

## Impacts and Importances of Biological Diversity in India

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### Abstract

Biological diversity, or biodiversity, is fundamental to sustaining life on Earth, yet it is increasingly threatened by anthropogenic activities that undermine ecological stability. India is recognized as one of the world's most biodiverse nations, encompassing 10 distinct bio-geographic zones. A biodiversity hotspot is defined as a region under critical threat from human actions, harboring rare and endemic species that exemplify evolutionary processes such as speciation and extinction. Globally, 25 biodiversity hotspots have been identified, including 15 located in tropical rainforest regions. India holds a unique position within global biodiversity, being classified as a megadiverse country. It supports more than 7% of the Earth's total biodiversity, despite occupying only about 2.5% of the planet's land surface. The country possesses one of the highest concentrations of wild relatives of cultivated plant species. Approximately 10% of the Western Ghats region, one of India's major biodiversity hotspots, is under legal protection. India's documented faunal diversity includes 91,307 animal species, accounting for approximately 7.46% of the world's known fauna. This includes an estimated 8,617 insect species, 21,723 species of fish, 240 amphibians, 397 mammals, 715 reptiles, 970 birds, 26,950 additional fish species entries, and around 1,550 identified viruses. These figures highlight India's critical role in the conservation and study of global biological diversity.

**Keywords:** *India, Biological, Diversity, Ecology, Values.*

### Introduction

India is recognized as one of the fifteen most biologically diverse countries in the world due to its vast variety of plant life. It is estimated that the country is home to around 5,000 species of flowering plants, representing 141 genera and 47 families. India possesses a rich variety of crops, including 46 species of cereals and millets, 81 types of pulses, 91 fruit species, 28 varieties of spices and condiments, 76 vegetable species, 15 fibre crops, and 14 oilseed varieties. "India has passed and notified the Biological Diversity Act, 2002" to ensure the protection and sustainable use of its vast biodiversity (Rawat and Agarwal 25).

**Table 1: Plant and Crop Diversity in India**

Category	Number of Species / Types
Flowering plants (total)	17,500 species
Flowering plants (initial estimate)	5,000 species
Plant families	47 families
Plant genera	141 genera

Category	Number of Species / Types
Medicinal plants	4,000 species
Food plants	3,000 species
Religious/socio-cultural plants	700 species
Fibre-yielding plants	500 species
Gum-producing plants	3,000 species

In total, approximately 17,500 species of flowering plants have been identified in India. Among these, more than 4,000 species are used for medicinal purposes, around 3,000 species are consumed as food, 700 are employed for indigenous religious and socio-cultural purposes, 500 yield fibres, and approximately 3,000 species produce gum. Two major biodiversity hotspots of India are the Western Ghats and the Himalayas. The Western Ghats extend into Sri Lanka, while the Himalayan range stretches into Myanmar. "The Western Ghats" are highlighted as one of the major biodiversity-rich regions of India, characterized by unique flora and fauna (Negi 112).

The Himalayan hotspot includes significant biodiversity, such as an estimated 10,000 species of vascular plants, 300 mammalian species, 979 bird species, and 269 fish species. The Western Ghats comprise diverse ecosystems, including tropical rainforests, montane pine forests, and monsoon forests. Key biological diversity characteristics of the Western Ghats include: 4,000 species of angiosperms, 332 butterfly species, 288 fish species, 156 amphibians, 225 reptiles, 508 bird species, and 137 mammal species. This region extends approximately 1,500 kilometers from the mouth of the Tapti River.

**Table 2: Biodiversity Hotspots in India**

Hotspot	Key Features
<b>Western Ghats</b>	- ~4,000 angiosperm species- 332 butterfly species- 288 fish species- 156 amphibians- 225 reptiles- 508 birds- 137 mammals
	- Ecosystems: tropical rainforests, montane pine forests, monsoon forests
	- Stretch: ~1,500 km (from Tapti River to Kanyakumari)
<b>Himalayas</b>	- ~10,000 vascular plant species- 300 mammalian species- 979 bird species- 269 fish species
	- Extends into Myanmar

Invasive species are those not native to a particular ecosystem and have the potential to disrupt ecological balance. These species often exhibit traits such as rapid reproduction, developmental plasticity, a broad dietary range, and the ability to survive in various environmental conditions. Due to these characteristics, invasive species can spread quickly and cause significant ecological damage. They may lead to the extinction of native flora and fauna by competing for limited resources and altering natural habitats, thereby reducing biodiversity.

Species extinction is a natural evolutionary process. It refers to the disappearance of a species from Earth. The diversity of life results from the continuous processes of extinction and speciation over the past 3.8 billion years. It is estimated that between 5 and 50 billion species have existed at various times in Earth's history. Fossil evidence suggests that most species that once lived are now extinct. "The term biological diversity was abridged as 'biodiversity'... means the variability among living organisms from all sources," emphasizing its broad ecological scope (Singh 240).

## Review of Literature

Sutherland et al. emphasize the urgent need for focused conservation efforts by identifying "100 questions that, if answered, would have the greatest impact on the practice of conserving biological diversity worldwide" (Sutherland et al. 558). This work serves as a strategic framework guiding future biodiversity research and policy formulation at the global scale.

Shahabuddin and Rao assess that these areas "harbour a species complement distinct from that of SPAs and show lowered abundances of monitored taxa that are of conservation importance" (Shahabuddin and Rao 2931). Their study provides comparative insights into conservation models, particularly within the Indian context.

Folke, Holling, and Perrings examine biodiversity loss from a socio-ecological systems perspective, underlining that "biodiversity in large-scale ecological systems affects human well-being," and emphasize the role of incentives in promoting conservation practices (Folke, Holling, and Perrings 1020). Their contribution links ecological theory to policymaking for sustainable resource use.

The Convention on Biological Diversity (CBD), adopted in 1992, is a pivotal legal instrument that asserts biodiversity protection as a global priority, stating that biodiversity can be assessed through "changes in parameters such as productivity and population sizes," especially in the context of climate change (Un 79). The convention serves as a foundational basis for national and international biodiversity policies.

Venkataraman outlines biodiversity's role in economic development and marine ecology, observing that "use of biological diversity is critical" and highlighting how ocean biodiversity "has profound effects on fertilization of eggs of marine species" (Venkataraman 278). His work underscores the ecological and functional importance of biodiversity across sectors.

## Objective

1. To know the impacts of biological diversity in India.
2. To know the value of biological diversity in India.
3. To know the biological diversity loss in India.
4. To understand the interrelationship cultural and biodiversity.

## Method

The field survey was conducted across different seasons to ensure comprehensive data collection. The survey commenced during the monsoon season, with data collection repeated monthly over a period of two years. Variations in the periodic occurrence and frequency of herbaceous species were systematically recorded. During the field visits, data collection was carried out across various distinct ecological zones, including degraded lands, barren lands, agricultural fields, and surrounding rural landscapes.

## Discussion

India occupies approximately 2.4% of the Earth's land area and contributes nearly 7% to global biological diversity. It harbors around 8% of the world's mammalian species, 13% of bird species, 6% of reptiles, 4% of amphibians, 12% of fish species, and 6% of the world's flowering plants. India is recognized as one of the twelve megadiversity hotspots globally, alongside countries such as Bolivia, Brazil, China, and Colombia. Over 91,200 species of animals and approximately 45,500 species of plants have been recorded within India's ten bio-geographic zones.

**Table 3: Biodiversity Statistics in India**

Category	Value / Percentage
Land area of India	2.4% of Earth's total land area
Contribution to global biodiversity	Nearly 7%
Mammalian species	8% of global total
Bird species	13% of global total
Reptile species	6% of global total
Amphibian species	4% of global total
Fish species	12% of global total
Flowering plants	6% of global total
Total animal species	Over 91,200
Total plant species	Approximately 45,500
Megadiversity ranking	1 of 12 megadiversity countries
Number of bio-geographic zones	10

India encompasses a wide variety of wetland ecosystems, ranging from high-altitude cold deserts to warm and humid coastal zones. These areas support diverse wetland vegetation and faunal assemblages. However, biological diversity in India is undergoing a rapid decline. Currently, approximately 39 species of mammals, 72 species of birds, and 1,336 species of plants are classified as vulnerable or critically endangered. Additionally, several species have not been observed in the past 6 to 10 years and may already be extinct.

**Table 4: Threatened and Potentially Extinct Species in India**

Taxonomic Group	Number of Threatened Species
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Taxonomic Group	Number of Threatened Species
Birds	72
Plants	1,336
Not observed in 6–10 years	Several species (may be extinct)
Mammals	39 (vulnerable or critically endangered)

India's total mangrove coverage is limited to about 4,445 square kilometers. Despite this, the country possesses significant marine biodiversity and ranks among the world's largest producers of fish. India has a long coastline stretching over 7,517 kilometers across seven maritime states, encompassing a wide range of coastal and marine ecosystems characterized by unique and rich biological diversity.

**Table 5: Ecosystem Coverage and Natural Features**

Ecosystem / Feature	Data
Wetland ecosystems	Ranges from cold deserts to humid coasts
Mangrove cover	4,445 sq. km
Marine biodiversity	High; India is among the top fish producers
Coastline	7,517 km across 7 maritime states
Vegetation cover (green plants)	23.39% of geographical area

Vegetation cover, particularly green plants, spans approximately 23.39% of India's geographical area, playing a critical role in maintaining ecological balance. However, due to a lack of public awareness about the importance of biodiversity and inadequate environmental conservation planning, this rich biological heritage is steadily declining. According to the IUCN Red List (version 2010.4), India has 66 species of mammals, 122 species of reptiles, 30 species of amphibians, and 255 species of plants categorized as critically endangered or vulnerable.

**Table 6: Institutional and Policy Framework**

Aspect	Details
Biodiversity governance (historically)	Managed by state governments
National level initiative	Ministry of Environment
Role of the Ministry	Coordinating national biodiversity policies and conservation
Conservation efforts	Facilitating effective, timely implementation

Forest and wildlife management in India has been under the jurisdiction of state governments. However, in recent years, biodiversity conservation has gained national prominence. This ministry is tasked with facilitating timely and effective implementation of policies for wildlife conservation and ecological sustainability across the country.

## **Result**

India became a party to the Convention on Biological Diversity (CBD) in 1993 and subsequently developed its first National Biodiversity Action Plan (NBAP). In 1999, the country formulated the National Policy and Macro-Level Action Strategy on Biodiversity to support the implementation of the CBD. This policy was prepared after extensive consultations with stakeholders across sectors, which led to increased national awareness about the CBD and built momentum for legislative action. The enactment of the Biological Diversity Act in 2002 followed, providing a legal framework to support India's obligations under the CBD.

The Act mandates the central government to integrate the conservation, sustainable use, and equitable sharing of benefits from biodiversity across all relevant sectors and policies, whenever deemed necessary. The 1999 policy and the 2002 Biodiversity Act both emphasized the integration of biodiversity concerns into sectoral and cross-sectoral policies and programs. The need to meet national and international environmental obligations—including those related to climate change and desertification—led the Government of India to adopt the National Environment Policy (NEP) in 2006. While the NEP aimed to establish a comprehensive environmental strategy, it also emphasized the protection of local and traditional knowledge systems and the safeguarding of biodiversity-rich areas. These developments were instrumental in the implementation of the 2002 Biodiversity Act, which aimed to conserve biodiversity and facilitate the documentation and dissemination of biological knowledge.

Following the enactment of the Biological Diversity Act, the National Environment Policy (2006) was designed to institutionalize environmental awareness and promote legislative support for conservation. It recognized the need for the sustainable management of all environmental components, including biodiversity. The NBA plays regulatory, advisory, and administrative roles on behalf of the Government of India, overseeing biodiversity conservation and ensuring equitable benefit sharing from biological resources.

At the grassroots level, local communities in both rural and peri-urban areas have formed BMCs as autonomous entities responsible for biodiversity documentation, sustainable resource use, and the conservation of indigenous cultivars, folk species, farm animals, and native breeds associated with local ecosystems.

## **Policies for Protocol**

- Agrarian Strategies
- National Land Management Policies
- Water Management Policies

## **Research and Tourism Policies**

- Agrarian Land Management Policies were formulated in 2005 under the initiative of the Ministry of Agriculture, Government of India, aiming to enhance sustainable agricultural practices and land productivity.
- National Land Management Policies were initially proposed in 1976, following recommendations by the National Land Use Policy Committee, to ensure optimal and scientific utilization of land resources.

- Water Management Policies were officially introduced in 2016 to address the sustainable use, distribution, and conservation of water resources at both regional and national levels.
- Research and Tourism Policies were implemented in 2002 with a focus on promoting responsible tourism practices, research-driven development, and conservation of natural and cultural heritage.

## Conclusion

Biological diversity is undergoing degradation at an increasingly rapid rate. Although there are multiple contributing factors, anthropogenic activities remain the primary cause of biodiversity loss. Developmental processes, due to inadequate consideration for environmental consequences, have resulted in unsustainable patterns that threaten ecological stability. Deforestation for agriculture, introduction of non-native species, lack of technical expertise in synthetic material usage, and overexploitation of natural resources have all contributed significantly to this decline. Additionally, climate change and global warming have emerged as major threats to ecological integrity, further accelerating environmental degradation. The Constitution of India outlines specific provisions for the protection and enhancement of environmental quality. It emphasizes the need for scientific efforts aimed at preserving and improving the ecosystem and conserving the country's native flora and fauna. It also places a moral and civic responsibility on citizens to show respect and concern for all forms of life. These constitutional directives reflect the national ethical commitment to environmental protection and sustainable development.

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