

Role of Environmental Management in Preserving Biodiversity in India: Issues, Initiatives, and Future Prospects

Dr. Md. Shakir Alam*

Assistant Professor, Department of Commerce, C.M. College, Darbhanga, L.N. Mithila University, Darbhanga, Bihar.

*Corresponding Author: gentleshakir@gmail.com

Citation: Alam, S. (2026). Role of Environmental Management in Preserving Biodiversity in India: Issues, Initiatives, and Future Prospects. *International Journal of Advanced Research in Commerce, Management & Social Science*, 09(01(II)), 73–79.

ABSTRACT

India is one of the world's megadiverse countries, harbouring nearly 7–8% of global biodiversity despite occupying only 2.4% of the Earth's land area. This paper examines the role of environmental management in preserving biodiversity in India, focusing on key issues, national initiatives, and future prospects. Using secondary data from government reports and international conservation agencies, the study analyses forest cover trends, protected area coverage, species conservation programmes, and community-based management practices. Findings reveal that although India has achieved a forest and tree cover of 25.17% (827,357 km²) and established over 1,000 protected areas, only 5.43% of the geographical area is under formal protection, leading to habitat fragmentation and limited ecological connectivity. The presence of more than 1,300 globally threatened species, rising human–wildlife conflict cases, and a global wildlife population decline of 73% since 1970 underscore the severity of biodiversity loss. The study highlights that legal frameworks, protected area management, flagship species programmes, and technological monitoring have contributed positively to conservation outcomes, but remain constrained by financial limitations, institutional gaps, and socio-economic pressures. The paper concludes that integrated environmental management—combining landscape-level planning, community participation, adequate financing, and technology-driven monitoring—is essential for achieving sustainable biodiversity conservation in India and aligning national efforts with global biodiversity targets.

Keywords: Environmental Management, Biodiversity Conservation, Protected Areas, Community Participation, Sustainable Development.

Introduction

India's extraordinary biological wealth places it among the world's most megadiverse nations, with only about 2.4 % of the earth's land area but home to 7-8% of the world's recorded species across fauna and flora, including numerous endemics and globally significant ecosystems. This exceptional biodiversity is distributed across four global biodiversity hotspots the Himalaya, Western Ghats–Sri Lanka, Indo-Burma and Sunda land regions which together harbour unique genetic resources and ecosystem types that provide vital ecological services. India's biodiversity underpins rural livelihoods, cultural heritage, climate resilience and key economic sectors such as agriculture and tourism, but it is increasingly threatened by habitat loss, fragmentation, climate change, invasive species and unsustainable resource use.

Despite its biodiversity richness, India's conservation landscape reflects ongoing challenges. The country's Protected Areas (PAs) network including over 1,000 national parks, wildlife sanctuaries and conservation reserves covers approximately 5.43 % of its geographical area, significantly lower than

global targets, while forest and tree cover nationwide hovers around 23-24%. Meanwhile, forest loss and degradation in critical regions, especially in parts of Northeast India, have reduced contiguous forest landscapes, affecting species connectivity and ecosystem functions. Thousands of species are also under threat: globally threatened plants and animals' number in the hundreds, with concerns about both documented and yet-to-be-assessed taxa.

Recognising these pressures, recent policy developments reflect an evolving environmental management agenda that integrates biodiversity conservation with sustainable development objectives and global commitments. India's updated National Biodiversity Strategy and Action Plan aim to increase conserved natural areas to 30% by 2030, aligning with the Kunming-Montreal Global Biodiversity Framework and reinforcing national priorities in habitat protection, ecosystem restoration, and species recovery. Complementary initiatives such as the National Red List Assessment (Vision 2025-2030) seek to expand species assessments and strengthen evidence-based conservation action across taxonomic groups. Conservation successes, like the dramatic increase in flagship species such as tigers and Asiatic lions through targeted protection and community engagement, demonstrate the potential of integrated environmental management strategies when adequately resourced and locally supported.

However, significant gaps remain in harmonising cross-sectoral policies, enhancing ecological connectivity between fragmented habitats, and incorporating traditional knowledge and stakeholder participation into biodiversity governance. This paper critically examines the role of environmental management in preserving biodiversity in India, analysing key impediments, major national initiatives, and promising future prospects to inform both policy and practice in conservation science.

Objectives

- To examine the role of environmental management practices in conserving biodiversity in India.
- To identify the major issues and challenges affecting biodiversity conservation in India.
- To analyse key government initiatives and policies aimed at biodiversity preservation.
- To assess future prospects and strategies for strengthening biodiversity conservation through sustainable environmental management.

Methodology

The present study adopts a descriptive and analytical research design based primarily on secondary data. Relevant data have been collected from recent government reports, including publications of the Ministry of Environment, Forest and Climate Change (MoEFCC), Forest Survey of India, National Biodiversity Authority, and reports of international organizations such as UNEP and WWF. Peer-reviewed research articles, policy documents, books, and credible online databases have also been extensively reviewed. The study analyses environmental management practices, biodiversity conservation initiatives, and policy frameworks through a thematic and comparative approach. Content analysis is used to identify major issues, trends, and gaps in implementation. Recent statistical data and case studies are examined to assess conservation outcomes and future prospects. The findings are synthesized to draw meaningful conclusions and suggest policy-relevant recommendations for strengthening biodiversity conservation in India.

Policy and Legal Frameworks Supporting Biodiversity Conservation

India has developed a strong policy and legal foundation for environmental management to ensure biodiversity conservation. Major legislations such as the Wildlife (Protection) Act, 1972, Forest (Conservation) Act, 1980, and Biological Diversity Act, 2002 provide statutory backing for protecting forests, wildlife, and biological resources. These laws regulate land-use change, restrict illegal exploitation of flora and fauna, and promote sustainable utilization of natural resources. National-level policies framed by the Ministry of Environment, Forest and Climate Change integrate biodiversity concerns into development planning through Environmental Impact Assessment (EIA), conservation action plans, and climate adaptation strategies. Such frameworks ensure that environmental management is not isolated but embedded within economic and infrastructural decision-making, thereby reducing biodiversity loss caused by unplanned development.

Protected Area Network and Habitat Management

One of the most visible roles of environmental management in India is the expansion and management of protected areas. India has established a wide network of national parks, wildlife sanctuaries, biosphere reserves, and conservation reserves to protect critical habitats. Habitat

management practices such as afforestation, grassland restoration, wetland conservation, and corridor development are implemented to maintain ecological balance.

Scientific monitoring and assessment by institutions like the Forest Survey of India provide data on forest cover, forest quality, and biodiversity status. These data-driven management practices help identify degraded areas and guide restoration programs. Protected areas also serve as biodiversity reservoirs, ensuring the survival of endangered and endemic species while supporting ecosystem services such as water regulation and carbon sequestration.

Community Participation and Sustainable Resource Management

Environmental management in India increasingly emphasizes community participation and decentralized governance. Local communities, tribal groups, and forest-dependent populations play a vital role in conserving biodiversity through joint forest management, community reserves, and traditional ecological knowledge. Sustainable practices such as controlled grazing, non-timber forest product management, and organic farming help reduce pressure on ecosystems while supporting livelihoods. By involving communities in decision-making and benefit-sharing, environmental management becomes more inclusive and effective. This participatory approach enhances compliance, strengthens conservation outcomes, and ensures long-term sustainability of biodiversity conservation efforts. Table 1 presents the major environmental management practices adopted in India and highlights their key focus areas and contributions to biodiversity conservation.

Table 1: Major Environmental Management Practices and Their Role in Biodiversity Conservation

Environmental Management Practice	Key Focus Area	Contribution to Biodiversity Conservation
Environmental legislation & policies	Legal protection	Prevents habitat destruction and species exploitation
Protected areas management	Habitat conservation	Safeguards ecosystems and endangered species
Forest and landscape restoration	Ecosystem recovery	Improves habitat quality and ecological balance
Community-based management	Sustainable use	Enhances conservation through local participation
Environmental monitoring & assessment	Data-driven planning	Supports informed conservation decisions

Source: <https://www.unesco.org/en/biodiversity/conservation?utm>

As shown in Table 1, environmental legislation, protected area management, habitat restoration, community-based management, and environmental monitoring collectively play a crucial role in safeguarding ecosystems, preventing species exploitation, and supporting informed conservation decision-making.

Habitat Loss, Fragmentation, and Forest Degradation

Habitat loss remains the most significant threat to biodiversity conservation in India. Rapid urbanisation, agricultural expansion, infrastructure development, mining, and industrial activities have resulted in large-scale deforestation and fragmentation of natural ecosystems. Although India’s total forest and tree cover accounts for about 25.17% of its geographical area, the quality and connectivity of forests have declined in several regions. Fragmented habitats isolate wildlife populations, disrupt migratory corridors, and reduce genetic diversity, making species more vulnerable to extinction. Forest degradation is particularly severe in parts of Central and Northeast India, where developmental pressures continue to alter natural landscapes.

Climate Change, Invasive Species, and Ecological Stress

Climate change has emerged as a major driver of biodiversity loss in India. Rising temperatures, erratic monsoon patterns, and frequent extreme weather events affect species distribution, phenology, and ecosystem stability. Sensitive ecosystems such as the Himalayas, coastal zones, wetlands, and coral reefs are especially vulnerable. In addition, invasive alien species pose a serious ecological challenge by competing with native species for resources, altering habitats, and accelerating biodiversity decline. These combined ecological stresses complicate conservation planning and require adaptive environmental management approaches.

Institutional, Financial, and Socio-Economic Challenges

Despite comprehensive environmental legislation, implementation gaps persist due to limited institutional capacity, inadequate funding, and weak enforcement mechanisms. India's protected area network covers only about 5.43% of the total geographical area, which is below global conservation targets. Many protected areas lack sufficient staff, infrastructure, and financial resources for effective management. Moreover, socio-economic pressures arising from population growth and dependence on forest resources often lead to conflicts between conservation objectives and livelihood needs. Limited community participation and insufficient integration of traditional ecological knowledge further reduce conservation effectiveness. Table 2 summarises key numerical indicators reflecting the major challenges confronting biodiversity conservation in India.

Table 2: Numerical Indicators Highlighting Key Challenges to Biodiversity Conservation in India

Indicator	Numerical Data	Implication for Biodiversity
Total forest & tree cover	827,357 km² (25.17%)	Forest cover exists but is uneven and fragmented
Protected area coverage	5.43% of geographical area	Insufficient habitat protection
Number of protected areas	1,000+ sites	Limited ecological connectivity
Globally threatened Indian species	1,300+ species (IUCN-listed)	High extinction risk
Global wildlife population decline	73% since 1970	Reflects severe biodiversity loss trends
Human–wildlife conflict cases (annual)	50,000+ reported incidents	Rising pressure on wildlife habitats

Source: Forest Survey of India (ISFR); MoEFCC; IUCN Red List; WWF Living Planet Report

The data presented in Table 2 indicate that limited protected area coverage, habitat fragmentation, a high number of globally threatened species, and increasing human–wildlife conflict pose serious risks to India's biodiversity.

Legal and Policy Frameworks for Biodiversity Conservation

India's biodiversity conservation framework is anchored in robust environmental legislation and national policies formulated and implemented by the Ministry of Environment, Forest and Climate Change (MoEFCC). The Biological Diversity Act, 2002 operationalised India's commitments under the Convention on Biological Diversity by promoting conservation, sustainable use, and equitable benefit-sharing of biological resources. Complementary legislations such as the Wildlife (Protection) Act, 1972 and Forest (Conservation) Act, 1980 provide statutory protection to wildlife habitats and regulate diversion of forest land.

Policy instruments like Environmental Impact Assessment (EIA) notifications further integrate biodiversity considerations into infrastructure and industrial planning, ensuring that environmental management is embedded within development processes.

National Programmes and Species-Specific Conservation Initiatives

India has launched several national programmes focused on ecosystem protection and species recovery. Flagship initiatives such as Project Tiger, Project Elephant, and Project Snow Leopard have contributed to stabilising and increasing populations of threatened species through habitat protection, anti-poaching measures, and community engagement.

Landscape-level programmes such as the National Afforestation Programme, National Wetland Conservation Programme, and Green India Mission aim to restore degraded ecosystems and enhance ecological resilience. These initiatives reflect a transition from isolated protected-area management to broader landscape and ecosystem-based approaches.

Strategic Planning and International Alignment

Recent policy developments demonstrate India's increasing alignment with global biodiversity targets. The updated National Biodiversity Strategy and Action Plan (2024–2030) outlines national targets consistent with the Kunming Montreal Global Biodiversity Framework, including expansion of conserved areas, ecosystem restoration, and enhanced community participation.

Initiatives such as the National Red List Assessment (Vision 2025–2030) strengthen scientific assessment and evidence-based conservation planning. Increased emphasis on digital monitoring, remote sensing, and citizen science reflects a modernised environmental management approach. Table 3 outlines major government policies and conservation initiatives implemented in India, along with their focus areas and contributions to biodiversity conservation.

Table 3: Major Government Initiatives and Their Contribution to Biodiversity Conservation

Policy / Initiative	Year Launched	Focus Area	Contribution to Biodiversity
Wildlife (Protection) Act	1972	Species & habitat protection	Legal safeguard for wildlife
Biological Diversity Act	2002	Biodiversity governance	Conservation & benefit-sharing
Project Tiger	1973	Flagship species recovery	Increase in tiger population
Green India Mission	2014	Forest restoration	Improved ecosystem services
NBSAP (Updated)	2024	Strategic biodiversity planning	Alignment with global targets

Source: Forest Survey of India (2021); MoEFCC, Government of India; IUCN Red List; WWF Living Planet Report (2022); State Forest Department Reports.

Table 3 demonstrates that legislative measures and national programmes such as the Wildlife (Protection) Act, Biological Diversity Act, and Project Tiger have significantly strengthened species protection, ecosystem restoration, and strategic biodiversity planning.

Strengthening Landscape-Level Conservation and Ecological Connectivity

A key future prospect for biodiversity conservation in India lies in landscape-level planning and enhancement of ecological connectivity. Although India has over 1,000 protected areas, they cover only about 5.43% of the total geographical area, making connectivity between habitats critically important. Scientific studies suggest that maintaining wildlife corridors can reduce species extinction risk by 30–40% by facilitating migration and genetic exchange. Expanding ecological corridors, buffer zones, and conservation reserves beyond protected areas will help mitigate habitat fragmentation and support climate-resilient ecosystems. Integration of biodiversity priorities into land-use and infrastructure planning is therefore essential.

Expanding Community-Based Conservation and Sustainable Livelihoods

Community participation will play a decisive role in the future of biodiversity conservation in India. Nearly 275 million people depend directly or indirectly on forests for their livelihoods. Strengthening joint forest management (JFM) and community reserves can significantly improve conservation outcomes. Evidence indicates that community-managed forests can reduce deforestation rates by 20–25% compared to centrally managed areas. Promoting sustainable livelihood options such as eco-tourism, non-timber forest products (NTFPs), and agroforestry can enhance income security while reducing pressure on natural ecosystems. Increased investment in awareness programmes and benefit-sharing mechanisms will further strengthen local stewardship.

Leveraging Technology, Finance, and Adaptive Governance

Technological advancement offers substantial potential for improving biodiversity monitoring and governance. Remote sensing and GIS-based monitoring now cover nearly 100% of India's forest area, enabling real-time detection of forest cover change. Citizen science platforms have contributed over 10 million biodiversity observations in recent years, improving species-level data availability. However, conservation financing remains limited, with biodiversity-related expenditure accounting for less than 0.1% of GDP. Expanding blended finance mechanisms, green bonds, and international funding can help bridge this gap. Adaptive governance systems that allow periodic policy review and cross-sectoral coordination will be critical for responding to emerging ecological challenges. Table 4 presents key numerical indicators relevant to future biodiversity conservation strategies in India.

Table 4: Numerical Indicators for Future Biodiversity Conservation Strategies in India

Strategic Indicator	Numerical Data	Significance for Future Conservation
Protected area coverage	5.43% of geographical area	Need for expansion & connectivity
Forest-dependent population	275 million people	Importance of community participation
Reduction in deforestation under community management	20–25%	Effectiveness of participatory governance
Forest area monitored by satellite	100% coverage	Improved monitoring and enforcement
Biodiversity-related public spending	0.1% of GDP	Need for increased conservation finance

Source: Forest Survey of India (ISFR); MoEFCC, Govt. of India; Wildlife Institute of India; IUCN Red List; WWF Living Planet Report; NCRB&MoEFCC reports.

As reflected in Table 4, expanding protected area coverage, strengthening community participation, enhancing technological monitoring, and increasing conservation financing are critical for achieving sustainable biodiversity conservation outcomes.

Results and Discussion

The study reveals that environmental management has contributed significantly to biodiversity conservation in India, but its effectiveness remains uneven across regions. Analysis shows that India's forest and tree cover stands at 827,357 km² (25.17% of geographical area); however, widespread fragmentation and regional disparities limit ecosystem resilience and wildlife connectivity. This finding confirms that forest cover alone is insufficient without effective landscape-level planning.

Results further indicate that although India has over 1,000 protected areas, they cover only 5.43% of the total land area, which is below global conservation benchmarks. While species-focused initiatives such as Project Tiger have led to population recovery of flagship species, the persistence of over 50,000 human wildlife conflict cases annually highlight ongoing management and coexistence challenges. These outcomes demonstrate that protected areas and species programmes must be supported by corridor development and community engagement.

Policy analysis shows that India has a robust legal and strategic framework, including the Biological Diversity Act and the updated National Biodiversity Strategy and Action Plan (2024–2030). However, limited financial investment less than 0.1% of GDP constrains effective implementation.

Future-oriented findings suggest that participatory conservation and technology-driven monitoring offer strong potential. Community-managed forests show 20–25% lower deforestation rates, and satellite monitoring now covers nearly 100% of forest areas, strengthening enforcement and planning. Overall, the results underscore that integrated environmental management combining policy support, ecological connectivity, community participation, adequate financing, and technological tools is essential for achieving sustainable biodiversity conservation in India.

Conclusion

The study concludes that environmental management plays a decisive and multifaceted role in preserving biodiversity in India, but its success depends largely on integration, scale, and effective implementation. Despite notable achievements such as maintaining over 25% forest and tree cover, expanding a network of more than 1,000 protected areas, and recovering populations of flagship species through targeted programmes, biodiversity conservation outcomes remain constrained by habitat fragmentation, limited ecological connectivity, climate change impacts, and rising human–wildlife conflicts. The findings highlight that legal and policy frameworks provide a strong institutional foundation, yet inadequate financial investment, uneven enforcement, and socio-economic pressures restrict their full potential. The analysis further demonstrates that community-based management, technological monitoring, and landscape-level planning significantly enhance conservation effectiveness when aligned with sustainable livelihood strategies. Therefore, the study emphasizes that long-term biodiversity conservation in India requires an integrated environmental management approach that balances ecological priorities with developmental needs, strengthens community participation, expands protected and connected landscapes, increases conservation financing, and adopts adaptive governance mechanisms to ensure ecological resilience and sustainable development.

References

1. Adams, W. M., Aveling, R., Brockington, D., Dickson, B., Elliott, J., Hutton, J., ... & Wolmer, W. (2004). Biodiversity conservation and the eradication of poverty. *science*, 306(5699), 1146-1149.
2. Berkes, F., J. Colding, and C. Folke. 2000. Rediscovery of traditional ecological knowledge as adaptive management. *Ecol Appl* 10: 1251–62.
3. Cincotta, R. P., Wisnewski, J., & Engelman, R. (2000). Human population in the biodiversity hotspots. *Nature*, 404(6781), 990-992.
4. Ekka, P., Parmar, K., Parmar, V., Kumar, A., & Saikia, P. (2022). Role of protected area in conservation and sustainable management of biodiversity: an Indian perspective. In *Land degradation neutrality: achieving SDG 15 by forest management* (pp. 229-247). Singapore: Springer Nature Singapore.
5. Ellis, E. C., Klein Goldewijk, K., Siebert, S., Lightman, D., & Ramankutty, N. (2010). Anthropogenic transformation of the biomes, 1700 to 2000. *Global ecology and biogeography*, 19(5), 589-606.
6. Hughes, T., Kerry, J., Álvarez-Noriega, M. *et al.* Global warming and recurrent mass bleaching of corals. *Nature* 543, 373–377 (2017). <https://doi.org/10.1038/nature21707>
7. Imhoff, M., Bounoua, L., Ricketts, T. *et al.* (2004) Global patterns in human consumption of net primary production. *Nature* 429, 870–873
8. John P. Croxall *et al.* Global Circumnavigations: Tracking Year-Round Ranges of Nonbreeding Albatrosses. *Science* 307, 249-250 (2005). DOI: [10.1126/science.1106042](https://doi.org/10.1126/science.1106042)
9. Kiers, E. T., Leakey, R. R., Izac, A. M., Heinemann, J. A., Rosenthal, E., Nathan, D., & Jiggins, J. (2008). Agriculture at a crossroads. *Science*, 320(5874), 320-321.
10. Lauren Persha *et al.* Social and Ecological Synergy: Local Rulemaking, Forest Livelihoods, and Biodiversity Conservation. *Science* 331, 1606-1608 (2011). DOI: [10.1126/science.1199343](https://doi.org/10.1126/science.1199343)
11. Lekha Laxman, Abdul Haseeb Ansari (2023). The conservation of earth's biodiversity, Conservation Policies for Agricultural Biodiversity, 10.1016/B978-0-12-821441-1.00007-5, 1-38
12. Naylor, R. (2011). Expanding the boundaries of agricultural development. *Food Security*, 3(2), 233-251.
13. S. L. Pimm *et al.* The biodiversity of species and their rates of extinction, distribution, and protection. *Science* 344, 1246752 (2014). DOI: [10.1126/science.1246752](https://doi.org/10.1126/science.1246752)
14. Singh, M., & Vallarasu, K. (2023). Environmental conservation and sustainability: Strategies for a greener future. *International Journal for Multidimensional Research Perspectives*, 1(3), 185-200.
15. Watson, J., Dudley, N., Segan, D. *et al.* The performance and potential of protected areas. *Nature* 515, 67–73 (2014). <https://doi.org/10.1038/nature13947>.

