

# Biodiversity & Conservation

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## Abstract

Biodiversity refers to the variety and variability of life forms within a given ecosystem, for example, the variety of species, ecosystems, and genetic variations. Biodiversity is critical for the health and stability of ecosystems and contributes to natural systems' resilience and functionality that sustain life on the planet. Biodiversity conservation is the practice of protecting and preserving such diversity to foster ecological balance, ensure resources for human survival, and protect nature's genetic wealth. Conservation of biodiversity aims at mitigating loss of biodiversity caused by habitat destruction, climate change, pollution, invasive species, and over exploitation.

The intersection of science, policy, and community engagement is at the core of biodiversity conservation. The efforts range from the establishment of protected areas like national parks and reserves to the promotion of sustainable agriculture, forestry, and fisheries. Restoration of degraded habitats, safeguarding of threatened species, and launching of biodiversity-friendly policies at the local, national, and international levels are also key components. The past several years have seen a greater emphasis on the need for a holistic approach incorporating ecological, socio-economic, and cultural aspects in conservation.

**Keywords:** Biodiversity, Conservation, Ecosystem, Species Preservation.

## Introduction

Biodiversity refers to the incredible variety of life on Earth, spanning the tremendous variety of species, ecosystems, and genetic diversity that make up our planet's natural heritage. It is the foundation of ecosystems and is essential for the provision of services that humans and all living organisms rely on, such as clean air, water, food, and climate. Biodiversity enables ecosystems to be stable and resistant to change, to maintain ecological processes, and to allow for the development of new species and life forms.

The present rate of biodiversity loss, driven by habitat destruction, pollution, overexploitation, climate change, and invasive species, among others, constitutes a significant threat to ecosystem health and human well-being. As species are lost and ecosystems decline, the services they provide are lost, ranging from agricultural productivity to the availability of medicinal drugs.

Conservation is the science and practice dedicated to the sustainable protection and management of biodiversity. Its objective is to prevent further loss of species, habitats, and ecosystems and to improve their recovery and resilience. Conservation efforts range from the establishment of protected areas, such as national parks and wildlife reserves, to more integrated strategies like sustainable agriculture, reforestation, and species conservation programs. International agreements like the Convention on

Biological Diversity (CBD) guide global conservation policy and action.

### Motivation

The government of India tracks various environmental indicators related to biodiversity, deforestation, and conservation on a yearly basis. These are reported by governmental agencies like the Ministry of Environment, Forest and Climate Change (MoEFCC), Forest Survey of India (FSI), and other ministries. These data points are given to highlight the need for conservation interventions. What follows is a summary of the data typically reported:

**Deforestation and Tree Cutting Statistics:** The Forest Survey of India (FSI) publishes an annual report known as the "State of Forest Report (SFR)" which provides a comprehensive analysis of India's forest cover. According to recent reports, India has been facing a loss in forest cover due to deforestation, agricultural expansion, mining, and urbanization. For example, in 2021, India lost 1,22,000 hectares of forest cover. With regard to tree cutting, though precise figures fluctuate year by year, commercial timber harvesting and illegal logging continue unabated. It has been estimated that 14 million trees are felled annually for timber, firewood, and other industrial products, and this is a major cause of deforestation.

**Biodiversity Loss and Threatened Species:** India harbors numerous endemic species, and biodiversity loss is a cause for concern. Records of the government, like the Red List of the Wildlife Institute of India (WII), monitor threatened species. For example, an increasing number of species are now considered endangered, with more species being threatened by habitat loss, poaching, and climate change. India is home to around 20% of the world's biodiversity, and this is coming under rising pressure. The IUCN Red List has recorded more than 600 species in India that are threatened with extinction in recent years. The way to reverse this trend is through conservation.

**Forest and Tree Cover in India:** As per the India State of Forest Report (ISFR) 2021, the forest and tree cover of India is approximately 80.9 million hectares, which is roughly 24.62% of the country's total geographical area. Forest cover has increased incrementally in the last couple of years due to afforestation efforts and the preservation of existing forests, although the rates of loss still remain a concern.

**Government Initiatives and Steps for Tree Plantations:** To mitigate the environmental impacts of tree cutting, the Indian government has launched several programs like the Green India Mission that aims to increase tree cover and promote sustainable forest management. The government has committed to planting over 1 billion trees in various parts of the country under different programs. The National Afforestation Programme (NAP) and Cambridge Declaration on Biodiversity have led to afforestation, reclaiming lands that were lost to deforestation.

### Literature Review

[1] "Importance of Biodiversity in India" India is one of the most biologically diverse countries in the world, with about 8% of the world's known species, spanning more than 450 species of mammals, 1,200 species of birds, 500 species of reptiles, and 50,000 species of plants (IUCN, 2020). India's biodiversity is not only significant in terms of species richness but also in terms of the ecological services such as pollination, seed dispersal, water purification, and carbon sequestration that are essential for human welfare and economic development.

Global Significance: India's biodiversity is of international significance, particularly in relation to its

biodiversity hotspots such as the Western Ghats, Sundarbans, and Himalayas. They harbor many endemic species and are extremely significant in maintaining ecological balance (Myers et al., 2000).

**Economic Value:** The literature brings out the economic value of biodiversity for India, as it underpins sectors such as agriculture, forestry, fisheries, and tourism. For instance, the National Biodiversity Action Plan (NBAP) estimates the economic value of India's forest ecosystem services at more than ₹1.5 trillion annually (MoEFCC, 2014).

[2] "Threats of Biodiversity" Despite the importance of biodiversity, India is facing significant threats to its ecosystems, resulting in habitat loss, fragmentation, and species extinction. The principal threats identified in literature are:

**Deforestation and Habitat Loss:** India lost about 1.28 million hectares of forest cover between 2019 and 2021 due to urbanization, infrastructure development, and agricultural expansion (FSI, 2021). This is considered to be one of the biggest drivers of biodiversity loss.

**Overexploitation of Natural Resources:** Poaching, overfishing, illegal logging, and unsustainable agriculture are leading to the decline of species. Sarkar et al. (2019) note that the demand for fuelwood and timber, particularly in rural communities, leads to deforestation and destruction of critical habitats.

**Climate Change:** Climate change is speeding up biodiversity loss by altering temperature and rainfall patterns, affecting productivity of ecosystems, and altering species distribution. Patwardhan et al. (2015) find that the impacts of climate change are already being observed in India's mountain ecosystems, particularly with species migration and shifts in seasonal patterns.

**Invasive Species:** Invasive species like *Lantana camara* and *Prosopis juliflora* have disrupted native ecosystems and caused severe declines in biodiversity. Invasive plant species pose a significant threat to native species since they compete with them for resources, Sharma et al. (2013).

[3] "Conservation Strategies and Efforts" In response to the biodiversity crisis, India has embraced several conservation policies and programs. These responses are of a multidimensional nature, ranging from legal protection, community involvement, sustainable use, and scientific research:

**Protected Areas and Wildlife Reserves:** India has an extensive network of protected areas, including national parks, wildlife sanctuaries, and biosphere reserves. The Wildlife Protection Act of 1972 and the National Wildlife Action Plan (2017-2031) have helped extend protection to endangered species such as tigers, elephants, and rhinoceroses (NBSAP, 2008).

**Community-Based Conservation:** Involving local communities in conservation has been in the limelight in recent years. A study by Kothari et al. (2012) shows that community-managed forests and participatory programs in states like Madhya Pradesh and Uttarakhand have led to successful biodiversity restoration and sustainable resource use.

**Afforestation and Reforestation Programmes:** The Indian government has launched several afforestation programmes, like the Green India Mission (2014), aimed at increasing tree cover and enhancing carbon sequestration. Singh et al. (2019) emphasize the necessity of afforestation as a response to the effects of deforestation and climate change.

**In-Situ and Ex-Situ Conservation:** Both in-situ conservation, wherein species are preserved in their natural habitats, and ex-situ conservation, such as botanical gardens and seed banks, have been established to maintain biodiversity. The NBAP offers a strategy for both approaches to protect species.

**Biodiversity Information and Monitoring:** The Indian government has established databases like the Biodiversity Information System to track species and monitor biodiversity trends. Rao et al. (2018) mention that the use of remote sensing technologies has improved the monitoring for biodiversity

conservation.

[4] “Challenges in Biodiversity Conservation” Despite the significant efforts made by the Indian government and other stakeholders, several challenges remain:

**Implementation Gaps:** The policies exist, yet there is a gap between policy making and implementation due to a shortage of funds, enforcement, and political pressures (Kumar, 2019). **Conflicts with Development Goals:** The demand for land for industrial and infrastructure development often comes into conflict with nature conservation. Gadgil and Guha (1992) note that environmental concerns tend to be overruled by developmental priorities, leading to the loss of biodiversity.

**Fragmentation of Habitats:** Fragmentation of habitats, especially due to agriculture and urbanization, is one key factor. Fragmentation limits the movement of species to migrate, search for food, or mates, thus resulting in dwindling populations (Bawa et al., 2004).

[5] “The Role of Policy and International Collaboration” India has also participated in international conservation efforts, being a signatory to international conventions like the Convention on Biological Diversity (CBD) and the Paris Agreement. Agrawal et al. (2017) in their paper discuss how India’s policy is aligned with international biodiversity objectives and its aspiration to bring degraded lands under restoration. The National Biodiversity Action Plan (NBAP): NBAP lays down India's action plan for the conservation and sustainable utilization of biodiversity. It demands mainstreaming biodiversity in development policies and biodiversity-friendly agriculture. **Global Partnerships:** India collaborates with international agencies such as the United Nations Environment Programme (UNEP) and World Wildlife Fund (WWF) in the global effort for biodiversity conservation.

## Analysis

### Analysis of the Threats to Biodiversity

India's biodiversity continues to be under pressure from natural, along with anthropogenic, factors. While climate change and natural disasters like floods and droughts have their role, human activities are the prime cause of biodiversity loss. Some of the most important threats discussed in the literature and governmental reports are:

**Deforestation:** Deforestation is a prime cause of loss of biodiversity with serious implications for habitat loss and fragmentation. Forest Survey of India (FSI) data show that India has lost substantial forest cover over the years. Forest loss of 1.28 million hectares in 2019-2021 is a stark reminder of this threat ("FSI," 2021).

**Effect:** Forests provide the natural habitats for most species, and their devastation leads to displacement, loss of genetic diversity, and species extinction. Forests also serve as significant carbon sinks, and their destruction contributes to climate change.

**Overexploitation:** Despite the existence of legal frameworks, overfishing, logging, and overhunting remain prevalent. The National Biodiversity Action Plan (NBAP) emphasizes the overexploitation of natural resources, often driven by economic activities ("NBAP," 2008). For example, illegal logging and timber extraction have resulted in the degradation of critical forest ecosystems.

**Impact:** Overexploitation disrupts the reproductive cycles of species, diminishes populations, and leads to ecosystem imbalances.

**Climate Change:** Climate change, exacerbated by deforestation, pollution, and industrial processes, radically alters habitat conditions. Patwardhan et al. (2015) indicated how shifting rainfall patterns and temperatures affect species migration and survival of vulnerable species in mountain

### ecosystems.

Impact: Climate change affects the timing of seasonal events (e.g., migration and flowering), alters habitat suitability, and enables the spread of invasive species.

### Analysis of Conservation Strategies

India has undertaken a variety of policies and programs for biodiversity conservation. The effectiveness of such measures can, nevertheless, be assessed based on their success and shortfalls:

**Protected Areas and Legal Framework:** Creation of National Parks, Wildlife Sanctuaries, and Biosphere Reserves has been a cornerstone of India's biodiversity conservation policy. The Wildlife Protection Act of 1972 and the National Wildlife Action Plan (2017-2031) have helped in the protection of endangered species such as the Bengal tiger, the Asiatic lion, and the one-horned rhinoceros ("NBSAP," 2008).

Successes: Protected areas have been successful in the conservation of flagship species. For example, India's Project Tiger has led to the dramatic recovery of tiger populations. Tiger populations have increased by about 30% since 2014, as per the National Tiger Conservation Authority (NTCA).

Limitations: Protected areas tend to be fragmented and are subjected to problems that include encroachment, poaching, and poor funding. Also, some of the areas are isolated from other habitats, which limits the gene flow between populations.

**Community-Based Conservation:** Schemes such as Joint Forest Management (JFM) and community forest management have helped involve local individuals in the conservation process. They ensure sustainable use of the resources while conserving the forest regions at the same time.

Successes: Studies such as those by Kothari et al. (2012) demonstrate the success of community-led conservation efforts, particularly in states such as Madhya Pradesh and Uttarakhand, where local participation has led to improved forest health and wildlife populations.

Challenges: Despite their success, community-based projects often face institutional challenges, such as limited access to decision-making, insufficient training, and shortage of support from government agencies.

### Policy Implementation Analysis and Challenges

Though India has a comprehensive set of policies and laws for biodiversity conservation, the implementation of the policies is often faced with several challenges: Inadequate Enforcement: Even though there are laws such as the Wildlife Protection Act and the Forest Conservation Act, the enforcement remains weak in most parts. Kumar (2019) acknowledges that weak enforcement, lack of patrolling, and corruption in the forest departments are long-standing problems. Conflicts with Development Objectives: Land demands for infrastructure, industry, and agriculture are often in direct conflict with conservation. Studies such as those by Gadgil and Guha (1992) highlight how developmental pressures from private and governmental sectors inevitably lead to the loss of crucial habitat and biodiversity. Fragmentation of Protected Areas: Although India has created a large network of protected areas, they are fragmented and lack corridors for the migration of species. Fragmentation affects gene flow, reduces populations of species, and limits the success of conservation initiatives.

### Threats of Biodiversity

India, with its vast range of species, animals, birds, mammals, and reptiles, is faced with enormous threats that have placed its natural heritage at risk. Biodiversity in India is not only necessary for maintaining ecological balance but also for supporting livelihood, agriculture, and economic processes. India's wildlife and even its endangered species, however, are increasingly facing pressure from various anthropogenic and natural causes. What follows is an analysis of the major threats to India's biodiversity:

### 1. Deforestation and Habitat Loss

Effect on Species, Animals, and Birds: Urban expansion, industrialization, agriculture, and infrastructure development have caused large-scale destruction of natural habitats. Deforestation poses a great danger to numerous animal and bird species that depend on forests for food, shelter, and breeding.

- Mammals such as tigers, elephants, and leopards are exposed to habitat fragmentation, which isolates their populations and reduces their access to resources. The outcome is human-wildlife conflict, with animals venturing into human settlements in search of food.
- Bird species such as the Great Indian Bustard and the Sarus Crane are facing increasing threat due to habitat loss because of land-use changes, agricultural expansion, and development projects.

Example: Tigers in India are confined mostly to national parks and protected reserves like Jim Corbett National Park and Sundarbans. However, the destruction of corridors connecting these habitats has threatened their genetic diversity and long-term survival.

### 2. Climate Change

Effect on Reptiles, Mammals, and Birds: Climate change is reshaping ecosystems in India, affecting the habitats of many species, particularly in the Himalayas, Western Ghats, and coastal regions. The rising temperatures, changing rainfall patterns, and rising incidence of extreme weather events are having a devastating impact on species survival.

- Reptiles, such as the Indian Star Tortoise, are endangered by changing temperatures that affect their reproductive patterns and habitats.
- Mammals like the Asiatic Lion and Indian Elephant are particularly vulnerable to the effects of climate change, which disrupt migration patterns, alter the availability of food sources, and exacerbate human-wildlife conflict.
- Birds like the Bar-headed Goose and Migratory Shorebirds, which rely on specific climatic conditions for breeding and migratory routes, are also at risk.

Example: The Indian Desert (Thar Desert) is facing changes in temperature and rainfall patterns, which are affecting the survival of desert species such as the Indian Fox and Desert Lark.

### 3. Overexploitation of Resources

Impact on Species, Animals, and Reptiles: India's wildlife is endangered due to overfishing, illicit hunting, and logging. Poaching and illegal wildlife trade are responsible for the decline in species populations, primarily mammals and birds.

- Elephants, tigers, and rhinos are generally poached for their tusks, hides, and horns. The Indian Rhinoceros, which once ranged widely in the Himalayas and Terai, has been driven to the verge of extinction due to poaching for its horn.
- Reptiles like the Crocodile and the Indian Python are also hunted for their skin, further decreasing their population.
- Marine wildlife such as the Olive Ridley Turtle, renowned for its mass nesting shores along the coast of India, is under danger from excessive fishing and unlawful egg gathering.

Example: Tiger poaching for skin, bones, and other body parts is a major threat. Despite protection under Indian law, illegal wildlife trade is still rampant, further endangering tiger populations.

#### 4. Invasive Species

Impact on Animals, Birds, and Reptiles: Invasive species are alien species that, upon introduction to a new ecosystem, create a disturbance in the natural balance and have a tendency to outcompete the native species for available resources. India has been invaded by invasive species that are dangerous to local flora and fauna.

- Invasive plant species like *Lantana camara* and *Prosopis juliflora* have altered the habitats of several animal species, like birds and mammals, by their impact on the composition of vegetation and food sources.
- Reptiles like the Indian Cobra and Russell's Viper are impacted by the spread of non-native species, which can introduce new predators and competitors.
- Bird species such as the House Sparrow are declining as they compete with invasive species such as the Common Mynah, which are fond of urban habitats.

Example: The Mangoes of the Western Ghats have been threatened by the encroachment of *Cinnamomum* and other alien species, which have reduced the diversity of native species that depend on these trees for food and habitat.

#### 5. Pollution

Impact on Species, Mammals, Birds, and Reptiles: India's pollution, especially of water bodies and the air, significantly affects the survival of other species. Industrial and farm runoff makes rivers and lakes become polluted, thus affecting aquatic life, including fish and amphibians.

- Reptiles, for example, the Indian Crocodile, are vulnerable to loss of habitat and water pollution, which affects their breeding and feeding grounds.
- Bird species, especially water-birds like the Sarus Crane, are threatened by the contamination of wetlands with toxic chemicals and wastes.
- Mammals, particularly urban mammals, are exposed to air pollution, which equates to adverse health effects, such as reduced lifespans and reproductive success.

Example: The River Ganges, sacred to millions, is one of the most polluted rivers in the world. The Ganges River Dolphin is on the endangered species list due to the pollution of their water habitat.

### Need of Biodiversity

#### 1. Ecosystem Stability and Functioning

- **Ecological Balance:** Biodiversity is key to ecosystem stability. Ecosystems that have high biodiversity are more resilient to ecosystem disruption in the form of disease, natural disasters, and climate change. For instance, forests, wetlands, and coral reefs deliver essential ecological services, including water purification, soil stabilization, and climate regulation.
- **Food Webs:** Different species co-exist in food webs, each performing some role—producers, consumers, and decomposers. The balance of these relationships keeps ecosystems functioning properly. The loss of any species can potentially destabilize food webs, causing chain reactions in other species.

#### 2. Economic Value

- **Agriculture and Food Security:** Biodiversity is essential for agriculture as it provides the genetic resources required for the improvement of crops and livestock. It helps in pest control,

pollination, and soil health that are essential for sustainable food production. In India, for example, biodiversity of pollinators such as bees and butterflies enable the cultivation of numerous crops such as fruits, vegetables, and spices.

- **Medicinal Resources:** Natural ecosystems in plants, animals, and microbes yield a great number of medicines. Up to 50% of the new medicines are derived from nature ("World Health Organization," 2015). India, as a nation rich in traditional knowledge, is one of the finest examples of the contribution of biodiversity to the health sector. Biodiversity loss may result in the loss of potential new medicines that might have been developed.
- **Tourism:** Wildlife tourism, particularly in India's national parks, reserves, and biosphere areas, is an important segment of the economy. The Bengal tiger, Asiatic lion, and Indian rhinoceros are some of the animals that attract tourists from all over the world, providing benefits to local economies and creating revenue.

### 3. Climate Regulation

- **Carbon Sequestration:** Biodiversity, especially in forests and oceans, is important for carbon sequestration, which is vital to combat climate change. Forests absorb enormous amounts of CO<sub>2</sub>, and marine ecosystems, such as mangroves and seagrasses, are also significant carbon sinks. India's Western Ghats and the Sundarbans are key areas for carbon storage and climate regulation.
- **Climate Resilience:** More diverse ecosystems are better able to withstand climatic changes. Biodiversity can help make ecosystems more resilient to environmental stresses, such as heatwaves, floods, and droughts. For instance, mangrove forests along the Indian coasts are natural barriers, protecting coastal communities from storm surges and erosion.

### 4. Cultural and Social Value

- **Cultural Heritage:** Biodiversity has immense cultural significance for communities, especially rural and tribal communities in India. The tribal communities depend on natural resources for their livelihood and cultural traditions. Sacred groves, forests, and rivers have spiritual and cultural importance for communities, especially in states like Kerala, Madhya Pradesh, and Odisha.
- **Traditional Knowledge:** The indigenous people of India possess rich traditional knowledge of plants, animals, and ecosystems that are vital for sustainable resource management. This knowledge preserves biodiversity in sacred groves and agroforestry systems, among others. Preservation of biodiversity also preserves these valuable cultural traditions.

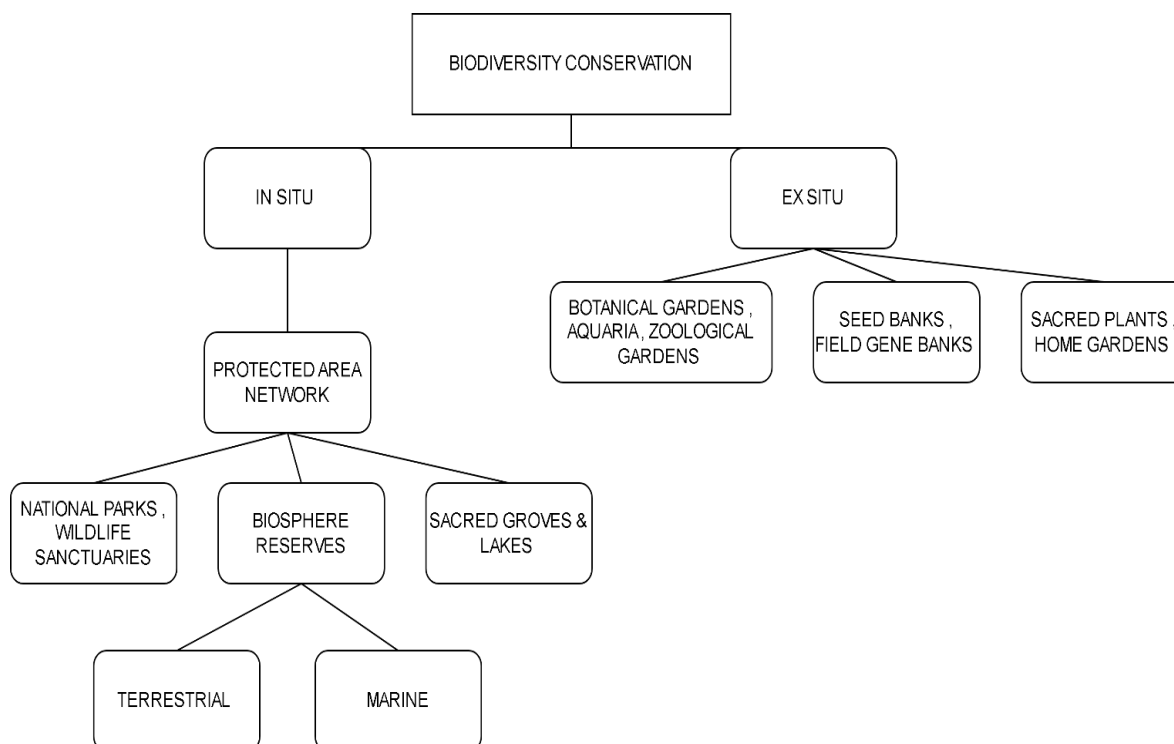
### 5. Recreational and Aesthetic Value

- **Beauty of Nature:** Biodiversity provides the natural beauty of landscapes, supplying places for recreation, leisure, and spiritual renewal. National parks, sanctuaries, and nature reserves provide sites for people to become one with nature, promoting mental and physical health. India's biodiversity in the form of places like the Himalayas, Nilgiris, and the Sundarbans attract millions of tourists every year.
- **Recreational Activities:** Biodiversity provides the basis for a variety of recreational activities such as bird watching, wildlife photography, hiking, and eco-tourism. These have economic and health benefits for local residents and tourists.

## Methodology

Biodiversity conservation is required to preserve the Earth's ecosystems, and it can be achieved through various methods. Among all, In Situ and Ex Situ are the most common conservation methods. Both In-

Situ and Ex-Situ methods of conservation have complementary roles in biodiversity conservation, with each of them addressing different aspects of conservation. It is Categorized in two types that is In-Situ and Ex-Situ conservation.



**Fig 1.1 Module 1- Biodiversity & Conservation Categories**

## 1. In-Situ Conservation (On-site Conservation)

In Situ conservation is the conservation of species and ecosystems in places where they naturally occur. This method seeks to conserve the natural habitat in which species have developed and adapted and where they can continue to grow and survive in the wild. It is the most effective way of maintaining ecological balance and biodiversity in the long term.

### Methodology for In-Situ Conservation

**Protected Areas:** Establishing national parks, wildlife sanctuaries, and biosphere reserves to protect crucial ecosystems and the species that depend on them.

- **Wildlife Corridors:** Creating biological corridors linking fragmented habitats to facilitate species migration, breeding, and gene flow.
- **Ecological Restoration:** Ecological restoration is the active process of restoring degraded ecosystems to nature so that species can migrate back to habitats.
- **Community Engagement:** Encouraging participation of local communities in the conservation and management of biodiversity so that conservation is sustainable and of benefit to both people and wildlife.

## 2. Ex Situ Conservation (Off-site Conservation)

Ex Situ conservation is the process of conserving species outside their natural habitats, usually in controlled environments like zoos, botanical gardens, gene banks, and seed banks. It is particularly helpful in the conservation of species that are in critical risk or whose habitats are in danger.

### Methodology for Ex Situ Conservation

Zoos and Aquariums: Breeding and maintaining endangered species in captivity in order to ensure their survival and sometimes to reintroduce them into the wild.

- **Botanical Gardens:** These are established to conserve plants, including endangered species, and provide research facilities for investigating plant biology and conservation.
- **Gene Banks:** A gene bank is an organization that preserves genetic material of plants, animals, and microorganisms. A gene bank preserves genetic diversity by collecting, storing, and managing DNA, sperm, eggs, and other biological samples for possible future utilization in breeding programs or for reintroduction of organisms into the wild.
- **Seed Banks:** A seed bank preserves seeds of various plant species, including crops, medicinal plants, and wild species, in order to conserve genetic material for future generations.

### Conclusion

Biodiversity is vital for the balance of the environment, the well-being of humans, and the stability of ecosystems. It supports crucial services such as food production, clean water supply, pollination, and climate regulation. The loss of biodiversity threatens not only wildlife but also the crucial services offered by ecosystems essential for the survival of humans. To counter this, conservation through the implementation of both In-Situ (on-site) and Ex-Situ (off-site) approaches is required.

In Situ conservation tries to protect species within their natural habitat for the purpose of long-term ecosystem well-being and stability. When their habitat is threatened, however, Ex Situ conservation methods such as gene banks, seed banks, and wildlife reserves are employed as back-up measures for the conservation of genetic diversity and species recovery. Gene and seed banks preserve genetic material for future breeding, restoration, and reintroduction, while wildlife reserves ensure safe environments where threatened species can reside and breed.

Collectively, these conservation measures constitute a combined method for biodiversity conservation, protecting species and ecosystems for generations to come. Through the combination of protecting their habitat and conserving their genes, these measures are essential for the preservation of a viable future for all life on the planet.

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