist and depend on each other for survival.

Why is biodiversity important?

The answer to this question is more important than just simply stating what biodiversity is. My personal experience as a student has thought me that I learn best when I have an example so I will give you an example of the importance of biodiversity.

The famous Yellowstone Park is a natural reserve and national park but before it was declared as such it was just another forest that man wanted to hunt in. The geographical region had many wolfs inhabiting its plains, for generations they were hunted until they became extinct in the region. After a while, the coyotes began to reproduce as they hade more space and they started hunting the small mammals, which lead to a decrease in the population of eagles in the area but the most significant change came because of the deer. After fifty years of no wolfs in the park the number of roe deer rose and since they had no natural predators, they no longer feared open grasslands. That's when they started grazing extensively which depleted the grass on the shore of the Yellow stone river and this, in turn, made the soil loos. The river began to take away a lot of soil and to deposit it in other places flooding certain areas while at the same time causing droughts to happen in other places.

Biologists came to the park with a wish to restore its wolf population and after a decade of planning and working they restored one pack to the park. The pack soon made the deer go back to the forest so they could be harder to hunt, the coyote's population dropped because they couldn't compete with the wolf, that led to the increase of small rodents which let to the return of carnivores' grate birds. But above all the grazing on the river edge stopped and after a few years, the Yellowstone river returned to its natural flow.

This story is completely true and I love to use it as an example of the importance of maintaining biodiversity. There are many regions in the world that have similar problems and if we do not do our best to conserve biodiversity, we could be looking at similar or even worst natural catastrophes.

Conclusion:

People tend to mass produce and they do this with most things. They will destroy a forest of many thousands of life forms to make a plantation with one single plant, the same is true of animal farming. With our need to be productive all the time we lose sight of the small things that make the system function as whole. Even though an insignificant thing as a bug or a wolf pack might seem the least important for our daily lives once we take them out of the picture, we see that the balance and wealth biodiversity gives to the planet is not something that can be easily compensated.

## ***CELEBRATE BIODIVERSITY***

***Madhavi Ranjan***
***PG Scholar,B.R.A.B.U. MUZ.***

**Introduction:**

Biodiversity, also referred to as the biological diversity refers to the diversified form of plants and animals that exists in our planet. It also denotes each and every aspect of the ecosystem such as micro-organisms, coral reefs, rainforests, deserts, forests etc.,

A good balance in biodiversity supports human race and humans on the other hand must ensure to save biodiversity. This essay is going to talk about the importance of biodiversity and the role of human beings in safeguarding the ecosystem.

Importance of Biodiversity:

There are more than 300,000 species of flora that has been identified and there should be many more unidentified varieties. Similarly there must be infinite variety of other species in our Earth and these together form a perfect natural protection for the human race. Biodiversity supports human race in different ways.

Few of them are listed below:

1. Some of the species capture and stores energy and releases it back in the atmosphere for human consumption.
2. Some biological species help in decomposing organic materials and thus acts as a natural recycling agent.
3. Plants and trees help in reducing pollution and maintain the purity of atmospheric air.
4. It is from the biological resources that humans receive food and shelter.
5. The astonishing beauty of biodiversity is the base for tourism industry to flourish.

**Decline in Biodiversity:**

The Earth's biodiversity is undergoing a severe decline and this is a great threat to the human race. There are several factors that lead to the decline in biological species, the most significant one being the behavior of human beings.

1. Human beings destroy forests to build houses and offices. Through deforestation humans are actually destroying the natural habitat of many plants and animals.

2. All new scientific inventions are causing harm to the environment. We cannot even find some species of birds today because of the increase in noise pollution.

3. Global warming is another reason for the decline in biodiversity. Some species require specific climate to survive and when the climatic conditions change continuously these species either migrate or become extinct. Decline in the number of coral reefs are a perfect example.

Steps to Be Taken:

The Government and different voluntary organizations must act upon immediately to create awareness among people on environmental issues and its consequences. It is also the responsibility of every common man to save mother Earth by maintaining a rich biodiversity.

**Conclusion:**

If proper care is not taken, the biodiversity of Earth may become extinct one day and if it happens then, humans have to find another planet to live. It's better to act now before it gets too late

# CONSERVING BIO-DIVERSITY: AN ENGINEERING APPROACH

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Engineering has always come up with the solutions that have fulfilled the needs of mankind. It has given man a powerful tool through the help of which the human race has surpassed every living species that ever existed on this planet. The Industrial revolution that started way back in the Eighteenth Century has reorganized the Earth for the convenience of humans. However, it neglected the short term and the long term impacts on the environment.This led to serious deterioration in the climate and the bio diversity of the planet. The stress of the technology is now upon sustainable engineering so that the perceptible threats to the nature and ultimately to the existence of human does not becomes severe.Biodiversity at large encompass the flora and fauna of this planet. This article gives a brief work of different Engineering and management tools that are being developed since the concern for the nature became significant.

## INTRODUCTION

The planet earth is estimated to support about 8.7million species of plants and animals of which only 1.2 million species have been discovered. This number does not include the count of the species that once existed but subsequently got extinct because of the certain geographical and astronomical events. In some of its reports Scientist estimates that around a trillion species currently exist on this planet. In short biodiversity refers to the varieties of the living species on the Earth, including plants, animals, bacteria and fungi. Thus one can say that the earth is the biggest zoological and botanical park that anyone can visit. Our country India is itself one of 17 mega diverse countries and is home to about 91,000 species of animals and 45,500 species of plants spread across ten bio-geographic regions. It contains three out of 34 biodiversity hotspot regions of the World. Every species has a defined living habits and they work together in order to survive and maintain their ecosystem. The interactions among the different ecosystems maintain the living conditions of the planet.

Homo Sapiensor more commonly the humans is one among this large group; the earliest footprint of modern human dates back to around two hundred thousand years ago. Since then it has outcasted every living entity and has moulded the nature in according to his requirements. However, these activities had a detrimental effect on other species as well as to the balance of the nature. Much of the Earth's biodiversity is in jeopardy due to human wants. This has resulted not only in the extinction of hundreds and thousands of animals and plants but has also resulted in unprecedented rise in extreme climate, calamity and topographical changes. These factors were somewhat ignored during the $18^{th}$ and the $19^{th}$ centuries.However,right after the term "biodiversity" first published by E.O. Wilson in the year 1988, since then the world's environmentalists, geologists, governments and independent agencies have started to take deep interest in this topic. The first convention on biodiversity took place in the year 1992 during the Earth Summit in Rio de Janerio, Brasil. This embarked a new chapter to safeguard the nature as a whole. One of the important goals of this convention is focused on conservation. Since then the different organizations are looking for the effective and innovative solutions to minimize the loss and increase the living index of the planet. .

## ENGINEERING SOLUTIONS

The global surface temperature has risen by 0.8°C since the pre-industrial time. The number may not seem to be significant, but, this has largely affected not only the geographical phenomena such as precipitation, sea-levels but has substantially altered species distributions, inter species relationships, migration, breeding, flowering and metabolic habits. Rigorous studies over greenhouse gases levels, ocean acidification and changes in soil properties have highlighted the adverse effect on both terrestrial as well as marine ecosystem.This is where the scope of climate engineering comes into picture. The computational models on vegetation, temperature gradient, CO2 levels, provide valuable insights on the geography of Earth. The need of the hour is to stretch its focus areas to study the effects of climate change onbiodiversity.

One of the simplest and effective methods is through the establishment of special containment zones. These are special protected areas where the protection is brought out through special regulations and laws on land and

resources use. These include both in-situ and ex-situ conservation techniques such as the National Parks, Biosphere Reserves, Wildlife Sanctuaries, Reserved Forests, Zoological and Botanical Gardens. Their special status is given by local Government and their standards are set by IUCN. At present, there are more than a hundred National Parks and 550 Wildlife Sanctuaries across India. Although they mostly involve management techniques, engineering research through the use of biotechnology, surveillance and monitoring can further give insights on species behavior and their endemism. Remote sensing techniques in these areas can generate parameters of physiology, growth, mortality and land coverage.

One of the ex-situ conservation methods is through the use of genetics. The United Nations (UN) estimates that around 1 million species are at risk of extinction. This demands exploring innovative methods to safeguard the biodiversity. With the increase in advancement of biological sciences, Genetic engineering can give promising results. Rewriting the genetic code, synthetic gene drive, has the possibility of giving species a shield against the present and future threats. This may seem a science fiction theory, however, the CBD, a multilateral treaty to conserve biodiversity does address the need to share genetic resources. Genetically Modified Organisms or Living Modified Organism can yield positive results. These methods do promises safety of endemic species and shields them against the invasive species. However, genetic engineering does possess threat to both the nature and the humans and hence it has to be engineered considering the socio economic as well as ethical aspects.

**CONCLUSION**

The present status and capacity of Science and Technology to understand the earth's biodiversity is adequate enough to address key issues as well as to propose solutions. However, their reach is limited by the regulations, access and policy of the local Government and International bodies. The biodiversity cannot be just protected by local measures but through an inclusive approach where the doors are opened for collaborative research and regulations are strictly enforced by the Governments. The United Nations and its various agencies across the globe have set out the regulations and norms for its member countries. The institutional framework and regulations developed through continuous world level conventions such as the Kyoto Protocal, Ramsar conventions, conventions on UNFCCC, Clean Development Mechanism, and many more have been successful to some extent. However, the recent withdrawal of US from the Paris Agreement and the use of more protectionist strategy that is emerging across the World possess challenges to meet the targets. As of January 2019, about 7.5% of World's oceans and 14.9% of World's land area has been brought under the protection zone.

# BIODIVERSITY

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Biodiversity also known as biological diversity is the variables that exist in the ecosystem between several species living in it. These living organisms include marine, aquatic, and terrestrial life. Biodiversity aims at understanding the positions that these organisms hold in the wider ecosystem.

Different types of things exist and generate diversity. Biodiversity is a significant and desirable variation in the existence of plants and animals on the earth's surface. Due to genetics, species and the ecosystem or habitat the variation exists. Biodiversity is an important aspect of the world because it enables living things on earth to survive and sustainably.

Depending on the particular variables, the variation in living things has resulted in different types of biodiversity. Genetic diversity is due to the shared genetic constituents of living organisms. Species of identical genes diverge, thereby increasing heterogeneity, and evolve differently. Diversity of species occurs when a habitat comprises various types of living things. Ecological diversity is in an ecosystem that contributes to biodiversity through the interaction of living things that share common energy sources.

When our ecosystem contains biodiversity, this translates into a greener environment. This is because plant life thrives in an environment that is healthy. This invariably affects humans as plants are consumed for our survival. A balanced environment will also contribute to reduce disease risk and how we adapt to them.

Biodiversity is affected by the increasing population, industrialization, development, etc. The increased human activity has reduced the natural area for plants, animals and other living creatures. Due to increased deforestation and other factors a number of plants and animals have gone extinct. Growing pollution is a huge threat to biodiversity, causing global warming and climate change. The reduction in biodiversity, in effect, would contribute to an ecological deficit that would endanger the human species and all living creatures alike.

Compared to other environmental issues, the issues of biodiversity and the ecosystem are less taken into consideration by peoples. As mentioned above, the biodiversity is related to the global ecosystem condition. Organism species on earth face the threat of habitat loss and extinction. If human beings do not take action to improve this situation, we would lose many valuable species. Worldwide, there are different areas of life species such as mammals, reptiles, birds, amphibians, fish and plants. Every all the various forms of life are now extinct, or one or more survivors. There are no scientists or study who can tell us how many species of life there are in the world, because our mother earth is a complex world, and until now the relevant organizations have been continually discovering new species to science. We do not know, therefore, exactly how many species we are losing. Some scientists estimate that the pace of biodiversity destruction today is between 1,000 and 10,000 higher than that of natural extinction.

The recent Covid-19 pandemic has shown mankind that if humans remain ignorant to existential threats to biodiversity then nature can use extreme steps to keep the balance. After the post-COVID-19-era the world may see more stringent regulations on the capture and consumption of wildlife. On the other hand, ubiquitous lockdown measures have effectively put a stop to many ongoing conservation efforts.

The human being cannot survive all alone on Earth. Various other modes of life are equally essential, and they play their roles in the collective preservation of the various organisms on Earth. Growing of the animals for its own collection of environmental contributions. Many animals have already been extinct because they do not thrive in the rising environmental conditions. It is also our responsibility to ensure that the other flora and fauna on the earth are not harmed by our practices.

Though the government has taken a range of measures to conserve the different ways of existence, we should all contribute individually to this cause. If we do not act now, we will once again be seeing the loss of fragile species, which will further disrupt the nature equilibrium.

# BIODIVERSITY

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Biodiversity also known as biological diversity is the variables that exist between several species living within the ecosystem. Such living creatures include marine, terrestrial, and earthly life. Biodiversity is designed to understand the positions these organisms hold in the wider ecosystem.

Biodiversity is the presence of different species of plants and animals on the earth. Moreover, it is also called biological diversity as it is related to the variety of species of flora and fauna. Biodiversity plays a major role in maintaining the balance of the earth.

Different types of things exist and generate diversity. Biodiversity reflects a important and beneficial difference in the life of plants and animals on the surface of the planet. The variation exists because of genetics, species, and the ecosystem, or habitat. Biodiversity is an important aspect of the world, because it enables the survival and sustainability of living things on earth.

The variation in living things has led to different types of biodiversity, depending on the particular variables. The shared genetic constituents of living organisms are responsible for genetic diversity. Species of the same genes diverge, thus increasing heterogeneity and evolving differently. Species richness exists as an ecosystem contains various forms of living beings. Ecological diversity is in an ecosystem that contributes to biodiversity by sharing common energy sources through the interaction of living things. This translates into a greener environment, when our ecosystem contains biodiversity. This is because flora and fauna thrive in a healthy environment. This inevitably impacts humanity because it absorbs plants for our life. A balanced environment will also help to reduce the risk of disease, and how we can adapt to it.

Biodiversity is threatened by population growth, industrialisation, production, etc. The increased activity of humans has reduced the natural area for plants, animals, and other living beings. A number of plants and animals have gone extinct because of increased deforestation and other factors. Growing pollution represents an enormous threat to biodiversity, causing global warming and climate change. In addition, that biodiversity will lead to an ecological deficiency which would threaten both the human race and all living creatures.

The issues of biodiversity and the ecosystem are less taken into consideration by peoples compared with other environmental issues. As mentioned above, the biodiversity has to do with the condition of the global ecosystem. Earthly species of organisms face the threat of habitat loss and extinction. If people do not act to improve this situation, we would lose many valuable species. There are various species of life worldwide, such as mammals, reptiles, birds, amphibians, fish, and plants. Every single life form is now extinct, or one or more survivors.

Biodiversity is extremely important to maintain the ecological system. Most Noteworthy many species of plants and animals are dependent on each other. Therefore, if one of them gets extinct, the others will start getting endangered too. Moreover, it is important for humans too because our survival depends on plants and animals. For instance, the human needs food to survive which we get from plants. If the earth does not give us a favourable environment then we cannot grow any crops. As a result, it will no longer be possible for us to sustain on this planet

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The human being cannot survive all alone on Earth. Various other modes of life are equally essential, and they

play their roles in the collective preservation of the various organisms on Earth. Growing of the animals for its own collection of environmental contributions. Many animals have already been extinct because they do not thrive in the rising environmental conditions. It is also our responsibility to ensure that the other flora and fauna on the earth are not harmed by our practices. While the government has taken a number of steps to maintain the different forms of life, we will all contribute to this cause individually. If we do not act now, we will see the loss of fragile species again, which will further disrupt the balance of nature.

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