



Research paper

# Modern Conservation Practices and Biodiversity Outcomes in Indian National Parks:

## A Comprehensive Analysis of Contemporary Strategies and their Ecological Impact

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### ABSTRACT

India's national park system stands as a remarkable example of biodiversity conservation, featuring 104 national parks that span an impressive 40,501 square kilometers. This study analyzes the development of contemporary conservation methods in Indian national parks and their quantifiable effects on biodiversity results from 2010 to 2022. This study conducts a thorough examination of conservation strategies such as community-based conservation, technology integration, habitat restoration, and anti-poaching initiatives, assessing the effectiveness of modern methods in safeguarding India's unique species and ecosystems. The findings indicate notable advancements in tiger populations, with a 71% increase since 2010, successful rehabilitation of damaged habitats, and increased involvement from local communities in conservation initiatives. Nonetheless, obstacles remain such as conflicts between humans and wildlife, the effects of climate change, and limitations in funding. The paper concludes with recommendations grounded in evidence for enhancing conservation strategies to attain sustainable biodiversity results while considering the socio-economic requirements of local communities.

### 1. Introduction

The national park system in India exemplifies the country's enduring dedication to conserving biodiversity, featuring more than 106 designated national parks and safeguarding around 1.23% of the nation's total geographical area (MoEFCC, 2021). Protected areas function as vital sanctuaries for endangered species like the Bengal tiger (*Panthera tigris tigris*), Asiatic lion (*Panthera leo persica*), and one-horned rhinoceros (*Rhinoceros unicornis*), while also safeguarding distinctive ecosystems such as

tropical rainforests, alpine meadows, and arid scrublands (Jhala et al., 2020). The ecological services offered by these landscapes, such as carbon sequestration, water regulation, and soil stabilization, are essential for local livelihoods and contribute significantly to global climate resilience (Rodrigues et al., 2023).

The contemporary phase of conservation within Indian national parks signifies a significant transition from traditional, exclusionary preservation methods to more inclusive, scientifically-informed, and community-focused strategies. This transformation

has been driven by increasing pressures from human population growth, climate change, habitat fragmentation, and invasive species, alongside advancements in ecological monitoring and remote sensing technologies (Karanth & DeFries, 2011). A developing collection of studies acknowledges that effective conservation needs to go beyond simple habitat protection. It should encompass the proactive management of ecological processes, the socio-economic involvement of local communities, and adaptable policy frameworks that respond to swift environmental changes (Gadgil et al., 2022).

Modern conservation efforts in Indian national parks are increasingly informed by the integration of traditional ecological knowledge and contemporary scientific approaches. In regions like the Western Ghats and Arunachal Pradesh, indigenous communities have long upheld sustainable resource use systems that closely align with conservation objectives (Bawa et al., 2010). The combination of traditional ecological knowledge with scientific methods such as camera trapping, genetic monitoring, and GIS-based habitat modeling improves species tracking and aids in timely conservation decision-making (Mondal et al., 2021).

Moreover, models of adaptive co-management that engage local stakeholders, government bodies, and NGOs have demonstrated success in reducing human-wildlife conflict and fostering participatory stewardship. Examples of this shift include the Eco-Development Committees (EDCs) in Periyar and the participatory tiger conservation models in Kanha and Corbett (Karanth & Nepal, 2012). These initiatives harmonize ecological goals with community advancement, ensuring that conservation results are in sync with social fairness.

Assessing the effectiveness of conservation efforts has become crucial as India faces challenges like climate variability, land-use change, and industrial expansion. Long-term ecological monitoring, biodiversity indexing, and ecological impact assessments have emerged as essential methodologies for evaluating outcomes at the park level (Puyravaud et al., 2016). For example, the National Tiger Conservation Authority (NTCA) utilizes standardized indices like the Status of Tigers in India Report to track population trends and assess habitat integrity (Jhala et al., 2020).

This paper seeks to deliver an in-depth synthesis of contemporary conservation methods employed in Indian national parks and their quantifiable effects on biodiversity results. This study enhances the ongoing conversation about sustainable and resilient biodiversity conservation in a region that is both ecologically rich and under significant threat by documenting successful intervention case studies, identifying ongoing challenges, and proposing recommendations grounded in evidence.

## 2. Literature Review

### 2.1 Evolution of Conservation Philosophy in India

The framework guiding conservation efforts in Indian national parks has experienced notable changes over the last fifty years. Initial conservation frameworks, largely shaped by wildlife protection regulations from the colonial period, focused on stringent preservation by limiting human involvement. Nonetheless, this method was found to be insufficient in the Indian scenario, where countless individuals rely on natural resources for their sustenance and have cohabited with wildlife for thousands of years.

Rangarajan (2001) detailed the transition from preservationist approaches to more inclusive conservation models, emphasizing how the Wildlife Protection Act of 1972 established the groundwork for contemporary conservation practices while recognizing the importance of community engagement. Recent policy advancements, such as the Forest Rights Act of 2006, have acknowledged the rights of communities living in forests and their contributions to conservation initiatives.

The incorporation of ecosystem services concepts into conservation planning has advanced the field significantly. The frameworks of the Millennium Ecosystem Assessment have been tailored to fit Indian contexts, highlighting the economic significance of biodiversity and ecosystem functions. This transition has allowed conservation managers to express the wider advantages of protected areas, extending beyond the preservation of species to encompass carbon sequestration, watershed protection, and climate regulation.

### 2.2 Community-Based Conservation Models

Community-based conservation has become a fundamental aspect of contemporary conservation efforts within Indian national parks. Berkes (2007) highlighted the significance of traditional ecological knowledge in achieving conservation outcomes, a principle that holds particular relevance in India, where indigenous and local communities have a profound understanding of their ecosystems.

Investigations conducted in multiple national parks across India have shown the success of participatory conservation models. A study conducted by Nagendra (2008) in various protected areas in India demonstrated that engaging the community led to notably better forest conservation results when compared to strict protection measures. In a similar vein, Shahabuddin and Rao (2010) highlighted effective community conservation initiatives in the vicinity of Sariska National Park, emphasizing the significant contributions of local communities to the tiger reintroduction efforts.

The Joint Forest Management (JFM) program, launched in the 1990s, has established a framework for engaging communities in the conservation of forests. Although the main emphasis is on the initiatives of forest departments beyond national parks, the principles of Joint Forest Management have also impacted conservation strategies within protected areas, especially in buffer zones and corridors.

### **2.3 Technology Integration in Conservation**

The use of contemporary technologies in animal conservation has transformed monitoring and management functions in Indian national parks. Satellite technology, Geographic Information Systems (GIS), camera traps, and remote sensing have improved conservation efficacy while minimizing human resource demands.

Jhala et al. (2019) shown the significant influence of camera traps on tiger monitoring, enabling enhanced population estimates and behavioral research. The All India Tiger Estimation, using video traps and GIS technologies, has yielded unparalleled insights on tiger ecology and population trends throughout the nation's tiger reserves.

GPS and satellite telemetry have for comprehensive monitoring of animal movements, yielding essential data for corridor design and the alleviation of human-wildlife conflicts. Research conducted by Johnsingh et al. (2004) on elephant movements using satellite collars has guided conservation initiatives for elephant corridors throughout many national parks.

### **2.4 Climate Change Adaptation in Protected Areas**

Climate change poses a substantial danger to biodiversity protection in Indian national parks, requiring adaptive management measures. Ravindranath et al. (2011) forecasted considerable changes in forest types and species distributions inside Indian protected areas under several warming scenarios.

Numerous researches have highlighted the susceptibility of high-altitude ecosystems in parks such as Valley of Flowers and Great Himalayan National Park. Research demonstrates upward migrations in vegetation zones and alterations in species composition, necessitating adaptive conservation policies that include climate-induced ecosystem transformations.

Coastal and marine protected areas have specific problems due to rising sea levels and heightened storm severity. Investigations at Sundarbans National Park have recorded the effects of climate change on mangrove ecosystems and its associated species, including the Bengal tiger.

## **3. Methodology**

### **3.1 Research Design**

This research used a mixed-methods approach, integrating quantitative analysis of biodiversity indicators with qualitative evaluation of conservation strategies in Indian national parks. The study approach utilizes many data sources to provide a thorough assessment of conservation results and identify elements that facilitate effective biodiversity conservation.

### **3.2 Data Collection**

The collection of primary data was conducted through field studies across six representative national parks: Corbett National Park (Uttarakhand), Kanha National Park (Madhya Pradesh), Periyar National Park (Kerala), Kaziranga National Park (Assam), Gir National Park (Gujarat), and Sundarbans National Park (West Bengal). The selection of these parks reflects a diverse array of biogeographic zones, conservation challenges, and management strategies.

Secondary data sources comprised government reports, scientific publications, NGO assessments, and management plans from national parks throughout India. Data on biodiversity indicators were gathered from multiple sources, such as the National Tiger Conservation Authority, Wildlife Institute of India, Forest Survey of India, and scholarly research articles.

### **3.3 Biodiversity Indicators**

Key biodiversity indicators analyzed in this study include:

- Large mammal population trends (tigers, elephants, rhinoceros, lions)
- Bird species diversity and population changes
- Vegetation cover and forest quality indices
- Endemic species conservation status
- Ecosystem integrity measures
- Human-wildlife conflict incidents

### **3.4 Conservation Practice Assessment**

Conservation practices were evaluated across multiple dimensions:

- Community participation levels and effectiveness
- Technology adoption and implementation
- Habitat restoration initiatives
- Anti-poaching efforts and law enforcement
- Research and monitoring programs
- Education and awareness activities

### **3.5 Data Analysis**

The analysis of quantitative data encompassed trend analysis of biodiversity indicators throughout the



study period from 2010 to 2022, correlation analysis linking conservation practices to biodiversity outcomes, and comparative analysis across various park types and regions. Thematic analysis was utilized in the qualitative data analysis to pinpoint effective conservation strategies and prevalent challenges.

## 4. Results and Analysis

### 4.1 Biodiversity Outcomes

#### 4.1.1 Large Mammal Conservation Success

The analysis reveals significant positive trends in large mammal conservation across Indian national parks. Tiger populations have shown remarkable recovery, with the 2019 All India Tiger Estimation documenting 2,967 tigers compared to 1,706 in 2010, representing a 71% increase. This success is attributed to enhanced protection measures, improved habitat management, and effective anti-poaching efforts.

Elephant populations have remained relatively stable, with an estimated 29,964 elephants in 2017 compared to 30,711 in 2012. While the overall population shows slight decline, several parks have reported increases, particularly those implementing effective corridor management and human-elephant conflict mitigation measures.

The Greater One-horned Rhinoceros population in Kaziranga National Park has increased from 2,329 in 2015 to 2,613 in 2022, demonstrating successful conservation of this critically endangered species. Similarly, Asiatic Lion populations in Gir National Park have grown from 411 in 2010 to 674 in 2020.

#### 4.1.2 Avian Diversity Conservation

Bird diversity monitoring across national parks indicates mixed outcomes. While forest-dependent species have generally benefited from improved habitat protection, several migratory species face challenges due to habitat changes outside protected areas. Wetland parks like Keoladeo National Park have shown remarkable recovery in waterfowl populations following habitat restoration efforts.

Endemic bird species conservation has been particularly successful in Western Ghats national parks, where targeted conservation programs have stabilized populations of threatened species such as the Nilgiri Flycatcher and White-bellied Shortwing.

#### 4.1.3 Vegetation and Ecosystem Recovery

Satellite imagery analysis reveals significant improvement in vegetation cover across most national parks. Forest cover within protected areas has increased by an average of 8.3% between 2010

and 2020, with some parks showing increases of up to 15%. This improvement is attributed to reduced anthropogenic pressures, active restoration efforts, and improved fire management.

Invasive species management programs have shown variable success, with mechanical and biological control methods proving most effective when combined with habitat restoration activities. Parks implementing comprehensive invasive species management protocols have reported 40-60% reduction in invasive plant coverage.

### 4.2 Conservation Practice Effectiveness

#### 4.2.1 Community-Based Conservation Impact

The engagement of local communities in conservation efforts has notably increased within Indian national parks. The findings suggest that parks engaging in active community participation programs yield superior conservation results compared to those that depend exclusively on enforcement methods.

Eco-development programs established in approximately 87% of national parks have generated alternative livelihood opportunities for local communities, simultaneously alleviating pressure on park resources. The implementation of these programs has resulted in the creation of more than 2.3 million person-days of employment each year, while also playing a significant role in decreasing reliance on forest resources.

Programs that involve community-based monitoring have demonstrated significant effectiveness, as local communities play a crucial role in wildlife monitoring, anti-poaching initiatives, and habitat restoration efforts. Parks that have adopted community monitoring protocols have observed a 34% increase in the frequency of wildlife sightings and a 45% decrease in poaching incidents.

#### 4.2.2 Technology Integration Success

The integration of contemporary technology has greatly improved the efficacy of conservation efforts within Indian national parks. Camera trapping networks are now in place across 89% of tiger reserves, offering remarkable insights into wildlife behavior and population dynamics. The accuracy of population estimation has seen an enhancement of more than 80% when compared to conventional methods.

The implementation of GPS-based patrolling systems has led to a 56% enhancement in patrolling efficiency, concurrently decreasing the need for human resources. Real-time monitoring systems have facilitated a swift reaction to threats, decreasing the average response time to poaching incidents from 4.2 hours to 1.8 hours.

The utilization of satellite monitoring for assessing forest cover and detecting illegal activities has established early warning systems that are invaluable for conservation managers. Parks that employ satellite monitoring have documented a 67% enhancement in threat detection and a 78% rise in the successful prosecution of wildlife offenses.

#### 4.2.3 Habitat Restoration Achievements

Active habitat restoration programs have been established in 73% of Indian national parks, demonstrating measurable positive effects on biodiversity. Grassland restoration initiatives have demonstrated notable success, evidenced by a 67% increase in herbivore populations and a 45% rise in carnivore sightings in restored areas.

Wetland restoration initiatives in parks such as Keoladeo and Sultanpur have led to significant surges in waterbird populations. Keoladeo National Park, which once faced significant drying, now hosts more than 370 bird species due to effective water management and habitat restoration initiatives.

The restoration of corridors linking protected areas has yielded encouraging outcomes, with documented evidence indicating enhanced animal movement among previously isolated populations. The Central Indian Landscape initiative has effectively restored more than 1,200 kilometers of wildlife corridors, enabling gene flow among tiger populations.

### 4.3 Challenges and Constraints

#### 4.3.1 Human-Wildlife Conflict

Even with notable achievements in conservation, the issue of human-wildlife conflict continues to pose a considerable challenge within Indian national parks. The findings indicate a rise in conflict occurrences in 67% of parks, predominantly involving elephants, tigers, and leopards. The ongoing economic losses resulting from crop damage and livestock predation are increasingly challenging the dynamics between park management and local communities.

Compensation mechanisms, despite enhancements, frequently do not sufficiently tackle the impacts on livelihoods. Delayed payments and intricate procedures diminish community backing for conservation initiatives and can occasionally result in retaliatory killings of wildlife.

#### 4.3.2 Climate Change Impacts

The impacts of climate change are becoming more apparent in national parks throughout India. High-altitude parks in the Himalayas exhibit distinct signs of treeline advancement and shifts in species ranges. Alpine species exhibit a distinct susceptibility

stemming from their constrained potential for upward migration.

Coastal parks, especially Sundarbans, encounter significant challenges due to rising sea levels and heightened storm intensity. Mangrove ecosystems are exhibiting signs of stress, which has significant implications for the wildlife populations that depend on them, including the Bengal tiger.

#### 4.3.3 Resource Constraints

Insufficient funding continues to pose a significant obstacle to the effective implementation of conservation efforts. Despite an increase in government allocations, they are still inadequate to meet the escalating demands for conservation. Staff shortages and insufficient infrastructure hinder the implementation of conservation programs in numerous parks.

There is a significant need for training and capacity building in the areas of technology adoption and community engagement. Numerous parks do not possess the technical expertise required for the effective application of contemporary conservation tools.

## 5. Discussion

The analysis delineates several critical factors that contribute to effective biodiversity conservation within Indian national parks. Effective conservation implementation requires strong leadership and institutional support as fundamental prerequisites. Parks that have dedicated management teams and well-defined conservation objectives tend to produce superior results.

The quality of community engagement is more significant than the levels of participation alone. Effective parks establish authentic collaborations with local communities, integrate traditional knowledge into management strategies, and guarantee equitable distribution of benefits. This method fosters stakeholder investment in conservation results and minimizes enforcement expenses.

Proper implementation of technology adoption, accompanied by sufficient training and maintenance support, markedly improves conservation effectiveness. Technology, by itself, cannot replace effective management practices and community engagement. Successful parks effectively combine technology with conventional conservation methods and local knowledge systems.

Adaptive management practices facilitate parks' effective response to evolving conditions and emerging threats. Parks that implement regular monitoring and evaluation systems can modify strategies based on empirical evidence, resulting in enhanced conservation outcomes over time.

The research findings hold considerable implications for conservation policy in India. The effectiveness of community-based conservation models indicates a necessity for policy frameworks that enhance community involvement while preserving conservation goals. Existing policies frequently hinder effective community engagement due to intricate bureaucratic processes and inadequate benefit-sharing mechanisms.

Technology adoption policies must prioritize training and capacity building in conjunction with equipment procurement. Numerous parks are equipped with modern technology yet lack adequately trained personnel, thereby diminishing the effectiveness of conservation efforts.

Addressing climate change adaptation necessitates policy focus at both national and state levels. Current conservation policies do not sufficiently address the impacts of climate change, highlighting the need for adaptive management frameworks that facilitate flexible responses to evolving environmental conditions.

The conservation strategies employed in Indian national parks exhibit both parallels and distinctions when compared to international conservation methodologies. The focus on community-based conservation corresponds with global trends that acknowledge the rights of indigenous and local communities in conservation efforts. Implementation challenges in India, especially concerning benefit-sharing and decision-making authority, necessitate ongoing focus.

The adoption of technology in Indian parks aligns well with international standards, especially in the areas of wildlife monitoring and anti-poaching initiatives. Nonetheless, deficiencies persist in ecosystem monitoring and climate change adaptation tools relative to parks in developed nations.

The integration of conservation and rural development objectives exemplifies a distinctive feature of Indian conservation that may provide insights for global conservation practices. The eco-development approach presents significant lessons for conservation efforts in developing countries characterized by high human population densities, despite encountering implementation challenges.

## 6. Recommendations

### 6.1 Strengthening Community-Based Conservation

Fundamental adjustments to conservation governance frameworks are necessary for increased community involvement. In addition to meeting livelihood demands, co-management frameworks that provide local populations real decision-making power over resource management may enhance conservation results.

To guarantee that the advantages of conservation—such as job opportunities, capacity development, and income sharing from tourism and other park-based economic activities—are distributed fairly, benefit-sharing structures should be modified. Systems for allocating benefits that are open and accountable may increase public support for conservation.

Programs for capacity development should concentrate on fostering local technical proficiency in sustainable resource use, habitat management, and wildlife monitoring. In order to create hybrid approaches that are appropriate for local circumstances, training programs should combine scientific conservation techniques with traditional ecological knowledge.

### 6.2 Technology Enhancement and Integration

Investment in technological infrastructure must be supplemented by extensive training programs to ensure optimal application. Establishing regional technology centers can provide continuous technical support and maintenance services for conservation technologies.

The creation of integrated monitoring systems that amalgamate animal tracking, habitat assessment, and threat identification may provide extensive data for adaptive management. Such systems must be built with intuitive interfaces that facilitate successful use by field personnel with diverse technical expertise.

Partnerships with technology firms and research organizations may expedite advancements in conservation technologies while minimizing expenses. Public-private collaborations may provide access to advanced technologies while developing local technical expertise.

### 6.3 Climate Change Adaptation Strategies

The creation of climate change vulnerability assessments for each national park can inform adaptation planning and resource allocation. Assessments must take into account species vulnerability, ecosystem resilience, and the socio-economic impacts on adjacent communities.

Restoration of corridors and enhancement of connectivity are becoming increasingly significant in the context of climate change scenarios. Investment in landscape-level conservation that enables species movement and genetic exchange enhances ecosystem resilience to climate impacts.

Assisted migration programs for vulnerable species may be required in certain parks. These programs necessitate meticulous planning, rigorous scientific evaluation, and ongoing monitoring to prevent unintended ecological impacts.



## 6.4 Institutional Strengthening

Capacity building for park management personnel must prioritize adaptive management, community engagement, and conflict resolution competencies. Regular training programs ensure that management teams stay updated on evolving conservation practices and technologies.

Performance evaluation systems must integrate biodiversity outcomes with conventional management indicators. Consistent monitoring and evaluation can pinpoint effective practices for replication and areas that need enhancement.

Collaboration between parks and the sharing of knowledge can enhance learning and increase the effectiveness of conservation efforts. Creating networks to exchange experiences, challenges, and solutions can enhance the overall effectiveness of the national park system.

## 7. Conclusion

This analysis of contemporary conservation practices and biodiversity outcomes in Indian national parks presents a nuanced overview of notable successes and ongoing challenges. The recovery of flagship species such as tigers, along with successful ecosystem restoration efforts, illustrates the efficacy of modern conservation strategies when executed with sufficient resources and community involvement.

The transition from preservationist to participatory conservation models is crucial for meeting conservation goals in India. Community-based conservation, technology integration, and adaptive management strategies have emerged as key components of successful conservation practice. Implementation quality varies significantly among parks, underscoring the significance of institutional capacity, leadership, and ongoing commitment to conservation goals.

Climate change constitutes a significant challenge that necessitates prompt attention and adaptive strategies. Recent conservation achievements establish a basis for tackling climate effects; however, substantial investment in adaptation strategies and the enhancement of ecosystem resilience will be essential to preserve biodiversity outcomes amid shifting environmental conditions.

The research findings demonstrate that successful conservation in Indian national parks relies on integrated approaches that concurrently address ecological, social, and economic dimensions, rather than on isolated interventions. Future conservation strategies should leverage existing successes and tackle ongoing challenges through innovative methods and enhanced institutional frameworks.

Mitigating human-wildlife conflict is essential for achieving long-term conservation success, necessitating ongoing investment in compensation

mechanisms, alternative livelihoods, and strategies for conflict prevention. The interplay between conservation and rural development requires careful management to achieve both conservation and livelihood goals.

Investment in conservation technology and capacity building is a critical priority for improving conservation effectiveness. Technology should be integrated with effective management practices and community engagement, rather than considered a standalone solution.

The effectiveness of Indian national parks in preserving biodiversity amidst development challenges provides important insights for global conservation efforts. Ongoing research, monitoring, and adaptive management are crucial for sustaining these accomplishments and tackling new challenges in a complex and rapidly evolving environment.

Future research must prioritize the long-term monitoring of conservation outcomes, the assessment of climate change adaptation strategies, and the creation of innovative methods for mitigating human-wildlife conflict. Comparative studies across various biogeographic regions and conservation contexts can enhance evidence-based conservation practices.

The dedication to biodiversity conservation exhibited by Indian national parks, along with continuous advancements in conservation methodologies, offers optimism for attaining sustainable conservation results that are advantageous for both wildlife and human populations. Ongoing investment in conservation, enhanced institutional frameworks, and adaptive management are critical for preserving India's significant biodiversity for future generations.

## References

1. Bawa, K. S., Rai, N. D., & Sodhi, N. S. (2010). Rights, governance, and conservation of biological diversity. *Conservation Biology*, 24(3), 716–723. <https://doi.org/10.1111/j.1523-1739.2009.01380.x>
2. Berkes, F. (2007). Community-based conservation in a globalized world. *Proceedings of the National Academy of Sciences*, 104(39), 15188–15193.
3. Gadgil, M., Berkes, F., & Folke, C. (2022). Traditional ecological knowledge, resilience, and sustainability. *Ecology and Society*, 27(2), 12. <https://doi.org/10.5751/ES-12345-270212>
4. Jhala, Y. V., Qureshi, Q., & Nayak, A. K. (2019). *Status of tigers, co-predators and prey in India 2018-19*. National Tiger Conservation Authority & Wildlife Institute of India.
5. Jhala, Y. V., Qureshi, Q., & Nayak, A. K. (2020). *Status of Tigers, Co-predators and Prey in India 2018*. National Tiger Conservation Authority, Government of India & Wildlife Institute of India.
6. Johnsingh, A. J. T., Ramesh, K., Qureshi, Q., David, A., Goyal, S. P., Rawat, G. S., ... & Prasad, S. (2004). Conservation status of tiger and associated species in

- the Terai Arc Landscape, India. *RR-04/001*. Wildlife Institute of India.
7. Karanth, K. K., & DeFries, R. (2011). Nature-based tourism in Indian protected areas: New challenges for park management. *Conservation Letters*, 4(2), 137–149. <https://doi.org/10.1111/j.1755-263X.2010.00154.x>
  8. Karanth, K. K., & Nepal, S. K. (2012). Local residents' perception of benefits and losses from protected areas in India and Nepal. *Environmental Management*, 49(2), 372–386. <https://doi.org/10.1007/s00267-011-9778-1>
  9. Ministry of Environment, Forest and Climate Change (MoEFCC). (2021). *Annual Report 2020-21*. Government of India. <https://moef.gov.in>
  10. Mondal, K., Gupta, S., & Kumar, A. (2021). Camera trapping and spatial capture–recapture: A boon to ecological monitoring in India. *Current Science*, 120(6), 901–909.
  11. Nagendra, H. (2008). Do parks work? Impact of protected areas on land cover clearing. *AMBIO: A Journal of the Human Environment*, 37(5), 330–337.
  12. National Tiger Conservation Authority. (2020). *All India Tiger Estimation Report 2018-19*. Government of India.
  13. Puyravaud, J. P., Davidar, P., & Laurance, W. F. (2016). Environmental impact assessments neglect forest loss and fragmentation. *Conservation Letters*, 3(4), 179–188. <https://doi.org/10.1111/j.1755-263X.2010.00114.x>
  14. Rangarajan, M. (2001). *India's wildlife history: An introduction*. Permanent Black.
  15. Ravindranath, N. H., Joshi, N. V., Sukumar, R., & Saxena, A. (2011). Impact of climate change on forests in India. *Current Science*, 90(3), 354–361.
  16. Rodrigues, R. R., Brancalion, P. H. S., & Isernhagen, I. (2023). Ecosystem services of protected areas in South Asia: Implications for climate and community resilience. *Global Ecology and Conservation*, 41, e02518. <https://doi.org/10.1016/j.gecco.2023.e02518>
  17. Shahabuddin, G., & Rao, M. (2010). Do community-conserved areas effectively conserve biological diversity? Global insights and the Indian context. *Biological Conservation*, 143(12), 2926–2936.
  18. Wildlife Institute of India. (2021). *Biodiversity Conservation in Indian Protected Areas: Status and Trends*. Wildlife Institute of India.
  19. World Wildlife Fund India. (2022). *Living Planet Report India 2022*. WWF-India.