

Assessment of Wildlife Diversity and Conservation Priorities in India

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ABSTRACT

India is one of the world's megadiverse countries and supports a remarkable diversity of terrestrial, freshwater, coastal and marine ecosystems. Although India occupies only about 2.4% of the world's geographical area, it supports approximately 7–8% of recorded global species diversity. The country's wildlife includes globally important populations of tiger, Asian elephant, Asiatic lion, greater one-horned rhinoceros, leopard, wild buffalo, snow leopard, gharial, several species of primates and numerous threatened birds and reptiles. Four global biodiversity hotspots—the Himalayas, Western Ghats, Indo-Burma region and Nicobar-related island ecosystems—occur partly within India. The present study assesses India's wildlife diversity and identifies major conservation priorities using secondary information, with particular emphasis on data available for or referring to the **2022 assessment period**. The study examines population trends of selected flagship species, protected-area conservation, habitat fragmentation, human-wildlife conflict, invasive species, poaching, climate change and the need for landscape-level conservation. The 2022 All India Tiger Estimation estimated India's tiger population at **3,682 individuals**, with an estimated range of 3,167–3,925. The assessment covered approximately 6.41 lakh km of survey effort and used camera trapping and spatially explicit capture-recapture approaches. The findings indicate that India has achieved measurable conservation gains for several flagship species, but species recovery remains uneven across landscapes. Conservation priorities should therefore extend beyond individual protected areas towards ecological corridors, habitat restoration, community participation, scientific monitoring, reduction of human-wildlife conflict and stronger protection of critically endangered species. The study concludes that India's future wildlife conservation strategy requires an integrated landscape approach combining protected areas, community-managed landscapes, ecological corridors, species recovery programmes and climate-resilient habitat management.

Keywords: *Wildlife diversity; biodiversity; India; conservation; protected areas; tiger; elephant; habitat fragmentation; endangered species; human-wildlife conflict.*

Introduction

India possesses exceptionally high biological diversity because of its wide range of geographical, climatic and ecological conditions. The country includes the Himalayan mountain system, Indo-Gangetic plains, deserts, semi-arid

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landscapes, tropical forests, Western Ghats, northeastern forests, wetlands, islands, coastal ecosystems and marine environments.

India's biological diversity is particularly significant because the country contains portions of four globally recognised biodiversity hotspots. The Indian landscape also supports numerous endemic and threatened species. According to IUCN's India overview, the country accounts for approximately 7–8% of recorded species while occupying only about 2.4% of global land area.

Wildlife conservation in India has developed through a combination of legislation, protected areas, species-specific programmes, scientific monitoring and community participation. Important programmes include Project Tiger, Project Elephant and species recovery programmes for critically endangered wildlife. The **Wildlife (Protection) Act, 1972**, the Biological Diversity Act, 2002, forest legislation and associated conservation policies have established an institutional framework for protecting India's wildlife. However, wildlife conservation cannot be evaluated solely by counting protected areas or individual animals. Contemporary conservation requires consideration of:

- Habitat Quality;
- Ecological Connectivity;
- Genetic Diversity;
- Population Viability;
- Human-Wildlife Conflict;
- Climate Change;
- Invasive Species;
- Infrastructure Development;
- Illegal Wildlife Trade;
- Community Participation
- Ecosystem Services.

The present study therefore attempts to provide an integrated assessment of wildlife diversity and conservation priorities using evidence relevant to the 2022 period.

Review of Literature

Biodiversity and wildlife conservation in India

India's biodiversity has been extensively documented by government institutions, universities and international conservation organisations. IUCN identifies India as a megadiverse country containing a wide variety of terrestrial, freshwater, coastal and marine ecosystems.

The Wildlife Institute of India (WII), National Tiger Conservation Authority (NTCA), Ministry of Environment, Forest and Climate Change (MoEFCC), Forest Survey of India (FSI) and state forest departments provide major sources of information for wildlife assessment.

Tiger conservation

Tiger conservation represents one of India's most prominent wildlife-management programmes. Project Tiger was initiated in 1973 and subsequently developed into a nationwide programme involving tiger reserves, landscape conservation and systematic monitoring. The 2022 tiger assessment provided evidence of continued population recovery. The official assessment estimated **3,682 tigers**, compared with 2,967 in 2018, although the assessment range was 3,167–3,925. The assessment involved extensive field surveys and camera trapping. WII reported 32,803 camera-trap locations and identification of more than 3,080 individual tigers during the 2022 exercise. This demonstrates the importance of systematic scientific monitoring in evaluating conservation outcomes.

Elephant conservation

The Asian elephant (*Elephas maximus*) is another major conservation priority in India.

According to information available around the 2022–23 period, India's most recent national elephant estimate was the **2017 estimate of 29,964 wild elephants**. WII reported that India contained approximately 60% of the Asian elephant population, with 32 elephant reserves covering about 76,508 km² across 14 states. Elephant conservation is particularly challenging because elephants require extensive landscapes and frequently move outside protected areas. Consequently, ecological corridors and conflict mitigation are critical.

Protected areas

Protected areas constitute the foundation of India's in-situ wildlife conservation strategy. They include:

1. National Parks;
2. Wildlife Sanctuaries;
3. Conservation Reserves; and
4. Community Reserves.

The protected-area system has expanded substantially over several decades. These areas provide habitats for threatened species, maintain ecological processes and support ecosystem services.

However, protected areas can become isolated ecological islands when surrounding landscapes are converted for agriculture, settlements, mining, roads, railways and other infrastructure.

Therefore, protected-area expansion alone cannot guarantee long-term wildlife conservation.

Habitat fragmentation

Habitat fragmentation is among the major threats to India's wildlife. Roads, railway lines, irrigation projects, mining, urbanisation, agriculture and other infrastructure can divide continuous habitats.

Large mammals such as elephants and tigers require connectivity between habitat patches. Fragmentation can restrict movement, increase mortality and intensify encounters between wildlife and humans.

The elephant situation illustrates this challenge. WII reported that a substantial proportion of India's elephants occur in fragmented landscapes rather than only in large contiguous forests.

Human-wildlife conflict

Human-wildlife conflict has become an increasingly important conservation issue.

Major conflict species include:

- Elephants;
- Tigers;
- Leopards;
- Bears;
- Wild Boar;
- Monkeys;
- Nilgai
- Several Other Large Mammals.

Crop damage, livestock depredation, human injuries and deaths can create negative attitudes toward wildlife conservation.

Consequently, conservation policy must address both ecological and socioeconomic dimensions.

Objectives of the Study

The major objectives of the study are:

1. To assess the status of wildlife diversity in India.
2. To examine selected wildlife population trends using data available for the 2022 period.
3. To assess the role of protected areas in wildlife conservation.
4. To identify major threats to India's wildlife.
5. To examine the significance of ecological corridors and habitat connectivity.
6. To assess major conservation programmes in India.
7. To identify priority species and landscapes requiring enhanced conservation attention.
8. To suggest strategies for strengthening wildlife conservation in India.

Methodology

Research design

The study follows a **descriptive and analytical research design** based primarily on secondary information.

Sources of data

Information was compiled from:

- Ministry of Environment, Forest and Climate Change;
- Wildlife Institute of India;
- National Tiger Conservation Authority;
- Forest Survey of India;
- Project Elephant;
- IUCN;
- Scientific Publications;
- Government Reports;
- Biodiversity Databases
- Published Research Literature.

The study gives particular emphasis to data relating to the **2022 assessment period**. The 2022 tiger assessment was officially published in 2023 by NTCA and WII and therefore represents an important source for a research paper intended for 2023 publication.

Wildlife Diversity of India

India's wildlife diversity is distributed across different biogeographic regions.

Major Wildlife Ecosystems of India

Ecosystem	Representative wildlife
Himalayan ecosystem	Snow leopard, Himalayan tahr, musk deer, red panda
Northeast forests	One-horned rhinoceros, hoolock gibbon, clouded leopard
Western Ghats	Lion-tailed macaque, Nilgiri tahr, gaur, tiger
Central Indian forests	Tiger, leopard, sloth bear, gaur, wild dog
Gangetic wetlands	Ganges river dolphin, gharial, freshwater turtles
Desert ecosystem	Great Indian Bustard, desert fox, chinkara
Mangroves	Royal Bengal tiger, estuarine crocodile, fishing cat
Coastal and marine ecosystems	Dugong, marine turtles, dolphins, coral-associated fauna
Islands	Nicobar megapode, dugong, endemic reptiles and birds

The distribution demonstrates that wildlife conservation in India requires ecosystem-specific as well as species-specific strategies.

Selected Wildlife Population Indicators**Selected Wildlife Population Indicators Relevant to the 2022 Period**

Species/group	Population estimate or indicator	Assessment period/source
Tiger	3,682	2022
Asian elephant	29,964	2017 estimate available during 2022 period
Asiatic lion	674	2020
Greater one-horned rhinoceros	Approximately 4,000+ nationally	Around 2022
Tiger habitat monitoring	6.41 lakh km survey effort	2022
Camera-trap locations for tiger assessment	32,803	2022
Wild tiger individuals uniquely identified	>3,080	2022
Elephant reserves	32	Around 2022

The tiger estimate of 3,682 is directly reported by the 2022 All India Tiger Estimation.

The elephant figure of 29,964 represents the national 2017 estimate that remained an important reference around the 2022 period; it should not be described as a new 2022 census.

Tiger Population: Evidence of Conservation Progress

Tiger Population Estimates in India

Year	Estimated Tiger Population
2006	1411
2010	1706
2014	2226
2018	2967
2022	3682

Source: NTCA/WII All India Tiger Estimation.

The data indicate a substantial increase in estimated tiger numbers between 2006 and 2022.

However, national-level growth should not be interpreted as uniform recovery across all tiger landscapes. Conservation outcomes vary geographically, and some populations remain vulnerable because of habitat isolation, prey availability, human pressures and other local factors.

Elephant Conservation

The Asian elephant requires large connected habitats.

The 2017 national estimate recorded approximately **29,964 wild elephants** in India.

Major elephant conservation issues

1. Habitat fragmentation.
2. Crop raiding.
3. Railway and road mortality.
4. Electric fencing.
5. Habitat degradation.
6. Expansion of agriculture.
7. Loss of traditional movement corridors.
8. Human-elephant conflict.

WII reported that only around 30% of wild elephants were living in large contiguous forests, while many others occurred in fragmented landscapes. This provides strong justification for prioritising elephant corridors in conservation planning.

Protected Areas and Wildlife Conservation

Protected areas are central to India's conservation strategy.

They perform several functions:

- Protection of Wildlife Habitats;
- Maintenance of Ecological Processes;
- Prevention of Hunting;
- Conservation of Threatened Species;

- Protection of Watersheds;
- Carbon Storage;
- Maintenance of Genetic Resources; And
- Provision of Opportunities For Ecological Research And Environmental Education.

The MoEFCC identifies protected areas as an important mechanism for maintaining ecological viability of wildlife-rich landscapes. Nevertheless, protected areas alone cannot conserve species whose home ranges extend beyond their boundaries.

Major Threats to Wildlife in India

- ❖ **Habitat loss:** Habitat conversion for agriculture, settlements, industries, mining and infrastructure remains one of the fundamental threats.
- ❖ **Habitat fragmentation:** Fragmentation divides large habitats into smaller patches and restricts animal movement.
- ❖ **Human-wildlife conflict:** Conflict becomes particularly serious where wildlife habitats overlap with agricultural and settlement areas.
- ❖ **Poaching and illegal wildlife trade:** Illegal hunting and wildlife trafficking continue to pose risks to selected species.
- ❖ **Climate change:** Changes in temperature, rainfall, drought frequency, extreme weather events and sea-level conditions can alter wildlife habitats.
- ❖ **Invasive species:** Invasive plants can alter habitat structure and reduce the availability of native vegetation. The 2022 tiger assessment programme also examined invasive plant spread and reported concerns over invasive species across Indian biomes.
- ❖ **Infrastructure development:** Roads, railway lines, transmission infrastructure and other linear projects can interrupt animal movement.
- ❖ **Pollution:** Plastic pollution, pesticides, industrial contaminants, sewage and other pollutants can adversely affect wildlife.

Conservation Priorities: Based on the assessment, the following conservation priorities are proposed.

Priority 1: Protect critical habitats: Critical wildlife habitats should receive effective protection from incompatible land-use changes.

Priority 2: Maintain ecological corridors: Wildlife corridors should be integrated into regional and infrastructure planning. This is particularly important for:

- ❖ Elephants;
- ❖ Tigers;
- ❖ Leopards;
- ❖ Bears;
- ❖ Wild Dogs
- ❖ Other Wide-Ranging Species.

Priority 3: Strengthen threatened-species recovery: Species with extremely small or fragmented populations should receive targeted recovery programmes. Priority groups include:

- Great Indian Bustard;
- Gharial;
- Red Panda;
- Snow Leopard;

- Lion-Tailed Macaque;
- Nilgiri Tahr;
- Dugong;
- Jerdon's Courser;
- Vultures;
- Indian Pangolin
- Selected Endemic Reptiles and Amphibians.

Priority 4: Reduce human-wildlife conflict: Conflict management should include:

- Early-Warning Systems;
- Rapid Response Teams;
- Compensation Mechanisms;
- Crop Protection;
- Community Participation;
- Safe Wildlife Passages
- Scientifically Designed Barriers.

Priority 5: Community participation: Local communities should be treated as important partners in conservation. Community-based conservation can contribute to:

- Habitat Protection;
- Wildlife Monitoring;
- Conflict Mitigation;
- Ecotourism;
- Restoration
- Sustainable Livelihood Development.

Priority 6: Scientific monitoring: Conservation decisions should increasingly rely on:

- Camera Trapping;
- Gis;
- Remote Sensing;
- Environmental Dna;
- Genetic Analysis;
- Acoustic Monitoring;
- Satellite Telemetry
- Long-Term Population Monitoring.

The 2022 tiger assessment demonstrates the value of large-scale scientific monitoring using camera traps and spatially explicit analytical methods.

Conservation Programmes in India**Major Wildlife Conservation Programmes**

Programme	Major target
Project Tiger	Tiger and tiger landscapes
Project Elephant	Asian elephant and elephant habitats
Project Snow Leopard	Himalayan high-altitude ecosystems
Project Crocodile	Crocodylians
Project Dolphin	River and marine dolphins
Integrated Development of Wildlife Habitats	Protected areas and wildlife habitats
Species Recovery Programme	Critically endangered species
National Biodiversity Programme	Biodiversity conservation
Project Cheetah	Reintroduction of cheetah
Vulture Conservation Programme	Threatened vulture species

India's conservation framework combines protected areas, species-specific programmes and landscape-level management.

Conservation Prioritisation Framework

A useful conservation-priority framework can be developed using five major criteria:

Suggested Conservation Priority Criteria

Criterion	Key indicator
Population status	Population size and trend
Habitat condition	Habitat availability and quality
Fragmentation	Connectivity between populations
Threat intensity	Poaching, conflict, infrastructure etc.
Ecological importance	Keystone/umbrella/endemic role

A species or landscape experiencing a combination of small population size, rapid habitat loss and severe fragmentation should receive enhanced conservation attention.

Findings of the Study

The major findings are as follows:

- **Finding 1: India possesses exceptional wildlife diversity:** India's geographical and ecological diversity supports a very large range of animal species and habitats.
- **Tiger conservation has produced measurable population recovery:** The 2022 national tiger estimate of 3,682 demonstrates substantial growth compared with previous national assessments.
- **Conservation success varies between species:** Improvement in the population of selected flagship species does not necessarily mean that all threatened wildlife is recovering.
- **Habitat connectivity is increasingly important:** Large mammals require landscapes extending beyond individual protected areas.
- **Elephant conservation requires landscape-level planning:** The distribution of elephants across fragmented landscapes makes corridor conservation and conflict mitigation essential.
- **Protected areas remain essential:** Protected areas provide important refuges for wildlife, but they need ecological connectivity with surrounding landscapes.
- **Human-wildlife conflict represents both a conservation and socioeconomic problem:** Long-term wildlife conservation requires mechanisms that reduce costs to local communities.
- **Scientific monitoring is increasingly important:** The 2022 tiger estimation illustrates how camera trapping, digital tools and spatial modelling can improve population assessment.
- **Climate change introduces additional uncertainty:** Conservation planning must increasingly incorporate climate projections and ecosystem resilience.
- **Community participation is indispensable:** Wildlife conservation cannot depend exclusively on government-managed protected areas because many species use human-dominated landscapes.

Suggestions

Based on the findings, the following suggestions are proposed.

- Expand ecological corridor protection between major wildlife habitats.
- Integrate wildlife considerations into infrastructure planning.
- Develop wildlife crossings across major roads and railway lines.
- Strengthen compensation and insurance mechanisms for affected communities.
- Increase investment in scientific wildlife monitoring.
- Strengthen anti-poaching and wildlife-crime investigation systems.
- Promote habitat restoration using native species.
- Develop climate-resilient conservation plans.
- Increase community participation in conservation.
- Promote biodiversity education among students and local communities.
- Strengthen conservation outside protected areas.
- Establish long-term monitoring programmes for threatened species.
- Improve coordination between neighbouring states sharing wildlife landscapes.
- Promote responsible ecotourism.
- Incorporate genetic diversity into species recovery programmes.
- Improve protection of wetlands, grasslands and coastal ecosystems in addition to forests.
- Give greater attention to lesser-known threatened species rather than concentrating exclusively on flagship mammals.
- Integrate biodiversity conservation with sustainable livelihood programmes.

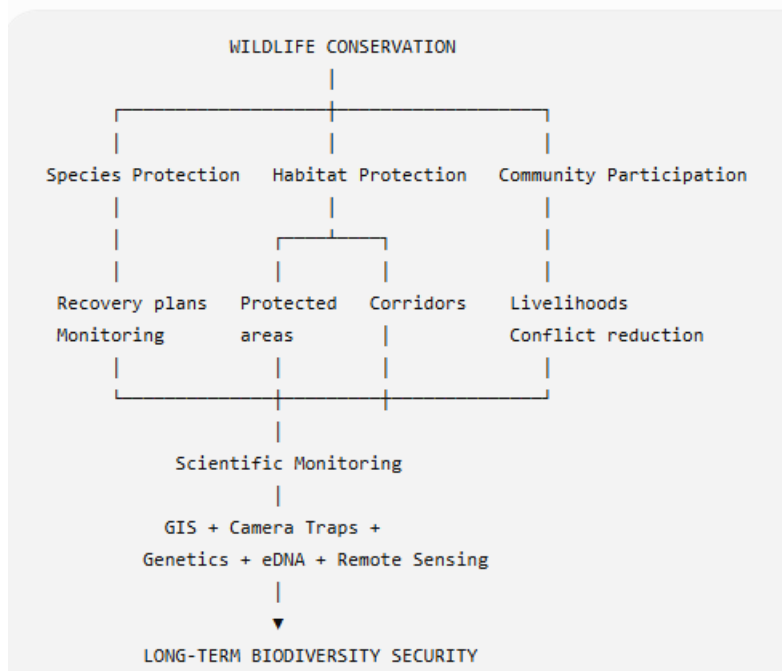
Discussion

The assessment demonstrates that India's wildlife conservation experience contains both significant achievements and continuing challenges. The increase in tiger numbers provides an important example of what sustained conservation intervention, habitat protection and scientific monitoring can achieve. The 2022 assessment used extensive field surveys and camera trapping and estimated 3,682 tigers. However, conservation should not be evaluated solely through national population totals. Wildlife populations can become increasingly concentrated in particular landscapes while disappearing from others. Maintaining genetic exchange and ecological connectivity is therefore important. Elephants provide a contrasting example. Their conservation requires extensive landscapes because elephants frequently move outside protected areas. WII's reporting on the distribution of elephants across fragmented landscapes demonstrates the importance of corridor protection and conflict mitigation. Similarly, threatened birds, reptiles, amphibians and small mammals may receive considerably less attention than charismatic species despite their ecological importance.

Therefore, India's conservation policy should combine: **Species conservation + Habitat conservation + Corridor conservation + Community participation + scientific monitoring.**

Proposed Conservation Model for India

Integrated Wildlife Conservation Model



Conclusion

India is a globally significant centre of wildlife diversity. Its diverse ecosystems support numerous endemic, threatened and ecologically important species. The country has developed a substantial conservation framework consisting of protected areas, species recovery programmes, scientific monitoring and community-oriented initiatives. The 2022 tiger assessment provides evidence of considerable progress in tiger conservation, with an estimated 3,682 tigers in the country. At the same time, the continued fragmentation of habitats and increasing interaction between wildlife and

human populations demonstrate that conservation challenges remain substantial. The future of wildlife conservation in India depends on moving from an exclusively protected-area approach towards a landscape and ecosystem approach. Protected areas must be connected through ecological corridors, degraded habitats should be restored and communities should participate meaningfully in conservation. The assessment therefore identifies habitat connectivity, threatened-species recovery, human-wildlife conflict mitigation, scientific monitoring, community participation and climate-resilient conservation as central priorities. A successful wildlife strategy should not merely aim to increase the number of individual animals. It should maintain viable populations, functional ecosystems, genetic connectivity and coexistence between wildlife and human communities. Such an integrated approach can contribute substantially to India's long-term biodiversity security and ecological sustainability.

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