

# **BRIDGING THE GAP**

**UNVEILING EFFECTIVENESS OF  
INDIA'S TIGER RESERVE MANAGEMENT**

**(A COMPILATION OF LESSONS LEARNT FROM FIVE CYCLES OF MANAGEMENT  
EFFECTIVENESS EVALUATION AND ALL INDIA TIGER ESTIMATION)**



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## INTRODUCTION

Survival of tigers is dependent on conservation and management efforts. To gauge the success of conservation efforts as well as to guide management inputs, it is important to assess the effectiveness of management of Tiger Reserves.

Post the disappearance of tigers in Sariska Tiger Reserve, the Government of India issued a directive to the Office of Comptroller and Auditor General (C&AG) of India and the Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India to conduct an independent audit and place the report in the Parliament.

The Wildlife Institute of India (WII) in close collaboration with global experts and National Tiger Conservation Authority (NTCA) developed a framework for independent evaluation procedure to evaluate Tiger Reserves of the country. The criteria and indicators adopted for conducting the Management Effectiveness Evaluation (MEE) using IUCN's World Commission on Protected Areas Framework for assessing the management effectiveness have been suitably adapted to suit Indian conditions. MEE Framework includes consideration of design issues, the adequacy and appropriateness of management systems and processes and the delivery of protected area objectives including conservation of values.

The 'independent' evaluation of Tiger Reserves in India was initiated in 2006 with 28 Tiger Reserves and till now five cycles of evaluation have been completed with the fifth cycle covering 51 Tiger Reserves. The subsequent cycles of evaluation have enhanced the management perspectives of Tiger Reserves.

With the help of MEE exercise, India objectively assessed that our Tiger Reserves are the best managed parks in the country due to various management strengths such as protection strategies, good managerial support, mitigation of human wildlife conflicts, compliance of statutory requirements, professionally prepared Tiger Conservation Plans etc. The Indian MEE exercises in the Tiger Reserves clearly demonstrate that our Tiger Reserves are effectively being conserved and managed through ecologically representative, well-connected and equitably governed systems of protected areas and are appropriately integrated into wider landscapes.

As mandated by the Tiger Task Force 2005, the quadrennial All India Tiger Estimation (AITE) intends to monitor the status of tigers at pan India level and involves the National Tiger Conservation Authority (NTCA), Wildlife Institute of India (WII) and 18 Tiger Range States (TRS). The four-yearly monitoring of tiger status based on modern animal abundance estimation science commenced since 2006, and covers all potential tiger bearing areas in the country. The monitoring protocol also evaluates status of other co-predators, prey and habitat in tiger landscapes.

The information generated by the five cycles of tiger status evaluation exercises resulted in major changes in policy and management of tiger populations and provided scientific data to fully implement provisions of the Wildlife (Protection) Act 1972, as amended in 2006, in letter and spirit. The major outcomes that were direct or indirect consequence of

information generated by the monitoring exercises were 1) Tiger landscape conservation plans, 2) designation and creation of inviolate critical core and buffer areas of tiger reserves, 3) identification and notification of new tiger reserves, 4) recognition of tiger landscapes and the importance of the corridors and their physical delineation at the highest levels of governance, 5) integrating tiger conservation with developmental activities using the power of reliable information in a Geographic Information System database 6) planning reintroduction and supplementation strategies for tigers and to prioritize conservation investments to target unique vulnerable gene pools and 7) creation of a digital database library for forest administrative units. All these provide an opportunity to incorporate conservation objectives supported with sound science based data, on equal footing with economic, sociological, and other values in policy and decision making for the benefit of the society.

**While India embarks upon adaptive management for tiger conservation in the country, it is essential that key recommendations emanating from different cycles of MEE and AITE are appropriately amalgamated into policy actions. This publication aims at compiling management issues and key recommendations evolved from different cycles of MEE and AITE and by analyzing them suggest action portfolios for Tiger Reserves of the country for compliance. This likely to provide valuable insights into the improvement of management processes and practices of Tiger Reserves in India.**



SHIVANG MEHTA



SHIBU NAIR

# NAGARJUNASAGAR SRISAILAM TIGER RESERVE

## 1. Brief Description

Spanning 3,296 square kilometers across Andhra Pradesh, Nagarjunasagar Srisailam Tiger Reserve shelters diverse wildlife within its dry mixed deciduous forests as a part of the Nallamala hills; an extension of the southern Eastern Ghats. Divided after state bifurcation, it encompasses a core area of 2,595 square kilometers, including the 1,194 square kilometer Gundla Brameswaram Sanctuary. The Krishna River flows through this crucial habitat for 130 kilometers, supporting tigers, leopards, dholes, various herbivores, and two tribal communities - the Chenchus and Lambadas. The reserve's extended core, with minimal human activity, boasts a higher tiger presence compared to areas with significant human interaction.

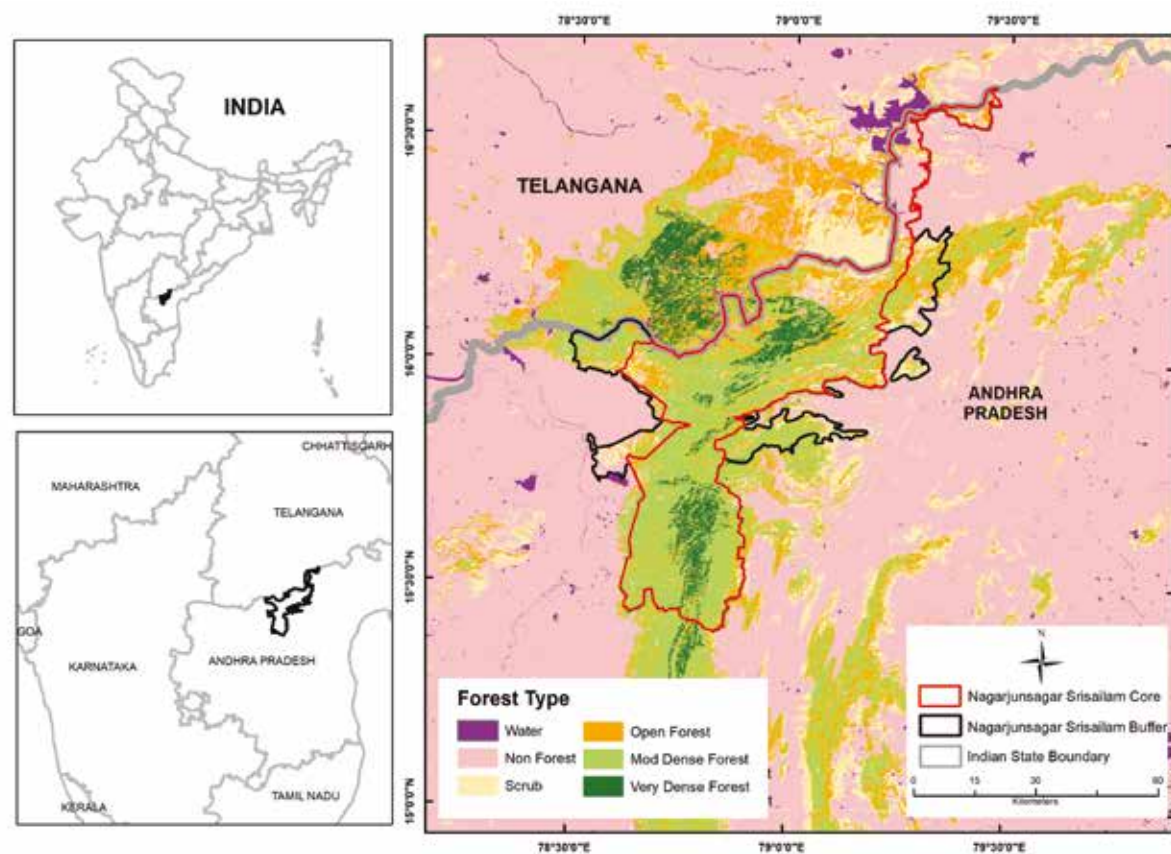


Figure 1: Location of Nagarjunasagar Srisailam Tiger Reserve within the state of Andhra Pradesh

## 2. Tiger population as per all India tiger estimation

The tiger population within Nagarjunasagar Srisailam Tiger Reserve has seen a slight fluctuation over the past decade. In 2014, the density was estimated at 0.85 tigers per 100 sq km, increasing to 0.91 in 2018. The latest assessment in 2022 shows a density of 0.77 tigers per 100 sq km. Since the 2018 national tiger estimation, the Nagarjunasagar-Srisailam Tiger Reserve has witnessed a significant increase in its tiger population, showcasing the positive impact of conservation efforts. This highlights the need for continued monitoring and conservation efforts to ensure the long-term stability of this tiger population.

### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Management Weaknesses and Actionable Points	Subsequent non-compliance over the years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>Address grazing and NTFP collection practices of Chinchu and Lambada communities to minimize habitat impact.</li> <li>Implement an annual cattle inoculation program for settlements near the reserve.</li> <li>Fill vacant Forest Ranger, Deputy Ranger, and Forester positions.</li> <li>Procure 2 motorboats, 6 water tankers with tractors, water bottles, and firefighting equipment.</li> <li>Improve vehicle resources for patrolling, considering law and order challenges.</li> <li>Establish direct communication with Project Tiger Directorate for expedited fund release.</li> <li>Train field staff in firearm handling, cleaning, and upkeep.</li> <li>Equip field staff with mobile phones for safe communication in Naxal-infested areas.</li> <li>Improve the current poor condition of the road network.</li> <li>Expedite pending ex-gratia compensation payments.</li> <li>Continue and strengthen the Ecodevelopment program, even if it deviates from Project Tiger Directorate guidelines.</li> </ul>	<ul style="list-style-type: none"> <li>Village dependence on forests and grazing harming wildlife.</li> <li>Illegal fishing and stakeholder conflicts threaten reserve.</li> <li>Pilgrimage disrupts habitat, highways pose infrastructure threats.</li> <li>Delayed funds, inadequate staff, and insufficient anti-poaching measures.</li> <li>Township expansion, encroachments, and night traffic fragment habitat.</li> <li>The unrecognized tiger corridor needs relocation.</li> <li>Large beat sizes and lack of proper vehicles hinder patrolling.</li> <li>Inactive EDCs and villages within reserve disturb wildlife.</li> <li>Inadequate veterinary facilities and delayed compensation.</li> <li>Lack of capacity building for staff.</li> </ul>	<ul style="list-style-type: none"> <li>Control livestock grazing to minimize competition with wild prey for tigers.</li> <li>Address subsistence-level hunting to improve prey population recovery.</li> <li>Prioritize relocation of human settlements from the core area to facilitate wildlife population growth.</li> <li>Target local tribal hamlets within the reserve for incentivized voluntary relocation to reduce disturbance.</li> <li>Focus conservation efforts on prey population to support tiger health and growth.</li> <li>Control anthropogenic pressure like livestock grazing and hunting within the reserve.</li> </ul>

MEE Year	Management Weaknesses and Actionable Points	Subsequent non-compliance over the years till 2022	Recommendations from AITE
2010	<ul style="list-style-type: none"> <li>Increase staffing levels and establish more anti-poaching camps for improved management.</li> <li>Implement regulations to protect critical tiger habitat from the expansion of Srisailam and the Mannanoor-Dornal road.</li> <li>Control the rapid expansion of Sundipenta irrigation township to minimize habitat disturbance.</li> <li>Address encroachments in the Nagarjunasagar Division to reduce fragmentation.</li> <li>Resist the proposal to remove speed breakers and ease night traffic ban on the Mannanoor-Dornal road.</li> <li>Divert heavy vehicles to the alternate highway to minimize disturbance on the Guntur-Kurnool State Highway.</li> <li>Augment staff strength for enhanced reserve protection.</li> <li>Expedite relocation of villages from core/critical habitat to improve wildlife well-being.</li> </ul>		<ul style="list-style-type: none"> <li>Prioritize the forested corridor connecting Nagarjunasagar Srisailam Tiger Reserve to Seshachalam biosphere reserve and protected areas for effective tiger movement and conservation.</li> </ul>
2014	<ul style="list-style-type: none"> <li>NTCA should officially recognize and secure the NSTR-SV tiger corridor with financial and technical support.</li> <li>Increase Beat Officer count to 495 (1 per 12 km<sup>2</sup>) to address current shortage and vast reserve area.</li> <li>Establish 170 additional base camps to reduce BO jurisdiction to 25 km<sup>2</sup> for improved coverage.</li> <li>Allocate budget for official motorbikes for all BOs (phased rollout over 7-8 years).</li> <li>Replace inactive Van Sanrakshan Samitis with EDCs in villages.</li> <li>Develop and include details of EDCs in the Tiger Conservation Plan (TCP).</li> </ul>		

MEE Year	Management Weaknesses and Actionable Points	Subsequent non-compliance over the years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Prepare a proposal for immediate relocation of identified villages within the reserve, seeking NTCA financial support.</li> <li>Commission a study to assess potential for future village relocations.</li> <li>Organize orientation and capacity-building courses for frontline staff on wildlife conservation.</li> <li>Establish a mobile veterinary service unit to address wildlife emergencies within the reserve.</li> </ul>		
2018	<ul style="list-style-type: none"> <li>Establish unified control under the Field Director for streamlined management.</li> <li>Address jurisdiction issues in Nandyal and Giddalur divisions through state intervention.</li> <li>Ban illegal fishing in Srisailem reservoir, relocate fishermen's huts, and offer alternative livelihoods.</li> <li>Involve Chenchus in eco-development activities and create EDCs in nearby villages to reduce dependence on the reserve.</li> <li>Conduct a study on villagers' willingness for relocation from core areas to reduce human pressure on wildlife.</li> <li>Reduce beat size to less than 25 sq. km for effective protection and fill vacant frontline staff positions.</li> <li>Address infrastructure needs for vehicles, buildings, and communication equipment.</li> <li>Provide Android phones for M-STrIPES application use by field staff.</li> </ul>		

MEE Year	Management Weaknesses and Actionable Points	Subsequent non-compliance over the years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Establish a mobile veterinary service unit with a veterinarian for wildlife emergencies.</li> <li>Address delays in central Project Tiger budget release and expedite compensation payments for human-wildlife conflict.</li> <li>Provide regular training programs for frontline staff on wildlife management.</li> <li>Explore establishing a Wildlife Capacity Building Centre at Srisailem.</li> <li>Implement dynamic management strategies considering climate change and anthropogenic pressure.</li> <li>Collaborate with an NGO for field trials on a habitat security protocol focusing on climate impact observation.</li> <li>Manage pilgrimage tourism to minimize threats to the reserve.</li> <li>Promote responsible and sustainable tourism through awareness programs.</li> </ul>		
2022	<ul style="list-style-type: none"> <li>Address resource dependence of 16 villages in the core area to reduce impact on wildlife.</li> <li>Mitigate impact of cattle grazing by scheduled tribes on wildlife fodder availability.</li> <li>Address illegal fishing in dams and stakeholder conflicts related to resource management.</li> <li>Implement proper management of pilgrimage tourism to minimize disturbance to habitat and wildlife.</li> <li>Address threats posed by Dornala–Srisailem highway to wildlife and bamboo degradation.</li> <li>Ensure timely release of central and state funds for effective reserve management.</li> <li>Prepare a new Tiger Conservation Plan (TCP) with stakeholder involvement, including community assessments and relocation willingness.</li> </ul>		

MEE Year	Management Weaknesses and Actionable Points	Subsequent non-compliance over the years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>Rationalize beat size to 10-20 sq km for improved coverage.</li> <li>Fill vacant staff positions and explore establishing a Wildlife Capacity Building Centre.</li> <li>Conduct land use classification and study over-matured bamboo patches.</li> <li>Upgrade outdated equipment used for wildlife monitoring and protection.</li> <li>Assess willingness of communities for relocation, prioritizing human-free core areas.</li> <li>Secure the NSTR-Sri Venkateswara corridor with NTCA support.</li> <li>Institutionalize compensation release process for swift human-wildlife conflict resolution.</li> </ul>		



**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- Recognizing the valuable insights gleaned from previous MEE cycles, it is recommended to prioritize and diligently implement the identified actionable points. This focused approach will significantly contribute to strengthened management and conservation efforts. By addressing the highlighted concerns through the suggested actions, the tiger reserve management can cultivate a more favorable environment for both wildlife and staff, ultimately ensuring the reserve's long-term prosperity and ecological well-being.
- Wildlife habitat in the core area is impacted by cattle grazing from villages; measures should be taken to relocate villages and engage in effective conservation strategies without causing disruptions.
- Illegal fishing in dams poses a threat to the tiger reserve; collaborative efforts among concerned departments are advised to address and mitigate this issue.
- Pilgrim influx disturbs habitat. Management of pilgrimage tourism is crucial to prevent disturbances to the habitat; awareness and capacity-building programs should be promoted for responsible tourism.
- Township expansion affecting the habitat should be controlled, and measures must be taken to address encroachments and habitat fragmentation.
- Fund release is often delayed due to state coordination issues. Coordinated efforts with the state government are needed to streamline fund release processes, ensuring timely assistance for effective management.
- Firearm training is lacking and cattle immunization is inadequate. Training programs for firearm handling and annual immunization initiatives for domestic cattle should be implemented to enhance wildlife conservation practices.
- Infrastructure is inadequate. Adequate infrastructure improvements are necessary for efficient patrolling and management activities within the extensive reserve.
- Inadequate staffing and insufficient anti-poaching camp over the years. Staffing deficiencies and inadequate anti-poaching camps require immediate attention for enhanced protection and effective reserve management.
- Threats loom large from night traffic; disturbance from heavy vehicles is also present. Night traffic threats and disturbances from heavy vehicles necessitate the implementation of measures to redirect traffic and minimize impact on wildlife.
- Unrecognized tiger corridor needs urgent village relocation. Urgent recognition and securing of the unrecognized tiger corridor should be pursued, with support from relevant authorities.
- Large beat sizes and beat officers lack proper vehicles prohibit proper patrolling. Beat officers with large beat sizes lacking proper vehicles hinder patrolling; provision of suitable vehicles and infrastructure improvements are recommended.



- m. Ecodevelopment Committees (EDCs) are inactive. Activation of EDCs is essential for effective protection efforts and community engagement in conservation activities.
- n. Villages within the reserve disturb wildlife and their habitats. Villages within the reserve impacting wildlife and habitats require relocation proposals and support from the National Tiger Conservation Authority (NTCA).
- o. Proper veterinary facilities are absent within the TR. Provision of proper veterinary facilities is imperative for wildlife rescue and conflict mitigation.
- p. Timely payment of ex-gratia compensation is often hindered due to delay in central fund release. Timely release of ex-gratia compensation is essential for addressing human-wildlife conflict; hence streamlining the process is recommended.
- q. The TR doesn't possess proper capacity building enterprises. Capacity-building initiatives for staff at various levels should be prioritized for improved wildlife management practices.

## 5. Conclusions

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The Nagarjunasagar-Srisailem Tiger Reserve has witnessed a heartening rise in its tiger population, a true reflection of the dedication and expertise demonstrated by the forest department. This success story underscores the effectiveness of ongoing conservation efforts within the reserve. However, it is important to acknowledge that challenges remain, particularly with regards to prey availability and human interference. By focusing on bolstering prey populations and minimizing human impact, a more flourishing environment for tigers and other wildlife within the reserve can be created. This might involve collaborative efforts with local communities, exploring solutions such as incentivized relocation programs and sustainable livelihood options. Additionally, strengthening the crucial forested corridor connecting NSTR to other protected areas will be key to long-term tiger conservation success. Open communication and collaboration with all stakeholders will be essential in achieving this shared goal.





## KAMLANG TIGER RESERVE

### 1. Brief Description

Kamlang Tiger Reserve (KTR), established in 2017, spans 783 km<sup>2</sup>, with a core area of 696 km<sup>2</sup> and a buffer zone of 87 km<sup>2</sup>. Situated amidst the Eastern Himalayan Biodiversity Hotspot, it borders Namdapha Tiger Reserve, Kamlang Reserve Forest, and Hukawng Wildlife Sanctuary in Myanmar. Renowned for its biodiversity, KTR is home to critically endangered species like the Malayan sun bear and hosts top predators such as tigers and clouded leopards. With diverse vegetation types and rich floral diversity, including endemic plants and orchids, it receives rain from both monsoons and is enriched by four major rivers and numerous wetlands. Minimal anthropogenic pressure and limited village presence around its periphery highlight its pristine conservation status.

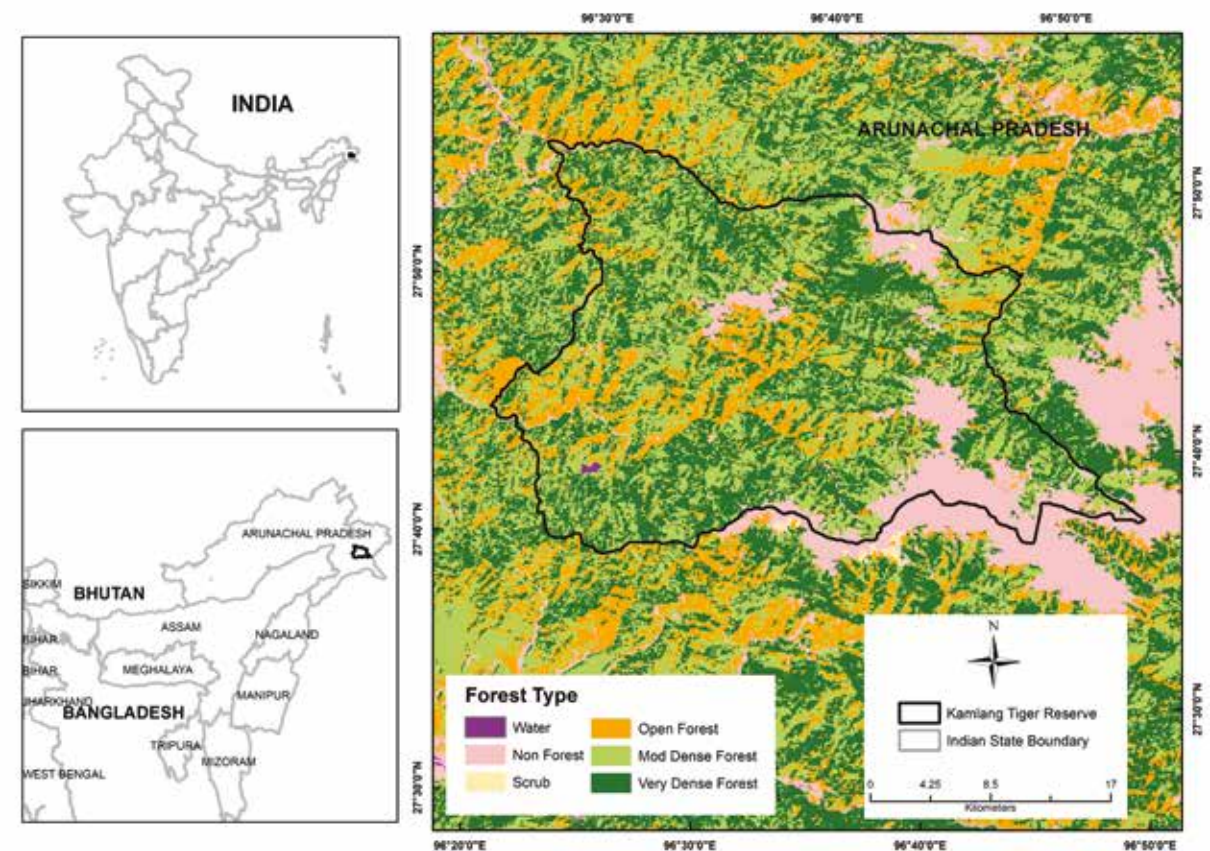


Figure 1: Map showing the location of Kamlang Tiger Reserve in the state of Arunachal Pradesh

### 2. Tiger Population as per All India Tiger Estimation

In 2018, despite the presence of four tigers within the boundaries of the tiger reserve, there was no observed utilization of the Kamlang Tiger Reserve itself. Extrapolating tiger density, as determined from both scat and camera trap images, using MaxEnt to potential tiger habitats indicated a prospective tiger population of 29 within the Dibang-Kamlang-Namdapha block. However, in 2022, no tigers were captured in photos during the cycle within the Kamlang Tiger Reserve, and no tiger-positive scat was collected from the reserve during the specified period.

### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p><b>Inadequate Anti-Poaching Infrastructure:</b> Only 2 anti-poaching camps for a vast 780 sqkm reserve led to inadequate coverage and monitoring. Lack of roads makes foot patrolling challenging, leaving remote areas vulnerable to poaching.</p> <p><b>Dependency on Forest Resources:</b> Communities rely on forests for timber, firewood, and engage in illicit cane removal, affecting the reserve's resources. Grazing of Mithun (livestock) in the forest competes with wild herbivores, impacting the ecosystem.</p> <p><b>Limited Research and Monitoring:</b> Insufficient efforts in researching and monitoring flora and fauna within the reserve.</p> <p><b>Poaching Threats and Tribal Activities:</b> Poaching activities by tribal communities using traditional weapons pose a significant threat to wildlife. Cross-border poaching from neighboring areas contributes to wildlife depletion.</p> <p><b>Encroachment Challenges:</b> Instances of attempted encroachments by settlers and tribal claims on reserve lands pose management challenges. Forest land encroachment for opium cultivation further exacerbates conservation issues.</p>	<p><b>Inadequate Anti-Poaching Infrastructure and Remote Accessibility:</b> Continuation of only 2 anti-poaching camps for a vast reserve area of 780 sqkm, leading to insufficient coverage. Lack of roads still making foot patrolling challenging, leaving remote areas vulnerable to poaching. More than 95% of the reserve remains inaccessible by roads, allowing poachers to move freely without checks.</p> <p><b>Dependency on Forest Resources and Community Engagement Challenges:</b> Continuous reliance of communities on forests for resources like timber, firewood, and Mithun grazing persists, impacting the ecosystem. Early-stage formation of eco-development committees (EDCs) and limited efforts to engage local communities for long-term conservation support continue.</p> <p><b>Equipment Shortages and Staff Limitations:</b> Persistent issues with unserviceable arms, inadequate gadgets, and insufficient staff insurance coverage affecting conservation efforts. Staff shortage persists</p>	<p><b>Priority Conservation Focus:</b> Given the high conservation rating for tigers in the North Eastern Hill populations, with potential genepool relevance to the critically endangered Panthera tigris corbetti in Myanmar, prioritize conservation investments in Namdapha Tiger Reserve (NTR), Kamlang Tiger Reserve (KTR), and consider elevating Dibang Wildlife Sanctuary (WLS) to a tiger reserve status.</p> <p><b>Investments in Connectivity:</b> Recognize the conservation significance of the landscape in Karbi-Anglong, which connects the source population in Kaziranga Tiger Reserve (KTR) to the southern tiger habitats of Intanki and Dampa Tiger Reserves (TR). Allocate major investments to safeguard and enhance connectivity in this landscape.</p>

Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p><b>Remote Inaccessibility and Staff Limitations:</b> More than 95% of the reserve is inaccessible by roads, allowing poachers to move freely without checks. Lack of staff presence in these inaccessible areas increases vulnerability to illegal activities.</p>	<p>with only 20 filled frontline positions out of the sanctioned 46, leading to sparse patrolling coverage.</p> <p><b>Infrastructure and Protection Challenges:</b> Ongoing lack of adequate infrastructure, including roads, patrolling paths, and camps, impairs monitoring and protection efforts. Technology deficiency remains a challenge, impacting the reserve's ability to effectively monitor and safeguard its resources.</p>	<p><b>Monitoring and Surveillance:</b> Intensify monitoring efforts, especially through camera trapping exercises, to improve the detection of tigers in Kamlang Tiger Reserve. Given the absence of photographic evidence in 2018 and 2022, strengthen routine monitoring exercises to enhance the documentation of tiger presence.</p> <p><b>Genetic Diversity Preservation:</b> Emphasize the importance of genetic diversity preservation, especially in populations like Kamlang, which may play a crucial role in maintaining genepool connectivity with critically endangered subspecies. Explore additional genetic sampling methods to ensure a comprehensive understanding of the tiger population in the region.</p> <p><b>Habitat Protection and Restoration:</b> Recognize Kamlang Tiger Reserve as a refuge for critically endangered species, despite the low abundance of tigers and other mammalian species. Prioritize habitat protection and restoration efforts to maintain a continuous stretch of forest, ensuring the sustenance of an excellent species assemblage.</p>

Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018			<p><b>Community Engagement and Conservation Education:</b> Involve local communities in conservation efforts and raise awareness about the importance of Kamlang Tiger Reserve as a biodiversity hotspot. Implement community-based conservation initiatives to promote coexistence and sustainable practices.</p> <p><b>Research Initiatives:</b> Support research initiatives to investigate the factors influencing the low abundance of tigers in Kamlang. Explore ecological and environmental factors affecting tiger populations and use the findings to guide conservation strategies.</p> <p><b>Collaboration with Myanmar Conservation Efforts:</b> Foster collaboration with conservation initiatives in Myanmar, especially those focused on <i>Panthera tigris corbetti</i>. Share knowledge and coordinate efforts to strengthen transboundary conservation strategies.</p>

Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<p><b>Infrastructure and Protection Challenges:</b> Lack of adequate infrastructure (roads, patrolling paths, camps) and technology impairs monitoring and protection. Staff shortage with only 20 filled frontline positions out of 46 sanctioned, resulting in sparse patrolling coverage.</p> <p><b>Financial Limitations:</b> Insufficient funds hinder infrastructure development and maintenance, affecting the reserve's functionality and competitiveness with other reserves.</p> <p><b>Equipment Shortages and Staff Welfare:</b> Unserviceable arms, insufficient binoculars, and lacking essential gadgets impact conservation efforts. Staff, including contingency workers, lack insurance coverage despite working in hazardous terrains.</p> <p><b>Veterinary Services and Emergency Preparedness:</b> Absence of a resident veterinary doctor affects immediate response during emergencies.</p> <p><b>Underdeveloped Tourism Facilities:</b> Inadequate tourist facilities, lack of formalized services, and absence of interpretation centres limit the tourism potential.</p> <p><b>Information Dissemination and Feedback Mechanism:</b> Lack of effective information dissemination through brochures, signage, and a dedicated website. Absence of a systematic feedback collection mechanism for visitor experiences and suggestions.</p>		

Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<p><b>Community Engagement Challenges:</b> Early-stage formation of eco-development committees (EDCs) and standalone self-help groups without institutional linkage. Limited efforts to engage local communities for long-term conservation support.</p> <p><b>Research and Biodiversity Studies:</b> Limited studies conducted despite the reserve's biodiversity richness and unexplored flora and fauna. Lack of attention from local universities and research institutions for exploration and study.</p> <p><b>Climate and Conservation Studies:</b> Failure to initiate studies on climate-related aspects despite the state's emphasis on climate-resilient forestry.</p> <p><b>Pending Actions from Conservation Plan:</b> Delay in implementing prescribed actions from the Tiger Conservation Plan, including corridor development and engagement with adjoining forest divisions. Lack of information and action regarding land use around fringe villages as outlined in the conservation plan.</p>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- a. The development of infrastructure such as roads, patrolling paths, and camps within the Kamlang Tiger Reserve is recommended to be prioritized. Investment in modern technology, including surveillance equipment, can significantly bolster monitoring and protection efforts. Additionally, enhancing connectivity to inaccessible areas will be instrumental in deterring illegal activities and enhancing overall conservation efforts.
- b. Prompt recruitment and training of additional personnel to address the persistent shortage of frontline staff are advisable. Equipping the staff with essential tools, including serviceable arms and gadgets, is deemed essential for effective patrolling. Furthermore, providing comprehensive insurance coverage for staff, including contingency workers, is considered crucial given the challenging terrains they work in.
- c. Increased financial support is deemed necessary to overcome limitations hindering infrastructure development and maintenance. Strategic allocation of funds to address critical needs, such as staff welfare, equipment procurement, and habitat restoration, will optimize resource utilization and support long-term conservation goals.
- d. Enhanced emergency response capabilities within the reserve can be achieved by employing a resident veterinary doctor. Establishing a robust system for immediate medical attention to wildlife and addressing health concerns is deemed vital. Developing and implementing comprehensive emergency preparedness plans will ensure effective management of wildlife health emergencies.
- e. Improvement of tourist facilities and services within the reserve, including interpretation centers, is recommended to enhance the overall visitor experience. Formalization of tourism services will ensure minimal ecological impact while developing a sustainable tourism model that generates revenue for conservation efforts.
- f. Establishment of effective information dissemination mechanisms, such as brochures, signage, and a dedicated website, is essential for visitor engagement. Implementation of a systematic feedback collection mechanism will enable continuous improvement based on visitor experiences and suggestions. Strengthening institutional linkages with local communities will emphasize the importance of their involvement in long-term conservation support.
- g. Encouragement and facilitation of biodiversity studies within the reserve through collaboration with local universities and research institutions are advised. Exploration of the unexplored flora and fauna richness of Kamlang Tiger Reserve will enhance scientific knowledge and guide conservation strategies. Supporting initiatives that promote climate-resilient forestry practices is crucial for long-term sustainability.
- h. Initiation of comprehensive studies on climate-related aspects within the reserve is recommended to align conservation strategies with climate resilience goals. Adapting

## NAMDAPHA TIGER RESERVE

to changing environmental conditions and exploring sustainable practices that contribute to climate change mitigation will strengthen conservation efforts.

- i. Expediting the implementation of prescribed actions from the Tiger Conservation Plan is essential. Prioritizing corridor development and engaging with adjoining forest divisions to enhance connectivity will support wildlife conservation. Addressing land use issues around fringe villages in alignment with the conservation plan is imperative for habitat protection.
- j. Strengthening the formation of eco-development committees (EDCs) and establishment of institutional linkages with self-help groups are advised. Implementation of community-based programs that empower local residents with sustainable alternatives to reduce dependency on forest resources will foster long-term conservation support.

### 5. Conclusions

Kamlang Tiger Reserve faces multifaceted challenges, including inadequate infrastructure, staffing shortages, and financial limitations. Urgent action is required to enhance monitoring capabilities, address human-wildlife conflict, and strengthen anti-poaching measures. The development of tourism facilities offers potential revenue streams for conservation. Community engagement is pivotal, requiring effective communication, alternative livelihoods, and sustainable practices. Research initiatives can unlock the reserve's biodiversity potential, while aligning conservation efforts with climate resilience is crucial. Swift implementation of the Tiger Conservation Plan and concerted efforts can transform Kamlang Tiger Reserve into a model for successful and sustainable wildlife conservation, ensuring the preservation of its unique ecosystems and biodiversity.



### 1. Brief Description

Namdapha Tiger Reserve (NTR) has an area of 1985 km<sup>2</sup> and is a floral and faunal biodiversity hotspot in the Eastern Himalayas. This tiger reserve (TR) forms the north-western part of the Mizoram-Manipur-Kachin (Myanmar) rain forest eco-region. With its wide range of altitudinal variation (200-4571 m), it harbours an extremely rich floral and faunal diversity.

Four *Panthera* species are found in NTR, i.e., the leopard, snow leopard, clouded leopard and tiger. It has other predators like the wild dog, Malayan sun bear, Asiatic black bear and Indian wolf. There are smaller carnivores like the Eurasian otter, Indian civet, masked palm civet, Asian golden cat, marbled cat, spotted linsang, binturong, fishing cat and mongoose. The large herbivores are represented by the wild boar, musk deer, hog deer, Himalayan and mainland serows, Indian muntjac, takin, sambar and bharal. Indian elephants were reported in the habitat, but only a migratory population has been reported presently in the fringe forest division.

The non-human primates include the slow loris, stump-tailed macaque, hoolock gibbon and Assamese macaque. The birds include the white-bellied heron, a critically endangered species, which was recorded in 1994. NTR is also known for its butterfly diversity, which includes the kohinoor, Naga tree brown, red caliph and East Himalayan purple emperor. The vegetation in NTR ranges from evergreen moist deciduous to temperate broad leaved to coniferous forests to alpine vegetation. More than 150 timber species are found in NTR, which has a rich diversity of dipterocarps, the hollong being the state tree of Arunachal.

### 2. Tiger Population as per All India Tiger Estimation:

In 2018, the tiger reserve reported 11 tigers, yet their actual utilization of the space remained uncertain. Extrapolating tiger density from scat and camera trap data through MaxEnt analysis indicated a potential tiger population of 29 within the Dibang-Kamlang-Namdapha block.

However, in 2022, no tiger was captured in photos during the cycle, highlighting a potential decline or shift in tiger presence. The tiger population in Namdapha has consistently been sparse, estimated at 540 km<sup>2</sup> in 2006. Although occupancy wasn't assessed in 2010, scat DNA confirmed tiger presence in 2014 and 2018, emphasizing the need for continuous monitoring to understand and address fluctuations in tiger populations over time.

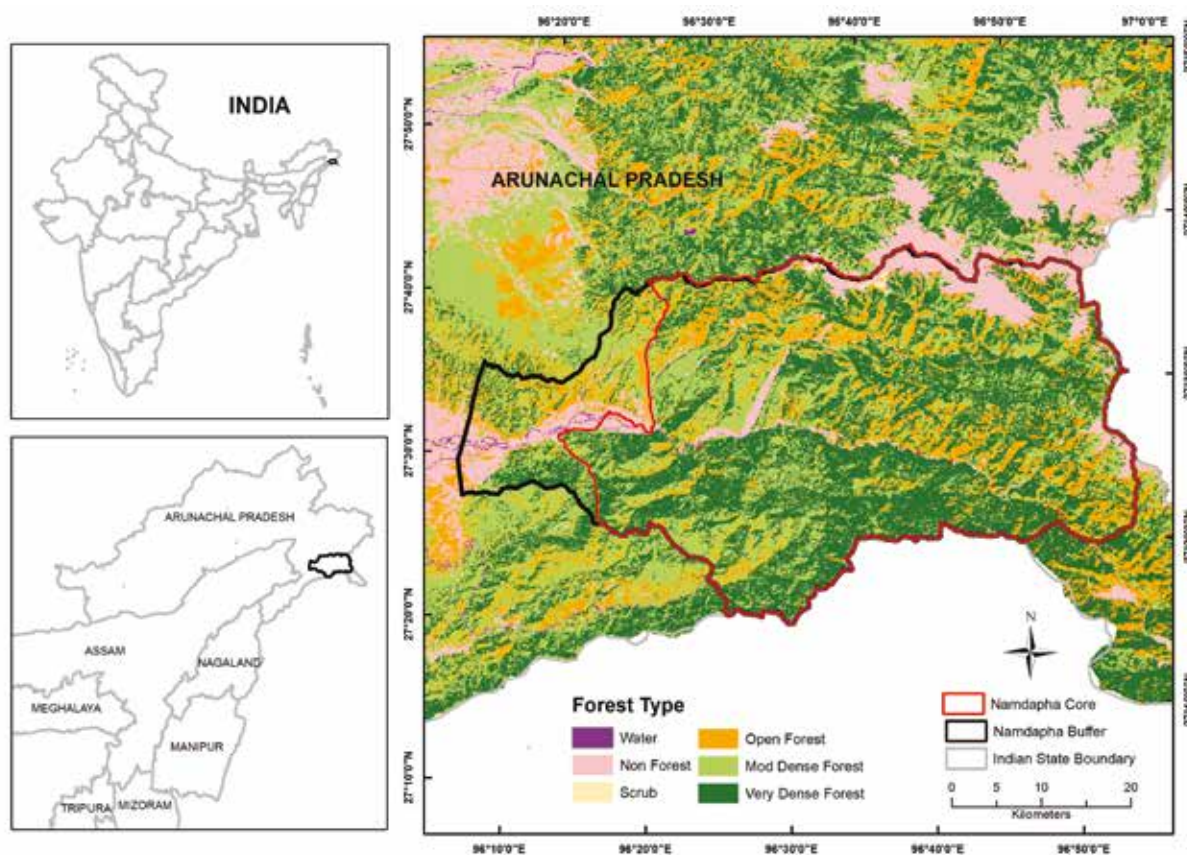


Figure 1: Map showing the location of Namdapha Tiger Reserve in the state of Arunachal Pradesh.



### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>Inadequate completion of legal procedures, especially delineation of buffer zones and unified control.</li> <li>Buffer zone delineation incomplete: Proposed buffer only on certain boundaries, lacking control by Park authority.</li> <li>Lack of compatibility in the buffer area, including forestry operations.</li> <li>The RF to the south, not designated as a buffer, even though it constitutes the border with Myanmar.</li> <li>Habitation persists within the core area (28 Lisu families) and recent hutments along the M.V. route.</li> <li>Livestock grazing pressure observed in adjoining areas, though none within the park.</li> <li>Lack of clarity regarding the involvement of other departments in the area.</li> <li>Management plan submitted two years ago but pending approval from CWLW (Chief Wildlife Warden).</li> <li>Poor regeneration status in the buffer area.</li> <li>Satisfactory regeneration status in the core area.</li> <li>Inadequate staff in position: Only one Ranger posted against three sanctioned posts, and three foresters against six.</li> </ul>	<p><b>Encroachment Issues:</b> Continuation of encroachment by tribes such as Lisu, impacting critical habitat through increased cultivation and settlements. Ongoing expansion of villages within sensitive areas of the reserve.</p> <p><b>Infrastructure and Staffing Challenges:</b> Persisting poor infrastructure, including inadequate roads, patrolling paths, and anti-poaching camps. Staff shortages and limited resources across the vast reserve, leading to accessibility issues and inadequate patrolling.</p> <p><b>Species Presence and Monitoring:</b> Lack of recent evidence or monitoring of tigers and elephants within the reserve, impacting population estimation and conservation efforts.</p> <p><b>Legal and Human Pressure:</b> Inadequate completion of legal procedures, delineation of buffer zones, and unified control, leading to continued challenges in managing boundaries. Presence of human habitation within core areas and grazing pressures persisting in adjoining zones.</p>	<ul style="list-style-type: none"> <li>Strengthen connectivity with Sonai Rupai Wildlife Sanctuary in Assam and the larger forest complex of Arunachal Pradesh. Collaborate on conservation efforts to mitigate high hunting pressures and facilitate habitat continuity into Namdapha, Intanki, and potentially into Myanmar.</li> <li>Continue DNA profiling of carnivore scats to confirm and monitor the presence of tigers in Namdapha Tiger Reserve. Implement routine monitoring exercises to supplement camera trap data, ensuring a comprehensive understanding of tiger populations.</li> <li>Prioritize the conservation of Namdapha as a confluence zone between tiger subspecies with a unique genetic structure. Undertake measures to safeguard this genetic diversity, which is of paramount importance for tiger conservation.</li> <li>Exercise caution in developmental activities, especially road construction and agriculture, to protect prime habitats within the productive valley. These habitats are crucial for wildlife, and their</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
			<p>preservation should be a priority in the face of developmental pressures.</p> <ul style="list-style-type: none"> <li>Implement systematic management strategies to control the spread of invasive species, such as <i>Ageratina adenophora</i> and <i>Chromolaena odorata</i>. Focus on priority areas identified in other Tiger Reserves and initiate removal efforts to prevent their establishment in Namdapha.</li> </ul>
2010	<ul style="list-style-type: none"> <li>Inadequate staff and most of them are not trained.</li> <li>Inadequate infra structure for staff, protection and other priority activities.</li> <li>Low priority to wildlife sector by state govt. No substantial support from civil and judiciary on control of poaching</li> <li>No eco development or activities to seek cooperation from various ethnic communities</li> <li>No buffer notified</li> <li>Enchroachment of 84 families of Lishu people settled in five villages within the core</li> <li>The road from Debang to Vijayanagar, now maintained by PWD could be helpful in protection but could be a major threat</li> <li>Lack of check post manned by park authorities in Gandhigram at the border of the TR.</li> </ul>		<ul style="list-style-type: none"> <li>Overcome logistics constraints and conduct grid-based sampling for more accurate biodiversity studies. Strengthen research initiatives to explore the diverse habitats within Namdapha, from subtropical broad-leaved forests to alpine meadows, and use findings to guide conservation strategies.</li> <li>Acknowledge the consistently low abundance of tigers in Namdapha and prioritize active management measures. Implement continuous law enforcement monitoring, explore ungulate population augmentation, consider tiger reintroduction strategies, and engage in participatory conservation with local communities.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
			<ul style="list-style-type: none"> <li>Collaborate with Myanmar on transboundary conservation efforts, recognizing the entry points of tigers into the Indian sub-continent and the existence of another tiger subspecies, <i>P. t. corbetti</i>, in Myanmar. Share knowledge and coordinate conservation strategies for the larger contiguous forested tracks.</li> </ul>
2014	<ul style="list-style-type: none"> <li>The inaccessibility gives rise to problems also. The road connectivity is very poor. Only one road, called the 80 mile road, passes through the park, of which only 32 km is patrolled by the staff. There are no other approach roads or inspection paths.</li> <li>It has very poor infrastructure. There is a lack of vehicles, buildings, arms and ammunition, wireless equipment, cameras, binoculars, GPS, computers/laptops, tourist facilities, etc.</li> <li>With a park area of 1985 km, it has only three ranges, and these are not evenly distributed, as a result of which there is skewed control and weak patrolling. The park is understaffed, and the staff are also not trained in wildlife management.</li> <li>The southern boundary (Nampong) and the eastern boundary (Gandhigram) have not been demarcated. The entire boundary issue needs a relook.</li> </ul>		<ul style="list-style-type: none"> <li>Establish a continuous monitoring system for tiger presence and biodiversity. Adopt an adaptive management approach that allows for flexible strategies based on ongoing monitoring and research findings.</li> <li>Engage local communities in conservation efforts, emphasizing the significance of Namdapha Tiger Reserve and its unique biodiversity. Raise awareness about the importance of tiger conservation and involve communities in participatory initiatives for the restoration and preservation of the area's biodiversity.</li> </ul>



MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>There is no systematic research work or publicity to attract visitors. The lack of good approach roads makes it a lonely place that otherwise has huge potential.</li> </ul>		
2018	<ul style="list-style-type: none"> <li>Poaching in the TR by communities residing in and around the TR such as Chakama, Lisu and Mishmi tribes and hunting of large predators such as tiger, leopard and musk deer by poachers from Myanmar are the biggest threat.</li> <li>The Lisu settlements inside the TR has been increasing each year. 65 households in 2004-2005, increased to 157 households in 2012. The Lisus convert forests into agriculture and orchards. The habitat is undergoing degradation.</li> <li>The protection strategy is not effective. Three poaching cases of sambar were registered in the TR during last 3 years.</li> <li>The Elephants have migrated from the reserve. Lisus are hunter and they are responsible for decrease in the wildlife population. The trained elephant can be illegally transported to Myanmar or Thailand.</li> <li>Lisus are demanding that the portion of the TR encroached by them denotified. They are not willing to leave encroached area.</li> </ul>		
2022	<p><b>Encroachment Issues:</b></p> <ul style="list-style-type: none"> <li>Lisu and other tribes' population growth leading to increased cultivation, impacting critical tiger habitat.</li> <li>Expansion of villages occupying sensitive areas within the reserve.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<p><b>Infrastructure and Staffing Challenges:</b></p> <ul style="list-style-type: none"> <li>Poor infrastructure for protection (roads, patrolling paths, anti-poaching camps) affecting accessibility and management.</li> <li>Limited staff and resources across the vast 1985 km<sup>2</sup> reserve, with more than half inaccessible due to various challenges (terrain, insurgency, approach issues).</li> </ul> <p><b>Inadequate Field Camps and Protection Measures:</b></p> <ul style="list-style-type: none"> <li>Insufficient field camps, compounded by the burning of one camp in 2022.</li> <li>Lack of anti-poaching/protection camps in sensitive areas along the Myanmar border.</li> <li>Vijay Nagar area lacks adequate vigilance despite its critical importance.</li> </ul> <p><b>Staffing Shortages and Aging Workforce:</b></p> <ul style="list-style-type: none"> <li>High number of vacancies among frontline staff.</li> <li>Aging staff members nearing retirement, including Range Officers.</li> <li>Overreliance on contingency staff and tiger protection force due to inadequate regular staff numbers.</li> </ul> <p><b>Financial Concerns:</b></p> <ul style="list-style-type: none"> <li>Non-payment of wages to contingency staff in the current financial year due to funding issues from the state government/NTCA.</li> </ul> <p><b>Species Presence and Monitoring:</b></p> <ul style="list-style-type: none"> <li>Lack of recent evidence (camera traps, indirect signs) of tigers and elephants within NTR.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>Delayed reports on scat samples sent for analysis in 2022, impacting population estimation.</li> <li>Challenges in accurately estimating tiger populations due to logistic constraints in specific regions.</li> </ul> <p><b>Declining Elephant Presence:</b></p> <ul style="list-style-type: none"> <li>Recent absence of elephant sightings within NTR, indicating a potential impact from hunting by tribes, possibly for markets in neighboring countries.</li> </ul>		



**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested Key Management Recommendations

- Measures aimed at controlling and mitigating encroachment by tribes such as Lisu and other communities to ensure the protection of critical tiger habitats are recommended to be implemented. Initiating community engagement programs can effectively raise awareness about the importance of preserving wildlife habitats and discourage activities leading to habitat degradation.
- Resources should be allocated towards improving infrastructure, including roads, patrolling paths, and anti-poaching camps, to enhance accessibility and management capabilities within the reserve. Addressing staffing shortages through recruitment and training of personnel, particularly in critical frontline positions, is advisable. Ensuring that staff is adequately equipped and supported will enable them to carry out their duties effectively.
- Additional field camps, particularly in areas along the Myanmar border and other sensitive zones, can strengthen protection measures within the reserve. Enhancing vigilance in critical areas, such as Vijay Nagar, and implementing measures to prevent and respond to incidents like the burning of camps should be prioritized.
- Collaboration with state government and national agencies to address financial issues promptly is advisable. Ensuring timely payment of wages to contingency staff is crucial for maintaining a motivated and efficient workforce.
- Monitoring efforts should be enhanced through the utilization of camera traps and other technologies to gather timely and accurate data on tiger and elephant populations. Addressing delays in reporting and analysis of scat samples will contribute to ensuring that population estimates are based on up-to-date information.
- Awareness programs aimed at informing local communities about the significance of Namdapha Tiger Reserve and their indispensable role in conservation efforts are suggested to be conducted. Establishing collaborations with local communities can effectively encourage their active participation in conservation initiatives and discourage activities detrimental to wildlife.
- Urgent action is recommended to investigate the decline in elephant presence. Immediate measures must be taken to prevent hunting and trafficking of elephants. Implementing strategies to protect and conserve elephant populations within the reserve is imperative.
- Collaborations with neighboring countries, particularly Myanmar, are advisable to strengthen and address common conservation challenges effectively. Coordinating efforts to preserve larger forested tracks and transboundary habitats is essential for

the long-term conservation of the region.

- i. Adaptive management strategies should be implemented promptly. These strategies should allow for flexibility in conservation approaches based on ongoing monitoring, research findings, and changing conservation dynamics in the region.

## 5. Conclusions

Namdapha Tiger Reserve, nestled in the Eastern Himalayas, stands as a crucial biodiversity hotspot. Despite facing challenges such as encroachment, inadequate infrastructure, and staffing issues, the reserve continues to host a diverse range of flora and fauna, including the elusive tiger. To secure the future of Namdapha, urgent steps are needed. Strengthening anti-encroachment measures, enhancing infrastructure, ensuring adequate staffing, and prioritizing species monitoring are essential. Collaborative efforts with local communities and neighboring countries, along with adaptive management strategies, will be key to preserving the unique genetic diversity of tigers and sustaining the rich ecosystems within the reserve. Namdapha Tiger Reserve's conservation journey hinges on proactive management, community engagement, and international cooperation to overcome existing challenges and safeguard its invaluable natural heritage.



## PAKKE TIGER RESERVE

### 1. Brief Description

Pakke Tiger Reserve (PTR), located in Arunachal Pradesh, covers an expanse of 862 km<sup>2</sup>, displaying diverse ecosystems with altitudes ranging from 150 m to 2000 m. The reserve is a vital part of the Indo-Chinese tiger range and is bordered by major rivers like Bhareli/Kameng and Pakke. PTR boasts a rich variety of flora, including Lowland Semi-evergreen and Evergreen Forests, hosting 343 woody angiosperm species and numerous orchids. Its faunal diversity is equally impressive, with 40 mammal species, including Bengal tigers, Indian leopards, and wild dogs, along with a myriad of bird species, reptiles, and amphibians. The conservation efforts in PTR involve 27 anti-poaching camps, manned by dedicated staff, local youths, and village elders, equipped with essential gear. Despite challenging terrain, approximately 41 km of roads have been constructed to facilitate logistics and deter wildlife criminals. This reserve stands out not only for its unique biodiversity, including endangered species like the Assam roofed turtle and pied warty frog but also for its significant butterfly diversity, contributing to the conservation landscape of India.

### 2. Tiger Population as per All India Tiger Estimation

In 2018, 111 camera points were utilized with an effort of 3561 trap nights, resulting in the identification of 3 unique tigers. By 2022, the camera trap effort expanded significantly, involving 135 active camera trap stations over 8755 trap nights, leading to the discovery of 6 individual tigers. Additionally, in 2014, a total of 7 tigers were captured, and interestingly, 3 of them were found to be shared with Namdapha Tiger Reserve. The 2010 population estimate indicated 9 tigers, and this count was shared with Nameri Tiger Reserve.



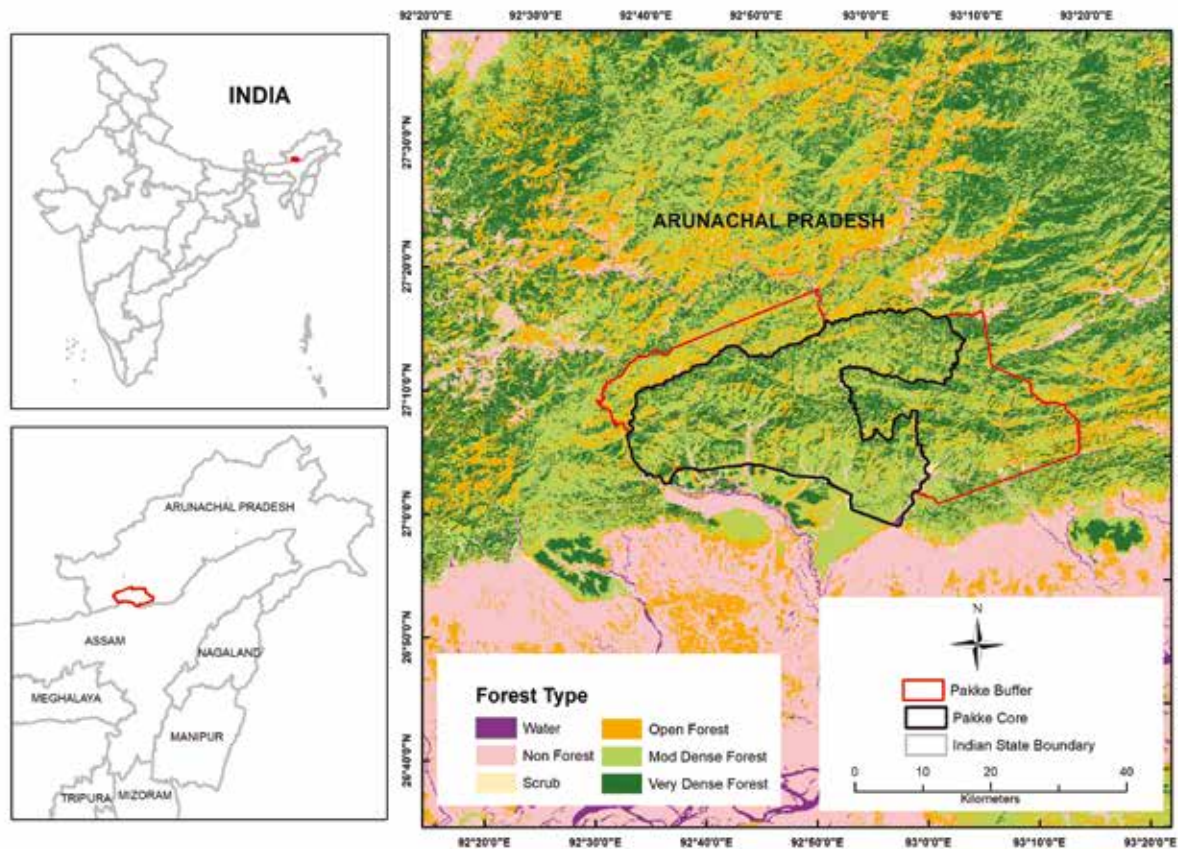


Figure 1: Map showing the location of Pakke Tiger Reserve in the state of Arunachal Pradesh.



### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>No identified buffer zone or unified control of the buffer area.</li> <li>Incompatibility in the buffer area, including proposed hydroelectric projects impacting river habitats.</li> <li>Detrimental land use in areas outside the buffer zone, affecting wildlife habitats and causing fragmentation.</li> <li>Pending management plan approval, necessitating site-specific revision.</li> <li>Inadequate infrastructure, equipment, and vehicles for effective management and patrolling.</li> <li>Inadequate staff presence and coverage across the reserve, with the existing staff being insufficiently equipped to handle the vast and rugged terrain.</li> <li>Delayed release of funds affecting the timely execution of conservation objectives.</li> <li>Insufficient disbursement of project allowances and travel funds for operational needs.</li> <li>Lack of a systematic data collection process, reliance on external agencies for research, and limited contribution to internal management strategies.</li> <li>Limited tourism regulation strategies due to the reserve's low-key tourism status.</li> <li>Limited development of tourist facilities or initiatives to attract visitors.</li> <li>Issues related to weed growth, gregarious woodland advancement, and potential impacts on habitat restoration.</li> </ul>	<p><b>Infrastructure and Logistical Challenges:</b>            Persisting Issue: The mountainous terrain still poses challenges for access and logistical support.            Improvement Needed: Inadequate road networks and accessibility during the rainy season remain a concern.</p> <p><b>Wildlife Monitoring and Estimation:</b>            Persisting Issue: Limited population estimation exercises for species beyond tigers.            Improvement Needed: Comprehensive population estimation for co-predators (leopards, clouded leopards, etc.) is lacking.</p> <p><b>Range Management and Accessibility:</b>            Persisting Issue: Uneven distribution and difficult terrain across ranges, leading to management issues.            Improvement Needed: Better range distribution and management strategies to address accessibility challenges.</p> <p><b>Shortage in Vehicles and Arms:</b>            Persisting Issue: Inadequate number of vehicles and arms, limiting essential protection functions.</p>	<p><b>Population Monitoring and Modeling:</b> Given the challenges in modeling the tiger population due to a small sample size, there is a need for increased and more extensive camera trap sampling across different parts of the reserve. Implement robust monitoring strategies to accurately estimate tiger populations and trends over time, enabling informed conservation decisions.</p> <p><b>Connectivity and Corridor Restoration:</b>            Strengthen connectivity within the tiger reserve, especially focusing on the weak and fragmented connections between Tale Valley Wildlife Sanctuary, Yordi-Rabe Supe Wildlife Sanctuary, and Mouling National Park.            Address the impact of linear infrastructure development on habitat connectivity, with a particular emphasis on maintaining strong connections between D'Ering Wildlife Sanctuary and Dibru Saikhowa National Park in the southern direction.</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>Inadequate anti-poaching infrastructure due to damaged camps and insufficient patrol paths.</li> <li>Challenges in monitoring daily activities due to staff inadequacy in dense forest areas.</li> <li>Variable levels of community involvement in ecotourism, insufficient fulfillment of reciprocal commitments, and challenges in establishing trust between local communities and reserve management.</li> <li>Limited efforts toward sustainable development and economic benefits for stakeholders.</li> </ul>	<p>Improvement Needed: Address the shortage to enhance the capabilities for protection and patrolling.</p> <p><b>Team Preparedness and Conservation Committees:</b>            Persisting Issue: Insufficient preparedness of the Rapid Response Team, absence of EDCs, and LAC.            Improvement Needed: Strengthen response team readiness and establish necessary conservation committees.</p> <p><b>Online Presence and Visitor Management:</b>            Persisting Issue: Lack of a dedicated website and online booking system for visitors.            Improvement Needed: Establish a website and improve online facilities for visitor management.</p>	<p><b>Invasive Species Management:</b>            Develop and implement systematic management strategies to control the spread of invasive species such as Mimosa diplotricha and Mikania micrantha within priority management areas, including Anshi Dandeli, Bhadra, Anamalai, Indravati, Nagarjuna Sagar Srisailam, Nameri, Pakke, Dampa, Valmiki, and others.            Prioritize removal efforts for these invasive species, especially in areas where their invasion is in the initial stage, to prevent their establishment in larger areas.</p> <p><b>Population Conservation Efforts:</b>            Collaborate with neighboring reserves, particularly Nameri Tiger Reserve, to collectively address the conservation needs of the shared tiger population block.            Explore innovative conservation approaches, such as augmentation of prey, habitat improvement, and possible reintroduction efforts, to ensure the survival and growth of the tiger populations in both Nameri and Pakke Tiger Reserves.</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006			<p><b>Community Engagement and Law Enforcement:</b>            Engage local communities in conservation efforts, emphasizing the significance of tiger reserves and seeking cooperation for protection and monitoring.            Strengthen law enforcement monitoring to address poaching threats, especially in areas where human settlements encroach upon critical tiger habitats.</p> <p><b>River Connectivity Conservation:</b>            Preserve the connectivity of rivers, such as Kameng and Brahmaputra, which act as natural extensions to the tiger population.            Implement measures to reduce human encroachment on river islands, ensuring the undisturbed flow of rivers for maintaining biological corridors.</p>
2010	<ul style="list-style-type: none"> <li>The frontline staff is insufficient and mostly comprises casual laborers.</li> <li>Inadequate funding and limited support from Project Elephant hinder conservation efforts.</li> <li>Infrastructure and visitor services are severely lacking and need significant improvement.</li> <li>There's a glaring absence of research initiatives and structured monitoring mechanisms within the reserve.</li> <li>Ethnic insurgency on the reserve's outskirts poses an additional challenge to its stability.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<ul style="list-style-type: none"> <li>The absence of an interpretation center or organized awareness programs hinders public engagement.</li> <li>Perceived threats from the construction of a 500MW power station and a 24km road along the Kameng River are alarming. These projects disrupt elephant movement and habitat.</li> <li>In the fringe areas, there's pressure from the collection of non-timber forest products (NTFP) and limited traditional tribal hunting activities.</li> </ul>		
2014	<ul style="list-style-type: none"> <li>Logging activities persist in the buffer areas due to inadequate control and handover to park management.</li> <li>Despite security measures in lower regions, hunting and cane collection persist in the northern parts of the reserve.</li> <li>Proposed dam construction on rivers could adversely affect the park's ecology. Elephant corridors like Dezling and Langka are under threat.</li> <li>Uncontrolled industrial units near Bhalukpong are causing pollution. Invasive species and shifting cultivation are leading to habitat degradation.</li> </ul>		
2018	<ul style="list-style-type: none"> <li>Buffer areas of Papum and Tenga Reserve Forests under separate DFOs; rampant illegal tree felling persists in both areas.</li> <li>Impact: Inability of TR management to control illegal activities leading to habitat degradation.</li> <li>Suspected porous northern border along Papu River allowing miscreants to enter for hunting, potentially impacting ungulate population growth.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Proposed hydroelectric project's tunnel may further ease border crossing, worsening the situation.</li> <li>Shortage of funds hindering habitat improvement efforts like weed control and prevention of tree invasion in grasslands.</li> <li>Impact: Decreased achievement of conservation targets due to limited financial resources.</li> <li>Inaccessibility Due to Terrain and Poor Road.</li> <li>Inhospitable terrain leading to poor road networks, especially in the northern TR portion; inaccessible during rainy seasons.</li> <li>Challenge: Limited access hampers management efforts and patrols in critical areas.</li> <li>Lack of adequate pursuit of legal matters in courts regarding conservation-related issues.</li> <li>Impact: Ineffectiveness in addressing conservation violations through legal means.</li> </ul>		
2022	<ul style="list-style-type: none"> <li>Majority mountainous terrain up to 2000m elevation causing access and logistical issues within PTR.</li> <li>PTR's tiger population declined to three in 2018–19; estimation exercises limited to tigers, neglecting co-predators' population assessment.</li> <li>Uneven distribution of area among three large, difficult-to-manage ranges within PTR, leading to management challenges.</li> <li>Insufficient vehicles impacting essential functions and duties within PTR.</li> <li>Shortage of arms limiting PTR's capacity to meet protection requirements adequately.</li> <li>Presence of invasive species threatening PTR, yet to be mapped and monitored.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>Rapid Response Team and Special Tiger Protection Force require strengthening in preparedness to address exigencies.</li> <li>Grazing incidents observed despite no human settlements within PTR.</li> <li>Delay in forming Eco-Development Committees (EDCs) and minimal progress in constituting these committees.</li> <li>Local Advisory Committee (LAC) yet to be constituted for PTR.</li> <li>Absence of a dedicated PTR website and online booking system for visitors.</li> <li>Detailed plan on carbon storage, capture, and loss assessment pending implementation within PTR.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested Key Management Recommendations

- It is recommended that persisting issues related to the mountainous terrain, which pose challenges for access and logistical support, be addressed. Improvement of road networks and accessibility, especially during the rainy season, would enhance management efforts and patrols.
- Comprehensive population estimation exercises for species beyond tigers, with a focus on co-predators such as leopards and clouded leopards, are advisable.
- Implementation of robust monitoring strategies to accurately estimate tiger populations and trends over time would facilitate informed conservation decisions.
- Development of better range distribution and management strategies to address challenges posed by uneven distribution and difficult terrain across ranges is recommended.
- Addressing the shortage of vehicles and arms to enhance essential protection functions and patrolling capabilities is necessary.
- Implementation of measures for mapping, monitoring, and controlling invasive species, such as *Mimosa diplotricha* and *Mikania micrantha*, within priority management areas is recommended.

- Prioritization of removal efforts for invasive species, especially in areas where their invasion is in the initial stage, to prevent their establishment in larger areas is advised.
- Strengthening the readiness of the Rapid Response Team and establishment of necessary conservation committees, including Eco-Development Committees (EDCs) and Local Advisory Committees (LAC), is essential.
- Establishment of a dedicated website for Pakke Tiger Reserve and improvement of online facilities, including an online booking system, for effective visitor management is recommended.
- Strengthening of connectivity within the tiger reserve, focusing on weak and fragmented connections between Tale Valley Wildlife Sanctuary, Yordi-Rabe Supe Wildlife Sanctuary, and Mouling National Park, is advisable.
- Addressing the impact of linear infrastructure development on habitat connectivity and maintenance of strong connections between D'Ering Wildlife Sanctuary and Dibru Saikhowa National Park in the southern direction is recommended.
- Collaboration with neighboring reserves, particularly Nameri Tiger Reserve, to collectively address the conservation needs of the shared tiger population block is advisable.
- Exploration of innovative conservation approaches, such as augmentation of prey, habitat improvement, and possible reintroduction efforts, to ensure the survival and growth of tiger populations in both Nameri and Pakke Tiger Reserves is recommended.
- Engagement of local communities in conservation efforts, emphasizing the significance of tiger reserves and seeking cooperation for protection and monitoring, is essential.
- Strengthening of law enforcement monitoring to address poaching threats, especially in areas where human settlements encroach upon critical tiger habitats, is advisable.
- Preservation of the connectivity of rivers, such as Kameng and Brahmaputra, which act as natural extensions to the tiger population, is recommended.
- Implementation of measures to reduce human encroachment on river islands, ensuring the undisturbed flow of rivers for maintaining biological corridors, is advised.

#### 5. Conclusions

Pakke Tiger Reserve (PTR) in Arunachal Pradesh, spanning diverse ecosystems and altitudes, plays a crucial role in preserving the Indo-Chinese tiger range. Despite facing challenges like mountainous terrain and invasive species, PTR showcases dedicated conservation efforts with anti-poaching camps and infrastructure development. While the 2022 tiger survey notes an increase in identified individuals, concerns arise from the declining trend in the Nameri-Pakke block. Shared populations highlight regional interconnectedness, urging innovative conservation strategies. Recommendations encompass infrastructure enhancement, wildlife monitoring, invasive species control, and community engagement. As PTR navigates these challenges, collaborative efforts, robust management, and local involvement will secure its position as a vital biodiversity stronghold in the Eastern Himalayas.

## KAZIRANGA TIGER RESERVE

### 1. Brief Description

Kaziranga National Park and Tiger Reserve, established in 2006 and declared a World Heritage Site in 1985, is renowned for its conservation of the world's largest population of one-horned rhinos, with around 2200 individuals. Situated in the Eastern Himalayan biodiversity hotspot, it features diverse habitats, including grasslands, swamps, and tropical forests, nurturing over 550 plant species, including medicinal plants. The reserve hosts a rich array of fauna, including endangered species like tigers, rhinos, and eastern swamp deer, along with diverse birdlife. Recognized as an Important Bird and Biodiversity Area, it supports the migration of various bird species during winter. Overall, Kaziranga serves as a vital sanctuary for endangered species and contributes significantly to global conservation efforts.

### 2. Tiger Population as per all India tiger estimation

In 2022, 230 camera traps captured 104 individual tigers over 13839 trap nights, indicating a healthy population. In 2018, 1568 photo-captures revealed 93 adult tigers, suggesting a slightly lower count. In 2014, 96 unique tigers were captured, estimating a population of 103 (SE range: 91-115). However, the 2010 estimate showed 106 tigers (SE range: 81-131), with a wider margin of error. Overall, the trend indicates a relatively stable or slightly increasing tiger population from 2010 to 2022.



SANJAY SHUKLA

SUMAN KOLEY



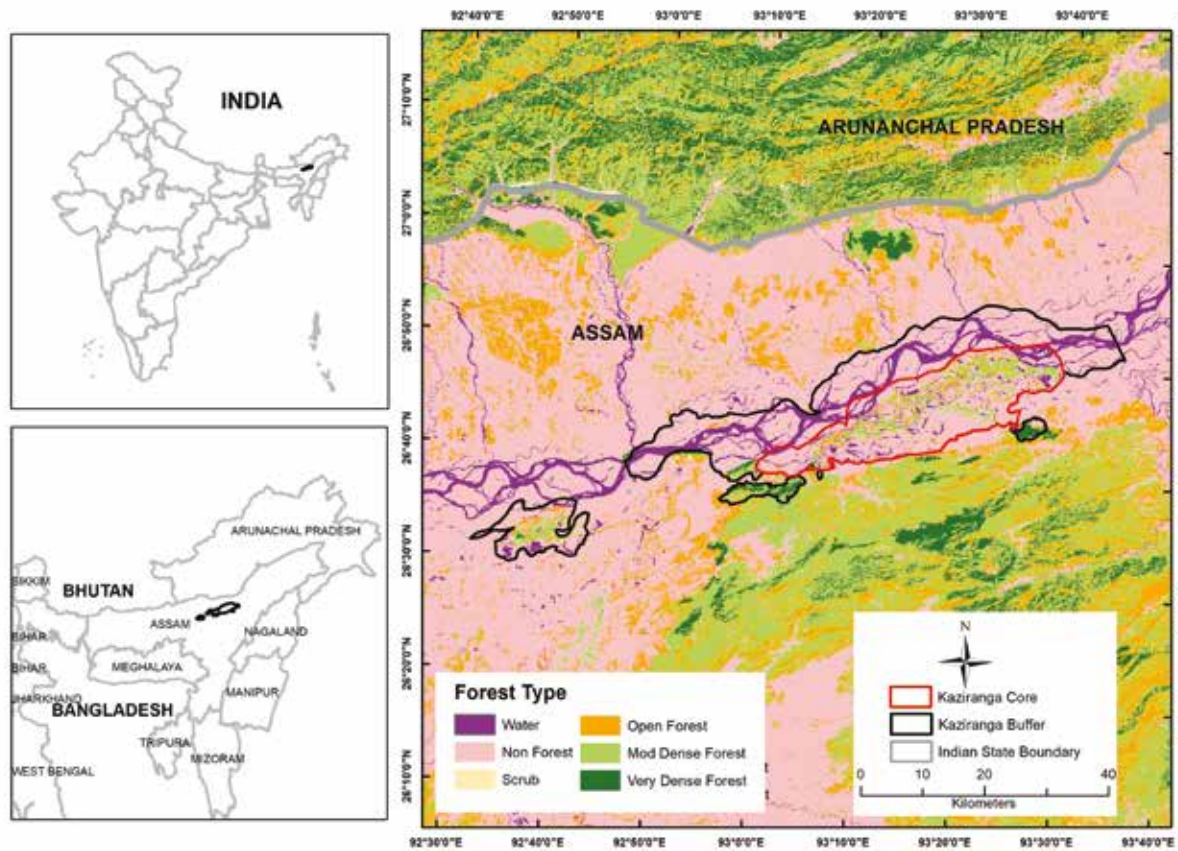


Figure 1: Map showing the location of Kaziranga Tiger Reserve in the state of Assam.



### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<p><b>Habitat Degradation:</b> Invasive Species: Mimosa invisa and Wild rosa causing habitat degradation. Wetland Degradation: Blockage of natural channels by water hyacinth leading to choking and sedimentation.</p> <p><b>Monitoring and Coordination:</b> Lack of Monitoring Mechanisms: Absence of habitat and population monitoring systems. Biotic Pressure: Increasing pressure on corridors and additional areas. Coordination Challenges: Lack of coordination/dialogue with adjacent tea estate management for conservation initiatives.</p> <p><b>Traffic and Funding:</b> Traffic Concerns: Speeding traffic along National Highway 37 affecting conservation efforts. Funding Delays: Delay in the release of funds impacting conservation initiatives.</p>	<p><b>Habitat Degradation:</b> Invasive Species: Presence of invasive species causing habitat degradation (Mimosa invisa, Wild rosa). Wetland Degradation: Blockage of natural channels by water hyacinth leading to choking and sedimentation.</p> <p><b>Buffer Area Challenges:</b> Insufficient Buffer Areas: Lack of suitable buffer areas and problems with transferring notified buffer areas. Monitoring and Coordination: Lack of Monitoring Mechanisms: Absence of habitat and population monitoring systems. Coordination Issues: Challenges in coordinating with adjacent areas for conservation initiatives.</p> <p><b>Infrastructure and Staffing:</b> Infrastructure Maintenance: Inadequate road maintenance, grazing issues, and infrastructure neglect. Staffing Concerns: Transfer of staff leading to shortages, compromising security. Management and Conservation Focus: Rhino-centric management, neglecting other species like tigers and lack of documentation on tiger dispersal.</p>	<p><b>Maintain Connectivity:</b> Ensure the preservation of ecological corridors connecting Kaziranga to neighboring reserves like Nameri-Pakke block to facilitate the metapopulation buildup and gene flow among tiger populations.</p> <p><b>Flood Mitigation Measures:</b> Implement permanent mitigation measures such as animal passages across major roads along the Khasi-Garo hills to provide refuge for wildlife during annual floods, particularly in areas like Karbi Anglong division.</p> <p><b>Habitat Restoration and Prey Augmentation:</b> Undertake adaptive management measures like habitat restoration and prey supplementation in areas with low prey abundance to support tiger population recovery, especially in satellite core areas like Sonai-Rupai Wildlife Sanctuary.</p> <p><b>Enhanced Law Enforcement:</b> Strengthen law enforcement efforts to combat pervasive threats like poaching, which significantly impact tiger populations. Improve monitoring and surveillance to prevent illegal activities within and around the reserve.</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010		<p>Poor Record-keeping: Neglect of habitat monitoring and population estimates for key species.</p> <p><b>Tourism Management:</b> Tourism Pressure: Heavy tourism in specific areas controlled by big business groups, impacting wildlife areas.</p> <p>Community Engagement: Local Community Involvement: The need for involving local communities in conservation and management plans.</p>	<p><b>Riverine Corridor Protection:</b> Secure riverine corridors, particularly through Biswanath, to restore connectivity between Kaziranga and Nameri-Pakke populations. Safeguard river islands from encroachment to maintain their role as natural extensions of tiger habitats.</p> <p><b>Address Anthropogenic Pressures:</b> Mitigate human-wildlife conflict by implementing strategies to minimize conflicts with communities residing around the reserve's periphery. Address barriers to wildlife movement posed by infrastructure development and human settlements.</p> <p><b>Invasive Species Management:</b> Prioritize the management and control of invasive plant species like <i>Ageratum conyzoides</i>, <i>Chromolaena odorata</i>, <i>Lantana camara</i>, <i>Mimosa diplotricha</i>, <i>Mikania micrantha</i>, and <i>Senna tora</i> within and around the reserve to maintain ecosystem integrity and support native flora and fauna.</p>
2014	<p><b>Buffer Area and Field Director's Challenges:</b> Buffer Area Issues: Lack of suitable buffer areas and transfer problems with notified buffer areas.</p> <p>Field Director Challenges: Dependency on the DFO'S office, inadequate office staff, and no exclusive office space.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<p><b>Habitat and Tourism:</b> Habitat Neglect: Poor habitat management with a focus solely on animal management.</p> <p>Tourism Pressure: Heavy tourism confined to specific areas, controlled by large business groups.</p> <p><b>Staffing and Record-keeping:</b> Staffing Issues: Transfer of staff leading to shortages, compromising security.</p> <p>Record-keeping: Lack of population estimates and neglect of key species monitoring.</p>		
2018	<p><b>Poaching Menace:</b> Despite being a symbol of pride for Assam, the rhinoceros faces a persistent threat from poachers. Anti-social elements from neighboring states like Nagaland and Manipur infiltrate the park's southern boundary from the Karbi Anglong hills, carrying sophisticated weapons like AK-47 rifles. The cover provided by the forests in Karbi Anglong aids these poachers. Moreover, the management structure in the district, under an autonomous council, doesn't answer to higher authorities responsible for wildlife conservation.</p> <p><b>Ineffectiveness of Anti-Poaching Measures:</b> Incidents of poaching, such as the killing of three rhinos in close proximity to an anti-poaching camp, raise suspicions of potential involvement or inefficiency of officials. With a considerable number of anti-poaching camps covering the park area, the failure to protect small, delineated zones surrounding each camp raises concerns about resource utilization and effectiveness.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p><b>Poor Infrastructure Maintenance:</b> The maintenance of roads within the core and buffer zones of the park is inadequate. The use of borrow pits for road construction results in uneven surfaces, and neglect of side drain maintenance exacerbates the issue. Fresh borrow pits and poorly maintained side drains are visible, indicating a lack of proper infrastructure upkeep.</p> <p><b>Uncontrolled Grazing:</b> Grazing activities within the park boundaries, despite the installation of preventive measures like solar fencing, pose a continuous problem. Goats entering the core areas and rampant grazing in sanctuaries like Laokhowa and Burachapori reflect the ineffective management of grazing activities.</p>		
2022	<p><b>Pending Tiger Conservation Plan (TCP) Revision:</b> The TCP revision is overdue, leaving the reserve to function under an unapproved plan. This situation compromises effective management strategies and might hinder conservation efforts.</p> <p><b>Incomplete Notifications for New Areas:</b> Despite notifications for new areas to be added to KTR by the Assam state government, these remain preliminary and haven't been executed fully, potentially impacting the reserve's expansion and wildlife conservation scope.</p> <p><b>Coordination with Karbi Anglong Autonomous Council:</b> The inadequate coordination between KTR and the Karbi Anglong Autonomous Council, especially concerning forested areas acting as corridors during floods, poses challenges</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<p>in ensuring the protection and safety of migrating wildlife.</p> <p><b>Shortage of Compatible Android Phones:</b> Insufficient compatible Android phones equipped with M-STrIPES are impacting tiger management and the collection of vital data, potentially affecting the reserve's conservation efforts and data-driven decision-making.</p> <p><b>Inadequate Record-Keeping and Monitoring:</b> The absence of an institutional mechanism to compile crucial data from various registers at the division level hampers effective protection strategies. Lack of continuous monitoring and utilization of collected information for adaptive management is a significant shortcoming.</p> <p><b>Lack of Institutional Mechanism:</b> KTR lacks structured mechanisms to obtain and analyze visitor feedback and suggestions, which could enhance visitor experiences and improve reserve management. Similarly, monitoring activities of eco-development committees in fringe villages is inadequate.</p> <p><b>Limitations of the WhatsApp Group:</b> While the WhatsApp group for officials aids in night patrolling duties, its effectiveness doesn't translate into proper record-keeping for future strategic use, limiting its long-term impact.</p> <p><b>Underdeveloped Interpretation Centers:</b> The condition of the reserve's interpretation centers doesn't align with the reserve's status. Visitors lack pre-visit briefings or informational materials, impacting their overall experience and potentially diminishing the educational value of their visits.</p>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested Key Management Recommendations

- a. Robust anti-poaching strategies are recommended to combat the persistent threat from poachers. This includes strengthening surveillance, increasing patrols, and deploying modern technology such as drones for monitoring.
- b. The maintenance of roads, including leveling uneven surfaces and clearing borrow pits, would be prioritized to enhance accessibility and ensure smooth movement within the core and buffer zones of the reserve.
- c. Measures to control grazing activities within the park boundaries, such as reinforcing solar fencing and implementing stricter enforcement measures, are advisable to prevent livestock intrusion into core areas.
- d. Expedited revision of the Tiger Conservation Plan (TCP) to align with current conservation priorities and challenges is advisable. This ensures that the reserve operates under an updated and comprehensive management framework.
- e. Close collaboration with the Assam state government to finalize and fully execute notifications for new areas to be added to Kaziranga Tiger Reserve would facilitate the expansion of protected habitats and conservation efforts.
- f. Coordination with the Karbi Anglong Autonomous Council to address challenges related to forested corridors during floods is recommended, ensuring effective protection and management of wildlife migration routes.
- g. An institutional mechanism for comprehensive data compilation and continuous monitoring at the division level would be established to enable informed decision-making and adaptive management strategies.
- h. Visitor experiences would be improved by developing pre-visit briefings, informational materials, and interactive interpretation centers within the reserve, enhancing awareness and understanding of conservation efforts.
- i. The shortage of compatible Android phones equipped with M-STrIPES would be addressed by procuring additional devices, enabling efficient tiger management and data collection for conservation planning.
- j. Engagement with local communities through eco-development committees, soliciting feedback and suggestions to enhance conservation efforts, and fostering community participation in reserve management is advisable.
- k. Regular training programs for reserve staff on modern conservation techniques, wildlife monitoring, and law enforcement would be conducted to enhance their skills and effectiveness in protecting the reserve's biodiversity.
- l. Collaboration with research institutions and conservation organizations to conduct

scientific studies, monitor wildlife populations, and implement evidence-based conservation strategies for the long-term sustainability of Kaziranga Tiger Reserve is recommended.

#### 5. Conclusions

In conclusion, Kaziranga Tiger Reserve stands as a beacon of hope and a testament to the remarkable success of conservation efforts in preserving biodiversity and protecting endangered species. Its status as a World Heritage Site underscores its global significance, particularly in safeguarding the world's largest population of one-horned rhinos. The reserve's diverse habitats, rich flora, and fauna, including iconic species like tigers and elephants, highlight its ecological importance and contribution to global conservation. Despite facing challenges such as poaching, habitat degradation, and human-wildlife conflict, Kaziranga continues to inspire awe with its resilience and unwavering commitment to conservation. With ongoing efforts to address these challenges, strengthen management strategies, and engage local communities, Kaziranga Tiger Reserve remains a shining example of successful wildlife conservation and a beacon of hope for future generations.



# MANAS TIGER RESERVE

## 1. Brief Description

Formerly known as North Kamrup Wildlife Sanctuary, Manas is among the initial nine tiger reserves established under the “Project Tiger” in 1973. Encompassing Baksa, Chirang, and Udalguri districts within the Bodoland Territorial Area Districts (BTAD) of Assam, the reserve spans an area of 2837.1 km<sup>2</sup>, with 526.22 km<sup>2</sup> designated as the core area. Bounded by the Manas River and its tributaries Beki and Hakua in the north, the Sankosh River in the west, and the Dhansiri River in the east, Manas is a UNESCO natural world heritage site and a part of the Ripu-Chirang Elephant Reserve. Adjacent to the Royal Manas National Park in Bhutan, it is situated in the eastern Himalayan biodiversity hotspot, hosting diverse avifauna, earning recognition as an “Important Bird Area”.

Manas exhibits three primary types of vegetation: tropical semi-evergreen, tropical moist deciduous, and alluvial grassland. Featuring a variety of alluvial grass species, the common tree species include *Dillenia pentagyna*, *Phyllanthus emblica*, *Bombax ceiba*, as well as species of *Leea*, *Grewia*, and *Mussandra*. The reserve serves as a sanctuary for 22 globally threatened mammal species, including the elephant (*Elephas maximus*), one-horned rhinoceros (*Rhinoceros unicornis*), wild water buffalo (*Bubalus arnee*), eastern swamp deer (*Rucervus duvaucelli ranjitsinhi*), tiger (*Panthera tigris*), leopard (*Panthera pardus*), and clouded leopard (*Neofelis nebulosa*). Additionally, Manas houses endemic and endangered species such as the pygmy hog (*Porcula salvanius*), hispid hare (*Caprologus hispidus*), golden langur (*Trachypithecus geei*), and the critically endangered Bengal florican (*Houbaropsis bengalensis*).

## 2. Tiger Population as per AITE

Since 2014, the tiger population and density in the Manas landscape have shown a notable upward trend, indicative of positive managerial efforts. In 2014, a total of 9 tigers were captured, with a density of 1.82 (0.63) per 100 sq. km. By 2018, from 342 photo-captures, 28 individual adult tigers were identified, although the density per 100 sq. km was not specified. The most recent data from 2022 revealed that the tiger reserve underwent thorough camera trap sampling, resulting in the identification of 57 individual tigers and a density of 7.91 (1.05) tigers per 100 km<sup>2</sup>. This increasing trend underscores the success of conservation efforts within the Manas landscape. Moreover, it's important to note that the entire Manas landscape, including Royal Manas National Park in Bhutan and Buxa Tiger Reserve in West Bengal, forms a single population block for tigers, highlighting the interconnectedness of conservation efforts across borders.

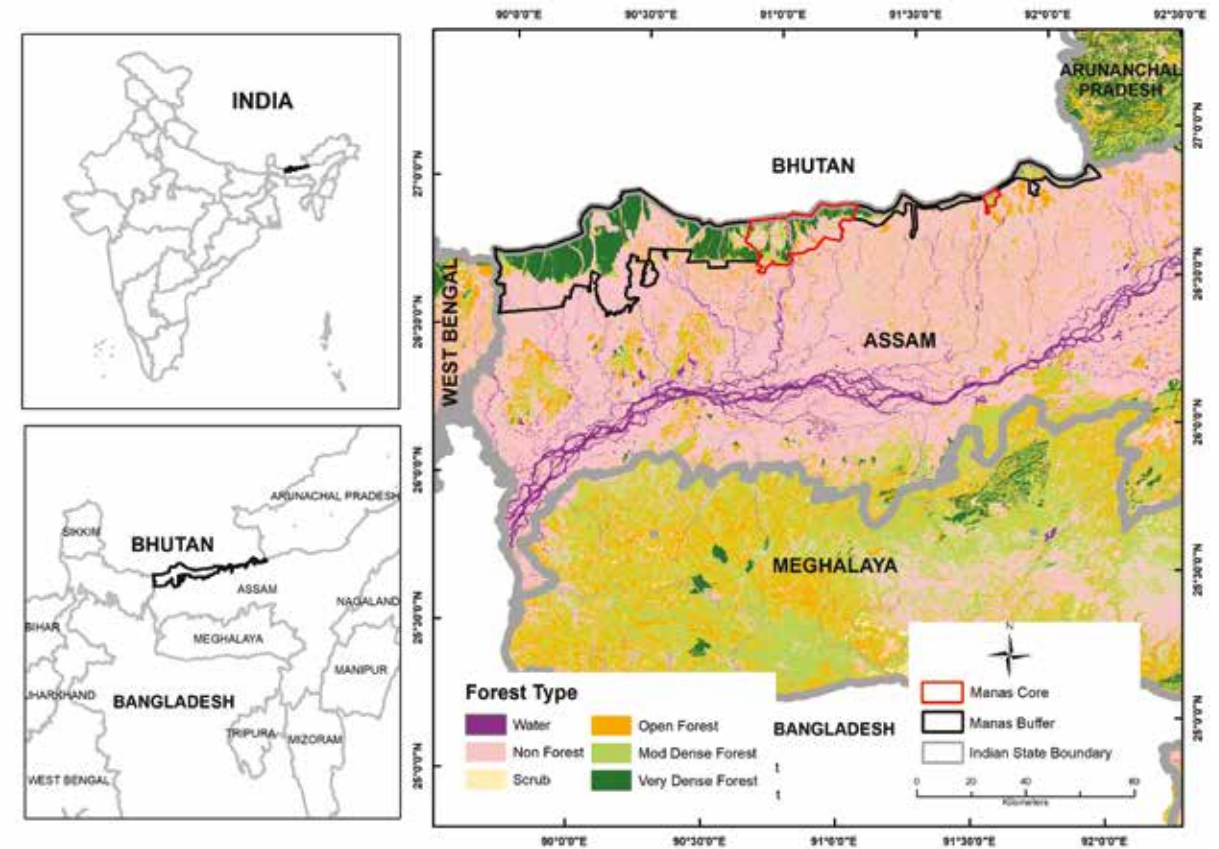


Figure 1: Map showing the location of Manas Tiger Reserve in the state of Assam.



### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>In the western buffer, there are 125 forest villages, with a few in the eastern buffer, both facing moderate to severe encroachments. The Indian side of the landscape is predominantly occupied by human settlements, with over 1600 hectares and 500 households encroaching in the past decade.</li> <li>Minimal grazing pressure, primarily on the fringe. Some cultivation also occurs on the fringe.</li> <li>Out of 431 field positions, 109 are currently vacant, and there are no ongoing recruitments.</li> <li>Aging vehicles increase maintenance costs. Replacement needed for some 4WD vehicles. Jet boat for shallow waters and inflatable rubber boats required. Review necessary for immobilizing equipment, accessories, drugs, and firearms based on current needs.</li> <li>Serious setbacks include inordinate delays, insufficient TA, delayed salary payments, non-payment of project allowances, and inadequate meeting of wage bills, which could potentially be resolved by routing the CA through the North East Council to the Bodoland Territorial Council.</li> <li>A proposal is pending for the strike force.</li> <li>Regular institutionalized training for the frontline staff in various aspects is required.</li> <li>Michelia, Eupatorium, Leea, and certain Lantana species are prominent weeds, predominantly impacting roadside areas.</li> </ul>	<ul style="list-style-type: none"> <li>Encroachment is a persistent issue, leading to habitat degradation. The need for urgent steps to relocate encroachments and maintain the inviolate nature of the Tiger Reserve has been emphasized.</li> <li>Recruitment and staff shortages are mentioned repeatedly, emphasizing the need for regular recruitment and training to prevent the accumulation of vacancies.</li> <li>Aging vehicles, inadequate equipment, and the need for replacements are recurring concerns. The maintenance and replacement of infrastructure, including vehicles and equipment, require attention.</li> <li>Delays in fund release, inadequate funds for various purposes, and issues related to salaries and allowances are highlighted, indicating a recurring financial challenge.</li> <li>Coordination challenges between different administrative authorities, such as the Field Director, Bodoland Territorial Council, and State Government, have been consistent over the years.</li> </ul>	<ul style="list-style-type: none"> <li>It is recommended to bring the contiguous forest patch under legal protection to uphold genetic connectivity and demographic viability across the landscape, thereby safeguarding the region's biodiversity.</li> <li>Effective measures should be implemented to address the spread of invasive species such as Chromolaena odorata and Mikania micrantha in the grasslands of Manas Tiger Reserve, as they pose a significant threat to endangered species like the pygmy hog, eastern swamp deer, and Bengal florican.</li> <li>Forest managers should carefully align the border road between India-Bhutan-Nepal to minimize its impact on wildlife values in the region, and appropriate mitigation measures should be undertaken wherever necessary.</li> <li>Continuous protection and support from local communities are essential for the ongoing recovery of the Tiger Reserve.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>Challenges in housing, uniform supply, subsidized ration provision, medical facilities, and non-payment of project allowance make it challenging to maintain posts in remote areas.</li> <li>Poaching is occurring, but it is currently well under control.</li> <li>Fires are predominantly occurring in grasslands and adjacent woodlands.</li> <li>Numerous patrolling camps, previously existing, were destroyed amid the insurgency period. Efforts to revive them are hindered by irregular fund flow.</li> <li>Analysis using data from daily monitoring is essential.</li> <li>Cases are being monitored, but progress is sluggish, with a low rate of convictions. Lawyers are hesitant due to the delayed payment of legal fees.</li> <li>Shortage of funds may create issues in future ex-gratia payments.</li> <li>Ecodevelopment activities are constrained by encroachment issues, and government efforts to address encroachments across the state have not yielded significant success.</li> <li>The issue of lack of registration of firearms is exacerbated by the presence of locally manufactured illegal firearms.</li> <li>Effective land-use management in the buffer and surrounding areas depends on collaboration with other agencies and local initiatives, beyond the control of the reserve managers.</li> </ul>	<ul style="list-style-type: none"> <li>Instances of poaching and challenges in law enforcement, including delayed legal fee payments, low conviction rates, and challenges in monitoring cases, have remained over the years.</li> <li>The presence and impact of invasive plant species, such as Chromolaena odorata and Leea crispa, on habitats are noted consistently, indicating ongoing challenges in invasive species management.</li> <li>Challenges in engaging with local communities, addressing their needs, and promoting awareness about conservation efforts remain</li> <li>The status and management of the buffer zone, including jurisdictional issues and coordination problems, are still unresolved.</li> <li>Issues related to tourism, including carrying capacity, control over tourist facilities, and the need to review tourism strategies, are mentioned repeatedly.</li> <li>Concerns about the safety of anti-poaching camps, the lack of safety mechanisms, and the need for effective patrolling are recurring issues.</li> </ul>	<ul style="list-style-type: none"> <li>Enhancing transboundary cooperation with Bhutan through activities such as monitoring, intelligence sharing, and joint patrolling is recommended to enhance the biodiversity values of the region.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006		<ul style="list-style-type: none"> <li>Challenges in implementing ecodevelopment activities due to encroachment issues, lack of funds, and insufficient engagement with local communities are recurrent.</li> <li>Incursions of wildlife into villages, leading to conflicts, are a recurring issue, emphasizing the need for a balanced approach to address human and wildlife needs.</li> <li>The need for comprehensive research, documentation of social values, and addressing research gaps are persistent themes.</li> <li>Challenges related to political unrest, ethnic strife, and administrative complexities are concerns affecting the reserve.</li> <li>The delayed release of funds by the state government is highlighted as an issue affecting the timely execution of conservation initiatives.</li> <li>The lack of complete control by the Field Director over the entire tiger reserve area, including buffer zones, is a major issue impacting effective management.</li> <li>Collaborative efforts with other agencies, local councils, and district administration for effective conservation are emphasized repeatedly.</li> </ul>	

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006		<ul style="list-style-type: none"> <li>Insufficient communication infrastructure, interpretation facilities, and awareness efforts hinder effective engagement with the local community.</li> <li>Challenges in implementing income-generating activities, coordinating with various government departments, and widening livelihood options for fringe-area communities have continued to pose a challenge.</li> </ul>	
2010	<ul style="list-style-type: none"> <li>Buffer Area spans different Forest Divisions, creating management problems due to diverse administrative controls. The Field Director lacks control over the Buffer, leading to coordination issues between different authorities.</li> <li>Initiating dialogue with the Forest Chief of Bodoland Territorial Council is crucial for improving the management of Manas Tiger Reserve. The goal is to propose placing buffer areas under the unified command of the Field Director, necessitating concurrence from both the State Government and Bodoland Territorial Council.</li> <li>Unprotected southern river tip at Narayanguri allows illegal fishing, posing a threat to reintroduced Rhinoceros protection.</li> <li>Villagers around the Core lack forest areas, relying on the fringe for resources. Lack of buffer leads to wildlife entering villages, causing conflicts. A trade-off needs to be established between human and wildlife needs.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Engaging with the district administration and local councils is imperative to channel funds for ecodevelopment activities. Selected volunteers would be trained in ecodevelopment to serve as a link between MTR and local villages. Establishing strong relationships with NGOs would be prioritized to garner wider support for the conservation of MTR.</li> <li>Inadequate anti-poaching camps, arms, living facilities, and communication in both Core and Buffer. Interpretation and information infrastructure is insufficient, hindering effective management.</li> <li>Volunteers, appointed post-conflict, lack training and accountability. Proper deployment and training needed for better utilization of this force. To enhance volunteer engagement, a structured deployment program should be prepared. Volunteers would be integrated into beats and work under the supervision of regular staff. Comprehensive training programs on ecodevelopment, ecotourism, wildlife monitoring, and interpretation would be designed for both staff and volunteers, aiming to boost awareness and efficiency.</li> <li>Fringe communities heavily depend on forests for various resources, leading to ecological challenges.</li> <li>Invasive plants thrive in the absence of proper forest management. In order to assess habitat recovery, habitat monitoring protocols would be developed to track changes in habitats and species.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Mapping the grasslands of the park is essential, followed by determining the minimum required grassland in MTR through collaboration with the scientific community and NGOs. Strategies would be implemented to prevent woodland encroachment in the identified grasslands.</li> <li>Conflict between Forest Right Act and Wildlife Protection Act encourages encroachment in MTR.</li> <li>Poor physical infrastructure hampers awareness efforts by NGOs.</li> <li>Ignorance about government projects, conservation, and high poverty levels persist.</li> <li>MTR lacks interpretative infrastructure, trained staff, and confidence to engage with the local community.</li> <li>Absence of a well-written TCP makes MTR susceptible to uncoordinated programs.</li> <li>Delayed release of funds by the state government hampers timely execution of initiatives. Ensuring timely release of funds by both the Bodoland Territorial Council and the State Government is critical for the success of these initiatives.</li> <li>Additionally, discussions should be initiated for the construction of a motorable road along the southern boundary to facilitate effective protection measures.</li> </ul>		
2014	<ul style="list-style-type: none"> <li>The Buffer Area, covering 2337.10 km<sup>2</sup>, falls outside the control of the Field Director, creating a management challenge due to jurisdiction under the Bodoland Territorial Council. The Buffer Area, currently under the control of the Bodoland Council,</li> </ul>		



MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<p>necessitates a constructive dialogue with the Field Director to resolve the existing impasse and streamline management responsibilities.</p> <ul style="list-style-type: none"> <li>The Core Area, comprising 500 km<sup>2</sup>, shares a lengthy southern boundary with tea estates and 60 villages. Villagers, primarily tea estate laborers, rely on the core area fringe for resources, while wildlife incursions into villages result in conflicts. Coordination with the district administration, council, and local communities is crucial for effective eco-development activities.</li> <li>The road running along the park's southern boundary, from Panbari to Bhuinpara, should be upgraded to an all-weather road, adequately maintained for regular inspection and patrolling.</li> <li>Adjoining tea estates' managers need to be reminded of their responsibility to arrange fuelwood for their labor forces and should be held accountable for this provision.</li> <li>Field staff should undergo training in eco-development, wildlife monitoring, and eco-tourism. Efforts should be made to enhance their interpretation abilities for increased awareness.</li> <li>Developing habitat monitoring protocols is essential to assess changes indicating the recovery of habitats and species within the park.</li> <li>Comprehensive mapping of the park's grasslands is necessary, and vigilant monitoring is required to prevent the invasion of tree species and the conversion of grasslands into woodlands.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Anti-poaching camps are exclusively in the core area, leaving the buffer zone unattended. Inadequate equipment, facilities, and living conditions for staff require qualitative improvement.</li> <li>Post-ethnic strife, locals appointed as volunteers lack training in forestry equipment handling and wildlife management. The fragile law and order situation, coupled with ethno-political upsurges, creates an atmosphere of uncertainty.</li> <li>Ensuring timely and adequate funds allocation to MTR is imperative for effective management and conservation initiatives.</li> <li>Establishing an institutional mechanism for regular meetings between officials from Bhutan, the district administration, and council officials is crucial to address problems promptly.</li> <li>The immediate completion of the boundary extension of Manas-WHB India, incorporating Manas NP, should align with UNESCO Operational Guidelines.</li> <li>Considering the transboundary nature of Manas WHS-India and Manas-WHS-Bhutan, efforts should be made to establish a Manas Indo-Bhutan WHS for comprehensive conservation.</li> </ul>		
2018	<ul style="list-style-type: none"> <li>Insufficient staff strength, with only two anti-poaching camps, hinders effective surveillance throughout the reserve's additional area. The Field Director hesitates to take over management due to this limitation.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>An additional 350 sq. km. area, currently managed under Chirang Territorial Division, has been designated as Manas Additional National Park. Despite being part of the buffer, the Field Director hesitates to take over due to inadequate staff. A notification to incorporate this area into the core of the Tiger Reserve (TR) is recommended.</li> <li>The last recruitment for a forest guard occurred in 2011-2012, and for a forester in 2014-2015. No RFO recruitments have taken place since 2011-12. The Assam Forest Protection Force, though young, is inadequate in numbers. Annual recruitment and training are essential to prevent accumulating vacancies.</li> <li>Regular checks on the physical fitness of field staff and members of the Assam Forest Protection Forces are essential to ensure their effectiveness in field duties.</li> <li>The State Government should prioritize the recruitment and training of frontline staff, particularly forest guards, to address the existing vacancies.</li> <li>The presence of numerous villages along the southern boundary poses challenges, as human and cattle populations depend on the forests, leading to grazing and firewood collection within 2 km from the reserve's southern boundary, causing habitat degradation.</li> <li>The Central Government's proposal to construct a road along the international border with Bhutan, accompanied by border security posts every 4 km, raises concerns about disturbing</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p>the inviolate nature of the Tiger Reserve and disrupting the international corridor of tigers and elephants.</p> <ul style="list-style-type: none"> <li>Grasslands in the reserve, including artificial ones created by clearing trees and burning debris, are managed by the practice of winter burning to stimulate fresh grass growth. Instances of expanding grasslands by clearing fresh forests were observed, raising environmental concerns. Expansion of grasslands by clearing tree growth should be halted, focusing on maintaining existing grasslands. Special attention should be given to clearing footpaths throughout the reserve to aid patrolling parties in effective surveillance.</li> <li>Recent introductions of swamp deer (44 in number) require further augmentation through strategic management interventions. The forest, covered with undergrowth and invasive species, necessitates efforts to create foot trails for enhanced surveillance.</li> <li>Over 400 ha of forest land in Kokilabad village has been leased to the State Agriculture Department for seed production, with activities including semen collection and milk production. Efforts are needed to retrieve the area after the lease expires, especially with new buildings being constructed.</li> <li>The impact of the Bodo agitation between 1989 and 2003 severely damaged Manas National Park, resulting in hunting of large mammals, illegal timber extraction, and depletion of tigers,</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p>rhinos, and elephants. Despite revival efforts since 2003, sporadic incidents of poaching and hunting continue to demoralize the management.</p> <ul style="list-style-type: none"> <li>• NGOs currently engage in education and awareness campaigns with communities residing on the southern fringes of the TR. Traditional practices such as collecting firewood and small timber and allowing cattle to graze in the forests need to be curtailed, with intensified efforts supported by EDCs and NGOs.</li> <li>• During a field visit, the MEE team noted a low population of ungulates in the reserve.</li> <li>• Invasive species and undergrowth in the forests pose challenges, covering large areas and making it difficult for patrolling parties to explore beyond established footpaths.</li> <li>• Establishing additional foot trails in all corners of the reserve is crucial for comprehensive surveillance efforts.</li> </ul>		
2022	<ul style="list-style-type: none"> <li>• MTR faces encroachment issues with approximately 36.78 km<sup>2</sup> in the original core and first addition area, some now under habitations. Previous attempts to remove encroachment were hindered by public pressure, leading to the removal of boundary pillars demarcating the core. Urgent measures must be taken by the state government, the Bodoland Territorial Council, and TR management to relocate encroachments in Manas TR. Priority should be given to reclaiming the area from the Seed Farm Area, Kokilabari, followed by eviction of Betbari and Panbari areas.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<p>Innovative strategies may be explored for areas where eviction is challenging, and the possibility of incorporating portions of Rairona National Park into the core of MTR should be considered to rationalize boundaries and maintain ecological integrity.</p> <ul style="list-style-type: none"> <li>• Filling staff vacancies, including Forest Rangers, is a priority to ensure effective TR management. Home Guards, NGO Service Providers, and others need wildlife management orientation and ration facilities similar to regular staff.</li> <li>• Capacity building and regular skill upgrading are crucial for effective TR management, necessitating a long-term arrangement.</li> <li>• The management should document and address all violations, including grazing, fodder and fuel collection, and maintain a comprehensive database for necessary actions.</li> <li>• Population estimation exercises should include critical species like the pygmy hog, hispid hare, Bengal florican, and swamp deer. Institutional mechanisms for monitoring seasonal migrations of birds such as the bar-headed goose need to be established.</li> <li>• Invasive species, including <i>Chromolaena odorata</i> and <i>Leucaena leucocephala</i>, infest significant areas, particularly grasslands. Despite a grassland management plan for removal, implementation remains a challenge due to insufficient funds.</li> <li>• The Field Director should compile and make publicly available all published research on the TR, identify research gaps, and formulate a strategy for</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<p>long-term research. New studies should address various aspects, including the impacts of changing the burning period of grasslands and documenting social, cultural, and spiritual values.</p> <ul style="list-style-type: none"> <li>MTR's connectivity and corridor areas within a larger landscape are fragmented due to settlements, impacting wildlife movement.</li> <li>Anti-poaching camps face elephant damage without effective safety mechanisms in place. Installation of solar-powered fences around anti-poaching camps, along with elephant-proof trenches, should be considered to prevent damage from raiding animals.</li> <li>Upgrading old anti-poaching camps and constructing new ones should be complemented by preparing a list of required items/equipment for each camp, promoting staff comfort, and encouraging healthy competition by awarding the best-kept camp monthly.</li> <li>Despite some improvement in staff positions, numerous vacancies are managed by deploying Home Guards and NGO Service Providers. Lack of wildlife management orientation and training, along with the absence of ration facilities, poses challenges.</li> <li>MTR's infrastructure requires upgrading, with unsatisfactory building conditions necessitating major maintenance. Inadequate working vehicles further hinder operational requirements.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Adequate vehicles should be provided by the state government, and efforts to mobilize CSR funds for vehicle acquisition should be explored.</li> <li>The veterinary hospital building is ready but lacks essential equipment for efficient service dispensation. Urgent action is required to equip the veterinary hospital for immediate operation.</li> <li>Detailed documentation of MTR's social, cultural, and spiritual values, including sacred groves, trees, deities/icons, and folklore, is yet to be undertaken.</li> <li>While rhinos have been reintroduced, efforts to maintain their numbers should consider the peak carrying capacity of earlier times. Caution should be exercised in habitat interventions to prevent parallel increases in prey, elephants, and tigers, leading to potential conflict situations.</li> <li>Wildlife Trust of India's single-string solar fencing, installed during the MEE team's visit, is found to be ineffective. Converting the single-string solar power fencing into multi-string fencing for improved effectiveness and electrifying more boundary lengths are recommended.</li> <li>Delayed receipt of the first installment of CSS funds, often in late March, leads to non-claiming of the second installment, putting the tiger reserve at a significant disadvantage. Timely releases of both central and state shares of funds are essential, with adequate funds provided for building maintenance.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>The formation of a Local Advisory Committee (LAC) for Manas Tiger Reserve is pending. The LAC is crucial for reviewing the tourism strategy, enforcing site-specific construction norms, advising local and state governments, and consistently monitoring tourist facilities and operations to prevent disturbance to wildlife during visitor excursions.</li> <li>Strengthening eco-development committees and initiating income-generating activities for fringe-area communities require coordination with government departments and active involvement of Tiger Conservation Foundations (TCFs).</li> <li>TCF, with the wider goal of inclusive management, should be strengthened in terms of income sources, technical staff, and field activities. Exploring increased entry fees and CSR resources for TCF is recommended, along with the creation of a corpus fund and adherence to NTCA guidelines.</li> <li>The complete control of the tiger reserve area has not yet been vested in the Field Director. Complete control of the TR should be under the Field Director's jurisdiction.</li> <li>The TR management's initiatives to halt night stays at Nokthanguri, restrict private vehicle entry, and limit vehicles from the Bhutan side must be continued and rigorously enforced.</li> <li>New tourism initiatives should not compromise the TR's carrying capacity, and any thoughts of opening new routes beyond prescribed limits should be reconsidered to maintain the reserve's ecological balance.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested Key Management Recommendations

- Encroachment persists, leading to habitat degradation and posing a threat to biodiversity. Urgent steps are required to address encroachments and uphold the inviolate nature of the Tiger Reserve.
- Recruitment and staff shortages are recurring issues, emphasizing the importance of regular recruitment and training to prevent vacancies from accumulating. Timely recruitment and training are crucial to ensure effective management and conservation efforts.
- Concerns about aging vehicles, inadequate equipment, and the need for replacements are recurrent. Attention must be paid to the maintenance and replacement of infrastructure, including vehicles and equipment, to support effective patrolling and management.
- Delays in fund release, inadequate funds for various purposes, and issues related to salaries and allowances are highlighted, indicating a recurring financial challenge. Timely release of funds is crucial for executing conservation initiatives and ensuring staff welfare.
- Coordination challenges between different administrative authorities, such as the Field Director, Bodoland Territorial Council, and State Government, have been consistent over the years. Efforts should be made to enhance coordination and streamline management responsibilities.
- Instances of poaching and challenges in law enforcement, including delayed legal fee payments, low conviction rates, and monitoring case challenges, have remained persistent. Strengthening law enforcement measures and addressing legal challenges are essential to effectively combat poaching.
- The presence and impact of invasive plant species on habitats are noted consistently, indicating ongoing challenges in invasive species management. Effective measures should be implemented to address the spread of invasive species and mitigate their impact on biodiversity.
- Challenges in engaging with local communities, addressing their needs, and promoting awareness about conservation efforts remain. Strengthening engagement with local communities through education, awareness, and livelihood programs is crucial for effective conservation.
- The status and management of the buffer zone, including jurisdictional issues and coordination problems, are still unresolved. Efforts should be made to address jurisdictional challenges and enhance management effectiveness in the buffer zone.

- j. Issues related to tourism, including carrying capacity, control over tourist facilities, and the need to review tourism strategies, are mentioned repeatedly. Developing sustainable tourism practices and enhancing tourism management strategies are essential for minimizing negative impacts on the reserve.

## 5. Conclusions

The Manas Tiger Reserve has faced significant challenges due to past armed conflicts, resulting in adverse effects on conservation efforts, including the extirpation of one-horned rhinoceros from the national park. However, positive managerial efforts have led to an increasing trend in the tiger population and density since 2006. The interconnected landscape of Manas, including Royal Manas National Park in Bhutan and Buxa Tiger Reserve in West Bengal, forms a crucial single population block for tigers. To ensure the genetic connectivity and demographic viability across this landscape, it is imperative to bring the contiguous forest patch under legal protection. Nevertheless, the spread of invasive species like *Chromolaena odorata* and *Mikania micrantha* in the grasslands of Manas poses a significant threat to endangered species such as the pygmy hog, eastern swamp deer, and Bengal florican. Additionally, careful alignment of the border road between India-Bhutan-Nepal is necessary to minimize its impact on wildlife values and implement appropriate mitigation measures where required. Overall, while there are challenges to address, the positive trajectory of tiger population growth and the potential for collaborative conservation efforts offer hope for the sustainable management of the Manas Tiger Reserve and its surrounding landscape.



## NAMERI TIGER RESERVE

### 1. Brief Description

Nameri Tiger Reserve (NTR) is a vital protected area located in Assam, India, nestled in the Sonitpur District along the Eastern Himalayan foothills. Covering a total area of 344 km<sup>2</sup>, NTR comprises a core area of 200 km<sup>2</sup> within Nameri National Park, originally part of Naduar Reserve Forest. Established as a wildlife sanctuary in 1985 and designated as a national park in 1998, it incorporates additional eastern and western buffer zones totaling 144 km<sup>2</sup>, added in 2000. In 2015, 120 km<sup>2</sup> of Sonai-Rupai Wildlife Sanctuary became a satellite core. Supervised by the DFO of the Western Assam Wildlife Division, field operations and anti-poaching activities are conducted under the Range Officer at Potalali within the western buffer, supported by 39 anti-poaching camps strategically positioned near natural barriers like the Jia-bhoreli and Bordikorai Rivers within the core. NTR is renowned for its diverse forest types and serves as a crucial habitat for globally threatened species such as the Asian elephant and the rare white-winged wood duck. It plays a pivotal role in conserving these species, particularly elephants, and is one of the last breeding habitats for the white-winged wood duck. Wildlife monitoring indicates a relatively low tiger density of 1.3 to 1.5 tigers per 100 km<sup>2</sup>, underscoring the reserve's significance in the conservation landscape of Assam's north bank.

### 2. Tiger Population as per all India tiger estimation

Tiger abundance of Nameri in 2010 was calculated to be 9 (SE range: 7-11) and the abundance was shared with Pakke Tiger Reserve. 49 camera traps were installed in 2014 and 6 individual tigers were identified. However, 2 tigers were captured in Pakke tiger reserve also. Tiger from a total of 39 photo-captures of tigers, 3 adult tigers were identified in 2018. These three tigers were also photo-captured in Pakke Tiger Reserve. Due to the small sample size, density parameters for tigers in Nameri Tiger Reserve could not be assessed using spatially explicit capture recapture analysis. total of 67 camera trap stations were active for 4100 trap nights, and 3 individual tigers were photo-captured in 2022. However, two tigers are common with Pakke Tiger Reserve of Arunachal Pradesh.

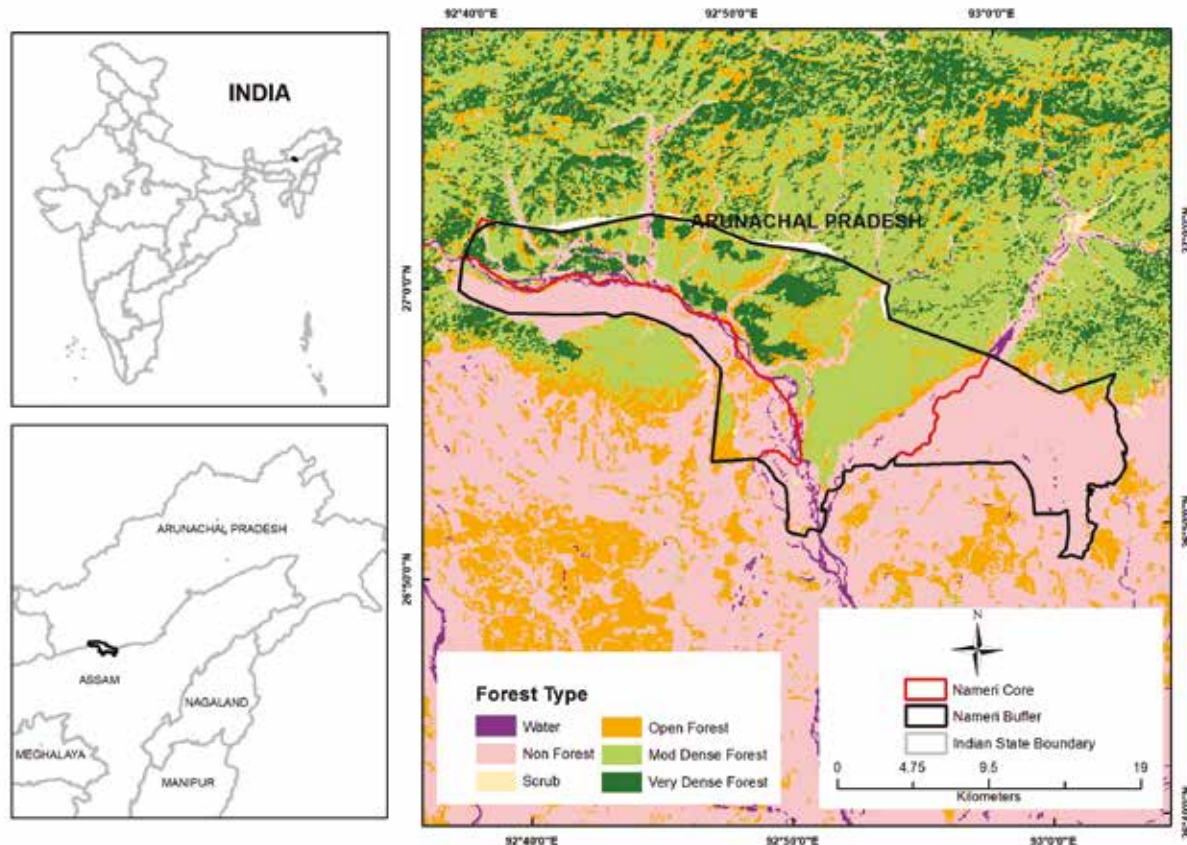


Figure 1: Map showing the location of Nameri Tiger Reserve in the state of Assam.



### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<p><b>Encroachment Issues:</b> Severe encroachment plagues the buffer areas with illegal hamlets and households, causing significant forest destruction. Continuous eviction efforts have failed, leading to recurrent re-encroachment, threatening the core area's integrity.</p> <p><b>Corridor Destruction and Political Support:</b> Destruction of vital corridors and political backing for encroachers in the Western buffer pose a severe threat to the reserve's core. Despite eviction attempts, re-encroachment persists, complicating conservation efforts.</p> <p><b>Management Plan Delay and Funding Shortage:</b> Delay in government approval for the Management Plan since 2004 has hampered operations. Insufficient funds impede critical activities like infrastructure development and equipment procurement.</p> <p><b>Resource and Infrastructure Challenges:</b> Shortage of essential equipment, damaged anti-poaching camps, and inadequate infrastructure impair wildlife protection. Financial and personnel management issues, including delayed salary disbursement and training inadequacies, demoralize staff.</p> <p><b>Ecological Concerns:</b> Grazing-induced invasive species like Lantana and Mikenia have emerged but aren't considered critical yet.</p>	<p><b>Encroachment Challenges:</b> Continual encroachment, particularly in buffer areas, poses a persistent threat, impacting the reserve's integrity, habitat, and wildlife. Despite eviction efforts, re-encroachment remains a prevalent issue.</p> <p><b>Manpower Shortage and Leadership Vacancies:</b> Severe shortage of staff, coupled with significant leadership gaps, has been consistent, affecting the reserve's operational efficiency and decision-making.</p> <p><b>Funding Irregularities:</b> The funding pattern from the government has been inconsistent and marked by prolonged delays, disrupting operational capabilities and hindering critical conservation efforts.</p> <p><b>Buffer Area Mismanagement:</b> Lack of direct park management control over buffer areas leads to encroachments, illegal activities, and inadequate protection measures, impacting both buffer and core areas.</p> <p><b>Lack of Administrative and Political Support:</b> Challenges persist in garnering administrative</p>	<ul style="list-style-type: none"> <li>• Prioritize management strategies that focus on the biodiversity values of the Nameri-Pakke-Eaglenest landscape rather than solely emphasizing tiger density.</li> <li>• Develop comprehensive conservation plans that address the diverse flora and fauna present in the region.</li> <li>• Recognize the essential role of local communities in successful conservation efforts.</li> <li>• Implement community engagement programs to garner support for wildlife conservation and sustainable practices.</li> <li>• Acknowledge the ecological barriers provided by Pakke Tiger Reserve in the north and the Jia Bhoroli or Kameng River in the south.</li> <li>• Emphasize the importance of securing and restoring riverine corridors, especially through Biswanath, to facilitate tiger movements and gene flow.</li> <li>• Implement adaptive management measures such as prey supplementation or augmentation to restore the declining tiger population.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<p><b>Community Engagement Challenges:</b> Hindrances due to encroachment, political interference, and adverse buffer area situations limit the effectiveness of ecodevelopment committees.</p> <p><b>Resource Control and Sustainable Development:</b> Political interference and adverse buffer area conditions restrict efforts toward sustainable resource conservation and development.</p> <p><b>Restoration Limitations:</b> Challenges in implementing restorative measures beyond reserve boundaries due to heavy local habitation in those areas.</p>	<p>and political backing due to local situations, impeding effective actions against encroachments and illegal activities</p> <p><b>Infrastructure Impact:</b> Construction projects like road expansions fragment vital elephant habitats and corridors, adversely affecting wildlife movement and habitats.</p> <p><b>Community Engagement Challenges:</b> Hindrances due to encroachment, political interference, and adverse situations in buffer areas limit the effectiveness of community development initiatives.</p> <p><b>Resource Exploitation and Ecological Concerns:</b> Illegal resource exploitation, invasive species, and habitat degradation threaten the reserve's ecological balance, posing persistent challenges to conservation efforts.</p>	<ul style="list-style-type: none"> <li>• Address the issue of low prey abundance in Nameri, recognizing its impact on tiger density over the years.</li> <li>• Recognize the importance of connectivity with Kaziranga and implement policies and managerial inputs to enhance and maintain this connectivity.</li> <li>• Advocate for measures that facilitate the movement of wildlife between Nameri Tiger Reserve and Kaziranga.</li> <li>• Strengthen collaboration with neighboring states, particularly Arunachal Pradesh, to address transboundary conservation challenges.</li> <li>• Work towards cooperative initiatives that consider the high hunting pressures and insurgency problems affecting the greater forest complex.</li> <li>• Intensify anti-poaching efforts to combat the pervasive threat of poaching within and around Nameri Tiger Reserve.</li> <li>• Collaborate with law enforcement agencies to curb illegal activities and protect the tiger population from further harm.</li> <li>• Invest in research initiatives to understand the dynamics of prey populations, tiger movements, and the impact of insurgency problems.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
			<ul style="list-style-type: none"> <li>• Implement robust monitoring programs to track changes in tiger populations, prey abundance, and overall ecosystem health.</li> <li>• Promote sustainable tourism practices within and around the reserve to minimize disturbances to wildlife.</li> <li>• Educate visitors about the delicate ecological balance and their role in supporting conservation efforts.</li> <li>• Enhance the capacity of local authorities, forest personnel, and community members in wildlife conservation and sustainable management practices.</li> <li>• Provide training programs that empower stakeholders to actively contribute to the protection and preservation of Nameri Tiger Reserve.</li> </ul>
2010	<p><b>Buffer Zone Management and Leadership Issues:</b> Lack of inclusion of the buffer zone under the Tiger Reserve jurisdiction and absence of a designated Field Director pose critical challenges in effective management and decision-making.</p> <p><b>Funding Shortage and Delayed Allocation:</b> The reserve faces significant funding challenges, receiving minimal funds that are disbursed very late, impacting operational capabilities and conservation efforts.</p>		



MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<p><b>Severe Manpower Shortage and Lack of Training:</b> A severe shortage of field staff, primarily within the age range of 40-48 years, affects the reserve's operational efficiency. Additionally, insufficient training in wildlife management further hampers conservation efforts.</p> <p><b>Inadequate Infrastructure and Protection Mechanisms:</b> Lack of infrastructure, including the absence of anti-poaching camps and staff in buffer areas, results in inadequate protection measures against illicit activities, posing threats to wildlife.</p> <p><b>Habitat Degradation and Encroachment:</b> Degradation of grasslands by invasive species like Bombax and the choking of water bodies by aquatic weeds affect the reserve's ecosystem. Severe encroachment and degradation in buffer areas by organized groups further exacerbate conservation challenges.</p> <p><b>Silting of Water Bodies:</b> Soil erosion and silt deposition in water bodies during the rainy season reduce their storage capacity, creating water scarcity for wildlife, particularly in late January and February.</p> <p><b>Population Increase and Ethnopolitical Unrest:</b> Rapid population growth in forest villages leads to increased encroachment on forest lands. Ethnic and political agitations create an uncertain atmosphere, impacting conservation efforts and overall management.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<p><b>Road Construction Impacting Wildlife Corridors:</b> The widening of the Balipara-Bhalukpong road passing through the buffer area negatively affects wildlife corridors, particularly those used by elephants.</p> <p><b>Underdeveloped Tourism and Ecodevelopment Initiatives:</b> Poorly developed tourism infrastructure and inadequate ecodevelopment initiatives limit the reserve's potential for sustainable tourism and community engagement.</p>		
2014	<p><b>Funding Irregularities:</b> Erratic government funding disrupts operational capabilities and hampers conservation efforts due to prolonged delays.</p> <p><b>Critical Manpower Shortage:</b> Severe staff scarcity coupled with an aging workforce necessitates urgent restructuring and staffing revisions.</p> <p><b>Buffer Area Mismanagement:</b> Buffer areas facing encroachment lack direct park management control, leading to illegal activities and encroachments that adversely affect both buffer and core areas.</p> <p><b>Lack of Support:</b> Administrative and political backing remains challenging due to local political situations, hindering effective action against encroachments and illegal activities.</p> <p><b>Infrastructure Impact:</b> Infrastructure projects like road construction disrupt and fragment crucial elephant habitats and corridors, affecting wildlife movement and habitats.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p><b>Agitation-Induced Degradation:</b> Naduar and Balipara Reserved Forests, key buffer zones, faced degradation during the Bedo agitation, leading to habitat destruction, wildlife poaching, and heightened human-elephant conflicts.</p> <p><b>Encroachment Challenges:</b> Significant encroachment (in core and satellite core areas) threatens the reserve, but there's no clear management plan addressing these encroachments.</p> <p><b>Stagnant Tiger Population:</b> Despite favorable habitat, the tiger population remains static, potentially due to insufficient prey and a lack of monitoring systems to track prey species within the reserve.</p> <p><b>Tribal Hunting Communities:</b> Fringe villages with traditional hunting practices pose challenges to conservation efforts, potentially impacting wildlife populations and exacerbating conflicts.</p> <p><b>Complete Forest Cover Loss in Buffers:</b> The buffer areas surrounding the reserve have lost entire forest covers, posing threats to the reserve's ecological balance and integrity.</p>		
2022	<p><b>Expired Tiger Conservation Plan:</b> The scientific Tiger Conservation Plan for core, buffer, and corridor areas expired in 2018, lacking an updated strategy.</p> <p><b>Staff Vacancies and Leadership Vacancy:</b> Significant staff vacancies (50% vacant positions) exacerbate management challenges, compounded by the absence of a dedicated Field Director post.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<p><b>Divergent Management Approaches:</b> Varied approaches exist between managing the core area and buffer zones, leading to disparities in strategies and management effectiveness.</p> <p><b>Human-Wildlife Conflict (HWC) Challenges:</b> Delays in compensating for human-wildlife conflicts, inadequate readiness of Rapid Response Teams (RRTs), and lack of systematic data on conflicts pose ongoing challenges.</p> <p><b>Encroachment and Resource Pressure:</b> High levels of encroachment in buffer zones, opportunistic cultivation, and competition from livestock impact natural resources and threaten ecosystem stability.</p> <p><b>Resource Exploitation and Encroachment:</b> Illegal resource exploitation, invasion by weed species, and encroachment by fringe-area villagers threaten the habitat and natural resources. Efforts for eviction and restoration are pending.</p> <p><b>Staff Welfare and Equipment Shortages:</b> Uniform provision limitations, lack of uniforms for Home Guards, inadequate equipment supply (night vision devices, GPS, medical facilities), and poor infrastructure for field staff.</p> <p><b>Funding Delays and Utilization Issues:</b> Prolonged delays in NTCA fund releases from the state government lead to partial utilization and hinder priority activities.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<b>Training and Community Development:</b> Inadequate maintenance of training records, poor implementation of staff development plans, and ineffective operation of formed EDCs limit community engagement and development initiatives.		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested Key Management Recommendations

- a. The implementation of a robust and sustainable strategy is recommended to address continual encroachment, particularly in buffer areas. Consideration of community engagement programs to discourage re-encroachment while strengthening efforts for eviction is advised. Additionally, the suggestion of advocating for policies empowering the Tiger Reserve with direct management control over buffer zones is made.
- b. The recommendation is made to address the persistent shortage of staff through timely recruitment and training programs. The suggestion of establishing a dedicated leadership position like a Field Director to enhance decision-making and operational efficiency is advised. Furthermore, prioritization of leadership development to ensure continuity in effective management is advisable.
- c. Advocacy for consistent and timely government funding to ensure uninterrupted operational capabilities is recommended. The suggestion of developing mechanisms to expedite fund disbursement for critical activities, such as infrastructure development and equipment procurement, is advised.
- d. The suggestion is made to align strategies for managing core areas and buffer zones to ensure uniformity and effectiveness in conservation efforts. Promotion of an integrated approach that considers the interconnectedness of habitats and wildlife corridors is advisable.
- e. Overcoming hindrances in community engagement posed by encroachment and political interference is recommended. Strengthening of ecodevelopment committees to ensure they play a pivotal role in sustainable resource conservation and development is advised.

- f. The recommendation is made for the implementation of comprehensive habitat restoration initiatives beyond reserve boundaries. Addressing challenges posed by infrastructure projects like road expansions that impact wildlife habitats and corridors is advisable.
- g. The recommendation is to invest in advanced monitoring systems to track changes in tiger populations, prey abundance, and overall ecosystem health. Collaboration with research institutions to gather systematic data on human-wildlife conflicts and the impact of conservation efforts is advised.
- h. Intensification of anti-poaching efforts with a focus on both core and buffer areas is recommended. Collaboration with law enforcement agencies to curb illegal activities and protect the tiger population is advised.
- i. The promotion of sustainable tourism practices within and around the reserve to minimize disturbances to wildlife is recommended. Advocacy for policies that enhance park management control over buffer areas, preventing encroachments and illegal activities, is advised.
- j. Strengthening of collaboration with neighboring states, administrative bodies, and political leaders to garner support for conservation initiatives is recommended. Advocacy for policies that address administrative and political challenges hindering effective action against encroachments is advised.
- k. The recommendation is to prioritize staff welfare by addressing uniform provision limitations and ensuring the availability of necessary equipment. Enhancement of training programs to develop the skills needed for effective wildlife management and protection is advised.
- l. Streamlining of compensation processes for human-wildlife conflicts, ensuring prompt and fair compensation, is recommended. Improvement of the readiness of Rapid Response Teams (RRTs) to handle conflicts efficiently is advised.
- m. The recommendation is to develop and implement an updated Tiger Conservation Plan for core, buffer, and corridor areas. Ensuring a continuous review and adaptation of management strategies based on evolving ecological and conservation needs is advised.
- n. The recommendation is made for the expediting of efforts for eviction and restoration to counteract illegal resource exploitation and invasive species. Implementation of proactive measures to prevent opportunistic cultivation and competition from livestock is advised.
- o. Improvement of the maintenance of training records for staff is recommended. Enhancement of the effectiveness of formed Ecodevelopment Committees (EDCs) to promote community engagement and development initiatives is advised.

## 5. Conclusions

The Tiger Reserve, spanning 2006-2022, faces persistent challenges such as encroachment, funding issues, and resource exploitation. Despite commendable efforts, re-encroachment remains a critical issue. Manpower shortages, funding irregularities, and the need for a unified management approach demand attention. Crucial recommendations include addressing encroachment through political support, filling leadership vacancies, ensuring consistent funding, and adopting an integrated management strategy. Strengthening community engagement, restoring habitats, investing in monitoring systems, and collaborating with neighboring states are vital for successful conservation. The journey reflects resilience, commitment, and the need for adaptive strategies to preserve biodiversity. The Tiger Reserve's future success hinges on holistic, community-driven, and ecologically sustainable conservation practices.



## ORANG TIGER RESERVE

### 1. Brief Description

Orang Tiger Reserve, established in 2016, covers an area of 492.46 square kilometers in Assam's Darrang and Sonitpur districts. It is under the jurisdiction of Mangaldoi Wildlife Division and is bordered by the Brahmaputra River to the south. The reserve features diverse vegetation types, including moist-deciduous forests, seasonal swamp-forests, and wet-alluvial grasslands. It is home to a variety of wildlife, including the greater one-horned rhinoceros, elephant, hog deer, and various species of cats, jackals, otters, and civets. Orang Tiger Reserve is also renowned for its bird and reptile diversity, making it one of Assam's top Important Bird and Biodiversity Areas (IBAs).

### 2. Tiger population as per AITE

It has one of the highest densities of tigers across the Indian subcontinent, with a robust population thriving within its boundaries. In 2014, the tiger population assessment involved the capture of 15 distinctive tigers. The subsequent survey in 2018 utilized a comprehensive approach, capturing a total of 176 images of tigers. Through detailed analysis, 16 individual tigers were successfully identified, including the documentation of three young tiger cubs. The most recent survey in 2022 employed advanced monitoring techniques, with 39 camera stations strategically positioned across the tiger reserve. This effort resulted in the identification of 16 individual tigers over a cumulative effort of 1189 trap nights, providing valuable insights into the dynamic tiger population within the reserve.



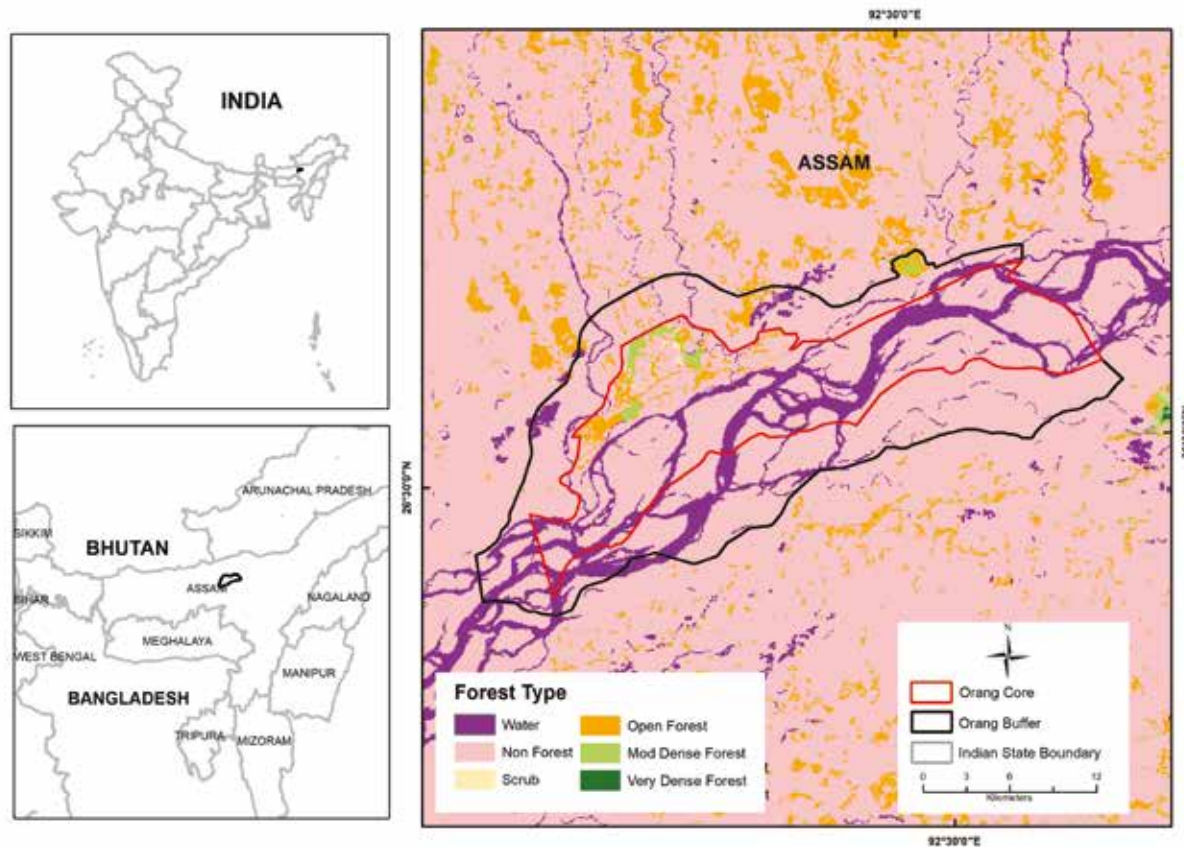


Figure 1: Map showing location of Orang Tiger Reserve in the State of Assam.



### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Since 1991, there has been a disturbingly high incidence of tiger killings, totaling 17, primarily through poisoning by villagers residing on the park fringes. This retaliation is often prompted by cattle depredation within the park due to illegal grazing.</li> <li>Biotic pressures in fringe areas have resulted in habitat degradation, rendering wild animals susceptible to various diseases present in domesticated animals.</li> <li>The rapid spread of invasive species, including Mimosa and Mikania, poses a significant threat to the park's ecosystem, diminishing the habitat for rhinoceros and other herbivores.</li> <li>Implementation of scientific grassland management practices is essential, particularly concerning the removal of invasive species, to ensure the ecological health of the reserve.</li> <li>Water bodies in the park are facing siltation issues, leading to water scarcity for rhinos and other mammals.</li> <li>Across the Brahmaputra River in the zone of influence, there are 14 villages and settlements with a human population exceeding 50,000 and a cattle count exceeding 30,000. The human population and their grazing cattle from fringe villages exert pressure on the park's habitat for timber, fuelwood, and grass resources.</li> </ul>	<ul style="list-style-type: none"> <li>There has been a consistent occurrence of tiger killings, particularly through poisoning by villagers, since 1991. This pattern indicates an ongoing conflict between local communities and the park's wildlife.</li> <li>Biotic pressures in fringe areas have consistently led to habitat degradation, making wild animals susceptible to diseases from domesticated animals.</li> <li>The rapid spread of invasive species, such as Mimosa and Mikania, remains a persistent threat to the park's ecosystem. This issue has likely continued over the years.</li> <li>The need for scientific grassland management, especially concerning the removal of invasive species, has been emphasized. This implies a recurring challenge in implementing effective ecological practices.</li> <li>There is a recurring problem of staff vacancies within OTR, emphasizing the need for continuous attention to human resource management.</li> </ul>	<ul style="list-style-type: none"> <li>Given the importance of Orang Tiger Reserve for tiger and wildlife conservation, it is imperative to intensify conservation efforts within the small protected area. This includes implementing rigorous anti-poaching measures and habitat restoration initiatives to safeguard the existing tiger population and other wildlife species.</li> <li>The presence of dense human habitation and agricultural fields surrounding the reserve poses a significant threat to its ecological integrity. Active management strategies should be implemented to mitigate human-wildlife conflicts and minimize encroachment into the reserve's territory.</li> <li>The river islands in the southern part of the reserve serve as crucial corridors for tiger movement and are essential for the population's growth and dispersal. It is essential to prioritize the protection of these islands from human disturbances and ensure their conservation as vital habitats for tigers and other wildlife.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Despite the Tiger Reserve (TR) being notified in February 2016, no efforts have been made to formulate a Tiger Conservation Plan (TCP). The management should prioritize the preparation of the TCP to enhance conservation measures.</li> <li>The Tiger Conservation Foundation (TCF) has not been constituted, highlighting a gap in the organized efforts to support tiger conservation. The management has submitted a proposal for the establishment of a Tiger Conservation Foundation, and it is crucial for the government to expedite its constitution. The ongoing process needs to be prioritized.</li> <li>EDCs are non-functional, indicating a lack of effective community engagement and participation in conservation initiatives. It is imperative for the management to guarantee the functionality of all EDCs and focus on educating and providing alternative livelihood options to the communities residing in the 14 villages. This approach aims to minimize their dependence on forests and control livestock grazing.</li> </ul>	<ul style="list-style-type: none"> <li>The buffer area of OTR still being under the control of adjoining territorial divisions suggests an ongoing challenge in consolidating unified control over the core and buffer areas.</li> <li>OTR faces resource dependence from local communities in the buffer zone, particularly in grazing areas, indicating a persistent issue.</li> <li>The lack of funds and a strong resource base for the Tiger Conservation Foundation is a recurring challenge in supporting conservation objectives.</li> <li>The absence of institutionalized coordination between OTR and rural development or line departments points to a recurring issue in collaborative efforts.</li> </ul>	<ul style="list-style-type: none"> <li>The recent addition of 201 km<sup>2</sup> as a buffer zone and the proposed expansion of the core area present an opportunity to strengthen tiger conservation efforts. Joining this additional area to the existing tiger population in the western part of Nagaon Wildlife Division would enhance habitat connectivity and contribute to the long-term viability of the tiger population in the region.</li> </ul>
2022	<ul style="list-style-type: none"> <li>Following the final government notification on August 25, 2022, regarding the second addition of 200.32 sq km to OTR, it is essential to expedite the handover process from revenue authorities to the forest department. Necessary records and maps should be obtained, and further actions should be taken to formally notify it as part of the existing tiger reserve area.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>The buffer area of OTR, still under the control of adjoining territorial divisions, needs to be transferred to OTR to consolidate unified control over the core and buffer. This is essential for addressing wildlife and human population conflicts in these areas.</li> <li>Obtain the notification for the Ecologically Sensitive Zone (ESZ) if it has been issued and initiate any follow-up actions required.</li> <li>To ensure effective management of OTR's activities, addressing the current 40% vacancies across various cadres is a top priority.</li> <li>Develop thematic training modules, conduct training sessions for park staff, and thoroughly document the training processes for future reference.</li> <li>EDCs in OTR should establish user groups and self-help groups, particularly involving women, to address livelihood issues. These groups can collaborate on common interests and partner with local banking institutions for microcredit/financing, with OTR providing training and infrastructure support.</li> <li>Invasive weeds pose a threat to OTR's habitat, with species like Chromolaena odorata, Mimosa, Mikania, and water hyacinth invading grasslands and wetlands. Current eradication efforts are insufficient, and strategies like girdling mother trees are being employed to control regeneration and preserve grasslands.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>OTR faces resource dependence from local communities in the buffer zone, particularly in grazing areas. Solar fencing initiatives, in collaboration with EDCs, should be intensified to address this issue.</li> <li>Take necessary steps for the formation of the Local Area Committee (LAC), which is yet to be established.</li> <li>Although the Tiger Conservation Foundation has been established, it lacks funds and a robust resource base to fulfill its objectives.</li> <li>Institutionalized coordination between OTR and rural development or line departments implementing programs in the buffer areas is currently lacking, necessitating efforts to establish effective collaboration.</li> <li>Revamp the complaint handling system in OTR, both online and offline, to enhance responsiveness. Implement a system for periodic submission of reports/returns on received complaints, processing details, actions taken, and conduct regular reviews.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested Key Management Recommendations

- Several pressing issues requiring immediate attention are faced by the Orang Tiger Reserve. One significant challenge is the ongoing threat posed by human encroachment and agricultural activities surrounding the reserve, compromising its ecological

integrity. To address this, proactive management strategies should be considered to minimize conflicts and prevent further encroachment into the reserve's territory.

- Another critical issue is the persistent problem of invasive species, particularly Mimosa and Mikania, which threaten the park's ecosystem and biodiversity. Effective eradication efforts and ecological management practices are deemed essential to control the spread of these invasive species and preserve the reserve's habitat.
- Furthermore, institutional coordination between the Orang Tiger Reserve and rural development departments is lacking, hindering collaborative conservation efforts. The establishment of effective partnerships and coordination mechanisms would facilitate better integration of conservation initiatives and enhance overall conservation outcomes.
- Additionally, the recurring problem of staff vacancies within the Orang Tiger Reserve needs urgent address. Ensuring adequate staffing levels across various cadres is crucial for effective reserve management and conservation efforts.
- Overall, prioritizing these pressing issues and implementing appropriate measures, such as proactive management strategies, invasive species eradication, institutional coordination, and addressing staffing shortages, is imperative for the sustainable management and conservation of the Orang Tiger Reserve.

#### 5. Conclusions

Orang Tiger Reserve, located in the Darrang and Sonitpur districts of Assam, stands as a vital stronghold for tiger conservation, boasting one of the highest densities of tigers in India and the world. Despite its relatively small inviolate protected area, the highly productive grasslands of Orang support a significant tiger population, making it crucial for wildlife conservation efforts. Situated as a single forested patch on the northern bank of the Brahmaputra, Orang was once entirely inhabited by human settlements but now serves as a breeding ground for tigers. While the tiger density remains stable, active management is imperative due to dense human habitation and agricultural fields surrounding the reserve. The river islands in the southern part provide crucial conduits for tiger movement and represent the only space left for population growth and dispersal. The recent addition of 201 km<sup>2</sup> as a buffer and an extension to the core area will further connect this tiger population to the western region of Nagaon Wildlife Division, thereby enhancing conservation efforts and ensuring the survival of this invaluable tiger habitat.

## VALMIKI TIGER RESERVE

### 1. Brief Description

Valmiki Tiger Reserve, situated at coordinates 27° 19' 54" N, 84° 9' 45" E, spans an area of 901 square kilometers, making it the sole tiger reserve in Bihar, India. Located in the far northeastern corner, it shares an international border with Nepal in the western Champaran district. The western boundary is formed by the Gandak River (Narayani in Nepal), and to the north, it is contiguous with Nepal's Chitwan National Park, with a forested boundary of approximately 100 kilometers. Additionally, there is a tenuous connection with Sohagibarwa Wildlife Sanctuary in Uttar Pradesh.

The topography of Valmiki Tiger Reserve is characterized by bouldary hills and doon (valleys) drained by numerous rivers and streams, gradually merging with flat alluvial plains in the south. These water sources play a crucial role in sustaining the wildlife within the reserve. Valmiki stands out as one of the last bastions of forests featuring a unique combination of terai-bhabar vegetation, providing a habitat for diverse fauna, including endemic and globally endangered species such as tigers and greater one-horned rhinoceros. Occasionally, the Asian elephant migrates from Chitwan National Park, Nepal.

The forest of Valmiki Tiger Reserve is also home to various felids, canids, ursids, and viverrids. This includes species like tiger (*Panthera tigris*), leopard (*Panthera pardus*), fishing cat (*Prionailurus viverrinus*), jungle cat (*Felis chaus*), leopard cat (*Prionailurus bengalensis*), Indian fox (*Vulpes bengalensis*), dhole (*Cuon alpinus*), sloth bear (*Melursus ursinus*), and large Indian civet (*Viverra zibetha*). The reserve's important prey species comprise chital (*Axis axis*), sambar (*Rusa unicolor*), hog deer (*Axis porcinus*), nilgai (*Boselaphus tragocamelus*), wild pig (*Sus scrofa*), and gaur (*Bos gaurus*).

### 2. Tiger population as per all India tiger estimation

In the Sohagibarwa-Valmiki complex, tiger population estimates varied over the years, with 15 (12-18) tigers reported in 2006, decreasing to 9 in 2010. Comparatively, tiger population increased to 22 (SE range- 17-26) in 2014, with 23 unique tigers captured during the survey. In 2018, 1161 tiger images were obtained, leading to the identification of 33 tigers and a density estimate of 2.5 (SE-0.43) tigers per 100 sq km. In 2022, a camera trapping exercise yielded a total of 1368 tiger images, from which 54 individual tigers were identified, resulting in an estimated tiger density of 4.32 (SE 0.06) tigers per 100 sq km. These findings illustrate fluctuations in tiger populations and densities over time within different regions, highlighting the importance of continued monitoring and conservation efforts.





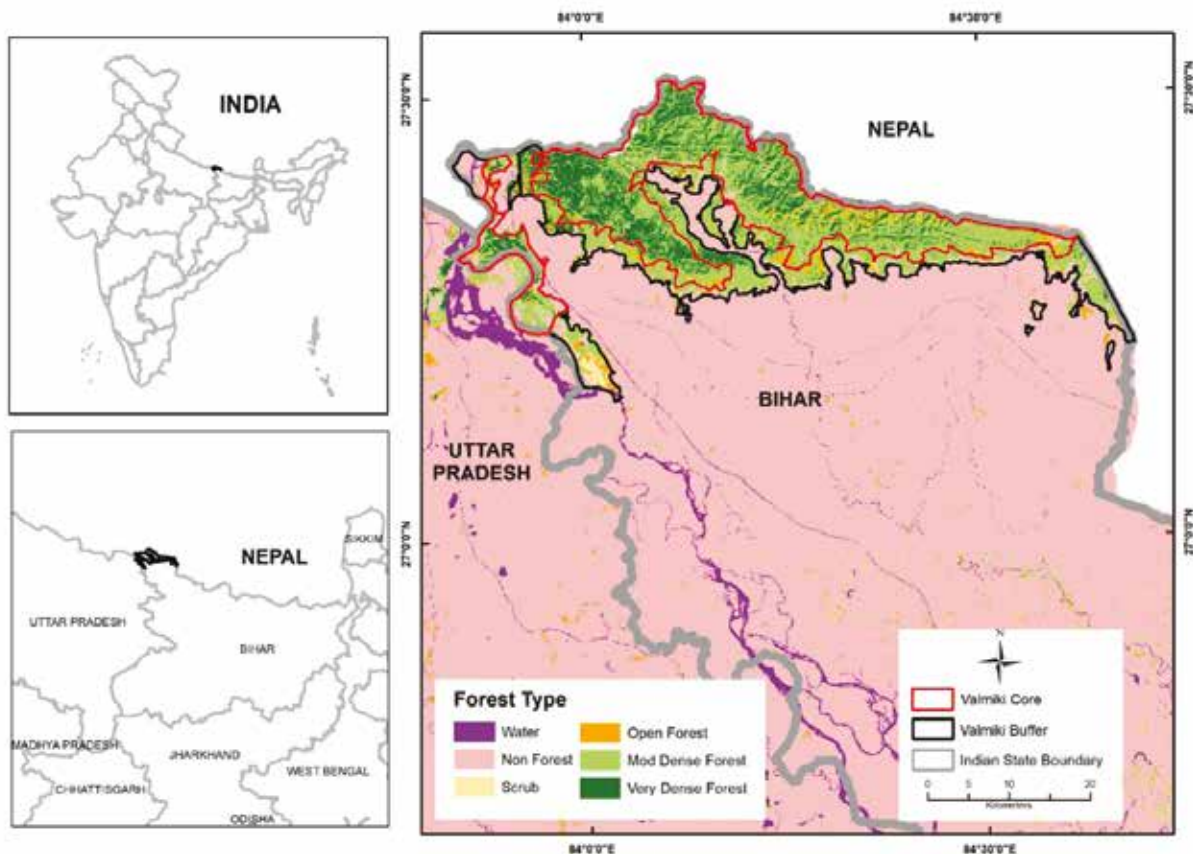


Figure 1: Map showing location of Valmiki Tiger Reserve in the state of Bihar



AYAN SADHU

### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Compliance	Weaknesses from AITE
2006	<ul style="list-style-type: none"> <li>A final notification for Valmiki Wildlife Sanctuary (WLS) is set to be released.</li> <li>Livestock grazing exerts a limited impact in specific narrow strips adjacent to the fringe villages of the buffer zone.</li> <li>Railway tracks spanning 6 km in the western part of the reserve's buffer area, along with a canal system of unspecified length in Madanpur Block and a section of Triveni Block, were constructed in the 1960s before the establishment of the sanctuary and tiger reserve.</li> <li>A revised final draft of the management plan has been prepared and is currently under revision.</li> <li>Approximately 30% of the staff positions are currently vacant. Inadequate and irregular staff training.</li> <li>Vehicles and equipment require urgent reinforcements.</li> <li>Field data collection and research processes are irregular and need to be streamlined.</li> <li>The climber Mikania spp is proliferating like a weed in certain wet/moist areas, and there is an invasion of Eupatorium shrubs encroaching upon fringe areas. Both issues require attention. Gregarious advancement has not been observed, but meadows still require management.</li> <li>Facilities must be enhanced to ensure effective working in adverse conditions and to improve living conditions, including the provision of sufficient safe accommodation.</li> </ul>	<ul style="list-style-type: none"> <li>Although it is noted that livestock grazing has a limited impact, there is a need for a comprehensive impact assessment to understand the extent of its effects on specific narrow strips near fringe villages in the buffer zone.</li> <li>The presence of railway tracks and canal systems constructed in the 1960s highlights a recurring weakness in outdated infrastructure within the reserve, requiring modernization to align with current conservation needs.</li> <li>Vacancies, inadequate training, and irregular staff training processes contribute to a recurring weakness in human resource management, impacting the efficiency of conservation efforts within the tiger reserve.</li> <li>The recurring issue of insufficient resources for vehicles and equipment indicates a weakness that affects the ability to carry out effective patrols, monitoring, and enforcement activities.</li> </ul>	<ul style="list-style-type: none"> <li>Valmiki Tiger Reserve has witnessed a notable increase in tiger numbers since the 2006 tiger monitoring exercise, highlighting successful conservation efforts and habitat management practices within the reserve over the years.</li> <li>Valmiki Tiger Reserve stands out as one of the few protected areas in India representing floodplain habitat and supporting diverse fauna, underscoring its ecological significance and the need for targeted conservation measures to safeguard this unique ecosystem.</li> <li>The wet grasslands, particularly in the Mohana range, face substantial human pressure, posing challenges to the conservation of this critical habitat and its associated wildlife. Urgent interventions are required to address human encroachment and mitigate its adverse impacts on the ecosystem.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Compliance	Weaknesses from AITE
2006	<ul style="list-style-type: none"> <li>The intelligence network for detecting poaching activities needs to be reinforced.</li> <li>Daily monitoring needs to be strengthened, and field observations of wildlife should be recorded and monitored more intensively.</li> <li>Ecodevelopment activities, recently launched, require intensification. Visits to adjoining areas are necessary for this purpose.</li> <li>The potential of ecotourism should be gradually harnessed, with a focus on involving the host community in the process.</li> <li>Current direct economic benefits to different stakeholders are insufficient and should be increased through Ecodevelopment, ecotourism, and extensive habitat management activities.</li> <li>Promoting agro and farm forestry in the areas adjacent to the buffer zone is essential to enhance restorative efforts beyond the tiger reserve.</li> </ul>	<ul style="list-style-type: none"> <li>The invasion of invasive plant species and the need for attention to climber proliferation demonstrate a recurring weakness in habitat management and the control of invasive species, impacting the overall ecosystem health.</li> <li>Inadequate facilities and living conditions for staff, including the absence of separate amenities for male and female workers, represent a persistent weakness that can affect the well-being and morale of those involved in conservation efforts.</li> <li>Delays in the release of funds, despite adequate funding from NTCA, is a recurring weakness affecting the timely implementation of conservation operations.</li> <li>Inadequate protection, insufficient staff with basic wildlife skills, and weak infrastructure contribute to a chronic weakness in enforcement and protection mechanisms within the tiger reserve.</li> <li>Encroachments affect connectivity, particularly near Kotraha and Lakshmipur, underscoring a weakness in maintaining ecological corridors and preventing human interference.</li> </ul>	<ul style="list-style-type: none"> <li>A comprehensive plan for the reintroduction of rhinos in Valmiki Tiger Reserve has been prepared, indicating a proactive approach towards biodiversity conservation and habitat restoration. Efforts are underway to execute this plan, aiming to enhance the ecological diversity and resilience of the reserve.</li> <li>The reserve, characterized by a high-density tiger population, experiences recurring conflicts between tigers and humans, leading to incidents of human fatalities and injuries. It is imperative to implement robust conflict management strategies to address these conflicts promptly and prevent any severe repercussions for both wildlife and human communities.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Compliance	Weaknesses from AITE
2006			<ul style="list-style-type: none"> <li>While collaboration with Nepal is emphasized, the need to streamline informal dialogue with the SSB and enhance transboundary collaboration indicates challenges in cross-border cooperation.</li> <li>The absence of specific actions related to climate change points to a recurring weakness in addressing climate-related challenges and adapting conservation strategies accordingly.</li> <li>The absence of a veterinarian and trained elephants, along with porous borders, highlights a weakness in managing human-wildlife conflicts and countering threats such as poaching.</li> <li>Insufficient staff training and the need for comprehensive capacity building programs indicates a persistent weakness in preparing personnel for effective wildlife management.</li> <li>Despite the absence of human habitation in the core, the biotic pressure from villages necessitates enhanced collaboration with local communities, showcasing a weakness in community engagement strategies.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Compliance	Weaknesses from AITE
2006		<ul style="list-style-type: none"> <li>The proposal to explore rhino reintroduction faces challenges.</li> <li>Weakness in evaluating and mitigating the ecological consequences of invasive plant species.</li> </ul>	
2010	<ul style="list-style-type: none"> <li>Core/critical area remains unnotified, and the buffer is yet to be officially designated. Urgently notify the core critical habitat and buffer area.</li> <li>Streamline tiger reserve management by appointing a dedicated field director, deputy director, and ACF.</li> <li>Ensure timely release of funds for effective operations.</li> <li>Lack of state government priority or commitment to the tiger reserve. Initiate dialogue at the highest level to secure the commitment of the state government and garner support for tiger conservation, given the current political stability and proactive government.</li> <li>Inadequate protection with weak infrastructure.</li> <li>Insufficient staff requiring training in basic wildlife skills. Address staff shortages, augment staff strength, and deploy well-equipped, armed, and well-trained personnel, involving local communities in the protection force.</li> <li>Capacity building at all levels, implementing a comprehensive protection strategy with patrolling camps, intelligence-based protection, and systematic wildlife monitoring.</li> <li>Shortage of grasslands.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Compliance	Weaknesses from AITE
2010	<ul style="list-style-type: none"> <li>Encroachments affecting connectivity, particularly near Kotraha and Lakshmipur, disrupting the link to the Madanpur range in western Valmiki. Re-establish connectivity of the Madanpur Range with the rest of the tiger reserve to ensure the viability of the tiger population.</li> <li>The Bagha-Valmiki road and Bagha-Chhitauni Railway Line intersect the park, posing additional challenges.</li> <li>Streamline informal dialogue with the SSB to minimize negative impact and sensitize the force to conservation issues.</li> <li>Enhance trans-boundary collaboration between India and Nepal for information sharing, joint patrols, and curbing illegal activities.</li> <li>Include the Done Valley in the buffer due to its sensitive location in the heart of the reserve</li> </ul>		
2014	<ul style="list-style-type: none"> <li>Invasion of invasive plants, including Phoenix sp., Eupatorium sp., and Lantana camara, hindering the regeneration of native species and causing avoidance by herbivores like Spotted Deer.</li> <li>General shortage of staff.</li> <li>Construction of a 6 km long reinforced concrete (RC) wall around the railway track. Advising the state government to immediately halt the construction of the 6 km reinforced concrete wall around the railway track and consider constructing a chain link wall. A review of the 4 m high underpass is also recommended.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Compliance	Weaknesses from AITE
2014	<ul style="list-style-type: none"> <li>Signs of biotic interference such as illegal felling, grazing, and weed infestation.</li> <li>Inadequate veterinary capability, dependent on veterinarians from Patna Zoological Park. Recommending the strengthening of veterinary services by appointing a full-time veterinary position and a minimum support staff of animal handlers.</li> <li>Emphasizing the need for training and reorientation of staff through management training programs to enhance the capacity of field staff in wildlife and habitat management, fostering a core team of wildlife managers in Bihar.</li> <li>The ecological contiguity between Valmiki Tiger Reserve, Chitwan National Park, and Sohaghi Barwa Wildlife Sanctuary in Uttar Pradesh is important as it facilitates genetic exchange. So a joint meeting is suggested between the Bihar and Uttar Pradesh state governments to designate Sohaghi Barwa Wildlife Sanctuary as a buffer for Valmiki Tiger Reserve, similar to the inclusion of Amangad Wildlife Sanctuary as the buffer for Corbett Tiger Reserve in Uttarakhand.</li> </ul>		
2018	<ul style="list-style-type: none"> <li>The effective management of VTR is compromised by the fact that over 90% of the park staff are contractual employees, representing a significant weakness. Urgently engage ex-service personnel, including gunmen, to strengthen protection mechanisms at sensitive areas within the TR.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Compliance	Weaknesses from AITE
2018	<ul style="list-style-type: none"> <li>Prioritize enhancing enforcement training and capacity building of existing staff, focusing on intelligence gathering, combing/raiding operations, and establishing an informer network with assistance from relevant authorities like the Wildlife Crime Control Bureau and Special Task Force; strengthen transboundary anti-poaching efforts with Nepal.</li> <li>Despite the absence of human habitation in the core, there is still biotic pressure from villages situated in the center and along the southern boundary. To address this, the TR should enhance collaboration with village communities for alternative livelihoods, energy sources, and employ a participatory approach for relevant aspects of management.</li> <li>Urgently delineate optimal agriculture land as part of a corridor/interlinking area in the western part of the reserve (Madanpur Range) to restore corridor connectivity and involve revenue authorities in land acquisition.</li> <li>Initiate pilot-scale voluntary relocation projects in one or two villages to showcase benefits; prioritize exposure visits to successfully relocated/rehabilitated sites, with plans for scaling the village relocation process in the future.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Compliance	Weaknesses from AITE
2018	<ul style="list-style-type: none"> <li>VTR needs to conduct an assessment of the impacts of invasive species like Phoenix and other weeds, which have extensively covered a significant part of the reserve. Scientifically evaluate the impact of invasive species like Phoenix, Mikania, and Eupatorium on the reserve, and implement mitigation measures; prioritize habitat development/management interventions to enhance palatable vegetation for prey augmentation.</li> <li>It is crucial to plan and implement climate change mitigation and adaptation measures within VTR.</li> <li>VTR faces challenges with the absence of a veterinarian and trained elephants, particularly in dealing with human-wildlife conflicts. The porous border with Nepal also poses a threat, necessitating collaborative efforts to counter poaching of tigers, prey, and other threatened species.</li> <li>Include adjoining protected areas, such as Sohagibarwa Wildlife Sanctuary, Uttar Pradesh, and divisions like Bettiah and Maharajganj, Uttar Pradesh, in the All India Tiger Estimation 2018; conduct training programs for personnel capacity building in coordination with the Wildlife Institute of India.</li> <li>Urgently bring a trained veterinarian and two or three kunki elephants for managing human-wildlife conflict.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Compliance	Weaknesses from AITE
2018	<ul style="list-style-type: none"> <li>Engage with wildlife authorities of Uttar Pradesh to include Sohagibarwa Wildlife Sanctuary within Valmiki Tiger Reserve.</li> <li>Shift the headquarters of DFOs closer to the TR, such as Bagha, to improve administrative efficiency.</li> <li>Explore the possibility of rhino reintroduction in the western part of Madanpur Range adjoining revenue areas of Kushinagar, Uttar Pradesh, for conservation breeding efforts and regulated ecotourism, following NTCA guidelines.</li> </ul>		
2022	<ul style="list-style-type: none"> <li>Despite receiving adequate funds from NTCA, Valmiki Tiger Reserve faces delays in fund disbursement, impacting effective management.</li> <li>In the core, although there is no human habitation, enclaved villages at the center and numerous villages along the southern boundary exert biotic pressure. Regular engagement with local communities is necessary to minimize their impact.</li> <li>Improve facilities in the Anti-Poaching Camp (APC), ensuring separate amenities for both male and female workers.</li> <li>Only 5% of the area is covered by grasslands, which are being invaded by woody growth and invasive weeds like Eupatorium, Lantana, Parthenium, and Cassia tora.</li> <li>Institutionalize joint data sharing and monitoring efforts with Chitwan National Park, Nepal, as Valmiki Tiger Reserve is a transboundary reserve.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Compliance	Weaknesses from AITE
2022	<ul style="list-style-type: none"> <li>Implement mitigation measures on National Highway No. 28B, which traverses the western boundary of the reserve, in accordance with the eco-friendly Guidelines for Linear Infrastructure by WII.</li> <li>Apply mitigation measures, following WII's eco-friendly Guidelines for Linear Infrastructure, to address the impact of the railway line passing through Madanpur Block.</li> <li>When undertaking soil and moisture conservation works, employ a scientific approach using tools like CLART, a GIS-based Android tool designed to enhance the planning of region-specific soil and water conservation measures, ensuring effective ground-level implementation.</li> <li>Implement strategies to retain migrating rhinos within Valmiki Tiger Reserve, particularly in Madanpur Block and the Sonha-Pachnad valley bordering Chitwan National Park, and address episodes of rhinos crossing the Thori-Jasauli border zone in the eastern end.</li> <li>Undertake specific actions related to climate change, whether through research or adaptive mechanisms, within Valmiki Tiger Reserve.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested Key Management Recommendations

It is crucial to prioritize and implement the recommendations outlined in the MEE cycles to enhance effective management and conservation efforts, as many key actionable points still await attention.

- Staff movement and infrastructure development in the reserve are significantly challenged by Naxal influence, impacting conservation efforts. It is recommended that a thorough security audit following standard protocols be conducted, and a detailed security plan aligned with the Tiger Conservation Plan (TCP) be developed. Collaboration with relevant authorities to mitigate Naxal influence, ensuring staff safety and freedom of movement within the reserve, is recommended.
- The reserve faces recurring conflicts between tigers and humans due to its high-density tiger population, resulting in human fatalities and injuries. Immediate implementation of robust conflict management strategies is considered vital to mitigate these conflicts and safeguard both wildlife and human communities.
- Proactive biodiversity conservation efforts are underscored by a comprehensive plan for reintroducing rhinos in Valmiki Tiger Reserve. Execution of this plan is deemed essential to enhance the reserve's ecological diversity and resilience.
- Urgent interventions are needed to address human encroachment and mitigate its adverse impacts on the ecosystem, as significant human pressure poses challenges to habitat conservation and wildlife protection, particularly in the wet grasslands, especially in the Mohana range.
- The presence of outdated infrastructure like railway tracks and canal systems highlights the need for modernization within the reserve to align with current conservation needs and ensure effective wildlife management.
- Staff shortages contributing to inadequate and irregular staff training are observed, with approximately 30% of staff positions vacant. Immediate measures are required to address staff shortages, enhance recruitment, and provide regular training to improve wildlife management capabilities.
- The proliferation of invasive plant species like Mikania and Eupatorium poses a threat to native vegetation and wildlife habitat, necessitating the implementation of effective management strategies to control invasive species and restore ecological balance within the reserve.
- Urgent reinforcement of facilities and equipment, including vehicles, is required to support effective field operations, patrols, and wildlife monitoring activities within

the reserve. Prioritizing the allocation of resources for infrastructure development is crucial to improving operational efficiency.

- i. Livestock grazing, although limited, warrants a comprehensive impact assessment to understand its effects on specific areas near fringe villages in the buffer zone. Conducting thorough assessments will aid in implementing targeted conservation measures to mitigate negative impacts.

## 5. Conclusions

The Valmiki Tiger Reserve has emerged as a beacon of success for tiger conservation in India, experiencing a steady rise in its tiger population since the 2006 monitoring exercise. This crucial reserve transcends geographical boundaries, forming an important trans-boundary linkage with Nepal's Chitwan National Park, further bolstering conservation efforts. Notably, Valmiki stands out as one of the few protected areas in India that meticulously safeguards the unique ecosystem of floodplain habitats and the diverse fauna they harbor. While Valmiki Tiger Reserve grapples with human-wildlife conflict, its commitment to conservation and the ongoing rhino reintroduction project offer a glimmer of hope for the future of this vital ecosystem. By addressing the challenges and implementing effective conflict management strategies, Valmiki can continue to be a shining example of successful tiger conservation in India.





# ACHANAKMAR TIGER RESERVE

## 1. Brief Description

The Achanakmar Tiger Reserve in Chhattisgarh covers 914 square kilometers, comprising a core zone of 626.2 square kilometers and a buffer zone of 287.8 square kilometers, located between 22°38' to 22°17' N latitude and 81°31' to 81°57' E longitude within the Maikal hills of the Satpuda ranges. It features Tropical moist and dry deciduous vegetation dominated by sal, alongside species like *Adina cordifolia*, *Anogeissus latifolia*, *Butea monosperma*, and others, with bamboo found on lower and higher slopes. The reserve hosts a diverse range of flora and fauna including tigers, leopards, sloth bears, hyenas, dholes, golden jackals, jungle cats, Indian foxes, chitals, sambars, gaurs, nilgais, wild pigs, barking deer, chowsinghas, Indian grey langurs, rhesus macaques, Indian porcupines, black-naped hares, and Indian giant squirrels.

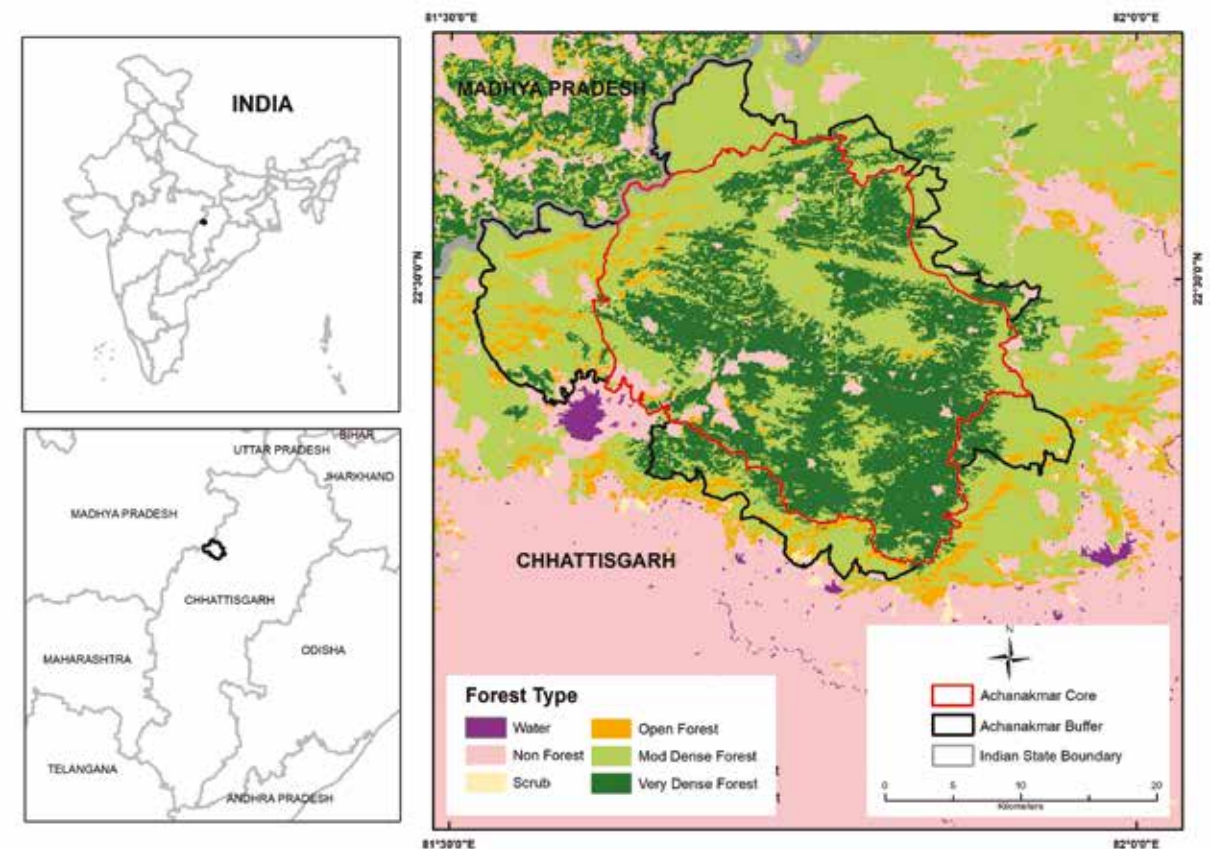


Figure 1: Map showing location of Achanakmar Tiger Reserve in the state of Chhattisgarh



## 2. Tiger Population as per all India tiger estimation

A worrying decline in tiger numbers has been observed at Achanakmar Tiger Reserve since 2014. Despite deploying 397 cameras and identifying 5 unique tigers in 2018, insufficient data in 2022 hindered precise population estimates. The estimated density in 2018 was just 0.46 tigers per 100 km<sup>2</sup>, highlighting the critical situation. This concerning trend is likely driven by poaching of both tigers and their prey, demanding urgent action to reverse the course.

## 3. Management Weakness and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<ul style="list-style-type: none"> <li>Address the decline in prey base and combat poaching and poisoning through a robust protection strategy while implementing systematic wildlife monitoring.</li> <li>Optimize management by appointing dedicated leadership positions separate from Territorial CF and DFO.</li> <li>Manage biotic pressure sensitively, especially during village relocations, and align tourism activities with wilderness preservation goals.</li> <li>Implement the proposed alternate road for the Bilaspur Amarkantak national highway to prevent park division and enforce speed regulations and night-time traffic restrictions until its completion.</li> <li>Enhance staff capabilities and efficiency through comprehensive wildlife-oriented skill-building programs.</li> </ul>	<ul style="list-style-type: none"> <li>Unsound protection depletes prey base.</li> <li>Poaching &amp; poisoned waterholes worsen threats.</li> <li>Village relocation struggles impact ecosystem.</li> <li>Monitor relocation &amp; align tourism with conservation.</li> <li>Bilaspur bypass delay harms park; enforce speed limits.</li> <li>Core area infrastructure hinders tourism alignment.</li> <li>Understaffing limits effective patrolling.</li> <li>Train staff on wildlife management.</li> <li>Inadequate veterinary care; need additional vet.</li> <li>Low tiger density; plan for introduction pending assessment.</li> <li>Revise Tiger Conservation Plan (TCP).</li> <li>Delayed funding hinders development.</li> </ul>	<ul style="list-style-type: none"> <li>Urgently implement stricter enforcement measures and regular foot patrolling, utilizing the successful MSTRIPES model, to combat poaching and protect both tigers and their prey.</li> <li>Prioritize safeguarding the crucial Kanha-Achanakmar and Bandhavgarh-Sanjay-Achanakmar corridors, facilitating tiger dispersal and ensuring healthy gene flow within the landscape.</li> <li>Implement comprehensive measures to improve the park's prey population, considering strategies like prey augmentation and habitat management.</li> <li>Evaluate the feasibility and sustainability of tiger translocation, following thorough assessments of security, habitat suitability, and potential impact on existing populations.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010		<ul style="list-style-type: none"> <li>High livestock numbers harm prey.</li> <li>Uncontrolled public vehicles threaten wildlife.</li> <li>Chronic water shortages exist.</li> <li>Community engagement lacking in TCP implementation.</li> <li>Research needs remain unmet.</li> </ul>	<ul style="list-style-type: none"> <li>Engage in open communication and collaboration with relevant stakeholders, including local communities and research institutions, to address existing challenges and develop informed conservation strategies.</li> <li>Maintain robust monitoring efforts to track tiger populations and threats, adapting management strategies as needed to ensure the long-term success of Achanakmar Tiger Reserve.</li> </ul>
2014	<ul style="list-style-type: none"> <li>Review staff strength to rationalize beats and patrolling camps.</li> <li>Increase the number of camps for more effective patrolling.</li> <li>Urgently review and provide the minimum required staff posts.</li> <li>Rationalize the buffer area to address discontinuity caused by State Forest Corporation activities and ensure unified control under the TR authorities.</li> <li>Conduct training programs for various staff levels, building wildlife management capacity.</li> <li>Include training modules in the Tiger Conservation Plan for Achanakmar Tiger Reserve</li> <li>Implement proper village relocation based on National Tiger Conservation Authority guidelines.</li> <li>Provide awareness courses for staff on relocation guidelines and visit successfully relocated villages for practical insights.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Ensure effective protection and management of areas, including former village sites, with urgent development of grasslands using suitable species.</li> <li>Address severe grazing pressure to achieve the purpose of relocation.</li> <li>Immediately allocate additional veterinarian and support staff to Achanakmar Tiger Reserve to enhance veterinary capabilities and address wildlife health needs.</li> <li>Streamline beats &amp; camps, highlight regional importance &amp; uncover hidden species in the revised Tiger Conservation Plan.</li> <li>Translate Standard Operating Procedures into Hindi and distribute them among field staff.</li> </ul>		
2018	<ul style="list-style-type: none"> <li>Prioritize relocating 19 villages with cattle to prevent further wildlife damage.</li> <li>Ensure post-relocation care for villagers, involving NGOs for support.</li> <li>Develop grasslands with suitable species, focusing on areas abandoned by village relocation.</li> <li>Orient frontline staff toward wildlife management through training and exposure to protected areas in adjacent states.</li> <li>Boost tourism with interpretation center, publicity and awareness materials, and upgraded Shiv Tarai accommodations.</li> <li>Undertake active management of the tiger population due to critically low density.</li> <li>Procure at least three patrolling vehicles for effective management.</li> <li>Develop a veterinary facility for rescuing and rehabilitating wild animals.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Find a permanent solution for the engagement of daily wagers in protection and development activities.</li> <li>Prioritize research activities on various aspects of management.</li> <li>Coordinate with Madhya Pradesh for corridor restoration and wildlife management activities.</li> <li>Request restricting public vehicles on the Kota-Keonchi road for wildlife conservation.</li> <li>Ensure timely release of funds for proper utilization in development activities. Review fund deficit status and consider additional funds for Achanakmar Tiger Reserve.</li> </ul>		
2022	<ul style="list-style-type: none"> <li>Prioritize relocating 19 villages to prevent further wildlife damage.</li> <li>Address the high livestock numbers impacting tiger prey species.</li> <li>Improve management infrastructure for protection and communication.</li> <li>Actively manage the tiger population based on standardized protocols and habitat suitability assessment.</li> <li>Conduct a security audit and annual land use mapping using satellite data.</li> <li>Undertake small research projects with local students, initiated by the state biodiversity board.</li> <li>Effectively control public vehicle movements on Kota-Keonchi road.</li> <li>Extend water conservation program to address deficiencies in various locations.</li> <li>Involve local communities for effective execution of TCP activities pending village relocation.</li> <li>Review the fund deficit status and meet additional fund requirements for timely development activities.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested Key Management Recommendations

- a. While recognizing the dedicated efforts invested in Achanakmar Tiger Reserve's management, it is crucial to acknowledge that several key recommendations identified through previous MEE cycles remain unimplemented. To optimize conservation outcomes and ensure effective management, prioritizing and adhering to these established recommendations is strongly advised. This proactive approach will contribute significantly to the reserve's long-term success and the well-being of its precious tiger population.
- b. Consistent reports of insufficient protection leading to depletion of the tiger prey base and increased poaching pressures. Stricter enforcement measures and regular foot patrolling (MSTriPES model) to combat poaching and protect both tigers and their prey should be implemented.
- c. Crucial corridors connecting Achanakmar to other tiger reserves remain unsecured, hindering dispersal and gene flow. Safeguarding the Kanha-Achanakmar and Bandhavgarh-Sanjay-Achanakmar corridors to facilitate tiger movement and maintain healthy populations should be prioritized.
- d. Continuously declining prey population threatens the tiger population's survival. Comprehensive measures to improve prey populations, including strategies like prey augmentation and habitat management should be implemented.
- e. Critically low tiger density necessitates active management for long-term sustainability. Evaluation of the feasibility and sustainability of tiger translocation, following thorough assessments of security, habitat suitability, and potential impact on existing populations, is recommended to address the critically low tiger density necessitating active management for long-term sustainability.
- f. Lack of dedicated leadership, insufficient staff capacity, and inadequate training hinder effective management. Optimization of management through the appointment of dedicated leadership, review of staff strength, and provision of comprehensive wildlife-oriented skill-building programs is recommended to address the lack of dedicated leadership, insufficient staff capacity, and inadequate training hindering effective management.
- g. Improper village relocation creates ecological disruptions and requires post-relocation care for villagers. Implementation of proper village relocation based on national guidelines, with effective protection of former village sites and development of grasslands in abandoned areas, is recommended to address the ecological disruptions and post-relocation care challenges associated with improper village relocation.

- h. Lack of patrolling vehicles, veterinary facilities, and water conservation measures hinder protection and animal welfare. Procurement of patrolling vehicles, development of a veterinary facility, extension of the water conservation program, and addressing infrastructure gaps for protection and communication are recommended to address the lack of patrolling vehicles, veterinary facilities, and water conservation measures hindering protection and animal welfare.
- i. Uncontrolled public vehicle movement and high livestock numbers threaten wildlife and ecosystem integrity. Implementation of effective control of public vehicles on designated roads, addressing high livestock numbers impacting prey species, and involvement of local communities in conservation efforts are recommended to address the uncontrolled public vehicle movement and high livestock numbers threatening wildlife and ecosystem integrity.
- j. Limited research activities and insufficient collaboration with stakeholders hinder informed decision-making. Encouragement of research projects, engagement in open communication and collaboration with relevant stakeholders, and prioritization of corridor restoration and wildlife management activities with neighboring states are recommended to address the limited research activities and insufficient collaboration with stakeholders hindering informed decision-making.
- k. Consistent delays in fund release and insufficient resources hamper development activities. Timely release of allocated funds, review of funding deficits, and consideration of additional resources for Achanakmar Tiger Reserve are recommended to address the consistent delays in fund release and insufficient resources hampering development activities.

#### 5. Conclusions

Achanakmar Tiger Reserve suffers from fragmented connections to neighboring tiger reserves, hindering vital tiger movement and gene flow. The Kanha-Achanakmar and Bandhavgarh-Sanjay corridors, crucial for dispersal and population health, are fragmented by infrastructure, settlements, and agriculture. This, coupled with poaching threats and a declining prey base, necessitates urgent action. Protection measures, prey augmentation, and potential tiger translocation are needed to secure Achanakmar's tiger population and ensure its long-term survival.

# INDRAVATI TIGER RESERVE

## 1. Brief Description

Established in 1981 and spanning over 2,700 square kilometers, the Indravati Tiger Reserve is a vital haven for diverse wildlife in central India. Formerly known as Kutru National Park, this reserve was incorporated into Project Tiger in 1983. Flowing along its northern border with Maharashtra, the Indravati River shapes the reserve's landscape, which features undulating hills like Kutroo, Kandlapatru, and Matti Murka, interspersed with numerous seasonal streams. The catchment area of this perennial river nurtures a rich mosaic of Southern Moist Mixed Deciduous Forests, both with and without Teak, alongside patches of Southern Dry Mixed Deciduous Forests. Indravati boasts a remarkable diversity of tree species, including Teak, Dhaora, Lendia, Saja, Salai, Moyan, and many more. This verdant tapestry provides habitat for a vibrant array of fauna, including Tigers, Leopards, Striped Hyenas, Wild Dogs, Wolves, Sloth Bears, and even Flying Squirrels. Herbivores like Spotted Deer, Sambar, Barking Deer, Blue Bulls, Wild Pigs, and Gaurs find sustenance in the reserve's abundant vegetation. Adding to the ecological richness, the reptile population thrives with the presence of Freshwater Crocodiles, Common Monitor Lizards, Indian Chameleons, various snakes like Common Kraits, Indian Rock Pythons, Cobras, and Russell's Vipers. Further enriching the historical and cultural landscape, the ruins of an ancient Shiva temple stand near the village of Pasewada.

## 2. Tiger Population as per All India Tiger Estimation

The first assessment of the tiger population in Indravati National Park was done in 2014. In 2018, Using scat DNA analysis, 3 tigers were identified, highlighting the dwindling population. In 2022, unfortunately, due to insufficient data, a comprehensive population estimate for tigers remains elusive.



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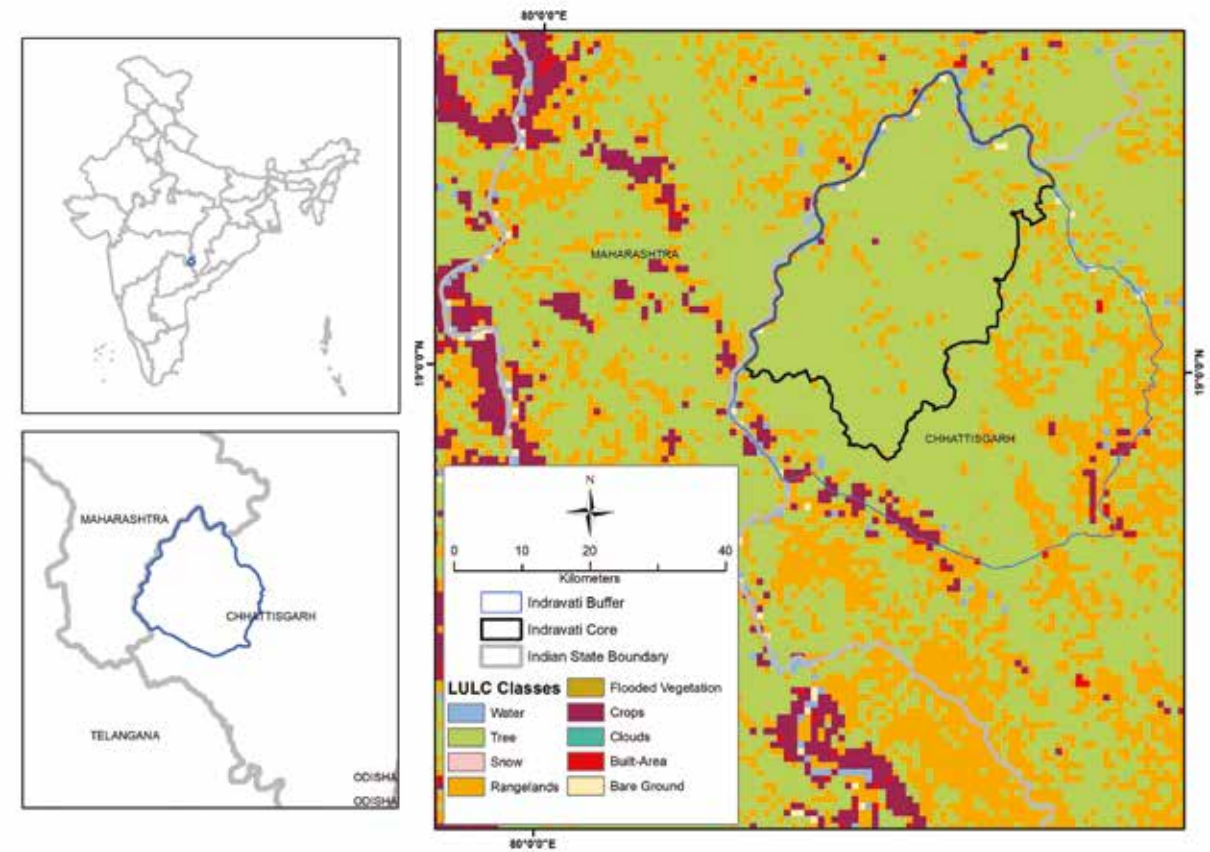


Figure 1: Map showing the location of Indravati Tiger Reserve in the state of Chhattisgarh

## 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>Place buffer zone under Field Director's control for improved management and conservation.</li> <li>Address biotic pressures from 56 villages within core area through coordinated efforts and government support.</li> <li>Implement unfulfilled 2000-2010 management plan.</li> <li>Fill Forest Ranger and staff vacancies in core area.</li> <li>Allow use of arms and communication equipment to address law and order situation.</li> </ul>	<ul style="list-style-type: none"> <li>LWE restricts effective management and conservation.</li> <li>Buffer zone lacks unified control, hindering management.</li> <li>Implementing planned activities faces challenges due to control issues.</li> <li>Significant staff shortages hinder effective operations.</li> <li>Limited stakeholder participation beyond forest department.</li> </ul>	<ul style="list-style-type: none"> <li>Prioritize restoration and protection of fragmented patches in the Indravati-Udanti-Sitanadi corridor.</li> <li>Implement active management, including prey augmentation and potential tiger supplementation, in the Indravati-Udanti-Sitanadi corridor after controlling biotic pressure.</li> <li>Address poaching, linear infrastructure, and mining threats to the Kanha-Navegaon-Tadoba-Indravati corridor.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>Resolve Naxalite issues to enable strike force deployment and research activities.</li> <li>Develop eco-tourism opportunities once law and order improve.</li> <li>Protect and preserve existing meadows.</li> <li>Verify and update outdated census data.</li> <li>Establish patrolling camps with staff residing in core area.</li> <li>Implement alternative communication methods like couriers or postal services.</li> <li>Develop ecotourism initiatives involving host communities outside core area.</li> <li>Provide restorative inputs beyond the reserve to address threats.</li> </ul>	<ul style="list-style-type: none"> <li>Lack of proper staff training hinders capacity.</li> <li>Villages in core and buffer zones harm wildlife habitat.</li> <li>Local tribal practices negatively impact wildlife and habitat.</li> <li>Water scarcity, limited diversity assessment, and poor infrastructure pose challenges.</li> <li>LWE disrupts tourism, reduces facilities, and hinders trained staff availability.</li> <li>Skewed tiger population and hindered Tiger Conservation Plan implementation.</li> <li>Limited research progress, especially for critically important Asiatic Wild Buffalo.</li> <li>Lack of systematic studies on climate change impact.</li> <li>Pending interstate collaboration for improved protection.</li> <li>Inadequate patrolling and enforcement infrastructure.</li> <li>Insufficient eco-development activities within the reserve.</li> <li>Underdeveloped tourism infrastructure and poor connectivity</li> </ul>	<ul style="list-style-type: none"> <li>Address the influence of left-wing extremism on conservation efforts in the Indravati area.</li> <li>Prioritize the removal of invasive weeds like Chromolaena odorata, Mesopharum sp., Mimosa, Mikania, Parthenium, Prosopis, Senna Tora, and Xanthium before they establish in larger areas.</li> </ul>
2010	<ul style="list-style-type: none"> <li>Establish permanent base to counter Left Wing Extremist influence and enable effective reserve management.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<ul style="list-style-type: none"> <li>Resume regular frontline staff visits to the core area for improved protection, patrolling, and communication.</li> <li>Bring the buffer zone under the Field Director's control for enhanced operational effectiveness.</li> <li>Strengthen protection measures in the buffer zone.</li> <li>Build positive relationships with communities surrounding the reserve.</li> <li>Focus habitat improvement efforts on less affected areas.</li> <li>Prioritize conservation of the Asiatic Wild Buffalo population through coordinated actions despite LWE challenges.</li> </ul>		
2014	<ul style="list-style-type: none"> <li>Improve access to inaccessible areas by addressing left-wing extremism to enable proper patrolling.</li> <li>Conduct an urgent review and fill wildlife management and conservation positions.</li> <li>Implement training programs to enhance wildlife and habitat management skills.</li> <li>Develop effective strategies to address poaching by tribal communities.</li> <li>Establish infrastructure, intelligence networks for illegal wildlife trade, and veterinary services.</li> <li>Introduce a mobile van with a vet and support staff to address wildlife emergencies.</li> <li>Ensure staff are posted effectively to critical areas.</li> </ul>		
2018	<ul style="list-style-type: none"> <li>Relocate villages in remote core areas to improve accessibility and reduce detrimental practices.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>• Create an interpretation center in Bijapur for public awareness despite the lack of tourism.</li> <li>• Appoint a dedicated Field Director, Deputy Director, and fill other staff positions to address dual control and distance issues.</li> <li>• Implement M-STriPES for improved protection, staff amenities, and water access.</li> <li>• Provide training programs for staff to improve wildlife management skills.</li> <li>• Address low prey and predator bases, traditional hunting, forest fires, and community participation issues.</li> <li>• Urgently approve the Tiger Conservation Plan.</li> <li>• Explore long-term conservation projects for the Asiatic Wild Buffalo.</li> <li>• Hold interstate coordination meetings with Maharashtra for better management.</li> <li>• Implement human-animal conflict mitigation strategies through eco-development, awareness programs, and community engagement.</li> <li>• Develop veterinary services for wildlife rescue and rehabilitation.</li> <li>• Formulate a protection strategy aligned with the security plan.</li> </ul>		
2022	<ul style="list-style-type: none"> <li>• Conduct a security audit to identify and minimize LWE threats.</li> <li>• Seek full control of the TR landscape for effective management.</li> <li>• Include key stakeholders beyond the forest department despite LWE restrictions.</li> <li>• Monitor forest cover remotely using annual land use mapping.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>• Involve local communities in conservation efforts until an inviolate space is created.</li> <li>• Address water scarcity issues during the dry season.</li> <li>• Regularly assess and monitor floral and faunal diversity despite LWE challenges.</li> <li>• Pursue actionable points from the previous MEE, focusing on crucial areas.</li> <li>• Develop tourism infrastructure despite limited tourist inflow.</li> <li>• Address inadequate trained human resources considering the size and threats.</li> <li>• Address skewed tiger population and obstacles to TCP activities.</li> <li>• Measure climate change impact on core habitat biodiversity.</li> <li>• Encourage local students to participate in research projects and surveys.</li> <li>• Focus on conservation initiatives for the Asiatic wild buffalo population.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- Despite ongoing efforts through MEE cycles, crucial actions for improving Indravati Tiger Reserve's management and conservation remain unaddressed. Prioritizing and implementing the identified recommendations is essential for achieving effective wildlife protection and habitat conservation within the reserve.
- LWE shackles access and cripples management, making the reserve a challenge for conservationists. Security strategies should be implemented to improve access within the reserve, facilitating better management.
- Shorthanded and untrained staff struggle to be the guardians of the wild, leaving

- the reserve vulnerable. Staff shortages should be addressed through recruitment, and comprehensive wildlife management training should be provided to enhance conservation efforts.
- d. Villages nestled within the reserve carve into the wilderness, squeezing the habitat and its inhabitants. Village relocation or alternative solutions to minimize habitat impact should be explored. Local communities should be engaged in conservation activities through inclusive and collaborative approaches.
  - e. Local practices, from hunting to resource collection, chip away at the wildlife sanctuary.
  - f. Crumbling infrastructure, thirsty lands, and broken communication lines leave the reserve gasping for support. Infrastructure improvements should be prioritized, addressing water scarcity and communication challenges to ensure effective management.
  - g. Tourists stay away due to LWE's shadow, leaving the reserve's beauty hidden and its potential untapped. Sustainable tourism infrastructure should be developed while addressing LWE concerns to unlock the reserve's potential and generate economic benefits.
  - h. Climate change whispers warnings, but research remains absent, leaving the reserve unprepared for future threats. Research on climate change impacts should be conducted, and adaptation strategies should be implemented to protect the reserve and its biodiversity.
  - i. Restoration of fragmented corridors should be prioritized, and threats like poaching, linear infrastructure, and mining should be addressed to improve connectivity for wildlife.
  - j. Measures should be implemented to remove invasive plant species before they spread and harm the native ecosystem.
  - k. The recommendations outlined in the 2000-2010 Management Plan should be implemented to address various management issues within the reserve.
  - l. Control of the buffer zone should be granted to the Field Director to improve operational effectiveness and facilitate coordinated management efforts.
  - m. Research and conservation measures specifically tailored to protect the critically important population of Asiatic Wild Buffalo should be conducted and implemented.
  - n. Poaching and other harmful practices should be addressed through collaborative approaches with tribal communities, promoting sustainable resource use and fostering positive relationships.
  - o. M-STriPES should be implemented to improve infrastructure, communication, and staff amenities within the reserve.
  - p. Strategies to mitigate human-animal conflict through eco-development initiatives, awareness programs, and community participation should be developed and implemented, fostering peaceful coexistence.
  - q. A comprehensive protection strategy aligned with the security plan should be formulated to ensure the safety of wildlife and staff within the reserve.

- r. Veterinary services dedicated to rescuing and rehabilitating injured or orphaned wildlife within the reserve should be established.

## 5. Conclusions

The connectivity corridors linking Indravati Tiger Reserve to surrounding tiger populations face critical challenges. Fragmented landscapes, poaching, infrastructure development, and mining threaten the Kanha-Navegaon-Tadoba-Indravati corridor, while the Indravati-Udanti-Sitanadi corridor requires urgent restoration and protection to facilitate tiger movement. Active management, including prey augmentation and potential tiger supplementation, may be necessary in the Udanti-Sitanadi-Indravati corridor if biotic pressures are controlled. Left-wing extremism further complicates conservation efforts in Indravati. Immediate action is needed to address these challenges. Prioritizing corridor restoration, tackling invasive species like *Chromolaena odorata* and others, and implementing effective anti-poaching measures are crucial steps. Collaborative efforts are essential to ensure the long-term survival of tiger populations in this critical landscape.



# UDANTI-SITANADI TIGER RESERVE

## 1. Brief Description

Udanti-Sitanadi Tiger Reserve is located in the Gariyaband district of Chhattisgarh, encompassing the Udanti and Sitanadi wildlife sanctuaries, named after the Udanti and Sitanadi rivers flowing through them. Covering a total geographical area of 1842.54 square kilometers. The Udanti-Sitanadi Tiger Reserve includes the territories of Tourenga, Mainpur, Indagaon, and Kulhadighat within the Udanti Forest Division, as well as portions of the Dhawalpur range in the East Raipur Forest Division and the Sankara range in the Dhamtari Forest Division. The eastern boundary of Udanti Sanctuary serves as an interstate boundary between Chhattisgarh and Odisha, and the two sanctuaries are connected by a 30-kilometer forest stretch facilitating the movement of wildlife between them. The forest types within USTR are characterized as Tropical Peninsular Sal forest and Southern Tropical Dry Deciduous Mixed forest, with Sal (*Shorea robusta*) being the dominant tree species, intermingled with *Anogeissus latifolia*, *Pterocarpus marsupium*, *Terminalia arjuna*, *Terminalia elliptica*, and Bamboo. Additionally, Teak (*Tectona grandis*) is found within the reserve. Udanti-Sitanadi Tiger Reserve is home to a diverse range of fauna, including the Tiger (*Panthera tigris*), Leopard (*Panthera pardus*), Jungle Cat (*Felis chaus*), Wild Dog (*Cuon alpinus*), Golden Jackal (*Canis aureus*), Gaur (*Bos gaurus*), Elephant (*Elephas maximus*), Sambar (*Rusa unicolor*), Nilgai (*Boselaphus tragocamelus*), Wild Pig (*Sus scrofa*), Barking Deer (*Muntiacus vaginalis*), and Chowsingha (*Tetracerus quadricornis*).

## 2. Tiger Population as per all India tiger estimation

In 2022, despite investing 3783 trap nights, no photographs of tigers were captured during sampling efforts. However, one tiger record was confirmed from a genetic sample obtained from scat. In previous years, a single tigress was recorded in a camera trap in 2018, and genetic samples confirmed the presence of two tigers in 2014.



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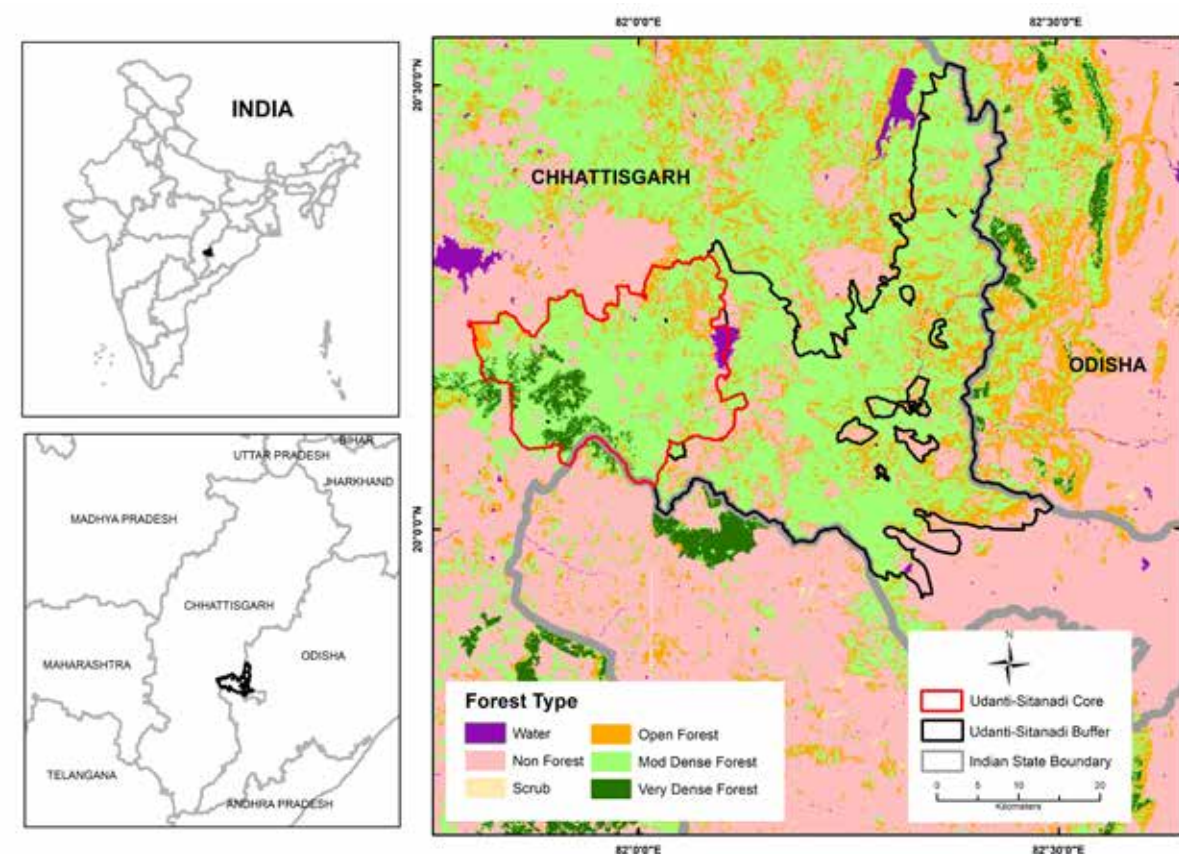


Figure 1: Map showing Udanti-Sitanadi Tiger Reserve in the State of Chhattisgarh

## 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	NA	<p>The management of the reserve requires enhanced senior focus, streamlined structure, and clarified reporting lines to improve coordination.</p> <p>Security and influence concerns encompass the threats posed by Left Wing Extremism (LWE), difficulties in managing Naxal influence, and obstacles to infrastructure development and protection efforts.</p> <p>The Tiger Reserve faces staffing and training challenges, including shortages, staff</p>	<p>Implement an urgent ungulate population recovery program to address low prey abundance due to high biotic pressure.</p> <p>Focus on habitat restoration and protection within the Udanti-Sitanadi-Indravati corridor to facilitate tiger movement.</p> <p>Recognize the need for active management, including prey augmentation and tiger supplementation, as tigers are unlikely to recover independently in this</p>



MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006		<p>reluctance for postings, and a deficiency of trained personnel across various levels.</p> <p>The reserve exhibits shortcomings in addressing the critically endangered Asiatic Wild Buffalo, lacks focused planning for key wildlife habitat development, and inadequately addresses the impact of Naxalism on conservation activities.</p> <p>Patrolling is insufficient and ineffective, communication facilities, particularly the Wireless Transmission network, are non-functional, and the absence of organized patrolling results in deserted camps at night.</p> <p>The reserve faces deficiencies in infrastructure and staff accommodation, potential threats from the intersection of highways and roads, and the underutilization of eco-center and tourism facilities.</p> <p>Persistent traditional hunting practices, difficulties in managing human-animal conflicts, and the underutilization of eco-center and tourism facilities are notable challenges in the reserve.</p> <p>The reserve experiences water scarcity in dry seasons, lacks adequate emphasis on grassland development and habitat management, and displays limited initiatives for the rehabilitation of the Wild Buffalo.</p>	<p>landscape without a source population.</p> <p>Ensure biotic pressure is brought under control to support the success of prey augmentation and tiger supplementation efforts.</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006		<p>Challenges persist with resistance and delays in village relocation, indicating a lack of a comprehensive approach to the resettlement process.</p> <p>The reserve experiences a lack of intensive and effective patrolling, an absence of a comprehensive protection strategy, and limited assessment of tiger status in areas least impacted by Naxalism.</p> <p>The eco-center and tourism facilities remain underutilized, there are insufficient efforts in promoting public participation and awareness programs, and challenges persist in developing the tourism potential around Devdhara waterfall focus, streamlined structure, and clarified reporting lines to improve coordination.</p> <p>Security and influence concerns encompass the threats posed by Left Wing Extremism (LWE), difficulties in managing Naxal influence, and obstacles to infrastructure development and protection efforts.</p> <p>The Tiger Reserve faces staffing and training challenges, including shortages, staff reluctance for postings, and a deficiency of trained personnel across various levels.</p> <p>The reserve exhibits shortcomings in addressing the critically endangered Asiatic Wild Buffalo, lacks focused planning for key wildlife habitat</p>	

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006		<p>development, and inadequately addresses the impact of Naxalism on conservation activities.</p> <p>Patrolling is insufficient and ineffective, communication facilities, particularly the Wireless Transmission network, are non-functional, and the absence of organized patrolling results in deserted camps at night.</p> <p>The reserve faces deficiencies in infrastructure and staff accommodation, potential threats from the intersection of highways and roads, and the underutilization of eco-center and tourism facilities.</p> <p>Persistent traditional hunting practices, difficulties in managing human-animal conflicts, and the underutilization of eco-center and tourism facilities are notable challenges in the reserve.</p> <p>The reserve experiences water scarcity in dry seasons, lacks adequate emphasis on grassland development and habitat management, and displays limited initiatives for the rehabilitation of the Wild Buffalo.</p> <p>Challenges persist with resistance and delays in village relocation, indicating a lack of a comprehensive approach to the resettlement process.</p> <p>The reserve experiences a lack of intensive and effective patrolling, an absence of a comprehensive protection</p>	

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006		<p>strategy, and limited assessment of tiger status in areas least impacted by Naxalism.</p> <p>The eco-center and tourism facilities remain underutilized, there are insufficient efforts in promoting public participation and awareness programs, and challenges persist in developing the tourism potential around Devdhara waterfall.</p>	
2010	<p>There is a lack of senior management focus. Management structure needs to be streamlined. Clarify reporting lines to enhance coordination between the Field Director, Superintendents, and DFOs. Ensure that park management has direct control over buffer areas.</p> <p>Increase senior management focus on the reserve by allocating dedicated resources and attention. Establish a clear mandate for senior management involvement in reserve matters.</p> <p>Develop and implement a comprehensive protection strategy for the entire reserve. Prioritize wildlife orientation for staff and integrate it into their training programs.</p> <p>Collaborate with relevant authorities to mitigate Naxal influence and ensure the safety and freedom of movement for park staff. Develop strategies to counteract the impact of Naxalism on conservation activities.</p> <p>Address staff shortages promptly. Invest in training and skill-building</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<p>programs for existing staff to enhance their wildlife management capabilities.</p> <p>Asiatic Wild Buffalo is critically endangered in this TR. Reassess and revamp the conservation program for the Asiatic Wild Buffalo. Implement urgent measures to address the near-extinction of the wild buffalo.</p> <p>Conduct a thorough assessment of tiger status in areas least impacted by Naxalism in adherence to NTCA protocols. Initiate concentrated conservation-oriented community efforts and habitat management in identified areas.</p>		
2014	<p>Lack of intensive and effective patrolling has led to heightened threats of poaching. Management is unable to control local consumption poaching and detect illegal trade, especially in bear parts. Enable regular visits, stay, and patrolling by staff and officials through improved management.</p> <p>Presence of the threat of Left Wing Extremism affecting staff movement and protection efforts.</p> <p>General shortage of staff with untrained personnel in wildlife management and conservation along with unwillingness to be posted in the TR. Adopt a proper transfer and posting policy for staff members in USTR to avoid disruptions. Provide training programs for all levels of staff, including director, DDs/ROs, and Dy. Ranger/Forester/FGs, to enhance wildlife management capabilities.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<p>Review and rationalize the locations and jurisdiction of patrolling camps based on management needs and threat perception. Increase the number of patrolling/anti-poaching camps, stationing them every 25 km for effective conservation.</p> <p>Absence of focused planning for key wildlife habitat development, particularly for Wild Buffalo habitats and Wild Buffalo is not mentioned in the Statement of Significance of the TCP. Include Rehabilitation of Wild Buffalo as part of the TCP. Incorporate water resource planning in the Wild Buffalo rehabilitation plan and TCP.</p> <p>Provide a mobile rescue van, two veterinary doctors, and support staff for reliable basic veterinary facilities.</p> <p>Train staff on the application of Option I (cash + hand-holding) for village relocation.</p> <p>Organize visits to Kanha and Satpura Tiger Reserves to familiarize staff and villagers with relocation options.</p>		
2018	<p>LWE activities hinder infrastructure development and protection efforts.</p> <p>Fifty-one villages, including 17 in Core I and 34 in Core II, are yet to be relocated, affecting the inviolability of the area. Initiate the relocation of villages to enhance inviolability and promote grassland/meadow development. Engage capable forest officers and reputed NGOs for effective village relocation outside the Tiger Reserve.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p>Dense forests and limited grassland result in a low prey base and subsequently, a low carnivore population in USTR. Assess and develop grasslands in areas with forest density below 30%, focusing on herbivore populations. Remove invasive species in tandem with grassland development, mapping and involving a field Agrologist.</p> <p>Core II in the Sitanadi area lacks a buffer to the west and north. Consolidate the Tiger Reserve by extending the buffer area to Kulhadighat, Dhavalpur, and Mainpur.</p> <p>A human-dominated buffer area between Core I and Core II may impede animal movements. Streamline land use activities in the buffer area to facilitate animal movements between Core I and Core II.</p> <p>Despite rivers and nallas, scarcity of water and moisture persists, aggravated during the monsoon when the reserve is cut off. Review the selection of sites for large ponds based on wildlife abundance and vulnerability. Increase the number of ponds while ensuring suitability for different animal sizes.</p> <p>Lack of organized patrolling, deserted camps at night, and non-functional communication facilities, especially the WT network. Implement M-STrIPES fully for improved protection. Maintain all roads for monsoon patrolling and monitoring. Revive the Wireless Transmission network for effective communication.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p>Prioritize the protection strategy according to a security plan.</p> <p>Develop veterinary services for translocation, conservation breeding, and rescue efforts.</p> <p>Shortage of staff and inadequate accommodation, with officers lacking wildlife management training. Rationalize frontline staff strength based on Tiger Reserve area. Provide wildlife management training for forest guards and depute Assistant Directors and Range Officers to well-managed Tiger Reserves in adjacent states.</p> <p>Highways and PWD roads intersecting the reserve pose threats, along with potential issues from proposed infrastructure projects.</p> <p>Traditional hunting practices persist, posing a significant threat to wildlife populations. Skillfully handle human-animal conflicts through cooperation with EDCs. Implement innovative eco-development work to garner support for Tiger Reserve protection.</p> <p>Underutilization of eco-centre and tourism facilities, including the eco-development potential around Devdhara waterfall. Develop daytime tourism around Devdhara waterfall with nature trails, treks, and informational centers. Conduct awareness programs, especially targeting school children, and provide basic facilities.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p>Provide furnished camps and quarters to counter staff absenteeism.</p> <p>Promote public participation and awareness programs.</p> <p>Consider separating the post and office of the Field Director from that of the CCF (Wildlife), Raipur, and shift the office to Gariyaband.</p>		
2022	<p>Conduct an immediate security audit, following standard protocols, to identify gaps and minimize threats. Develop a detailed security plan in line with the TCP.</p> <p>Implement annual land use and land cover mapping using high-resolution digital data from NRSA or other agencies to monitor the forest cover and related attributes remotely.</p> <p>Pursue actionable points from the previous Management Effectiveness Evaluation, such as village relocation, wildlife management training, community awareness programs, M-STrIPES implementation, interpretation facilities, human-wildlife conflict management, grassland development, road maintenance, and rescue and rehabilitation.</p> <p>Encourage small research projects by local college and university students, in addition to major projects proposed by research institutes, departments, and universities, to assess and monitor the flora and fauna.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<p>Focus on more concentrated conservation initiatives for establishing a healthy population of the Asiatic wild buffalo in the tiger reserve.</p> <p>Extend water conservation works initiated by the TR to other areas in the core and buffer zones. Explore innovative methods involving local communities for executing planned activities, supplementing the existing approach through EDCs and forest department schemes.</p> <p>Investigate the potential for eco-tourism activities, building on the success observed at Mechka Eco Park, and explore the possibility of establishing similar activities in other areas.</p> <p>Delay the initiation of tiger introduction plans until a proper security and habitat assessment is conducted, and the TR management gains full control over the area for intensive tiger population management.</p> <p>Address the lack of infrastructure and inadequate camera traps effectively to obtain an accurate picture of tigers and prey species in the reserve.</p>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- a. Significant challenges are posed to staff movement and infrastructure development by Naxal influence, affecting conservation efforts. A thorough security audit following standard protocols should be conducted, and a detailed security plan aligned with the Tiger Conservation Plan (TCP) should be developed. Collaboration with relevant authorities to mitigate Naxal influence, ensuring staff safety and freedom of movement within the reserve, is recommended.
- b. Effective conservation efforts and patrolling are hindered by staff shortages and inadequate wildlife management training. It is recommended that staff shortages be promptly addressed, comprehensive training and skill-building programs for existing staff be invested in to enhance their wildlife management capabilities, and frontline staff strength be rationalized based on the reserve area to ensure efficient management.
- c. Low prey abundance and habitat degradation necessitate urgent attention to support carnivore populations, particularly the critically endangered Asiatic Wild Buffalo. Implementation of an urgent ungulate population recovery program and focus on habitat restoration initiatives can enhance the prey base and improve overall ecosystem health, particularly for the Asiatic Wild Buffalo.
- d. Effective management and protection efforts are hindered by inadequate infrastructure, including non-functional communication facilities, and deserted patrolling camps at night. Prioritizing the restoration and maintenance of communication facilities, ensuring adequate infrastructure including furnished camps and quarters for staff accommodation, and reviving the patrolling system to improve protection within the reserve are recommended.
- e. Enhanced community engagement and awareness programs are needed due to limited public participation, underutilization of eco-tourism facilities, and challenges in managing human-wildlife conflicts. Public participation should be promoted, and collaboration with local communities should be encouraged to implement innovative eco-development initiatives, fostering support for reserve protection and conservation efforts.

#### 5. Conclusions

The Udanti-Sitanadi tiger reserve faces significant challenges in its quest to support a thriving tiger population. Hunting pressure, both from local communities and external sources, threatens the resident animals. While connected to the Indravati Tiger Reserve through forest corridors, these crucial pathways are fragmented by linear infrastructure, creating bottlenecks for tiger movement. Worryingly, no tigers were documented in camera traps in 2022, highlighting the urgency of the situation. Furthermore, the reserve struggles with low prey abundance due to high biotic pressure, necessitating an immediate ungulate population recovery program. While the Udanti-Sitanadi-Indravati corridor holds promise for facilitating tiger movement, its restoration and protection are paramount. The absence of a source population in the current landscape suggests that natural tiger recovery is unlikely, and active management strategies may be necessary in the future. However, such actions must be carefully evaluated and implemented only after effectively addressing the existing biotic pressure. By taking decisive steps to address these challenges, the Udanti-Sitanadi tiger reserve can pave the way for a brighter future for its tigers.





## PALAMAU TIGER RESERVE

### 1. Brief Description

Palamau Tiger Reserve, situated in the western part of the Chotanagpur plateau and spanning across Latehar and Garhwa districts, features an undulating terrain with valleys, hills, and plains. The region is intersected by three rivers—North Koyal, Auranga, and Burha—with Burha being the sole perennial river in an otherwise draught-prone area. The geological composition is characterized by gneiss, including granite and limestone, and the region is abundant in minerals such as Bauxite and Coal. The predominant habitat is dominated by Northern Tropical Dry Deciduous Sal (*Shorea robusta*) forests and associated ecosystems. Additionally, smaller patches of Northern Tropical Moist Deciduous forests coexist, including sub-types like Moist Peninsular Sal, Dry Peninsular Sal, Northern Dry Mixed Deciduous, Aegle, and Dry Bamboo Brake. Phoenix sylvestris is observed growing along smaller streams, with common associations of Butea, Carissa, Capparis, and Salvadora in various areas. Palamau Tiger Reserve boasts a diverse fauna, featuring keystone and principal species such as the Tiger (*Panthera tigris*), Asiatic Elephant (*Elephas maximus*), Leopard (*Panthera pardus*), Grey wolf (*Canis lupus pallipes*), Wild dog (*Cuon alpinus*), Gaur (*Bos gaurus*), Sloth bear (*Melursus ursinus*), and Four-horned antelope (*Tetracerus quadricornis*). The documented species include 39 mammals, 170 birds, and 8 reptiles, contributing to the rich biodiversity of the reserve.

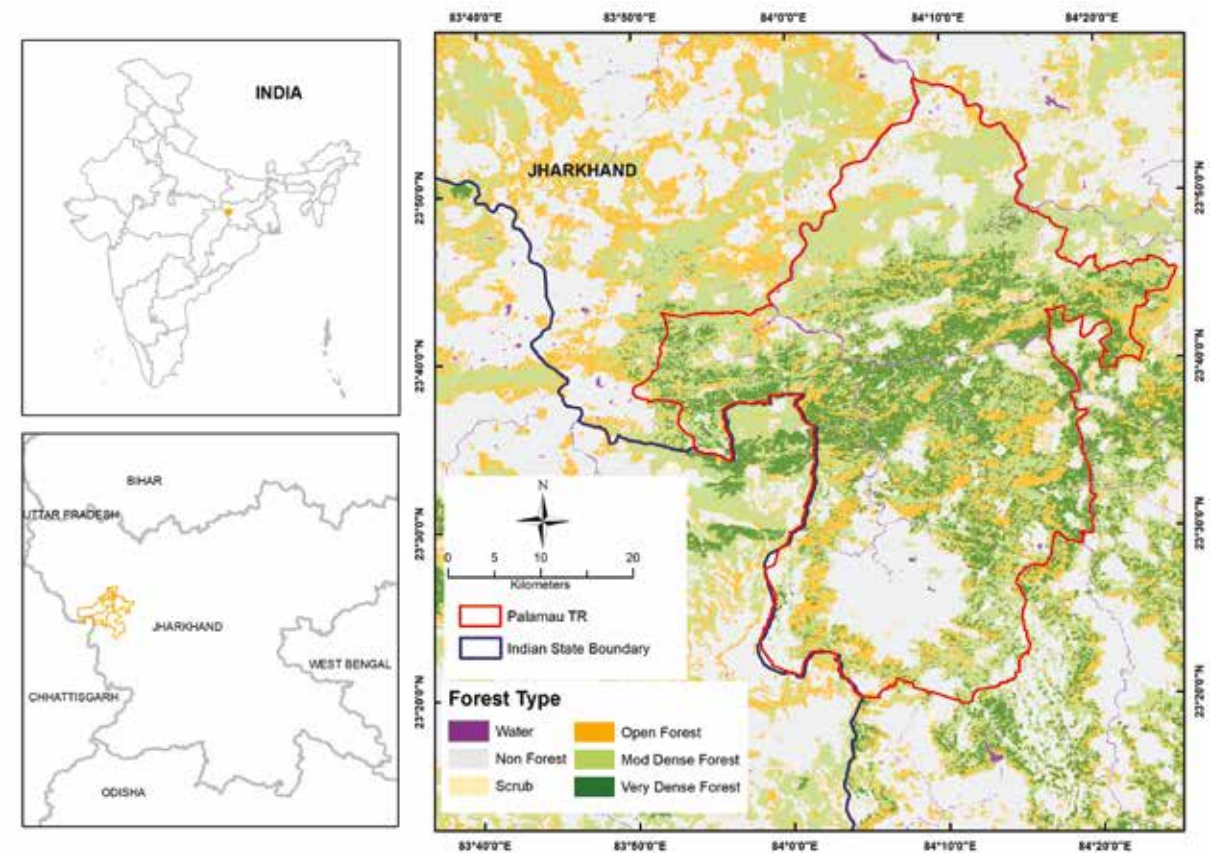


Figure 1: Map showing the location of Palamau Tiger Reserve in the state of Jharkhand

## 2. Tiger Population as per all India tiger estimation

Tiger population of Palamau is substantially low. Three different individuals were identified through genetic analysis of scats in 2014. However, no photo-capture of tigers was attained in 2018 and in 2022. Genetic analysis of three potential tiger scats has shown that they originate from the same individual tiger, pointing to the presence of only one tiger in the reserve. The critically low tiger population in Palamau is considered functionally extinct, posing a high risk of complete annihilation.

## 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>A final notification is imminent, declaring Palamau as a Tiger Reserve.</li> <li>Three forest villages continue to exist in Palamau.</li> <li>Grazing activities persist in three villages within Palamau.</li> <li>The presence of fire is minimal, accounting for less than 1% of the total area.</li> <li>The persistence of Naxalism remains a significant threat and contributes to the challenging state of affairs in Palamau.</li> <li>Urgent action is required to fill the vacant staff positions promptly.</li> <li>There is an excess of over-aged individuals, and their effectiveness in management is limited and they lack training.</li> <li>The delay in the disbursement of ex-gratia compensation is attributed to the late sanction.</li> <li>Essential supplies and acquisitions are required.</li> <li>Field observations are being conducted but are not documented due to their perceived lack of essentiality.</li> </ul>	<ul style="list-style-type: none"> <li>Mahuaduar Wolf Sanctuary, located adjacent to Palamau Tiger Reserve is not included as buffer</li> <li>Persistent threat of Naxalism and lack of political stability in the state continues to significantly challenge the situation</li> <li>Ongoing challenges with voluntary relocation of villages from critical tiger habitat</li> <li>Chronic inadequate funding remains a persistent issue</li> <li>Significant staff vacancies pose challenges.</li> <li>Absence of proper/ streamlined training programs for both permanent and temporary staff.</li> <li>Negligible proportion of grasslands in the reserve</li> <li>Continued inadequacy in patrolling and enforcement infrastructure</li> <li>Insufficient eco-development activities within the Tiger Reserve</li> </ul>	<ul style="list-style-type: none"> <li>Emphasize capacity building for forest officers, specifically in habitat and species management, across all aspects and levels.</li> <li>Once capacity building for forest officers is achieved, the focus can shift to prey restoration.</li> <li>Establishing a sizable inviolate core area is crucial, ideally spanning over 800 km<sup>2</sup>. The current designated core area of 414 km<sup>2</sup> is deemed insufficient for optimal conservation efforts.</li> <li>Consider introducing tigers from Bandhavgarh Tiger Reserve in Madhya Pradesh, genetically closest to the Palamau population, to supplement the tiger population in Palamau.</li> <li>The agricultural lands vacated by resettled villages should be converted and managed as grasslands.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>Does not have own veterinary facility, however post mortem is carried out.</li> </ul>	<ul style="list-style-type: none"> <li>Lack awareness programs for Paramilitary forces.</li> <li>Lack of proper veterinary facilities</li> <li>Impact of linear infrastructure not properly addressed</li> <li>Continuous monitoring and surveillance of wild animals, coupled with timely veterinary interventions are absent</li> </ul>	<ul style="list-style-type: none"> <li>Declare Guru Khasidas National Park in Chhattisgarh to facilitate long-term tiger movement from Bandhavgarh-Sanjay into Palamau Tiger Reserve.</li> <li><i>Mimosa diplotricha</i> needs to be removed systematically with utmost priority. Invasion of <i>Parthenium hysterophorus</i> is restricted to small areas which need management attention before becoming widespread.</li> <li>Implement a comprehensive plan involving resettlement, habitat consolidation, and prey and tiger supplementation to restore tigers and establish a functional ecosystem in the Palamau Tiger Reserve.</li> </ul>
2010	<ul style="list-style-type: none"> <li>Forty percent of the reserve is beyond the control of administration. Enhance and foster relationships with local communities, particularly in light of the LWE threat.</li> <li>Identify and prioritize areas least affected by naxalism for focused attention, including robust protection measures, necessary habitat interventions, and vigilant monitoring.</li> <li>There is a shortage of over 80 percent of staff. Address staffing gaps immediately and ensure timely payment for daily wage workers.</li> </ul>		



MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<ul style="list-style-type: none"> <li>Ensure the prompt disbursement of funds to clear the backlog of payment of daily wages; as of the mid-February report submission, state funds were still pending release.</li> <li>The administrative structure of the park is deemed weak and counter-productive. Revamp the management structure by appointing a dedicated field director alongside DFOs and ACFs to facilitate organized and systematic management.</li> <li>There is a lack of wildlife orientation and a need for more focused management within the reserve.</li> <li>Railway tracks spanning 20 kilometers pass through the Tiger Reserve.</li> <li>Political instability in the state is resulting in a lower level of priority given to conservation efforts.</li> <li>There is anthropogenic and grazing pressure, with nearly 1.5 lakh cattle contributing to the challenges.</li> </ul>		
2014	<ul style="list-style-type: none"> <li>The Mahuaduar Wolf Sanctuary, located adjacent to Palamau Tiger Reserve, is not included as a buffer, limiting conservation efforts.</li> <li>There is a critical shortage of staff members in the reserve. Recommend an immediate high-level review by the state government to fill the critical positions, particularly focusing on Forest Guards.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>The available field staff lacks training in wildlife management and conservation. Prioritize training and reorientation programs for field staff to build wildlife management capacity in Jharkhand and foster a core team of wildlife managers.</li> <li>The staff's aptitude for wildlife conservation is missing, and their orientation towards wildlife is notably weak.</li> <li>All posts, including the Field Director, are on an annual retention basis.</li> <li>Initiate the relocation of eight villages within the core area/critical tiger habitat, enhancing the prey base and supporting tiger population growth. Urge the state government to promptly implement relocation plans, especially for the village of Kujrum, which has voluntarily sought relocation.</li> <li>Address the absence of veterinary services in Palamau TR by promptly providing a veterinarian and essential support staff for animal care.</li> <li>Biotic interference, such as illegal felling of trees, overgrazing, and weed infestation, is evident.</li> <li>Weeds like Parthenium and Lantana camara are impeding the regeneration of native species.</li> <li>Engage paramilitary forces, specifically CRPF, in tiger conservation and protection through joint meetings with the state government to raise awareness.</li> <li>Regulate the state highway passing through the TR to ensure the effective protection of the forest.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>The Mahuadanr Wolf Sanctuary adjacent to Palamau Tiger Reserve is not designated as a buffer.</li> <li>Accelerate the planned relocation of two villages within the critical tiger habitat (CTH) to enhance habitat and prey base, contributing to the overall well-being of the tiger population in Palamau TR. Emphasize the voluntary appeal from Kujrum village for relocation.</li> <li>Advocate for the initiation of the relocation process for eight villages in the CTH at the highest government level. Recommend providing assistance to Palamau TR management for swift and effective village relocation. Integrate ongoing government schemes, such as drinking water and rural electrification, to support and sustain the relocation efforts.</li> <li>The gradual decline and local extinction of key species like the mouse deer (<i>Moschiola indica</i>), four-horned antelope (<i>Tetracerus quadricornis</i>), slender loris (<i>Loris lydekkerianus</i>), and Wild Dog (<i>Cuon alpinus</i>) are alarming.</li> <li>There is no existing breeding or reintroduction plan in place for the conservation of these species.</li> <li>Technological interventions, including animal tracking and camera traps, are deemed grossly inadequate.</li> <li>A noticeable reduction in the numbers of prey species within the Tiger Reserve is observed.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>The reintroduction program for sambar and spotted deer lacks a standard protocol, and the involvement of the Wildlife Institute is peripheral.</li> <li>The construction of an enclosure for breeding sambar is questioned, as hard release could have served the purpose, and construction within the core area could have been avoided.</li> <li>Discourage the construction of concrete structures in the core area. Camouflage existing concrete watch towers overlooking waterholes using native climbers and earthy-colored paintings.</li> <li>Despite recent compliance with the orders of the Hon'ble High Court of Jharkhand to fill frontline posts, the deployment of personnel has been haphazard.</li> <li>Prioritize comprehensive wildlife training and capacity-building programs for field staff in Palamau TR, aiming to create a skilled workforce and establish a core team of wildlife managers for the region and beyond. Utilize retired and experienced staff members in developing course curriculum for the forest college.</li> <li>Knowledge about the diurnal movements of ungulates, elephants, and tigers, as well as the areas frequented by these animals, is poor due to deficiencies in vigilance, infrastructure, and systematic patrolling.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Effective wildlife training is crucial for building the capacity of PTR's field staff, fostering a skilled wildlife management team in Jharkhand, and prioritizing comprehensive on-the-job learning for newly recruited staff, with retired members contributing to curriculum development in the existing forest college.</li> <li>Address the lack of permanent veterinary services in Palamau TR by appointing a full-time veterinarian and providing minimum support staff for wildlife rescue facilities on a priority basis.</li> <li>Encourage people's participation through ecodevelopment activities outside the TR, developed in consultation with villagers. Involve major stakeholders in peripheral management interventions. Reduce livestock grazing pressure and promote stall feeding, particularly for buffaloes.</li> <li>The elephant population has experienced a decline, as indicated by the latest census conducted in May 2017, mirroring the trend observed for tigers.</li> <li>Regulate vehicular speed on the state highway and railway passing through the TR by implementing laws, deploying speed guns, and establishing check posts with barriers. Conduct a roadkill study and restrict heavy vehicles at night. Explore alternative routes for long-term sustainability.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Sensitize the CRPF personnel in the TR through short training programs on forest and wildlife protection. Conduct joint meetings with paramilitary forces to raise awareness about tiger conservation and protection.</li> <li>Focus on developing and strengthening connecting corridors, including the Palamau-Sanjay-Bandavgarh, Palamau-Badalkol-Achanakmar-Kanha, and Palamau-Garhwa-Kaimur corridors, to combat the reserve's increasing isolation due to surrounding infrastructure development.</li> </ul>		
2022	<ul style="list-style-type: none"> <li>Urgent steps are needed to expedite the voluntary rehabilitation of the 34 villages from the core area in a time-bound manner.</li> <li>Develop a detailed 5-year plan for the eradication of invasive alien species and grassland management as they limit the availability of prey. Enhance staff capacity for grassland management.</li> <li>Urgently complete the Wildlife Recovery Plan prepared by the Wildlife Institute of India and implement recommendations for restocking chital and sambar populations and reintroducing tigers on priority.</li> <li>Commission a study to identify critical stretches for long-term mitigation and retrofitting measures to maintain landscape permeability in light of the linear infrastructure for safe wildlife movements.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>Take necessary steps to fill existing vacancies. Consider redeployment of frontline staff, ACFs, and RFOs from adjoining territorial divisions for restocking herbivore and carnivore populations.</li> <li>The present TCP (2013-14 to 2022-23) is approved by the NTCA, and the next 10-year plan is underway. Ensure effective community consultation for the preparation of plans for the buffer and corridor areas.</li> <li>Establish a well-equipped wildlife rehabilitation cum disease surveillance center supervised by trained wildlife veterinarians, in line with the expectations set for tiger reserves by 2023.</li> <li>The zone of influence, comprising about 200 villages, impacts the habitat through NTFP collection, firewood and small timber collection, grazing leading to the spread of fires, weed infestation, and poaching of small animals.</li> <li>The ESZ of PTR has been notified, but committees have not been constituted, and the Zonal Master Plan is pending. Expedite the constitution of committees and preparation of the Zonal Master Plan for the ESZ.</li> <li>The newly recruited frontline staff need to urgently trained in special wildlife conservation courses. Periodic Training Need Assessments (TNAs) for key stakeholders should be conducted to establish learning objectives for upcoming training courses and formulate the Annual Training Plan.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Deploying about 10 watch towers as makeshift anti-poaching camps is compromising staff presence and the efficiency of M-STRIPES; a protection audit is essential to review camp and watchtower needs, emphasizing widespread M-STRIPES utilization.</li> <li>Gate collections and CSR funding contribute minimally to internal revenue, posing financial challenges.</li> <li>Revise the PTR website to comply with the latest edition of the Guidelines for Indian Government Websites by NIC. Upload research/studies reports and learning resources on the website.</li> <li>Continuous monitoring and surveillance of wild animals, coupled with timely veterinary interventions, are vital for successful wildlife conservation and managing zoonotic diseases. Trained wildlife health professionals are crucial for overseeing wildlife health, disease monitoring, and preventing the transmission of multi-host pathogens to humans and domestic animals.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- a. The expedited voluntary relocation of villages within these areas is recommended, considering the importance of preserving critical tiger habitat. Priority should be given to Kujrum village, which has already shown willingness to relocate, to improve the prey base, boost tiger population, and enhance overall ecosystem functionality. The

agricultural lands left vacant by resettled villages could be converted and managed as grasslands.

- b. The effective management of the reserve could greatly benefit from the immediate high-level review by the state government to address the critical shortage of staff, particularly Forest Guards. Prioritizing redeployment from adjoining divisions, timely payment for daily wage workers, and enhancing capacity building for forest officers in all aspects of habitat and species management should be considered.
- c. Enhancement of wildlife training and capacity-building programs for PTR staff is recommended to improve their skills in wildlife conservation. Utilization of retired personnel in curriculum development and prioritization of on-the-job learning for new recruits could be beneficial. The establishment of a core team of skilled wildlife managers in Jharkhand is also recommended.
- d. The appointment of a full-time veterinarian and support staff to establish permanent wildlife rescue facilities is crucial for the health and well-being of the animals in the reserve. The establishment of a well-equipped wildlife rehabilitation and disease surveillance center supervised by trained veterinarians would further enhance animal health management and disease control.
- e. Positive outcomes could be yielded by building close relationships with local communities, especially in areas affected by Naxalite threats. Identifying and prioritizing areas least affected by Naxalism for focused protection, habitat improvements, and vigilant monitoring is recommended.
- f. The smooth functioning of conservation efforts necessitates the prompt release of state and central government funds to clear backlogs and address financial limitations.
- g. Important steps in advancing conservation efforts include documenting and utilizing field observations for effective management and decision-making, prioritizing research on key species and habitat requirements, and ensuring effective knowledge sharing through research reports, training programs, and website updates.
- h. Improvement of management and addressing challenges like grazing pressure and wildlife conflict could be achieved by integrating forest areas in the buffer zone under unified control.
- i. Reduction of grazing pressure and minimization of human-wildlife conflicts could be facilitated by promoting stall feeding for livestock grazing and considering alternative land-use practices for communities bordering the reserve.
- j. Contribution to the overall health of the ecosystem could be made by developing and implementing a detailed 5-year plan for eradicating invasive alien species and enhancing staff capacity for grassland management.
- k. Preservation of habitat and wildlife requires the continuation of efforts to minimize fire occurrences and maintain fire susceptibility below 1%.
- l. Significant benefits for wildlife conservation could be achieved by regulating vehicle speed on both the state highway and railway passing through PTR to minimize roadkill and enhance wildlife safety. Consideration of alternative routes and long-term infrastructure modifications could also be beneficial.
- m. Prudent steps towards preserving biodiversity include focusing on developing and strengthening connecting corridors to combat increasing isolation and facilitate wildlife

movement. Advocating for declaring Guru Khasidas National Park in Chhattisgarh to facilitate long-term tiger movement into PTR is advisable.

- n. Implementation of the Wildlife Recovery Plan prepared by the Wildlife Institute of India for restocking chital and sambar populations is recommended. Consideration of the careful evaluation and potential reintroduction of tigers is also suggested. One possibility could be to introduce tigers from Bandhavgarh Tiger Reserve, considering its genetic proximity, to supplement the PTR population.
- o. Greatly enhanced wildlife monitoring efforts and addressing knowledge gaps regarding the diurnal movements of key species could be achieved by utilizing technology such as animal tracking and camera traps.
- p. Promotion of sustainable livelihoods and reduction of resource dependence on the reserve could be facilitated by developing ecodevelopment programs outside the PTR in consultation with villagers.
- q. Advisory recommendations include the active involvement of major stakeholders in peripheral management interventions, such as buffer zone management and corridor restoration. Raising awareness about tiger protection could be facilitated by sensitizing CRPF personnel about PTR's conservation efforts and conducting joint meetings with paramilitary forces.
- r. Compliance with website guidelines and ensuring that information is readily accessible to visitors and stakeholders could be achieved by revising the PTR website.
- s. Tailored training programs development and addressing specific skill gaps for key stakeholders could be facilitated by conducting periodic Training Needs Assessments.

## 5. Conclusions

The Palamau tiger population is critically low and faces a serious risk of extinction due to high anthropogenic disturbances such as livestock grazing, NTFP collection, and the movement of security forces and Naxalites. The absence of a disturbance-free area, essential for a tiger reserve's breeding nucleus, is a significant challenge. Even the core area has human settlements that need incentivized voluntary relocation, as directed by NTCA and state government initiatives. The Jharkhand Forest Department lacks direct control over reducing political unrest, hindering proper law and order within Palamau Tiger Reserve. Restoration efforts, including prey supplementation, are futile without addressing this issue. The top priority is to restore complete control of Palamau to the wildlife wing of the forest department. The second priority is the voluntary, incentivized resettlement of villages and livestock from the core zone, aligning with NTCA guidelines, to establish an inviolate core, ideally exceeding 800 km<sup>2</sup> (the current 414 km<sup>2</sup> core is insufficient). Palamau operates far below its potential, a victim of a multitude of challenges that impede its ability to function as a thriving tiger reserve. The urgency is stark: immediate action is necessary to prevent the irreversible loss of this iconic species from the ecosystem.

## 1. Brief Description

Bandipur Tiger Reserve, located in Karnataka, is one of the pioneering tiger reserves in India, established in 1973 under Project Tiger. Covering a total area of 1469.69 km<sup>2</sup>, it includes a Critical Tiger Habitat of 872.24 km<sup>2</sup> and a buffer zone of 597.45 km<sup>2</sup>. Positioned in the Chamarajanagar and Mysore districts, Bandipur boasts diverse forest types like Scrub-Type Forest and Southern Tropical Deciduous Forests. It is a key biodiversity area, part of the Nilgiri Biosphere Reserve and the Bandipur-Mudumalai-Sathyamangalam-Wayanad-Nagarahole landscape complex, hosting a significant tiger population. Being a vital component of the Western Ghats Biogeographic Zone, Bandipur houses 35 mammal species, 289 bird species, 34 reptile species, 21 amphibian species, and 25 fish species. The 2019-20 monitoring indicates a tiger population of 143 (8), contributing to the larger tiger population in the landscape. Additionally, Bandipur is integral to the Mysore Elephant Reserve, accommodating 3047 elephants, making it a crucial habitat for diverse wildlife. Notably, Bandipur Tiger Reserve is devoid of human settlements within its core area, ensuring minimal human and biotic interference. Designated as the first eco-sensitive zone in the country in 2012, it spans 479.18 km<sup>2</sup>, encompassing 123 villages. Despite the anthropogenic modifications surrounding the park, including agricultural lands and plantations, Bandipur stands as a well-preserved and managed tiger reserve in India.

## 2. Tiger Population as per All India Tiger Estimation

In the 2010 cycle, Bandipur Tiger Reserve recorded a tiger population estimate of 39 (SE-2.62). Moving to the 2014 cycle, the estimate increased to 120 tigers (standard error range: 107-134). By 2018, with 534 camera traps deployed, 1,479 tiger detections were recorded, identifying 126 individual tigers, resulting in a density of 7.70 (SE 0.71) tigers per 100 km<sup>2</sup>. In the latest 2022 cycle, the number of tiger images surged to 3,761, with 150 individual tigers identified and a tiger density estimated at 9.50 (SE 0.77) tigers per 100 km<sup>2</sup>. In the span from 2010 to 2022, Bandipur Tiger Reserve has witnessed a remarkable surge in its tiger population, with the number of individual tigers increasing from 39 to 150.

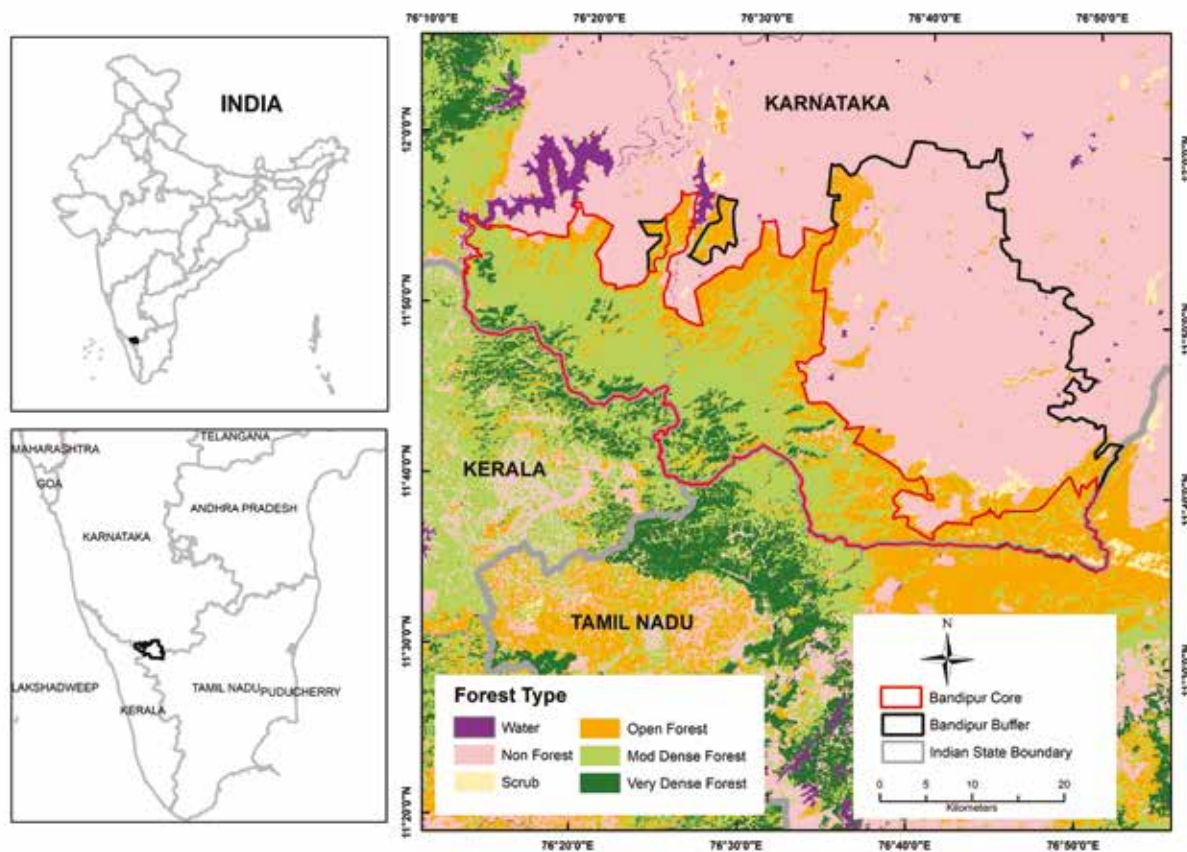


Figure 1: Map showing the location of Bandipur Tiger Reserve in the state of Karnataka.

### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>Buffer area within Bandipur but ideally needs the status of a Sanctuary or Conservation Reserve for flexibility.</li> <li>Moderate progress in both reserves, with room for improvement in Bandipur.</li> <li>Challenges in compatible land use, especially in the buffer impacting ecosystems.</li> <li>Livestock grazing issues in Bandipur within core and adjoining areas.</li> <li>Historical plans in place for effective conservation.</li> <li>Satisfactory regeneration status in both reserves.</li> </ul>	<p><b>Anthropogenic Pressure:</b> Presence of villages with considerable human and cattle populations. Continuous human-wildlife conflicts causing fatalities, cattle deaths, and property loss. Limited Eco-Development Committees (EDCs) and insufficient funding hindering local participation.</p> <p><b>Invasive Species:</b> Presence of invasive species, particularly <i>Lantana camara</i>. <i>Lantana</i> covering a significant percentage</p>	<ul style="list-style-type: none"> <li>Given the high human pressures, especially livestock grazing and fuel wood collection, strategic measures should be implemented to minimize these impacts. Collaborative efforts with local communities for sustainable practices and awareness programs can help alleviate pressures.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>Inadequate wildlife-trained staff in both reserves.</li> <li>Potential workforce issues in the future for both reserves.</li> <li>Need improvement in availability and maintenance, especially in Rajiv Gandhi NP.</li> <li>Habitat amelioration needed in tourism zones.</li> </ul>	<p>of the Tiger Reserve, impacting native flora and fauna.</p> <p><b>Regeneration Challenges:</b> Poor regeneration of natural forests, especially bamboo. Stands of dead bamboo culms affecting fodder for elephants and increasing the risk of fire hazards.</p> <p><b>Tourism Impact:</b> Heavy tourist traffic on national highways, causing problems for the movement of wild animals. Persistent threat of poaching, although reduced.</p> <p><b>Staffing Issues:</b> Lack of proper training in wildlife management for most staff members. Large number of vacancies among frontline staff impacting effective patrolling and conservation efforts.</p> <p><b>Land Use Changes:</b> Intensified land usage and changes in the buffer zone affecting the fragile ecosystem. Transition of buffer village residents from traditional to commercial farming systems.</p> <p><b>Infrastructure Impact:</b> Presence of national highways passing through the reserve, posing threats to wildlife. Proposed construction of a railway line/elevated highway further threatening wildlife habitat.</p> <p><b>Fire Hazards:</b> Historical large-scale forest fires damaging extensive forest areas.</p>	<ul style="list-style-type: none"> <li>Addressing the disturbances caused by major highways, such as the Mysore-Ooty highway and Gundulpet-Sultan Bathery highway, is essential. Implementing wildlife-friendly infrastructure, like wildlife crossings and speed restrictions, can mitigate the negative impact of vehicular traffic on wildlife.</li> <li>The loss of bamboo and extensive invasion by <i>Lantana</i> pose significant ecological challenges. Restoration programs focusing on bamboo conservation and effective management strategies to control the spread of invasive species like <i>Lantana</i> are crucial for maintaining the Reserve's biodiversity.</li> <li>Recognizing the importance of connectivity, particularly the Kudremukh-Bhadra complex to the Nagarahole-Bandipur-Mudumalai-Wayanad complex, emphasizes the need for safeguarding viable corridor systems. Conservation efforts should prioritize maintaining and enhancing these ecological corridors to facilitate the movement of wildlife.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006		<p>Ongoing risk of forest fires impacting wildlife and habitat.</p> <p><b>Livestock Grazing:</b> Ongoing livestock grazing in the buffer zone. Efforts to stop grazing are underway, but achieving the target is challenging.</p> <p><b>Research and Development:</b> Lack of in-house adaptive experimental research facilities impacting data acquisition and management decisions. Absence of large-scale eco-development activities and skill development for local tribes and EDC members.</p>	<ul style="list-style-type: none"> <li>Building on the success of long-term monitoring and conservation activities, continued efforts should be made to uphold successful practices like voluntary relocation, prohibition of nighttime vehicular traffic, and initiation of eco-development projects. This includes adapting and implementing similar strategies in other areas where relevant.</li> <li>Given the River Moyar acting as a political boundary between Karnataka and Tamil Nadu, fostering collaboration between the two states is vital. Coordinated efforts in conservation and management can ensure the ecological integrity of the region across state borders.</li> </ul>
2010	<ul style="list-style-type: none"> <li>Spreading invasive species particularly Lantana.</li> <li>Weak support of local communities due to weak eco-development programs.</li> <li>Increasing human wildlife conflicts in certain pockets</li> <li>Weak component of staff training</li> <li>Important corridors outside the Tiger Reserve</li> </ul>		
2014	<p><b>Long Boundary Interface:</b> Presence of about 150 villages with a cattle population of 3 lakhs. Intense anthropogenic pressures on the reserve due to the long boundary/interface with humans and cattle.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<p><b>Human-Wildlife Conflicts:</b> High-scale conflicts involving elephants, wild boars, and occasionally tigers/leopards. Elevated instances of human-wildlife conflicts, posing threats to both animals and local communities.</p> <p><b>Inadequately Trained Staff:</b> Acute shortage of wildlife-trained staff members in the Tiger Reserve. Inadequate training to effectively manage and mitigate wildlife-related issues.</p> <p><b>Poor Participation of Local People:</b> Lack of meaningful participation of local communities in protection and conservation. Small number of Eco-Development Committees (EDCs) and limited income generation activities hinder community involvement.</p> <p><b>Poor Regeneration and Weed Invasion:</b> Poor regeneration of natural forests, especially bamboo, due to anthropogenic pressures. Invasion by exotic weeds, such as Lantana, affecting the natural ecosystem.</p> <p><b>Lack of Baseline Data:</b> Inadequate baseline data and adaptive experimental research. Lack of essential information for informed management decisions.</p> <p><b>Weak Coordination:</b> Lack of synergy among governmental and non-governmental organizations/institutions. Weak coordination hampers effective conservation efforts.</p>		



MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<p><b>Presence of Highways:</b> Existence of National Highways (NH-67 and NH-212) inside the core area. Poses serious problems to the movement of wild animals, disrupting natural habitats.</p> <p><b>Forest Fires:</b> Serious issues with forest fires, resulting in large burnt areas. Lack of effective fire prevention measures impacting the ecosystem and wildlife.</p>		
2018	<p><b>Anthropogenic Pressure:</b> Presence of around 150 villages, with 112 in the buffer zone, exerting considerable human and cattle population pressure. Significant human-wildlife conflict, leading to fatalities, cattle deaths, and property loss.</p> <p><b>Limited Eco-Development Committees (EDCs):</b> Only 22 EDCs for 112 villages in the buffer zone. Insufficient funding from Tiger Conservation Foundation, resulting in poor local participation in park management.</p> <p><b>Invasive Species - Lantana Camara:</b> Lantana camara covers 50-60% of the Tiger Reserve. Poses a threat to native flora and fauna.</p> <p><b>Bamboo Crop Loss:</b> Stands of dead bamboo culms due to gregarious flowering four years ago. Lack of bamboo regeneration impacts fodder for elephants and increases the potential for fire hazards.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p><b>Tourist Traffic Impact:</b> Heavy tourist traffic on national highways, particularly the one leading to Ooty. Poses a serious problem for the movement of wild animals.</p> <p><b>Transition to Commercial Farming:</b> Transition of buffer village residents from traditional to commercial farming systems. Poses challenges for park management.</p> <p><b>Continuous Threat of Poaching:</b> Although reduced, there is a continuous threat of herbivore poaching by local people.</p> <p><b>Lack of Proper Wildlife Management Training:</b> Most staff members lack proper training in wildlife management.</p> <p><b>Frontline Staff Vacancies:</b> Large number of vacancies among frontline staff, impacting effective patrolling and conservation efforts.</p>		
2022	<p><b>Linear Shape and Periphery Interaction:</b> Linear shape with a 314.6 km outer boundary, shared with 136 villages. Exposes over 50% of the reserve to external human interactions, increasing conflicts.</p> <p><b>High Human-Wildlife Conflict:</b> 314.6 km periphery with high-density human and cattle populations. Constantly increasing human and livestock populations in the buffer zone fuel conflicts.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<p><b>Changing Land Use in Buffer Zone:</b> Intensified land usage and change in land use pattern in the buffer zone. Resulting in high-pressure on the fragile ecosystem and causing human-elephant conflicts.</p> <p><b>National Highways Impact:</b> National highways (212 and 67) passing through, posing threats to wildlife. Proposed railway line/elevated highway construction may further damage wildlife habitat.</p> <p><b>Invasive Alien Species:</b> Presence of invasive species like Lantana camara affecting wildlife habitat. 38% of core area covered with high-density Lantana, hindering wildlife movement.</p> <p><b>Forest Fires:</b> Historical large-scale forest fires damaging extensive forest areas. Impacting wildlife and habitat, posing a persistent threat.</p> <p><b>Staff Vacancies:</b> Persistent vacancies of about 40.7% in frontline staff positions. Hindering supervision and execution of fieldwork, impacting reserve management.</p> <p><b>Poaching and Illegal Activities:</b> Dependence of local villages on reserve resources leading to poaching and illegal activities. Threats include poaching, illegal tree cutting, and removal of forest produce.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<p><b>Absence of Research Facilities:</b> Lack of in-house adaptive experimental research facilities. Hampers frontline staff experience, capacity building, and data acquisition for management decisions.</p> <p><b>Poor Bamboo Regeneration:</b> Poor regeneration of bamboo at Kabini backwaters area. Affects elephant fodder supply, creating a potential shortage in the future.</p> <p><b>Limited Eco-Development Activities:</b> Absence of large-scale eco-development activities and skill development for local tribes and EDC members. Weakness in promoting sustainable development and community involvement.</p> <p><b>Religious Pilgrimage Impact:</b> Presence of small temples within the reserve leading to religious pilgrimages. Challenges in halting such activities due to local culture and traditions.</p> <p><b>Livestock Grazing in Buffer Zone:</b> Ongoing livestock grazing in the buffer zone. Efforts underway to stop grazing, but achieving the target will take time.</p>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- a. Strategic measures aimed at minimizing anthropogenic pressures, particularly conflicts arising from livestock grazing and fuel wood collection, are suggested to be considered in order to alleviate stress on the ecosystem.
- b. Close collaboration with local communities to promote sustainable practices, conduct awareness programs, and establish initiatives aimed at reducing human-wildlife conflicts in the area is recommended.
- c. Disturbances caused by major highways, such as the Mysore-Ooty and Gundulpet-Sultan Bathery highways, are suggested to be addressed by considering the implementation of wildlife-friendly infrastructure like wildlife crossings and speed restrictions to mitigate potential impacts on wildlife.
- d. Restoration programs to address the loss of bamboo and invasion by Lantana, with a focus on bamboo conservation and management strategies to control the spread of invasive species, are proposed to be developed and implemented.
- e. The importance of ecological connectivity, particularly the Kudremukh-Bhadra complex to the Nagarahole-Bandipur-Mudumalai-Wayanad complex, is suggested to be recognized, and efforts to maintain and enhance viable corridor systems to facilitate wildlife movement are recommended to be prioritized.
- f. Successful conservation practices such as voluntary relocation, prohibition of nighttime vehicular traffic, and initiation of eco-development projects, while also suggesting adaptation and implementation of similar strategies in other relevant areas, are recommended to be continued.
- g. Collaboration between Karnataka and Tamil Nadu, considering the River Moyar's role as a political boundary, is recommended to be fostered to coordinate efforts and ensure the ecological integrity of the region across state borders.
- h. Population monitoring efforts through regular camera trap surveys and other effective methods are recommended to be strengthened, utilizing the data for informed conservation decisions and to track trends over time.
- i. Meaningful participation of local communities in protection and conservation activities is proposed to be promoted by enhancing the number of Eco-Development Committees (EDCs) and providing adequate funding for improved local involvement.
- j. Comprehensive strategies for managing invasive species like Lantana camara are suggested to be developed, implementing measures to control their spread and protect native flora and fauna.
- k. Effective fire prevention measures to address historical large-scale forest fires, safeguarding extensive forest areas from potential fire hazards to ensure the protection of wildlife and habitat, are recommended to be implemented.
- l. The impact of national highways passing through the reserve, proposing wildlife-

friendly measures to minimize threats to wildlife, and evaluating and managing the potential impact of proposed railway line/elevated highway construction are advised to be addressed.

- m. Staff shortages are proposed to be addressed through efficient recruitment processes and providing wildlife management training to staff members for effective patrolling and conservation efforts.
- n. In-house adaptive experimental research facilities to enhance data acquisition and support management decisions, encouraging frontline staff experience and capacity building, are suggested to be established.
- o. Large-scale eco-development activities and skill development programs for local tribes and EDC members, promoting sustainable development practices to strengthen community involvement, are recommended to be initiated.
- p. Challenges posed by religious pilgrimages within the reserve with cultural sensitivity are advised to be addressed, working towards balancing local culture and traditions with conservation priorities.
- q. Efforts to stop ongoing livestock grazing in the buffer zone, implementing measures to achieve the targeted reduction, considering the potential long-term benefits for wildlife and habitat, are recommended to be continued.

#### 5. Conclusions

Bandipur Tiger Reserve, established in 1973, showcases commendable success in tiger conservation, marked by a significant population increase. Challenges like human-wildlife conflicts, invasive species, and infrastructure threats persist. The reserve's commitment to strategic measures, community collaboration, and ecological connectivity is vital. Ongoing efforts in adaptive management, technological innovation, and sustainable practices position Bandipur as a beacon of hope for balanced biodiversity and human coexistence.



# BHADRA TIGER RESERVE

## 1. Brief Description

Bhadra Tiger Reserve, situated in the Western Ghats at coordinates 75° 38' E and 13° 34' N, was designated as a protected area in 1998, covering 492 km<sup>2</sup>. Positioned at an altitude of 670-760 m, the reserve experiences monthly mean temperatures ranging from 10-32 °C and an annual rainfall between 2000-2540 mm. The diverse vegetation includes wet evergreen forests and moist deciduous forests, prominently featuring bamboo dominance. The park's low-lying valleys, once occupied by swampy grasslands and village settlements engaged in rice agriculture, underwent significant transformation following a substantial relocation effort in 2002.

As a result of the extensive village relocation, large mammal populations within the park are gradually experiencing an upward trend. The Malenad landscape in the Western Ghats sustains diverse carnivores and herbivores, including the tiger (*Panthera tigris*), leopard (*Panthera pardus*), Asiatic wild dog (*Cuon alpinus*), sloth bear (*Melursus ursinus*), Asiatic elephant (*Elephas maximus*), gaur (*Bos gaurus*), sambar (*Rusa unicolor*), chital (*Axis axis*), barking deer (*Muntiacus vaginalis*), four-horned antelope (*Tetracerus quadricornis*), wild pig (*Sus scrofa*), mouse deer (*Moschiola indica*), and hanuman langur (*Semnopithecus entellus*).

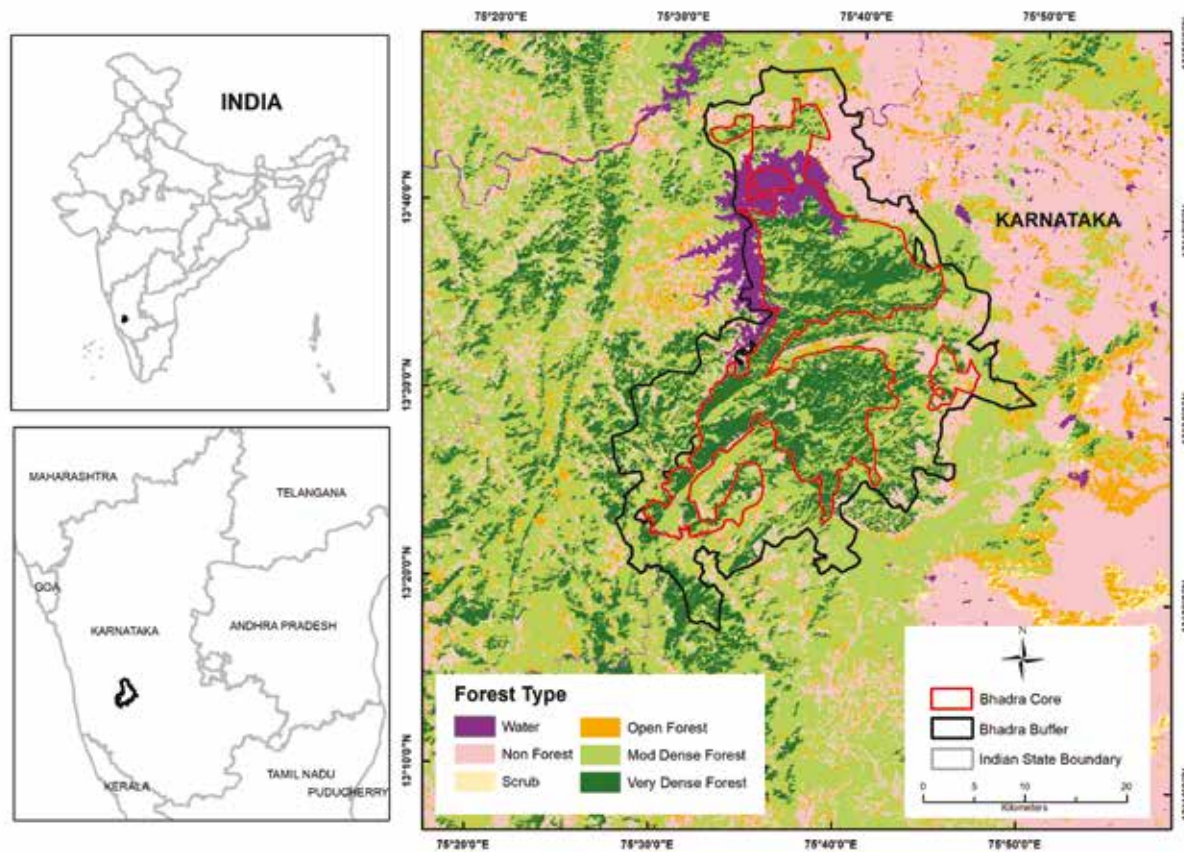


Figure 1: Map showing the location of Bhadra Tiger Reserve in the state of Karnataka.

## 2. Tiger Population as per all India tiger estimation

In 2006, the population was 58 (se range: 52-65), showing a decreasing trend to 40 (se range: 38-42) in 2010. The 2014 cycle recorded 22 tigers (se range: 20-25). In 2018, 28 individual tigers were identified, with a density of 2.86 (SE 0.55) per 100 sqkm. The estimated population was 30 (se: 0.32). In 2022, with 10808 trap-nights, 28 tigers were identified, and the density was estimated at 2.34 (SE 0.44) per 100 sq. km. The data suggests fluctuations in tiger populations over the years, highlighting the importance of ongoing monitoring for conservation efforts.

## 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>Incorporating certain regions along the western boundaries is recommended to form a distinct ecological entity. This extension may encompass sections of the drawdown area of the Bhadra reservoir, along with the islands situated within this region. A redefinition of the boundaries is necessary.</li> <li>There is a need for increased involvement and influence in the management of Reserve Forests that constitute the buffer zone.</li> <li>The relocation efforts have been commendable, but there is room for improvement along the eastern boundary.</li> <li>There is potential for improvement in ensuring the timely release of CA.</li> <li>Increased focus on monitoring and extension activities is recommended.</li> <li>The areas vacated by villages require thorough monitoring and intensive management.</li> <li>There is a requirement for more scientific and regular exercises.</li> </ul>	<ul style="list-style-type: none"> <li>Persistent weaknesses in frontline staff vacancies, inadequately maintained infrastructure, and road networks.</li> <li>Challenges in boundary definition and management of Reserve Forests in the buffer zone.</li> <li>Ongoing room for improvement in relocation efforts, timely release of CA, and monitoring of vacated areas.</li> <li>Consistent weaknesses in baseline information, long-term monitoring, and human-wildlife conflict resolution.</li> <li>Continual issues with the spread of invasive species, existence of human settlements inside the reserve, and biotic pressures from fringe areas.</li> </ul>	<ul style="list-style-type: none"> <li>Given the historically low tiger density in Bhadravathi Forest Division, it is imperative to intensify tiger monitoring efforts through advanced technologies such as camera traps and spatial analysis. Regular and systematic surveys will provide accurate data on tiger presence and distribution, enabling informed conservation strategies.</li> <li>Recognizing the challenges posed by human habitations and agricultural fields surrounding the forests, it is crucial to implement effective human-wildlife conflict mitigation measures. This may include community engagement programs, habitat restoration initiatives, and the development of sustainable practices that minimize conflicts and promote coexistence.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>The minor forest along the periphery should be managed as multiple-use areas.</li> <li>Permitting and regulating grazing in multiple-use areas can provide improved control for immunization.</li> <li>There is potential for improvement in ecotourism through the introduction of the concept of trained guides through increased involvement of the host community.</li> </ul>	<ul style="list-style-type: none"> <li>Need for enhanced community participation, efficient corridor linkages, and improved morale among protection staff through rigorous capacity-building programs.</li> <li>Ongoing difficulties in managing separated forest areas due to government lands and reservoirs.</li> <li>Persistent challenges in regulating tourism growth, maintaining ecological balance, and addressing potential threats from resorts and home stays.</li> <li>Consistent weaknesses in implementing security plans, filling staff vacancies, and addressing weaknesses in intelligence networks.</li> <li>Continual need for thorough monitoring of areas vacated by villages and the introduction of scientific exercises for better conservation practices.</li> <li>Ongoing challenges in strengthening eco-development activities, involving local communities, and ensuring optimal water levels for conservation.</li> </ul>	<ul style="list-style-type: none"> <li>The impact of national and state highways dissecting the forests should be mitigated to facilitate unrestricted tiger movement. Implementing wildlife corridors, underpasses, or overpasses can help in maintaining connectivity, reducing the risks associated with vehicular traffic, and fostering genetic exchange between tiger populations.</li> </ul>
2010	<ul style="list-style-type: none"> <li>Inadequately maintained road network and infrastructure, contributing to spreading invasive species.</li> <li>Presence of some human settlements inside the reserve.</li> <li>Pressures from fringe areas/ buffer zones.</li> <li>Inadequate staff capacity.</li> <li>Weak baseline information and long-term monitoring.</li> <li>Human-wildlife conflicts.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Potential spread of tourism in the vicinity of the Tiger Reserve.</li> <li>Leased area to SAIL not yet closed.</li> <li>Proposal to raise the height of the existing Bhadra Dam.</li> <li>Recently established Tiger Foundation.</li> <li>Growing interest in research among institutions and individuals.</li> <li>Biologically rich areas adjoining the Tiger Reserve.</li> <li>Potential for awareness-raising initiatives.</li> </ul>		
2014	<ul style="list-style-type: none"> <li>Expedite the transfer of the buffer area to TR management within a defined timeframe.</li> <li>Activate corridor linkages to improve wildlife management.</li> <li>Low morale among frontline protection staff due to a lack of professional knowledge regarding wildlife behavior, protection, and law enforcement. Implement vigorous capacity-building programs for personnel in wildlife management, focusing on short-term training courses in wildlife management, planning processes, and monitoring.</li> <li>Inadequately maintained road network, poor protection infrastructure in interior areas, and an ineffective intelligence network.</li> <li>Spreading of invasive species such as Lantana, Eupatorium, and Parthenium. Pay special attention to prevent the spread of invasive alien species, particularly in grasslands occupying 18% of the reserve area.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>• Presence of five human settlements inside the reserve and biotic pressures from fringe areas. Intensify efforts to relocate remaining villages outside the reserve.</li> <li>• Enhance community participation in TR management per NTCA guidelines, incentivizing cooperation and intelligence sharing.</li> <li>• Difficulty in monitoring and managing the Bababudangiri State Forests (Kemmanugundi), Madhuguni State Forests, and Aldhara State Forests due to separation from the main reserve by government lands and the Bhadra reservoir.</li> <li>• Prioritize conducting an exercise to address frontline staffing needs and urgently fill vacancies among frontline staff. Develop and gain approval for the security plan and staff development plan for the Tiger Reserve.</li> <li>• Enhance the interpretative displays at the Muthodi interpretation centre with more scientific and technical content.</li> <li>• Organize tourism management in adherence to Supreme Court/NTCA guidelines. Regulate the unregulated growth of resorts and home stays in and around the TR to mitigate potential threats. Urgently approve the pending proposal to notify an eco-sensitive zone around the TR to regulate tourism growth.</li> <li>• Strengthen eco-development activities.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>• Conduct regular meetings with the Irrigation Department (Bhadra reservoir) to ensure optimal water levels for conservation.</li> <li>• Conduct Phase-IV monitoring following NTCA guidelines and improve M-STrIPES implementation with rigorous monitoring at higher levels.</li> <li>• Issue national-level guidelines for climate change, integrating specific plans to reduce carbon loss and increase capture while conserving unique habitats and ecosystems, especially grasslands, to support wildlife conservation in TR.</li> </ul>		
2018	<ul style="list-style-type: none"> <li>• The corridor connectivity with other sanctuaries and reserves, excluding Shettihalli Wildlife Sanctuary, faces fragility and disjointedness due to numerous revenue villages and coffee estates in the buffer areas.</li> <li>• Improvements are required in the protection provided through anti-poaching camps and boat patrolling in the Bhadra reservoir. Efforts should be made to persuade the "Paradeshppana Mutt" and relocate the remaining five villages within the reserve.</li> <li>• Human-animal conflict, particularly involving elephants, is a frequent occurrence in the buffer area and fringe villages.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>The TCP explicitly mentions the need to study the effects of the Bhadra reservoir on the overall climatic conditions of the Tiger Reserve, but as of now, no such study has been conducted. Additionally, there is a notable absence of specific research reports on the flora and fauna of Bhadra Tiger Reserve, creating an information gap for the implementation of science-based conservation actions.</li> <li>Findings from research-based studies on various aspects of Bhadra Tiger Reserve, including endangered animals and plants, habitat management, and man-animal conflicts, should be documented. A comprehensive agenda must be developed to guide research initiatives in these areas.</li> <li>Invasive species like <i>Lantana</i>, <i>Eupatorium</i>, <i>Parthenium</i>, and <i>Cassia spectabilis</i> are spreading within the reserve.</li> <li>The participation of local people from fringe and buffer villages in conservation efforts is not encouraging. Out of 18 EDCs, only one is functioning properly.</li> <li>The Karnataka Government's Chinara nature camp scheme, aimed at exposing government school children to nature, is commendable and should be extended to students in schools adjacent to the Tiger Reserve to raise awareness.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Regular interaction between Tiger Reserve Forest personnel and villagers relocated to 'MC Hall' (located 50 km away from the reserve) is essential. Frequent exchanges among previously relocated villagers should be encouraged to foster cooperation and knowledge sharing in problem-solving.</li> <li>Due to the insufficient participation of local people in park management, initiatives to involve them in activities like intelligence sharing, ecotourism, and other park-related efforts are crucial.</li> <li>The significant increase in tourist numbers over the last three years should be regulated by defining ecotourism zones in accordance with the guidelines of the NTCA.</li> <li>Regulations should be established to control the proliferation of resorts and home stays in the coffee estates between buffer zones to minimize their threats to the Tiger Reserve.</li> <li>Besides a fire management plan, additional management plans, such as those for eradicating invasive species and monitoring schedules for various threatened animals, need to be developed and meticulously implemented.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Vacancies exist in frontline staff positions, including watchers and forest guards. Furthermore, the professional training provided to staff members in wildlife management is deemed inadequate. Swift action should be taken to fill vacancies in frontline staff positions. Comprehensive staff development training programs focused on wildlife management, protection, and monitoring should be systematically planned and implemented to enhance the capacity of frontline staff.</li> <li>Regular technical training programs on the use of M-STriPES, Phase IV monitoring, big cat carcass disposal protocols, and wildlife behavior should be organized for field staff, ranging from Range Officers to Beat Forest Guard positions.</li> <li>The formation of EDCs in areas where relocation has taken place is still under consideration.</li> <li>Discontent among villagers outside the Protected Area System (PAS) persists due to various disputes related to land and income generation activities.</li> <li>Continuous efforts are needed to bring buffer areas under the unified control of the Field Director to consolidate protection measures in the landscape and restore corridors</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>The presence of vacancies in frontline protection/law enforcement staff is a critical issue. Expediently fill vacancies among frontline staff. Establish an in-house staff training facility.</li> <li>Develop training modules for protection and enforcement, regularly conducting capacity-building programs for frontline staff.</li> <li>Conduct an extensive threat analysis and mapping, along with the preparation of threat management plans.</li> <li>Effectively implement security audits.</li> <li>Document research-based findings for planning and implementation of various management practices.</li> <li>The road network, protection infrastructure, and intelligence network are inadequately maintained, particularly during periods of heavy rainfall, posing challenges to effective conservation efforts. Improve patrolling amenities with night vision gear and all-terrain vehicles.</li> <li>The spread of invasive species within the reserve is a growing concern that requires proactive management strategies.</li> <li>Assess carbon storage, capture, and loss for management actions in the tiger reserve.</li> <li>Human settlements persist at the fringe of the reserve, posing potential threats to the natural habitat and wildlife.</li> <li>Biotic pressures originating from fringe areas contribute to ecological challenges within the reserve.</li> </ul>		



MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>• The lack of professional training for frontline staff in protection work and law enforcement hampers the efficiency of conservation efforts.</li> <li>• Inadequate baseline information and a lack of long-term monitoring systems hinder a comprehensive understanding of the reserve's ecosystem.</li> <li>• The separation of Bababudangin State Forests (Kemmannugundi), Madhuguni SF, and Adhara SF areas from the main reserve by government lands and Bhaira Reservoir complicates the monitoring and management of the entire reserve as a cohesive unit.</li> <li>• Enhance public participation in various management and implementation programs.</li> <li>• Appoint a permanent wildlife veterinarian and improve veterinary infrastructure.</li> <li>• Appoint an in-house research officer for Bhadra Tiger Reserve.</li> <li>• Regulate private resorts and homestays in coffee estates between buffer zones. Strengthen EDCs and SHGs by involving them in livelihood activities beyond eco-tourism.</li> <li>• Strengthen public relation infrastructure.</li> <li>• Enhance Salim Ali Interpretation Centre at Muthoch Wildlife Range.</li> <li>• Establish a Braille corridor in the interpretation centre to cater to visually challenged individuals. Ensure that visitor plates have handicapped-friendly infrastructure and logistics.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- a. It is advisable to consider implementing proactive wildlife conflict mitigation measures to address the pressures on resources and reduce human-wildlife conflict risks. This could involve community engagement, habitat restoration, and promoting sustainable practices. Additionally, exploring the feasibility of relocating remaining villages outside the reserve may be beneficial.
- b. The exploration of the construction of wildlife corridors, underpasses, or overpasses is suggested to address the fragmentation caused by national and state highways. This initiative aims to enhance connectivity and minimize traffic risks for tigers.
- c. The lack of professional training for frontline staff is recognized as a challenge, and it is recommended to provide comprehensive training in law enforcement, protection, and monitoring. Furthermore, enhancing research efforts to gather vital data can significantly contribute to more effective conservation strategies.
- d. Possibilities for unifying management across separated key forest areas are suggested to address the complications arising from their separation. This could facilitate a more holistic approach to conservation efforts.
- e. Enhancing public relations infrastructure and strengthening Eco-Development Committees is advisable to address the low public participation in conservation and limited awareness about the reserve. Additionally, expanding ecotourism opportunities beyond homestays can actively involve local communities.
- f. Considering the appointment of a permanent wildlife veterinarian and improving veterinary infrastructure within the reserve is advisable.
- g. Establishing an in-house research officer dedicated to Bhadra Tiger Reserve could enhance research efforts.
- h. Strengthening the Salim Ali Interpretation Centre and promoting accessibility for visually challenged individuals is recommended for improved awareness and inclusivity.
- i. Regulating private resorts and homestays near the reserve to minimize disturbance to the habitat is advisable.

## 5. Conclusions

The Bhadra Tiger Reserve, nestled in the Western Ghats, stands as a vital bastion for diverse wildlife. Despite facing challenges such as fluctuating tiger populations, human-wildlife conflicts, and habitat fragmentation, the reserve has made commendable strides through initiatives like village relocations. The management recommendations underscore the importance of proactive measures, from wildlife corridors for connectivity to comprehensive training for frontline staff. Addressing these aspects, along with strengthening community engagement and research efforts, will fortify Bhadra Tiger Reserve's role in biodiversity conservation and sustainable coexistence.



## BILIGIRI RANGANATHA TEMPLE (BRT) TIGER RESERVE

### 1. Brief Description

This tiger reserve is known as Biligiri Ranganathaswamy Temple (BRT) Tiger Reserve. This unique bio-geographical entity, situated as the ecological bridge connecting the Western Ghats and Eastern Ghats in south India, is located between latitudes 11° 43' N and 12° 09' N and between longitudes 77° 01' and 77° 15' E. The entire tiger reserve lies in the southernmost district of Karnataka, called Chamarajanagara. The protected area and its adjoining forest areas form the entire forest areas of Chamarajanagar Taluk and Yelandur Taluk and parts of the forest of Kollegal and Hanur taluks. The tiger reserve spreads over 574.82 km<sup>2</sup>, the forested area of 359.10 km<sup>2</sup> being the core and the remaining 215.72 km<sup>2</sup> being the buffer zone. There is a 198 km boundary surrounded by agricultural lands. There is a tribal community living within the tiger reserve known as the Soliga tribe. There are 57 tribal settlements called podus with 3823 tribal families. It is estimated that the BRT has about 800 species of higher plant, representing 445 genera and 123 families. There are 115 tree species, 105 shrubs, 445 herbs and 101 climbers and lianas. The area is endowed with a rich diversity and abundance of animal life. There are over 40 species of larger mammal, over 250 species of bird, 30 species of reptile, 15 species of amphibian and 10 species of fish. These animals appear in various schedules of the Wild Life (Protection) Act, 1972 indicating their endangered status.

### 2. Tiger Population as per All India Tiger Estimation

In 2014, a total of 99 camera trap locations were simultaneously sampled over 30 sampling occasions, resulting in a cumulative sampling effort of 2966 trap nights. During this period, 52 unique tigers were identified. In 2018, a total of 86 tigers (SE-8) were observed utilizing the tiger reserve, with 52 tigers found specifically inside the reserve boundaries. In the recent tiger monitoring cycle, a total of 637 tiger images were captured, leading to the identification of 37 individual tigers. The tiger density was estimated to be 4.18 (SE 0.69) tigers per 100 sq km. Over the monitoring cycles, there has been a notable variation in tiger population estimates, with a decrease in the number of identified individuals observed in recent years, despite fluctuations in sampling efforts and methodology.

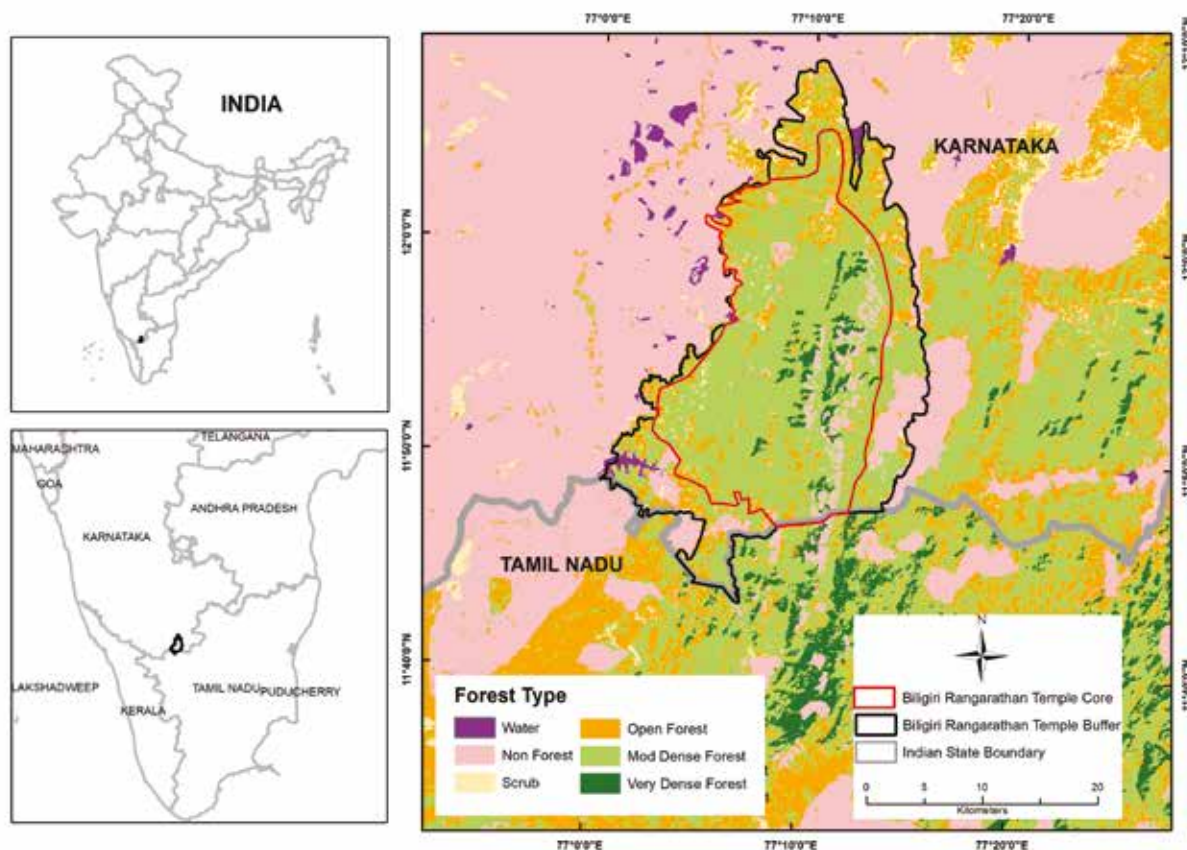


Figure 1: Map showing the location of BRT Tiger Reserve in the state of Karnataka.

### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<p><b>Soliga Settlements:</b> Presence of 10 Soliga settlements with 396 families inside the core area. Potential conflict with wildlife and conservation goals.</p> <p><b>Enclosures and Coffee Estates:</b> BR Hills Enclosure and five coffee estates are within the core area. Poses challenges to natural habitat and wildlife conservation.</p> <p><b>Impact of Roads:</b> Chamarajnagara road and Kollegal-Hasanur road pass through the reserve. Hinders the movement of elephants and other wildlife.</p>	<p><b>Human-Wildlife Conflicts:</b> Continuous occurrence due to proximity to fringe villages. Requires ongoing proactive measures for conflict mitigation.</p> <p><b>Enclosures within Core Area:</b> Presence of enclosures affecting biodiversity. Need continuous assessment and mitigation efforts.</p> <p><b>Impact of Roads:</b> Major roads passing through, hindering wildlife movement. A consistent concern over the years, especially for elephants.</p>	<p><b>Investigate Tiger Decline:</b> Given the significant decrease in tiger numbers over the past two cycles, thorough investigation and analysis are imperative. This investigation should delve into the underlying causes of the decline, such as habitat degradation and human settlements, to formulate targeted conservation measures.</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<p><b>Recently Constituted JFM Institutions:</b> Joint Forest Management (JFM) institutions (VFCs/EDCs) recently constituted. May need time to establish effective conservation practices.</p> <p><b>Pilgrim Attraction and Environmental Impact:</b> Pilgrims attracted to temples and holy trees contribute to annual fires and littering. Environmental impact due to large numbers of pilgrims.</p> <p><b>Lack of Interpretation/Visitor Centre:</b> Absence of interpretation and visitor centers. Hinders educational and awareness efforts for visitors.</p> <p><b>Invasive Alien Species (IAS):</b> Around 60% of the area covered by invasive alien species. Poses a threat to native flora and fauna.</p> <p><b>Lack of Wildlife Management Training for Top-Level Officers:</b> Top-level officers lack wildlife management training. Potential for uninformed decisions impacting wildlife management.</p> <p><b>Frontline Staff Vacancies:</b> Vacancies in frontline staff (Dy. RFOs, Forest Guards, and Forest Watchers) at around 27%. Impacts effective patrolling and conservation efforts.</p>	<p><b>Frontline Staff Vacancies:</b> Vacancies in frontline staff positions observed over multiple years. Ongoing challenge requiring continuous recruitment and training efforts.</p> <p><b>Lack of Wildlife Management Training:</b> Top-level officers consistently lack wildlife management training. Poses a persistent risk of uninformed decisions impacting wildlife management.</p> <p><b>Invasive Species Coverage:</b> Approximately 60% of the reserve consistently covered with invasive species. Represents an ongoing threat to the natural ecosystem.</p> <p><b>Limited Visitor Facilities:</b> Inadequate facilities for visitors persistently. Hinders efforts to promote responsible tourism.</p> <p><b>Commercialization of BRT Enclosure:</b> Enclosure around the temple consistently faces commercialization. Continuous impact on conservation efforts due to resorts and homestays.</p> <p><b>Interface with Village Settlements:</b> Large portions of the boundary interfacing with village settlements. Persistent vulnerability to threats like illegal activities and conflicts.</p>	<p><b>Mitigate Human Settlement Impact:</b> Addressing the presence of human settlements within the reserve is crucial to mitigate habitat degradation and ensure the well-being of tigers. Strategies should focus on relocating or providing alternative livelihood options for communities residing within the reserve boundaries to reduce human-wildlife conflicts and habitat disturbance.</p> <p><b>Combat Invasive Species:</b> The proliferation of invasive species poses a significant threat to the ecological balance of the reserve. Implementing effective management strategies to control and eradicate invasive species, such as rigorous monitoring and targeted removal efforts, is essential to restore and maintain the natural habitat for tigers and other wildlife.</p> <p><b>Leverage Potential for Population Expansion:</b> Recognizing BRT Hills' potential as a key area for expanding tiger populations in the north-east region of the Nilgiri clusters, conservation efforts should prioritize enhancing habitat quality and connectivity. Measures such as habitat restoration, corridor protection, and community engagement can facilitate the growth of tiger populations in the area.</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014		<p><b>Non-functional VFC/EDC Structures:</b> Village Forest Committee (VFC) and Eco-Development Committee (EDC) structures consistently not functioning properly. Hinders effective community involvement in conservation efforts.</p> <p><b>Forest Fire Management:</b> Lack of sufficient fire prevention measures consistently observed. Ongoing need for hiring fire watchers, early burning, and fire brigade deployment.</p>	<p><b>Enhance Connectivity:</b> Strengthening connectivity between BRT Hills and neighboring tiger reserves, such as Nagarahole, Bandipur, Sathyamangalam, Mudumalai, and Wayanad, is essential for maintaining a robust tiger population in the Western Ghats. Collaborative efforts should focus on preserving and enhancing ecological corridors to facilitate unhindered movement of tigers and ensure genetic diversity.</p>
2018	<p><b>Tribal Settlements:</b> Presence of 57 tribal settlements, including 10 Sholiga settlements in the core area. Increasing population and demands for infrastructure pose a constant threat.</p> <p><b>Impact of Major Roads:</b> Major roads passing through the reserve disturb wildlife movement, especially elephants. Sathyamangalam-Chamrajnagar and Kollegal-Hasanur roads are significant concerns.</p> <p><b>Vacancies and Ageing Frontline Staff:</b> Nearly 30% of sanctioned posts for frontline staff are vacant. Average age of existing frontline staff is above 50, indicating a potential workforce issue.</p> <p><b>Lack of Properly Trained Staff:</b> Absence of properly trained wildlife staff and deployment of personnel without wildlife management aptitude. A significant weakness in effective wildlife management.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p><b>Insufficient Non-Plan Funds:</b> Inadequate funds, particularly for building and vehicle maintenance. Constraints in managing infrastructure and operational needs.</p> <p><b>Invasive Species Coverage:</b> Approximately 60% of the reserve is covered with invasive species, specifically Lantana. Poses a threat to the natural ecosystem.</p> <p><b>Limited Visitor Facilities:</b> Inadequate facilities for visitors, lacking interpretation or visitor centers for ecotourism. Hinders the potential for promoting responsible tourism.</p> <p><b>Commercialization of BRT Enclosure:</b> The BRT enclosure around the temple (500 acres) has become a commercial center. Attracts land grabbers, leading to resorts and homestays, impacting conservation efforts.</p> <p><b>Presence of Coffee Estates:</b> Five big coffee estates and associated labor force pose challenges to conservation efforts. Potential conflicts with wildlife and habitat disturbance.</p> <p><b>Lack of Wildlife Management Training:</b> Top-level staff not trained by WII or adequately in wildlife management. Staff lacks training and skills in enforcement, especially in legal matters.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p><b>Interface with Village Settlements:</b> A large portion of the boundary interfaces with village settlements. Vulnerability to threats such as illegal activities, hunting, and man-animal conflicts.</p> <p><b>Non-functional VFC/EDC Structures:</b> Village Forest Committee (VFC) and Eco-Development Committee (EDC) structures are not functioning properly. Hinders effective community involvement in conservation efforts.</p>		
2022	<p><b>Human-Elephant Conflicts:</b> Common due to proximity to more than 100 fringe villages. Need proactive measures for conflict mitigation.</p> <p><b>Enclosures within Core Area:</b> Presence of enclosures impacts biodiversity. Require assessment and mitigation strategies.</p> <p><b>Threat from Interstate Border:</b> Vulnerability to illegal activities along the interstate border. Need enhanced protection and surveillance.</p> <p><b>Frontline Staff Vacancy at Forest Watcher Level:</b> Approximately 30% vacancy in frontline staff positions. Urgent recruitment and training needed.</p> <p><b>Vacant Post of Second Division Surveyor:</b> Sanctioned surveyor position is vacant. Recruitment and regular surveys required for effective land management.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<p><b>Broken Elephant Corridors:</b> Human settlements and grants have disrupted elephant corridors. Ongoing land acquisition to restore corridors.</p> <p><b>ESZ Master Plan Preparation:</b> Absence of an ESZ Master Plan. Urgent need for development and implementation.</p> <p><b>Forest Fire Management:</b> Lack of sufficient fire prevention measures. Need for hiring fire watchers, early burning, and fire brigade deployment.</p>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- It is suggested that a thorough investigation be conducted into the significant decrease in tiger numbers observed over the past two cycles. This analysis should focus on identifying the underlying causes of the decline, such as habitat degradation and human settlements, in order to formulate targeted conservation measures.
- Addressing the presence of human settlements within the reserve is recommended as a crucial step to mitigate habitat degradation and human-wildlife conflicts. Strategies should prioritize the relocation or provision of alternative livelihood options for communities residing within the reserve boundaries.
- The implementation of effective management strategies to control and eradicate invasive species is advisable, utilizing rigorous monitoring and targeted removal efforts. This is essential to restore and maintain the natural habitat for tigers and other wildlife.
- It is recommended that enhancing habitat quality and connectivity within BRT Hills be prioritized to leverage its potential as a key area for expanding tiger populations. Measures such as habitat restoration, corridor protection, and community engagement can facilitate population growth.

- e. Strengthening connectivity between BRT Hills and neighboring tiger reserves is advisable to maintain a robust tiger population in the Western Ghats. Collaborative efforts should focus on preserving and enhancing ecological corridors to facilitate unhindered movement of tigers and ensure genetic diversity.
- f. The implementation of proactive measures for conflict mitigation due to the proximity to fringe villages is suggested. This includes strategies such as habitat management, community engagement, and early warning systems.
- g. It is recommended that the impact of enclosures and coffee estates on biodiversity and wildlife conservation be assessed and mitigated. This may involve habitat restoration, sustainable land management practices, and stakeholder engagement.
- h. Addressing frontline staff vacancies and ensuring proper training in wildlife management is advised. Recruitment, training programs, and capacity-building initiatives are essential to enhance patrolling and conservation efforts.
- i. Developing adequate visitor facilities, interpretation centers, and ecotourism initiatives is suggested to promote responsible tourism. This can help raise awareness about conservation and generate alternative livelihood opportunities.
- j. Revitalizing Village Forest Committee (VFC) and Eco-Development Committee (EDC) structures to promote effective community involvement in conservation efforts is recommended. This includes capacity building, income generation activities, and participatory decision-making processes.

## 5. Conclusions

In conclusion, the Biligiri Ranganathaswamy Temple Tiger Reserve (BRT) stands as a critical ecological bridge connecting the Western Ghats and Eastern Ghats in southern India. Despite its rich biodiversity and potential for tiger conservation, BRT faces numerous challenges such as habitat degradation, human settlements, invasive species proliferation, and inadequate staffing. The decline in tiger numbers underscores the urgent need for comprehensive investigation and targeted conservation measures. Mitigating human settlement impact, combating invasive species, enhancing habitat connectivity, and strengthening community participation are key priorities. Addressing frontline staff vacancies and promoting responsible tourism are crucial for effective management. By implementing these recommendations, BRT can safeguard its unique biodiversity and ensure the long-term survival of tigers and other wildlife species.

# KALI (ANSHI-DANDELI) TIGER RESERVE

## 1. Brief Description

Kali Tiger Reserve, formed by merging Dandeli Wildlife Sanctuary and Anshi National Park, spans 1,306 sq km in Karnataka. Designated in 2007, it covers diverse landscapes across Karnataka, Goa, and Maharashtra, with a rich mix of deciduous and semi-evergreen forests totaling over 5,000 sq km. Heavy seasonal rainfall, ranging from 3000-6000 mm, influences the western part. Human settlements, industries, and reservoirs coexist, shaping the Malenad landscape. The biodiversity includes tigers, leopards, wild dogs, elephants, gaurs, sambar, and diverse wildlife, making it a crucial Western Ghats habitat despite human impact.

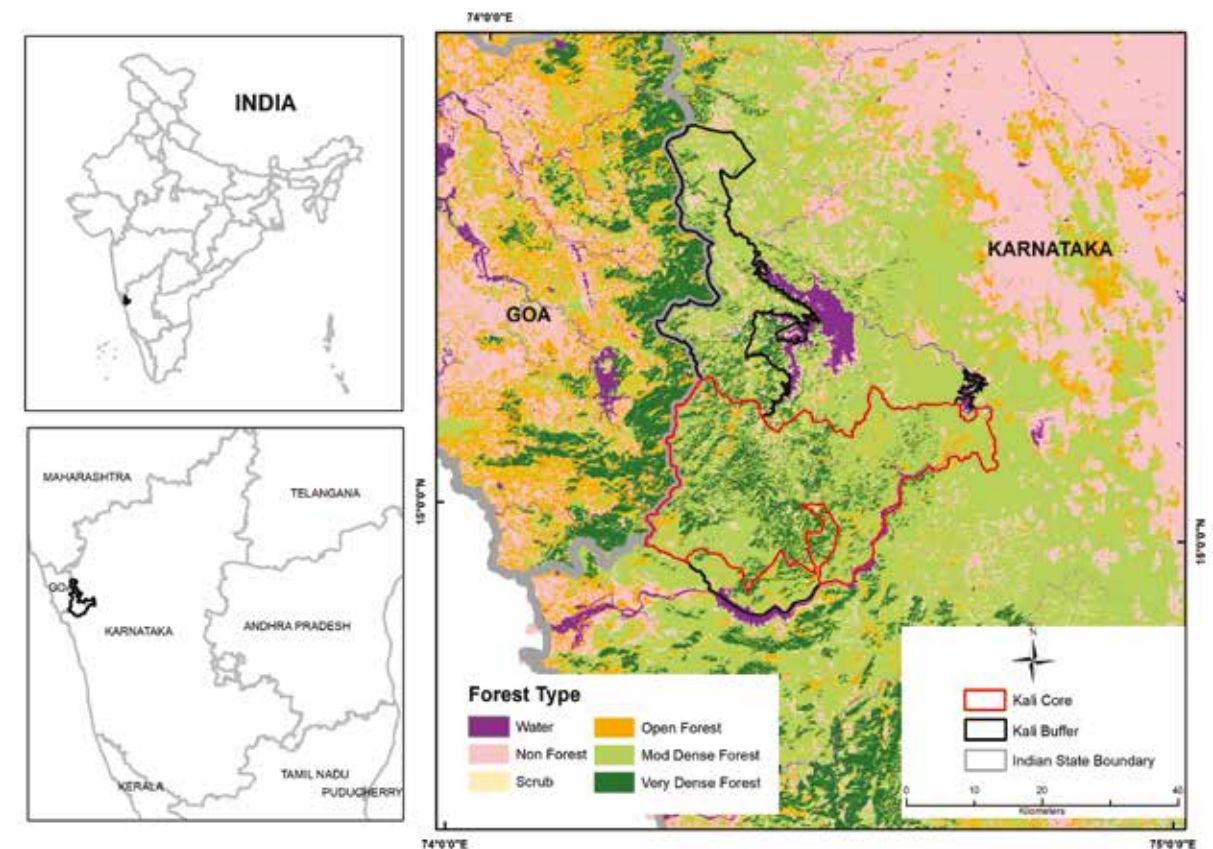


Figure 1: Map showing the location of Kali Tiger Reserve in the state of Karnataka.

## 2. Tiger Population as per All India Tiger Estimation

Kali Tiger Reserve has witnessed a promising increase in tiger density, rising from 0.20 (0.08) tigers/100 km<sup>2</sup> in 2014 to a robust 0.57 (0.14) tigers/100 km<sup>2</sup> in 2022. While initial capture efforts identified just 3 unique tigers in 2014, camera trap deployments in 2018 and 2022 revealed 4 and 17 individuals respectively, indicating a growing population and successful dispersal. Notably, the 2022 survey observed a male-biased sex ratio with

no cubs captured, suggesting potential areas for further investigation and conservation efforts. These positive trends are a testament to the dedicated work of forest officials and highlight the reserve's crucial role in the Western Ghats tiger landscape. Continued vigilance and targeted conservation strategies will be key to ensuring the long-term success of Kali's tiger population.

### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<ul style="list-style-type: none"> <li>Fifty-two villages within the TR exhibit substantial development, contributing to the spread of invasive species and the introduction of exotic ones.</li> <li>In the TR, there is a deficiency in staff capacity, with only nine inadequately equipped to address the various challenges faced by the reserve.</li> <li>The TR lacks essential baseline information and long-term monitoring measures, posing a significant threat to effective conservation and management.</li> <li>The increasing instances of human-wildlife conflicts pose a considerable threat to the well-being of both the local communities and the wildlife within the TR.</li> <li>Anticipated future pressures from tourism in and around the TR could become a threat if not carefully planned and managed.</li> <li>The relocation of well-developed agricultural enclosures within the TR presents a challenging task, further complicating conservation efforts and habitat preservation.</li> </ul>	<ul style="list-style-type: none"> <li>Extensive human-cattle interface along its boundary, substantial anthropogenic pressure from 52 villages, and monoculture Acacia plantations compromising wildlife values.</li> <li>Long-standing challenges involve a lack of essential baseline information, a 25-30% vacancy in permanent staff, and weak communication networks due to the hilly terrain.</li> <li>Frequent man-animal conflicts, inadequate training in wildlife management for staff, and insufficient systematic research on prey-predator dynamics are ongoing issues.</li> <li>Challenges in relocation efforts, weak enforcement capacity, and the presence of revenue enclaves pose consistent threats to the reserve's conservation goals.</li> <li>Over the years, water scarcity during summers, a State highway cutting across the reserve, and inadequate garbage disposal plans persist as challenges.</li> </ul>	<ul style="list-style-type: none"> <li>Kali Tiger Reserve faces challenges of low tiger and ungulate densities due to human pressures. Key actions, such as village resettlement, protection measures, and conflict mitigation, are essential to harness the reserve's potential as a source tiger population in the Northern Western Ghats landscape while preserving its critical grasslands.</li> <li>Address the challenge of low ungulate and tiger densities in Kali Tiger Reserve, likely attributed to heightened human pressures within the reserve.</li> <li>Implement NTCA's incentivized voluntary village resettlement scheme to relocate 52 villages from critical core tiger habitat within the Tiger Reserve.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010		<ul style="list-style-type: none"> <li>The absence of long-term research, insufficient training for staff, and a lack of systematic censuses for threatened species are recurring weaknesses affecting effective reserve management.</li> <li>Inconsistent engagement with Eco-Development Committees, challenges in resolving relocation and settlement rights, and gaps in addressing human-wildlife conflict have been persistent concerns.</li> <li>Continuous weaknesses include the absence of comprehensive corridor plans, a backlog of pending wildlife cases, and a need for enhanced record-keeping under CSS-PT.</li> <li>Ongoing issues involve a lack of clarity in TCP values, insufficient efforts in notifying eco-sensitive zones, and challenges in obtaining feedback from tourists for facility improvements.</li> <li>Consistent weaknesses encompass the absence of a formal security plan, weak mitigation measures for future linear development, and insufficient attention to the potential of eco-tourism.</li> <li>Over the years, the lack of systematic long-term ecological research, weaknesses in economic valuation, and inadequate veterinary support for human-wildlife conflict management and rescue efforts have persisted.</li> </ul>	<ul style="list-style-type: none"> <li>Highlight the importance of management actions, including incentivized voluntary village resettlement, stringent protection measures, developmental project mitigation, and human-wildlife conflict minimization in and around the reserve.</li> <li>Emphasize the need to maintain the unique grassland ecosystems within the reserve and discourage any tree plantation activities in these areas.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010		<ul style="list-style-type: none"> <li>The reserve's vulnerabilities include gaps in systematic planning to address human-wildlife conflict impacts and a need for improved facilities to enhance wilderness experiences for visitors.</li> </ul>	
2014	<ul style="list-style-type: none"> <li>The extensive boundary of the reserve interfaces with a densely populated landscape, marked by significant human and cattle presence.</li> <li>Anthropogenic pressures on the reserve are heightened by the existence of 52 villages and a substantial cattle population, posing serious challenges to conservation efforts. Mitigate the threat posed by revenue enclaves within the reserve.</li> <li>The conservation values of the reserve are compromised by frequent conflicts between humans and animals, negatively impacting the delicate ecological balance.</li> <li>Numerous vacancies, particularly in the frontline staff cadre, contribute to the challenges faced by the reserve in effectively managing and protecting its biodiversity. Urgent recruitment is required for vacant posts, especially Forest Guards, to strengthen the reserve's workforce.</li> <li>Both senior officials and frontline staff lack training in wildlife management, highlighting a crucial gap in the expertise needed for preserving the reserve's unique ecosystems. Conduct a thorough training needs assessment to build staff capacity, urgently preparing a staff development plan.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>The hilly and undulating terrain hampers communication networks in certain ranges, affecting the efficiency of coordination and response efforts within the reserve. Improve the wireless network within the reserve to enhance communication capabilities.</li> <li>Activate dormant Eco-Development Committees (EDCs) among the 62 villages, systematically planning eco-development works.</li> <li>Regulate home stays in revenue enclaves and periphery, while promptly notifying an eco-sensitive zone.</li> <li>Issue national-level guidelines for climate change in wildlife habitats, integrating them into the TCP without compromising conservation goals.</li> <li>Prioritize measures to reduce carbon loss and enhance capture, especially in grasslands, while managing the unique habitats and ecosystems of the TR.</li> <li>Temples such as Ulvi and Kavala attract large numbers of devotees, adding to the human presence and potential disturbances in the reserve. Regulate pilgrimage tourism and expedite the relocation of villages within the core area.</li> <li>A State Highway cutting across the reserve poses additional challenges, potentially disrupting wildlife corridors and increasing the risk of accidents involving animals.</li> </ul>		



MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Despite receiving substantial rainfall, the terrain and soil characteristics lead to rapid water drainage, resulting in water scarcity for animals during the summer months, further stressing the reserve's ecosystem. Implement systematic censuses for all threatened species in the reserve, following established protocols. Preserve existing grasslands/open areas instead of plantation work, particularly in areas designated for such purposes.</li> <li>The TCP should meticulously list and describe values under various themes, with detailed assessments and criteria for periodic monitoring. Critical sections of the draft plan lack essential details, requiring immediate attention to expedite approval. Swift action is needed to create a comprehensive corridor plan and buffer plan, ensuring quick approval for effective conservation measures.</li> <li>Address the backlog of pending wildlife and other cases, particularly those pending for more than three years.</li> <li>Enhance record-keeping related to the execution of works under the CAMPA – Project Tiger (CSS-PT).</li> <li>Notify forest patches around the core area without buffer as buffers, following the scientific concept of core and buffer zones.</li> <li>Approval for the security plan should be obtained promptly and seamlessly integrated into the TCP.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Phase-IV monitoring should adhere to the National Tiger Conservation Authority (NTCA) guidelines.</li> <li>Establish an institutionalized responsive system to address grievances, maintain regular logs, and introduce mechanisms for obtaining feedback, including through websites.</li> </ul>		
2018	<ul style="list-style-type: none"> <li>Develop a systematic weed management plan and thematic or zone-specific plans instead of ad hoc interventions, aligning with budgetary provisions.</li> <li>Despite ongoing efforts, the relocation process for the 52 villages/hamlets within the core area, declared a critical tiger habitat in 2007, requires sustained attention and progress. Prioritize the resolution of relocation and settlement rights for communities at the earliest to mitigate potential threats. Expand the formation of EDCs to include all fringe and core area villages, ensuring comprehensive community involvement.</li> <li>Establish planned and formal settings for addressing water, fire, weed, research, and training issues. Develop a formal security plan to address various concerns within the reserve.</li> <li>Execute relocation efforts comprehensively and holistically to ensure seamless integration of families into their new surroundings and society.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Streamline research activities and establish regular feedback mechanisms from the researcher community to analyze how findings can enhance the management of the Tiger Reserve habitat.</li> <li>Establish a comprehensive, long-term garbage disposal plan to address waste management effectively within the reserve.</li> <li>Immediately address water scarcity issues in specific pockets of the reserve during the summer months.</li> <li>Recognize the direct exposure of the core area to fringe villages, particularly in the southern and south-eastern parts, leading to significant anthropogenic pressure due to dense human and cattle populations.</li> <li>Recommend formal wildlife courses conducted by esteemed institutes like WII to enhance staff skills, proposing a vertical training program lasting at least a week.</li> <li>Advocate for regular annual seminars and workshops focusing on research activities to keep staff updated and informed.</li> <li>Ensure scientific assessment and record-keeping for threatened species, including tigers and elephants, within the Tiger Reserve. Implement systematic monitoring of prey populations and adhere to SOPs for conflict management involving both large and small animals.</li> <li>Establish a formal system to obtain feedback from tourists, enhancing visitor facilities based on their input.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Preserve forest connectivity through good practices and surveillance systems like drones.</li> <li>Assess the role of Tiger Reserves in climate change at a landscape level and extend economic valuation by NTCA-IIFM to this specific TR.</li> <li>Procure new vehicles for patrolling and rapid responses, opting for less noisy vehicles during safari activities.</li> <li>Implement mitigation measures for future linear development infrastructure to safeguard the reserve.</li> <li>Scientifically assess tiger populations, including minimum-number estimations, following the Phase IV monitoring protocol.</li> </ul>		
2022	<ul style="list-style-type: none"> <li>The reserve has an extensive boundary interfacing with densely populated human and cattle areas in the landscape.</li> <li>Anthropogenic pressures significantly impact the reserve due to the presence of 52 villages and a substantial cattle population. Scale up the ongoing voluntary village relocation efforts, addressing the presence of settlements within Kali Tiger Reserve.</li> <li>Actively engage all eco-development committees by identifying locally relevant economic and livelihood opportunities to garner public support for the tiger reserve.</li> <li>Conservation values are compromised by frequent man-animal conflicts.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>• Monoculture Acacia plantations, lacking undergrowth or regeneration of native species, diminish wildlife values. Remove large Acacia plantations on grasslands and manage these areas according to the TCP's prescriptions for grasslands.</li> <li>• There is a 25-30% vacancy in the permanent field staff, affecting the reserve's operational capacity.</li> <li>• Weak communication networks exist in certain ranges due to the hilly and undulating terrain.</li> <li>• Religious temples like Ulvi and Kavala attract a large number of devotees, influencing the reserve's dynamics.</li> <li>• A State highway cuts across the reserve, posing challenges to wildlife corridors and increasing the risk of accidents.</li> <li>• The absence of long-term research on prey-predator dynamics at both regional and landscape levels hinders effective management solutions.</li> <li>• Plan for systematic long-term ecological research within Kali Tiger Reserve. Assess the economic valuation of Kali Tiger Reserve.</li> <li>• Strengthen law enforcement capacity by establishing a dedicated forensic cell, considering Kali TR's crucial role as a protected area in the landscape.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>• Establish a veterinary support system to address the challenges of human-wildlife conflict management and wildlife rescue and rehabilitation.</li> <li>• Undertake a systematic study on elephants, incorporating regular monitoring to assess the population status annually.</li> <li>• Establish a framework for interstate cooperation/ collaboration with Goa to strengthen the protection of connected tiger populations in the shared landscape.</li> <li>• Implement systematic planning to address the rise in human-wildlife conflict in the landscape, mitigating its impact on local communities and wildlife conservation.</li> <li>• Recognize the emerging importance of the reserve as a destination for wilderness experiences and develop eco-tourism, focusing on improving facilities and providing a meaningful user experience.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- a. Considering the significant pressure on resources and the increased risks of human-wildlife conflict posed by 52 villages within and around the reserve, it is advisable to prioritize the scaling up of voluntary village relocation programs. This strategic initiative is aimed at moving settlements outside the core area, contributing to conservation efforts. Active engagement of Eco-Development Committees in identifying sustainable livelihood opportunities will strengthen local support for these crucial conservation endeavors.

- b. To address concerns related to monoculture Acacia plantations affecting wildlife value and disrupting natural biodiversity, it is recommended that the removal of large Acacia plantations on grasslands be considered. Following the TCP's prescriptions for managing these areas will contribute to restoring ecological balance. Additionally, implementing systematic water management plans is advisable to alleviate stress on the ecosystem during the summer months.
- c. Recognizing the challenges posed by a 25-30% vacancy in permanent staff and weak communication networks impacting effective control and monitoring, it is recommended that staff vacancies be urgently filled. Comprehensive training programs should be provided to enhance field skills and wildlife management expertise. Improving communication infrastructure with robust wireless networks covering challenging terrain will further enhance operational efficiency.
- d. Addressing the disruption caused by a state highway bisecting the reserve and increasing animal-vehicle collision risks, it is advisable that corridor restoration plans be developed and implemented. These plans aim to improve wildlife movement and mitigate highway risks through the strategic placement of underpasses or overpasses. Managing pilgrimage tourism and regulating devotee influx around sensitive areas will contribute to maintaining reserve dynamics.
- e. To overcome the lack of long-term research on prey-predator dynamics and economic valuation hindering informed management decisions, it is recommended that systematic long-term ecological research within the reserve be planned. This includes studying prey-predator dynamics at regional and landscape levels. Additionally, conducting an economic valuation assessment of Kali Tiger Reserve will provide valuable insights for informed decision-making.
- f. Strengthening law enforcement for effective wildlife crime investigation and prosecution can be achieved by establishing a dedicated forensic cell. This initiative is crucial for maintaining the integrity of the reserve and ensuring justice for wildlife crimes.
- g. Addressing wildlife rescue and rehabilitation needs arising from human-wildlife conflict is recommended through the development of a veterinary support system. This proactive measure will contribute to the well-being of wildlife in challenging situations.
- h. Undertaking a systematic study of elephants with regular monitoring to assess population status and inform protection strategies is advisable. This initiative is essential for the conservation of elephant populations within the reserve.
- i. Establishing a framework for interstate cooperation with Goa is recommended to strengthen the protection of connected tiger populations across shared landscapes. Collaborative efforts will enhance conservation outcomes.
- j. Developing systematic plans to address rising human-wildlife conflict in the landscape is advisable. This includes mitigating its impact on local communities and wildlife conservation. Implementing measures that foster coexistence will contribute to a

harmonious relationship between communities and wildlife.

- k. Recognizing the reserve's potential for wilderness tourism, it is advisable to develop eco-tourism experiences focusing on responsible visitor behavior and meaningful user engagement. This approach ensures that tourism aligns with conservation goals and promotes a sustainable balance between visitor experiences and wildlife protection.

## 5. Conclusions

While Kali Tiger Reserve holds potential as a source tiger population for the northern Western Ghats, its current low ungulate and tiger densities reflect significant human pressure. To unlock this potential, prioritize the incentivized resettlement of all 52 villages within the critical core tiger habitat, following NTCA guidelines. Implement stringent protection measures, mitigate developmental project impacts, and minimize human-wildlife conflict around the reserve. Critically, preserve existing grasslands without any tree plantation activities, allowing these vital ecosystems to flourish and support a healthy prey base for tigers. By taking these decisive actions, Kali Tiger Reserve can fulfill its critical role in tiger conservation and ensure the long-term success of these majestic predators in the region.



# NAGARHOLE TIGER RESERVE

## 1. Brief Description

Nagarhole, situated at 76° 05' E and 12° 04' N, was designated as a National Park in 1955, covering an expanse of 644 square kilometers. Positioned at an elevation of 700-960 m, the park experiences monthly mean temperatures ranging from 20-27 °C, with an annual rainfall varying between 1000 mm in the eastern parts and 1500 mm in the western parts. The predominant vegetation comprises tropical moist-deciduous and tropical dry deciduous forests, displaying a heterogeneous matrix due to anthropogenic habitat modifications. The landscape surrounding the protected area includes extensive forested areas, coffee plantations in the western region (Kodagu District), and a mosaic of crops in the eastern parts. Despite the relocation of over 600 families from within Nagarhole, a few still inhabit the reserve. The park features numerous streams and rivulets, along with significant water bodies such as the Kabini and Taraka reservoirs situated in the west and southeastern parts, respectively.

Nagarhole shares contiguity with Wayanad Wildlife Sanctuary (Kerala) to its south and Bandipur National Park to its southeastern parts. This Malenad landscape within the Western Ghats sustains diverse carnivores and herbivores, including tiger (*Panthera tigris*), leopard (*Panthera pardus*), Asiatic wild dog (*Cuon alpinus*), sloth bear (*Melursus ursinus*), Asiatic elephant (*Elephas maximus*), gaur (*Bos gaurus*), sambar (*Rusa unicolor*), chital (*Axis axis*), muntjac (*Muntiacus vaginalis*), four-horned antelope (*Tetracerus quadricornis*), wild pig (*Sus scrofa*), mouse deer (*Moschiola indica*), and hanuman langur (*Semnopithecus entellus*).

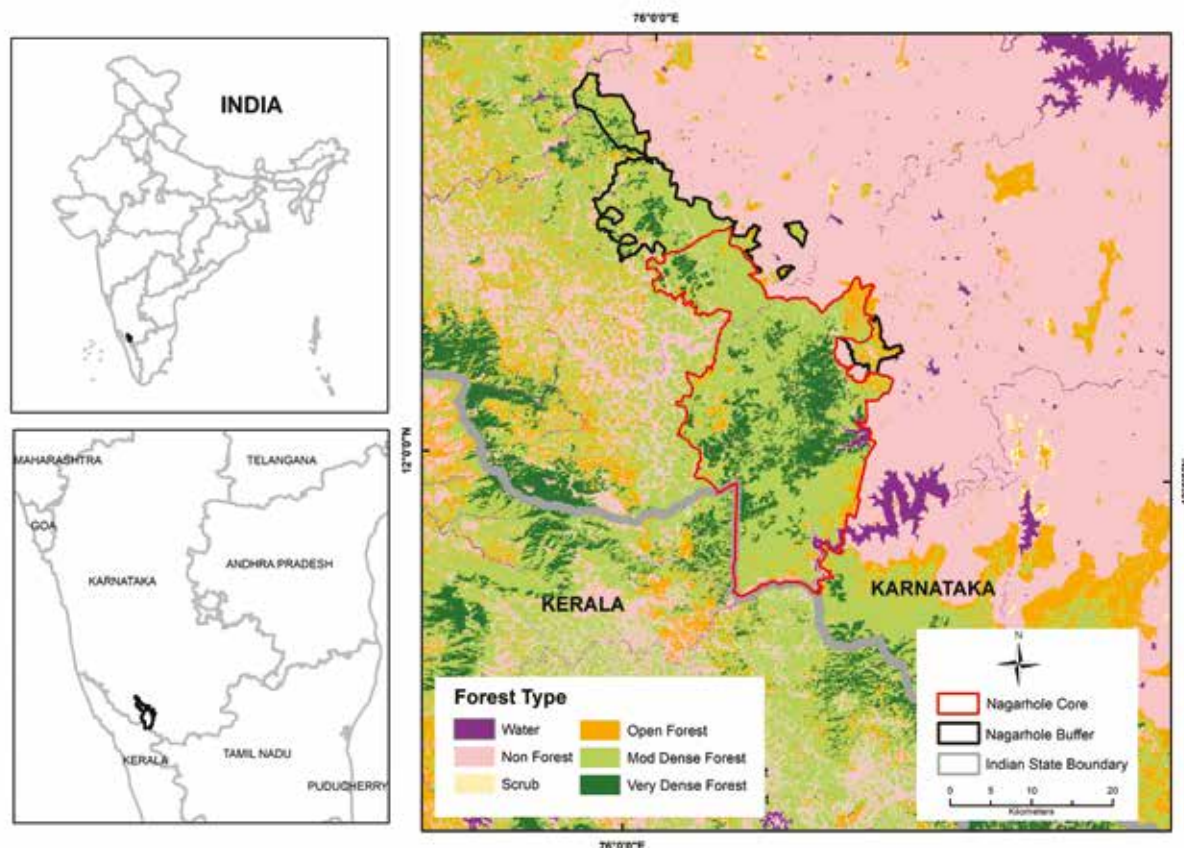


Figure 1: Map showing the location of Nagarhole Tiger Reserve in the state of Karnataka

## 2. Tiger Population as per All India Tiger Estimation

In 2014, the tiger population assessment recorded the capture of 72 unique tigers, resulting in a calculated density of 11.09 tigers per 100 square kilometers (SE 0.91) for the Effective Sampled Area. The population estimate for the Protected Area stood at 77. Transitioning to 2018, the deployment of 329 camera traps in Nagarhole Tiger Reserve yielded 1,571 tiger detections, including 22 images of cubs. This effort led to the identification of 125 individual tigers, with a density estimated at 11.82 tigers per 100 square kilometers (SE 1.05) within the Tiger Reserve. Fast forward to 2022, a total of 2,933 tiger images were obtained, revealing 140 individual tigers and estimating a tiger density of 11.15 tigers per 100 square kilometers (SE 0.95). These comprehensive findings provide crucial data for informed conservation strategies and management decisions within Nagarhole Tiger Reserve.

## 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<ul style="list-style-type: none"> <li>The core area is encumbered with settlements, leading to increased biotic pressures.</li> <li>Limited support from local communities, NGOs, and stakeholders, with insufficient overall participation.</li> <li>Rising anthropogenic pressures and ineffective ecodevelopment programs for supporting the livelihoods of local residents.</li> <li>Inadequate allocation of resources.</li> <li>Insufficient visitor services and information.</li> <li>Shortage of trained frontline staff, along with a shortage in the total number of staff.</li> <li>Frequent transfer of officers, disrupting continuity in management.</li> <li>Escalating tourism poses a threat to the ecosystem.</li> <li>Growing conflicts with certain stakeholders.</li> </ul>	<ul style="list-style-type: none"> <li>Persistent encroachment and settlements in the core area leading to increased biotic pressures and human-animal conflicts.</li> <li>Limited support from local communities, NGOs, and stakeholders, resulting in insufficient overall participation.</li> <li>Growing anthropogenic pressures, ineffective ecodevelopment programs, and inadequate resource allocation impacting local livelihoods.</li> <li>Shortage of trained frontline staff and frequent transfer of officers disrupting continuity in management.</li> <li>Escalating tourism, conflicts with stakeholders, and developmental projects in adjoining areas pose ongoing threats.</li> <li>Insufficient protection measures along the porous interstate boundary with Kerala.</li> </ul>	<ul style="list-style-type: none"> <li>The core area of the Tiger Reserve currently accommodates approximately 33 tribal settlements. A strategic resettlement plan is imperative to relocate these tribal settlements outside the core area.</li> <li>State highways intersecting the critical habitat within the Tiger Reserve present a significant challenge. Appropriate mitigation measures are necessary to address the impact of state highways on the reserve's critical habitat.</li> <li>Unhindered animal movement through the core critical habitat is a key goal that should guide the implementation of mitigation strategies.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<ul style="list-style-type: none"> <li>Developmental projects in adjoining areas, including plantations, contribute to environmental challenges.</li> <li>Increasing human-wildlife conflicts.</li> <li>Growing interest from research institutions in the region.</li> <li>Increasing government support for conservation initiatives.</li> </ul>	<ul style="list-style-type: none"> <li>Dormant EDCs and weak coordination among institutions persist as challenges.</li> <li>Absence of adaptive experimental research and inadequate baseline data hinder informed conservation decisions.</li> <li>Lack of an interpretation or visitor centre and handicapped-friendly infrastructure limits nature education and awareness initiatives.</li> </ul>	<ul style="list-style-type: none"> <li>A continuous increase in invasive species poses an ongoing challenge to the reserve's ecological balance.</li> <li>The reinforcement of corridors is vital for facilitating the establishment of a metapopulation of tigers in adjacent forest divisions.</li> </ul>
2014	<ul style="list-style-type: none"> <li>The critical tiger habitat within Nagarhole Tiger Reserve faces the challenge of 33 tribal settlements, along with 96 villages in the periphery and numerous encroachments, exerting significant pressure on natural resources and negatively impacting wildlife populations and habitats.</li> <li>Bring the buffer area promptly under the unified control of the Field Director. Implement systematic training programs outlined in the draft TCP for the entire staff, prioritizing frontline staff with detailed schedules and calendars.</li> <li>Deploy wildlife-trained personnel in Nagarhole Tiger Reserve (NTR). Expedite the approval of TCP, security plan, and staff development plans.</li> <li>Establish and develop an interpretation centre in alignment with the TCP's recommendations. Introduce trained guide services for departmental safaris.</li> <li>Conduct Phase-IV monitoring following NTCA guidelines. Enhance the daily monitoring protocol according to NTCA guidelines.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Systematically identify and institutionalize participatory programs involving local communities in the protection and conservation of the TR, addressing areas for stakeholder engagement outlined in the TCP.</li> <li>Monoculture plantations covering approximately 107 square kilometers within the reserve, with teak occupying 92.3 sq km, eucalyptus 5.3 sq km, and miscellaneous trees 9.4 sq km, were established before 1984.</li> <li>State Highways, including Mysore-Mananthavady, Hunsur-Kutta, and H.D. Kote-Kallahatti-Murkal, pass through the core area of the reserve, posing challenges to the free movements of wild animals.</li> <li>The long boundary with revenue villages and private coffee estates on the eastern and western sides of Nagarhole Tiger Reserve, extending over 200 km, makes it susceptible to threats such as illegal timber cutting, grazing, and snaring for bush meat. Activate dormant EDCs and ensure significant income generation activities in villages lacking EDCs.</li> <li>Human-wildlife conflicts involving Elephants, Wild Boars, and occasionally Tigers and Leopards are prevalent.</li> <li>An acute shortage of wildlife-trained staff members in the reserve impacts effective conservation efforts.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>The porous interstate boundary with Kerala, specifically along the River Kabini, facilitates illegal activities such as fishing and timber cutting.</li> <li>Inadequate baseline data and the absence of adaptive experimental research hinder informed conservation decisions.</li> <li>Weak coordination between government and non-government organizations/ institutions hampers effective conservation initiatives.</li> <li>Despite being famous for wildlife tourism, Nagarahole Tiger Reserve lacks an interpretation centre or visitor centre, limiting opportunities for nature education and awareness about wildlife conservation.</li> <li>Establish an institutionalized responsive system for timely processing of grievances/ complaints/feedback. Introduce mechanisms for regular feedback, including through websites.</li> <li>Review the soil and water conservation management strategy immediately, particularly in response to drought-related Elephant deaths reported in the TCP.</li> <li>Streamline land use changes around the TR, especially in Kodagu district, with the notification of an eco-sensitive zone.</li> <li>Conduct systematic and scientific censuses for all threatened species in addition to regularly assessed species, aligning with established protocols.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Improve record-keeping related to the execution of works under the Centrally Sponsored Scheme-Project Tiger (CSS-PT).</li> <li>Issue national-level guidelines for assessing climate change impacts, integrating adaptation measures into TCP, and providing specific plans for carbon loss reduction and increased capture without compromising habitat conservation objectives.</li> <li>Expedite the notification of an eco-sensitive zone around Nagarahole Tiger Reserve to address changing land use and mitigate potential threats from home stays in the adjacent Kodagu district.</li> </ul>		
2018	<ul style="list-style-type: none"> <li>The Tiger Reserve faces a significant space crunch, with a perimeter of 220 km, of which 150 km is densely populated, leading to escalating human-animal conflicts.</li> <li>Tribal settlements within the core area, comprising 33 settlements with 1461 families, and 96 villages on the periphery, along with coffee estates, contribute to substantial biotic pressure, negatively impacting wildlife populations and habitats. Consider replicating the successful relocation of tribal families from the core area to Nagapura and Shettyimaly, and expedite voluntary relocation efforts for remaining families in the future.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>State highways like Mysore-Mananthavady and Hunsur-Kutta, totaling 75.30 km across the core and critical tiger habitat, pose a serious challenge, causing road hits and hindering free movement of animals.</li> <li>A considerable staff vacancy, with 31% of 386 total staff positions vacant, especially in frontline roles such as Dy. Forest Range officer and forest watchers, poses a major issue for effective Tiger Reserve management.</li> <li>Apart from a few top-level officers, inadequate training on wildlife protection and management issues hampers the overall competence of the staff. Develop a comprehensive staff training plan to systematically provide wildlife management, protection, and conservation training to the entire field staff.</li> <li>Delay in the notification of the proposed buffer zone around the western side of the Tiger Reserve results in the core and buffer not being under unified administrative control. Take action to bring the core and buffer areas under the unified control of the Field Director.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Despite the formation of 80 Eco-Development Committees, most are defunct and unhelpful, providing little support to Tiger Reserve management. Address the challenge of dormant EDCs by revitalizing defunct ones, considering the shortage of funds, and ensuring the participation of local communities in conservation activities within the Tiger Reserve.</li> <li>The absence of an interpretation or visitor centre in Nagarhole Tiger Reserve undermines nature education and awareness efforts for students and wildlife tourists.</li> <li>Regulate tourism activities in accordance with guidelines issued by the NTCA. Review the threat posed by the proliferation of home stays around the Tiger Reserve in Kodagu District, ensuring changes in land-use align with the objectives of Tiger Reserve management.</li> <li>Despite having 33 Anti-poaching camps, the inadequate protection mechanism and staff strength struggle to maintain constant vigilance over the large and porous interstate border with Kerala.</li> <li>The annual removal of invasive species, specifically Lantana camara, is insufficient, considering the extent of the problem within the Tiger Reserve.</li> </ul>		



MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Monoculture plantations covering a total area of 107 sq. km. (teak 92.3 sq. km.; eucalyptus 5.3 sq. km.; miscellaneous species 9.4 sq km) established before 1984 pose a threat to wildlife habitats.</li> </ul>		
2022	<ul style="list-style-type: none"> <li>The Nagarhole Tiger Reserve faces challenges with 6,145 tribal people residing in 54 hamlets and 14 village settlements within the Critical Tiger Habitat, exerting pressure on natural resources and impacting wildlife negatively. Expedite the rehabilitation of tribal families from the core area of the Tiger Reserve.</li> <li>Monoculture plantations covering 107 km<sup>2</sup> inside the reserve, primarily teak, eucalyptus, and miscellaneous species, lack undergrowth and pose minimal wildlife value.</li> <li>State highways, including Mysore-Mananthavady, Hunsur-Kutta, and HD. Kote-Kallahatti-Murkal, crossing the reserve cause traffic disturbances, endangering wildlife through road hits.</li> <li>Approximately 150 km of the reserve's boundaries interface with human settlements, leading to threats such as illegal activities, timber cutting, and increased human-wildlife conflicts.</li> <li>Delay in notifying the buffer zone on the western side of Nagarhole Tiger Reserve, due to misconceptions and local resistance, hinders effective conservation efforts.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Despite a current staff shortage, the reserve expects additional members, addressing the 25% vacancy in the permanent field staff.</li> <li>Many EDCs, once formed, are now dormant, hampering cooperation with fringe-area communities. Strengthen and support the 35 active EDCs out of the total 108 in Nagarhole Tiger Reserve.</li> <li>Weak coordination among forest department, EDCs, NGOs, and other government organizations results from a lack of frequent dialogues.</li> <li>Absence of adaptive experimental research limits immediate solutions to management problems, hindering efforts to address issues like invasive weeds and monoculture plantations.</li> <li>Carry out research and collaborate with research institutions or organizations to utilize the outcomes for course correction.</li> <li>The porous interstate boundary with Kerala allows illegal activities like fishing and timber cutting, impacting conservation efforts.</li> <li>Frequent changes in Deputy Directors (DCFs) within short tenures disrupt continuity in management, affecting the reserve's overall functioning.</li> <li>Administration of the core, proposed buffer, and tribal relocation by a single Deputy Director/Director increases workload and potential delays in management decisions.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Inadequate regeneration of native species due to weed occupation and monoculture plantations covering 107 km<sup>2</sup> is a significant weakness. After recognizing the commendable work in lantana removal the need for continuous funding support should be emphasized.</li> <li>Absence of updated baseline data and weak database management system hinders effective coordination and planning within the reserve.</li> <li>Lack of an interpretation or visitor centre at Nagarhole Tiger Reserve limits nature education and awareness initiatives, despite its popularity for wildlife tourism.</li> <li>Conduct a study on carbon storage, carbon capture, and loss assessment in consultation with technical agencies.</li> <li>Establish a Braille corridor in the interpretation center for visually challenged individuals.</li> <li>Ensure all visitor places have handicapped-friendly infrastructure and logistics to promote accessibility.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- Options for relocating remaining tribal families should be explored, considering the significant pressure on resources and wildlife from tribal settlements, villages, and other human activities. Additionally, mitigation of these pressures could be achieved through notification of buffer zones and better land use planning around the reserve.

- The threats posed by monoculture plantations, state highways, and human settlements along porous boundaries can be addressed through the phased withdrawal of plantations, exploration of road diversions, and enhanced protection measures along the Kerala border.
- To improve management effectiveness, addressing the high staff vacancy by prioritizing recruitment efforts is crucial. Providing adequate training for staff members and revitalizing Eco-Development Committees can enhance community engagement and support conservation efforts.
- Enhancing visitor experiences and supporting informed conservation decisions can be achieved by establishing a visitor center and improving data management systems. Collaboration on research initiatives focusing on issues like invasive species and climate change can provide valuable insights for management strategies.
- To promote continuity and collaboration, minimizing officer transfers, expediting buffer zone notification processes, and enhancing communication channels among various stakeholders are advisable. These measures would contribute to a more cohesive and effective management approach, fostering better coordination and shared goals among all involved parties.
- Mitigating human-wildlife conflicts through awareness programs focused on fostering coexistence and implementing enhanced protection measures to minimize conflict incidents is recommended.
- Prioritizing the control of invasive species such as Lantana camara to uphold habitat quality and biodiversity is advisable. Effective management strategies for invasive species should be implemented to safeguard the overall health of the ecosystem.
- Lastly, establishment of an interpretation center with accessibility features tailored for disabled visitors is suggested. This initiative can enrich visitor engagement and foster inclusivity within the reserve.

#### 5. Conclusions

Nagarahole Tiger Reserve faces significant challenges such as the presence of tribal communities within the core area, which increases pressure on resources and wildlife interactions. Urgent relocation efforts are needed to mitigate this issue. Additionally, state highways fragment critical habitat, hindering animal movement and requiring immediate mitigation measures. The invasion of invasive species like lantana camara further degrades habitat quality, necessitating continuous control efforts. Despite these challenges, focused conservation efforts can strengthen vital corridors and establish a robust metapopulation in the surrounding region. Addressing these critical issues will ensure the continued success of Nagarahole Tiger Reserve as a sanctuary for tigers and other wildlife.

## PARAMBIKULUM TIGER RESERVE


### 1. Brief Description

An area of the Nelliampathy-Anamalai landscape of the southern Western Ghats in India known as the Parambikulam Tiger Reserve is one of the country's most ecologically significant areas. It is situated in Kerala's Palakkad District. It is one of the world's biodiversity hotspots, supporting a variety of habitat types. It is characterized by endemism, moist deciduous forests, dry deciduous forests, and shola forests. Low, marshy grasslands, or vayals, are another uncommon environment. With a total area of 643.66 km<sup>2</sup>, including a core area of 390.89 km<sup>2</sup> and a buffer area of 252.77 km<sup>2</sup>, it was designated a tiger reserve in 2010. Along with a healthy population of tigers, this area is home to large carnivores including the leopard, wild dog and sloth bear. It is also home to elephants and other herbivores, such as the spotted deer and samba.

### 2. Tiger Population as per All India Tiger Estimation

In Parambikulam Tiger Reserve, monitoring efforts have provided insights into the tiger population dynamics over the years. In 2014, 15 individual tigers were captured. Surveys in 2018 revealed significant advancements in monitoring techniques, with 254 camera traps deployed, resulting in 468 tiger detections, including 10 images of cubs. From these detections, 27 individual tigers were identified, with an estimated tiger density of 1.95 per 100 km<sup>2</sup>. By 2022, monitoring efforts continued with 242 camera points and over 11,000 trap nights, capturing 31 unique tigers. These ongoing monitoring efforts underscore the commitment to understanding and conserving tiger populations in Parambikulam Tiger Reserve, vital for their long-term survival in the region.



 RATHIKA RAMASAMY



 SUMAN KOLEY

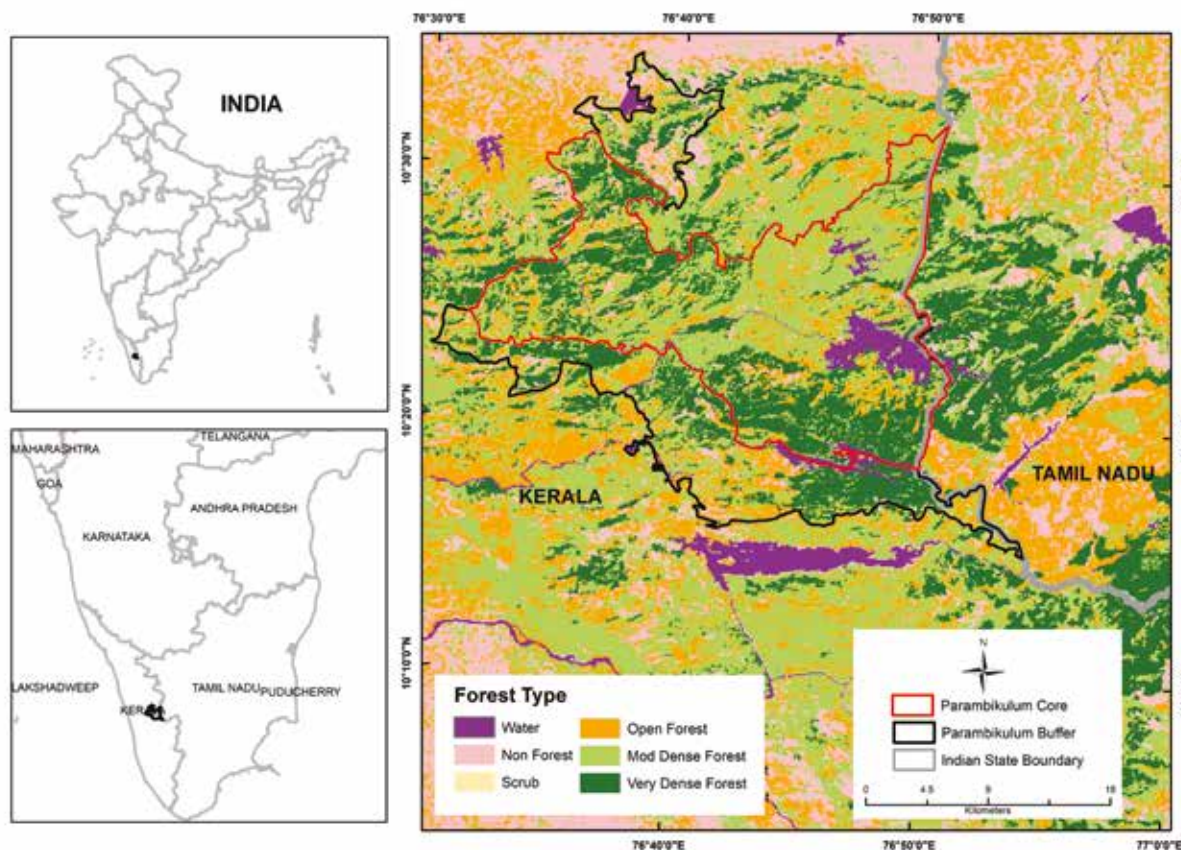


Figure 1: Map showing the location of Parambikulam Tiger Reserve in the state of Kerala.

### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<ul style="list-style-type: none"> <li>Large area under exotic plantations.</li> <li>Inadequate trained staff.</li> <li>Monitoring systems yet to be strengthened.</li> <li>Inadequate incentives to attract and retain staff.</li> <li>Some disturbance due to reservoirs and settlements inside TR (Buffer zone).</li> </ul>	<p><b>Large Area under Exotic Plantations:</b> Identified as a weakness multiple times, indicating its recurrence. Inadequate Trained Staff: Continues to be an ongoing issue, suggesting a persistent challenge in staffing and training.</p> <p><b>Monitoring Systems Weakness:</b> Mentioned repeatedly, indicating a consistent need for improvement in monitoring systems. Inadequate Incentives for Staff: The lack of effective incentives for staff is noted as a continuous challenge.</p>	<p><b>Enhanced Protection Measures:</b> Strengthening anti-poaching efforts and increasing patrolling frequency within the reserve to mitigate threats to tiger populations such as poaching and habitat destruction.</p> <p><b>Prey Base Augmentation:</b> Implementing strategies to enhance prey density within the reserve, such as habitat management, prey species reintroduction, and protection of existing prey populations. A robust prey base is essential for sustaining tiger populations.</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010		<p><b>Buffer Zone Challenges:</b> Issues related to buffer zones, including administrative control gaps, persistently mentioned.</p> <p><b>Presence of Tribal Settlements:</b> Continues to be a concern, indicating an ongoing challenge to the inviolate status.</p> <p><b>Unregistered Gun License Holders:</b> Mentioned multiple times, suggesting a persistent issue with unregistered gun holders.</p> <p><b>Lack of Professional Training:</b> The continuous absence of formal wildlife management training for frontline staff is noted.</p> <p><b>Insufficient Information on Species Distribution:</b> The ongoing lack of information on the distribution status of unique and rare species persists.</p> <p><b>Threats from Temple Visitors:</b> Consistently noted as a concern, suggesting the recurring nature of potential threats.</p> <p><b>Issues with Tribal Dog Tradition:</b> The continuous risk of diseases spreading due to the tribal tradition of bringing dogs into forests.</p> <p><b>Uncontrolled NTFP Collection:</b> The repeated challenge of uncontrolled collection of Non-Timber Forest Products from the buffer zone.</p>	<p><b>Habitat Restoration:</b> Initiating habitat restoration projects to improve the quality and extent of tiger habitat within the reserve. This can include initiatives like reforestation, habitat connectivity enhancement, and invasive species management.</p> <p><b>Community Engagement:</b> Involving local communities in conservation efforts through participatory approaches, including awareness programs, livelihood alternatives, and capacity building. Engaging local communities fosters a sense of ownership and promotes conservation stewardship.</p> <p><b>Research and Monitoring:</b> Continued monitoring of tiger populations and their habitats through scientifically rigorous methods such as camera trapping, genetic analysis, and habitat assessment. Research findings can inform adaptive management strategies for better conservation outcomes.</p> <p><b>Mitigation of Human-Wildlife Conflict:</b> Implementing measures to minimize human-tiger conflicts through strategies like the establishment of predator-proof livestock enclosures, early warning systems, and compensation schemes for affected communities.</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010			<p><b>Corridor Protection and Connectivity:</b> Prioritizing the protection and restoration of wildlife corridors to facilitate gene flow and movement of tigers between different habitats. This includes mitigating the impacts of linear infrastructure like highways on wildlife movement.</p> <p><b>Invasive Species Management:</b> Developing and implementing invasive species management plans to control the spread of invasive plants like <i>Mimosa diplotricha</i> and <i>Mikania micrantha</i>, which can negatively impact native habitats and wildlife.</p> <p><b>Collaborative Conservation Efforts:</b> Collaborating with other stakeholders, including government agencies, NGOs, and research institutions, to leverage resources and expertise for effective tiger conservation in the landscape.</p> <p><b>Long-term Funding and Institutional Support:</b> Ensuring sustained funding and institutional support for tiger conservation initiatives in the Parambikulam Tiger Reserve to maintain long-term conservation efforts and achieve conservation goals.</p>
2014	<ul style="list-style-type: none"> <li>145.76 km of core area not part of the national park or sanctuary, designated as reserve forest.</li> <li>252.77 km in the buffer area not under administrative control of the TR.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>No buffer zone in the northern part of the TR.</li> <li>Presence of six tribal settlements surrounded by core area, compromising inviolate status.</li> <li>Unregistered gun license holders in a 10 km radius of the protected area.</li> <li>Lack of professional courses in wildlife management for frontline staff, except for DD, Wildlife Education.</li> <li>Insufficient information on distribution status of unique/rare species; lacking monitoring protocols.</li> <li>Potential increase in visitors to the temple posing threats to the TR.</li> <li>Tribal tradition of bringing dogs into the forests may spread diseases to wild animals.</li> <li>Uncontrolled collection of Non-Timber Forest Products (NTFP) from the buffer zone.</li> <li>Cultivation of ganja reported in remote forest areas.</li> </ul>		
2018	<p><b>Unprotected Core Area:</b> A significant portion (145.76 sq. km.) of the total core area (390.89 sq. km.) is not a part of the national park or sanctuary, making it mostly unprotected and vulnerable.</p> <p><b>Limited Protected Buffer Area:</b> Only 3987 sq. km. out of the total buffer area (252.77 sq. km.) is protected, leaving 212.90 sq. km. unprotected. This poses a threat to the integrity of the buffer zone.</p> <p><b>Lack of Unified Administrative Control:</b> The core and buffer areas are not under the unified</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p>administrative control of the Field Director, leading to potential challenges in coordinated management efforts. The buffer is spread over three forest divisions, and a part of the northern portion lacks proper buffering.</p> <p><b>Insufficient Wildlife Management Training:</b> Field staff lack formal training in wildlife management, with only some short-term, in-house training programs being conducted. This gap in training may impact the effectiveness of conservation efforts.</p> <p><b>Challenges in Regulating TITFP Collection:</b> Dependence of fringe village communities on TITFP (presumably Non-Timber Forest Products) collection from reserve areas poses a major issue. Regulating this activity is a challenge, potentially leading to unsustainable resource extraction and human-wildlife conflicts.</p>		
2022	<ul style="list-style-type: none"> <li>Inaccessibility during monsoon due to hilly terrain and thick vegetation.</li> <li>Power lines and tar roads in core area causing disturbance and man-animal conflicts.</li> <li>Invasions of woody/exotic species into grasslands affecting prey base support.</li> <li>Non-registration of licensed arms holders poses a threat to sandalwood and fauna.</li> <li>Lack of buffer on northern and western sides may have future adverse impacts.</li> <li>Large administrative units and inadequate staff affecting protection and management.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Staff without wildlife management orientation is a concern for effective management.</li> <li>Landlocked status, surrounded by Tamil Nadu, creates access challenges for Field Director.</li> <li>Inadequate communication facilities and poor mobile network hinder emergency response.</li> <li>Poor infrastructure and camping facilities impacting tiger reserve management.</li> <li>Long inter-state boundary, private estates, and sandalwood smuggling affecting flora and fauna protection.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- It is advisable that immediate steps be taken to ensure the protection of the entirety of the core area, including areas designated as reserve forests but not under the jurisdiction of the national park or sanctuary.
- Increasing efforts to protect the buffer zone by extending administrative control and implementing effective management strategies is recommended. This includes addressing areas currently not under protection and regulating human activities to minimize negative impacts on wildlife.
- Working towards establishing unified administrative control over both core and buffer areas is suggested to streamline management efforts and improve coordination among different forest divisions.
- Providing comprehensive and formal training programs in wildlife management for frontline staff is recommended to enhance their capacity in conservation and protection efforts.
- It is advised to develop and enforce regulations to control the collection of Non-Timber

Forest Products (NFTP) from reserve areas to ensure sustainability and minimize human-wildlife conflicts.

- f. Measures to mitigate habitat disturbances such as power lines, tar roads, and invasive species encroachment are recommended to minimize disruptions to wildlife and reduce human-animal conflicts.
- g. Investing in infrastructure development and camping facilities within the reserve is suggested to support effective management and enhance visitor experiences while ensuring minimal impact on wildlife habitats.
- h. Improving communication facilities and network coverage within the reserve is advisable to enable swift emergency responses and better coordination among staff members.
- i. Collaborating with neighboring states to address challenges related to sandalwood smuggling, private estates, and cross-border wildlife protection is recommended to ensure comprehensive conservation efforts across borders.
- j. Addressing staffing shortages and enhancing the capacity of existing staff members through training and incentives is advisable to improve protection and management efforts within the reserve.

## 5. Conclusions

In conclusion, the Parambikulam Tiger Reserve stands as a crucial bastion for biodiversity conservation within the southern Western Ghats of India. Through ongoing monitoring efforts and assessments, significant strides have been made in understanding the dynamics of its tiger population over the years. Despite notable achievements, challenges persist, ranging from habitat disturbances to staffing shortages and regulatory gaps. However, the dedication to conservation evidenced by the continuous monitoring, identification of weaknesses, and recommendations for improvement underscores a commitment to safeguarding this ecologically significant landscape. By addressing these challenges and implementing key management suggestions such as enhancing core area protection, strengthening buffer zone management, and investing in staff training and infrastructure, Parambikulam Tiger Reserve can further solidify its role in preserving the region's biodiversity and ensuring the long-term survival of its iconic tiger population. Through collaborative efforts and sustained commitment to conservation, Parambikulam can continue to thrive as a beacon of biodiversity in the heart of the Western Ghats.

## 1. Brief Description

Periyar Tiger Reserve (PTR) in Kerala spans 925 km<sup>2</sup>, making it the largest continuous forest block in the southern Western Ghats. Established in 1950, it became a Project Tiger reserve in 1978, officially named Periyar Tiger Reserve. With 777 km<sup>2</sup> designated as the Periyar Wildlife Sanctuary Proper, and an additional 148 km<sup>2</sup> in the Goodneikal Range, PTR's core area was identified as Critical Tiger Habitat in 2007. The reserve boasts three major reservoirs—Periyar Lake, Pampa, and Kakki—alongside 288 artificial waterholes for wildlife sustenance. Notably, PTR is devoid of settlements or human interference in its core zone. Successful eco-development programs engage local communities in reserve management, aided by a skilled administrative staff. The reserve's extensive infrastructure supports protection, ecotourism, education, and communication objectives. Rich in biodiversity, PTR has been a focal point for numerous scientific research projects, contributing to a profound understanding of its ecosystems. The reserve operates in a culture valuing literacy and environmental awareness, garnering media coverage and public acclaim for its initiatives. The Periyar Tiger Conservation Foundation (PTCF) plays a pivotal role, providing essential expertise and technical assistance for scientific monitoring of tigers and their habitats.

## 2. Tiger Population as per All India Tiger Estimation

In 2006, estimated population was of 23 (SE range: 20 to 27) tigers. In 2010, 10 individuals were identified in Periyar Tiger Reserve with the population estimate of 12 tigers in the reserve. A total of 261 camera trap stations were set up in 2014 and sampled simultaneously over 109 sampling occasions accounting for cumulative sampling 2 effort of 28449 trap nights. 22 individual tigers were identified in 2014 with population estimate of 20 tigers. A total of 390 camera traps were deployed in Periyar Tiger Reserve in 2018, yielding 498 tiger detections (including one image of cub) from which 26 individual tigers were identified. Camera trapping was carried out by the forest department, with an effort of 9758 trap-nights. Total of 1220 tiger images were obtained from which 30 tiger individuals were identified. Tiger density was estimated at 1.43 (SE 0.27) tiger per 100 km<sup>2</sup>.

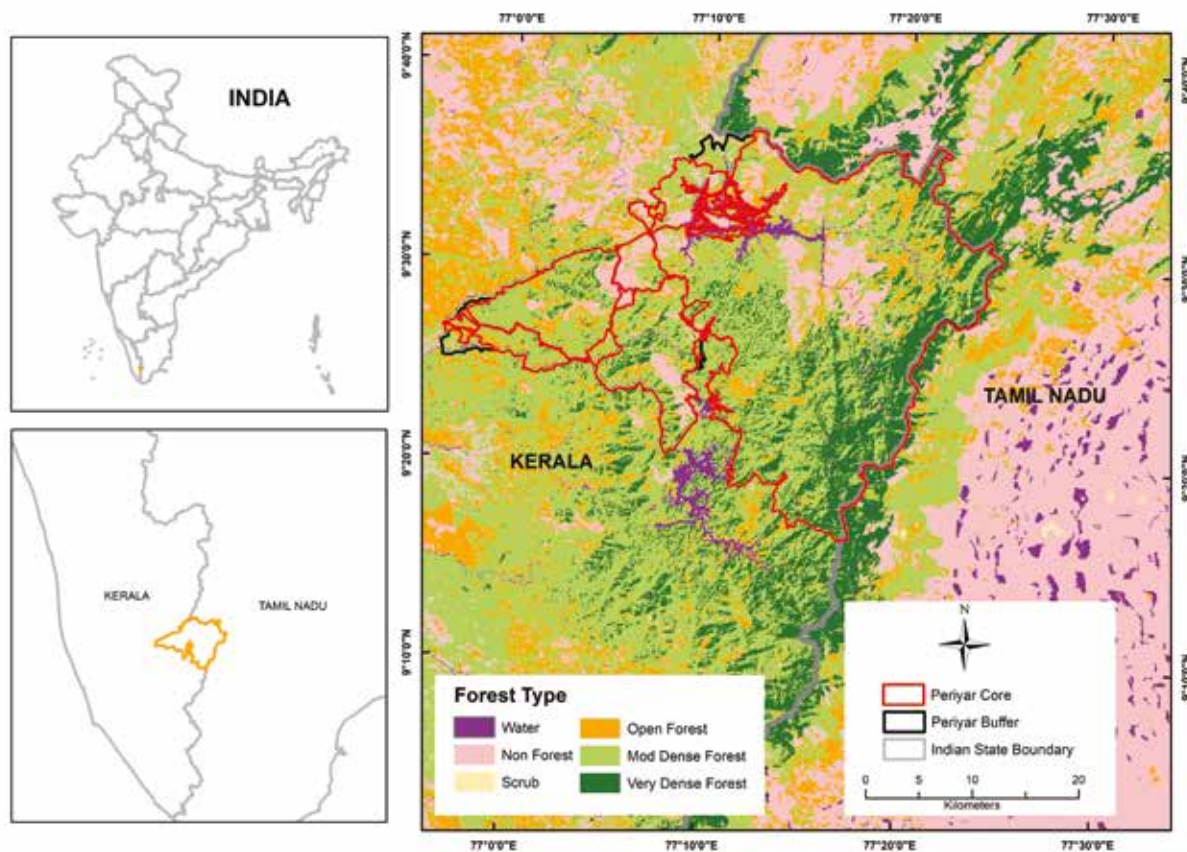


Figure 1: Map showing the location of Periyar Tiger Reserve in the state of Kerala.

### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<p><b>Delineation of Buffer Zone:</b> Unified control of the buffer is not fully achieved, pointing to potential challenges in coordinated management efforts.</p> <p><b>Compatible Land Use:</b></p> <p><b>Human Pressure:</b> Although some aspects score well, there are concerns about livestock grazing pressure within the core area and adjoining regions.</p> <p><b>Management Plan Updated:</b> While the score is good, ongoing efforts for regular updates are essential for effective conservation.</p>	<p><b>Inaccessible Interior During Monsoon:</b> Interior of the reserve becomes inaccessible due to difficult terrain, especially during the monsoon. Hampers effective patrolling and management.</p> <p><b>Spread of Invasive Woody Species and Weed Infestation:</b> Presence of invasive woody species in grasslands and progressive weed infestation. Requires habitat amelioration efforts in specific areas.</p>	<ul style="list-style-type: none"> <li>Potential to enhance tigers south of the Palghat gap exist in the Parambikulam Anamalai complex as well as in Periyar.</li> <li>Habitat connectivity seems to be of concern between Parambikulam-Anamalai Tiger Reserves and Periyar Tiger Reserve in the southern population.</li> <li>Strengthen the protection regime in Periyar Tiger Reserve through the implementation of foot patrolling with M-STriPES (Monitoring System for Tigers' Intensive Protection and Ecological Status).</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<p><b>Regeneration Status in the Core and Buffer:</b> Regeneration status in the core is satisfactory, but there may be areas for improvement in the buffer.</p> <p><b>Staffing and Equipment:</b> The average age of staff, the number of staff in position, and equipment availability score less than maximum, indicating potential challenges.</p> <p><b>Strike Force Availability:</b> While satisfactory, there is a suggestion to establish additional camps along the Tamil Nadu border.</p> <p><b>Disbursement of Salary/Project Allowance/TA:</b> Ongoing efforts are noted, but improvements may be needed.</p> <p><b>Field Data Collection &amp; Research:</b> The score indicates some discrepancies, suggesting a need for better adherence to established guidelines.</p> <p><b>Field Staff Training:</b> Not all field staff have undergone professional training, indicating a gap in skills.</p> <p><b>Weed Growth in the Habitat:</b> There is evidence of weed presence, suggesting habitat amelioration is required in specific areas.</p>	<p><b>Shortage of Funds:</b> Financial constraints exacerbated by a decline in tourist flow. Impact from the 2018-19 Kerala floods and the subsequent COVID-19 pandemic.</p> <p><b>Tourism Impact:</b> Safety concerns during nature walks, especially in areas prone to encounters with elephants and gaurs. Though biotic pressure from tourism reduced, safety remains an issue.</p> <p><b>Biotic Pressure from Sabarimala Pilgrimage:</b> Annual pilgrimage to Sabarimala temple (1-1.5 crore devotees) exerts substantial biotic pressure. Significant impact on natural resources within the core area.</p> <p><b>Boundary Porosity and Illegal Entry Points:</b> Challenge with a porous interstate boundary. Approximately 90 km long border with Tamil Nadu has 18 illegal entry points.</p>	<ul style="list-style-type: none"> <li>Shift management focus beyond tigers and adopt a holistic approach that considers the conservation needs of various species and ecosystems, recognizing the high biodiversity values in Periyar.</li> <li>Implement strategies to improve prey density in the forests, acknowledging its critical role in influencing tiger density.</li> <li>Undertake habitat management practices supporting the natural prey base for a sustainable ecosystem.</li> <li>Emphasize the importance of maintaining a viable tiger population in the landscape for the long term and implement landscape-level conservation initiatives beyond reserve boundaries.</li> <li>Adopt an integrated wildlife management approach, considering the ecological needs of all species in the ecosystem.</li> <li>Collaborate with wildlife experts, researchers, and conservation organizations to develop and implement comprehensive management plans.</li> <li>Involve local communities in conservation efforts to promote understanding and support for biodiversity-centric management.</li> </ul>



MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006			<ul style="list-style-type: none"> <li>• Establish community-based conservation initiatives to create shared responsibility for wildlife and habitat protection.</li> <li>• Invest in research initiatives to understand the dynamics of biodiversity in the Periyar Tiger Reserve.</li> <li>• Implement effective monitoring programs to assess the impact of conservation efforts on tiger and prey populations, enabling adaptive management strategies.</li> <li>• Mimosa diplotricha, Mikania micrantha occurred in priority management areas in Periyar. It should be systematically managed.</li> <li>• Periyar and KMTR landscapes</li> <li>• harbor tiger populations with essential connectivity between them, ensuring gene flow and future expansion. Preserving and restoring these wildlife corridors in the Western Ghats are vital for the continued survival and thriving of the region's diverse wildlife.</li> <li>• One of the conservation issues which need immediate focus and resolution is the proliferation of invasive species in the Shola grasslands and around the Periyar lake, which are prime habitat for faunal diversity in the reserve.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006			<ul style="list-style-type: none"> <li>• The unregulated pilgrimage to the temples situated inside the Tiger Reserve, during certain times of the year.</li> <li>• Management issues due to conflicts between state boundaries is also a conservation impediment</li> <li>• Tiger density in Periyar tiger reserve has been consistently low since the previous cycles [1.2 (0.26 SE) in 2014 and 1.38 (0.29 SE) in 2018, Jhala et al. 2015 and 2020].</li> </ul>
2010	<p><b>Grasslands under Exotic Eucalyptus Plantations:</b> Significant grassland area occupied by exotic eucalyptus plantations.</p> <p><b>Stagnation in Ecodevelopment Program:</b> Ecodevelopment program facing challenges, particularly second-generation issues.</p> <p><b>Small and Unnotified Buffer Zone:</b> Buffer zone is small and yet to be officially notified.</p> <p><b>Lack of Active Wildlife Management in Adjoining Landscape:</b> Adjoining areas in the landscape are not actively managed for wildlife interventions.</p> <p><b>Ongoing and Proposed Developments in Shingotta Gap:</b> Shingotta Gap faces ongoing and proposed developments, posing a threat to the area.</p> <p><b>Inadequate Systems for Sabarimala Pilgrimage Area:</b> Inadequate management systems for the Sabarimala pilgrimage area.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<p><b>Inaccessibility During Monsoon:</b> The reserve becomes inaccessible during the monsoon, limiting patrolling efforts.</p> <p><b>Unprotected Core Area:</b> A portion of the notified core area (148 km) is not part of any wildlife sanctuary/ national park, lacking protection.</p> <p><b>Limited Buffer Area:</b> Only 44 km is designated as the buffer area, excluding significant portions of adjacent forest divisions, compromising core-buffer integration.</p> <p><b>Infestation of Woody Species:</b> Grasslands and vayals are progressively infested with woody species.</p> <p><b>Spread of Invasive Alien Species:</b> Invasive alien species (exotic weeds) are spreading progressively into the reserve.</p> <p><b>Unregistered Licensed Gun Holders:</b> Licensed gun holders within 10 km of the boundary are not registered.</p> <p><b>Biotic Pressure during Carnivals:</b> Biotic pressure during Sabarimala and Mangaladevi carnivals needs better control.</p> <p><b>Uncontrolled NTFP Collection:</b> Collection of Non-Timber Forest Products (NTFP) by forest-dependent communities needs better control.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<p><b>Water Holes Paucity:</b> Water holes at hilltops face scarcity during critical periods.</p> <p><b>Lack of Information on Lower Flora and Fauna:</b> Information about lower groups of flora and fauna is lacking from a managerial standpoint.</p>		
2018	<p><b>Boundary Porosity and Illegal Entry Points:</b> The reserve faces a challenge with a porous interstate boundary, approximately 90 km long, with Tamil Nadu, which has 18 illegal entry points.</p> <p><b>Land Use and Encroachment:</b> A portion (148 sq. km.) of the core area was carved out from Ranni Forest Division, which is not part of any protected area network. Additionally, the presence of Pachakanam, a private estate and a plantation, within the core area poses a threat to the reserve's integrity.</p> <p><b>Inaccessibility During Monsoon:</b> Many parts of the reserve become inaccessible during the monsoon, making foot patrolling extremely difficult.</p> <p><b>Invasive Species:</b> The spread of invasive species, particularly Lantana Camara, in grasslands and vayals (bolds) poses a significant threat to the natural ecosystem.</p> <p><b>Biotic Pressure from Sabarimala Pilgrimage:</b> The annual pilgrimage to the Sabarimala temple, located inside the core area, by a large number of devotees (1-1.5 crore) exerts substantial biotic pressure on the natural resources of the reserve.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p><b>Non-Adherence to Sabarimala Master Plan:</b> The non-adherence to the Sabarimala Master Plan by the Travancore Devaswom Board further threatens the ecology of the Tiger Reserve.</p> <p><b>Tourism Impact:</b> Although the biotic pressure from tourism has reduced considerably, there is still concern about the safety of tourists during nature walks, especially in areas with a high likelihood of encounters with elephants and gaurs.</p> <p><b>Lack of Registered Gun Holders Information:</b> Licensed gun holders within 10 km from the boundary of the protected area are not registered with the Tiger Reserve authorities.</p> <p><b>Lack of Alternate Livelihood Provisions:</b> Around 5000 people belonging to various tribes depend on the reserve for their livelihoods. Action is needed to provide them with alternate livelihood provisions while preserving their eco-cultural association with the forest.</p> <p><b>Potential Impact of Mullaperiyar Dam Proposal:</b> There is a proposal to increase the height of the Mullaperiyar dam, and contingency plans should be prepared to face and mitigate any adverse impacts on the Periyar Tiger Reserve.</p> <p><b>Staff Training and Infrastructure:</b> An exclusive Human Resource Development (HRD) plan is needed to train the entire frontline staff in wildlife management and protection. Additionally, there is a plan for reorganization of the ranges and the establishment of 18 more Anti-poaching camps (APCs) at vulnerable points, which needs prompt implementation.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<p><b>Biological Pressure from Sabarimala Pilgrimage:</b> Significant biological pressure during the Sabarimala pilgrimage, affecting up to 1 crore people over a 2-month season.</p> <p><b>Inaccessible Interior during Monsoon:</b> The reserve's interior becomes inaccessible due to difficult terrain, particularly during the monsoon.</p> <p><b>Spread of Invasive Woody Species and Weed Infestation:</b> Presence of invasive woody species in grasslands and infestation by weeds like Lantana.</p> <p><b>Shortage of Funds:</b> Financial constraints, exacerbated by a decline in tourist flow following the 2018-19 Kerala floods and the subsequent impact of the COVID-19 pandemic.</p>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- It is suggested that efforts aimed at achieving unified control of the buffer zone while addressing potential challenges in coordinated management be strengthened. Implementation of a comprehensive buffer zone management plan could significantly enhance ecological integrity.
- Consideration should be given to the development and enforcement of strategies to manage livestock grazing within the core area and adjoining regions. Regular assessment and adjustment of grazing policies can help maintain a balance between conservation and sustainable land use practices.
- Regular updates to the management plan are recommended for effective and adaptive conservation strategies. Incorporation of the latest scientific findings and technological

advancements into the management plan can enhance its effectiveness.

- d. Focus should be placed on areas for improvement in the buffer zone's regeneration status, with an emphasis on habitat enhancement. Implementation of habitat amelioration efforts in specific areas can help control invasive species and encourage natural regeneration.
- e. Potential challenges in staffing, average staff age, and equipment availability should be addressed. Establishment of a Human Resource Development Plan, including regular training programs and skill enhancement for all staff members, could be beneficial.
- f. Consideration should be given to the establishment of additional patrolling camps along the Tamil Nadu border to strengthen protection. Ensuring the availability and effectiveness of strike forces for immediate response to poaching threats is essential.
- g. Robust financial strategies should be developed to address the shortage of funds exacerbated by a decline in tourist flow. Exploration of diverse funding sources, partnerships, and sustainable tourism initiatives for consistent revenue may be beneficial.
- h. Investment in research initiatives to understand biodiversity dynamics, particularly lower groups of flora and fauna, is advisable. Implementation of effective monitoring programs can help assess the impact of conservation efforts on tiger and prey populations.
- i. Local communities should be involved in conservation efforts to create shared responsibility for wildlife and habitat protection. Establishment of community-based conservation initiatives, considering the eco-cultural association of tribes with the forest, could foster greater involvement.
- j. Collaboration with neighboring tiger reserves, such as the Parambikulam-Anamalai complex, for habitat connectivity and gene flow is recommended. Resolution of management conflicts arising from state boundaries through collaborative efforts may prove fruitful.
- k. Consideration should be given to shifting the management focus beyond tigers to adopt a holistic approach considering various species and ecosystems. Collaboration with wildlife experts, researchers, and conservation organizations for comprehensive management plans could be beneficial.
- l. Implementation of strategies to manage biotic pressure from tourism, especially during Sabarimala pilgrimage and nature walks, should be considered. Ensuring adherence to the Sabarimala Master Plan and addressing safety concerns for tourists is advisable.
- m. It is suggested to systematically manage invasive species like *Mimosa diplotricha* and *Mikania micrantha* in priority areas. Prioritization of the removal of invasive woody species, particularly *Lantana Camara*, in grasslands and vayals can help preserve native ecosystems.
- n. Preservation and restoration of wildlife corridors between Periyar and KMTR landscapes for gene flow and biodiversity conservation are recommended. Undertaking habitat management practices supporting the natural prey base can contribute to a sustainable

ecosystem.

- o. Monitoring and mitigation of the impact of ongoing and proposed developments in critical areas like Shingotta Gap are crucial. Development of contingency plans for potential adverse impacts of the Mullaperiyar Dam proposal on the reserve is advisable.
- p. Emphasis on adaptive management strategies, regular reassessment, and adjustment of conservation plans based on monitoring results are recommended. Implementation of an institutionalized mechanism for efficient complaint/grievance redressal and feedback review can enhance conservation efforts.
- q. Development and implementation of specific plans to assess and adapt to the impacts of climate change are advisable. Integration of climate change guidelines into the Tiger Conservation Plan ensures carbon capture without compromising wildlife conservation objectives.
- r. Encouragement of all licensed arms within 10 km of the reserve boundary to be registered as per WL (P) Act, 1972 is recommended. Strengthening efforts to quickly convict offenders involved in poaching incidents through rigorous legal pursuit is advised.
- s. Expediting the notification of eco-sensitive zones under the Environment Protection Act to regulate tourism and developmental activities, ensuring the protection of sensitive ecosystems, is recommended.
- t. Conducting a thorough study of hilltops to determine water availability and animal presence is suggested. Implementation of management interventions to improve habitat and water sources based on the study's findings is advisable.
- u. Strengthening of the protection regime by implementing foot patrolling with M-STrIPES for intensive protection and ecological status monitoring is recommended. This can enhance surveillance and protection of the reserve's biodiversity.
- v. Effective implementation of the Sabarimala Master Plan, addressing concerns, and optimizing conservation measures are advisable. Collaboration with stakeholders to ensure alignment with conservation objectives is recommended.
- w. Timely registration of licensed arms within the stipulated distance of the Tiger Reserve boundary as per WL (P) Act, 1972 is advisable. This measure can help regulate firearm possession and enhance wildlife protection efforts.

## 5. Conclusions

Periyar Tiger Reserve faces multifaceted challenges, including boundary porosity, invasive species, and tourism pressures. Despite persistent efforts, issues like livestock grazing and outdated management systems persist. The recommendations emphasize unified buffer zone control, community engagement, and robust financial strategies. Implementing these measures is crucial for sustained conservation, biodiversity protection, and fostering a harmonious coexistence between the reserve and local communities. A proactive approach, incorporating modern technology, community involvement, and adaptive management, is essential to secure the long-term ecological integrity of Periyar Tiger Reserve.

## BANDHAVGARH TIGER RESERVE

## 1. Brief Description

Bandhavgarh Tiger Reserve, situated in the central Indian highlands between the Vindhya and Satpura mountain ranges, spans an area of 1536.938 km<sup>2</sup>, including Bandhavgarh National Park and Panapata Wildlife Sanctuary. Its rugged terrain features small hillocks and grassy swamps, hosting diverse vegetation such as moist peninsular low-level Sal and dry deciduous scrub. Home to various species of birds, butterflies, and reptiles, the reserve's major carnivores include tigers, leopards, sloth bears, and wild dogs. Prey species like chital, sambar, and gaur are present, with gaur reintroduced in 2011 from Kanha Tiger Reserve. Bandhavgarh serves as a significant source population for tigers and emphasizes the importance of forest corridor connectivity with neighboring reserves for tiger movement and meta-population maintenance.

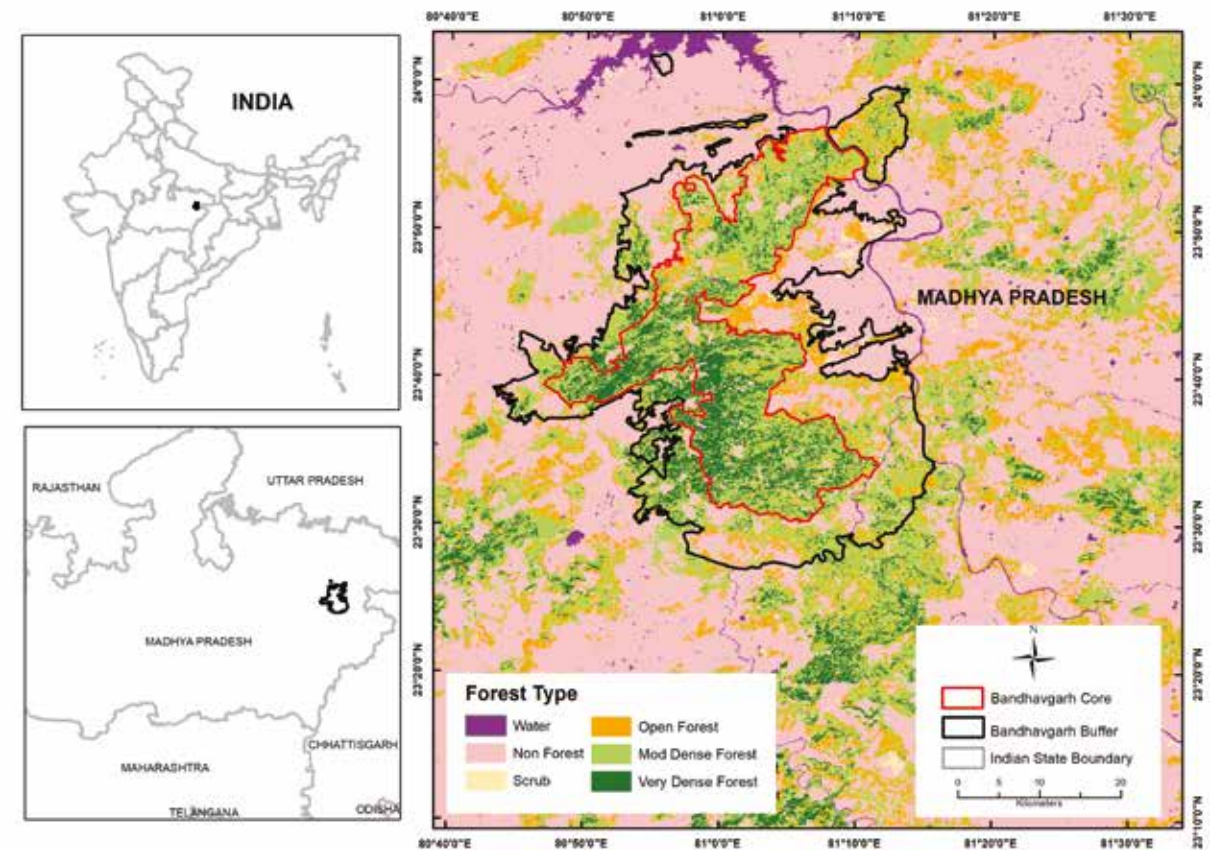


Figure 1: Map showing the location of Bandhavgarh Tiger Reserve in the state of Madhya Pradesh.

## 2. Tiger Population as per All India Tiger Estimation

The Bandhavgarh landscape, covering 2000 km<sup>2</sup>, has been a significant habitat for tigers over the years. In 2006, the tiger population was reported at 47 ( $\pm 1$ , SE range 37-57) individuals, followed by 59 (SE range: 47-71) in 2010 and 63 (SE range: 55-71) in 2014. A substantial camera trapping effort in 2018, involving 216 stations and 62 sampling occasions totaling 12836 trap nights, resulted in the identification of 124 tigers within the reserve and an estimated 104 individuals. During this sampling period, 1316 tiger detections were recorded, with a density estimate of 5.83 (SE 0.57) tigers per 100 km<sup>2</sup>. The detection-corrected sex ratio indicated a bias towards females. By 2022, the tiger population within the reserve increased, with 135 tigers directly identified and 165 utilizing the reserve. In 2022, a comprehensive camera trapping effort of 20138 trap nights yielded 4300 tiger photos, identifying 134 individual tigers (>1 year) and estimating a density of 7.5 (SE 0.65) tigers per 100 km<sup>2</sup>. Additionally, the detection-corrected tiger sex ratio in Bandhavgarh was found to be 1.76 females per male.

## 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>Panpatha Wildlife Sanctuary, notified in 1983, and the proposed extended area of Bandhavgarh National Park are still pending final notification.</li> <li>Despite the identification and delineation of a 462.685 km<sup>2</sup> buffer area for the TR and the submission of a proposal to the CWLE in July 2004, it has not yet been notified as a buffer, and control remains under the respective territorial divisions of Umeria and Katni.</li> <li>Continued grazing and NTFP collection by villagers persist unabated in the proposed National Park extension and Wildlife Sanctuary, leading to widespread degradation in the surrounding areas, buffer zone, and beyond, with no compatible land-use practices in place.</li> </ul>	<ul style="list-style-type: none"> <li>Unabated grazing and collection of NTFP by villagers in proposed park extensions and wildlife sanctuaries lead to widespread degradation with no compatible land-use practices.</li> <li>Presence of villages in the national park and wildlife sanctuary exerts significant pressure on core areas, affecting tiger habitat continuity.</li> <li>Insufficient frontline staff, aged workforce, and lack of dedicated strike force compromise effective protection.</li> <li>High traffic on state highways within the TR hinders wildlife movements and leads to accidents.</li> </ul>	<ul style="list-style-type: none"> <li>Bandhavgarh Tiger Reserve, with its high ungulate biomass and consequent high tiger density, serves as a vital source of dispersing tigers to neighboring protected areas, such as Achanakmar, Sanjay-Dubri, and potentially Palamau, playing a crucial role in their recovery; however, in recent months, the presence of around 45 wild elephants, including breeding females and calves, entering from adjoining Chhattisgarh forests, underscores the need for conservation strategies not only for tigers but also for the protection of these newly resident elephants in the reserve.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>Six villages in the National Park, and eight villages in the Wildlife Sanctuary, exert significant pressure on the core area, while the delineated buffer zone, comprising 61 villages, faces substantial livestock grazing pressure. In the proposed National Park extension and Wildlife Sanctuary, a total of 10,042 cattle, along with cultivation in specific areas, contribute to substantial pressure on the TR, while there are four ongoing cases of encroachment involving 1.6 hectares of forest land, triggering eviction notices.</li> <li>Activities in the buffer areas closely resemble operations in the territorial Forest Divisions, marked by ongoing exploitation of all forest resources, leading to a significant level of degradation.</li> <li>Two highways, namely Umeria-Rewa and Katni-Parasi-Tale, traverse through the Tiger Reserve for a significant distance.</li> <li>Preparation of the management plan has been delayed significantly but is back on the track under the leadership of the present Field Director.</li> <li>Regeneration in the Buffer Area is generally poor due to free grazing and the collection of fuel and fodder, especially in the vicinity of villages located in the core area.</li> </ul>	<ul style="list-style-type: none"> <li>Annual visitor numbers exceeding 100,000 since 2008 pose threats to tiger dispersal opportunities, with increased conflicts and insufficient protection measures.</li> <li>Crop damage compensation delays cause resentment among villagers, impacting human-wildlife conflict management.</li> <li>Minimal progress in eco-development initiatives and challenges in fund release hinder community support and conservation efforts.</li> <li>Expansion of the tourism zone beyond recommended limits raises concerns about habitat disturbance and visitor safety.</li> <li>Absence of an approved Tiger Conservation Plan for 15 years hampers strategic conservation efforts.</li> <li>Growing elephant population poses threats to human safety; integration as a conservation priority is lacking.</li> <li>Grassland nutritional capacity reduction due to invasive species infestation requires urgent attention.</li> <li>Revenue department handling crop compensation leads to delays and discontent among villagers.</li> <li>Delays in fund release hinder timely implementation of crucial management initiatives.</li> <li>Inadequate communication equipment impacts patrolling effectiveness and timely response to incidents.</li> </ul>	<ul style="list-style-type: none"> <li>The recovery of low-density tiger reserves depends significantly on the importance of the Bandhavgarh-Sanjay-Guru Ghasidas-Palamau Corridor, while the connectivity between tiger habitats in Kanha-Bandhavgarh and Bandhavgarh-Noradehi-Satpuda is essential for maintaining a meta-population framework and genetic exchange, necessitating restoration initiatives and meticulous management to ensure seamless movement permeability.</li> <li>Control measures for the limited invasion of <i>Mesosphaerum suaveolens</i>, <i>Senna tora</i>, <i>Xanthium strumarium</i> should be implemented promptly to prevent it from becoming widespread.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>The field staff situation in the Tiger Reserve is inadequate, with 66 beats, 6 check posts, and an additional 6 posts required for tourism regulation. Only 60 posts are sanctioned, and the average age of the staff is approximately 50 years.</li> <li>Each range in the Tiger Reserve should have at least one vehicle.</li> <li>There is no dedicated strike force; however, an ad-hoc arrangement is formed when needed. The Field Director can assemble and train field staff as a strike force for intelligence collection when required.</li> <li>There has been minimal in-house research or field data collection conducted thus far.</li> <li>The convergence of tourist vehicles during tiger shows in the Tala range poses a safety risk, as demonstrated by a recent incident where an injured tigress mauled a visitor. Potential solutions may involve reviewing and limiting the frequency of such shows, considering the safety of both visitors and tigers, and exploring alternative safari options like elephant-backed tours on non-show days. While influential Hotel and Resort owners attempt to assert their influence, the current Field Director has been partially successful in mitigating this impact.</li> </ul>	<ul style="list-style-type: none"> <li>Failure to integrate TR into the broader landscape impedes effective conservation and connectivity efforts.</li> <li>Limited awareness efforts persist, hindering community engagement and support.</li> </ul>	

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>The Field Director and other officers lack training in wildlife courses.</li> <li>The areas surrounding the village within the core area are degraded and lack cohesive woodlands.</li> <li>There is a possibility for more surprise visits by officers, especially in Ranges other than Tala Range, where biotic pressure is higher. The discovery of grazing cattle deep in the core area highlights the necessity for more intensive touring by officers.</li> <li>Managing the spill-over population from Tala range in the adjoining forest areas, including the designated buffer zone, is crucial for benefiting from regular breeding in Tala Range. Therefore, the immediate transfer of control and management of the buffer zone to the Field Director and prioritizing the relocation of villages is essential.</li> <li>Additional patrolling camps are required, especially in disturbed areas, to strengthen surveillance and address issues such as illegal grazing on the outer periphery.</li> <li>Patrolling should undergo close monitoring through surprise checks conducted by the Field Director and other officers, with a specific schedule drawn by Range Officers and higher-ranking officials for sensitive areas.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>Villages like Garhpuri inside the core and Bagdara, Gadawa, and Gohdi on the fringe exhibit significant degradation, emphasizing the necessity of relocating villages from the core area. Additionally, ecodevelopment programs should be expanded on a larger scale in other villages, with increased community involvement to address the declining expenditure on this crucial initiative.</li> <li>Awareness levels are limited, necessitating ongoing efforts to enhance awareness in the region.</li> <li>The short tenure of Field Directors in Bandhavgarh, influenced by resistance from resort owners and conflicting interests, contributes to marked differences in management practices compared to the adjoining Kanha Tiger Reserve.</li> <li>Coordination is currently lacking, hindering the alignment of development activities around the Tiger Reserve with ecodevelopment programs; the non-transfer of the designated buffer zone to the Tiger Reserve Management further complicates progress in this direction.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>Restorative efforts in the designated buffer zone are challenging without its handover to the Tiger Reserve Management, and broader landscape planning is essential for effective tiger management beyond the reserve; Madhya Pradesh, with the most Tiger Reserves and extensive forests, has a unique opportunity to lead in State Level Landscape Planning supported by the Government of India for comprehensive tiger conservation.</li> </ul>		
2010	<ul style="list-style-type: none"> <li>Buffer Zone is not under the administrative control of the Field Director, resulting in management challenges.</li> <li>Annual visitor numbers exceeding 100,000 since 2008 pose a threat to tiger dispersal opportunities, with a ring of resorts around the reserve causing conflicts.</li> <li>A deficiency of 33 forest guards and 10 mahawats impacts effective reserve protection.</li> <li>Complaints about crop damage must be recorded with the revenue department, leading to disenchantment as it is not their priority.</li> <li>Fourteen villages are situated inside the core, posing challenges to conservation efforts.</li> </ul>		



MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>The TR lacks an approved TCP by the NTCA, with urgent compliance required for the core area, and no efforts made for the buffer area and corridors. Develop and obtain approval from NTCA for comprehensive TCP covering the core area, buffer area, and corridors to ensure clarity in implementation.</li> <li>Review the extent of the core area utilized for tourism activities to ensure compliance with the latest guidelines, exploring phased tourism shifts to potential buffer areas like Panpatha and Dhamokar ranges.</li> <li>Strengthen wildlife monitoring efforts in the buffer zone to ensure proper and effective data collection.</li> <li>Electrocution of wild animals, including Tigers, in the forest areas adjoining the TR poses a grave threat, with four Tiger deaths reported in 2012-2013.</li> <li>The frequent transfer of Field Directors negatively impacts TR management, violating the Tripartite MOU and resulting in two transfers in the last two years.</li> <li>Four villages in Bandavgarh National Park and eight villages in Panpatha Wildlife Sanctuary, located in critical tiger habitat, cause significant biotic disturbance. Prioritize the relocation of 11 villages in critical tiger habitat, securing necessary funds from NTCA, and address concerns of villagers, including offering an escalated component to the relocation package.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Undertake eco-development initiatives to reduce villagers' dependence on the TR and rigorously address forest encroachments to improve the condition of the buffer zone.</li> <li>Implement forestry working in the buffer area followed by successful plantations of indigenous species, investigate reasons for past failures, and ensure vigilant management for future endeavors.</li> <li>Instances of human-wildlife conflicts are reported from the buffer and surrounding areas, leading to resentment among villagers, especially with delayed crop compensation cases.</li> <li>Heavy traffic on State Highways passing through the TR obstructs the movement of wild animals, causing accidents and wildlife casualties.</li> <li>Over 62 villages in surrounding areas exert intense human and cattle pressure on buffer zone forests, resulting in degradation, denudation, and inadequate restoration efforts.</li> <li>Upgrading and metalling of forest roads in the buffer range without TR management consent or assessment of compatibility with long-term conservation goals.</li> <li>Chain link fences along the core area boundary obstruct the movement of wild animals and may contribute to human-wildlife conflict incidents.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Debris from construction projects, such as stop dams, found dumped downstream, obstructing water flow and affecting drainage in the TR.</li> <li>Expansion of the tourism zone beyond the recommended limit, with approximately 28% of the core area opened for tourism activities. Address problems with the current online booking system for safaris, preventing issues like impersonation by tourists and false implications of tourist guides, making the system more transparent and accountable.</li> <li>Annual fairs at Sheshshaiya, Kabir Caves, and around Bandhavgarh fort attract large gatherings, contributing to potential disturbances in the TR.</li> <li>Despite significant biotic pressure, eco-development activities within the TR are minimal, with stakeholders, including EDCs, facing challenges in utilizing allocated funds</li> <li>Investigate reported encroachment by a renowned tourist resort on TR land, taking suitable actions to rectify the situation.</li> </ul>		
2018	<ul style="list-style-type: none"> <li>The MEE team observes that the TR predominantly concentrates on managing tiger conflicts and ex-situ conservation, with insufficient attention given to its potential role as a large source population in the broader landscape.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Although a TCP has been prepared, its approval by the NTCA is pending, awaiting corrections from the state. The management needs to address gaps in the TCP as highlighted by NTCA and work towards its approval.</li> <li>A plan should be formulated to integrate Bandhavgarh Tiger Reserve into the larger conservation landscape, ensuring connectivity with forests in Uttar Pradesh, Chhattisgarh, and Madhya Pradesh. Enhanced protection and conflict management are crucial for Bandhavgarh to function as a source population in the landscape.</li> <li>Ensure adherence to Standard Operating Procedures (SOPs) issued by NTCA when necessary.</li> <li>The core area still harbors 10 villages, including Gadhpuri, Bagdari, Saijwahi, Gangital, Kushmah, Kothiya, Bamera, Kaseru, Badwahi, and Baghaia, impacting the continuity of tiger habitat.</li> <li>The relationship between park management and villagers remains tumultuous, primarily due to human-wildlife conflicts. Develop and implement a comprehensive, long-term, and participatory plan for managing human-wildlife conflicts in the region.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Approximately 20% of frontline staff positions are reportedly vacant or ineffective, compromising protection systems. Inadequate communication equipment, such as wireless sets, adds to the challenges. Given the presence of people from hunting tribes in the surrounding districts, security threats to the park need consideration and proactive measures. Fill vacant positions of frontline staff for effective protection within the Tiger Reserve, especially in buffer areas.</li> <li>Take measures to address tourism pressures and regulate the proliferation of resorts around the Tiger Reserve.</li> <li>Reinforce the ongoing eco-development program to garner support from local communities for the Tiger Reserve.</li> <li>Strengthen issue-based research programs within the park. Additionally, systematically execute a weed eradication program.</li> <li>Document and disseminate the wildlife and cultural values of Bandhavgarh Tiger Reserve for better public awareness and understanding.</li> </ul>		
2022	<ul style="list-style-type: none"> <li>Bandhavgarh Tiger Reserve lacks an approved TCP even after 15 years of its declaration, and the current draft TCP is awaiting approval from the NTCA. The tiger reserve management should actively seek approval for the TCP from the NTCA.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>The tiger reserve is experiencing a growing population of elephants, posing potential threats to human safety as local communities are not accustomed to living alongside elephants. Integrate elephant management as a conservation priority, ensuring a single-channel mechanism for timely crop damage compensation through the forest department.</li> <li>Adopt a Zonal Master Plan for the tiger conservation landscape, akin to the model implemented in Satpura Tiger Reserve, rationalizing land use patterns.</li> <li>The infestation of grasslands with invasive species may diminish the nutritional carrying capacity for wild ungulates in the tiger reserve. Implement a priority grassland management plan with dynamic monitoring, integrating research institutions for cyclic weed eradication, and scientific planning.</li> <li>Compensation for crop losses is handled by the revenue department, leading to delays that result in resentment among villagers.</li> <li>Delays in fund release impede the park authorities from achieving targets related to grassland management, weed eradication, and other initiatives.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>High traffic volumes on the Umaria-Rewa and Paraxi-Khitauli state highways, passing through the Tiger Reserve, obstruct the movements of wild animals, contributing to instances of wildlife mortality.</li> <li>Regulate land use patterns hostile to tiger conservation in the landscape, applying legal provisions. Implement smart green technologies for mitigating road infrastructure impacts, ensuring landscape permeability for wildlife dispersal.</li> <li>Conduct regular security audits following NTCA protocols. Distribute arms and ammunition to frontline staff to enhance protection measures.</li> <li>Initiate a scientific study on carbon credits and sequestration to understand the tiger reserve's role in climate change mitigation and align with Sustainable Development Goals.</li> <li>Expand research collaborations on key management issues with national and international institutes, agencies, and universities.</li> <li>Strengthen the dissemination mechanism of relevant management information in the public domain.</li> <li>Increase awareness among stakeholders on garbage disposal, waste management, water harvesting, plastic pollution, and rights in the eco-sensitive zone.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- It is recommended to expedite the final notification of Panpatha Wildlife Sanctuary and the proposed Bandhavgarh National Park extension to bolster habitat protection and seamlessly integrate them into the reserve's management framework.
- Considering the management challenges posed by the lack of control over the designated buffer zone, it is advisable to transfer control to the Tiger Reserve management to ensure holistic and coordinated conservation efforts.
- To address habitat degradation resulting from continued grazing and resource collection by villagers, implementation of alternative livelihood programs and enforcement of stricter regulations on resource use within protected areas is advisable.
- Prioritizing the relocation of villages from critical tiger habitat, while offering fair compensation and sustainable livelihood alternatives, is recommended to alleviate pressure on tiger habitat.
- Implementation of land-use regulations compatible with tiger conservation in the buffer zone and promotion of sustainable practices among local communities can help mitigate resource exploitation and degradation.
- It is advisable to implement mitigation measures such as wildlife overpasses and underpasses along highways traversing the Tiger Reserve to ensure safe animal crossings and maintain landscape connectivity.
- To enhance patrolling effectiveness, recommendation includes filling vacant staff positions, providing modern communication equipment, and enhancing training for field staff.
- Establishment of a dedicated strike force within the Tiger Reserve for proactive intelligence gathering and enforcement actions is advised to enhance the response to poaching and wildlife crime.
- Developing and implementing a comprehensive human-wildlife conflict management plan, including awareness programs, compensation mechanisms, and deterrents, is advisable to minimize negative interactions.
- Advocacy for safer power line materials or underground cables in sensitive areas to prevent electrocution incidents is recommended to address the threat posed by power lines.
- Recommendation includes reviewing the extent of the core area used for tourism activities and considering phased shifts to buffer areas while adhering to tourism guidelines to mitigate disturbance and potential conflict with tigers due to high visitor numbers.
- Addressing problems with the online booking system for safaris to prevent abuse and ensuring transparency in tourist management is advisable to manage tourism zone

# KANHA TIGER RESERVE

- expansion beyond recommended limits.
- m. It is recommended to develop and obtain NTCA approval for a comprehensive Tiger Conservation Plan encompassing the core area, buffer zone, and corridors to guide effective management actions.
- n. Reinforcement of the eco-development program with increased funding and community participation to address villagers' dependence on the reserve is advisable to build support for conservation efforts.
- o. Streamlining of fund allocation and disbursement processes to ensure timely support for crucial conservation activities is recommended to address delays in releasing funds for management initiatives.
- p. Recommendation includes enhancing research efforts on key issues like wildlife populations, habitat use, and human-wildlife interactions within the reserve to overcome limitations in in-house research and field data collection.
- q. Expanding research collaborations with national and international institutions to improve knowledge sharing and address critical conservation challenges is recommended to overcome the lack of collaboration with research institutions and universities.
- r. Conducting regular security audits and distributing arms and ammunition to frontline staff for enhanced protection is advisable to ensure the security of the reserve and its wildlife.
- s. Initiation of studies on carbon sequestration and ecosystem services to highlight the reserve's value in climate change mitigation is recommended to emphasize its role in environmental conservation.
- t. Implementation of a comprehensive awareness program for stakeholders on waste management, water conservation, and responsible behavior within the eco-sensitive zone is advisable to promote sustainable practices and conservation awareness.

## 5. Conclusions

Bandhavgarh's thriving tiger population thrives due to its rich ungulate base, making it a crucial source for dispersing tigers into neighboring reserves like Achanakmar, Sanjay-Dubri, and potentially Palamau. The recent arrival of a wild elephant herd from Chhattisgarh further underscores the reserve's ecological significance. Protecting these newly arrived elephants alongside the resident tigers necessitates immediate implementation of tailored conservation strategies. Maintaining strong corridor connectivity with surrounding reserves like Sanjay-Dubri, Achanakmar, and Kanha is crucial for facilitating vital inter-reserve movement of tigers and other wildlife, promoting genetic exchange, and mitigating human-tiger conflict.

## 1. Brief Description

Kanha Tiger Reserve, located in Madhya Pradesh, is nestled within the Maikal hills of the Satpura range, spanning the Mandla and Balaghat districts. Its diverse landscape comprises flat hilltops, grassy expanses, dense forests, and riverine forests. Divided into core, buffer, and microsatellite core zones, Kanha boasts a rich variety of vegetation, including moist sal forests and miscellaneous forests. With over 600 species of flora and 36 mammal species, including iconic carnivores like tigers and leopards, Kanha supports a thriving ecosystem. Recognized for its conservation success under Project Tiger, Kanha plays a crucial role in preserving India's rich biodiversity.

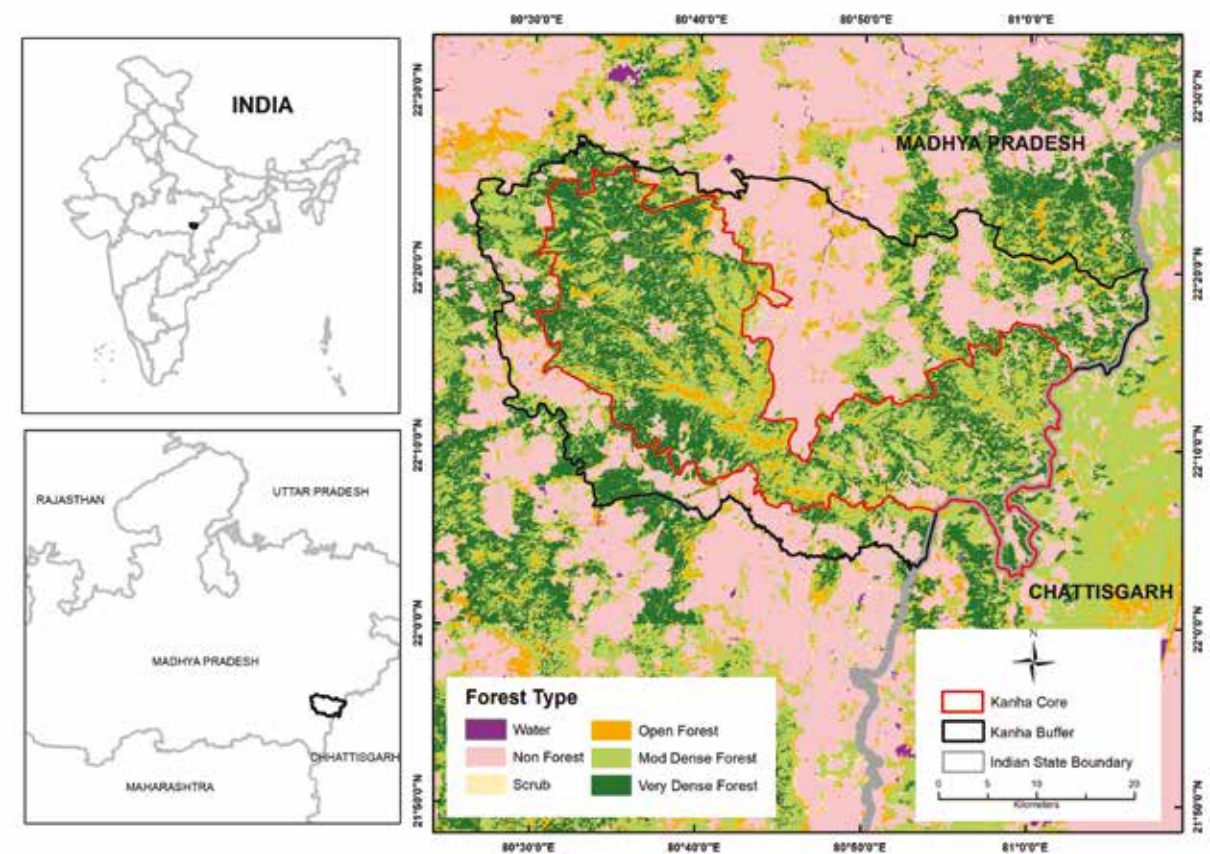


Figure 1: Map showing the location of Kanha Tiger Reserve in the state of Madhya Pradesh.

## 2. Tiger Population as per All India Tiger Estimation

In 2014, a total of 74 unique tigers were captured in the core area, and 20 in the buffer zone, resulting in a density of 6.10 tigers per 100 square kilometers in the core and 2.01 tigers per 100 square kilometers in the buffer. Moving to 2018, the sampling period yielded 1732 detections of tigers, from which 88 adult individuals were identified. The calculated tiger density in 2018 was 4.40 tigers per 100 square kilometers. By 2022, 105 individual tigers were identified, leading to a computed tiger density of 5.57 tigers per 100 square

kilometers. These findings underscore the fluctuations in tiger distribution and density over the years, emphasizing the importance of ongoing monitoring and conservation efforts by forest officials to ensure the well-being of the tiger population in both core and buffer areas.

### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>The Tiger Reserve management lacks the capability to ensure land use compatibility beyond the buffer zone. Without a comprehensive landscape plan for areas beyond the buffer zone, achieving compatibility remains unlikely. Wildlife concerns, habitat preservation, and the safeguarding of corridors and connectivity beyond the buffer zone are given minimal attention.</li> <li>Village relocation in the immediate vicinity of the NP has posed challenges for Park Management. It is now recommended that relocations should not be closer than 10 km from the PA boundary. The relocation program faces delays due to an unattractive package, necessitating an urgent revision to ensure timely implementation.</li> <li>The presence of around 10,000 cattle within the core villages and over 35,000 cattle in the buffer area creates significant pressure.</li> </ul>	<ul style="list-style-type: none"> <li>The Tiger Reserve management lacks the capability for land use compatibility beyond the buffer zone, emphasizing the need for a comprehensive landscape plan for areas beyond the buffer to address wildlife concerns, habitat preservation, and corridor connectivity.</li> <li>Village relocation near the NP faces challenges, necessitating a revision of relocation packages and a relocation distance not closer than 10 km from the PA boundary.</li> <li>Over 35,000 cattle in the buffer area and 10,000 in core villages exert significant pressure on Tiger Reserve resources.</li> <li>The public highway and electric lines inside the NP and buffer zone pose threats to wildlife, requiring strengthened measures for protection.</li> <li>Beyond the buffer zone, there is limited attention to safeguarding corridors and connectivity, demanding increased efforts for landscape planning and coordination.</li> </ul>	<ul style="list-style-type: none"> <li>The Kanha-Pench Corridor, Kanha-Navegaon-Tadoba-Indravati Corridor, and Kanha-Bandhavgarh, Kanha-Satpura corridors play crucial roles in connecting tiger habitats, but they necessitate restoration efforts and meticulous management to ensure seamless movement permeability.</li> <li>The tiger reserve faces a significant threat from the recent emergence of left-wing extremism, known to induce severe declines in wildlife populations.</li> <li>The invasion of <i>Ageratina Adenophora</i>, <i>Chromolaena odorata</i>, <i>Mesosphaerum suaveolens</i>, <i>Mikania micrantha</i>, <i>Parthenium hysterophorus</i>, and <i>Prosopis juliflora</i> is in the initial stage, highlighting the urgency for its high-priority removal before it establishes itself in a larger area.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>A public highway stretching 28 km inside the NP and 20 km through the buffer zone is utilized by various vehicles and pedestrians throughout the year. Additionally, approximately 231.60 km of electric lines (201.60 km<sup>2</sup> in the buffer zone and 30 km in the NP) pose a threat to wildlife, making several areas within the Reserve susceptible to electrocution.</li> <li>Extend landscape planning beyond the buffer to safeguard existing corridors and connectivity in forest areas. Coordinate the working plans of adjoining Forest Divisions with the Tiger Reserve's Management Plan to ensure compatibility of land use beyond the buffer zone.</li> <li>Regeneration in the Buffer Area is generally good, except for areas near human habitations where degradation has occurred.</li> <li>The potential exploitation of changed tiger behavior by illegal trappers and the risk of an overwhelming number of visitors through private travel agencies due to continued tiger shows, providing a misleading understanding of tiger behavior, require urgent examination across all tiger reserves where such shows are conducted.</li> <li>While past 3-year poaching incidents in the TR don't suggest a high level of poaching, there is a need for strict vigilance, along with the development of an intelligence network, to prevent tiger and panther poaching.</li> </ul>	<ul style="list-style-type: none"> <li>Despite efforts to control overuse in core areas, the presence of eight villages necessitates expedited funding for relocation.</li> <li>Proliferation of resorts and high visitor numbers pose challenges to landscape and corridor planning, requiring regulatory measures and sustainable tourism practices.</li> <li>The degradation of key grasslands is of concern, emphasizing the need for grassland management and weed eradication efforts.</li> <li>The pending notification of the eco-sensitive zone around PAs hinders regulation and restricts activities around the Tiger Reserve.</li> <li>Despite coordination efforts, risks of animal electrocution persist, demanding enhanced measures and regular monitoring.</li> <li>Addressing gaps in mid-level officer positions and implementing security audit recommendations are crucial for effective management.</li> <li>Delays in fund release hinder timely execution of conservation activities and management objectives.</li> <li>Ongoing ecodevelopment programs need strengthening for sustainable conservation efforts.</li> <li>Left-Wing Extremism Concerns: Urgent government attention is needed to address left-wing extremism, preventing adverse impacts on staff morale and management control.</li> </ul>	

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>Efforts to control the overuse of Tiger Reserve resources in the core areas, where 18 villages remain, are underway, with a focus on addressing resource overuse in the buffer zone through ecodevelopment activities.</li> </ul>		
2010	<ul style="list-style-type: none"> <li>Eight villages still exist within, necessitating expedited and assured funding for willing relocation.</li> <li>Inherited from the past, the annual visitor numbers surpassing 100,000 since 2006 pose challenges, and the proliferation of resorts is rapidly obstructing tiger dispersal routes, posing a severe threat to landscape and corridor planning.</li> <li>Concerns arise over the degradation of key barasingha, Sonf, and Rondha grasslands, characterized by diminishing tall grass patches, reduced palatable grasses, and an increase in weeds, indicating regression.</li> <li>Crop depredation complaints, investigation, and compensation processes under the revenue department, where it is not a priority, result in people's disenchantment, posing a threat.</li> <li>With 150 villages in the buffer, active EDCs, and the need for strong resource support for ecodevelopment activities, appropriate areas must be designated under the provisions of an eco-sensitive zone.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Excessive human and cattle pressure in the northern and southern buffer zones bordering East Mandla and north Balaghat territorial divisions leads to forest degradation. Restoration efforts, eco-development initiatives, and alternative livelihoods for local communities are crucial for maintaining a healthy buffer.</li> <li>Efforts should be made to incorporate Chilpi forest range in Chhattisgarh into the adjoining sanctuary, enhancing the overall connectivity in the region.</li> <li>Prioritize wildlife habitat improvement practices such as developing water bodies and grasslands in the linkages between Kanha Tiger Reserve's core zone and Phen Wildlife Sanctuary.</li> <li>The Tiger reserve management should take the lead in mainstreaming protocols for field protection and wildlife monitoring in corridor linkages, acting as the nodal agency and fostering data exchange on wildlife crimes with forest/police departments.</li> <li>Pursue NGOs operating in the Tiger reserve to shift their focus from the core zone to the buffer zone, collaborating on eco-development programs to strengthen buffer zones and corridors crucial for long-term wildlife survival.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Recent cases of tiger deaths due to infighting, possibly stemming from an increased tiger population and poor sub-adult dispersal, highlight the necessity for strategic measures. Improving prey resources, enhancing buffer conditions, and strengthening corridor connectivity are imperative for mitigating intra-specific conflicts.</li> <li>Existing tourism resort owners should explore alternate energy sources and cease purchasing firewood from villagers, encouraging reliance on authorized depots of the forest department and Forest Corporation.</li> <li>Urgent relocation of villages within the core is essential to eliminate human and cattle disturbances, ensuring the critical tiger habitat remains undisturbed.</li> <li>Urgently notify the eco-sensitive zone around protected areas to regulate and restrict activities around the Tiger reserve, ensuring land use aligns with Tiger conservation needs.</li> <li>The Tiger reserve management should request the LAC to cancel the alienation of lands purchased for tourist resorts in the Kanha-Pench corridor, preserving the ecological integrity of the region.</li> <li>Considering up to 20% of the critical tiger habitat is earmarked for tourism, consider a phased shift of tourism to the buffer zone to make the core area inviolate and free from human and cattle disturbance, ensuring the long-term survival of Tigers.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Despite NTCA guidelines limiting core area utilization for tourism, there is an increase in tourist lodges and land acquisition by hoteliers in the Kanha-Pench corridor. Tiger reserve management's efforts to restrict tourism and prevent land alienation should be reinforced, emphasizing the need for sustainable tourism practices.</li> </ul>		
2018	<ul style="list-style-type: none"> <li>Despite management efforts to coordinate with the Madhya Pradesh State Electricity Board, there is a need to strengthen measures against animal electrocution, emphasizing regular monitoring and prompt repair of power transmission lines. Enhance coordination with the electricity department and District Administration to prevent poaching-by-electrocution, focusing on safeguarding critical corridors connecting neighboring Tiger Reserves.</li> <li>Establish a sniffer dog squad at Kanha, mirroring models in other Madhya Pradesh Tiger Reserves, to combat wildlife poaching and illegal trade in the park and its surroundings.</li> <li>The existing Madhya Pradesh Tiger Conservation Society, overseeing multiple Tiger Reserves, should enhance its efforts to raise funds for infrastructure development and staff welfare in both Tiger Reserves and buffer areas, particularly focusing on increasing fund allocation to buffer zones.</li> </ul>		



MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Discuss resort proliferation issues in the Local Advisory Committee (LAC) and establish a regulatory mechanism for effective management.</li> <li>Address staffing gaps in mid-level officer positions and implement security audit recommendations to enhance the reserve's protection capabilities.</li> <li>While Forest Guard positions are fully staffed, addressing reported gaps in Foresters and Deputy Rangers is crucial for effective management.</li> <li>The proliferation of tourism resorts around Kanha requires regulatory measures to manage the increasing pressures of tourism, ensuring sustainable growth and conservation practices.</li> <li>Restrict the use of fuelwood by resorts to minimize environmental impact.</li> <li>Strengthen ongoing ecodevelopment programs to ensure sustainable conservation efforts.</li> <li>Pursue the notification and implementation of the Eco-Sensitive Zone (ESZ).</li> <li>Ensure timely release of funds from the State treasury for the timely execution of conservation activities.</li> </ul>		
2022	<ul style="list-style-type: none"> <li>Left-wing extremism reports pose a significant concern. The Madhya Pradesh government should urgently address left-wing extremism in the tiger reserve to prevent adverse impacts on frontline forest staff morale and management control.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>Limited-scale poaching remains a persistent issue, particularly in the periphery of the Tiger Reserve.</li> <li>Conduct regular security audits of the park following NTCA protocols.</li> <li>Funding delays impede park authorities from achieving targets in grassland management and weed eradication.</li> <li>Compensation for crop losses, handled by the revenue department, faces delays, causing dissatisfaction among villagers.</li> <li>Approximately 50 km of the Chilpi-Mukki highway lacks wildlife mitigation measures, posing a threat to the core zone of the Tiger Reserve.</li> <li>Address the restoration of corridors and the establishment of an eco-sensitive zone, engaging with various stakeholders, including territorial divisions, local communities, district administration, and other relevant departments.</li> <li>Address the increasing human-elephant interactions resulting from elephant herds migrating into Kanha, taking immediate action to mitigate potential crop damage and property issues.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- a. Considering the lack of comprehensive landscape planning beyond the buffer zone, it would be advisable to extend such planning to areas adjoining the buffer zone. This extension would ensure that land use practices align with tiger conservation needs and protect critical corridors. Coordination between adjoining Forest Divisions and the Tiger Reserve Management Plan should be prioritized to achieve this goal effectively.
- b. Village presence within the core area and high grazing pressure from cattle pose significant threats to tiger habitat. Prioritizing and expediting the relocation of willing villages within the core area, along with implementing strict measures to control cattle grazing, could mitigate these threats effectively.
- c. The presence of public highways and electric lines inside the reserve and buffer zone presents challenges to wildlife movement and safety. Exploring options such as rerouting or undergrounding roads and power lines within the reserve, especially in key corridors, could minimize these threats. Enhancing coordination with the electricity department to ensure regular maintenance of power lines can further prevent incidents like electrocution.
- d. To address the degradation of key grasslands, collaboration with research institutions to develop and implement a dynamic grassland management plan is recommended. This plan should include strategies for weed eradication, monitoring, and adaptive management to restore the value of grasslands for ungulates and tigers.
- e. To mitigate disturbances caused by high visitor numbers and resort proliferation, gradual shifting of tourism activities to the buffer zone could be considered. Implementing stricter regulations and sustainable practices for existing tourism resorts would further minimize disruptions to tiger habitats and dispersal routes.
- f. Streamlining the mechanism for crop damage compensation and ensuring timely payments by making the forest department the nodal agency could foster community tolerance towards wildlife. Implementing mitigation measures to minimize human-elephant conflict is also advisable.
- g. Addressing left-wing extremism issues in the region is crucial to ensuring the safety and effectiveness of forest staff. The Madhya Pradesh government should take proactive steps to address these challenges and support conservation efforts in the reserve.
- h. Ensuring timely release of funds from the State treasury for conservation activities and addressing staffing gaps would strengthen the reserve's protection capabilities. Implementing security audit recommendations in line with NTCA protocols is also recommended.
- i. Establishing dedicated anti-poaching squads focusing on the buffer zone and periphery of the reserve would enhance anti-poaching efforts and strengthen security measures

to combat poaching activities effectively.

- j. Making the forest department the nodal agency for streamlined crop damage compensation processes and pursuing the notification and implementation of the Eco-Sensitive Zone (ESZ) around the reserve would improve conflict management and landscape protection efforts.
- k. Strengthening ongoing ecodevelopment programs to provide sustainable livelihood options for local communities would garner support for conservation efforts effectively.
- l. Establishing a sniffer dog squad to combat wildlife poaching and illegal trade could enhance anti-poaching measures and improve wildlife protection in the reserve.
- m. Enhancing efforts of the Madhya Pradesh Tiger Conservation Society to raise funds for infrastructure development and staff welfare in Tiger Reserves and buffer zones is crucial for long-term conservation success.
- n. Addressing resort proliferation issues in the Local Advisory Committee and establishing regulatory mechanisms for effective management would help mitigate the negative impacts of resort expansion on tiger habitats and surrounding ecosystems.
- o. Addressing fuelwood use by resorts to minimize their environmental impact should be prioritized through collaborative efforts between stakeholders and regulatory interventions.
- p. Implementing a science-based and adaptive management approach grounded in robust data and information would enhance the effectiveness of conservation efforts and improve outcomes for tiger populations and their habitats.
- q. Engaging with stakeholders like territorial divisions, local communities, and relevant departments for collaborative efforts in corridor restoration and buffer zone management is advisable to ensure holistic conservation efforts and effective landscape protection.

#### 5. Conclusions

Kanha Tiger Reserve has one of the highest tiger densities in the world and plays a crucial role in the Satpura-Maikal landscape of Central India. Its healthy tiger population serves as a source for tigers in surrounding areas like Pench, Achanakmar, Bandhavgarh, and Satpuda Tiger Reserves. Kanha's diverse prey base and rich ungulate biomass support this thriving tiger population. The Kanha tiger reserve faces a new threat in the form of recent left-wing extremism, which can severely impact wildlife populations. The forest department should take necessary measures to address this emerging threat and ensure the continued well-being of Kanha's tigers like increase patrolling and surveillance in areas affected by left-wing extremism, work with local communities to build trust and cooperation, implement anti-poaching measures to protect tigers and other wildlife, and monitor tiger populations closely to track any changes in density or distribution. By taking these steps, the forest department can help to mitigate the threat of left-wing extremism and ensure the long-term conservation of Kanha's tigers.

# PANNA TIGER RESERVE

## 1. Brief Description

Panna Tiger Reserve (PTR) is located in the Vindhyan mountain range in northern Madhya Pradesh, spanning Panna and Chhatarpur districts. The geography includes the upper Talgaon plateau (Panna Range), middle Hinnauta plateau (Hinnauta Range), and the Ken river valley (Mandla and Chandranagar Ranges). Positioned in the Deccan Peninsula central-Highlands biogeographic zone, it extends between 79°45' to 80°09' E longitudes and 24°27' to 24°46' N latitudes, characterized by extensive plateaus and gorges. The diverse vegetation includes southern tropical dry deciduous teak mixed forest, northern tropical dry deciduous mixed forest, dry deciduous scrub forest, anogeissus pendula forest, Boswellia forest, and dry bamboo brakes. PTR hosts a variety of fauna, including tiger, leopard, sloth bear, striped hyena, wild dog, jungle cat, golden jackal, sambar, chital, nilgai, chinkara, four-horned antelope, wild pig, and hanuman langur. Tiger reintroduction efforts were successful after local extinction due to poaching. Besides its abundant wildlife, PTR features ancient rock paintings dating back around two thousand years.

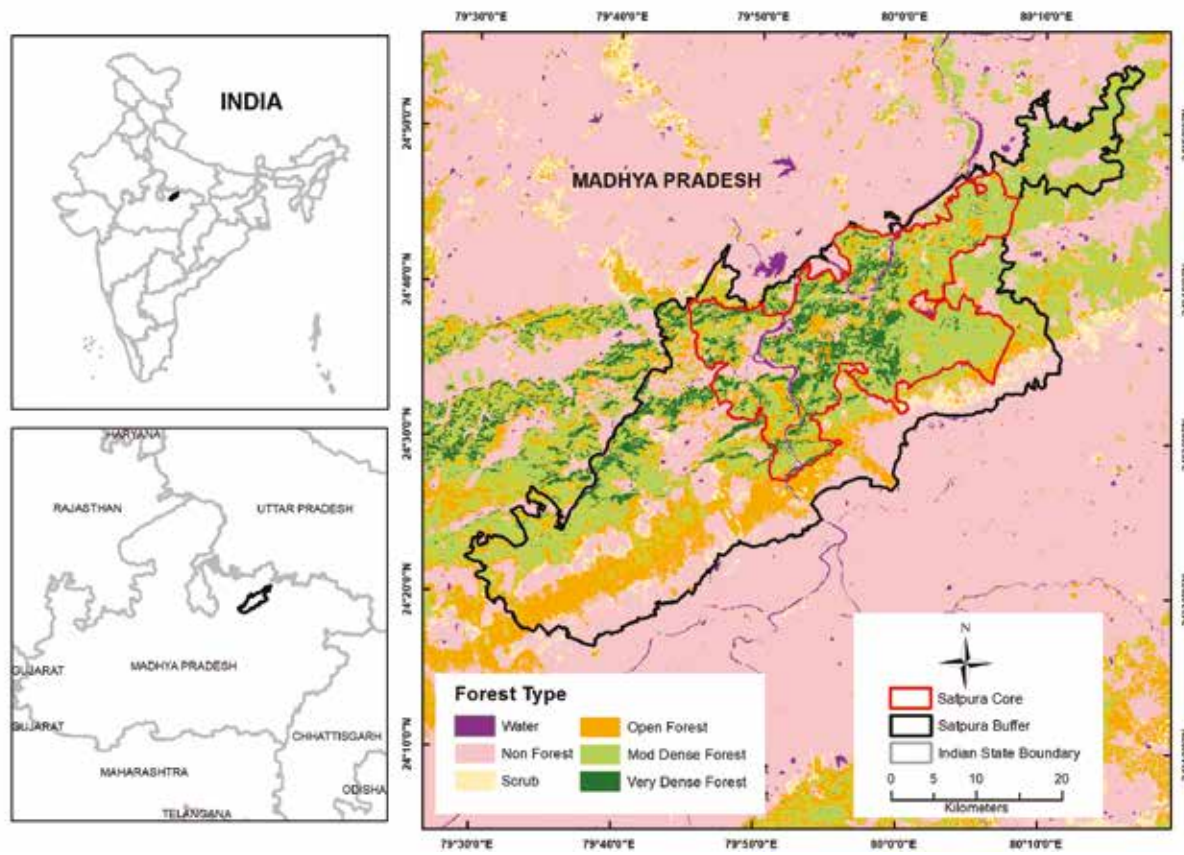


Figure 1: Map showing the location of Panna Tiger Reserve in the state of Madhya Pradesh.

## 2. Tiger Population as per All India Tiger Estimation

The Panna Tiger Reserve has demonstrated successful recovery in its reintroduced tiger population. In 2018, 25 adult individual tigers were identified, and the estimated density was 1.41 (SE 0.28) tigers per 100 sq. km. By 2022, following the capture of 55 individual tigers (>1 year of age) from 2034 tiger photos, the estimated tiger density increased to 3.18 (SE 0.43) tigers per 100 sq. km. The sex ratio remains female-biased, and there has been a continual increase since 2014. However, the reserve faces a significant threat from development projects such as the Ken-Betwa river project, which could have detrimental impacts on the reserve as a whole.

## 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>The final notification under the Wildlife Protection Act-1972 for Panna Tiger Reserve has not been issued, primarily attributed to the presence of villages in the core area slated for relocation. Additionally, the delineation of the proposed 1000 km<sup>2</sup> buffer zone, spanning north and south territorial divisions of Panna and Chhattarpur, lacks unified control by Panna TR.</li> <li>Thirteen villages within the core area, comprising a human population of 5753 and a cattle population of 7104, exert significant pressure on the Tiger Reserve through activities such as the collection of NTFP, grazing, and fodder collection.</li> <li>Without the implementation of a comprehensive Ecodevelopment Programme, the 125 villages within the identified buffer zone area may pose challenges in aligning with the objectives of the Project Tiger.</li> </ul>	<ul style="list-style-type: none"> <li>Thirteen villages within the core area exert significant pressure on the reserve, engaging in activities like fuelwood collection, grazing, and fodder collection, posing threats to habitat quality and wildlife.</li> <li>Inadequate implementation of a comprehensive Ecodevelopment Programme in the buffer zone area may challenge Project Tiger's objectives, affecting the harmony between conservation and local communities.</li> <li>Adverse impacts from ongoing NMDC mining activities near the Hinnauta Range Headquarters raise concerns about potential threats to the reserve, especially given the significant worker colony and heaps of excavated material near the reserve boundary.</li> </ul>	<ul style="list-style-type: none"> <li>The primary threat to Panna Tiger Reserve arises from the proposed Ken-Betwa river linking project, which entails the diversion of approximately 500 km<sup>2</sup> of forests from the reserve.</li> <li>The vital ecological corridors and wildlife movement hinge on the connectivity between Panna Tiger Reserve and Ranipur Tiger Reserve, playing a crucial role in broader landscape-level conservation. Restoration of connectivity to the west could potentially facilitate the dispersal of tigers from Panna to Nauradehi Wildlife Sanctuary in the south and to Madhav National Park in the north.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>Mining activities by NMDC near the Hinauta Range Headquarters of Panna TR have a considerable adverse impact, with a large worker colony and heaps of excavated material near the reserve boundary. The ongoing project, expected to last 15 to 20 years, raises concerns, especially since there is a potential discovery of diamond occurrences inside the TR, requiring careful management to avoid future operational mining that could jeopardize the reserve.</li> <li>The proposed buffer area faces inadequate regeneration status primarily due to the presence of a large number of villages.</li> <li>There are 5 vacancies for Range Forest Officers, 7 vacancies for Game Supervisors, &amp; 4 vacancies for Forest Guards.</li> <li>The reported inadequacy in TR management equipment includes shortages in camera traps, arms, GPS devices, survey instruments, firefighting tools, equipment for forensic studies, and wireless communication devices.</li> <li>A vehicle for the Veterinary Doctor and water tankers equipped with tractors for all four ranges are essential to provide water during the lean hot season, which coincides with the fire season.</li> </ul>	<ul style="list-style-type: none"> <li>The proposed buffer area faces regeneration challenges due to the presence of numerous villages, affecting habitat quality and complicating conservation efforts.</li> <li>Vacancies in critical positions, including Range Forest Officers, Game Supervisors, and Forest Guards, weaken the TR's protection capabilities.</li> <li>Lack of essential vehicles for the Veterinary Doctor and water tankers equipped with tractors for all four ranges during the lean hot season affects water supply and firefighting capabilities.</li> <li>The porous nature of the TR from all sides raises concerns about the potential for poaching, emphasizing the need for stringent vigilance.</li> <li>Continuous human and cattle pressure in critical tiger habitats requires more focused efforts in relocating villages within the TR.</li> <li>Absence of control over the identified buffer zone hampers restorative efforts beyond the TR, requiring landscape planning to address this gap.</li> <li>Sustainable development initiatives through Ecodevelopment Programmes in villages near the TR need intensified efforts for effective conservation.</li> </ul>	<ul style="list-style-type: none"> <li>Mesosphaerum suaveolens, Prosopis juliflora, Senna tora, Xanthium strumarium must be systematically and urgently removed with the highest priority.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>The issue of a rush of vehicles and a large number of tourists congregating at a particular place after tracking and sighting tigers necessitates a serious review at the highest level.</li> <li>The TR's porous nature from all sides raises concerns about the potential for tiger and leopard poaching through traps, emphasizing the need for stringent vigilance, especially in light of recent incidents in Sariska.</li> <li>Avoid creating additional tourism facilities within the core area, given the emergence of numerous facilities on private land outside the TR, and instead, enforce stricter regulations for tourists.</li> <li>The degradation of habitats due to grazing and fuelwood collection around villages inside and outside the TR necessitates more focused efforts in the attempted relocation of villages within the TR. Successful relocation, particularly for villages along the Ken River with irrigated and fertile lands, requires lucrative packages and should be prioritized at the state level for effective tiger conservation.</li> <li>The absence of control by the TR Management over the identified buffer zone hinders restorative efforts beyond the TR, necessitating landscape planning to address this gap.</li> </ul>	<ul style="list-style-type: none"> <li>Lack of a mandatory TCP hampers planned and scientific reserve management, requiring expedited finalization and approval by NTCA. The reserve's failure to prepare a TCP and the absence of a dedicated individual for technical support indicate weaknesses in planning and management.</li> <li>Shortages in critical positions like forest guards, mahawats, and chara cutters demand immediate attention and recruitment to strengthen protection and monitoring efforts.</li> <li>Inconsistent coordination with NGOs and the Forest Department's inability to achieve broader support for conservation efforts highlight collaboration challenges.</li> <li>Lack of legal entities for corridors and uncontrolled resort development threaten tiger habitats, emphasizing the need for legal means to address these concerns.</li> <li>Annual population estimation, continued use of monitoring models, and effective weed control measures are essential for informed conservation decisions and ecosystem health.</li> <li>State CAMPA guidelines need amendments to prioritize ecological concerns, ensuring funds allocation for wildlife habitat conservation.</li> </ul>	

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>Sustainable development initiatives in villages near the TR through Ecodevelopment Programmes should be intensified, and a coordinated development program integrating all rural development initiatives should be formulated for enhanced effectiveness and sustainability.</li> </ul>	<ul style="list-style-type: none"> <li>Lack of a coordinated development program integrating rural development initiatives hampers effective conservation in buffer zones.</li> </ul>	
2010	<ul style="list-style-type: none"> <li>Extinction of all tigers by 2009 necessitates urgent reassessment of beat, circle, and range sizes, along with infrastructure and logistics planning, to support sustained livelihoods and ecodevelopment within the proposed buffer area.</li> <li>Fine-level data, interstate agreements, and mechanisms are crucial between identified landscapes like Kanha and Pench, Satpura and Melghat, Panne-Bandhavgarh-Sanjay, and Guru Ghasidas NP. Establishing legal entities for corridors, integrating land uses with habitat integrity, and addressing uncontrolled resort development through legal means are essential for safeguarding tiger habitats.</li> <li>Annual population estimation is essential for multiple reasons, emphasizing the need for regular assessments. Continuing the Sykes and Horrill model for monitoring vegetation change is necessary for informed conservation decisions.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<ul style="list-style-type: none"> <li>Beyond weed control, active habitat restoration measures should be implemented to enhance overall ecosystem health.</li> <li>State CAMPA guidelines should prioritize ecological concerns, necessitating amendments to allocate 35% of funds for wildlife habitat conservation. Clarification on specific wildlife habitats and populations requiring preservation is imperative.</li> <li>Notification for the Buffer Zone is pending, compounded by challenging surroundings with communities known for high-density firearms and poaching traditions, urging strong collaboration with district administration and police.</li> <li>Managing buffer zones for visible benefits to people is key to conservation success, given the numerous villages in these areas. Incorporating the 'security of ecosystems' as a mandatory reference frame in District Plans can ensure conservation priorities without threatening individual interests.</li> <li>A dedicated individual with a technical team is crucial, supporting the Forest Department in technical matters and correspondence. English should be the medium of communication for national and international collaboration.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<ul style="list-style-type: none"> <li>• Mobility requires immediate attention, requiring more vehicles (including 4WDs) for officers, RFOs, and patrolling, along with motorboats for patrolling the extensive stretches of the Ken River and its tributaries.</li> <li>• Communication infrastructure needs improvement, with a shortage of functional wireless and handheld sets, impacting effective patrolling and communication across camps and checkpoints.</li> <li>• Working strength faces shortages in critical positions like forest guards, mahawats, and chara cutters, which are essential for protection and monitoring, demanding immediate attention and recruitment.</li> <li>• The potential reintroduction of tigers, including five growing cubs of varying ages and sexes, warrants careful consideration and thoughtful planning for their successful assimilation.</li> <li>• NGOs contribute significantly to TRs with known profiles, providing field vehicles, communication equipment, and support to patrolling camps. Expanding outreach to enlist broader NGO support is essential, and the Forest Department alone cannot achieve this.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>• The reserve hasn't prepared a mandatory Tiger Conservation Plan (TCP), crucial for planned and scientific reserve management. The Tiger reserve management should expedite the finalization and approval of the TCP by NTCA.</li> <li>• The proposed dam and tunnel within the core area may submerge critical tiger habitat, requiring a reassessment for conservation purposes.</li> <li>• Human and cattle pressure persists in the critical tiger habitat, affecting grasslands, complicating rehabilitation efforts, and inducing behavioral changes in tigers. Removal of feral cattle from critical Tiger habitats is essential for conservation efforts.</li> <li>• Speeding vehicles on NH-75 and SH-46 through the reserve lack measures to reduce accidents and wildlife casualties, as earlier speed breakers were removed. Install speed breakers on NH-75 and SH-46 at vital wildlife movement points within critical Tiger habitats.</li> <li>• Open stone walls at crucial crossing points to facilitate unhindered wildlife movement across the Tiger reserve's forests.</li> <li>• Improve the corridor in the 30 km stretch in Satna Forest Division connecting Bandhavgarh and Panna Tiger Reserves by planting vacant revenue/forest land along the river.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Villages around the reserve depend on the critical tiger habitat for fuelwood and grazing, posing threats to wildlife and complicating tiger rehabilitation. Immediate funds are crucial for relocating approximately 180 families from three villages on the left bank of the River Ken in Chattarpur District.</li> <li>NMDC mines in Panna, though not in the critical tiger habitat, pose a long-term threat; urgent plans addressing closure, restoration, and monitoring are needed. Proactively suspend the continuation of NMDC mines beyond 2020 to safeguard the long-term survival of Tigers, co-predators, and prey animals.</li> <li>Reassess and suspend the Ken-Betwa River Link Project, considering its severe impact on biodiversity conservation in Panna Tiger Reserve.</li> <li>Address dissatisfactions within the field staff by posting out discontented members, bringing in motivated individuals with proven track records.</li> <li>Inactive eco-development committees need activation for participatory strategies, integrating welfare schemes, and addressing livelihood issues of dependent communities. Enhance assistance to and activation of eco-development committees, seeking support from grassroots NGOs to reduce villagers' dependence on forests and provide alternate livelihood options.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Fast-changing land-use patterns in agricultural lands around the reserve should be monitored to preserve corridor values.</li> <li>Stone walls demarcating different areas obstruct wildlife movement; opening them at animal crossing points is recommended.</li> <li>Recent village relocations exhibit shortcomings, with families still inside the reserve, abandoned cattle, and inadequate steps taken for relocation success.</li> </ul>		
2018	<ul style="list-style-type: none"> <li>A WWF India study on Panna identified existing corridors connecting the reserve with territorial forest divisions, highlighting severe threats like fuelwood collection, cattle grazing, and tree lopping affecting the habitat quality. Incorporate the identification of potential tiger habitat and requirements into regional development plans, ensuring safe wildlife passages between Panna Tiger Reserve and other protected areas.</li> <li>Exercise extreme caution while involving local people in tiger monitoring, conducting thorough antecedent checks, and establishing a robust protocol for handling information about tiger locations, both radio-collared and others.</li> <li>Panna's TCP is pending submission to the NTCA, with only an indicative plan currently in place. Submit the TCP to the NTCA at the earliest opportunity.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>During the visit, it was observed that daily wagers involved in monitoring lacked a clear criterion or protocol for information confidentiality, posing a concern, especially with radio-collared tigers requiring secrecy about their movements.</li> <li>Implement a robust program, in collaboration with the District Administration, Rural Development Department, and civil society organizations, for the rehabilitation of Pardhi and Kanjar communities, steering them away from wildlife hunting, backed by stringent enforcement actions.</li> <li>A significant number of forest guard and forester positions remain vacant, affecting the overall protection efforts.</li> <li>The core area of Panna still hosts three villages that require relocation and rehabilitation efforts.</li> <li>Panna faces challenges with SH 46 and NH 75, posing threats to wildlife on the highways, and their management is beyond the control of TR Management Authorities.</li> <li>Revoke the lease of the National Mineral Development Corporation, Panna, after its expiration in 2020, as the extensive infrastructure poses a threat to the long-term conservation of the reserve.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>The Ecodevelopment program in Panna is reported to be weak, with EDCs not functioning effectively. Strengthen Ecodevelopment programs, enhance the proactivity of EDCs, and scale up capacity-building initiatives in Panna with the involvement of NGOs and corporates, recognizing the crucial support of local communities for the recovery and long-term survival of Panna's tigers.</li> <li>Strengthen research focused on conservation and livelihoods rather than project-based research.</li> <li>Improve the existing wireless communication network within and around the park.</li> <li>Develop a tiger landscape conservation strategy and action plan for the safe movement of tigers from Panna to adjoining territorial forests, aligning with national and regional social and economic development plans.</li> </ul>		
2022	<ul style="list-style-type: none"> <li>The TCP for the core, buffer, and corridor areas is well-prepared, but its implementation lacks administrative legality without official approval.</li> <li>The Integrated Landscape Management plan for Panne TR, approved by NTCA, needs to be converted into a time-bound action plan, emphasizing implementation by the state forest department for holistic tiger conservation in Madhya Pradesh.</li> </ul>		



MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>The park authorities should proactively train in-house field staff members in drone technology, specifically thermal imaging, to enhance monitoring capabilities, especially during nighttime when straying animals may increase.</li> <li>Procuring a second tranquilizing gun, training local veterinarians in tranquilization, and conducting climate and carbon studies are essential steps for PTR's veterinary and ecological management.</li> <li>The proposed Ken-Betwa link project, if executed, will submerge 51 km<sup>2</sup> of pristine riparian vegetation, disrupting water flow and jeopardizing the existence of specialized wildlife species.</li> <li>The presence of three villages in the core, 49 villages in the buffer, and 151 settlements within 5 km from the PTR boundary exerts significant pressure on the limited biomass resources in the park. Expediting the relocation of the remaining three villages—Dhadhan, Palkoha, and Khanyeru-Mmen—is crucial for the core area to be free of biotic pressures.</li> <li>Innovative planning involving the district administration is essential to reduce dependence on park resources, focusing on reducing fuelwood consumption and grazing pressures.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>The extensive NH 75 and SH 46 pose a serious threat to wildlife movements in the park, with high-speed vehicles offering little chance for safe crossings, endangering various species. Proposed road shifts for NH 75 and SH 46, along with comprehensive road kill data collection, are vital for wildlife mitigation measures.</li> <li>Despite the preparation of 35 micro plans for 151 EDCs, there's a lack of a clear funding mechanism to sustain the functioning of these BDCs.</li> <li>The corridor plan has identified four crucial corridors connecting PTR with other reserves, but with the growing tiger population (57-60), conflicts between tigers and humans are anticipated.</li> <li>At the ground level, wildlife management training is lacking, with only 25 out of 167 sanctioned Forester posts filled; urgent measures are needed to fill the remaining vacancies.</li> <li>The Local Advisory Committee (LAC), formed in 2018, has yet to conduct any meetings, indicating a need for active engagement and collaboration.</li> <li>Strengthening research efforts, engaging local universities, and encouraging wildlife-related research are necessary to provide critical data for informed decision-making.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>• Identifying and mapping natural salt licks, incorporating them into patrolling plans, and considering the potential hindrance of eco-tourism on wildlife dispersal in corridor plans are vital aspects that need attention.</li> <li>• Encouraging women's participation in TR management, awarding meritorious staff during national events, and strengthening wildlife health monitoring amid zoonotic concerns are significant considerations.</li> <li>• Reintroducing bamboo in depleted areas, enhancing the dog squad with tracking capabilities, educating and providing alternative livelihoods for hunting tribes, and creating designated cremation places outside PTR are key conservation measures.</li> <li>• Systematically removing invasive weeds, identifying and conserving threatened species habitats, studying tiger population growth and carrying capacity, creating a Special Tiger Protection Force, and conducting a security audit are crucial initiatives for PTR's sustainable management.</li> <li>• PTR should prepare a Drought Management Plan for emergent threats, ensuring proactive measures to address adverse climate impacts.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- a. It's imperative to give urgent attention to prioritizing and implementing the numerous actionable points identified in past MEE cycles. These recommendations, if overlooked, could pose significant risks to the effectiveness of management and conservation efforts. Swift action to address these outstanding points will be essential in ensuring the success of conserving the tiger reserve and the entire ecosystem.
- b. Considering the substantial human and cattle populations within the core area, it might be beneficial to prioritize and expedite the relocation of the 13 villages. Collaborating with the district administration to provide alternative livelihood options could help alleviate biotic pressures and create an inviolate core for effective tiger conservation.
- c. Strengthening buffer zone management through coordinated efforts, implementing sustainable land-use practices, and promoting regeneration initiatives could enhance its role in habitat protection.
- d. Advocating for stricter regulations on mining activities, conducting environmental impact assessments, and collaborating with relevant authorities to minimize the ecological footprint and potential harm to the reserve is advisable. Exploring the establishment of natural salt licks could also be beneficial.
- e. Implementing comprehensive habitat restoration measures, including weed control, systematic reintroduction of bamboo, and creation of designated areas for activities outside the reserve, could minimize disturbances and enhance habitat quality.
- f. Monitoring population growth, establishing a Special Tiger Protection Force, managing potential human-wildlife interactions, and developing plans to manage tiger populations effectively and establish wildlife corridors are recommended to address rising tiger numbers and inadequate corridor connectivity.
- g. Addressing staffing shortages by expediting recruitment processes and providing adequate training could enhance the efficiency of field personnel in protecting and monitoring the reserve.
- h. Prioritizing the procurement of necessary equipment, upgrading technology, and ensuring resource availability for effective patrolling and wildlife monitoring could significantly improve field operations and monitoring capabilities.
- i. Expediting the TCP approval process to ensure a comprehensive plan guiding conservation actions and management strategies is recommended to address delayed finalization of the Tiger Conservation Plan.
- j. Investing in modern monitoring technologies and methodologies could enhance accuracy and effectiveness in surveillance techniques, replacing outdated methods.
- k. Upgrading infrastructure, including communication networks, and providing necessary resources for efficient reserve management could address weak communication

networks, lack of dedicated vehicles, and poor patrolling infrastructure.

- l. Revitalizing EDCs, increasing funding for community programs, and actively involving local communities in conservation initiatives could foster a sense of ownership and responsibility, addressing inactive EDCs and insufficient funding issues.
- m. Providing alternative livelihood opportunities, educating communities on sustainable practices, and implementing resource management strategies to reduce dependence on the reserve could alleviate unsustainable pressure from villages relying heavily on the park for resources.
- n. Implementing measures to boost staff morale, provide incentives, and ensure a conducive working environment could enhance dedication to conservation among field staff facing morale issues.
- o. Collaborating with the district administration to implement road shifts, speed restrictions, and effective wildlife crossing points to reduce the risks associated with human-wildlife conflicts is advisable to address high-speed traffic on highways and limited wildlife crossings.
- p. Implementing rehabilitation programs, providing alternative livelihoods, and engaging in community dialogue to mitigate conflicts and promote coexistence could address conflicts arising from traditional hunting practices.
- q. Advocating for cancellation of proposed projects, exploring alternative water management solutions, and raising awareness about potential harm to biodiversity could minimize threats to critical tiger habitat posed by proposed projects.
- r. Collaborating with relevant authorities to establish unified control over the buffer zone could ensure coordinated and effective conservation efforts, addressing hindrances to coordinated conservation efforts caused by management by different entities.
- s. Regulating land-use patterns to preserve corridor values and maintain habitat connectivity is recommended to address potential loss of corridor values due to land-use patterns.
- t. Encouraging research collaborations and focusing on tiger dispersal patterns, wildlife health, and climate impacts could inform proactive management strategies. Conducting research on the impact of ecotourism on wildlife behavior and incorporating findings into management strategies is advisable.
- u. Advocating for stricter regulations on mining activities, evaluating the feasibility of relocating cremation places, and conducting environmental assessments could minimize disturbance within the reserve.

## 5. Conclusions

The tiger population in Panna Tiger Reserve has exhibited a notable recovery since the reintroduction efforts in 2009. The proactive management initiatives undertaken by the forest department have played a significant role in this successful recovery. Panna Tiger Reserve, along with the surrounding territorial forest divisions, constitutes a significant wildlife habitat in the fragmented forested landscape of north Madhya Pradesh. The ecological connectivity persists through the recently declared Ranipur Tiger Reserve in Uttar Pradesh, extending from Panna Tiger Reserve. This linkage is vital for preserving ecological corridors and facilitating wildlife movement, contributing significantly to broader landscape-level conservation initiatives. Restoration of connectivity to the west could potentially enable the dispersion of tigers from Panna to Nauradehi WLS (South) and Madhav NP (North). It stands as a crucial tiger habitat in the central Indian highlands, emphasizing its importance for biodiversity conservation.



# PENCH TIGER RESERVE

## 1. Brief Description

The Pench Tiger Reserve, renowned as Mowgli land from Rudyard Kipling’s “The Jungle Book,” lies on the southern slope of the Satpura-Maikal landscape in Madhya Pradesh, covering an area of 1179.632 km<sup>2</sup>. It includes Pench Priyadarshini National Park and Pench Mowgli Wildlife Sanctuary as its core, with a significant buffer zone. The reserve boasts diverse forest types dominated by teak and bamboo, providing habitat to a rich biodiversity, including tigers, leopards, sloth bears, wild dogs, and various ungulates. It shares borders with Maharashtra’s Pench Tiger Reserve and is connected to Kanha Tiger Reserve through crucial forest corridors. However, the NH7 highway poses a barrier to habitat connectivity, especially towards Kanha Tiger Reserve, highlighting the importance of preserving the Kanha-Pench corridor for wildlife dispersal.

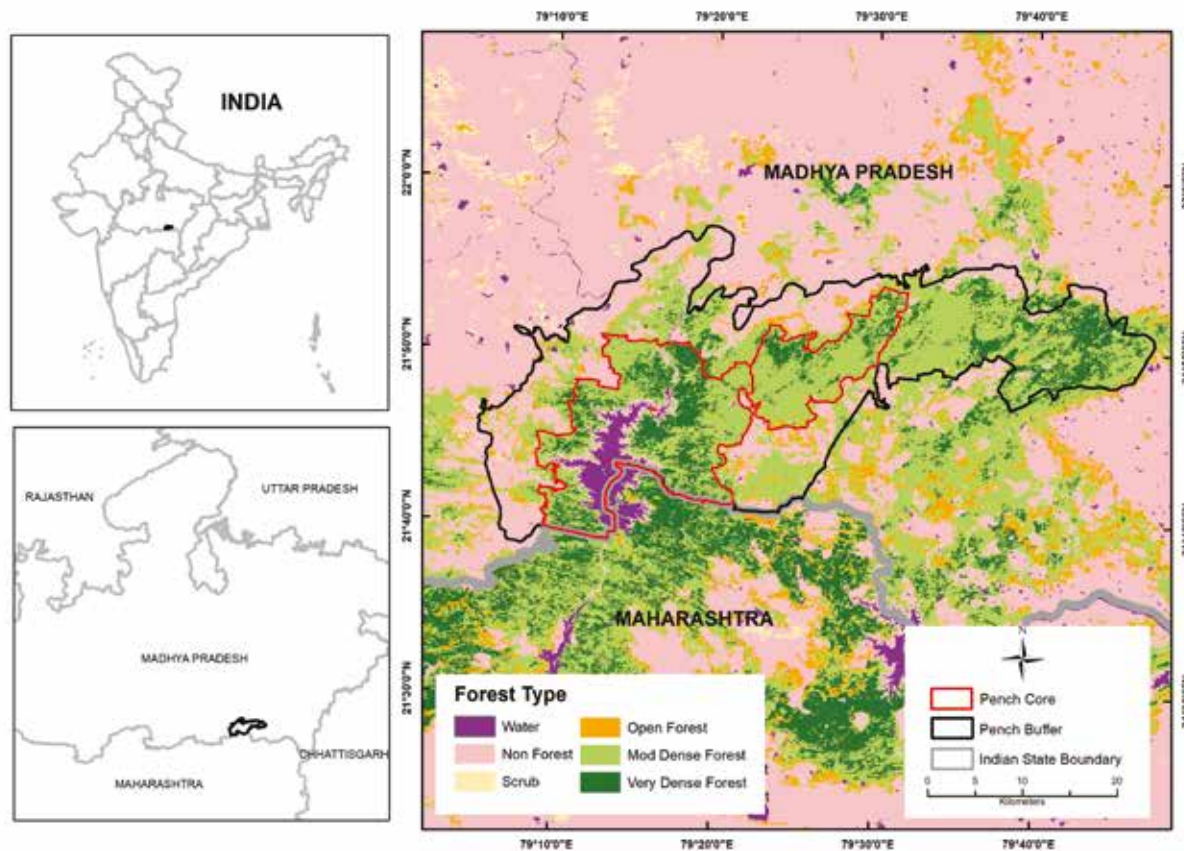


Figure 1: Map showing the location of Pench Tiger Reserve in the state of Madhya Pradesh.

## 2. Tiger Population as per All India Tiger Estimation

The tiger population at Pench has exhibited a significant increase since the last cycle of the National Tiger Estimation Exercise in 2018. In 2014, 44 unique tigers were captured, with a density of 5.67 (SE 0.87). Over the sampling period, a total of 875 tiger detections were recorded, leading to the identification of 56 adult individual tigers and an estimated density of 5.50 (SE 0.85) tigers per 100 sq km. By 2018, the unique tigers captured had risen to 77, with a density of 5.50 (SE 0.7). This growth in tiger numbers underscores the success of conservation efforts and habitat management in the Pench region. Forest managers should take note of this positive trend, emphasizing the importance of ongoing conservation strategies to ensure the continued thriving of the tiger population in the area. Regular monitoring and adaptive management practices will be essential to sustain and further enhance the success observed in Pench Tiger Reserve.

## 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>• Buffer zone has been identified and delineated on the ground, but its control and management are under the jurisdiction of the South Seoni and East and South Chhindwara Forest Divisions.</li> <li>• Transfer control of the Buffer Zone to the Field Director promptly, particularly the area west of NH-7, as it serves as crucial habitat for the spill-over tiger population. Managing this buffer zone with the same intensity as the core is essential for optimizing the potential of both Pench Tiger Reserves in Madhya Pradesh and Maharashtra to support a robust tiger population.</li> </ul>	<ul style="list-style-type: none"> <li>• Buffer zone management intensity needs enhancement, particularly west of NH-7, crucial for tiger habitat.</li> <li>• Landscape approach adoption for land use compatibility beyond the buffer is necessary in Madhya Pradesh.</li> <li>• Ongoing challenges persist with crop damage complaints due to wildlife-human conflicts.</li> <li>• Coordination gaps in interstate efforts between Madhya Pradesh and Maharashtra hinder effective wildlife patrolling.</li> <li>• Despite 20% core area allocation, tourism impact reduction efforts are insufficient.</li> <li>• Roads within the core area require improved maintenance, focusing on side drain upkeep.</li> </ul>	

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>To ensure compatibility of land use beyond the buffer zone, adopting a landscape approach for tiger management in Madhya Pradesh is crucial. A comprehensive approach by the State Government is essential, considering the extensive contiguous habitat of tigers from Pench (MP and Maharashtra) to Kanha, to plan future development activities carefully and safeguard vital corridors and connectivities.</li> <li>45% of the population in the surrounding villages lacks access to cultivation, relying predominantly on forests for their livelihoods.</li> <li>The TR's management plan, prepared for 2001-10 and approved until 2005, solely addresses the core area and lacks mention of the designated buffer, prompting the need for its comprehensive revision, currently underway.</li> <li>Regeneration status is satisfactory overall, but certain areas in South Chhindwara exhibit poor regeneration due to excessive biotic pressure.</li> <li>The major weed, Parthenium, is found in the submergence area that emerges after water recedes. Intensive uprooting efforts have successfully reduced weed presence, particularly in meadows. Lantana, while not a significant issue, is being eradicated in areas where alternative ground cover is sufficient.</li> </ul>	<ul style="list-style-type: none"> <li>Stone walls demarcating core and buffer zones hinder wildlife movement and may pose a financial burden for removal.</li> <li>Invasive weed and hotel proliferation challenges persist, impacting reservoir health and wildlife movement.</li> <li>Electrocution risks remain due to overhead power lines, demanding urgent mitigation measures.</li> <li>Illegal fishing issues persist despite ongoing efforts to control activities in Totladoh Reservoir.</li> <li>NH 7 poses a continual threat to wildlife, necessitating immediate action for accident prevention.</li> <li>Weaknesses in the security audit and frontline staff training impact protection measures.</li> <li>Lack of institutionalized interstate coordination and buffer zone resource uncertainty hampers comprehensive conservation efforts.</li> <li>Weaknesses in addressing water hyacinth invasion and exotic tree species growth remain persistent.</li> <li>Bamboo distribution monitoring over the years requires enhanced intervention strategies.</li> <li>Ongoing challenges with livelihood programs and relocation efforts for impacted villages persist.</li> </ul>	

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006		<ul style="list-style-type: none"> <li>Research and lab facilities remain essential for in-depth biodiversity studies and informed management decisions.</li> <li>Long-standing concerns regarding the impact of NH 44 on arboreal animals call for consistent monitoring and preventive measures.</li> <li>Forest fire management requires continual improvement, considering seasonal variations and vulnerable areas.</li> <li>Immediate action is needed to address weaknesses in water hyacinth invasion control and exotic tree species removal.</li> </ul>	
2010	<ul style="list-style-type: none"> <li>The critical core area faces a shortage of personnel, with 14 forest guards and 6 foresters, the majority lacking training in wildlife management.</li> <li>The Buffer Zone is not under the administrative control of the Field Director, creating a potential challenge for effective management.</li> <li>The Buffer Zone, containing 107 villages, lacks certainty in resources for eco-development, posing concerns for sustainable conservation efforts.</li> <li>Complaints of crop damage are recorded and investigated, with compensation ordered by the revenue department; however, it is not their priority, leading to disenchantment among stakeholders.</li> <li>Formal and robust support is needed for patrolling and crime control in the interstate coordination between Madhya Pradesh and Maharashtra.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Fishing rights in the Pench River were surrendered following the Pench National Park's notification, compensated by the government. Despite a ban on reservoir fishing, substantial illegal activities persist with nearly 100 boats, necessitating collaborative efforts with Revenue and Police departments for effective control. A crucial high-level meeting, engaging the Forest, Police, and Revenue departments of Maharashtra and Madhya Pradesh, is necessary to tackle the problem of illicit fishing in Totladoh reservoir, with an additional focus on developing alternative livelihood options for the affected fishing community.</li> <li>Despite designating 20% of the core area for tourism, there is a need, in accordance with Supreme Court guidelines, to reduce this percentage, contemplating the use of buffer zone areas like Ghatkohka buffer range for tourism, facilitating a gradual transition from the core area to the buffer zone. This shift is essential for maintaining the inviolability of the core area and ensuring the long-term survival of tigers.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>National Highway 7, traversing the eastern boundary, poses significant threats to wildlife and their habitat in the Pench Tiger Reserve's core area. The proposed highway widening may worsen habitat fragmentation, potentially isolating the Pench-Kanha corridor and obstructing gene flow among wildlife populations. To address the hindrance of animal movements caused by heavy traffic and the push for road widening, urgent implementation of mitigation measures is essential to ensure the seamless movement of wild animals across the landscape.</li> <li>The Pench Tiger Reserve and adjacent forest divisions should collaborate to develop an effective corridor plan, crucial for managing non-protected area forests in alignment with tiger conservation objectives, in response to the rapid decline in the functional status of corridors in the central Indian landscape.</li> <li>Recent data revealing a swift rise in herbivore counts, especially Chital, due to active habitat management, prompts the reserve management to assess the habitat's carrying capacity and contemplate scaling back intensive interventions to optimize grazing pressure on grasslands.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Roads in the core area undergo regular maintenance, but side drains lack proper upkeep, requiring attention. Earth excavation near trees during water hole desilting and vertical cutting of water-impounding areas' sides have been observed, prompting the management to adopt gentler approaches to safeguard tree roots and maintain sloping edges.</li> <li>Stone walls erected to demarcate core and buffer zones hinder wildlife movement and need strategic openings to facilitate wildlife crossings. Stone wall barriers between the core and buffer areas should be strategically opened to facilitate wildlife movement, although the complete removal of these walls may entail significant costs.</li> <li>Despite mitigation efforts, invasive weeds in the Totladoh reservoir's drawdown area present a considerable management challenge, while the increasing number of hotels and resorts near the Turiya gate is altering land-use, pressuring natural resources, potentially obstructing wildlife movements, and conflicting with long-term tiger conservation goals.</li> </ul>		
2018	<ul style="list-style-type: none"> <li>Electrocution-related deaths of wild animals, including tigers, are a growing concern in the Pench region.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Illegal fishing in Totladoh Reservoir poses a significant challenge, leading to strained relationships between villagers and forest department staff, though Tiger Reserve authorities are actively working to curb this illicit activity.</li> <li>The presence of NH 7, cutting through Pench Tiger Reserve and the Kanha Pench Corridor, has been a contributing factor to wildlife fatalities. Introduce measures to minimize accidents on NH 7.</li> <li>Implement the security audit recommendations to enhance protection in and around the reserve.</li> <li>Institutionalize interstate coordination between Madhya Pradesh and Maharashtra, involving NTCA and civil society organizations in the discussions.</li> <li>Strengthen tourism in the buffer areas for better conservation outcomes.</li> <li>Implement the landscape conservation strategy and action plan to address fragmented corridors.</li> <li>Enhance research efforts related to the biodiversity of the park.</li> <li>Provide frontline staff with specific refresher training periodically on protection and conservation.</li> </ul>		
2022	<ul style="list-style-type: none"> <li>The Pench Tiger Reserve is surrounded by 107 villages scattered in and around its buffer area, potentially posing a threat to the habitat.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>Develop suitable livelihood programs for villages like Ambadi, Khamba, and Khamreeth on the periphery to reduce resource dependence, or alternatively plan rehabilitation for relocation to mitigate their impact on PTR resources.</li> <li>Illegal fishing activities conducted by residents from nearby villages in Maharashtra and Madhya Pradesh create challenges for the administration, while weed growth in the submergence area of Ritladoh reservoir presents significant ecological concerns. Implementing electronic surveillance in the Ritladoh reservoir is crucial for preventing illegal fishing activities in Pench Tiger Reserve.</li> <li>Conduct comprehensive research on the diverse flora and fauna in PTR, focusing on abundance, seasonality, and ecosystem correlations, establishing a well-equipped lab for long-term studies on keystone species to assist in effective management decisions.</li> <li>The 110 kV power line passing through the buffer area of the Tiger Reserve, spanning 547.098 km, with 150 km traversing a sensitive portion, poses a severe threat of electrocution to wildlife. Address the issue of wildlife electrocution by advocating for the use of plastic-coated overhead wires or underground cables in compliance with Supreme Court orders, prioritizing insulation for the vulnerable 150 km section passing through the park.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Take immediate action to study and improve the distribution of bamboo in PTR, utilizing satellite/aerial images for the past 30 years and implementing interventions such as planting bamboo rhizomes along water sources and sowing bamboo seed balls.</li> <li>Expand the dog squad presence in Pench Tiger Reserve to each peripheral range, enhancing wildlife crime detection and acting as a deterrent.</li> <li>Monitor and aesthetically trim trees along National Highway 44 to mitigate potential dangers for arboreal animals like leopards encountering fast-moving traffic.</li> <li>Reevaluate forest fire management strategies, identifying vulnerable areas based on seasonal and vegetational variations and slope aspects for more effective fire management.</li> <li>Address the invasion of water hyacinth in core area water bodies and remove the exotic tree species, Cassia mines, along the boundaries to prevent habitat overrun.</li> </ul>		



**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### **4. Suggested key management recommendations**

- a. Considering that buffer zone control currently falls outside the Pench Tiger Reserve's jurisdiction, it's advisable to explore transferring control, particularly west of NH-7, to the Field Director. This move would ensure consistent application of protection measures throughout the reserve and its periphery.
- b. To address the issue of incompatible land use beyond the buffer zone, it's recommended to adopt a landscape approach for tiger management in Madhya Pradesh. This approach should prioritize the integration of development activities outside the reserve while safeguarding vital corridors and maintaining connectivity crucial for tiger conservation.
- c. With a significant portion of villagers surrounding the reserve lacking agricultural land and depending on forests for their livelihoods, it's suggested to develop and implement sustainable livelihood programs tailored to forest-dependent communities. These programs would help alleviate resource pressure on the reserve while providing alternative means of income for local communities.
- d. To mitigate ongoing conflict arising from crop damage by wildlife, it's advisable to improve compensation mechanisms and streamline claim processing for affected villagers. Additionally, exploring and promoting wildlife-friendly agricultural practices could help minimize crop damage while fostering coexistence between villagers and wildlife.
- e. In light of the limitations posed by insufficient staffing and training, it's recommended to increase personnel in the core area and provide dedicated wildlife management training for staff members. This initiative would enhance patrolling effectiveness and overall conservation efforts within the reserve.
- f. Given the challenges in interstate coordination between Madhya Pradesh and Maharashtra, it's suggested to institutionalize mechanisms for improved collaboration. Involving relevant authorities such as NTCA and NGOs would facilitate more effective cross-border patrolling and intelligence sharing, thereby strengthening law enforcement efforts.
- g. To address ongoing challenges related to invasive weeds, hotel proliferation, and illegal fishing in Totladoh Reservoir, it's advisable to implement a series of targeted measures. These measures could include intensive weed control, regulation of hotel development near sensitive areas, and collaboration with relevant departments to enforce fishing bans in the reservoir.
- h. Recognizing the need for better maintenance of roads within the core area to minimize habitat fragmentation, it's recommended to prioritize road maintenance activities. Focus should be placed on improving side drain upkeep to ensure proper water flow and prevent erosion, thereby preserving habitat integrity.
- i. To mitigate the impact of stone walls on wildlife movement, it's suggested to strategically create openings in these barriers. This approach would facilitate safe animal crossings

- while considering the cost-effectiveness of complete removal.
- j. Given the significant threat posed by NH-7 to wildlife due to heavy traffic, it's advisable to implement mitigation measures such as wildlife overpasses and underpasses. These measures would help minimize roadkill incidents and maintain crucial connectivity across the landscape.
  - k. Recognizing the importance of corridors connecting Pench with other reserves for tiger dispersal and gene flow, it's recommended to develop and implement an effective corridor management plan. Collaboration with surrounding forest divisions would be essential to restore and maintain these crucial wildlife movement pathways.
  - l. To address the lack of research and monitoring data on the reserve's biodiversity and ecological processes, it's suggested to undertake comprehensive research initiatives. Establishing a well-equipped lab for long-term studies and regularly monitoring key species and ecosystem variables would provide valuable insights for informed management decisions.
  - m. Given the threat posed by overhead power lines to wildlife due to the risk of electrocution, it's advisable to advocate for safer line materials or underground cables. Priority should be given to sections crossing sensitive areas to mitigate the risk effectively.
  - n. To tackle the decline in bamboo distribution, it's recommended to conduct a study and implement interventions such as planting bamboo near water sources. This approach would help improve bamboo availability for herbivores within the reserve.
  - o. Considering the importance of wildlife crime detection and prevention, it's advisable to expand the presence of dog squads and implement training programs to enhance their effectiveness in combating wildlife crime.
  - p. Recognizing the potential hazards for arboreal animals along NH-44, it's recommended to monitor and manage these risks effectively to minimize impacts on wildlife populations.
  - q. Given the importance of forest fire management, especially considering seasonal and spatial variations, it's advisable to reassess and improve existing strategies. This could involve updating protocols and resources to ensure effective response and mitigation efforts.
  - r. To address the invasion of water hyacinth and the presence of invasive exotic tree species like Cassia mines, it's recommended to take proactive measures to prevent habitat degradation. This could include removal of invasive species and implementing strategies for long-term habitat restoration and conservation.

## 5. Conclusions

Pench Tiger Reserve's thriving tiger population is bolstered by its advantageous location. Sharing a contiguous border with its Maharashtrian counterpart, Pench forms a transboundary reserve, multiplying conservation efforts. Its connections to Kanha through Seoni, Balaghat, and Mandla divisions, and to Satpura via Chhindwara, further strengthen the landscape's ecological integrity. Pench's high prey biomass also plays a crucial role in supporting its flourishing tigers. However, challenges remain. Highways and state highways dissect crucial corridors like Pench-NNTR, lacking forest connectivity, and Pench-Satpura, with a bottleneck and human-dominated railway stretch. These corridors require special attention to ensure seamless wildlife movement and inter-reserve migration. By addressing these critical issues, Pench Tiger Reserve can continue to be a haven for tigers and a shining example of successful transboundary conservation in central India.



GS BHARDWAJ

## SANJAY-DUBRI TIGER RESERVE

### 1. Brief Description

The Sanjay-Dubri Tiger Reserve, nestled in the northeastern part of Madhya Pradesh's Siddhi district, shares its border with Chhattisgarh's Guru Ghasidas National Park. Covering an area of 1674.511 km<sup>2</sup>, it comprises the core tiger habitat zone of Sanjay National Park and Dubri Wildlife Sanctuary, along with a buffer zone in the forested regions of Siddhi and Shahdol districts. The reserve's topography ranges from plains in Dubri to gently undulating terrain in Sanjay, with several perennial rivers flowing through. Its diverse vegetation, including north Indian moist deciduous peninsular sal and dry deciduous peninsular sal, supports a rich array of flora and fauna. Predators like tigers, leopards, sloth bears, striped hyenas, and wild dogs roam here, preying on species such as chital, sambar, nilgai, and wild pigs. Occasionally, herds of wild elephants seek shelter in the reserve, highlighting its connectivity with neighboring states like Chhattisgarh, Jharkhand, and Odisha.

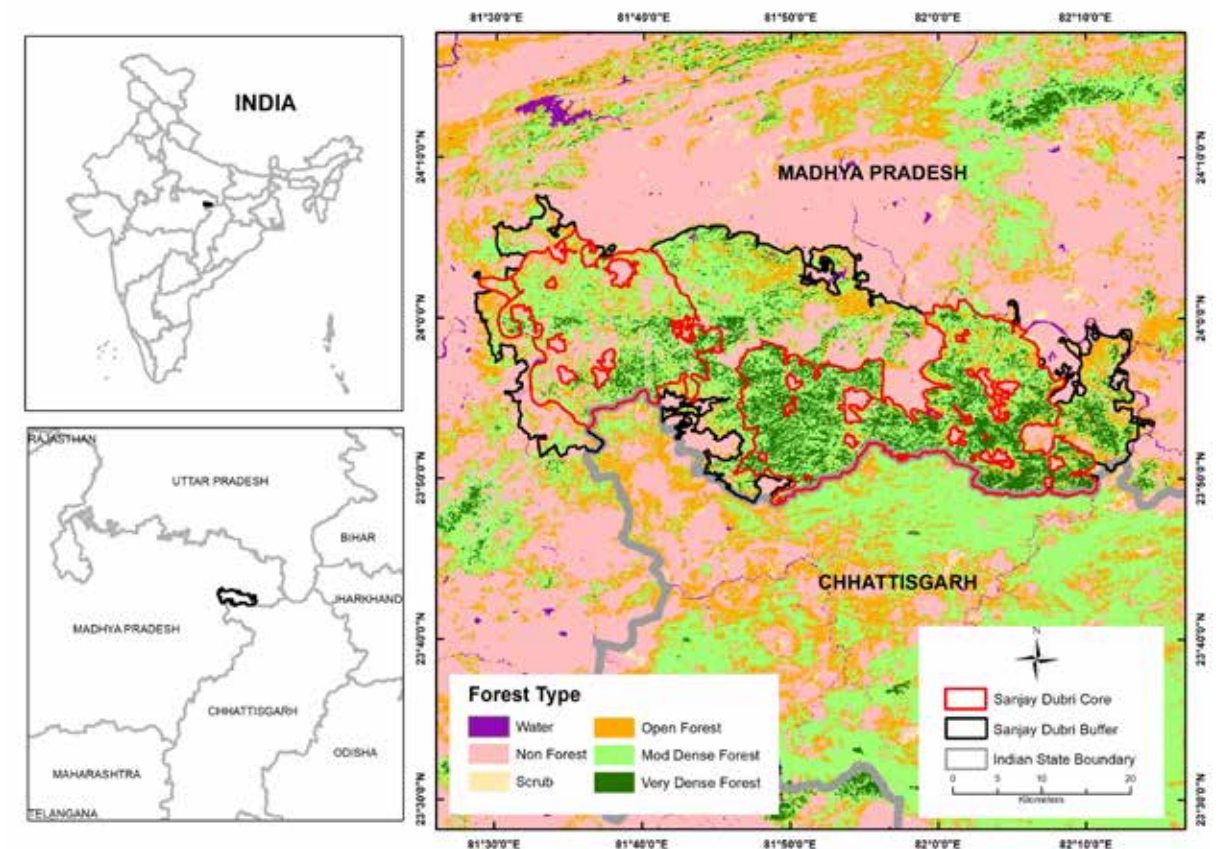


Figure 1: Map showing the location of Sanjay-Dubri Tiger Reserve in the state of Madhya Pradesh.

## 2. Tiger Population as per All India Tiger Estimation

In 2014, a capture effort successfully documented 6 unique tigers. Subsequent surveys in 2018 revealed a total of 98 tiger detections during the sampling period, with 5 adult individuals identified. The calculated tiger density was 0.23 (SE 0.10) per 100 sq km. Fast forward to 2022, where an extensive effort of 17011 trap nights was dedicated, resulting in 874 tiger photos. From this dataset, 16 individual tigers aged over 1 year were identified. The updated tiger density estimate stood at 0.78 (SE 0.20) per 100 sq km, indicating a significant increase since the 2018 assessment. These findings signify positive growth in the tiger population, underlining the success of conservation efforts and emphasizing the need for continued vigilance and strategic management of the forest ecosystem.

## 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<ul style="list-style-type: none"> <li>Initiating the new reserve in 2006 requires time for plans and strategies to materialize on the ground.</li> <li>Prey population remains notably low even in extensive and excellent habitats.</li> <li>Since 2000, the tiger population has been recorded between 6 and 7.</li> <li>Pugmarks of a female and a male tiger as floaters were observed at two widely separated locations.</li> <li>Notification for the 9 critical core areas is pending.</li> <li>The proposed area includes 47 villages with over 30,000 people and more than 40,000 livestock.</li> <li>Engaging villages in dialogue for voluntary relocation is challenging, but tactful efforts are being made in anticipation.</li> <li>Insufficient frontline working strength includes 18 forest guards, 10 foresters, and 3 RFOs.</li> </ul>	<ul style="list-style-type: none"> <li>Initiation of the reserve in 2006 lacked timely realization of plans and strategies on the ground.</li> <li>Over the years, the prey population has remained notably low in extensive and excellent habitats.</li> <li>Since 2000, the tiger population has stagnated between 6 and 7, reflecting challenges in conservation efforts.</li> <li>Pending notification for the nine critical core areas hinders effective management and protection measures.</li> <li>Engaging villages for voluntary relocation remains challenging, impacting conservation goals.</li> <li>Insufficient frontline staff (forest guards, foresters, RFOs) undermines protection efforts.</li> <li>Inadequate training for staff in wildlife management poses a significant concern.</li> </ul>	<ul style="list-style-type: none"> <li>The Sanjay-Dubri Tiger Reserve's tiger population is notably low and necessitates intensive management efforts, including habitat management and law enforcement, to establish a robust prey base.</li> <li>Additional supplementation of tigers should only be considered after achieving significant prey recovery.</li> <li>The reserve is linked to Bandhavgarh Tiger Reserve on the west, Palamau Tiger Reserve on the east in Jharkhand through habitat linkages, and is contiguous with Guru Ghasidas National Park on the south in Chhattisgarh. Recognized as a potential tiger meta-population landscape, this area demands intensive conservation efforts.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<ul style="list-style-type: none"> <li>Lack of wildlife training is a significant concern.</li> <li>Limited resources include only two 4 WD vehicles among 7 RFOs and 11 motorcycles among 19 foresters. Binoculars, cameras, and GPS devices are insufficient. Only 16 wireless stations, 7 on vehicles, and 60 handheld sets are available.</li> <li>There are only 4 permanent patrolling camps, necessitating an increase for effective protection.</li> <li>A de novo assessment is required for realistic sizes of management units and working strength.</li> <li>Guru Ghasidas National Park in Chhattisgarh is a continuum to the new reserve. Strong formal management cooperation and network at all levels are crucial for effective conservation efforts.</li> <li>The revenue department, responsible for receiving complaints, investigating, and settling compensation for crop damage, lacks prioritization for these matters.</li> </ul>	<ul style="list-style-type: none"> <li>Limited resources, including vehicles, equipment, and accessories, hinder effective park management.</li> <li>Lack of control over the buffer zone affects eco-development planning and wildlife conservation efforts.</li> <li>Weak prioritization in tourism management results in underdeveloped visitor facilities.</li> <li>Only one out of 40 villages in the critical tiger habitat has been relocated, affecting conservation efforts.</li> <li>Pending approval of the Tiger Conservation Plan (TCP) contributes to ad-hoc activities and delays in developmental and protection works.</li> <li>Buffer zone not under administrative control impedes concrete actions for forest strengthening.</li> <li>Heavy dependence of fringe communities on the forest necessitates steps for reduction and alternate livelihoods.</li> <li>Inadequate infrastructure and monitoring contribute to the reserve's low tiger density.</li> <li>The railway track and industrial activities in Singrauli pose threats to wildlife protection.</li> <li>Absence of eco-development committees and community participation in buffer management.</li> <li>Chital breeding efforts face challenges, requiring a review of techniques and consultation with experts.</li> </ul>	<ul style="list-style-type: none"> <li>Systematic management with top priority is essential for <i>Mesosphaerum suaveolens</i>. The invasion of <i>Prosopis juliflora</i> is potentially in its initial stage and requires high-priority removal before it establishes itself in a larger area.</li> <li>The significance of the Bandhavgarh-Sanjay-Guru Ghasidas-Palamau Corridor lies in its crucial role for the recovery of low-density tiger reserves. Protection of the Bandhavgarh-Sanjay-Achanakmar corridors is imperative to facilitate the dispersal of the tiger population in the landscape and uphold gene flow between the populations.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010		<ul style="list-style-type: none"> <li>Insufficient scientific information hampers effective wildlife management and conservation.</li> <li>The absence of a comprehensive Tiger Conservation Plan delays crucial conservation and management efforts.</li> </ul>	
2014	<ul style="list-style-type: none"> <li>Numerous revenue villages in Dubri Wildlife Sanctuary and Sanjay National Park contribute to biotic disturbance in the critical tiger habitat.</li> <li>Core zones face significant challenges, including grazing, illicit tree felling, and forest fires due to the high village population.</li> <li>Only one out of 40 villages in the critical tiger habitat has been relocated (Kanjara, 24 families). Families from 23 villages have volunteered for relocation, but 16 villages have not fully opted for it.</li> <li>Advocate for the inviolability of the critical Tiger habitat by relocating and rehabilitating villages within. Emphasize compliance with Wildlife (Protection) Act provisions for alternative arrangements for affected persons.</li> <li>The Tiger Reserve lacks a comprehensive Tiger Conservation Plan. Activities proposed in the Annual Plan of Operation are ad hoc due to the absence of proper planning. NTCA's observations on the TCP were received in October 2013, instructing completion within two weeks. Despite instructions, no action has been taken, emphasizing the need for a prioritized completion of the TCP.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Despite notification, the buffer zone is not under the control of the Field Director. Lack of control hampers concrete actions to strengthen buffer forests under significant human pressure. Urgent need to bring the buffer zone under the administrative control of the Field Director.</li> <li>Tourism confined to buffer forests due to anthropogenic activities in the critical Tiger habitat. Suggested areas for tourism include the forest areas of Bhui mand buffer range along the Gopad River. Allocate funds to convert all temporary patrolling camps into permanent structures.</li> <li>Activate existing EDCs in adjoining villages and constitute new ones for proactive measures in reducing village dependence on forests. Involvement of NGOs to help villages find alternatives and minimize dependence on forests.</li> <li>The prey base is low, potentially impacted by biotic pressure and recent poaching.</li> <li>Inadequate infrastructure and a lack of wildlife monitoring contribute to the reserve's low tiger density.</li> <li>Encourage the management to tap into NGO funds for infrastructure, including vehicles, equipment, and accessories. Utilize funds to enhance frontline protection force and patrolling camps.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>• Unnatural deaths of wildlife occur on the railway track and under electric lines. Heavy industrialization in Singrauli District, on the reserve's right bank, poses threats from pollution and labor impact.</li> <li>• Buffer areas not under Field Director's control result in poor or no eco-development planning. Absence of eco-development committees and minimal community participation in buffer management.</li> <li>• Recent tiger release (P212) from Panna Tiger Reserve lacks proper scientific understanding. The relocated tiger faces a higher dependence on cattle kills, escalating human-wildlife conflicts.</li> <li>• Insufficient scientific information hampers wildlife management.</li> <li>• Grassland management efforts are compromised due to poor protection against domestic cattle grazing.</li> </ul>		
2018	<ul style="list-style-type: none"> <li>• TCP approval is pending due to clarification or amendments sought by NTCA. The management of SDTR should expedite the approval of TCP from NTCA to avoid delays in developmental and protection works.</li> <li>• Urgent need to expedite the process to address various issues and streamline management practices.</li> <li>• Protect the buffer area of SDTR, an extension of Bandhavgarh Tiger Reserve, with activities suitable for wildlife management and conservation.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>• Only six out of 41 villages in the core and buffer areas have been relocated. The presence of remaining villages hampers the development and effectiveness of the Tiger Reserve. The relocation of villages within the core area should be prioritized for the conservation of SDTR.</li> <li>• Presence of 22 km of railway track, two railway stations, and an 11 KVA power line pose threats to wildlife protection.</li> <li>• Shortage of frontline staff (143 out of 198 posts) hampers the protection strategy. Fill vacant posts among field staff, especially frontline staff, for effective wildlife management.</li> <li>• Inadequate infrastructure, especially vehicles and motorbikes, hinders effective park management. Lack of a water tanker and GPS shortages further impede operational efficiency. Prioritize infrastructure development, including accommodation/patrolling camps, communication facilities, water amenities, and essential equipment like GPS and WT handsets.</li> <li>• Newly recruited forest guards possess a good academic background but lack proper orientation towards wildlife management. The need for improved training and orientation to enhance outcomes in wildlife conservation.</li> <li>• Address socio-economic challenges in SDTR through awareness campaigns, providing alternate livelihoods, intelligence gathering, and enforcement against bush-meat hunting.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Proper monitoring of wildlife status observed, but patrolling camps are not being utilized effectively. Protection staff being deputed for other duties affects the efficient protection of wildlife. Implement daily monitoring of wild animals in adherence to NTCA guidelines and SOPs for strengthened protection. Review the deployment of ex-servicemen for protection improvement and fully implement M-STRIPES for efficient attendance and patrolling. Ensure frontline staff, especially from the core area, is not frequently diverted for non-TR management duties.</li> <li>Initiate steps to reduce heavy dependence of fringe communities on the forest for fodder and fuel wood.</li> <li>Periodically review the impacts of the increase in labor force in SDTR towards Singrauli. Explore the possibility of mechanized interventions and trained elephants to address labor scarcity issues for effective execution of work.</li> <li>Absence of visitor facilities and a lack of prioritization in tourism management for SDTR. Develop tourist facilities according to the tourism plan, focusing on Eco Zone 2 (Badkadol side) and later Eco Zone 5 (Gopad side). Ensure conformity with NTCA guidelines for development.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>SDTR experiences a poor prey base leading to suppressed predator populations. Addressing prey population concerns is crucial for maintaining a balanced ecosystem.</li> <li>A Chital enclosure constructed in the Bulandol area aims to facilitate breeding but faces challenges with a low breeding rate. Review efforts to augment the chital population through enclosures. Test soil and water quality, consult accredited labs or technical institutes like WII, Dehradun, or SFRI, Jabalpur for guidance.</li> <li>Prioritize the development of ponds and grasslands in Dubri, along with the removal of invasive species from crucial herbivore habitats.</li> <li>Establish inter-state coordination and liaison between the Field Director, SDTR, and Chhattisgarh Forest Department for monitoring elephants visiting from Guru Ghasidas National Park.</li> <li>Develop appropriate habitats in SDTR in consultation with authorities.</li> </ul>		
2022	<ul style="list-style-type: none"> <li>The tiger relies considerably on livestock due to low wild prey density in the Tiger Reserve (CZ, BZ, and ESZ), posing a significant challenge for conservation. The low density of wild herbivores necessitates intensive studies for better understanding and appropriate conservation measures. Supplementation of ungulates from other protected areas should be augmented.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>Officially communicate the approval of the core plan by the state government to strengthen its administrative implementation, considering its passage through non-forest areas.</li> <li>32 villages in the Critical Zone (CZ) and 89 villages in the Buffer Zone (BZ) exert immense pressure on TR resources, leading to habitat degradation and competition between cattle and wild ungulates for fodder. Urgent steps are needed to relocate the 32 villages in the core zone. The high population of domestic cattle and goats intensifies grazing pressure, requiring progressive habitat recovery programs.</li> <li>Formulate micro plans for the 138 Forest Development Committees (FDCs) to assess and plan alternate income generation, reduce dependence on fuel and fodder, and overall village development in compensation for TR creation.</li> <li>The 22 km rail track, 99 km roads, and electrical lines within the TR pose threats to wildlife and park wildness by bisecting and fragmenting the park. Implement measures like realigning infrastructure and providing safe crossings to protect wildlife.</li> <li>Ongoing industrial activities in Singrauli District have adverse effects on the TR, with coal, iron ore, and limestone mines. Evaluate expansion or development projects in terms of their impact on wildlife and habitat, especially focusing on existing mines and industries within the impact zone.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Encourage small, field-based research projects addressing critical management issues (grassland management, water management, habitat use, resource competition, invasive species, waterhole management, disease prevalence, etc.) based on priority and fund availability.</li> <li>There are 76 vacant posts from the FG level to the FRO level, demanding immediate attention for effective management and conservation efforts.</li> <li>Improve amenities, ventilation, and maintenance of 71 patrolling camps and 23 check posts. Elephant-proof damaged camps for human safety.</li> <li>Crop damage compensation, handled by the revenue department, requires review as it is not a priority for them.</li> <li>Chital breeding in the enclosure's herbivore section remains low. Identify reasons for poor breeding and consult experts and institutions for appropriate solutions. Adopt techniques from captive breeding centers, adjust the sex ratio of breeding adults, and provide enriched feed to accelerate breeding. Explore similar initiatives for in-situ augmentation of the chital population.</li> <li>Enhance coordination between SDTR and Guru Ghasidas NP of Chhattisgarh to share information on elephant migration and address human-wildlife conflicts effectively.</li> <li>Assess and map bamboo distribution in the TR using GIS tools. Regenerate bamboo in areas where it has declined.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>• Equip the elephant management/patrolling team with better safety gadgets. Expose the team to successful strategies implemented in similar areas like Chhattisgarh's Sub (Sum*, Funbikapur, etc.).</li> <li>• Establish a field hospital with temporary animal holding facilities for emergency situations.</li> <li>• Develop a field-based laboratory for basic laboratory work and handling biological samples in consultation with local institutions and experts. Provide dedicated and trained staff for each facility.</li> <li>• Implement a centralized system to manage data related to wildlife health activities, including disease surveillance, necropsy details, rescue, rehabilitation, animal treatment, and preventive medicine programs.</li> <li>• Formulate a separate action plan to conserve threatened species in SDTR, such as the wolf, pangolin, vultures, narrow-headed soft turtle, sloth bear, chousingha, and Indian skimmer. Include wildlife research as a crucial component of this conservation plan.</li> <li>• Improve the available habitat to address the needs of the resident population of 19 wild elephants and potential transit elephants passing through the park.</li> <li>• Plan habitat enhancements for the growing elephant populations and the reintroduction of Gaur, ensuring sustainability and compatibility with wildlife needs.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- a. It would be beneficial to develop a detailed timeline for the implementation of plans and strategies for the newly established reserve, aligning them with conservation objectives. This approach will help effectively track progress and address potential challenges along the way.
- b. Considering the low prey population in otherwise suitable habitats, it is advisable to conduct thorough studies to identify factors affecting prey numbers. Implementing habitat enhancement strategies and considering translocations could potentially bolster prey populations and restore ecological balance.
- c. Establishing a robust monitoring program, leveraging advanced technologies, is essential for effectively tracking tiger movements and behavior patterns. This will provide valuable insights for informed conservation decisions and proactive management interventions.
- d. It is recommended to expedite the notification process for critical core areas, emphasizing their significance in safeguarding tiger habitats and promoting biodiversity conservation. Timely notification is vital for securing these areas and ensuring their long-term protection.
- e. Engaging in dialogue with villages for voluntary relocation using community-centric approaches that highlight the benefits of relocation would be advisable. Collaborating closely with local authorities to facilitate the process and address any concerns raised by the communities is recommended.
- f. Prioritizing recruitment efforts to address frontline workforce shortages, providing necessary training and capacity-building initiatives, would significantly enhance the effectiveness of wildlife protection efforts. Conducting awareness campaigns and addressing socio-economic challenges can further reinforce these efforts.
- g. Establishing comprehensive training programs for forest guards, focusing on wildlife management, conservation practices, and the use of advanced technologies, is recommended. Addressing socio-economic challenges to ensure the well-being and effectiveness of newly recruited personnel is essential.
- h. Investing in infrastructure development to address resource shortages, including vehicles, equipment, and communication devices, would enhance operational efficiency in the field. Upgrading communication facilities and ensuring adequate resources will strengthen field operations.
- i. Increasing the number of strategically located patrolling camps to improve protection and monitoring coverage across the reserve is advisable. This would strengthen the presence of field staff and enhance overall reserve management.
- j. Conducting a thorough assessment to determine optimal management unit sizes and workforce requirements for effective conservation is recommended. This will provide valuable insights for resource allocation and management planning.
- k. Establishing formal management cooperation and networks with Guru Ghasidas



National Park in Chhattisgarh to promote collaborative conservation efforts and information sharing is advisable.

- l. Advocating for improved prioritization within the revenue department to streamline and expedite crop damage compensation processes is recommended. This will ensure timely support to affected communities and foster positive relations with stakeholders.
- m. Developing comprehensive micro plans for Forest Development Committees in revenue villages to reduce dependence on forests and initiate sustainable village development programs is advisable.
- n. Prioritizing the relocation of villages within the core area, emphasizing compliance with Wildlife (Protection) Act provisions, would contribute to creating inviolate spaces for tiger conservation and habitat protection.
- o. Prioritizing the completion of the Tiger Conservation Plan (TCP) and advocating for control over the buffer zone is recommended. Aligning management actions with the approved plan will ensure effective conservation efforts.
- p. Developing tourism facilities according to the plan, allocating funds for infrastructure development, and converting temporary patrolling camps into permanent structures would enhance visitor experiences while minimizing disturbances to critical tiger habitats.
- q. Activating existing EDCs, constituting new ones, and involving NGOs to assist villages in finding alternatives and reducing dependence on forests is recommended. This will promote community participation in buffer management and foster sustainable conservation practices.
- r. Establishing a field hospital, improving patrolling efficiency, and conducting regular health assessments to mitigate the impact of unnatural deaths on wildlife are advisable. Evaluating the effects of industrialization on wildlife and implementing appropriate mitigation measures is essential.
- s. Collaborating with experts, conducting scientific studies, and investing in research to enhance understanding of tiger releases and wildlife management practices is recommended. This will ensure informed decision-making and effective conservation outcomes.
- t. Establishing a prioritized action plan to address urgent issues systematically and ensure timely implementation of management practices is advisable. This will help in expediting the resolution of key challenges and streamlining management processes.
- u. Prioritizing the relocation of remaining villages within the core area to create inviolate spaces for effective tiger reserve conservation is recommended. Collaborating closely with local communities to facilitate the relocation process and address any concerns raised is essential.
- v. Investing in advanced monitoring technologies, enhancing coordination with NGOs, and implementing habitat enhancement strategies to address concerns regarding inadequate wildlife monitoring and a poor prey base is advisable. This will strengthen conservation efforts and improve ecological balance within the reserve.

## 5. Conclusions

Since the 2018 national tiger estimation, the tiger population within Sanjay Dubri Tiger Reserve has exhibited a gratifying upward trend. This positive development can be attributed, in part, to several key management initiatives undertaken by the reserve authorities. One such initiative involves exploring incentivized voluntary relocation programs from villages situated within the reserve. This strategy aims to establish an inviolate core area, effectively reducing human pressure on the habitat. Consequently, prey populations are expected to rebound, creating a more sustainable ecosystem for tigers. Further bolstering the prey base, the reserve witnessed the successful reintroduction of gaur this year, sourced from Kanha and Satpura Tiger Reserves. Additionally, ongoing chital supplementation programs from Bandhavgarh Tiger Reserve are providing a vital boost to the tiger's natural food sources. Sanjay Dubri's strategic location facilitates connectivity with crucial protected areas across state borders. The reserve seamlessly adjoins Guru Ghasidas National Park in Chhattisgarh, Palamau Tiger Reserve in Jharkhand, and Bandhavgarh Tiger Reserve in Madhya Pradesh, because of the intervening forests of Shahdol Forest Division. This connectivity allows for natural wildlife movement, even welcoming occasional visits from wild elephant herds. To solidify these gains and ensure long-term tiger conservation success, the reserve management should maintain rigorous monitoring, prioritize habitat improvement and foster community engagement. By proactively implementing these measures and continuously adapting strategies based on scientific data, the Sanjay Dubri Tiger Reserve team is ensuring a thriving tiger population and a robust, sustainable ecosystem for generations to come.



# SATPURA TIGER RESERVE

## 1. Brief Description

Satpura Tiger Reserve (STR) is situated in the Satpura landscape in the Deccan Peninsula biogeographic zone of the central Indian highlands, south of the Narmada River, covering coordinates between 77°53'48" to 78°34'0" E longitudes and 22°19'28" to 22°45'30" N latitudes in the Hoshangabad district of Madhya Pradesh. The reserve spans a total area of 2133.30 km<sup>2</sup>, comprising the core habitats of Satpura National Park, Bori Wildlife Sanctuary, and Panchmarhi Wildlife Sanctuary, and a buffer zone including Hoshangabad Division, Rampur Bhatodi Project Division, and west Chhindwara Division. The terrain is rugged with deep valleys, sandstone peaks, narrow gorges, rivulets, dense forests, and reservoirs. The vegetation types include southern moist mixed deciduous, southern dry mixed deciduous, and dry peninsular sal. Sal forests cover the high ranges of the Panchmarhi plateau, while dense teak forests spread over its lower hill ranges. The reserve hosts diverse mammal species, including tiger, leopard, sloth bear, wild dog, striped hyena, golden jackal, chital, sambar, gaur, barking deer, four-horned antelope, blackbuck, chinkara, and wild pig. Notably, the woolly horseshoe bat, *Rhinolophus luctus*, is recorded only in the Panchmarhi plateau within the central Indian landscape. The endangered central Indian hard ground swamp deer (*Rucervus duvauceli branderi*) was reintroduced in 2015-2016 from Kanha Tiger Reserve to establish a new population.

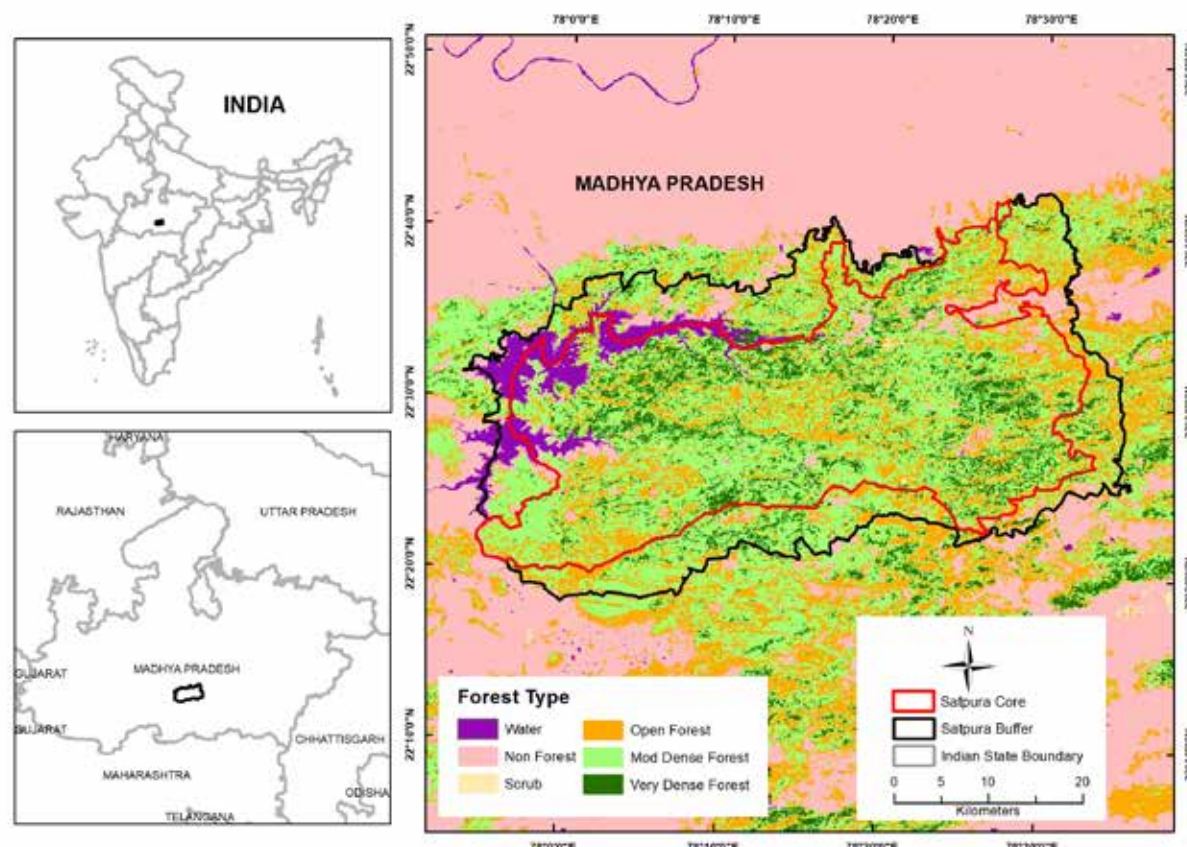


Figure 1: Map showing the location of Satpura Tiger Reserve in the state of Madhya Pradesh

## 2. Tiger Population as per All India Tiger Estimation

The tiger population in Satpura Tiger Reserve has demonstrated recovery following the relocation of villages in 2014-2016. Management interventions, such as restocking of chital and barasingha in the relocated sites, contributed to an increased prey base, facilitating rapid recovery. Since the National Tiger Estimation Exercise in 2018, the tiger population at Satpura has seen growth. In 2022, 50 individual tigers were identified, resulting in an estimated tiger density of 2.01 (SE 0.28) tigers per 100 sq. km. The incentivized voluntary village relocation has positioned Satpura as the largest inviolate area for tigers in Madhya Pradesh. The reserve holds the potential to become one of the largest tiger populations in India if prey recovery in tiger reserves is achieved.

## 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Human and cattle populations in the villages within the core critical tiger habitat exert significant biotic pressure.</li> <li>Despite the voluntary relocation of the remaining 29 villages, there is no firm commitment from the State Government or NTCA regarding financial support for relocation. Efforts can be made to remove the other 29 villages potentially making a significant portion of the reserve inviolate.</li> <li>Religious tourism in Pachmarhi and traffic movement on National Highway 19A cause disturbances in the core area. The Supreme Court has directed the removal of the temple town of Pachmarhi and about 20 villages from the eastern and north-eastern parts of the core area.</li> </ul>	<ul style="list-style-type: none"> <li>Despite voluntary efforts, the lack of firm financial commitment from the government for village relocation poses an ongoing weakness.</li> <li>Attempts to develop grasslands post-village relocations face challenges, with evidence of abandoned cattle movement and a lack of effective measures for disease prevention.</li> <li>Submission of the TCP faced challenges with NTCA observations, indicating a need for comprehensive rewriting and detailed planning.</li> <li>Despite robust protection, surveillance challenges persist at Tawa Reservoir, contributing to ongoing threats of illegal fishing.</li> <li>Pilgrim influx in Pachmarhi consistently poses a threat, requiring ongoing efforts to regulate movements as directed by the court.</li> </ul>	<ul style="list-style-type: none"> <li>Incentivized voluntary village relocation has established Satpura as the largest inviolate area for tigers in Madhya Pradesh.</li> <li>Active coal mines on both the east and west sides of the corridor require vigilant monitoring and mitigation efforts with restorative inputs.</li> <li><i>Ageratum conyzoides</i> should be systematically managed with priority.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Approximately 1% of the Satpura Tiger Reserve is covered by grasslands. Attempts to develop grasslands on available sites after village relocations have been made with expert assistance, but evidence shows the movement of abandoned cattle in these areas.</li> <li>No effective measures have been implemented to make the area free of cattle post-village relocation, posing a potential threat of communicable diseases to wild counterparts.</li> <li>The reserve submitted a TCP to the NTCA for approval. NTCA communicated observations highlighting the need for a comprehensive rewrite of the plan. A lack of detailed planning for each component in the TCP makes it challenging for the management to scientifically manage the reserve.</li> </ul>	<ul style="list-style-type: none"> <li>While current manpower suffices for the core area, consistent attention is needed to address potential staff shortages in the extensive buffer zone.</li> <li>The influx of tourists and pilgrims continues to pose significant threats, leading to disturbances, plastic pollution, and garbage issues.</li> <li>The delay in acquiring wireless sets for the tiger reserve remains a persistent concern, affecting communication and management operations.</li> <li>The Betul—Bhopal highway consistently hinders wildlife movements in the Satpura—Melghat corridor, impacting natural habitats and migration patterns.</li> </ul>	
2018	<ul style="list-style-type: none"> <li>The final notification for the core area has been issued, local people have been granted fishing rights in Tawa Reservoir for local consumption. Implement rigorous surveillance at Tawa reservoir to control illegal fishing and address the issue of garbage left by visitors, particularly plastic bags.</li> <li>Despite robust protection measures, the vast area of the reservoir makes it challenging to rule out illegal fishing activities.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>A significant number of pilgrims visit Pachmarhi during February/March, causing considerable disturbance in the protected area. Regulate the movement of the large number of pilgrims in consultation with administration and law enforcement agencies, leveraging a court order.</li> <li>While the current manpower is sufficient for the core area, the extensive buffer zone may require additional staff strength to ensure effective management.</li> <li>Enhance the 795 sq. km. buffer added to STR by deploying additional manpower for improved management and protection.</li> <li>Utilize the 795 sq. km. handed over to STR as a buffer by developing tourist facilities to keep the core area undisturbed.</li> <li>Develop visitor facilities in the new buffer area, including an interpretation center and tourist amenities, to divert tourists from the core area.</li> <li>Explore the potential for non-vehicular tourism in STR, similar to the approach taken by Periyar Tiger Reserve.</li> <li>Inadequate number of WT sets in STR was observed, posing challenges for field officials, particularly in remote areas, where untimely repairs can hinder communication. Follow up on the allotment of new wireless frequencies by the Government of India, purchase new WT sets, and improve communication infrastructure.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>The Betul-Bhopal highway passing through the Satpura-Melghat corridor poses a hindrance to the movement of wild animals, impacting their natural habitat and migration patterns. Execute the NTCA-approved corridor plan in a time-bound manner to ensure the safety and unhindered movements of animals. Ensure STR functions as a source population for other habitats outside the reserve by implementing the approved corridor plan promptly.</li> <li>Due to labor scarcity resulting from village relocations in the core area, explore possibilities of restricted mechanized interventions for execution of work.</li> </ul>		
2022	<ul style="list-style-type: none"> <li>The influx of tourists and pilgrims in Pachmarhi poses a significant threat to the tiger reserve, leading to disturbances in the park and issues related to plastic pollution and garbage disposal.</li> <li>The delay in acquiring wireless sets for the tiger reserve is a matter of concern, affecting communication and management operations.</li> <li>The Betul—Bhopal highway (NH 46) passing through the Satpura—Melghat corridor near Kesla Ghat causes hindrances to wildlife movements, impacting the natural habitat and migration patterns.</li> <li>Initiate a scientific study on carbon credit and sequestration in the tiger reserve to comprehend its role in climate change mitigation.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Establish sample plots in the grasslands of STR for scientific monitoring, particularly to assess the impact of village relocations on abiotic factors like water, air, and soil quality.</li> <li>Set up a well-equipped training cum orientation center within STR to conduct regular training and refresher courses for frontline staff in Satpura and other tiger reserves and protected areas in Madhya Pradesh.</li> <li>Collaborate with the Special Area Development Authority (SADA) and Cantonment Board in Pachmarhi for effective waste management and garbage disposal.</li> <li>Regulate land use patterns hostile to tiger conservation in the landscape as part of implementing the Zonal Master Plan, adhering to existing legal provisions.</li> <li>Ensure appropriate mitigation of all road and railway infrastructure in and around STR, incorporating smart green technologies such as animal passage structures, to maintain landscape permeability for the uninterrupted dispersal of tigers and other wildlife.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- a. It's advisable to address the unimplemented actionable points from past MEE cycles, which currently pose a growing threat to Satpura Tiger Reserve. To safeguard its future, it would be prudent to activate a plan prioritizing and implementing these critical points. Collaborative efforts involving park management, local communities, and government agencies are recommended to focus on the actionable recommendations outlined in MEE reports. By taking decisive action now, effective management and conservation can be ensured, preventing irreversible damage and securing a thriving future for the reserve.
- b. Considering the disturbances caused by religious tourism in Pachmarhi and traffic movement on National Highway 19A within the core area, it is suggested to implement Supreme Court directives to address these issues. This could involve regulating the movement of pilgrims through effective collaboration with administration and law enforcement agencies.
- c. Approximately 1% of the Satpura Tiger Reserve is covered by grasslands, and efforts to develop these post-village relocations face challenges. It is recommended to implement effective measures to make areas free of cattle post-village relocation. This would help address the potential threat of communicable diseases to wildlife counterparts.
- d. It is advisable to revise the TCP with detailed planning for each component, thereby facilitating scientific management and obtaining approval from NTCA.
- e. Addressing challenges related to fishing rights granted in Tawa Reservoir, including illegal fishing and garbage disposal, is crucial. Implementing rigorous surveillance to control illegal fishing and addressing garbage issues at Tawa Reservoir is recommended to ensure environmental protection.
- f. While the current manpower is deemed sufficient for the core area, additional staff strength may be required for the extensive buffer zone. Enhancing staffing in the buffer zone and developing tourist facilities to keep the core area undisturbed is suggested.
- g. To address issues related to the influx of tourists and delayed acquisition of wireless sets affecting management operations and communication, it is advisable to develop visitor facilities in the new buffer area. Exploring non-vehicular tourism and expediting the acquisition of wireless sets for efficient communication are recommended.
- h. The Betul-Bhopal highway passing through the Satpura-Melghat corridor hinders wildlife movements. It is recommended to execute the NTCA-approved corridor plan promptly to ensure the safety and unhindered movements of animals.
- i. Labor scarcity post-village relocations may hinder manual interventions in the core area. Exploring possibilities of restricted mechanized interventions to address labor scarcity challenges is suggested.
- j. Addressing disturbances and issues related to plastic pollution caused by the influx of tourists and pilgrims in Pachmarhi is essential. Collaborating with SADA and Cantonment

Board for effective waste management and garbage disposal is recommended.

- k. To address the lack of scientific studies on carbon credit and sequestration in the tiger reserve, initiating a scientific study on carbon credit and sequestration is advisable to comprehend its role in climate change mitigation.
- l. Considering the inadequate number of WT sets posing challenges, establishing a training center could be beneficial. Following up on new wireless frequencies, purchasing new WT sets, and establishing a well-equipped training cum orientation center within STR for regular training and refresher courses are recommended.
- m. To mitigate the impacts of the Betul-Bhopal highway on wildlife movements and habitat, ensuring landscape permeability is crucial. Implementing the corridor plan promptly and incorporating smart green technologies for infrastructure mitigation could be effective strategies.
- n. Vigilant monitoring of active coal mines and systematic management of Ageratum conyzoides is recommended. Mitigating coal mine impacts with restorative inputs and prioritizing systematic management of Ageratum conyzoides are advisable steps to take.

#### 5. Conclusions

Incentive-driven voluntary village relocation has transformed Satpura into the largest pristine haven for tigers in Madhya Pradesh. This reserve boasts enormous potential to harbor one of India's largest tiger populations, contingent on successful prey restoration within its boundaries. Satpura's connectivity network includes Melghat Tiger Reserve to the west, while Chhindwara Forest Division in the southeast bridges the gap to Pench Tiger Reserve, ultimately connecting to Kanha Tiger Reserve further east. However, active coal mines on both sides of the crucial corridor necessitate vigilant monitoring and mitigation measures, including restorative actions, to ensure uninterrupted passage for wildlife.





## BOR TIGER RESERVE

### 1. Brief Description

The Bor Tiger Reserve in Maharashtra was officially established on August 16, 2014, covering a core area of 138.12 km<sup>2</sup>, encompassing Bor Sanctuary, New Bor Sanctuary, and the extended New Bor Sanctuary. This reserve marks the 47th tiger reserve in India and the sixth in Maharashtra, strategically located in Seloo Tahsil of Wardha District and Hingana Tahsil of Nagpur District. Representing a typical Central Indian biodiversity, the reserve, despite its smaller size, holds significant importance within the broader landscape. It forms a crucial link in the network of tiger reserves and protected areas, connected through vital corridors to reserves like Tadoba Andhari, Pench, Melghat, and Umred-Paoni-Karhandala WLS. Currently, the administrative control of the core area lies with the Field Director of Pench Tiger Reserve, while the Bor (Wildlife) Division, overseen by the Division Forest Officer (Wildlife) in Nagpur, manages the core area. However, the Management Effectiveness Evaluation (MEE) recommended bringing the buffer area under the unified control of the Field Director. The core area comprises two ranges: Bor (wildlife) covering 61.10 km<sup>2</sup> and New Bor (wildlife) covering 77.02 km<sup>2</sup>. Each range is subdivided into rounds, beats, and camps, managed by the Bor Wildlife Division authorities. Proposals for administrative reorganization in the 355.82 km<sup>2</sup> buffer area aim to consolidate under the Field Director's unified control. This proposed reorganization includes three ranges: Kawadas, Hingani, and Bangdapur, each structured with rounds and beats for better management.

### 2. Tiger Population as per All India Tiger Estimation

In 2018, in Bor Tiger Reserve, a total of 107 tiger detections were recorded, leading to the identification of 6 adult individual tigers and an estimated density of 0.6 tigers per 100 km<sup>2</sup>. Additionally, 374 photos of tigers were obtained over 5961 trap nights. However, for year 2022, 9 unique tigers (<1 year of age) were identified and an estimated density of 1.02 tigers per 100 km<sup>2</sup>. This indicates a potential increase in tiger presence and density in Year 2 compared to Year 1, highlighting the importance of continued monitoring and conservation efforts in the reserve.

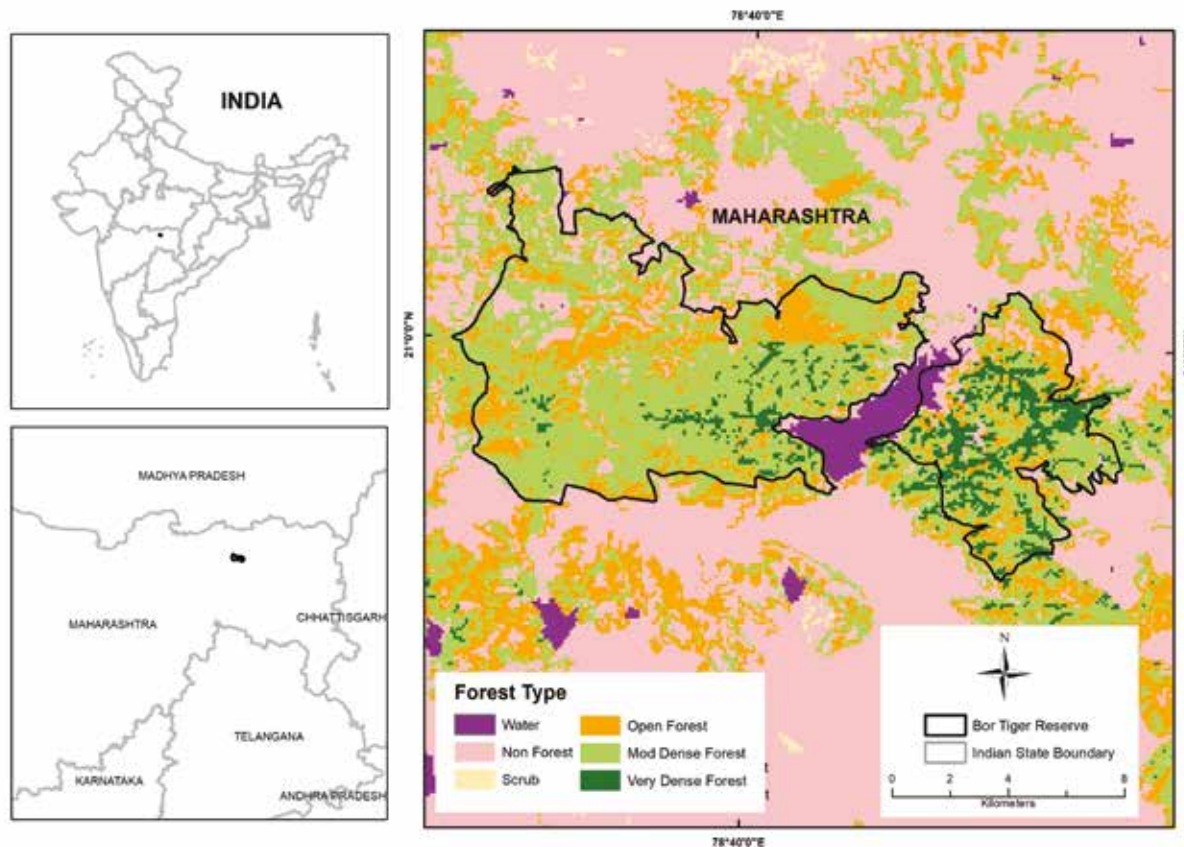


Figure 1: Map showing the location of Bor Tiger Reserve in the state of Maharashtra.

### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Lack of unified control in the buffer zone hampers effective tiger-focused management.</li> <li>Small core area surrounded by a human-dominated buffer increases human-wildlife conflicts.</li> <li>Field personnel spend significant time monitoring tigers outside their assigned beats, impacting protection efforts.</li> <li>Serious threats including poaching, water scarcity, habitat loss, and disease transmission are identified in the draft TCP.</li> </ul>	<ul style="list-style-type: none"> <li>Lack of unified control in the buffer zone, impacting effective management strategies.</li> <li>Small core area surrounded by a human-dominated buffer, increasing human-wildlife conflicts.</li> <li>Field personnel spending significant time monitoring tigers outside their assigned beats, affecting protection efforts.</li> <li>Serious threats including poaching, water scarcity, habitat loss, and disease transmission identified in both years.</li> </ul>	<p><b>Eco-sensitive Zone Management:</b> Given the developmental pressures around the reserve, it is crucial to effectively manage the eco-sensitive zone (ESZ) encompassing the reserve. Strict enforcement of regulations within the ESZ can help mitigate adverse impacts on wildlife habitats and maintain ecological integrity.</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Restricted prey population in 11 compartments needs diversification to prevent cattle dependence.</li> <li>Land-use patterns outside the sanctuary hinder tiger movements.</li> <li>Poor water retention in substratum aggravates water scarcity during critical periods.</li> <li>Staff lacks necessary skills in wildlife protection, management, crime investigation, and ecodevelopment.</li> <li>Frontline staff are unaware of and not following mandated Standard Operating Procedures (SoPs) from NTCA.</li> <li>Exclusion of Bordharan reservoir from the Critical Management plan could impact overall protection.</li> <li>Poor preparedness in addressing human-wildlife conflicts, inadequate equipment, and support from territorial forest divisions.</li> <li>Underreporting of wildlife-related offenses and inadequate attention to wildlife crimes.</li> <li>Need to secure the integrity of the corridor between Tadoba-Andhari Tiger Reserve (TATR) and Bor due to road interruptions.</li> </ul>	<ul style="list-style-type: none"> <li>Restricted prey population in compartments, needing diversification to reduce cattle dependence.</li> <li>Land-use patterns outside the sanctuary hindering tiger movements.</li> <li>Poor water retention in the substratum aggravating water scarcity during critical periods.</li> <li>Staff lacking necessary skills in wildlife protection, management, and crime investigation.</li> <li>Frontline staff being unaware of and not following mandated Standard Operating Procedures (SoPs) from NTCA.</li> <li>Underreporting of wildlife-related offenses and inadequate attention to wildlife crimes.</li> </ul>	<p><b>Unified Administrative Control:</b> Bringing the entire area of the reserve under unified administrative control is essential for cohesive management and coordination of conservation efforts. This can streamline decision-making processes and ensure consistent implementation of conservation measures.</p> <p><b>Human-Tiger Conflict Mitigation:</b> Implementing measures to reduce negative interactions between humans and tigers is paramount. This includes improving law enforcement activities to prevent poaching and illegal encroachment, as well as implementing appropriate mitigation measures for development activities that may encroach upon tiger habitats.</p> <p><b>Community Engagement and Sensitization:</b> Engaging local communities in conservation efforts and raising awareness about the importance of tiger conservation is crucial. Sensitization programs can help foster a sense of stewardship among local residents and promote coexistence with wildlife.</p> <p><b>Early Warning Systems:</b> Establishing early warning systems to alert authorities and local communities about potential conflicts or threats involving tigers can help prevent incidents and facilitate timely response measures.</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018			<p><b>Habitat Restoration and Corridor Management:</b> Restoring degraded habitats and managing wildlife corridors connecting Bor Tiger Reserve with neighboring reserves can enhance habitat connectivity and facilitate the movement of wildlife, including tigers. Restoration efforts should focus on maintaining permeability and ensuring smooth movement between tiger habitats.</p> <p><b>Invasive Species Management:</b> Implementing comprehensive invasive species management strategies is essential to control the spread of the woody shrub. This may include methods such as manual removal, mechanical control, biological control using natural predators, and chemical treatments in sensitive areas.</p>
2022	<ul style="list-style-type: none"> <li>Lack of unified control over the core and buffer areas, with a small core compared to the larger peripheral buffer.</li> <li>Proximity to human settlements leading to interference, fires, and poaching; potential for unregulated resort development.</li> <li>Varied land uses in the buffer increasing human-tiger interactions.</li> <li>Poor water retention causing summer water scarcity.</li> <li>Disruptive late-hour fishing in Bor backwaters disturbing wildlife.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Insufficient registered Gypsy vehicles leading to private vehicles entering, compromising security protocols.</li> <li>Inadequate Central Sector Scheme (CSS) funding straining TR management.</li> <li>High vulnerability to weed infestation like Hyptis and Lantana.</li> <li>Dominance of teak habitat with limited grasslands, except in areas like the relocated Navargaon village with better fodder growth.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- It could be beneficial to consider establishing unified administrative control over both the core and buffer areas of the reserve. This could facilitate cohesive management strategies and ensure consistent implementation of conservation measures across the entire reserve.
- Suggesting the implementation of effective measures to mitigate human-tiger conflicts is crucial. This could involve strengthening law enforcement activities to prevent poaching and illegal encroachment, as well as implementing appropriate mitigation measures for development activities that may encroach upon tiger habitats.
- Engaging local communities in conservation efforts and raising awareness about the importance of tiger conservation may yield positive results. Considering sensitization programs to foster a sense of stewardship among local residents and promote coexistence with wildlife could be beneficial.
- Proposing the establishment of early warning systems to alert authorities and local communities about potential conflicts or threats involving tigers might help prevent incidents and facilitate timely response measures.
- Recommending the restoration of degraded habitats and the management of wildlife corridors connecting Bor Tiger Reserve with neighboring reserves could enhance habitat connectivity and facilitate the movement of wildlife, including tigers. Restoration efforts could focus on maintaining permeability and ensuring smooth movement between tiger habitats.



- f. Suggesting the implementation of comprehensive invasive species management strategies could be crucial to control the spread of invasive species like Hyptis and Lantana. This might include methods such as manual removal, mechanical control, biological control using natural predators, and chemical treatments in sensitive areas.
- g. Advising strict enforcement of regulations within the eco-sensitive zone (ESZ) encompassing the reserve to mitigate adverse impacts on wildlife habitats and maintain ecological integrity amidst developmental pressures could be considered essential.
- h. Recommending the provision of training programs and capacity-building initiatives for reserve staff to enhance their skills in wildlife protection, management, crime investigation, and ecodevelopment could improve their effectiveness in implementing conservation measures and addressing threats to tiger populations.
- i. Suggesting fostering collaboration with local communities, government agencies, NGOs, and research institutions to leverage resources and expertise for effective tiger conservation might enhance conservation outcomes and promote community participation in conservation initiatives.
- j. Advising the strengthening of law enforcement activities within the reserve to combat poaching, illegal encroachment, and other wildlife-related offenses could be crucial. Increasing patrolling frequency and equipping frontline staff with necessary resources and support to effectively monitor and protect tiger habitats might be beneficial.
- k. It may be worthwhile to implement measures to improve water retention in the reserve, especially during critical periods of water scarcity. This could involve considering the construction of water management infrastructure, such as check dams or artificial waterholes, to ensure adequate water availability for wildlife.
- l. Recommending the development of sustainable tourism practices and regulations to minimize the negative impacts of tourism on tiger habitats and reduce human-wildlife conflicts could be beneficial. Implementing carrying capacity assessments and visitor management strategies to ensure responsible tourism practices within the reserve might help achieve this goal.
- m. Suggesting investment in scientific research and monitoring programs to continuously assess tiger populations, prey densities, habitat quality, and ecosystem health within the reserve could provide valuable insights. Research findings could inform adaptive management strategies and conservation planning efforts.

## 5. Conclusions

In conclusion, Bor Tiger Reserve in Maharashtra stands as a critical stronghold for tiger conservation efforts within the Central Indian landscape. Despite facing various challenges such as habitat fragmentation, human-wildlife conflicts, and inadequate administrative control, the reserve has shown promising signs of tiger population growth and habitat restoration. Through collaborative conservation efforts, enhanced law enforcement, capacity building, and sustainable tourism management, Bor Tiger Reserve has the potential to serve as a model for effective tiger conservation in the region. However, continuous monitoring, research, and adaptive management are essential to address ongoing threats and ensure the long-term viability of tiger populations and their habitats in the reserve. With concerted efforts from stakeholders, Bor Tiger Reserve can continue to thrive as a vital refuge for tigers and other wildlife species, contributing significantly to the broader conservation objectives of India's tiger conservation program.



# MELGHAT TIGER RESERVE

## 1. Brief Description

Nestled within the South-Western Satpura mountain ranges bordering Madhya Pradesh, Melghat Tiger Reserve is a sprawling region covering approximately 2768.52 sq. km. Characterized by tropical dry deciduous forests and teak trees, it serves as a crucial catchment area for major rivers. The reserve experiences three distinct seasons with significant rainfall during the monsoons. Temperature variations are notable, with cooler summers in the north compared to the warmer south. Melghat's conservation history dates back to the alarming decline in tiger population in 1972, leading to its inclusion in Project Tiger in 1973. Initially covering 1571.74 sq. km, it expanded to encompass 2029.04 sq. km and later defined the core area with the creation of Gugamal National Park in 1987. Known for its untouched natural forests, deep valleys, and towering hills, Melghat is home to diverse ecosystems and rich biodiversity, making it a significant conservation area in India.

## 2. Tiger Population as per All India Tiger Estimation

In Melghat Tiger Reserve, tiger population estimates varied over the years. In 2006, there was a high-density population of 30 tigers ( $\pm 1$  SE range of 21-39), with a recorded presence in 1,828 km<sup>2</sup> of contiguous habitat. However, by 2010, the estimated population increased to 35 tigers (SE 30-39), indicating a positive trend. In 2014, the number of identified tigers decreased to 25 (21-30). In 2018, during sampling, a total of 1159 tiger detections were recorded, identifying 46 individual adult tigers. SECR models estimated a tiger density of 1.49 (SE 0.22) tigers per 100 km<sup>2</sup>. In terms of effort for 2022, 26751 trap nights were invested, resulting in 2974 tiger photos obtained. From these, 57 unique tigers (>1 year of age) were identified, with a tiger density estimated at 1.92 (SE 0.26) tigers per 100 km<sup>2</sup>. These fluctuations in population highlight the importance of ongoing monitoring and conservation efforts in the reserve.

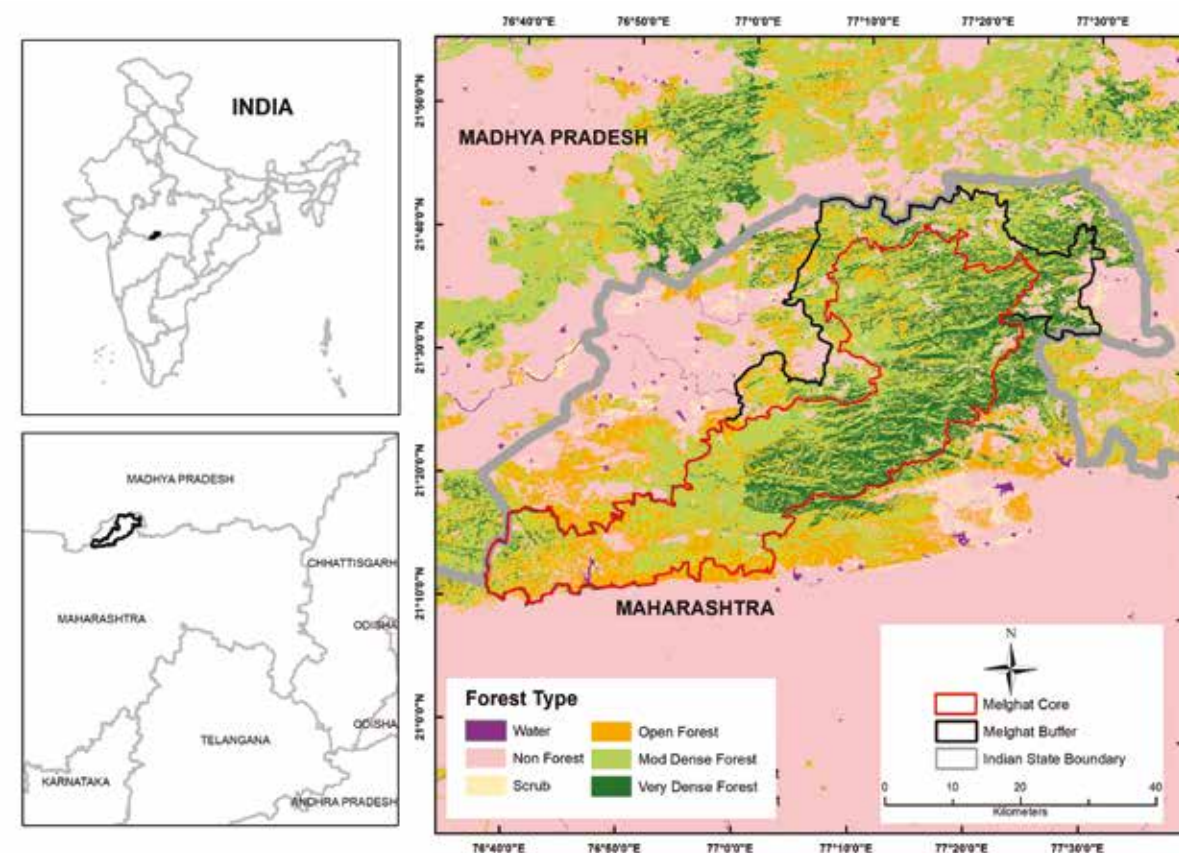


Figure 1: Map showing the location of Melghat Tiger Reserve in the state of Maharashtra.

## 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>Land use in the buffer area compatible with TR objectives, but beyond the buffer, timber, bamboo operations, and NTFP for commercial purposes hinder conservation.</li> <li>Presence of villages around the reserve causing grazing, fuelwood collection, and degradation, impacting wildlife.</li> <li>Relocation of villages in the core area remains slow, affecting herbivores and carnivores due to human presence, grazing, and cultivation practices.</li> </ul>	<ul style="list-style-type: none"> <li>Relocation of villages from core areas remains slow, impacting herbivore and carnivore habitats.</li> <li>Traffic within the reserve and connectivity from external roads pose challenges.</li> <li>Inadequate steps to reduce biotic pressure by relocating villages outside the park.</li> <li>Road development and upgrades affect wildlife movement and habitat integrity.</li> </ul>	<p><b>Consolidation of Source Populations:</b> Enhance protection and habitat management in tiger source populations of Melghat, Tadoba, and Pench to consolidate these populations. This includes measures to increase survival rates of dispersing tigers, thereby contributing to the overall tiger population and its genetic diversity.</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>Influence of multiple villages in the Multiple Use Area (MUA) exerting pressure through grazing, collection of forest resources, and commercial operations.</li> <li>PWD-managed roads increasing disturbances and road kills despite precautions by the reserve management.</li> <li>Management plan in place, but regeneration in core and buffer areas affected by frequent fire incidents.</li> <li>Vacancies in forest staff cadre against sanctioned positions impacting patrolling and management.</li> <li>Equipment and vehicle adequacy reported as satisfactory.</li> <li>Fire incidents pose a significant challenge, adversely affecting grasslands and herbivore populations, requiring proactive fire management strategies.</li> <li>Tourism well-regulated, but lack of recycling gate receipts and need for improved facilities.</li> <li>Local involvement in ecotourism needs enhancement.</li> <li>Ecodevelopment efforts insufficient in impacting surrounding villages positively.</li> <li>Limited economic benefits to stakeholders beyond wages for specific tasks, requiring more comprehensive sustainable development initiatives.</li> <li>Unified control over TR resources exists, but there's a risk of restarting forestry operations in the MUA, potentially detrimental to the reserve.</li> </ul>	<ul style="list-style-type: none"> <li>Vehicular traffic from connected villages disturbs prime habitats and limits wildlife sightings.</li> <li>Inadequate staff strength and wildlife training hinder effective management.</li> <li>Lack of trained personnel for crime investigation in wildlife offenses.</li> <li>Frequent leaves taken by existing staff impact continuity and effectiveness.</li> <li>Insufficient efforts to prevent threats like poaching, encroachment, uncontrolled fires, and grazing.</li> <li>Lack of habitat improvement interventions and monitoring of wildlife usage.</li> <li>Sparse wildlife sightings due to human occupation of critical valleys and rugged terrain.</li> <li>Lack of control over a significant portion of the buffer area.</li> <li>Forest rights legislation perceived as favoring claimants, impacting the reserve's inviolate core concept.</li> <li>Limited economic benefits beyond wages, requiring comprehensive sustainable development initiatives.</li> <li>Inadequate monitoring of livelihoods and eco-development initiatives within the reserve.</li> <li>Management handover to Forest Development Corporation affecting visitor services.</li> <li>Unplanned development threatening connectivity and causing wildlife accidents.</li> </ul>	<p><b>Interstate Cooperation:</b> Foster interstate cooperation for the management of Melghat and Pench Tiger Reserves, essential for the long-term survival of tiger populations and maintaining habitat connectivity.</p> <p><b>Habitat Restoration and Corridor Management:</b> Implement habitat restoration initiatives and manage wildlife corridors connecting Melghat Tiger Reserve with neighboring reserves. This will enhance habitat connectivity and facilitate the movement of wildlife, including tigers.</p> <p><b>Human-Tiger Conflict Mitigation:</b> Implement measures to reduce negative interactions between humans and tigers, including improved law enforcement to prevent poaching and illegal encroachment, and implementing appropriate mitigation measures for development activities that encroach upon tiger habitats.</p> <p><b>Community Engagement and Sensitization:</b> Engage local communities in conservation efforts and raise awareness about the importance of tiger conservation. Sensitization programs can foster stewardship among residents and promote coexistence with wildlife.</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>Lack of restorative inputs beyond TR, necessitating coordinated efforts between neighboring forest divisions and TR management for corridor conservation.</li> <li>Weaknesses noted in efforts toward sustainable development, calling for an integrated approach for community development and ecosystem conservation.</li> </ul>	<ul style="list-style-type: none"> <li>Presence of invasive species like Lantana impacting habitat quality.</li> <li>Large forest cover loss in recent years without identification of causes or mitigation strategies.</li> </ul>	<p><b>Early Warning Systems:</b> Establish early warning systems to alert authorities and local communities about potential conflicts or threats involving tigers. This can help prevent incidents and facilitate timely response measures.</p> <p><b>Incentivized Voluntary Relocation:</b> Implement incentivized voluntary relocation of human habitation from critical tiger habitats within the reserve. This will reduce human pressures on the habitat and enhance wild ungulate populations, subsequently benefiting carnivore populations.</p> <p><b>Invasive Species Management:</b> Develop and implement comprehensive management strategies to control the spread of invasive species, such as Prosopis juliflora, Senna tora, and Xanthium strumarium, within priority management areas of the reserve. This includes targeted removal efforts, habitat restoration, and ongoing monitoring to prevent their establishment and spread.</p> <p><b>Infrastructure Mitigation:</b> Implement appropriate mitigation measures while developing linear infrastructure to minimize its impact on tiger habitats and movement corridors. This includes measures to reduce habitat fragmentation and maintain habitat connectivity.</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<ul style="list-style-type: none"> <li>Reduce biotic pressure by relocating villages outside the park.</li> <li>Decrease traffic within TR, but external connections still pose traffic challenges.</li> <li>Additional efforts required to prevent roads from becoming a significant threat to the park.</li> <li>Implement measures to mitigate potential negative impacts on wildlife due to road usage.</li> <li>Inadequate staff strength and wildlife training hinder effective management.</li> <li>Challenging terrain and living conditions deter staff from opting for postings.</li> <li>Existing staff tend to take frequent leaves, impacting continuity and effectiveness.</li> <li>Address the significant issue of human-wildlife conflicts within the park.</li> <li>Develop and implement strategies for effective conflict resolution and management.</li> <li>Reflect on past weaknesses to avoid repeating similar challenges.</li> <li>Use past experiences to inform and improve current management strategies.</li> </ul>		
2014	<ul style="list-style-type: none"> <li>Despite relocation efforts, 21 villages persist in the core, occupying crucial flat valleys and water sources, disrupting prey population establishment.</li> <li>Vehicular traffic from connected villages affects prime habitats like plateaus and valleys, limiting wildlife sightings and disturbing natural ecosystems.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Sparse wildlife sightings due to the reserve's vastness, rugged terrain, and occupation of key valleys by villages, impacting the natural movement of animals.</li> <li>Handover of management to Forest Development Corporation of Maharashtra (FDCM) lacks adequate resources, affecting the quality of services provided to visitors staying overnight in Semadoh, an important spot for tourists in MTR.</li> </ul>		
2018	<ul style="list-style-type: none"> <li>Around 60% of the buffer area is not under the Field Director's control, affecting protection efforts due to delayed transfers.</li> <li>Lack of regular/refresher training for frontline staff, hindering core skill development.</li> <li>No planned interventions for habitat improvement or monitoring its condition and wildlife usage.</li> <li>Ongoing threats like poaching, encroachment, uncontrolled fire, and grazing impacting the reserve's integrity.</li> <li>Unplanned development (road and railway upgrades) threatening connectivity with other tiger areas, causing wildlife accidents.</li> <li>Gauge upgrading along railway lines within the core area threatening wildlife habitat due to increased fast train traffic.</li> <li>Multiple illegal entry points, villages within the core, intrusion for resources, illicit activities, and recurrent fires due to human intrusion.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Lack of forest cover along the northern boundary leading to constant threats from villagers intruding for poaching and resources.</li> <li>Large parts of the reserve infested with Lantana, degrading habitat quality.</li> <li>Basic crime investigation skills among field personnel, impacting investigations into wildlife crimes like recent tiger poaching.</li> <li>Grasslands in vacated village areas neglected, some infested with unpalatable species, affecting habitat restoration efforts.</li> <li>Lack of monitoring for livelihoods and eco-development initiatives within the reserve.</li> <li>No full-time veterinarian available within the Tiger Reserve, impacting wildlife health management.</li> <li>Presence of temples attracting large numbers of visitors, potentially disturbing wildlife.</li> <li>Implementation of Forest Rights Act (FRA) perceived as favoring claimants, leading to disturbances within the reserve impacting its inviolate core concept</li> </ul>		
2022	<ul style="list-style-type: none"> <li>Lack of research or mapping to identify causes behind the significant loss (19.36 km<sup>2</sup>) of forest cover over the past decade.</li> <li>Insufficient monitoring of the economic values derived from the Tiger Reserve, impacting informed decision-making.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>Slow progress in relocating six villages, with challenges in removing remaining families like in Pili and Pastalai, potentially exacerbated by external support from left-wing extremism.</li> <li>Consideration for renovation of roads within the core area poses challenges, awaiting suggestions post a visit from the CEC, with potential implications for the reserve's independence from surrounding communities.</li> <li>Instances of various forest offenses such as illegal felling of teak and other timber species reported in the forest registers, yet no substantial steps taken to identify or bring perpetrators to justice, beyond grazing and fire-related offenses.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- It might be beneficial to accelerate the process of relocating villages from the core areas to reduce biotic pressure and human-wildlife conflicts. Addressing challenges hindering relocation, such as external support from left-wing extremism and slow progress in removing remaining families, could be prioritized.
- Considering implementing measures to reduce vehicular traffic within the reserve, particularly from connected villages, could help minimize disturbances to prime habitats and wildlife sightings. It's important to cautiously consider road upgrades and renovations to mitigate their impact on habitat integrity.
- Addressing staff shortages and inadequate training by recruiting additional personnel and providing regular/refresher training programs could be considered. Enhancing core skill development among frontline staff to improve effectiveness in wildlife management and crime investigation is advisable.

- d. Developing and implementing interventions for habitat improvement, including monitoring wildlife usage and restoring grasslands in vacated village areas, could enhance habitat quality. It may also be important to control the spread of invasive species like Lantana.
- e. Strengthening efforts to prevent threats such as poaching, encroachment, uncontrolled fires, and grazing is crucial. Enhancing surveillance and enforcement measures to protect the reserve's integrity and wildlife populations is recommended.
- f. Mitigating the impact of linear infrastructure development on tiger habitats and movement corridors should be considered. Ensuring that road and railway upgrades are carefully planned to minimize habitat fragmentation and wildlife accidents is important.
- g. Engaging local communities in conservation efforts and raising awareness about the importance of tiger conservation could yield positive results. Fostering stewardship among residents and promoting coexistence with wildlife through sensitization programs may be beneficial.
- h. Establishing early warning systems to alert authorities and local communities about potential conflicts or threats involving tigers could be a proactive approach. This could help prevent incidents and facilitate timely response measures.
- i. Continuing to implement incentivized voluntary relocation of human habitation from critical tiger habitats within the reserve to reduce human pressures and enhance wild ungulate populations is advisable.
- j. Developing and implementing comprehensive strategies to control the spread of invasive species like *Prosopis juliflora*, *Senna tora*, and *Xanthium strumarium* within priority management areas of the reserve is important. This may include targeted removal efforts, habitat restoration, and ongoing monitoring.
- k. Addressing concerns related to the implementation of the Forest Rights Act (FRA) to ensure it does not compromise the inviolate core concept of the reserve is essential. Monitoring and managing disturbances arising from FRA claims within the reserve effectively should be prioritized.
- l. Conducting research and mapping to identify the causes behind significant forest cover loss and monitoring economic values derived from the Tiger Reserve could provide valuable insights. Using findings to inform decision-making and conservation strategies effectively is recommended.

## 5. Conclusions

Melghat Tiger Reserve, nestled within the South-Western Satpura mountain ranges, stands as a critical bastion of biodiversity in Maharashtra. Despite facing challenges such as human-wildlife conflicts, habitat degradation, and infrastructural developments, the reserve has demonstrated resilience and ongoing efforts towards tiger conservation. With fluctuations in tiger population over the years and persistent threats to its integrity, Melghat requires concerted action in relocation efforts, habitat restoration, threat mitigation, and community engagement. By implementing robust management strategies and fostering collaboration with stakeholders, Melghat can continue to thrive as a vital stronghold for tigers and wildlife in India.

## NAWEGAON-NAGZIRA TIGER RESERVE

### 1. Brief Description

Nawegaon-Nagzira Tiger Reserve (NNTR), located in the central part of Gondia and Bhandara districts in Maharashtra, was established on December 12, 2013. Covering an area of 1894.90 sqkm, it comprises five protected areas and serves as a vital corridor for other tiger reserves in India. Encompassing Nawegaon National Park, Nagzira Wildlife Sanctuary, and others, NNTR forms a crucial habitat in the Tropical Dry Deciduous Forest, housing a diverse range of flora and fauna typical to Central India. The reserve, strategically positioned within the Central Indian Landscape, holds an eco-sensitive zone of 2333.39 km<sup>2</sup> under the Environment (Protection) Act, 1986. It offers a conducive environment for a variety of wildlife species. The tiger population in NNTR has shown a positive trend, with the latest Phase-IV data revealing an increase to 8 adult tigers (3 males, 5 females), 2 sub-adults, and 9 cubs in 2022. This reflects growth from 2013 when there were 6 tigers (3 males, 2 females, 1 cub), indicating successful conservation efforts. Overall, NNTR stands as a promising habitat, witnessing a rise in tiger numbers and featuring an extensive array of wildlife, although some staffing vacancies require attention for more effective management.

### 2. Tiger Population as per All India Tiger Estimation

In 2018, the survey yielded a total of 170 tiger detections during the sampling period, leading to the identification of 6 individual adult tigers. The calculated tiger density was 0.49 (SE 0.20) tigers per 100 km<sup>2</sup>. In contrast, the 2022 survey involved an effort of 16269 trap nights, resulting in 422 tiger photos. From these, 11 unique tigers aged over 1 year were identified. The estimated tiger density for 2022 was higher at 0.64 (SE 0.20) tigers per 100 km<sup>2</sup>. Comparatively, the 2022 survey reflects an increase in both the number of identified tigers and the calculated tiger density, suggesting positive developments in the tiger population within the surveyed area over the four-year period.



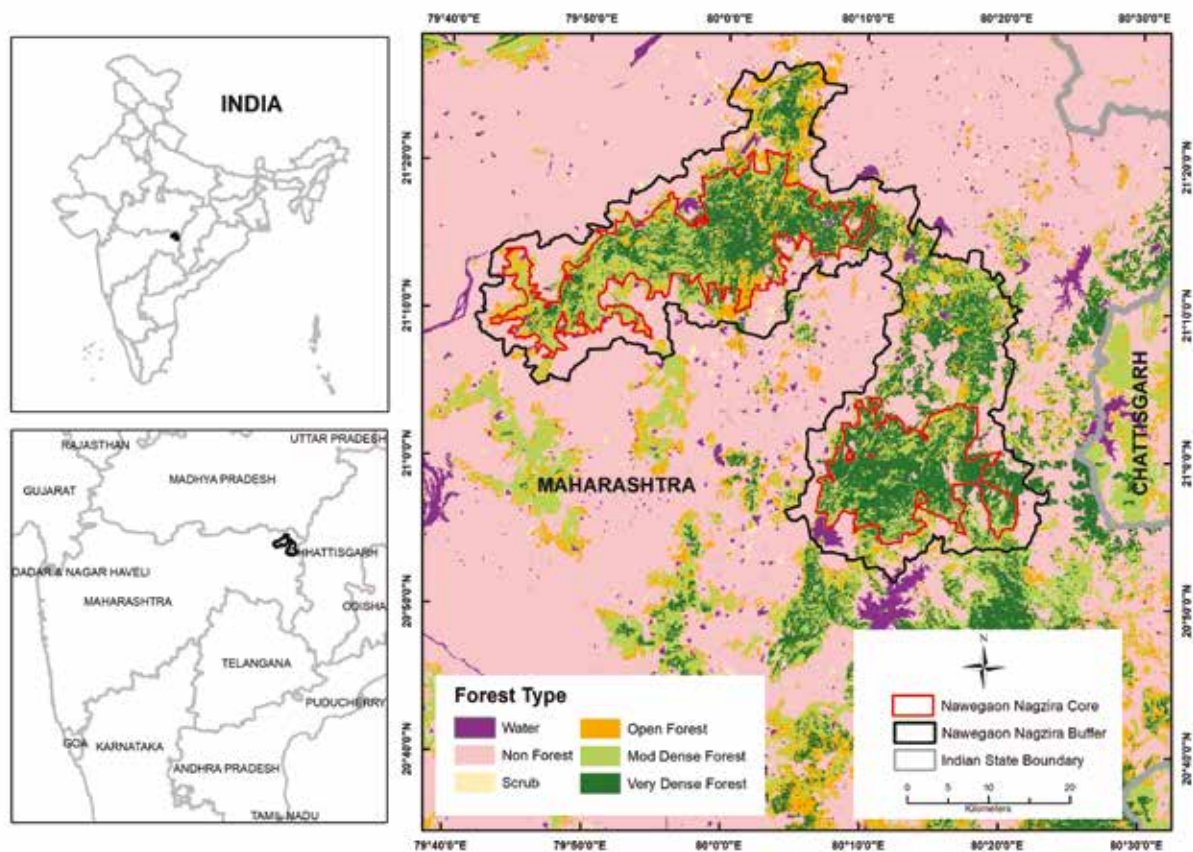


Figure 1: Map showing the location of NNTR in the state of Maharashtra.

### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Buffer area control remains with territorial division and FDCM, hindering unified management efforts.</li> <li>Inadequate buffer zone delineation and encroachment of core habitat by FDCM tourist complex affect the sanctity and increase human-tiger conflicts.</li> <li>Hostile village Pittezari near Nagzira Sanctuary impacts habitat despite TR's efforts at outreach.</li> <li>High dhole population might impact tiger population, requiring further research for understanding and management.</li> </ul>	<ul style="list-style-type: none"> <li>Buffer area control remains fragmented between territorial divisions and the Forest Development Corporation of Maharashtra (FDCM), hindering unified management efforts.</li> <li>Habitat Encroachment and Fragmentation: Inadequate buffer zone delineation and encroachment of core habitats by various developments (like FDCM tourist complexes) affect sanctity, increase human-tiger conflicts, and result in fragmented habitats.</li> </ul>	<p><b>Continue Translocation Initiatives:</b> Building on the success of the recent translocation of two female tigers from Brahmapuri Forest Division, the reserve should proceed with additional translocations to increase tiger numbers and genetic diversity.</p> <p><b>Prey Supplementation:</b> Address the issue of low tiger abundance by implementing a plan to supplement the prey base within the reserve. Collaborate with experts to identify and introduce suitable prey species.</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Dense woody undergrowth in New Nagzira Sanctuary limits fodder growth, affecting herbivore habitat and movement.</li> <li>Equal monetary distribution to buffer villages causes resentment among Economic Development Committees (EDCs) due to lack of consideration for varying needs.</li> <li>Low prey density, high dhole abundance, skewed tiger sex ratio, and electrocution poaching pose significant threats to the tiger population.</li> <li>Fragmented forests and villages pose connectivity issues between Nawegaon and Nagzira blocks, worsened by highway widening projects impacting wildlife movement and increasing roadkill cases.</li> <li>Lack of mutation after forest land transfer for relocation hinders rehabilitation and land distribution, complicating the relocation project.</li> </ul>	<ul style="list-style-type: none"> <li>Hostile villages near sanctuaries continue to impact habitats despite conservation outreach efforts.</li> <li>High dhole populations potentially affecting tiger populations require further research for better understanding and management.</li> <li>Dense woody undergrowth in certain areas limits fodder growth, impacting herbivore habitat and movement.</li> <li>Equal monetary distribution among buffer villages leads to resentment among committees due to varying needs not being considered.</li> <li>Persistent threats like low prey density, high dhole abundance, skewed tiger sex ratio, and electrocution poaching continue to endanger tiger populations.</li> <li>Fragmented forests and villages pose connectivity issues between blocks, compounded by highway widening projects, affecting wildlife movement and causing increased roadkill.</li> <li>Lack of mutation after forest land transfer hinders rehabilitation and complicates the relocation project.</li> <li>Inadequate infrastructure, vacancies in key positions, and insufficient specialized personnel continue to impact effective management and conservation efforts.</li> <li>Lack of proper visitor amenities, delayed funds from the government, impacting critical activities and staff salaries.</li> </ul>	<p><b>Enhance Law Enforcement Monitoring:</b> Strengthen law enforcement measures to combat illegal activities threatening tigers. This includes increased patrolling, technological surveillance, and collaboration with local law enforcement agencies.</p> <p><b>Community Sensitization:</b> Conduct awareness programs in adjoining forest communities to promote coexistence and reduce negative human-tiger interactions. Emphasize the benefits of tiger conservation for both the ecosystem and local communities.</p> <p><b>Research and Monitoring:</b> Invest in ongoing research to monitor the tiger population, behavior, and ecosystem health. Use research findings to inform adaptive management strategies.</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>Fragmented habitat with two separate blocks, creating challenges for management and protection efforts.</li> <li>Linear development activities like railway lines and highways fragment the corridor and buffer areas, posing long-term threats.</li> <li>Buffer area control remains decentralized, split among multiple forest divisions and the FDCM.</li> <li>Limited grassland area affecting fodder growth and prey base, compounded by teak plantations in transferred sanctuaries.</li> <li>Existence of a Community Forest Rights (CFR) area within the Critical Tiger Habitat.</li> <li>Reports of left-wing extremism affecting wildlife management in Nawegaon Block.</li> <li>High density of villages in the buffer zone leading to human-wildlife conflicts.</li> <li> <ul style="list-style-type: none"> <li>Inadequate infrastructure including office/residential buildings and vehicles impacting management and surveillance.</li> </ul> </li> <li>Vacancies in key positions affecting anti-poaching and conflict mitigation operations.</li> <li>Lack of proper signage, interpretation centers, and visitor amenities.</li> <li>Insufficient specialized wildlife-trained personnel within NNTR.</li> <li>Delayed release of funds from the state government impacting various essential activities and salaries for STPF staff since October 2021.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- Consider addressing the issue of fragmented habitat with two separate blocks by implementing measures to enhance connectivity, allowing for more effective management and protection efforts.
- It might be beneficial to assess and mitigate the impact of linear development activities such as railway lines and highways that may further fragment the corridor and buffer areas, posing long-term threats to the reserve's integrity.
- Centralizing and streamlining control over the buffer area, currently decentralized among multiple forest divisions and the Forest Development Corporation of Maharashtra (FDCM), could ensure unified and efficient management efforts.
- Consider implementing measures to address limited grassland areas affecting fodder growth and prey base within the reserve.
- It may be advisable to evaluate and potentially modify teak plantations in transferred sanctuaries to enhance biodiversity and support the natural habitat.
- Collaborating with local communities and authorities to harmonize the existence of the Community Forest Rights (CFR) area within the Critical Tiger Habitat, ensuring compatibility with tiger conservation goals, could be beneficial.
- Addressing reports of left-wing extremism affecting wildlife management in the Nawegaon Block by collaborating with security forces and implementing measures to ensure the safety of both wildlife and personnel may be necessary.
- Developing and implementing strategies to mitigate human-wildlife conflicts in the buffer zone, with a focus on areas with a high density of villages, might help reduce conflicts and enhance coexistence.
- Investing in adequate infrastructure, including office/residential buildings and vehicles, to support effective management and surveillance operations within the reserve could improve operational efficiency.
- Addressing vacancies in key positions promptly to ensure the efficient functioning of anti-poaching and conflict mitigation operations could strengthen wildlife protection efforts.
- Improving visitor amenities, including proper signage, interpretation centers, and other facilities, to enhance the overall experience of visitors while promoting awareness about tiger conservation could foster greater public support for conservation efforts.
- Advocating for timely release of funds from the state government to ensure the continuous functioning of essential activities and timely payment of salaries for Special Tiger Protection Force (STPF) staff may be crucial for maintaining operational continuity.
- Continuing translocation initiatives to increase tiger numbers and genetic diversity might help bolster the tiger population within the reserve.
- Developing and implementing a comprehensive plan for prey supplementation to address the issue of low tiger abundance within the reserve could contribute to restoring ecological balance and supporting tiger populations.



## 5. Conclusions

In conclusion, Nawegaon-Nagzira Tiger Reserve (NNTR) stands as a significant stronghold for tiger conservation, showcasing positive trends in tiger population growth from 2013 to 2022. The recent Phase-IV data indicates a commendable increase to 8 adult tigers, 2 sub-adults, and 9 cubs, reflecting successful conservation efforts. However, certain challenges persist, including fragmented habitats, decentralized buffer zone control, and human-wildlife conflicts. The management recommendations derived from weaknesses identified over the years highlight the need for strategic interventions. Ensuring habitat connectivity, centralizing buffer zone control, addressing issues related to fodder growth and prey base, harmonizing the presence of Community Forest Rights (CFR) areas, and improving security measures are crucial steps. Infrastructure development, timely filling of vacancies, and enhanced visitor amenities contribute to the effective functioning of the reserve. Furthermore, ongoing translocation initiatives and prey supplementation plans are key elements to sustain and enhance the tiger population. NNTR's success hinges on a holistic approach that addresses ecological, social, and administrative aspects. The reserve's strategic location as a vital corridor for other tiger reserves adds to its significance. Continued collaboration among stakeholders, timely funding, and adaptive management will play pivotal roles in securing a thriving future for tigers and biodiversity within Nawegaon-Nagzira Tiger Reserve.



GS BHARDWAJ

## PENCH TIGER RESERVE

### 1. Brief Description

Established in 1999, Pench Tiger Reserve spans 741.41 km<sup>2</sup>, featuring a core zone of 439.41 km<sup>2</sup> and a buffer zone of 301 km<sup>2</sup>. Initially declared as Pench National Park in 1975, it became India's 25th tiger reserve. Characterized by Southern Tropical Dry Deciduous forests and divided by the Pench River, it hosts diverse wildlife, including tigers, leopards, wild dogs, and various herbivores. The reserve, crucial for water conservation, contributes to the Totladoh reservoir, ensuring water availability in and around Nagpur. The Wildlife Institute of India employs camera-trapping for monitoring, revealing a notable increase in the tiger population from nine in 2008 to 44 in 2020. Conservation efforts involve habitat restoration, removal of structures, and innovative plantations like the MIYAWAKI model. Protection measures include enhanced surveillance, protection huts, and collaborations with neighboring forest departments for joint operations, anti-poaching, and wildlife safety. Strategies to prevent electrocution and snaring, such as aerial bunch cabling and anti-snare drives, are actively implemented, showcasing comprehensive efforts to safeguard Pench Tiger Reserve's biodiversity.

### 2. Tiger population as per All India Tiger Reserve

In 2008, the Pench Tiger Reserve in Maharashtra recorded a tiger presence in 424 km<sup>2</sup>, support a population of 19 tigers, contributing as a source population shared with MP. In 2010, the tiger population in Pench Maharashtra was estimated at 9 to 13 tigers within a 1,088 km<sup>2</sup> area. By 2014, the tiger population increased to 35 tigers. In 2018, a camera trap survey yielded 1,530 detections, identifying 48 individual adult tigers, with a density of 4.64 (SE 0.71) tigers per 100 km<sup>2</sup>. In 2022, a camera trap survey conducted over 8,470 trap nights resulted in 1,043 tiger photos. From these, 48 unique tigers (>1 year of age) were identified, and the tiger density increased to 5.11 (SE 0.74) tigers per 100 km<sup>2</sup>. The comparison highlights a significant growth in the tiger population and density over the years, reflecting successful conservation efforts in Pench Tiger Reserve.

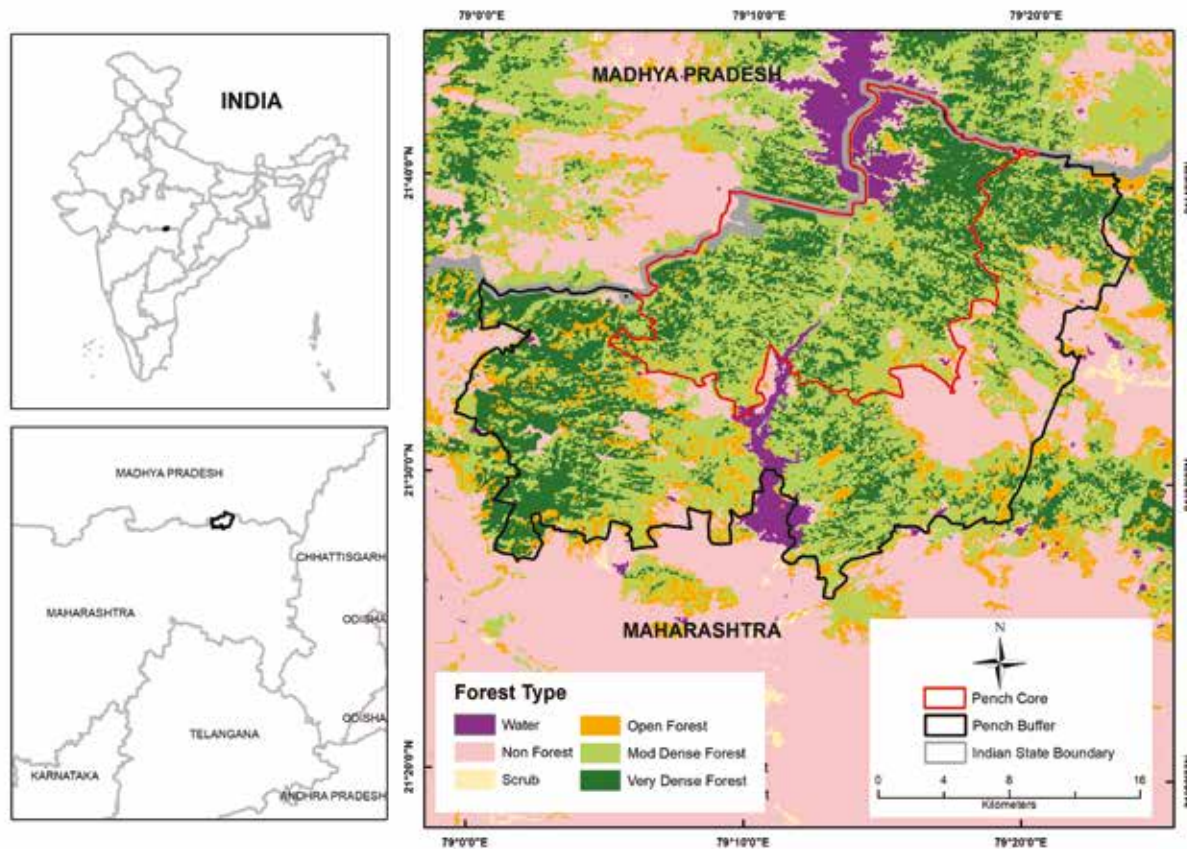


Figure 1: Map showing the location of Pench Tiger Reserve in the state of Maharashtra.

### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Key Recommendations from AITE
2006	<p><b>Buffer Area Control:</b> Lack of control over the designated buffer area by the TR management hampers effective management.</p> <p><b>Human Pressures:</b> Presence of habitation, livestock grazing, cultivation, encroachment, and unchecked collection of Non-Timber Forest Products (NTFP) pose challenges.</p> <p><b>Area Management:</b> Delay in transferring control of the buffer area to the Field Director affects land use compatibility and management beyond the buffer zone.</p>	<p><b>Buffer Area Management:</b> Lack of control and delayed transfer of authority over the buffer area, leading to challenges in land use compatibility and management beyond the buffer zone.</p> <p><b>Human Pressures and Settlement Influence:</b> Continuous human pressures from habitation, livestock grazing, cultivation, encroachment, and resource collection from nearby villages impacting conservation efforts.</p>	<p><b>Corridor Mitigation:</b> Identify and implement proper mitigation measures to address the precarious corridor linkage near Nayagaon, Parasia tehsil, where agriculture, habitation, highway, and railway tracks intersect. Focus on making the corridor viable for regular movement of tigers and other wildlife.</p> <p><b>Infrastructure Development:</b> Prioritize scientific inputs and conduct thorough environmental impact</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Key Recommendations from AITE
2006	<p><b>Legal Issues:</b> Pending relocation of Fulzari village and actions ordered by the court against certain settlements within the core area.</p> <p><b>Resource Overuse:</b> Overgrazing, encroachment, and incompatible land use practices affect the habitat and wildlife spillover from the national park.</p> <p><b>Infrastructure &amp; Facilities:</b> Limited tourism facilities, insufficient staff training, and inadequate field staff amenities hamper effective conservation efforts.</p> <p><b>Collaboration &amp; Management:</b> Limited involvement of local communities, inadequate networking, and ineffective utilization of gate receipts for TR development.</p> <p><b>Ecological Impact:</b> Insufficient sustainable development efforts, leading to potential ecological imbalance and lack of control over resource usage in and around the reserve.</p>	<p><b>Staffing Issues:</b> Persistent insufficient staffing, frequent turnover, and transfers affecting park management due to replacements lacking wildlife management knowledge.</p> <p><b>Illegal Activities:</b> Continuous threats from persistent illegal fishing despite prohibitions, impacting the ecosystem and management efforts.</p> <p><b>Tourism Planning and Impact Assessment:</b> Inadequate tourism planning based on primary data, absence of impact assessment, and lack of provisions for visitor safety or emergency plans.</p> <p><b>Ecological Impact and Resource Overuse:</b> Ongoing overuse of resources, overgrazing, incompatible land use practices, and insufficient sustainable development efforts leading to potential ecological imbalances.</p> <p><b>Community Engagement and Networking:</b> Limited involvement of local communities, ineffective utilization of gate receipts, and inadequate collaboration/networking for reserve development.</p> <p><b>Poaching Threats:</b> Continuous poaching threats in the buffer zone, affecting wildlife sustainability.</p>	<p>assessments before implementing any infrastructure development in the landscape connected to Pench Tiger Reserve. Ensure that infrastructure projects do not hamper the connectivity of the reserve to adjoining tiger reserves.</p> <p><b>Connectivity Preservation:</b> Recognize the significance of Pench Tiger Reserve (MH) and Pench Tiger Reserve (MP) as a single population block connected to larger landscapes. Implement measures to preserve connectivity with the Eastern Vidarbha Landscape and Kanha-Achanakmar landscape. Address potential threats posed by infrastructure developments in the Vidarbha landscape.</p> <p><b>Invasive Species Management:</b> Implement systematic management plans to address the invasion of Mesosphaerum suaveolens, Parthenium hysterophorus, Senna tora, and Xanthium strumarium in priority management areas within and around Pench Tiger Reserve. Prioritize removal efforts in areas where the invasion is potentially in the initial stage.</p> <p><b>Corridor Protection:</b> Develop and enforce strategies to protect the Kanha-Navegaon-Tadoba-Indravati Corridor, recognizing its critical role in linking tiger populations</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Key Recommendations from AITE
2006			<p>across Maharashtra and Chhattisgarh. Mitigate threats such as fragmented patches, poaching, linear infrastructures, and mining to ensure the functionality of this vital corridor.</p> <p><b>Satpura-Pench Corridor:</b> Address the pressures faced by the Satpura-Pench Corridor, connecting Satpura and Pench Tiger Reserves. Implement urgent mitigation measures to counteract challenges arising from agriculture and human settlements, ensuring the preservation of this important ecological linkage.</p> <p><b>Collaborative Conservation Efforts:</b> Strengthen collaborations with forest departments of neighboring regions, law enforcement agencies, and relevant authorities to conduct joint operations, enforce anti-poaching measures, and ensure the overall safety of wildlife in and around Pench Tiger Reserve.</p> <p><b>Continuous Monitoring and Research:</b> Invest in continuous monitoring and research initiatives to assess the impact of existing threats, track the effectiveness of implemented mitigation measures, and adapt strategies accordingly. This will contribute to the long-term conservation and sustainability of Pench Tiger Reserve.</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Key Recommendations from AITE
2010	<p><b>Buffer Area Challenges:</b> High anthropogenic pressures in the buffer, leading to human-wildlife conflicts, yet unclear management approach for addressing these issues.</p> <p><b>Insufficient Staffing:</b> Inadequate staff strength hindering effective wildlife protection and management; urgent need for augmentation.</p> <p><b>Lack of Capacity Building:</b> Urgent necessity for capacity building focused on wildlife protection and management for the existing staff.</p> <p><b>Neglect of Landscape Planning:</b> Lack of serious efforts to identify and secure wildlife corridors, particularly towards the east, leading to fragmentation.</p> <p><b>Research Gap:</b> Limited past research in the reserve; need for encouragement and facilitation of additional research to support better planning and monitoring of management efforts.</p>		
2014	<p><b>Human Settlement Influence:</b> 56 villages within 10 km affecting PTR via resource use, grazing, and movement of people, impacting conservation efforts.</p> <p><b>Staff Turnover Impact:</b> Transfer of experienced staff affecting park management due to replacements lacking wildlife management knowledge.</p> <p><b>Threat of Commercial Tourism:</b> Private lands near PTR might be used for large-scale tourism, potentially harming PTR's core values.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Key Recommendations from AITE
2014	<p><b>Persistent Illegal Fishing:</b> Despite prohibitions, illegal fishing remains a threat, fueled by vested interests inciting local fishing communities.</p> <p><b>Highway Expansion Concerns:</b> Upgrading the nearby national highway could impede wildlife movement without suitable crossings and corridors.</p>		
2018	<p><b>Inadequate Monitoring Efforts:</b> Insufficient monitoring of tigers and effectiveness of habitat management and eco-development initiatives.</p> <p><b>Complacency in Core Protection:</b> Suspected complacency among officers regarding core habitat protection, despite the real threat of organized poaching.</p> <p><b>Illegal Fishing Concerns:</b> Illegal fishing in Totladoh reservoir demands significant management time; need to reclaim areas for grasslands.</p> <p><b>Incomplete Data Analysis:</b> Phase IV monitoring data, despite NGO support, remains unanalyzed.</p> <p><b>Tourism Planning and Impact Assessment:</b> Lack of primary data-based tourism planning, absence of impact assessment on TR, and no provisions for visitor safety or emergency plans.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Key Recommendations from AITE
2018	<p><b>Conservation Fee Collection Issue:</b> Failure to collect conservation fees from hotels except one at Sillari Gate; hotel owners not paying property tax to the panchayat.</p> <p><b>Inactive Ecotourism Committee:</b> The Local Advisory Committee for Ecotourism is constituted but remains inactive.</p> <p><b>Cattle Pressure in Buffer:</b> Significant threat from cattle pressure originating from 44 villages in the buffer zone.</p> <p><b>Poaching Threat in Buffer Zone:</b> Tigers facing poaching threats in the buffer zone of the TR.</p>		
2022	<p><b>TCP Approval Delay:</b> Delay in approval of the ten-year Tiger Conservation Plan (TCP) for the period 2022-23 to 2031-32.</p> <p><b>Erratic Fund Flow:</b> Erratic fund flow despite receiving adequate funds from the National Tiger Conservation Authority (NTCA) and the state government.</p> <p><b>Staff Training Need:</b> Need for staff training due to imminent transfers of experienced personnel.</p> <p><b>Illegal Fishing Threat:</b> Significant time and effort required to address the threat of illegal fishing in the Tbtladoh reservoir.</p> <p><b>Tourism Booking System Issue:</b> Lack of user-friendly and easily accessible online tourism booking system.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Key Recommendations from AITE
2022	<p><b>Pending Website Approval:</b> Website development completed but awaiting approval.</p> <p><b>Weak Social Media Presence:</b> Weak social media presence on platforms such as Facebook and Twitter.</p> <p><b>Conservation Fee Collection Issue:</b> Inability to levy conservation fees from one resort, Wild Woods Resorts (Ali Arcadia).</p> <p><b>Absence of Steering Committee Meetings:</b> Absence of Steering Committee meetings since 2019. Local Advisory Committee Revision: Immediate revision required for the Local Advisory Committee for Ecotourism.</p> <p><b>Reserve Identity Confusion:</b> Confusion between Pench Tiger Reserve in Maharashtra and Pench Tiger Reserve in Madhya Pradesh, suggesting a need for separate identities through renaming.</p>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- Consider identifying and implementing proper mitigation measures to address the precarious corridor linkage near Nayagaon, Parasia tehsil, where agriculture, habitation, highway, and railway tracks intersect. It might be beneficial to focus on making the corridor viable for regular movement of tigers and other wildlife.
- It could be beneficial to prioritize scientific inputs and conduct thorough environmental impact assessments before implementing any infrastructure development in the landscape connected to Pench Tiger Reserve. Ensuring that infrastructure projects do

- not hamper the connectivity of the reserve to adjoining tiger reserves is important.
- Recognize the significance of Pench Tiger Reserve (MH) and Pench Tiger Reserve (MP) as a single population block connected to larger landscapes. It may be advisable to implement measures to preserve connectivity with the Eastern Vidarbha Landscape and Kanha-Achanakmar landscape. Addressing potential threats posed by infrastructure developments in the Vidarbha landscape is crucial.
- Consider implementing systematic management plans to address the invasion of Mesosphaerum suaveolens, Parthenium hysterophorus, Senna tora, and Xanthium strumarium in priority management areas within and around Pench Tiger Reserve. It might be advisable to prioritize removal efforts in areas where the invasion is potentially in the initial stage.
- It might be beneficial to develop and enforce strategies to protect the Kanha-Navegaon-Tadoba-Indravati Corridor, recognizing its critical role in linking tiger populations across Maharashtra and Chhattisgarh. Mitigating threats such as fragmented patches, poaching, linear infrastructures, and mining could ensure the functionality of this vital corridor.
- Consider addressing the pressures faced by the Satpura-Pench Corridor, connecting Satpura and Pench Tiger Reserves. Implementing urgent mitigation measures to counteract challenges arising from agriculture and human settlements could ensure the preservation of this important ecological linkage.
- Strengthening collaborations with forest departments of neighboring regions, law enforcement agencies, and relevant authorities to conduct joint operations, enforce anti-poaching measures, and ensure the overall safety of wildlife in and around Pench Tiger Reserve could be beneficial.
- It might be advisable to invest in continuous monitoring and research initiatives to assess the impact of existing threats, track the effectiveness of implemented mitigation measures, and adapt strategies accordingly. This could contribute to the long-term conservation and sustainability of Pench Tiger Reserve.
- Consider addressing challenges in buffer areas, such as human-wildlife conflicts and unclear management approaches. Ensuring effective control and timely transfer of authority over buffer areas to prevent land use compatibility issues might be advisable.
- Addressing issues of insufficient staffing, high turnover, and lack of capacity building could be beneficial. Augmenting staff strength, providing necessary training, and encouraging research to enhance wildlife protection and management might improve the situation.
- Implementing tourism planning based on primary data, conducting impact assessments, and establishing provisions for visitor safety and emergency plans could be considered. Ensuring that tourism activities are sustainable and contribute to conservation efforts might be advisable.
- Combatting persistent illegal activities, especially fishing in the Totladoh reservoir, could be addressed. Implementing measures to reclaim areas for grasslands and

# SAHYADRI TIGER RESERVE

ensuring effective management time allocation to address illegal fishing concerns might be beneficial.

- m. Enhancing community engagement by involving local communities in conservation efforts could be beneficial. Facilitating effective utilization of gate receipts and collaborating with local communities for the development of the reserve might foster a sense of ownership and stewardship.
- n. Implementing robust strategies to prevent poaching threats, particularly in buffer zones, could be considered. Strengthening anti-poaching measures and collaborating with law enforcement to ensure the sustained safety of wildlife within Pench Tiger Reserve might be advisable.

## 5. Conclusions

Pench Tiger Reserve, established in 1999, showcases commendable success in tiger conservation. Monitored through advanced techniques like camera-trapping, the tiger population has grown significantly from nine in 2008 to 44 in 2020. The reserve's diverse habitat, characterized by Southern Tropical Dry Deciduous forests, underscores its ecological importance. Despite successes, challenges persist, including inadequate monitoring, potential complacency, and illegal activities such as fishing in the Totladoh reservoir. To ensure continued success, the reserve must address these challenges through key recommendations, including corridor preservation, invasive species management, and enhanced community engagement. As a crucial link in the larger landscape and a contributor to water conservation, Pench Tiger Reserve's significance goes beyond its boundaries. A holistic approach, focusing on sustained monitoring, adaptive management, and community involvement, will be vital for the long-term conservation and ecological integrity of this remarkable tiger reserve.



SHIBU NAIR

## 1. Brief Description

Established in 2010, STR, the fourth tiger reserve in Maharashtra, encompasses Chandoli National Park and Koyna Wildlife Sanctuary, totalling 741.22 km<sup>2</sup>. Recognized as a UNESCO World Natural Heritage Site in 2012, it's a biodiversity hotspot with endemic species. The critical tiger habitat spans 600.12 km<sup>2</sup>, with a buffer area of 565.45 km<sup>2</sup>. Administered by the Maharashtra State Government, it has two wildlife divisions, four sub-divisions, and a mobile squad unit. Despite being a biodiversity-rich region, the resident tiger population is absent, with only transient tigers visiting due to the distant source population.

## 2. Tiger population as per All India Tiger Reserve

In 2010, tiger numbers estimated for the Sahyadris (20-22 tigers within 560 km<sup>2</sup>) appear to be overestimates, necessitating field verification through camera trapping for accurate assessment. In 2014, scat DNA analysis identified seven individual tigers. However, in 2018, no tigers were camera-trapped in the area, raising questions about the accuracy of the estimates. In 2022, with 17,400 trap nights, no tiger captures were recorded in the camera traps.

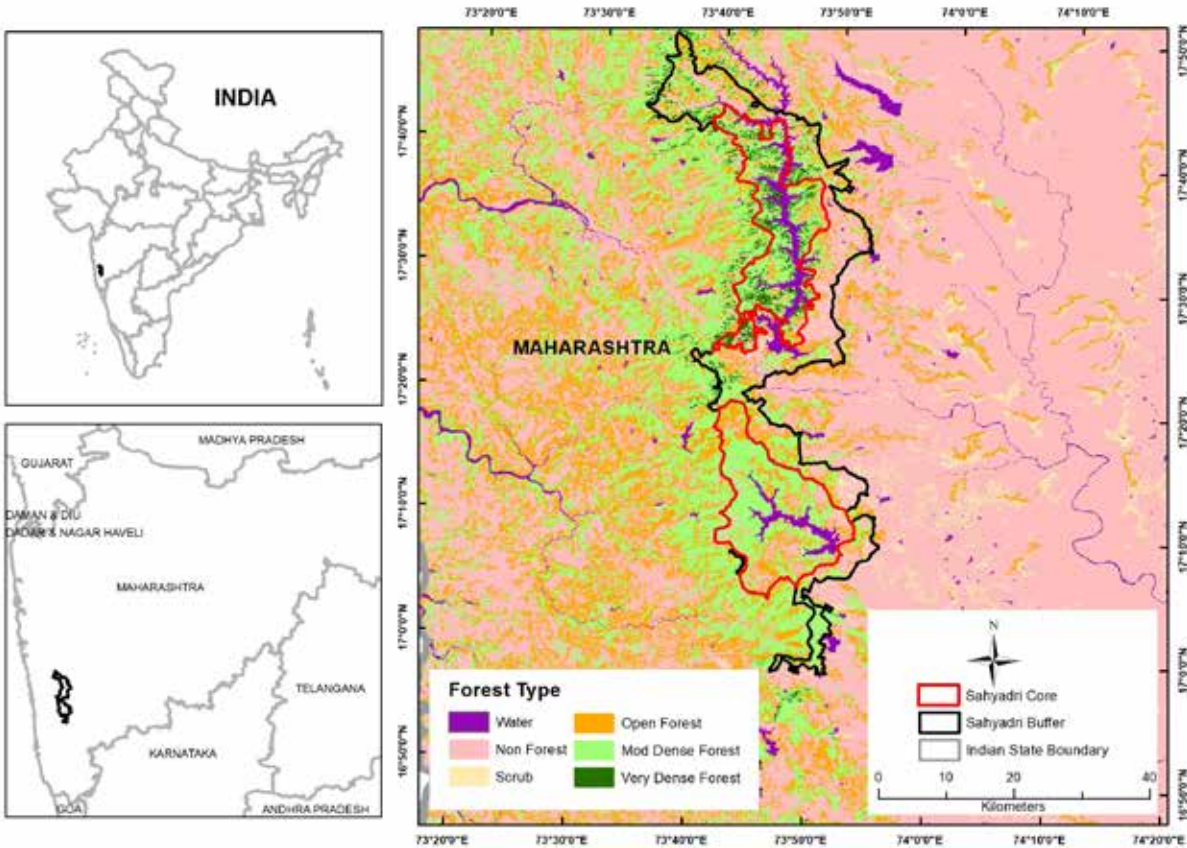


Figure 1: Map showing the location of Sahyadri Tiger Reserve in the state of Maharashtra.

### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<p><b>Village Presence and Anthropogenic Pressure:</b> Presence of 15 villages in the Core with additional anthropogenic pressure from surrounding villages, contributing to habitat disturbance.</p> <p><b>Mining and Windmills Impact:</b> Mining outside the reserve and the establishment of windmills causing disturbance, pollution, and landscape damage.</p> <p><b>Threats to Private Forests (Malki Lands):</b> Felling in Malki lands (private forests), leading to habitat loss and disturbance to wildlife species.</p> <p><b>Kumri Cultivation Threat:</b> Kumri cultivation posing a threat to the landscape and ecosystem.</p> <p><b>Inadequate Staff Strength and Capacity:</b> Poor staff strength and capacity, requiring urgent augmentation for effective reserve management.</p> <p><b>Resentment and Lack of Awareness:</b> Resentment towards the reserve, possibly driven by new regulations; lack of awareness about regulations affecting local communities.</p> <p><b>Need for Core and Buffer Notification:</b> Delay in notifying the Core and Buffer areas, requiring immediate action.</p>	<p><b>Anthropogenic Pressure and Village Presence:</b> Continuous presence of villages in the core area, contributing to persistent habitat disturbance.</p> <p><b>Inadequate Staff Strength and Capacity:</b> Ongoing lack of sufficient staff and capacity for effective reserve management.</p> <p><b>Resentment and Lack of Awareness:</b> Persistent local resentment, possibly driven by new regulations, coupled with inadequate awareness.</p> <p><b>Delayed Core and Buffer Notification:</b> Continued delays in notifying the core and buffer areas, indicating a lack of immediate action.</p> <p><b>Fragmented Tiger Movement Corridor:</b> Persistence of fragmentation in the critical tiger habitat connected by a buffer on private lands.</p> <p><b>Highway Upgrades and Corridor Threats:</b> Ongoing threats to the critical corridor due to highway upgrades passing through buffer areas.</p> <p><b>Inaccessible Terrain and Infrastructure Deficiency:</b> Long-standing issues with inaccessible terrain, loss of local terrain knowledge, and insufficient infrastructure.</p>	<p><b>Village Relocation and Anthropogenic Activities:</b> Recognize the success of relocating 32 villages to reduce anthropogenic activities, but continue incentivized voluntary relocations to further minimize human impact and enhance conservation efforts.</p> <p><b>Tiger Repopulation Strategies:</b> Expedite the implementation of projects to augment the cheetal population, providing a robust prey base. Focus on strategic locations and expand efforts to encourage transiting tigers to establish residency.</p> <p><b>Camera Trap Placement Enhancement:</b> Improve the sampling scale of camera trap deployments, ensuring comprehensive coverage, especially in the western edge of Chandoli National Park and buffer forests between Radhanagri and Chandoli. This enhances habitat use assessments for various species.</p> <p><b>Habitat Preservation and Connectivity:</b> Emphasize habitat preservation and connectivity with neighboring reserves. Develop a comprehensive management plan to reduce human impacts, enforce strict anti-poaching measures, and explore alternative livelihoods to enhance conservation.</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<p><b>Village Resettlement Priority:</b> Urgent need to address the resettlement of villages in the core area.</p> <p><b>Mitigating Anthropogenic Pressures:</b> Planning and handling anthropogenic pressures from surrounding villages sensitively to gain local support.</p> <p><b>Eco-tourism and Livelihood Initiatives:</b> Prioritize awareness building, EDC formation, and involvement of communities in eco-tourism and livelihood improvement activities.</p> <p><b>Clear Planning for Buffer Areas:</b> Clearly plan the functioning of buffer areas, explain regulations to communities to avoid misunderstandings.</p> <p><b>Ecologically Sensitive Area (ESA) Demarcation:</b> Demarcate Ecologically Sensitive Areas around the reserve to contain mining activities.</p> <p><b>Illegal Activities and Insufficient Infrastructure:</b> Illegal activities like tree felling, inadequate staff, and infrastructure requiring urgent augmentation.</p> <p><b>Delayed Notifications and Lack of Awareness Campaign:</b> Need for quick notifications and a comprehensive awareness campaign to counter misinformation and engage local communities effectively.</p> <p><b>Higher-Level Planning for Connectivity:</b> Recognizing the need for higher-level planning to ensure connectivity within the conservation landscape spanning four states.</p>	<p><b>Legal Handling Challenges:</b> Continuous challenges in legal handling due to the complex jurisdiction involving multiple administrative units.</p> <p><b>Limited Prey Base and Biotic Interference:</b> Sustained issues with a limited prey base, coupled with ongoing biotic interference.</p> <p><b>Land Use Demands and Illegal Activities:</b> Persistent challenges with growing demands for land and inadequate regulation of illegal activities.</p> <p><b>Administrative Coordination Challenges:</b> Ongoing difficulties in coordination with other departments due to the reserve's spread over four districts.</p> <p><b>Threats to Unique Plateau Biodiversity:</b> Continued existence of windmills posing a threat to the ecologically unique plateau.</p> <p><b>Uncertain Tiger Population and Hunting Impact:</b> Ongoing uncertainty regarding the resident tiger population, occasional visits reported, and an impact of hunting.</p> <p><b>Fragmentation due to Mining and Exotic Plantation:</b> Continued fragmentation of the tiger corridor due to previous mining and the impact of large-scale exotic plantation.</p> <p><b>Distant Source Population and Unregulated Developments:</b> Persistent challenges with a</p>	<p><b>Population Recovery Planning:</b> Initiate population recovery plans for tigers in collaboration with source populations like Kali Tiger Reserve and corridor forests through Goa. Prioritize reducing human impacts, controlling poaching, and restoring a robust prey base before considering tiger augmentation.</p> <p><b>Invasive Species Management:</b> Implement systematic management plans to address the invasion of <i>Ageratum conyzoides</i>, <i>Chromolaena odorata</i>, <i>Mesosphaerum suaveolens</i>, <i>Lantana camara</i>, <i>Mimosa diplotricha</i>, and <i>Xanthium strumarium</i>. Prioritize removal efforts in areas where invasion is potentially in the initial stage.</p> <p><b>Corridor Protection and Collaboration:</b> Strengthen collaborations with forest departments of neighboring states, law enforcement agencies, and relevant authorities to protect and preserve the Sahyadri Tiger Reserve and its connecting corridors. Focus on joint operations, anti-poaching measures, and ensuring overall wildlife safety.</p> <p><b>Continuous Monitoring and Research:</b> Invest in continuous monitoring and research initiatives to assess the impact of existing threats, track the effectiveness</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010		distant source population, transient tiger visits, and a lack of regulation for developments.	<p>of implemented mitigation measures, and adapt strategies accordingly. This will contribute to the long-term conservation and sustainability of Sahyadri Tiger Reserve.</p> <p><b>Community Engagement and Awareness:</b> Engage local communities in conservation efforts, raise awareness about the importance of tiger reserves, and explore community-based conservation models. This will foster a sense of ownership and support for the protection of Sahyadri Tiger Reserve.</p>
2014	<p><b>Inaccessible Terrain:</b> Lack of tracks or routes, and loss of local terrain knowledge, making the reserve's terrain inaccessible.</p> <p><b>Infrastructure and Facilities Deficiency:</b> Insufficient infrastructure and facilities, especially in terms of equipment and trained staff, hindering effective conservation.</p> <p><b>Legal Handling Challenges:</b> Need for a special counsel or legal officer to handle cases in various courts, given the complex jurisdiction involving multiple administrative units.</p> <p><b>Limited Prey Base:</b> Pilot studies indicate a limited prey base for carnivores, potentially impacting the predator ecosystem.</p> <p><b>Biotic Interference:</b> Poaching, collection of Non-Timber Forest Products (NTFP), firewood gathering, grazing, fires, and road traffic in the buffer area causing biotic interference.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<p><b>Land Use Demands:</b> Growing demands for land for windmills, resorts, and roads, reducing suitable habitat for wildlife dispersal.</p> <p><b>Infrastructure Improvement:</b> Enhance infrastructure for the protection network, staff housing, and monitoring and communication.</p> <p><b>Ecotourism Potential Untapped:</b> Recognize the potential for ecotourism in the UNESCO-recognized Western Ghats complex; build community-based ecotourism for improved conservation outcomes.</p> <p><b>Voluntary Relocation:</b> Consider voluntary relocation programs for villages within the Tiger Reserve. <b>Incentives for Staff:</b> Provide incentives, such as one-step higher pay and allowances, to Sahyadri staff in difficult and tribal-dominated areas.</p> <p><b>Unified Command for Buffer Areas:</b> Transfer buffer areas in different divisions under a unified command to strengthen management.</p> <p><b>Additional Staff Deployment:</b> Deploy additional staff, increase their strength, establish a robust communication network, and provide incentives to enhance protection efforts.</p> <p><b>Ungulate Species Repopulation:</b> Explore the possibility of repopulating habitats with ungulate species to support ecosystem balance.</p>		



MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p><b>Uncertain Tiger Presence:</b> Lack of confirmed tiger presence in the reserve despite reported evidence, with unclear reasons for their disappearance.</p> <p><b>Inadequate Field Staff Facilities:</b> Field staff unfamiliar with staying in camps, facing inadequate facilities and equipment. Temporary camps in some areas, especially Chandoli, with an ineffective wireless network.</p> <p><b>Staff Unaware of SOPs:</b> Frontline staff unaware of Standard Operating Procedures (SOPs) issued by the National Tiger Conservation Authority (NTCA).</p> <p><b>Traditional Hunting and Poaching:</b> Ongoing traditional hunting and poaching for bush meat in the area.</p> <p><b>Critical Tiger Habitat Disruption:</b> Two separate units of the Critical Tiger Habitat connected by a forested buffer facing incompatible land-use issues, including deforestation for resorts. The national highway upgrade poses a threat to the critical corridor.</p> <p><b>Inexperienced Guards:</b> Young and untrained guards not acclimatized to forest life.</p> <p><b>Poor Management Integration:</b> Limited management efforts to consolidate the two protected areas constituting the Tiger Reserve, with insufficient internal roads in Koyana Wildlife Sanctuary and deteriorating road conditions in Chandoli National Park.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<p><b>Inadequate Prey Base:</b> The current prey base in the Tiger Reserve is inadequate to support a viable population of tigers.</p> <p><b>Unassessed Impact of Leopard Release:</b> Release of leopards in the Tiger Reserve without a scientific assessment of the impact on the already prey-deficient ecosystem.</p> <p><b>Lack of Risk Analysis:</b> Absence of risk analysis, especially related to wildlife crime, for identifying high-risk areas within the reserve</p>		
2022	<p><b>Uncertain Tiger Population:</b> Absence of resident tigers; evidence from genetic analysis and sporadic camera traps suggests occasional visits by about eight tigers from Radhanagari WLS to Vishalgad CR.</p> <p><b>Hunting and Poaching Impact:</b> Traditional hunting and poaching for meat possibly contribute to low prey density, hindering direct sightings of wild animals.</p> <p><b>Inaccessible Terrain:</b> Undulating terrain and a vast water body make the Koyana part of Sahyadri Tiger Reserve challenging for proper surveillance and access to the interior.</p> <p><b>Fragmented Tiger Movement Corridor:</b> Two distinct units of the Critical Tiger Habitat connected by a forested buffer, but the corridor is on private lands, leading to potential incompatible land-use.</p> <p><b>Highway Upgrades and Corridor Threats:</b> Upgrading of national</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<p>and regional highways passing through the buffer and corridor areas poses a threat to wildlife movement.</p> <p><b>Fragmentation due to Mining:</b> Fragmentation of the tiger movement corridor likely caused by previous bauxite mining in the area.</p> <p><b>Exotic Plantation Impact:</b> Large-scale plantation of exotic species in Koyna, affecting edge habitats and potentially impacting biodiversity.</p> <p><b>Distant Source Population:</b> The source population of tigers is far away; only transient tigers visit, with no settled population.</p> <p><b>Unregulated Commercial Developments:</b> Lack of regulation and monitoring for commercial developments in corridor/connectivity areas.</p> <p><b>Administrative Coordination Challenges:</b> Spread over four districts, making coordination with other departments and administrative control challenging.</p> <p><b>Threats to Unique Plateau Biodiversity:</b> Existence of windmills on the ecologically unique and sensitive lateritic plateau (Sada) poses a threat to biodiversity and heritage values.</p>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- a. It would be beneficial to acknowledge the success achieved through the relocation of 32 villages, as it has positively contributed to mitigating anthropogenic activities and aiding conservation efforts.
- b. Considering the positive outcomes observed from incentivized voluntary relocations, it may be advisable to continue such initiatives to further reduce human impact and enhance conservation efforts in the region.
- c. Projects aimed at augmenting the cheetal population could be expedited to provide a more robust prey base, supporting carnivore populations and overall ecosystem health.
- d. It might be worthwhile to focus on strategic locations and explore the possibility of expanding efforts to encourage transiting tigers to establish residency in suitable habitats.
- e. Enhancing the sampling scale of camera trap deployments could significantly improve monitoring capabilities and provide more comprehensive coverage of wildlife populations.
- f. Special attention could be given to areas like the western edge of Chandoli National Park and buffer forests between Radhanagri and Chandoli for habitat conservation efforts, given their ecological significance.
- g. Emphasizing the importance of habitat preservation and connectivity with neighboring reserves could help maintain ecological integrity and facilitate wildlife movement across landscapes.
- h. Developing a comprehensive management plan focusing on reducing human impacts, enforcing strict anti-poaching measures, and exploring alternative livelihoods for local communities could lead to more sustainable conservation outcomes.
- i. Initiating population recovery plans for tigers in collaboration with source populations like Kali Tiger Reserve and corridor forests through Goa could enhance genetic diversity and contribute to the long-term viability of tiger populations.
- j. Prioritizing actions aimed at reducing human impacts, controlling poaching, and restoring a robust prey base before considering tiger augmentation measures could ensure a more holistic approach to conservation planning.
- k. Implementing systematic management plans to address the invasion of various invasive species, with a focus on areas where invasion is at an early stage, could help prevent further spread and protect native habitats.
- l. Prioritizing removal efforts in areas where invasion is potentially in the initial stage could be advisable to minimize the impact of invasive species on native ecosystems.
- m. Strengthening collaborations with forest departments of neighboring states, law enforcement agencies, and relevant authorities could enhance wildlife protection

efforts through joint operations and knowledge sharing.

- n. Focusing on joint operations, anti-poaching measures, and overall wildlife safety could contribute to the effective protection of wildlife within the Tiger Reserve.
- o. Investing in continuous monitoring and research initiatives to assess the impact of existing threats and track the effectiveness of implemented mitigation measures would provide valuable insights for adaptive management.
- p. Tracking the effectiveness of implemented mitigation measures and adapting strategies accordingly based on ongoing monitoring and evaluation could lead to more efficient conservation outcomes.
- q. Encouraging the active involvement of local communities in conservation efforts could foster a sense of ownership and stewardship towards wildlife and their habitats, leading to more sustainable conservation practices.
- r. Raising awareness about the importance of tiger reserves and exploring community-based conservation models could help garner support and participation from local communities in conservation initiatives.
- s. Enhancing infrastructure for the protection network, staff housing, monitoring, and communication could improve operational efficiency and effectiveness in wildlife conservation efforts.
- t. Addressing challenges related to inaccessible terrain, lack of tracks, and loss of local terrain knowledge through strategic planning and capacity building initiatives could improve conservation outcomes in challenging environments.
- u. Recognizing the potential for ecotourism in the UNESCO-recognized Western Ghats complex and exploring avenues for sustainable ecotourism development could provide alternative livelihood options for local communities while promoting conservation.
- v. Considering the development of community-based ecotourism initiatives as a means to generate revenue and support conservation efforts could provide economic incentives for local communities to engage in conservation activities.
- w. Exploring the possibility of implementing voluntary relocation programs for villages within the Tiger Reserve could minimize human-wildlife conflicts and habitat disturbance while ensuring the safety and well-being of local communities.
- x. Providing incentives for staff, such as one-step higher pay and allowances, could recognize and reward their dedication and contribution to wildlife protection efforts, fostering morale and commitment.
- y. Considering transferring buffer areas in different divisions under a unified command to streamline management efforts and enhance coordination could improve the effectiveness of conservation measures across the reserve.
- z. Deploying additional staff, increasing their strength, and establishing a robust communication network could enhance surveillance and response capabilities within the Tiger Reserve, contributing to improved wildlife protection.
- aa. Exploring the possibility of repopulating habitats with ungulate species to support ecosystem balance and enhance prey availability for carnivores could be a valuable conservation strategy to consider.

## 5. Conclusions

The Sahyadri Tiger Reserve, established in 2010, stands as a crucial bastion of biodiversity within Maharashtra. Spanning Chandoli National Park and Koyna Wildlife Sanctuary, it embraces a UNESCO World Natural Heritage Site, marked by its endemic flora and fauna. Challenges, however, persist – from the absence of a resident tiger population to human-induced pressures and fragmented corridors. The management recommendations underscore the need for proactive measures, including habitat preservation, community engagement, and strategic repopulation initiatives. As the Sahyadri Tiger Reserve strives for conservation excellence, collaborative efforts, continuous monitoring, and adaptive strategies will be pivotal for securing its future and fostering a thriving ecosystem.



# TADoba ANDHARI TIGER RESERVE

## 1. Brief Description

Tadoba Andhari Tiger Reserve, also known as Tadoba Tiger Reserve, is situated in Maharashtra's Chandrapur district, approximately 150 km from Nagpur city. Covering 1727 sq. km, it comprises Tadoba National Park and Andhari Wildlife Sanctuary. The reserve is renowned for its ancient teak forests and diverse wildlife, including tigers, leopards, wild dogs, and various mammalian species. It forms part of the Central India forest tract and serves as a crucial habitat for numerous wildlife species. However, habitat connectivity with neighboring reserves like Tipeswar Wildlife Sanctuary and Indravati National Park is under threat due to development projects and mining activities, posing challenges to the reserve's metapopulation dynamics.

## 2. Tiger population as per All India Tiger estimation

The population dynamics of tigers in Tadoba Tiger Reserve reveal notable trends over the years. In 2008, the survey recorded a population of 19 tigers, followed by a substantial increase to 69 tigers in 2010, indicating a period of significant growth. However, by 2014, the population estimation decreased to 51 tigers, suggesting a decline. Nonetheless, in 2018, intensive sampling efforts identified 82 individual adult tigers, accompanied by a calculated tiger density of 6.09 tigers per 100 sqkm. Continuing these efforts into 2022, the reserve invested 21063 trap nights, resulting in the identification of 97 unique tigers through 3942 photos. The tiger density remained stable at 6.33 tigers per 100 sqkm, reflecting the persistence of the tiger population within the reserve despite fluctuations in numbers. These findings emphasize the importance of sustained conservation measures to safeguard the tiger population and its habitat in Tadoba Tiger Reserve.

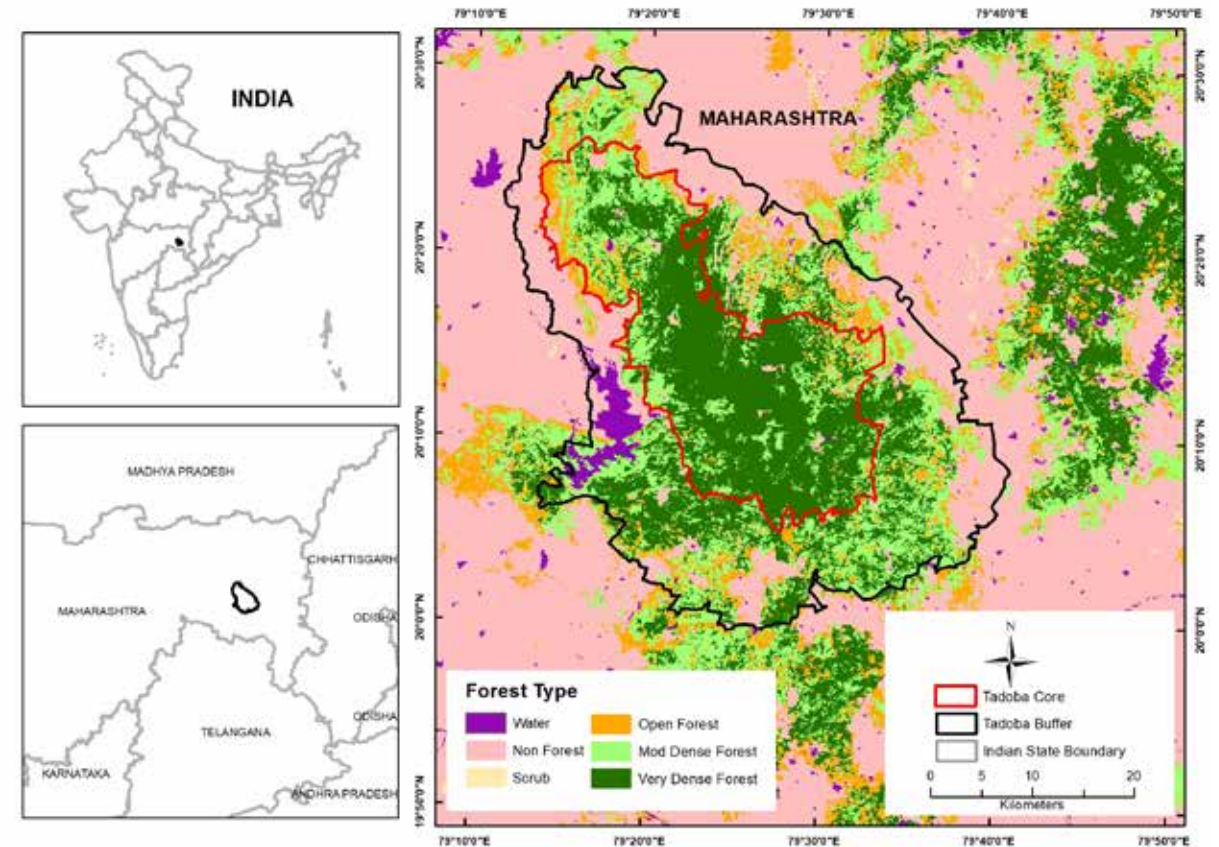


Figure 1: Map showing the location of Tadoba Tiger Reserve in the state of Maharashtra.

## 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<p><b>Buffer Zone Delineation:</b> Non-transfer of forest buffer to TR management hinders proper zoning, affecting core, buffer, and tourism areas.</p> <p><b>Compatible Land Use:</b> Land use beyond the buffer zone includes incompatible activities like forestry operations, impacting TR management goals.</p> <p><b>Human Pressure:</b> High human and livestock population in villages near the TR, leading to pressures like illicit grazing, fuelwood, fodder collection, and cultivation.</p>	<p><b>Outdated TCP Data:</b> The Tiger Conservation Plan (TCP) repeatedly contains outdated data, necessitating a mid-term revision for up-to-date information.</p> <p><b>Vision Document Alignment:</b> Lack of alignment between the vision document and TCP objectives has been a recurring weakness, highlighting the need for better integration of technical and managerial aspects during mid-term appraisals.</p>	<p><b>Conflict Management and Coexistence:</b> Implement effective strategies to manage human-tiger conflicts promptly, focusing on timely response to conflict situations and addressing the root causes. Encourage sustainable ecotourism initiatives that support local livelihoods to foster coexistence between wildlife and communities.</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<p><b>Management Plan:</b> The existing Management Plan is outdated, stretching from 1997-98 to 2006-07, needing a more recent and comprehensive revision.</p> <p><b>Regeneration Status:</b> Regeneration in the buffer zone, especially near villages, is inadequate, affecting the overall biodiversity conservation efforts.</p> <p><b>Staffing and Equipment:</b> Vacancies among frontline staff, exceeding recommended beat sizes, and insufficient specialized equipment for effective wildlife monitoring.</p> <p><b>Tourism Regulation:</b> Lack of a comprehensive study to assess the carrying capacity for tourism, potentially leading to unmanaged visitor pressure.</p> <p><b>Financial Disbursement:</b> Delay in the release of funds at the state government level, affecting the timely execution of conservation initiatives.</p> <p><b>Research Collaboration:</b> Limited collaboration and feedback loop between external research agencies and TR management, hindering the timely application of research findings.</p> <p><b>Patrolling and Anti-Poaching Measures:</b> Limited strike force capacity and the need for a more organized approach to anti-poaching efforts.</p>	<p><b>Incomplete Village Relocation:</b> Despite relocation efforts, the persistence of one remaining village (Rantalodi) poses a continual challenge, impacting the inviolability of the core area.</p> <p><b>High-Impact Villages Analysis:</b> The recurring need to prioritize high-impact villages (nine out of 23) for resource dependence analysis indicates a persistent challenge in strategic management for these areas.</p>	<p><b>Habitat Protection and Connectivity:</b> Ensure the protection of high ungulate biomass and maintain habitat connectivity with neighboring forest divisions. Strengthen efforts to manage sink habitats for dispersing tigers, particularly in areas interspersed with human habitation.</p> <p><b>Tiger Population Monitoring:</b> Continue monitoring and management efforts to sustain the high tiger density in the region. Implement measures to address threats such as left-wing extremism, which hinder sampling in certain forest grids.</p> <p><b>Invasive Species Management:</b> Develop and implement systematic management strategies to control the spread of invasive species like <i>Mesosphaerum suaveolens</i>, <i>Senna tora</i>, and <i>Xanthium strumarium</i> within priority management areas of the reserve. Targeted removal efforts and habitat restoration should be prioritized to prevent their establishment and spread.</p> <p><b>Prey Supplementation:</b> Given the low density of major prey species and instances of tiger predation on livestock, implement prey supplementation programs within the reserve. Enhancing prey availability will help minimize negative human-tiger interactions and support the tiger population's health.</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<p><b>Infrastructure and Visitor Facilities:</b> Inadequate visitor facilities such as interpretation centers, directional signage, and information dissemination.</p> <p><b>Ecodevelopment and Stakeholder Engagement:</b> The scale of funding for eco-development programs is deemed insufficient to address the needs of the numerous villages in proximity to the TR.</p> <p><b>Unified Control and Buffer Management:</b> Lack of unified control over the entire buffer zone, with a need for better coordination with adjoining Forest Divisions.</p> <p><b>Sustainable Development Efforts:</b> Limited efforts towards sustainable development beyond eco-development programs.</p> <p><b>Lack of Reciprocal Commitments:</b> Limited commitment from local communities to reciprocate conservation efforts.</p> <p><b>Landscape Integration:</b> Absence of a landscape plan and integration with adjoining Forest Divisions for a holistic conservation approach.</p>		<p><b>Community Engagement and Awareness:</b> Engage local communities in conservation efforts and raise awareness about the importance of tiger conservation. Promote stewardship among residents and facilitate coexistence with wildlife through education and outreach programs.</p> <p><b>Research and Monitoring:</b> Conduct further research and monitoring to understand the dynamics of tiger populations and their interactions with the ecosystem. This information will inform adaptive management strategies for the long-term conservation of tigers and their habitats in Tadoba Andhari Tiger Reserve.</p>
2010	<p><b>Village Presence and Biotic Pressure:</b> Persistent presence of several villages in the core area, exerting significant biotic pressure on the Tiger Reserve (TR).</p> <p><b>Bamboo Removal and Disturbance:</b> Unregulated bamboo removal by</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<p>local communities, both within and outside the TR, causing significant disturbance to the ecosystem.</p> <p><b>Corridor Threats from Mining and Development:</b> High-pressure activities such as mining and development in the corridors connecting the TR with other habitats, posing a threat to the TR's insular population and causing landscape fragmentation.</p> <p><b>Human-Tiger Conflict Risks:</b> The creation of a fragmented landscape around the TR is increasing the risk of severe human-tiger conflicts, especially when tigers disperse into the disturbed surroundings.</p> <p><b>Limited Efforts in Providing Alternate Incomes:</b> Apart from ecotourism, limited efforts by the TR in providing or facilitating alternate sources of income for forest-dependent communities.</p> <p><b>Community Engagement and Awareness Gap:</b> Lack of full engagement with communities in and around the TR through awareness programs and systematic interactions, critical in a high-conflict area.</p> <p><b>Accelerated Resettlement:</b> Urgent acceleration of the resettlement process to prevent the TR from becoming isolated and disconnected from additional habitat patches outside.</p> <p><b>Shortage of Wildlife Trained Staff and Vehicles:</b> Address the severe shortage of wildlife-trained staff and vehicles to enhance protection</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<p>and management capabilities in the TR.</p> <p><b>Infrastructure Enhancement:</b> Adoption of suitable infrastructure to support protection and management efforts within the TR.</p> <p><b>Securing Fragile Corridors:</b> Increased attention and efforts to ensure the security of fragile corridors, preventing them from being permanently disrupted.</p> <p><b>Proactive Community Engagement:</b> Proactive engagement of local communities to build a stronger connection, enhance awareness, and foster a collaborative approach towards conservation.</p> <p><b>Alternate Income Opportunities:</b> Systematic efforts to provide or facilitate alternate sources of income for forest-dependent people, reducing dependency on activities that disturb the ecosystem.</p>		
2014	<p><b>Human-Wildlife Conflict due to Population Presence:</b> Presence of 41,644 people in 59 villages around the reserve contributing to potential human-wildlife conflicts.</p> <p><b>Livestock Overpopulation in Buffer Zone:</b> High livestock population (41,820) in the buffer zone, indicating a need for reduction to mitigate ecological impacts.</p>		
2018	<p><b>Village Pressure on Buffer and Core:</b> Significant pressure from 23 villages located just outside the core area, leading to resource strain on the buffer and core zones.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p>Challenges in containing illegal bamboo extraction due to the presence of bamboo artisans in many villages.</p> <p><b>Political Pressure for Monsoon Tourism:</b> Unending political pressure to allow tourism in the core zone during the monsoon, causing demoralization among management and staff.</p> <p><b>Outdated Tiger Conservation Plan:</b> The approved Tiger Conservation Plan (2015-2026) contains decade-old data. Lack of efforts to analyze and prescribe protection and management measures based on the outdated data. Generic habitat management prescriptions with no system for monitoring their effectiveness.</p> <p><b>Ineffective Wildlife Crime Prevention:</b> Inadequate informer network leading to ineffective information-based wildlife crime prevention. Weak wildlife crime investigation skills among frontline personnel.</p> <p><b>Threat from Chandrapur-Mul-Gadchiroli Road:</b> Chandrapur-Mul-Gadchiroli road poses a serious threat to wildlife, with 21 wild animals killed in road hits over the last 3 years. Need for retrofitting along critical accident-prone stretches of the road.</p> <p><b>Complacency towards Poaching Threat:</b> Perceived complacency</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p>of TR authorities toward the threat of organised poaching gangs targeting tigers.</p> <p><b>Ineffective Protection in Adjoining Forest Divisions:</b> Lack of effective protection measures in adjoining forest divisions, leading to a rise in poaching cases in the corridors falling in the Vidarbha region.</p> <p><b>Increasing Tiger-Human Conflict:</b> Rising incidents of tiger-human conflict around Tadoba, indicating challenges in managing such conflicts effectively.</p>		
2022	<p><b>Unaddressed TCP Issues:</b> The TCP, extended to 2025-26, still contains outdated data and lacks essential prescriptions. A mid-term revision is suggested for updating the document.</p> <p><b>Vision Document Alignment:</b> While TATR plans a vision document, alignment with TCP objectives is crucial. Technical and managerial aspects of the vision document should be included in the mid-term appraisal of the TCP.</p> <p><b>Incomplete Village Relocation:</b> Though five out of six villages have been relocated, efforts should be intensified to relocate the remaining village (Rantalodi) to make the core area inviolate.</p> <p><b>High-Impact Villages Analysis:</b> TATR prioritizes nine out of 23 high-impact villages for a resource's dependence analysis, emphasizing the need for strategic management in these areas.</p>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- a. It could be beneficial to implement effective strategies to manage human-tiger conflicts promptly. This could involve focusing on timely responses to conflict situations and addressing the root causes behind such conflicts. Additionally, encouraging sustainable ecotourism initiatives that support local livelihoods could foster coexistence between humans and tigers.
- b. It is important to ensure the protection of areas with high ungulate biomass and maintain habitat connectivity. Strengthening efforts to manage sink habitats for dispersing tigers, particularly near human habitation, could help minimize potential conflicts.
- c. Furthermore, there is a need to systematically implement invasive species management strategies to control the spread of invasive species like *Mesosphaerum suaveolens*, *Senna tora*, and *Xanthium strumarium* within priority management areas. Targeted removal efforts and habitat restoration initiatives could be essential to prevent their establishment and spread.
- d. Consider implementing prey supplementation programs within the reserve to enhance prey availability. This could help minimize negative human-tiger interactions and support the overall health of the tiger population.
- e. Engaging local communities in conservation efforts could prove beneficial. Raising awareness about tiger conservation and promoting stewardship through education and outreach programs could foster a sense of responsibility towards wildlife conservation among local residents.
- f. Conducting further research to understand tiger population dynamics and ecosystem interactions could provide valuable insights. Utilizing research findings to inform adaptive management strategies could enhance conservation efforts.
- g. It may be advisable to address outdated Tiger Conservation Plan (TCP) issues and ensure alignment with the objectives outlined in the vision document. Conducting mid-term revisions for up-to-date information and effective management planning could be beneficial.
- h. Intensifying efforts to relocate remaining villages impacting the core area could be considered. Prioritizing high-impact villages for resource dependence analysis and strategic management could aid in this process.
- i. Adopting suitable infrastructure to support protection and management efforts within the reserve could enhance operational efficiency and effectiveness.
- j. Strengthening wildlife crime prevention measures could be essential. Improving informer networks and enhancing frontline personnel skills for effective crime prevention could help deter illegal activities. Implementing retrofitting along critical accident-prone stretches of roads to reduce wildlife fatalities could also be beneficial.

- k. Enhancing collaboration with adjoining forest divisions for effective protection measures could improve coordination and overall conservation outcomes.
- l. Addressing rising incidents of tiger-human conflicts effectively through proactive management strategies could help mitigate conflicts and ensure the safety of both humans and tigers.

#### 5. Conclusions

In conclusion, Tadoba Tiger Reserve stands as a vital stronghold for tiger conservation in Maharashtra, showcasing significant population fluctuations over the years. Despite challenges like habitat fragmentation, human-wildlife conflicts, and outdated management plans, the reserve has demonstrated resilience through sustained conservation efforts. The tiger population, supported by effective prey supplementation and community engagement, has maintained stability, emphasizing the importance of continued vigilance and adaptive management. With enhanced habitat protection, proactive conflict resolution measures, and updated conservation strategies, Tadoba Tiger Reserve can secure a thriving future for its iconic wildlife and remain a beacon of tiger conservation in Central India.







# DAMPA TIGER RESERVE

## 1. Brief Description

Dampa Tiger Reserve, situated in Mamit district of Mizoram (23 20' to 23 47'N, 92 15' to 92 30'E), spans 988 km<sup>2</sup>, with 500 km<sup>2</sup> designated as critical core habitat in its Tiger Conservation Plan. Positioned in the Lushai hills, it shares borders with the Chittagong Hill Tract regions of Bangladesh to the west and is traversed by rivers like Teirei, Keisalam, Seling, and Saza, along with small perennial rivulets. Recognized as part of the "Indo-Burma Biodiversity Hotspot" and an Important Bird and Biodiversity Area (IBA), Dampa boasts diverse vegetation, including moist deciduous forest, tropical wet evergreen forest, semi-evergreen forest, and higher-altitude tropical grassland. Tree species such as *Michelia champaca*, *Mesua ferrea*, and *Terminalia bellirica* are prevalent, with some areas historically used for shifting cultivation now dominated by bamboo brakes. The reserve, in the eastern Himalayas, harbors various mammalian species, including dhole, clouded leopard, Asiatic golden cat, marbled cat, leopard cat, Himalayan black bear, Malayan sun bear, elephant, gaur, sambar, red serow, barking deer, wild pig, Himalayan crestless porcupine, and Asiatic brush-tailed porcupine.

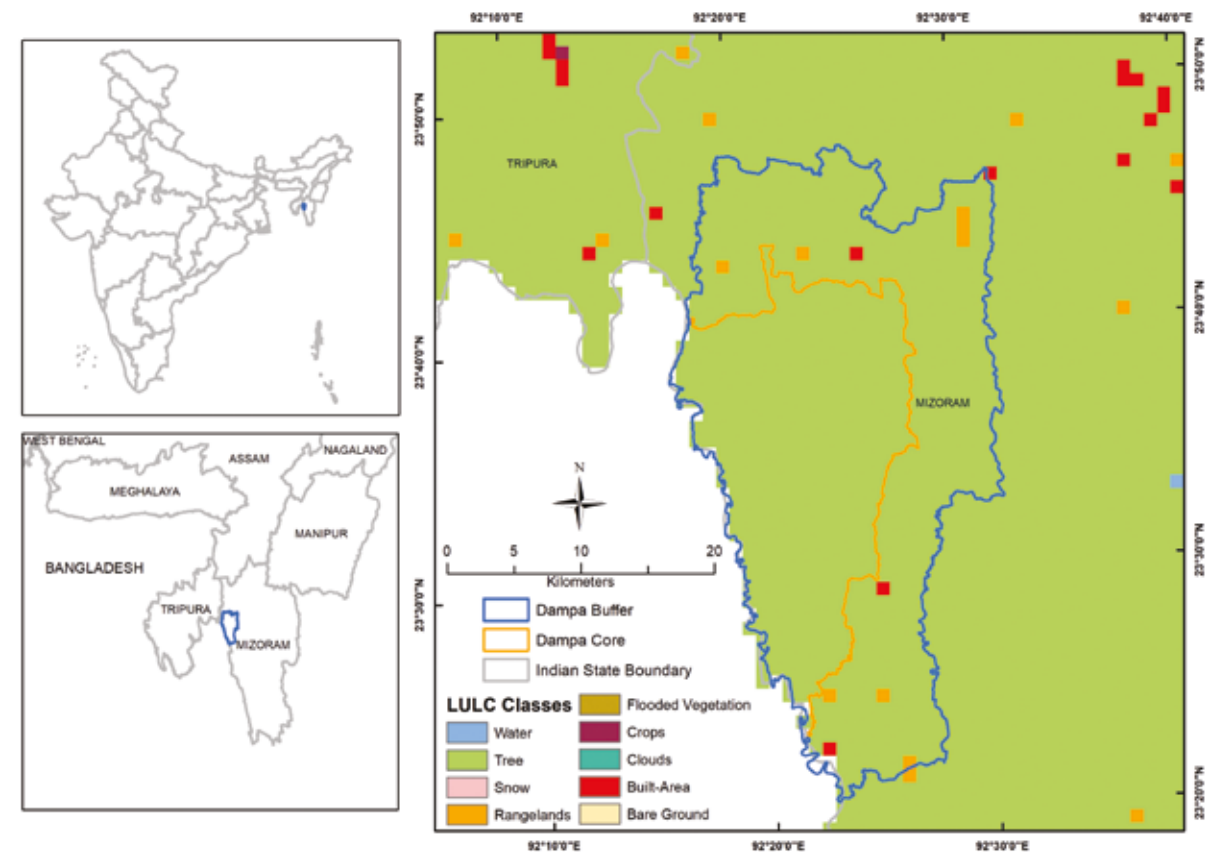


Figure 1: Map showing the location of Dampa Tiger Reserve in the state of Mizoram.

## 2. Tiger Population as per All India Tiger Estimation

Tiger population of Dampa is substantially low, and tiger presence was confirmed through scat DNA in 2014. No tiger was photo captured during 2018 and 2022. However, as per media reports and communication made by the Tiger Reserve staff, a tiger was photo-captured during routine monitoring exercise in 2021.

## 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>Expediting upgradation of Dampa Tiger Reserve to National Park status due to the absence of rights within the reserve.</li> <li>Need of unified control under the Tiger Reserve authority for cohesive management of the entire Tiger Reserve.</li> <li>Avoidance of Jhoom (shifting cultivation) within the reserve to protect biodiversity.</li> <li>Timely release of funds from both Central and State Governments for effective management and conservation.</li> <li>Prioritizing and implementing comprehensive research initiatives within the Tiger Reserve.</li> <li>Addressing the absence of substantial grasslands within the Tiger Reserve.</li> <li>Intensifying enforcement along the Bangladesh border by establishing more patrolling camps to combat poaching and enhance protection.</li> <li>Promoting eco-development activities within the Tiger Reserve to boost sustainable conservation efforts.</li> </ul>	<ul style="list-style-type: none"> <li>Yet to attain National Park status.</li> <li>Buffer area remains outside unified TR authority control.</li> <li>Ongoing challenges with Jhoom cultivation.</li> <li>Chronic inadequate funding remains a persistent issue.</li> <li>Significant staff vacancies pose challenges.</li> <li>Absence of proper/ streamlined training programs for both permanent and temporary staff.</li> <li>Limited progress in research initiatives.</li> <li>Negligible proportion of grasslands in the reserve.</li> <li>Pending trans-boundary collaboration for enhanced protection.</li> <li>Continued inadequacy in patrolling and enforcement infrastructure.</li> <li>Insufficient eco-development activities within the Tiger Reserve.</li> <li>Lack of special interpretation programs for Paramilitary forces.</li> <li>Establishment of new ranges has been initiated.</li> </ul>	<ul style="list-style-type: none"> <li>Before contemplating the reintroduction of tigers from the sole source in the North-Eastern Hills and Brahmaputra Landscape, Kaziranga Tiger Reserve, it is imperative to establish a robust protection system and address insurgency concerns in the area.</li> <li>Despite the low abundance of tigers and other biota in this reserve, its significance lies in the conservation of crucial carnivores like the clouded leopard. Dampa serves as a conduit for the movement of tigers within the North East hills forests. To rejuvenate the tiger population in this reserve, it is imperative to implement regular law enforcement monitoring and prey augmentation.</li> <li>Addressing the Ageratina adenophora, Ageratum conyzoides, Chromolaena odorata, and Mimosa diplotricha invasion is crucial at this early stage, and swift removal should be a top priority to prevent its establishment in a broader area.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>Given the private ownership of lands outside the Tiger Reserve, more efforts required on modifying shifting cultivation practices for sustainable land use.</li> </ul>	<ul style="list-style-type: none"> <li>Tourism infrastructure is under-developed.</li> <li>Inadequate connectivity within and outside the TR as well as poor enforcement infrastructure still prevail.</li> <li>Phase-IV monitoring of tigers lacks adherence to NTCA protocols.</li> </ul>	
2010	<ul style="list-style-type: none"> <li>Need on unified control of Tiger Reserve.</li> <li>Under-funding and delays in government funds, impacting infrastructure and protection.</li> <li>Limited permanent field staff necessitates reliance on temporary Muster Roll staff.</li> <li>Lack of implementation of TCP-outlined activities for effective reserve management.</li> <li>Immediate initiation of brief training for Muster Roll staff by Tiger Reserve Management. Special interpretation programs for paramilitary forces can enhance their understanding.</li> <li>Border challenges with Bangladesh.</li> <li>Poorly maintained roads within the Tiger Reserve hinder staff movement.</li> <li>In the buffer zone, 19 villages practicing shifting cultivation face wildlife-related damages.</li> <li>Lack of village level micro-planning for effective planning.</li> <li>Lack of concerted efforts to locate key habitats of unique animal species and implementing monitoring and protection measures.</li> <li>Mikania weed infestation as a major threat for habitat in the Tiger Reserve.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Extensive border challenges with Bangladesh and Myanmar, especially the porous 70 km stretch.</li> <li>Severe understaffing issues at Dampa.</li> <li>Untrained staff.</li> <li>Lack of control over the buffer area hampers effective park management, necessitating its integration into unified control.</li> <li>Creating new ranges within Dampa Tiger Reserve is essential for effective management and protection of diverse ecosystems and wildlife.</li> <li>Villages practicing shifting cultivation near the core area face wildlife-related conflicts.</li> <li>Shortage of firearms, wireless equipment, field gear, and visitor facilities at Dampa Tiger Reserve.</li> <li>The Reserve lacks essential connectivity and infrastructure, impacting effective protection and visitor facilities.</li> </ul>		
2018	<ul style="list-style-type: none"> <li>Vacancy in FD position and 79% staff vacancy affecting protection.</li> <li>Acute staff shortage leads to reliance on temporary wildlife guards.</li> <li>Poor enforcement with inadequate permanent patrolling camps.</li> <li>Lack of research activities due to unfilled Research Officer position.</li> <li>Irregular steering committee meetings for Tiger Conservation and Tiger Foundation.</li> <li>Prevalent Jhoom cultivation in the buffer zone, including indiscriminate felling of trees and bamboos.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Limited coordination with Border Security forces at the international border for information exchange and enhanced protection.</li> <li>The 15 villages of the buffer zone pose a threat to Dampa TR.</li> </ul>		
2022	<ul style="list-style-type: none"> <li>Vacancy in 54% of field positions, especially Forest Guards and Foresters.</li> <li>Tiger Protection Force (TPF) deployment issues, lack of gadgets, and equipment hinder efficient smart patrolling.</li> <li>Scant staff incentives and training modules.</li> <li>Insufficient funds and delays impact Tiger Reserve management.</li> <li>Insufficient ecological information for key species.</li> <li>High threat from poaching due to lack of efforts for detection, evidence collection, and prosecution.</li> <li>Challenging terrain with limited road network.</li> <li>Forest areas in the buffer zone not under unified command.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- Many of the key actionable points identified throughout the MEE cycles remain unaddressed. Therefore, it is advisable to prioritize and adhere to the recommendations provided to ensure effective management and conservation efforts.
- The buffer is not under the administrative control of the Tiger Reserve. Urgent effort should be made for a unified control under Field Director for Dampa Tiger Reserve.

- c. Staff has been inadequate, with a major proportion of permanent positions vacant since 2006. Filling these positions should be prioritized. Preference should be given to the indigenous communities for recruitment in the frontline cadre.
- d. All stakeholders should collaborate to accelerate fund allocation and ensure timely provision of essential funds for efficient Tiger Reserve management. Compliance with TCP guidelines is essential. APOs should be prepared as per TCP budget and should be submitted to NTCA regularly for timely release of fund.
- e. It is imperative to upgrade the patrolling infrastructure and camp facilities within the Tiger Reserve. This includes investing in modern equipment, communication tools, and suitable accommodation for field staff. Additionally, the swift implementation of M-STriPES, a critical technological tool for smart patrolling and monitoring, is crucial. Range offices should be developed as composite technical and managerial hubs.
- f. Resettlement of Serhmun village, ensuring families opting for incentivized, voluntary relocation in adherence to NTCA guidelines should be prioritized. The relocated village site should be developed as a grassland seeking expertise of forest managers experienced with grassland development.
- g. Performing Phase IV estimations annually and building the reserve's in-house data analysis capacity through the services of the deployed Biologist is vital. Utilize the Biologist for assessing carrying capacity and monitoring endangered species, including tigers.
- h. Tiger Reserve managers must actively pursue and apprehend all offenders, ensuring their punishment through successful prosecution. Provide specialized training to investigative staff for detection, evidence collection, and forensic reports. Establish mechanisms for regular court case monitoring, and engage special counsels in significant cases for effective deterrence through rigorous punishment. Periodic special drives should be carried out for ensuring zero pendency of Schedule I wildlife offence cases.
- i. Issues pertaining to human wildlife conflict in the landscape should be addressed with utmost priority. State of the art preventive and control measures should be prioritized. Maintaining monthly charts of human wildlife conflict score in the GIS domain and syncing with M-STriPES data, syncing monthly calendar of local harvest/phenology/NTFP collection with spatial movement of wild animals, special proficiency of frontline/community stewards in rescuing wild animals in distress are some of the actions those should be envisaged under this.
- j. Tiger Reserve management should embark on eco-development and eco-tourism programs with a mission-oriented approach. Implement Income Generating Activities (IGA) and Self-Help Group (SHG) programs, leveraging funds from the district and other sources, to address livelihood issues and provide viable alternatives should be prioritized. This comprehensive strategy aims to foster sustainable development and community engagement while supporting conservation efforts within the Tiger Reserve.
- k. The invasion of *Ageratina adenophora*, *Ageratum conyzoides*, *Chromolaena odorata*, *Mimosa diplotricha*, is potentially in the initial stage and demands high-priority removal efforts to prevent its establishment in a larger area. Swift and proactive measures are

- l. crucial to curb the spread of this invasive species and protect the ecological integrity.
- l. The corridor connectivity in the north-east hills landscape matrix is confronted with diverse threats, such as the development of multiple linear infrastructures, hydroelectric projects, and the depletion of prey species from forested patches. Addressing these challenges is imperative to secure the long-term survival and well-being of the diverse wildlife populations in this ecologically critical landscape. Proactive measures are essential to mitigate the impact of human activities and maintain the integrity of these vital wildlife corridors.
- m. The North Eastern hill tigers have been prioritized for conservation due to their genetic distinctiveness and diversity. This population is unique in its connectivity to Myanmar, where the tiger population, although almost decimated, represents a different subspecies, *Panthera tigris corbetti*. Preserving the evolutionary distinctiveness of this gene pool requires transboundary connectivity and cooperation, emphasizing the importance of collaborative efforts to safeguard these tigers and their unique genetic heritage.
- n. There is currently no official website for Dampa Tiger Reserve, which hinders the dissemination of knowledge and limits its potential for attracting tourists. Establishing an official website should be a priority for the reserve management to address this issue.
- o. Tiger Reserve management should aim at prioritizing research and involving external organizations in cataloging flora and fauna. Species specific programmes for conserving other Rare, Endangered, Threatened (RET) species and their niche habitats should be adopted.
- p. The co-occurrence agenda of buffer, corridor and beyond (upto a 10 km. radius from the periphery of the core needs to be implemented as a landscape strategy). There are several stakeholders governmental and non-governmental including the local people. The government departments need to be mutually complementary in their action in the interest of biodiversity at large, with a focus on human-wildlife interface.
- q. Endeavour should be made for enhancing transnational cooperation and collaboration with Bangladesh and Myanmar for sharing of information and enhancing protection along the international borders. Collaborative efforts can also include joint patrolling, anti-poaching activities, and habitat management. These would be a better approach for maintaining tiger gene flow instead of fencing along the international borders which may act as deterrent for tiger and other wildlife movements.

## 5. Conclusions

Dampa Tiger Reserve plays a crucial role as a cross-boundary reserve, facilitating tiger and wildlife conservation by connecting to other protected and forested areas. The potential reintroduction of tigers from Kaziranga Tiger Reserve in the North-Eastern Hills and Brahmaputra Landscape is plausible. However, effective protection measures, control of insurgency and recovery of habitat and prey are prerequisites for considering the reintroduction of tigers in Dampa Tiger Reserve.



## SATKOSIA TIGER RESERVE

### 1. Brief Description

Satkosia Tiger Reserve is situated at the bank of the Mahanadi River. It is expanded in the districts of Anugul, Nayagarh, Dhenkanal, Cuttack, and Boudh in Odisha. The tiger reserve consists of two sanctuaries: Satkosia Gorge Wildlife Sanctuary and Baisipalli Wildlife Sanctuary. The combined area of these two sanctuaries is 963.87 km<sup>2</sup>, and they have been officially designated as the Satkosia Tiger Reserve. The reserve consists of a core area spanning 523.61 km<sup>2</sup> and a buffer area covering 440.26 km<sup>2</sup>. Satkosia Tiger Reserve is known for its unique landscape of hills along the gorge. Satkosia is situated in a transitional zone that stretches between the Chhota Nagpur Plateau and the Deccan Plateau. The tiger reserve showcases unique and indigenous species from both biotic provinces. It is also known as a breeding center for endangered freshwater fauna such as magar, ghariyal, and Chitra turtles.

### 2. Tiger Population as per All India Tiger Estimation

The population trend reveals a concerning decline over the years, with only three tigers estimated in 2014, eight in 2010, and six in 2006. In the latest 2022 cycle, despite investing 18886 trap nights, no photographs of tigers were captured, indicating a concerning absence of tiger presence. In 2018 cycle, where only four detections of a single tigress were recorded, rendering density estimation impossible. These figures highlight a notable decrease in tiger numbers and underscore the urgent need for enhanced conservation efforts to reverse this decline and restore tiger populations in the area.



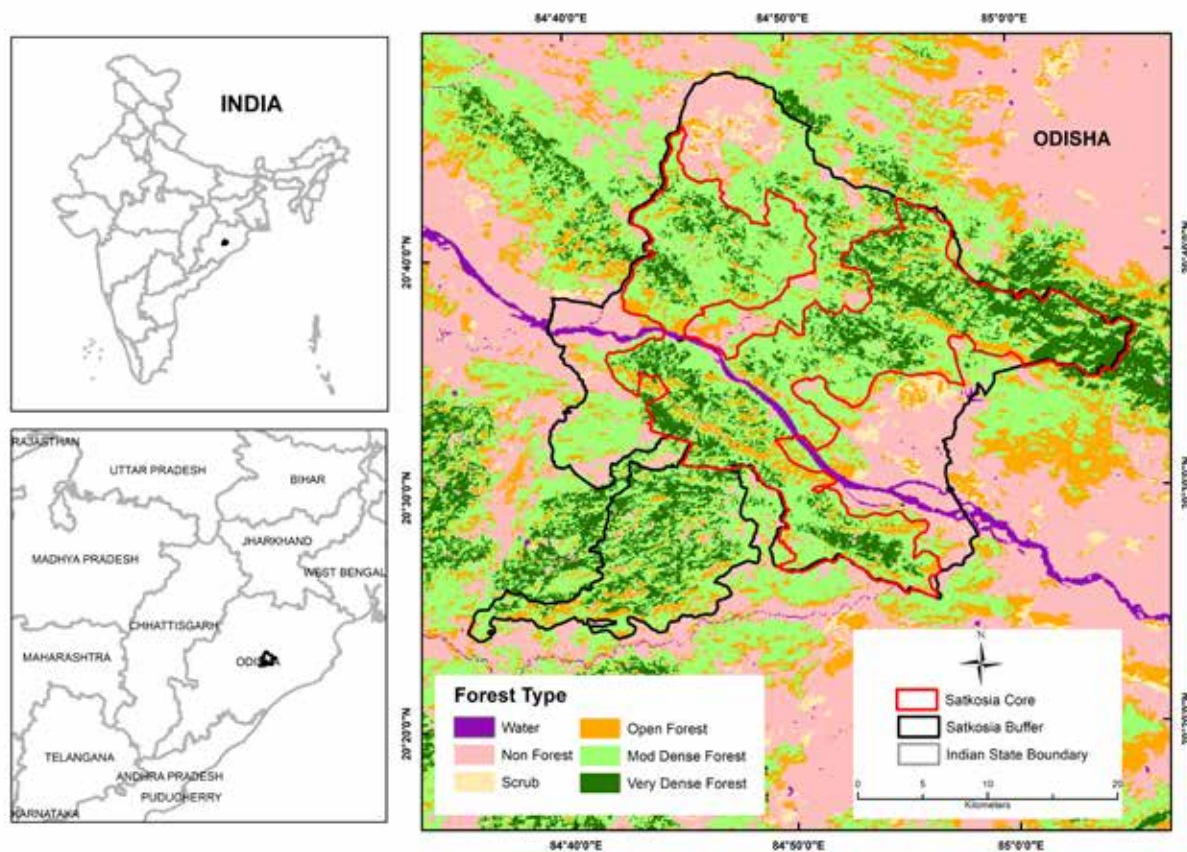


Figure 1: Map showing the location of Satkosia Tiger Reserve in the state of Odisha.

### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<p><b>Gharial Conservation Failure:</b> Inability to protect the gharial population in its only non-Himalayan river system despite the initiation of the Indian Crocodile Project. Only three gharials believed to exist in the sanctuary.</p> <p><b>Poor Protection and Monitoring:</b> Inadequate protection measures, lack of wildlife orientation, and absence of proper monitoring systems.</p> <p><b>Faulty Management Structure:</b> The Field Director oversees only</p>	<ul style="list-style-type: none"> <li>Gharial Conservation Failure: Despite initiatives like the Indian Crocodile Project, the inability to protect the gharial population persists, leading to a drastic reduction in their numbers, with only three believed to exist within the sanctuary.</li> </ul>	<p><b>Reintroduction Efforts:</b> Despite past unsuccessful attempts, continued efforts for tiger reintroduction should be pursued in Satkosia Tiger Reserve. This should be coupled with measures to enhance prey availability and habitat quality to support the reintroduced tiger population.</p> <p><b>Corridor Protection:</b> Given the endangered status of the corridor between Similipal and Satkosia due to mining and infrastructural projects, it is imperative to prioritize</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<p>a part of the reserve, focusing more on territorial divisions and plantations. Neglect of Baissipalli Wildlife Sanctuary by the management.</p> <p><b>Village Pressure:</b> Intense pressure due to the presence of 106 villages within the reserve. Dependence on the reserve for fuel, timber, fodder, and fishing contributes to increased human-wildlife conflict.</p> <p><b>Uncontrolled Tourism Impact:</b> Tourism activities aren't harmonized with the wilderness. Unregulated tourist traffic, especially during peak times like New Year and holidays, causes significant disturbance due to the movement of numerous vehicles, impacting the reserve adversely.</p>	<ul style="list-style-type: none"> <li><b>Human Settlements Impact:</b> The presence of numerous human habitations within the reserve's core, buffer, and surrounding zones has consistently posed a threat to effective reserve management. This has intensified over the years, causing ongoing challenges.</li> <li><b>Inadequate Protection and Monitoring:</b> Insufficient protection measures, a lack of wildlife orientation, and the absence of proper monitoring systems have persisted, leaving the reserve vulnerable to threats like poaching and habitat degradation.</li> <li><b>Village Presence Encroachment:</b> The encroachment of villages into the core area of the reserve has remained a persistent issue, undermining effective reserve management and encouraging poaching, especially by traditional hunters.</li> <li><b>Staff Shortages and Training Needs:</b> Continuous shortages of Range Officers and frontline staff (Forest Guards), along with a lack of adequate training, have persisted, impacting the effectiveness of wildlife protection and reserve management.</li> </ul>	<p>corridor protection. Implement stringent measures to mitigate the impact of these activities on wildlife movement and ensure habitat connectivity between the two reserves.</p> <p><b>Anti-Poaching Measures:</b> Deploy armed special tiger protection forces within Similipal and Satkosia Tiger Reserves to combat poaching effectively. Strengthen patrolling efforts and enhance surveillance to safeguard tigers and their prey from illegal activities.</p> <p><b>Invasive Species Management:</b> Develop and implement strategies to control the spread of invasive plant species like Ageratina adenophora, Chromolaena odorata, and Mimosa diplotricha within Satkosia Tiger Reserve. Targeted removal efforts and habitat restoration should be prioritized to prevent their encroachment and preserve native biodiversity.</p> <p><b>Research and Monitoring:</b> Conduct comprehensive research and monitoring programs to assess the status of tiger populations, prey abundance, and habitat quality in Satkosia Tiger Reserve. This information will inform evidence-based management decisions and facilitate adaptive conservation strategies.</p> <p><b>Community Engagement:</b> Engage local communities living in and around the reserve through awareness programs</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010		<ul style="list-style-type: none"> <li>• <b>Poaching Challenges:</b> Despite efforts to control poaching, the practice continues due to the high density of human settlements, leading to ongoing threats to wildlife within the reserve.</li> <li>• <b>Degradation Due to Fires and Grazing:</b> Frequent fires for collection purposes and grazing by a high population of cattle have continuously degraded the reserve's habitat, affecting natural regeneration and fostering invasive species.</li> <li>• <b>Community Opposition and Conflict:</b> Disputes arising from the closure of roads and conflicts over village relocations have continued, generating community opposition that poses challenges to the reserve's conservation efforts.</li> <li>• <b>Insufficient Research and Monitoring:</b> Weak research activities and inadequate monitoring systems have persisted, leading to unsuccessful conservation initiatives, such as the unsuccessful release of gharials into the river.</li> <li>• <b>Funding and Resource Challenges:</b> Uncertain and delayed funding, along with inadequate district agency support, has been an ongoing obstacle, affecting the planned deployment of resources and hindering conservation activities.</li> </ul>	<p>and collaborative conservation initiatives. Foster stewardship among residents and promote sustainable livelihood options to reduce dependency on activities that pose threats to wildlife and their habitats.</p> <p><b>Infrastructure Development:</b> Invest in appropriate infrastructure within Satkosia Tiger Reserve to support protection and management efforts. This includes establishing visitor facilities, interpretation centers, and directional signage to enhance visitor experiences while ensuring minimal disturbance to wildlife.</p> <p><b>Policy Advocacy:</b> Advocate for policy measures that prioritize wildlife conservation and habitat protection in the region. Collaborate with government agencies, non-profit organizations, and local stakeholders to influence decision-making processes and secure long-term conservation commitments for Satkosia Tiger Reserve.</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<p><b>Staff Shortages and Camps:</b> Severe shortage of Range Officers in both Satkosia and Mahanadi Wildlife Divisions affecting effective reserve management. Inadequate number of anti-poaching camps hampers protection efforts.</p> <p><b>Village Presence in Core Area:</b> Presence of villages (Raiguda in Satkosia, Marada, Kuturi, Salapaganda, Musuguda in Mahanadi) within the core area undermines effective management, encourages poaching, especially by traditional hunters.</p> <p><b>Frontline Staff Aptitude:</b> Lack of adequate wildlife conservation orientation among frontline staff (Forest Guards) affects their effectiveness in wildlife protection and management.</p> <p><b>Poaching Control and Conflict Mitigation:</b> Ineffective control of wildlife poaching for local consumption by some tribal communities, compounded by inadequate rescue and conflict mitigation capabilities, including a lack of veterinary services.</p> <p><b>Health Challenges and Allowance Issues:</b> Frequent staff incapacitation due to malaria infestation. Non-payment of 'Project Allowance' to the Director adds unnecessary strain to effective reserve management.</p>		
2018	<p><b>Human Habitations Impact:</b> Presence of numerous human habitations within and around the reserve (four in the core, 116 in the buffer, and 234 in the surrounding impact zone) posed a significant</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p>threat, impeding effective management.</p> <p><b>Proximity to Industrial Township:</b> The reserve's proximity to Angul, a major industrial township, attracted laborers, leading to increased human intervention and disturbances.</p> <p><b>Continued Poaching Challenges:</b> Despite protection measures, hunting and poaching persisted due to the large number of settlements, posing an ongoing management challenge.</p> <p><b>Degradation Due to Roads and Fires:</b> Several roads in the core and buffer, frequent fires by trespassers, and a high presence of cattle caused severe regressive impacts on the reserve's ecosystem.</p> <p><b>Health and Manpower Issues:</b> Malaria, insufficient staff, lack of motivation among frontline workers, and a shortage of trained personnel were major challenges affecting effective park management.</p> <p><b>Community Opposition:</b> Closure of roads in the core zone led to community opposition, especially in Marada village, exacerbated by negative media coverage, posing challenges to conservation efforts.</p> <p><b>Poor Research and Monitoring:</b> Weak research activities and inadequate monitoring resulted in the unsuccessful release of 800 gharials into the river.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p><b>Conflict Over Relocation:</b> Providing good facilities to one relocated village, Raigoda, led to hostility from the Sarauli village outside the reserve, demanding similar benefits and harassing relocated households. Resolving this conflict was crucial for the success of the relocation program.</p>		
2022	<p><b>Human Habitations Impact:</b> Numerous human settlements in and around the reserve (four in the core, 131 in the buffer, 234 in the surrounding zone) pose a severe threat to effective reserve management.</p> <p><b>Continued Poaching Threat:</b> Despite escalated protection measures, subsistence hunting and poaching persist due to the high density of human settlements, challenging the reserve's management.</p> <p><b>Degradation from Fires and Grazing:</b> Frequent fires for mahua flower collection, increasing kendu yield, and a high cattle (including goat) population impact the habitat severely, fostering invasive species and hindering natural regeneration.</p> <p><b>Staff Shortages and Lack of Training:</b> Inadequate staff (65% Forest Guard, 33% Range Forest Officer vacancies), insufficiently trained manpower, and a lack of trained frontline cadre are major challenges faced by the park.</p> <p><b>Research and Training Insufficiency:</b> In-house research deficiencies, inadequate training, especially for new frontline staff, and insufficient collaboration</p>		



MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<p>with local universities hinder progress.</p> <p><b>Missing Advisory Committee and CSR Support:</b> Absence of a Local Advisory Committee and insufficient corporate social responsibility (CSR) funding from local industries limit support.</p> <p><b>Corridor Management Gap:</b> Lack of a management plan for monitoring and enhancing protection in identified corridor areas hinders conservation efforts.</p> <p><b>Pending Special Protection Force:</b> Delay in establishing the Special Tiger Protection Force limits enhanced protection measures.</p> <p><b>High Dependence on Hired Vehicles:</b> Excessive reliance on hired vehicles affects patrolling in remote and mountainous terrains, impacting surveillance.</p> <p><b>Funding and Resource Delays:</b> Uncertain and delayed funding affects planned anti-poaching camp deployment, compounded by inadequate district agency funding.</p>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- Considering past unsuccessful attempts, it may be worth continuing efforts for tiger reintroduction in Satkosia Tiger Reserve. Accompanying this initiative with measures to enhance prey availability and improve habitat quality could better support the reintroduced tiger population.

- Given the endangered status of the corridor between Similipal and Satkosia due to mining and infrastructural projects, it might be advisable to prioritize corridor protection. Implementing stringent measures to mitigate the impact of these activities on wildlife movement and ensuring habitat connectivity between the two reserves could be crucial.
- Deploying armed special tiger protection forces within Similipal and Satkosia Tiger Reserves could enhance efforts to combat poaching effectively. Strengthening patrolling efforts and improving surveillance to safeguard tigers and their prey from illegal activities may be considered.
- Developing and implementing strategies to control the spread of invasive plant species like *Ageratina adenophora*, *Chromolaena odorata*, and *Mimosa diplotricha* within Satkosia Tiger Reserve could be beneficial. Prioritizing targeted removal efforts and habitat restoration to prevent their encroachment and preserve native biodiversity may help mitigate their impact.
- Conducting comprehensive research and monitoring programs to assess the status of tiger populations, prey abundance, and habitat quality in Satkosia Tiger Reserve could provide valuable insights. Utilizing this information to inform evidence-based management decisions and facilitate adaptive conservation strategies may be advisable.
- Engaging local communities residing in and around the reserve through awareness programs and collaborative conservation initiatives could foster stewardship among residents. Promoting sustainable livelihood options to reduce dependency on activities that pose threats to wildlife and their habitats might contribute to conservation efforts.
- Investing in appropriate infrastructure within Satkosia Tiger Reserve to support protection and management efforts could enhance conservation outcomes. Establishing visitor facilities, interpretation centers, and directional signage to improve visitor experiences while ensuring minimal disturbance to wildlife could be considered.
- Advocating for policy measures that prioritize wildlife conservation and habitat protection in the region could be important. Collaborating with government agencies, non-profit organizations, and local stakeholders to influence decision-making processes and secure long-term conservation commitments for Satkosia Tiger Reserve may help advance conservation goals.

#### 5. Conclusions

In conclusion, Satkosia Tiger Reserve faces multifaceted challenges ranging from habitat degradation and human-wildlife conflicts to poaching and inadequate management infrastructure. The decline in tiger population numbers over the years underscores the urgency for comprehensive conservation efforts. Despite these challenges, there are opportunities for recovery through enhanced protection measures, community engagement, and habitat restoration initiatives. It is imperative to prioritize capacity building, collaborative partnerships, and adaptive management strategies to safeguard the reserve's biodiversity and restore its ecological integrity. By addressing these issues holistically and fostering sustainable development practices, Satkosia Tiger Reserve can emerge as a beacon of conservation success, ensuring the long-term survival of its iconic tiger population and the rich biodiversity it harbors.

# SIMILIPAL TIGER RESERVE

## 1. Brief Description

Similipal Tiger Reserve (STR), established in 1973, spans 2750 km<sup>2</sup> in Odisha's Mayurbhanj District, with a core area of 1195 km<sup>2</sup>. Known for its biodiversity, it hosts rare pseudo-melanistic tigers and a rich array of flora and fauna, including 1352 plant species, 101 orchid species, 62 reptile species, 361 bird species, and 55 mammal species. Village rehabilitation efforts have created vast meadows attracting diverse wildlife. Equipped anti-poaching camps and Special Tiger Protection Force (STPF) deployments enhance protection. Organized eco-tourism generates revenue and benefits locals. Infrastructure and research initiatives are promising, funded by the state and CAMPA. Unified control under the Field Director facilitates monitoring. Staff shortages among frontline personnel pose challenges, necessitating the extensive use of casual labor. Establishing a Local Advisory Committee is crucial for coordinating developmental schemes. Invasive alien species around villages signal habitat concerns. Developing a staff deployment plan is essential for effective management. Regular assessments of ecological, economic, and socio-cultural values are necessary for resource mobilization and community engagement.

## 2. Tiger Population as per All India Tiger Estimation

In 2006, the tiger population was estimated at 20 individuals, with a standard error range of 17 to 23. Moving forward to 2010, there was an increase in tiger abundance, with an estimated population of 23 tigers, though with a wider standard error range indicating some uncertainty. Subsequently, in 2014, the tiger population slightly decreased, with an estimated count of 17 individuals, within a standard error range of 14 to 19. Transitioning to the 2018 cycle, with 248 tiger images captured and eight adult tigers identified, resulting in an estimated tiger density of 1.02 tigers per 100 square kilometers. Finally, in the 2022 cycle, although the effort increased significantly to 20,655 trap nights, the number of unique tigers identified were 16, indicating a potential decline in the tiger population density to 0.91 tigers per 100 square kilometers.

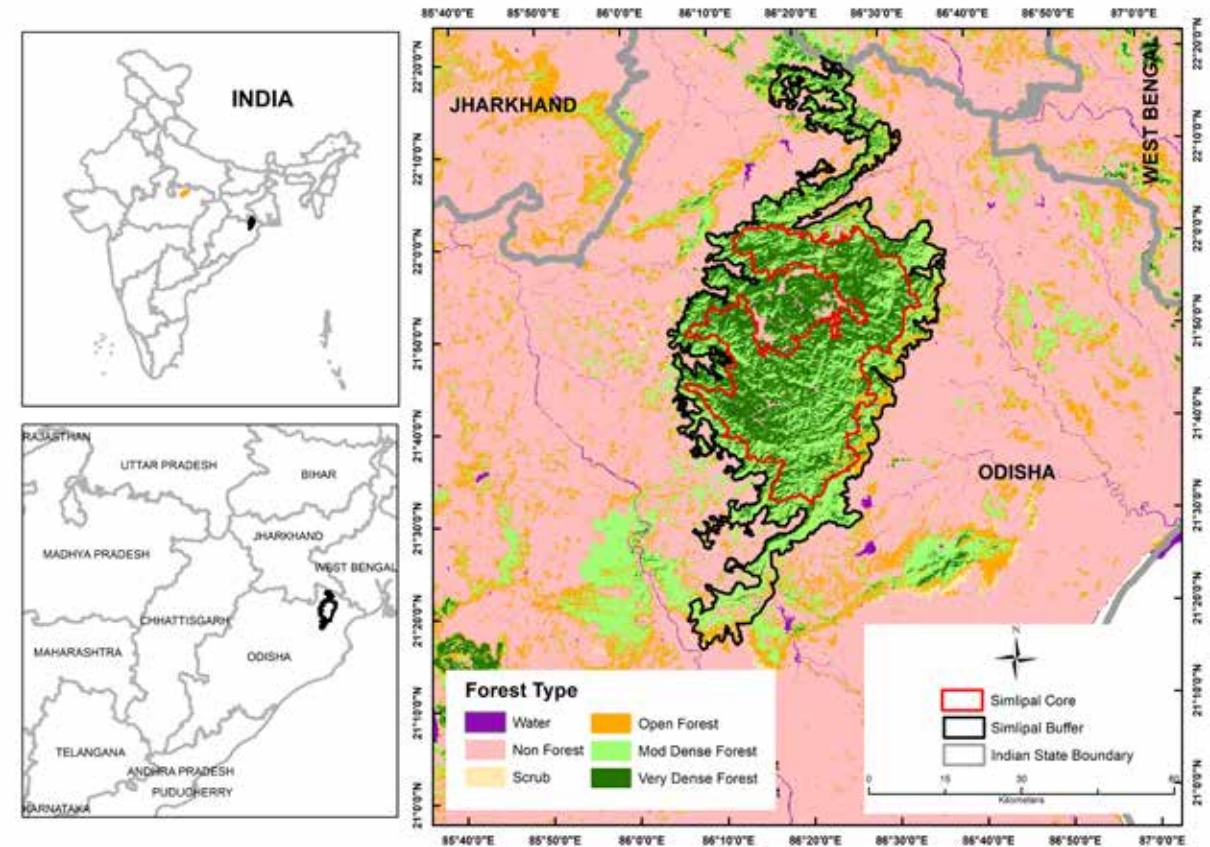


Figure 1: Map showing the location of Similipal Tiger Reserve in the state of Odisha.

## 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<p><b>Incomplete Legal Procedures:</b> Discrepancies in the area declaration remain unresolved due to pending village relocations from the proposed NP since 1994.</p> <p><b>Management Plan Status:</b> While the management plan is updated, execution in certain areas like human habitation within the core is incomplete.</p> <p><b>Human Pressure Issues:</b> Presence of villages within the core area, limited relocation efforts since 1994, and livestock grazing in the core affect conservation efforts.</p>	<p><b>Vacancies Among Frontline Staff:</b> Continual high vacancies in critical positions like RFOs, Dy ROs, Foresters, and Forest Guards, leading to reliance on casual laborers, posing potential future management issues.</p> <p><b>Training Gaps in Protection Forces:</b> Lack of specialized training in arms usage for the BTPF and underutilization of sanctioned STPF positions, impacting the reserve's protection capabilities.</p>	<p><b>Enhanced Anti-Poaching Measures:</b> Given the organized poaching threats and recent incidents, immediate deployment of an armed special tiger protection force is crucial to safeguard the tiger population. Strengthen patrolling efforts and enhance surveillance to effectively combat poaching activities.</p> <p><b>Corridor Restoration:</b> The restoration of critical corridors like the Similipal-Satkosia Corridor is essential for maintaining connectivity</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<p><b>Staffing Challenges:</b> High vacancies in core positions (Forest Guards, Foresters, and Forest Rangers) affect operational efficiency.</p> <p><b>Field Staff Training:</b> Lack of formal training programs for field staff in wildlife management, ecological awareness, and public relations.</p> <p><b>Infrastructure and Equipment:</b> Limited welfare measures for staff, insufficient field equipment, and aged staff due to long-term vacancies.</p> <p><b>Ecodevelopment Progress:</b> Ongoing efforts in eco-development activities but gradual implementation and scope for improvement in various areas.</p> <p><b>Tourism and Facilities:</b> Adequate tourism facilities with room for enhancements in certain areas to improve wildlife viewing and awareness.</p> <p><b>Trust and Local Engagement:</b> Good relationship and trust with eco-development committee members and local NGOs.</p> <p><b>Patrolling and Wildlife Management:</b> Regular patrolling in sensitive zones but issues with daily monitoring, network strategy, and inadequate field data collection.</p>	<p><b>Absence of Local Advisory Committee (LAC):</b> The non-existence of an LAC hampers tourism strategy review, advice on local issues, and convergence of developmental schemes for buffer villages.</p> <p><b>Threats from Surrounding Villages:</b> Challenges persist from buffer and core area villages, contributing to illicit activities, invasive species spread, poaching, forest fires, and trade, directly impacting reserve conservation efforts.</p> <p><b>Underutilization of MSTRIPES:</b> Incomplete observations during patrolling limit the effectiveness of MSTRIPES in aiding crucial management decisions.</p> <p><b>Lack of Structured Staff Development Plan:</b> Absence of a well-structured staff development plan leads to unplanned training, hindering skill enhancement and professional growth.</p> <p><b>Control Over Potential Corridors:</b> The fragmented control over identified potential corridors (Hadgarh and Kuldiha sanctuaries) hinders coordinated conservation strategies and efforts.</p>	<p>between tiger habitats. Implement restoration efforts to mitigate fragmentation issues and ensure unhindered wildlife movement.</p> <p><b>Genetic Diversity Conservation:</b> Recognize the importance of Similipal's unique tiger lineage and prioritize conservation efforts to maintain genetic diversity. Restore historical connectivity with source populations like Bandhavgarh to facilitate genetic exchange and population sustainability.</p> <p><b>Community Engagement:</b> Engage local communities in conservation initiatives through awareness programs and participatory approaches. Foster stewardship among residents to reduce human-wildlife conflicts and promote sustainable livelihood options.</p> <p><b>Invasive Species Management:</b> Develop and implement strategies to control the spread of invasive plant species like <i>Ageratum conyzoides</i>, <i>Chromolaena odorata</i>, and <i>Mimosa diplotricha</i> within the reserve. Prioritize targeted removal efforts and habitat restoration to preserve native biodiversity.</p> <p><b>Research and Monitoring:</b> Conduct comprehensive research and monitoring programs to assess the status of tiger populations, prey abundance, and habitat</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006			<p>quality in Similipal Tiger Reserve. Utilize scientific findings to inform evidence-based management decisions and adaptive conservation strategies.</p> <p><b>Infrastructure Development:</b> Invest in appropriate infrastructure within the reserve to support protection and management efforts. Establish visitor facilities, interpretation centers, and directional signage to enhance visitor experiences while minimizing disturbance to wildlife.</p> <p><b>Policy Advocacy:</b> Advocate for policy measures that prioritize wildlife conservation and habitat protection in the region. Collaborate with government agencies, non-profit organizations, and local stakeholders to influence decision-making processes and secure long-term conservation commitments for Similipal Tiger Reserve.</p>
2010	<p><b>Fragmented control structure:</b> The Field Director had limited jurisdiction, overseeing only a part of the core critical tiger habitat, while other areas were managed by different authorities, complicating cohesive management strategies.</p> <p><b>Traditional mass hunting and emerging commercial poaching:</b> The reserve faced threats from traditional mass hunting practices and the new challenge of commercial poaching targeting tuskers and prey species for bush meat.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<p><b>Persistent staff shortages:</b> Despite an increase in staff and casual workers post a previous naxal attack, there remained a considerable shortage, raising concerns about the commitment levels of casual workers and affecting operational efficiency.</p> <p><b>Funding delays:</b> The reserve experienced delays in fund disbursement, impacting essential operations and hindering conservation activities.</p> <p><b>Lack of state commitment:</b> The state failed to establish an enabling mechanism for effective protection, showing inadequate commitment to conservation efforts.</p> <p><b>Poor community relations:</b> Troubled relationships with local communities complicated collaborative conservation efforts, impeding successful conservation strategies in Similipal Tiger Reserve in 2010.</p>		
2014	<p><b>Inadequate Patrolling:</b> Lack of planned, supervised, or supported patrolling by top management. Staff Shortage: Only three out of seven core ranges have Range Officers (ROs) posted, leading to a 6-7 month absence of ROs in the remaining ranges. Malaria infestation discourages staff from serving in the reserve.</p> <p><b>Poaching Challenges:</b> Continuing issue of poaching evidenced by camera traps, animal congregations near salt-licks, and sightings of locals with hunting tools inside the reserve.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<p><b>Insufficient Anti-Poaching Camps:</b> 94 functional anti-poaching camps (63 core + 31 buffer) aren't adequate to effectively control poaching by local tribal communities.</p> <p><b>Villages in Core Area:</b> Presence of three villages within the core area incentivizes traditional hunting by villagers, impacting wildlife conservation efforts.</p> <p><b>Frontline Staff Aptitude:</b> Need for improved wildlife conservation orientation among frontline Forest Guards (FGs).</p> <p><b>Rescue and Conflict Mitigation:</b> Inadequate infrastructure and veterinary services for wildlife rescue and conflict mitigation.</p> <p><b>Malaria Impact:</b> Frequent staff absence due to malaria infestation affects operational effectiveness.</p>		
2018	<p><b>Anti-poaching camp construction issues:</b> Lack of smokeless chulhas and basic amenities causing hazards for protection watchers residing in the camps.</p> <p><b>Insufficient resources in buffer camps:</b> Lack of solar lights, cots, and essential equipment. No ration allowances for daily wage Protection Assistants.</p> <p><b>Challenges with Special Tiger Protection Force (STPF):</b> Lack of training in weapon usage, no arms provided, insufficient food allowance, and deployment requires better planning.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p><b>Staffing gaps in STPF:</b> Numerous vacant positions impacting effective protection. Recruitment notifications for vacant positions are pending.</p> <p><b>Inadequate patrolling:</b> Limited patrolling duration with minimal staff, affecting surveillance and protection efforts.</p> <p><b>Lack of wildlife training:</b> Frontline staff inadequately trained in wildlife management.</p> <p><b>Absence of systematic vegetation diversity studies:</b> No comprehensive study on Similipal's diverse vegetation despite its unique forest composition. Forest patches dying due to frost, unwanted regeneration in certain areas.</p> <p><b>Malaria outbreaks:</b> Health challenges causing staff absenteeism and impacting operations.</p> <p><b>Human settlements posing threats:</b> Presence of multiple villages in buffer and core areas (64 villages in the buffer and one village Bakua) contributing to illicit activities like poaching, forest fires, and illegal trade, NTFP collection affecting reserve conservation efforts.</p>		
2022	<p><b>Vacancies Among Frontline Staff:</b> Numerous vacancies in key positions like RFOs, Dy ROs, Foresters, and Forest Guards force reliance on casual laborers, potentially causing future management issues.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<p><b>Training Gaps in BTPF and STPF:</b> Lack of specialized training in arms usage for the BTPF and underutilization of STPF posts, with only a fraction of the sanctioned positions working, impacting reserve protection.</p> <p><b>Non-Constituted Local Advisory Committee (LAC):</b> Absence of an LAC prevents strategic review of tourism, advice on local issues, and hampers the convergence of developmental schemes for buffer villages.</p> <p><b>Threats from Surrounding Villages:</b> The 64 buffer villages and one core village pose threats like illicit activities, invasive species spread, poaching, forest fires, and trade impacting the reserve.</p> <p><b>Underutilization of MSTRIPES:</b> Although extensively used, incomplete observations during patrolling limit MSTRIPES' effectiveness in aiding management decisions.</p> <p><b>Lack of Staff Development Plan:</b> Absence of a structured staff development plan leads to unplanned training in specialized areas, impacting skill enhancement.</p> <p><b>Control Over Potential Corridors:</b> The lack of unified control by the Field Director over Hadgarh and Kuldiha sanctuaries, identified as potential corridors, affects coordinated conservation efforts.</p>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- a. Consider enhancing anti-poaching measures by increasing the deployment of trained personnel in key areas. Regular patrols and surveillance could deter poaching effectively, and utilizing technology such as camera traps and drones might enhance monitoring and detection of illegal activities.
- b. It may be beneficial to develop and implement community-based conservation programs to involve local communities in protecting the reserve. Conducting awareness campaigns to educate villagers about the importance of wildlife conservation and the negative impacts of poaching could foster greater local support.
- c. Introducing alternative livelihood options for communities living near the reserve could help reduce their dependency on forest resources. Providing training and support for sustainable agricultural practices, eco-tourism ventures, and handicraft production might offer viable alternatives.
- d. Addressing staffing shortages could involve recruiting qualified personnel for vacant positions and providing regular training and skill development programs. Establishing clear job roles and responsibilities could ensure efficient management and operation of the reserve.
- e. Implementing habitat restoration projects to enhance the quality of natural habitats within the reserve might be beneficial. Controlling the spread of invasive species through targeted eradication efforts and the promotion of native flora could contribute to habitat improvement.
- f. Upgrading existing infrastructure such as anti-poaching camps, visitor centers, and research facilities could enhance the overall experience for staff and visitors. Improving road networks and signage within the reserve could facilitate better access and navigation.
- g. Fostering partnerships with government agencies, non-governmental organizations, and research institutions could leverage resources and expertise for conservation initiatives. Establishing joint monitoring and research programs might provide valuable data on wildlife populations and habitat health.
- h. Implementing a robust monitoring and evaluation system to assess the effectiveness of conservation measures could inform adaptive management strategies. Using monitoring data to identify emerging threats and adapt management strategies accordingly might enhance conservation outcomes.
- i. Forming a Local Advisory Committee comprising representatives from local communities, government agencies, and conservation organizations could provide guidance and support for management decisions. The committee could also facilitate communication between stakeholders.
- j. Enforcing strict penalties for poaching and illegal activities within the reserve might

deter offenders. Advocating for stronger legal protection measures and policies to safeguard wildlife and their habitats could be beneficial.

- k. Investing in scientific research to improve understanding of the reserve's ecosystems, species dynamics, and conservation challenges could yield valuable insights. Encouraging innovation in conservation techniques and technologies might enhance the effectiveness of management efforts.
- l. Developing a comprehensive management plan with clear objectives, targets, and timelines for achieving conservation goals could provide a structured framework for management activities. Considering the long-term ecological, social, and economic impacts of management practices might ensure their sustainability.

#### 5. Conclusions

In conclusion, Similipal Tiger Reserve stands as a crucial stronghold for biodiversity conservation in Odisha, India. Despite facing challenges such as poaching, habitat degradation, and community conflicts, concerted efforts have been made to protect its rich flora and fauna. With the implementation of effective anti-poaching strategies, community engagement initiatives, habitat restoration programs, and collaborative conservation efforts, there is hope for the continued survival and thriving of the reserve's unique wildlife populations. Moving forward, sustained commitment from all stakeholders, coupled with innovative management approaches and adaptive strategies, will be essential in securing the long-term viability of Similipal Tiger Reserve and ensuring its significance for generations to come.





# MUKUNDARA HILLS TIGER RESERVE

## 1. Brief Description

Mukundara Hills Tiger Reserve, established in 2013, encompasses Mukundara National Park, Darrah Sanctuary, Jawahar Sagar Wildlife Sanctuary, and part of Chambal Gharial Sanctuary. Spread across four districts of Rajasthan, namely Kota, Bundi, Chittorgarh, and Jhalawar, the reserve covers a total area of 759.99 square kilometers, with a core area of 417.17 square kilometers and a buffer area of 342.82 square kilometers. Its flora is diverse, featuring species like *Anogeissus pendula*, *Boswellia senate*, *Acacia catechu*, and various others. The reserve boasts a rich fauna, including mammals like Chital, Sambar, Neelgai, Hyena, Leopard, and Tiger, as well as a variety of bird species and reptiles. Additionally, numerous fish species inhabit the rivers and water bodies within the park.

## 2. Tiger Population as per All India Tiger Estimation

In the 2022 camera trapping cycle, the forest department conducted trapping with 8451 trap-nights, resulting in 43 tiger images, with one female tiger identified. In contrast, the 2018 cycle deployed 236 camera traps over 8316 trap nights, capturing 23 images of a single male tiger. Spatially explicit density estimation was not conducted for Mukundara Tiger Reserve, given the known absolute abundance of reintroduced tiger populations. Following the survey, the tiger population increased by one female and two males, bringing the current adult tiger count to four.

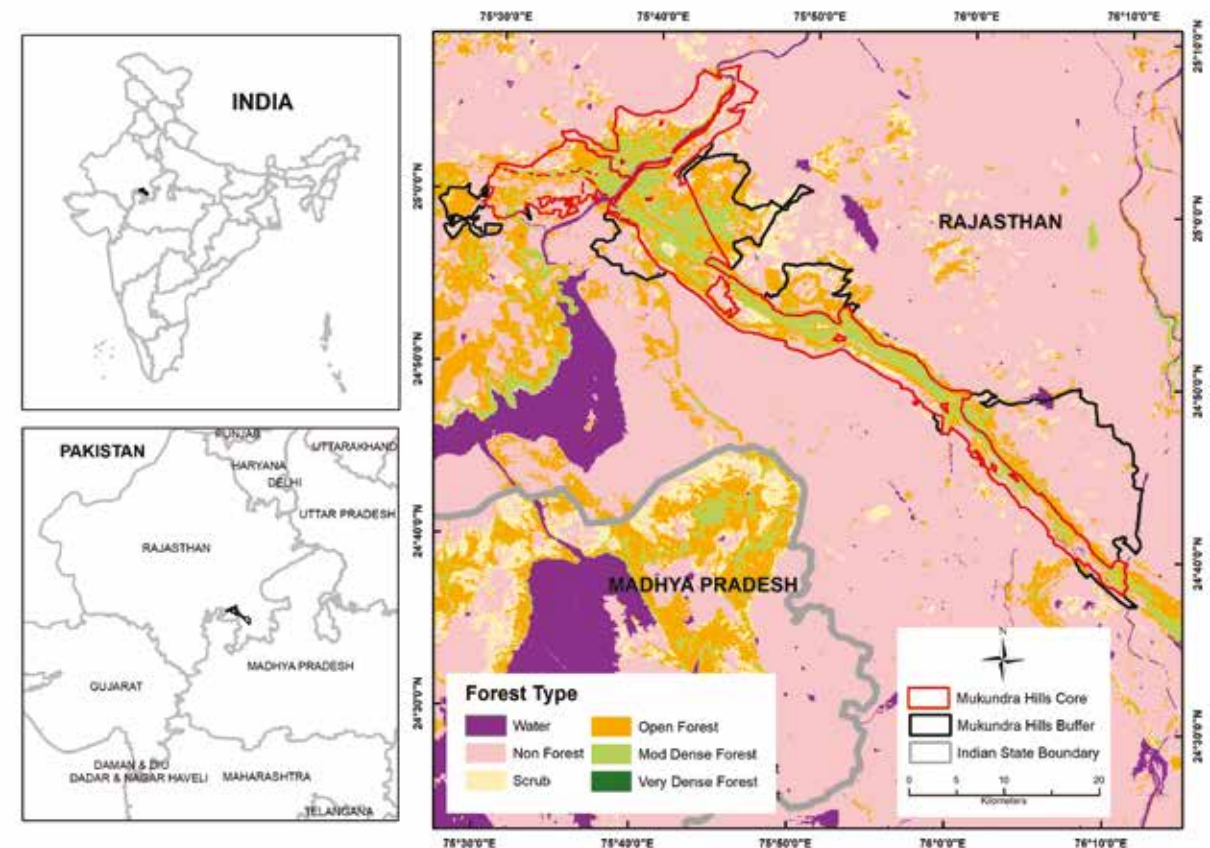


Figure 1: Map showing the location of Mukundara Hills Tiger Reserve in the state of Rajasthan.

### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<p><b>Limited Training in Wildlife Management:</b> While staff members have exposure to participatory management methods through the ecodevelopment program, there is a notable absence of formal training in wildlife management. This gap in expertise could hinder effective conservation strategies and wildlife protection measures.</p> <p><b>Insufficient Research and Monitoring:</b> The absence of a structured research and monitoring program within MHTR hampers the comprehensive understanding of biodiversity values and socio-economic issues. While some information is available through Kota University's involvement, there is a need for a systematic investigation to guide conservation efforts effectively.</p> <p><b>Human Settlements and Habitat Damage:</b> The presence of 16 villages within MHTR, primarily inhabited by cattle herders and farmers with small landholdings, poses a significant challenge. Their occupation in prime valleys causes substantial damage to the habitat, impacting the reserve's ecosystem.</p> <p><b>Human-Wildlife Conflicts:</b> The heavy movement of humans and livestock inside MHTR leads to frequent human-wildlife conflicts. Such conflicts often result in challenges for both human safety and wildlife conservation efforts within the reserve.</p>	<p><b>Limited Wildlife Management Training:</b> Insufficient formal training for staff in wildlife management persists, hindering effective conservation strategies.</p> <p><b>Inadequate Research and Monitoring:</b> Lack of structured research programs continues, impacting biodiversity understanding and effective conservation guidance.</p> <p><b>Human Settlement Challenges:</b> Continuous presence of human settlements within the reserve causes ongoing habitat damage and human-wildlife conflicts. Infrastructure Threats: Highways and railways passing through the reserve remain without adequate wildlife mitigation measures, posing continuous threats.</p> <p><b>Invasive Species Infestation:</b> The spread of invasive plants like Prosopis and Lantana persists, impacting herbivore habitats consistently.</p> <p><b>Staff Shortage and Training:</b> Vacant frontline staff positions and inadequate training remain a persistent issue.</p> <p><b>Community Engagement and Dependency:</b> Limited participation of local communities in decision-making and a reversal in reducing dependency on forests for fuelwood continues.</p>	<p><b>Continued Reintroduction Efforts:</b> Continue efforts to reintroduce locally extinct mammals within their historic ranges. Given the successes observed in other reserves, consider potential reintroduction programs for species like gaur and barasingha in Mukundra Hills Tiger Reserve.</p> <p><b>Management of Human Disturbance:</b> Address substantial human disturbance in the dry deciduous forests of Mukundra Hills Tiger Reserve to prevent further degradation of prime tiger habitats. Implement measures to mitigate human-wildlife conflicts and ensure the protection of tiger populations.</p> <p><b>Metapopulation Management:</b> Adopt a metapopulation management approach for tiger conservation in Mukundra Hills Tiger Reserve. Collaborate with nearby tiger reserves like Ranthambhore, Ramgarh, and Mukundara to periodically exchange individuals, maintaining genetic diversity, and promoting a healthy tiger population.</p> <p><b>Invasive Species Management:</b> Develop and implement strategies to manage invasive species like Lantana camara within the reserve.</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<p><b>Infrastructural Challenges and Wildlife Accidents:</b> The passage of National Highway-12 (NH-12) and the Delhi-Mumbai railway line through MHTR poses a threat to wildlife. Incidents involving wild animals and vehicles or railway lines, such as the reported tiger death in 2013, highlight the need for measures to reduce wildlife accidents and ensure animal safety.</p>	<p><b>Human-Wildlife Conflict:</b> Frequent conflicts between humans and wildlife remain due to heavy movement within the reserve.</p> <p><b>Research and Monitoring Gaps:</b> Ongoing lack of comprehensive monitoring and research activities beyond basic biodiversity documentation. Funding Challenges: Delayed fund releases, shortage in conservation funds, and minimal engagement with partners persist as challenges for the reserve's management.</p>	<p>Prioritize removal efforts in priority management areas and conduct regional management experiments to upscale control mechanisms, considering the adaptability of invasive species to changing ecological settings.</p> <p><b>Enhanced Research and Monitoring:</b> Invest in research and monitoring programs to assess the status of reintroduced mammal populations, track tiger population dynamics, and evaluate the effectiveness of management interventions. Utilize scientific findings to inform evidence-based decision-making and adaptive management strategies.</p> <p><b>Stakeholder Engagement:</b> Engage local communities, government agencies, non-profit organizations, and other stakeholders in conservation initiatives. Foster collaboration and participation to ensure the sustainable management of Mukundra Hills Tiger Reserve and the surrounding landscape.</p>
2018	<p><b>Biotic Pressure:</b> The reserve faces significant pressure from villages within and around it, causing stress on the habitat due to grazing and poor socioeconomic conditions of inhabitants.</p> <p><b>Geographical Challenges:</b> Unusual core shape and buffer areas, combined with excessive mining in connecting corridors, make it hard to ensure long-term viability for tigers.</p>		



MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p><b>Poor Prey Base:</b> Insufficient prey base, with unclear fate of introduced animals and high predation pressure from other species, leading to potential dissipation and elimination of released populations.</p> <p><b>Man-Made Infrastructure:</b> Development infrastructure like railways and highways passing through the reserve pose serious challenges to management. Invasive Species: Infestation of Prosopis and Lantana plants destructively impacts grasslands and habitats for herbivores.</p> <p><b>Poaching Risk:</b> Lack of visible anti-poaching measures could activate local poachers upon tiger reintroduction, potentially supported by organized crime.</p> <p><b>Staff Inexperience:</b> Frontline staff lacks proper training and experience in wildlife management and protection.</p> <p><b>Community Hostility:</b> Hostility from villagers residing in the reserve creates confrontations with management, hindering conservation efforts.</p> <p><b>Premature Tiger Release:</b> Incomplete preparations, inadequate training, and low prey base make the plan to release tigers within 6 months ill-timed and potentially ineffective.</p> <p><b>Construction Challenges:</b> Construction of masonry walls to protect the reserve from biotic pressures needs to be carefully executed to avoid cutting off crucial corridors.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p><b>Relocation Issues:</b> Villages relocated to forest lands face legal and administrative issues, impacting their eligibility for support and impeding the relocation process.</p> <p><b>Dependence Reduction Impact:</b> The effectiveness of interventions to reduce villagers' reliance on forests, like the current number of LPG connections, needs assessment and evaluation.</p>		
2022	<p><b>Linear Reserve Shape:</b> Vulnerable to human pressures from surrounding villages, potentially leading to increased human-tiger conflicts as the tiger population grows.</p> <p><b>Feral Cattle Population:</b> Growing population of feral cattle within the reserve poses a threat by damaging the reserve's grasslands.</p> <p><b>Pending Conservation Plan Approval:</b> Delay in approval of the Tiger Conservation Plan (TCP) by the National Tiger Conservation Authority (NTCA).</p> <p><b>Invasive Species Infestation:</b> Spread of invasive plants like Prosopis, Lantana, and Ocimum cannum limiting herbivore habitats.</p> <p><b>Unmitigated Infrastructure Threats:</b> Highways and railways passing through the reserve lack wildlife mitigation measures, posing significant threats.</p> <p>Staff Shortage and Aging Workforce: Vacant frontline staff positions and an aging workforce</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<p>lacking formal wildlife management training. Inadequate family accommodations provided.</p> <p><b>LPG Dependency Reversal:</b> Despite past efforts to reduce fuelwood demand with LPG connections, a majority of beneficiaries have reverted to collecting fuelwood from the forest.</p> <p><b>Limited Community Engagement:</b> Environmental Development Committees (EDCs) lack participation in decision-making, minimal public information sharing by reserve management.</p> <p><b>Lack of Compensation Provision:</b> Absence of wildlife-related crop damage compensation in Rajasthan may breed hostility among local communities, escalating human-wildlife conflicts.</p> <p><b>Research and Monitoring Gaps:</b> Few research projects beyond biodiversity documentation, lacking comprehensive monitoring, trend analysis, and future projections.</p> <p><b>Funding Delays and Shortage:</b> Delayed fund releases and unutilized funds, shortage in the Tiger Conservation Fund, minimal engagement with conservation partners and NGOs.</p>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- a. It may be beneficial to consider implementing robust measures to mitigate human-wildlife conflicts, particularly focusing on addressing the heavy movement of humans and livestock within the reserve. Developing and enforcing guidelines aimed at preventing habitat damage caused by human settlements could be explored. Prioritizing education and exploring alternative livelihood options for local communities might help minimize their impact on wildlife habitats.
- b. Exploring collaboration opportunities with relevant authorities to implement wildlife mitigation measures along highways and railways passing through the reserve could be considered. Strategies such as fencing, underpasses, and signage to reduce wildlife accidents and ensure safer passage for animals might be worth considering.
- c. Considering devising and executing effective strategies to manage invasive plant species like Lantana camara and Prosopis could be beneficial. Prioritizing removal efforts in priority management areas and considering conducting regional management experiments to assess the efficacy of different approaches could be explored.
- d. Addressing the persistent issue of staff shortages by expediting recruitment processes and offering formal training programs in wildlife management might enhance operational efficiency and conservation effectiveness. Enhancing operational efficiency and conservation effectiveness through better-trained personnel could be beneficial for reserve management.
- e. Exploring the possibility of adopting a metapopulation management approach for tiger conservation might be considered. Collaborating with nearby reserves to periodically exchange individuals and maintain genetic diversity could promote a healthy tiger population across the landscape.
- f. Strengthening engagement with local communities by promoting their participation in decision-making processes and fostering collaboration to ensure the sustainable management of the reserve and surrounding areas might be advisable. Considering the valuable insights and perspectives of community members could enrich reserve management efforts.
- g. Investing in research and monitoring programs to assess the status of reintroduced mammal populations and track tiger population dynamics might be beneficial. Evaluating the effectiveness of management interventions using scientific findings and utilizing them for evidence-based decision-making could enhance conservation efforts.
- h. Prioritizing the construction of wildlife-friendly infrastructure within the reserve, such as masonry walls, could be explored. These measures could help mitigate biotic pressures and protect critical habitats without disrupting crucial corridors vital for wildlife movement.

- i. Advocating for timely fund releases and seeking partnerships with conservation organizations and NGOs to address funding shortages might be advisable. Collaborative efforts could enhance reserve management effectiveness and ensure the continuity of conservation initiatives.
- j. Evaluating and refining the tiger reintroduction strategy, ensuring adequate prey base, habitat suitability, and preparation before releasing tigers into the reserve, might maximize success and minimize potential risks associated with reintroduction efforts.

## 5. Conclusions

Mukundara Tiger Reserve, despite facing challenges like human-wildlife conflicts and invasive species, has shown dedication to biodiversity conservation. Through initiatives like mammal reintroductions and community engagement, it aims to protect its unique ecosystems. To ensure continued success, it must prioritize infrastructure management, invasive species control, and staff training. By fostering partnerships and adopting innovative conservation strategies, Mukundara can secure its place as a vital sanctuary for India's wildlife.



SANDESH KADUR

# RANTHAMBHORE TIGER RESERVE

## 1. Brief Description

Ranthambhore is one of the earliest tiger reserves in India, established in 1973, and holds a long history of tiger conservation in India. It is located at the intersection of two ancient mountain ranges, the Aravalis and Vindhyas, and at the confluence of seven river systems. The Ranthambhore TR (Division I) is the only source population in the semi-arid western Indian landscape (Sadhu et al. 2017). Along with Kailadevi Wildlife Sanctuary, Kuno National Park, Madhav NP, Ramgarh Visdhari TR, Mukundara Hills TR, Ranthambhore TR forms the greater Ranthambhore ecosystem, which marks the westernmost distribution of tigers in the world (Figure V.2.43). Ranthambhore is also one of the best places to see wild tigers, and one of the few places where long-term research on tigers were conducted which contributed substantially in the field of tiger ecology and conservation.

## 2. Tiger Population as per All India Tiger Estimation

Starting from the earliest cycle in 2006, the tiger population estimates for Ranthambhore Tiger Reserve have shown a gradual increase over the years. In the 2006 cycle, the tiger abundance was estimated at 32 (SE range: 30-35). This number is stable with 31 (30-32) in 2010. Subsequently, in 2014, the population showed further growth with an estimation of 37 (SE range: 30-41) tigers. Moving forward to 2018, the camera trapping session recorded 880 tiger detections, identifying 53 individual tigers, maintaining a density of 9.6 (SE 1.3) tigers per 100 sqkm. Finally, in the latest 2022 cycle, the tiger population witnessed a significant surge, with 2390 tiger images captured, identifying a total of 57 tiger individuals, once again reaffirming Ranthambhore's position as the central Indian landscape's tiger stronghold, boasting a density of  $9.6 \pm 1.27$  tigers per 100 km<sup>2</sup>.



SHIBU NAIR

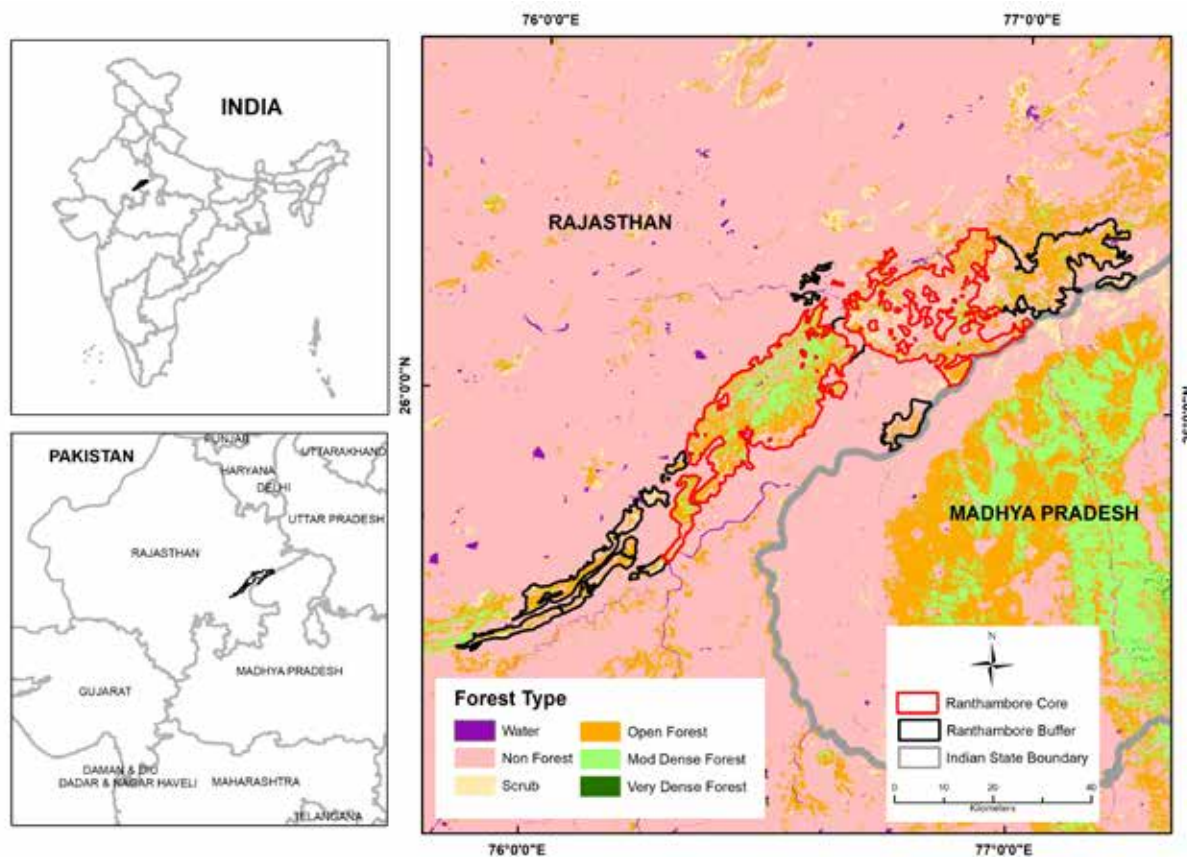


Figure 1: Map showing the location of Ranthambore Tiger Reserve in the state of Rajasthan.

### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<p><b>Human Dominance:</b> Villages, agricultural areas, and livestock grazing heavily impact compatible use. Human influence is extensive, especially in buffer zones.</p> <p><b>Staffing Issues:</b> Shortage of staff, particularly guards. Those available are mostly older, between 45 to 49 years.</p> <p><b>Equipment Shortage:</b> Lack of handheld wireless sets, weapons, binoculars, and cameras.</p>	<p><b>Human Dominance and Pressure:</b> Continuous presence and impact of human activities on the reserve's integrity.</p> <p><b>Staffing and Resources:</b> Shortage of staff, aging workforce, and inadequate resources.</p> <p><b>Human-Wildlife Conflict Resolution:</b> Challenges in addressing and resolving conflicts.</p> <p><b>Community Involvement:</b> Limited participation and benefits</p>	<p><b>Habitat Restoration and Management:</b> Implement robust habitat restoration programs to address the spread of invasive species like <i>Prosopis juliflora</i>.</p> <p><b>Metapopulation Conservation:</b> Prioritize the conservation of Ranthambore as a metapopulation by establishing wildlife corridors to connect nearby tiger-bearing areas. Monitor sink populations like Mukundara, Ramgarh,</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<p><b>Tourism Threat:</b> Tourism, especially in the Ranthambore fort area, poses a significant threat to the reserve's integrity.</p> <p><b>Inadequate Monitoring:</b> Monitoring of tigers is relatively good, but analysis of pugmark traces and monitoring of other species are lacking.</p>	<p>for local communities in tourism and conservation efforts.</p> <p><b>Monitoring and Management:</b> Insufficient wildlife monitoring, research, and habitat management efforts.</p> <p><b>Infrastructure and Funding:</b> Challenges related to infrastructure, facilities, and conservation funding.</p>	<p>Kailadevi, and Dholpur to facilitate the establishment of a metapopulation within the greater Ranthambore ecosystem.</p> <p><b>Tiger Reintroduction and Monitoring:</b> Introduce breeding females to establish resident viable populations in smaller sink populations like Mukundara, Kuno, Datia, and Ramgarh.</p> <p><b>Human-Wildlife Conflict Management:</b> Implement effective strategies to mitigate tiger-human conflicts, especially in areas where sharp boundaries between forests and human habitation exist.</p> <p><b>Research and Collaboration:</b> Collaborate with research institutions, government agencies, and NGOs to enhance scientific knowledge and conservation efforts in the region.</p> <p><b>Habitat Connectivity and Corridor Protection:</b> Protect and maintain crucial wildlife corridors to facilitate the movement of tigers and other wildlife between different habitats. Implement measures to mitigate infrastructure threats, such as highways and railways, to ensure safe passage for wildlife.</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006			<p><b>Prey Base Augmentation:</b> Focus on augmenting the wild prey population to support the resident tiger population adequately.</p> <p><b>Capacity Building and Training:</b> Provide training and capacity-building programs for frontline staff to enhance their skills in wildlife management and protection.</p>
2010	<p><b>Village Resettlement:</b> Urgency for resettling villages to reduce biotic pressure and conflict.</p> <p><b>Community Involvement in Tourism:</b> Suggested increased community participation in tourism revenue-sharing.</p> <p><b>Meta-Population Management:</b> Recognized the need for managing smaller TRs as meta-populations.</p>		
2014	<p><b>Connectivity Challenges:</b> Highlighted limited connectivity with neighboring protected areas, impacting genetic viability.</p> <p><b>Village Relocation Issues:</b> Inadequate management and training for relocating villages within the reserve.</p> <p><b>Education and Awareness:</b> Lack of educational focus, interpretation centers, and management of religious sites.</p> <p><b>Human-Wildlife Conflict:</b> Identified tensions and potential threats from religious sites affecting wildlife.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p><b>Anthropogenic Pressures:</b> High pressures from villages within and around the reserve.</p> <p><b>Habitat Planning:</b> Absence of long-term planning for habitat improvement and research activities.</p> <p><b>Community Engagement:</b> Tensions and lack of compensation leading to strained relations between villagers and the reserve.</p> <p><b>Infrastructure Shortcomings:</b> Insufficient resources and facilities for field staff.</p>		
2022	<p><b>Geographical Vulnerability:</b> Linear shape vulnerability to human-tiger interfaces due to reserve shape.</p> <p><b>Feral Cattle Concerns:</b> Increasing feral cattle population damaging reserve grasslands.</p> <p><b>Management Delays:</b> Delay in the approval of Tiger Conservation Plan.</p> <p><b>Invasive Species:</b> Presence of invasive plant species impacting herbivores.</p> <p><b>Infrastructure Threats:</b> Highways and railway tracks without wildlife mitigation measures.</p> <p><b>Staffing Challenges:</b> Staff shortage and aging workforce without proper wildlife management training.</p> <p><b>Fuelwood Dependence:</b> Continued reliance on forests for fuelwood despite previous initiatives.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<p><b>Community Engagement:</b> Limited involvement of EDCs (Ecodevelopment Committees) in decision-making.</p> <p><b>Compensation Issues:</b> Lack of compensation for crop damage escalating conflicts.</p> <p><b>Research and Funding:</b> Insufficient research, monitoring, and underutilization of funds earmarked for conservation.</p>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- Consider implementing comprehensive habitat restoration programs aimed at combating the spread of invasive species like *Prosopis juliflora*. Regular monitoring and management of habitat quality could ensure optimal conditions for tiger and prey populations.
- It may be advisable to prioritize Ranthambhore as a metapopulation hub and establish wildlife corridors connecting it with nearby tiger-bearing areas. Monitoring and managing sink populations such as Mukundara, Ramgarh, Kailadevi, and Dholpur could facilitate metapopulation establishment within the greater Ranthambhore ecosystem.
- Introducing breeding females into smaller sink populations like Mukundara, Kuno, Datia, and Ramgarh might help establish resident viable tiger populations. Robust monitoring programs could track the success and health of reintroduced tiger populations effectively.
- Exploring effective strategies to mitigate conflicts between tigers and humans, especially in areas with sharp boundaries between forests and human habitation, could be beneficial. Engaging local communities in conflict resolution efforts and ensuring equitable distribution of benefits from tourism and conservation initiatives may foster better coexistence.
- Consider fostering collaborations with research institutions, government agencies, and NGOs to enhance scientific understanding of Ranthambhore's ecology and support conservation efforts. Investing in research programs focused on habitat connectivity,

prey base dynamics, and human-wildlife interactions could inform evidence-based management strategies.

- It might be advisable to safeguard crucial wildlife corridors to facilitate the movement of tigers and other wildlife between different habitats. Implementing measures to mitigate threats posed by infrastructure developments such as highways and railways could ensure safe passage for wildlife.
- Focus could be placed on augmenting the wild prey population within the reserve to adequately support the dietary needs of the resident tiger population. Monitoring prey population dynamics and implementing measures to address any decline in prey abundance may contribute to tiger conservation efforts.
- Providing comprehensive training and capacity-building programs for frontline staff to enhance their skills in wildlife management, protection, and conflict resolution could be beneficial. Investing in staff recruitment and retention efforts could address shortages and ensure a competent and motivated workforce.
- Working towards resettling villages located within the reserve boundaries might alleviate biotic pressure and reduce human-wildlife conflicts. Fostering greater community involvement in tourism revenue-sharing schemes and conservation initiatives could promote local stewardship of natural resources.
- Establishing educational programs and interpretation centers to raise awareness among visitors and local communities about the importance of tiger conservation and habitat preservation could be considered. Developing strategies to manage religious sites within the reserve sensitively might minimize their impact on wildlife and habitat integrity.
- Ensuring timely approval and implementation of the Tiger Conservation Plan could secure funding for conservation activities and infrastructure development. Optimizing the utilization of funds earmarked for conservation, research, and monitoring might maximize their impact on Ranthambhore's ecological sustainability.

#### 5. Conclusions

In conclusion, Ranthambhore Tiger Reserve stands as a beacon of hope for tiger conservation efforts in India, showcasing a remarkable success story of population recovery and habitat preservation. Over the years, Ranthambhore has demonstrated a steady increase in tiger numbers, reaffirming its position as a stronghold for these majestic predators in the central Indian landscape. Despite facing numerous challenges such as human-wildlife conflicts, habitat degradation, and infrastructural threats, the reserve has persevered, thanks to dedicated management efforts and collaborative initiatives. Moving forward, it is imperative to continue prioritizing habitat restoration, metapopulation management, and community engagement to ensure the long-term viability of Ranthambhore's tiger population. By addressing these challenges and building on past successes, Ranthambhore Tiger Reserve can serve as a model for sustainable tiger conservation, inspiring similar efforts across the country and beyond.

# SARISKA TIGER RESERVE

## 1. Brief Description

Sariska TR the westernmost limit of tigers in the country and holds a unique assemblage of flora and fauna representatives of Aravalli range. The park plays an important role in the overall conservation of tigers in the landscape and acts as umbrella species besides having high tourism value. The 1200 km<sup>2</sup> of forests (core and buffer) acts as a watershed for rain water and the existing vegetation plays an important role in soil and moisture conservation. The Ruparel River that originates within the park and is the major source of water for many villages including the Alwar city. The STR landscape plays a crucial role in enhancing ecological services.

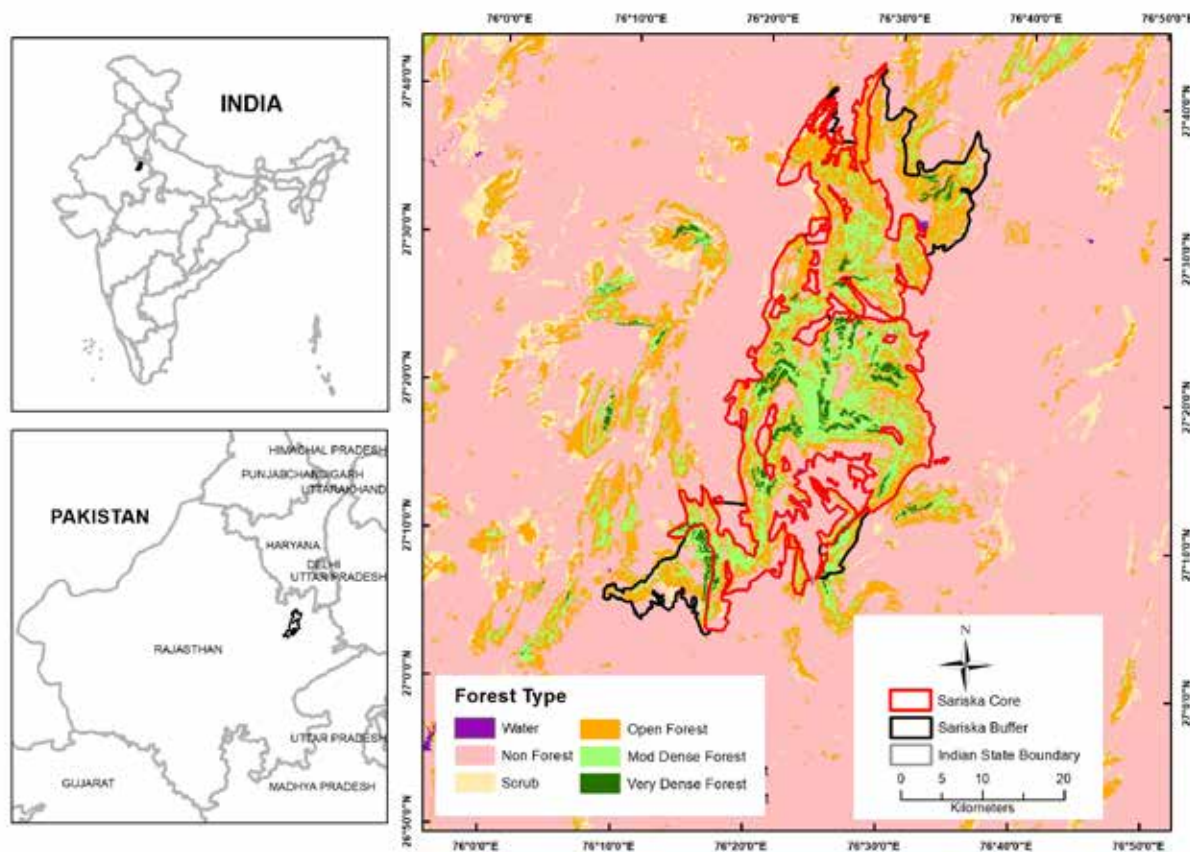


Figure 1: Map showing the location of Sariska Tiger Reserve in the state of Rajasthan.

## 2. Tiger Population as per All India Tiger Estimation

Tiger abundance in Sariska in 2010 was estimated to be 5. In 2014, camera traps were deployed in two blocks consisting of 61 and 78 detectors respectively and sampled for a total of 50 days and tiger population estimated was 9 (9-9). In Sariska in 2018, 426 camera traps yielded 451 tiger images, identifying 11 individuals. Spatially explicit density wasn't

estimated due to known absolute abundance from the reintroduced tiger population. As the Sariska tiger population is known and monitored, in 2021 and 2022 have not estimated the abundance, but use the total count. At present there are 24 adult tigers in Sariska Tiger Reserve with 19 unique tigers captured.

## 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<p><b>Human Settlement Pressures:</b> High human population in buffer zones leading to heavy cattle presence, habitat degradation, and lack of opportunities beyond the buffer.</p> <p><b>Village Presence in Reserve:</b> Existence of villages within the reserve, relocation proposals pending, habitat degradation due to heavy lopping, inadequate staff, and aging workforce.</p> <p><b>Infrastructure and Equipment Deficiencies:</b> Lack of essential equipment such as telephones, email/fax facilities, aging vehicles, and insufficient funding for maintenance and operations.</p> <p><b>Ineffective Research and Data Analysis:</b> Inadequate data analysis and supervision, leading to the neglect of collected data and an inability to predict or address the decline of tigers effectively.</p> <p><b>Tourism Impact:</b> High pressure from religious tourism causing diversion of frontline staff, allowing opportunities for poaching and grazing, impacting wildlife protection.</p>	<p><b>Fragmented Habitat and Human Pressures:</b> Continuous issues with fragmented habitat due to proximity to human settlements, resulting in biotic pressure, habitat degradation, and heavy human-wildlife conflicts.</p> <p><b>Village Presence and Resource Exploitation:</b> Existence of villages within and around the reserve leading to habitat degradation, resource extraction, and disturbance to wildlife.</p> <p><b>Infrastructure Deficiencies:</b> Lack of essential infrastructure, outdated equipment, inadequate vehicles, and insufficient funding impacting the effectiveness of field officers and conservation efforts.</p> <p><b>Ineffective Research and Monitoring:</b> Inadequate research projects, neglect of collected data, and absence of effective monitoring leading to missed opportunities for planning and improving conservation strategies.</p>	<ul style="list-style-type: none"> <li>Human disturbance within the reserve significantly hampers wildlife conservation efforts in Sariska.</li> <li>Biotic pressures, particularly livestock grazing, diminish the available resources in the park, resulting in a comparatively low population density of ungulates.</li> <li>Certain inviolate pockets within the reserve harbor a rich diversity of fauna, presenting a crucial opportunity for wildlife recovery.</li> <li>The recent camera trapping survey revealed higher photocapture rates of large carnivores in the relocated village areas, emphasizing the importance of these inviolate zones.</li> <li>Anthropogenic pressure inside Sariska Tiger Reserve remains a major concern for its long-term conservation.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<p><b>Weed Infestation:</b> Presence of weed infestation affecting approximately 40 km<sup>2</sup>, potentially due to grazing and wild fires, impacting habitat quality.</p> <p><b>Decline in Tiger Population:</b> Serious decline in tiger numbers with unclear reasons, casting doubt on the accuracy of recorded estimates of other species.</p> <p><b>Ineffective Monitoring and Patrolling:</b> Reports of monitoring efforts through staff chaukis and patrolling, but lacking in utility and success, potentially leading to failure in protecting wildlife.</p> <p><b>Limited Scope Beyond Reserve:</b> Inadequate resources and support for managers, making it challenging to address strategies beyond the reserve's boundaries even if opportunities exist.</p>	<p><b>Religious Tourism Impact:</b> High influx of tourists and festivals causing habitat loss, pollution, hindrance to animal movements, and disturbances, especially within critical tiger habitats.</p> <p><b>Road Impact and Wildlife Disturbance:</b> Major roads bisecting the reserve contributing to noise, pollution, road kills, and hindering wildlife movements.</p> <p><b>Invasive Species Infestation:</b> Overgrowth of invasive species disrupting grasslands and impacting herbivores dependent on these habitats for food.</p> <p><b>Pending ESZ Notification and Mining Activities:</b> Delay in declaring the Eco-Sensitive Zone leading to unregulated mining activities, affecting wildlife movement and habitat integrity.</p> <p><b>Lack of Waste Management:</b> Pilgrimage-related waste posing a significant challenge, demanding comprehensive waste management strategies.</p> <p><b>Staff Vacancies and Outsourcing Issues:</b> High permanent staff vacancies and reliance on outsourced or contractual staff, compromising long-term protection efforts and management sustainability.</p>	<ul style="list-style-type: none"> <li>The widespread influence of human activities presents a major impediment to the restoration of wildlife, notably tigers, in Sariska.</li> <li>Prolonged human disturbance has caused degradation in different parts of the reserve, leading to a reduction in prey populations and the encroachment of invasive weeds like Parthenium hysterophorus, Prosopis juliflora, Prosopis juliflora, Senna tora, and Xanthium strumarium.</li> <li>The inclusion of religious tourism and highways within the reserve poses significant threats to the wildlife.</li> <li>Effectively addressing these challenges necessitates prioritizing the voluntary relocation of villages and mitigating disturbances arising from current developmental activities.</li> <li>It is imperative to systematically and with utmost priority address and eliminate invasive weeds to facilitate the recovery and conservation of wildlife in the affected areas.</li> </ul>
2010	<p><b>Fragmented and Poorly Shaped Reserve:</b> Highly fragmented, poorly shaped reserve exposed to anthropogenic pressures due to proximity to human settlements, roads, and religious tourism, exacerbating human-wildlife conflicts.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<p><b>Anthropogenic Disturbances:</b> Presence of numerous settlements in core areas, roads cutting through the reserve, widespread cattle grazing, fires during dry seasons, and mining activities outside the reserve impacting habitat and wildlife.</p> <p><b>Weed Infestation:</b> Increasing problem of weeds in grassland areas used by herbivores for grazing, affecting habitat quality.</p> <p><b>Lack of Community Engagement:</b> Failure to engage local communities, resulting in poor support for conservation efforts and negative perceptions due to restrictions and human-wildlife conflicts.</p> <p><b>Staff Shortage and Training:</b> Limited trained wildlife staff and overall shortage, despite opportunities for training programs through organizations like the Wildlife Institute of India (WII) not effectively utilized for monitoring or research planning.</p> <p><b>Complacency and Monitoring Absence:</b> Absence of effective monitoring leading to complacency, resulting in missed opportunities to utilize existing research material for planning and improvement.</p>		
2014	<p><b>Biotic Disturbance from Villages:</b> Presence of numerous villages (27) within and around the reserve (300 villages) leading to widespread cattle grazing, biomass extraction, and fire incidents during dry seasons.</p> <p><b>Illegal Entry and Poaching:</b> The reserve's open boundaries facilitate illegal entry, potentially enabling poachers and unauthorized human activities from all sides.</p>		



MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<p><b>High Visitor Traffic:</b> Significant annual influx of devotees and visitors to Pandupol temple, causing surges during specific events, impacting wildlife and habitats.</p> <p><b>Highway Encroachment:</b> Two state highways pass through the park, with heavy vehicular traffic affecting wildlife movement and habitat integrity.</p> <p><b>Infrastructure Deficiencies:</b> Lack of essential infrastructure like vehicles, telephone facilities for staff, impacting the effectiveness of field officers.</p> <p><b>Illegal Activities and Water Retention:</b> Presence of dhabas engaging in illicit tree felling, impacting water retention due to insufficient large waterbodies within the reserve.</p> <p><b>Boundary Issues and Mining Activities:</b> Improper demarcation leading to litigations, disputes, and mining activities in areas near the reserve, potentially affecting habitat.</p> <p><b>Limited Community Engagement:</b> Minimal engagement with local communities through Environmental Development Committees (EDCs), resulting in inadequate local support for conservation efforts.</p> <p><b>Underutilization of WII Presence:</b> Regular presence of Wildlife Institute of India (WII) not effectively utilized for data</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	collection, research, or monitoring purposes, missing opportunities for leveraging expertise.		
2018	<p><b>Slow Tiger Population Growth:</b> Despite reintroduction efforts, factors like human disturbance, grazing, and habitat degradation continue to impede tiger population growth.</p> <p><b>Isolation and Genetic Diversity:</b> Lack of connectivity with other tiger habitats limits natural gene pool exchange.</p> <p><b>Village Presence and Resource Utilization:</b> Villages within the core habitat lead to excessive degradation due to resource utilization, impacting tiger fecundity.</p> <p><b>Lack of Solutions for Grazing Pressure:</b> No viable solutions for grazing pressure persist due to cattle intrusion, impacting tiger habitat and fecundity.</p> <p><b>Inadequate Support for Relocated Villages:</b> Relocated villages lack ongoing support, impacting their eligibility for benefits and leading to discouragement for further relocations.</p> <p><b>Human Disturbance from Temples:</b> Religious tourism leads to disturbances, including feeding animals, altering their behavior and causing congregation along roads.</p> <p><b>Tourism Management and Wildlife Disturbance:</b> Lack of control over religious tourists feeding animals, risking wildlife safety, and altering their behavior.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p><b>Infrastructure and Safety:</b> Inadequate infrastructure, lack of vet support, and safety concerns for visitors unaddressed in ecotourism plans.</p> <p><b>Human-Wildlife Conflict:</b> Incidents of conflict exist, but there's a lack of full-time vet support for rescued wildlife.</p> <p><b>Administrative and Political Interference:</b> Lack of constituted committees, non-levying of conservation fees, political interference, demoralizing workforce.</p> <p><b>Community Hostility and Management Relationship:</b> Hostility from villages impacts management efforts, inadequate efforts to improve community relations.</p> <p><b>Inadequate Committees and Training:</b> Insufficient EDCs and lack of frontline staff training in wildlife management and SOP awareness further hamper effective management.</p>		
2022	<p><b>Limited Genetic Diversity:</b> STR's isolated tiger population faces inbreeding risks due to minimal connectivity with other protected areas.</p> <p><b>Vulnerable Boundaries:</b> Porous borders make the reserve susceptible to poaching and encroachment, leading to extensive resource exploitation.</p> <p><b>Human Pressures:</b> With 24 villages inside and 153 in the periphery, human activities like grazing and lopping heavily impact the park's resources, affecting the ecosystem.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<p><b>Religious Impact:</b> Presence of 309 temples affects wildlife habitat due to festivals, pollution, and hindrance to animal movements, particularly in critical tiger habitats.</p> <p><b>Road Impact:</b> The bisecting road (SH 248A) disrupts wildlife movements, contributing to noise, pollution, and road kills in the park.</p> <p><b>Invasive Species:</b> Overrun by invasive plants like Prosopis juliflora and Lantana camera, the park's grasslands suffer, endangering herbivores dependent on grass for food.</p> <p><b>Pending ESZ Notification:</b> Delay in declaring the Eco-Sensitive Zone allows unregulated mining activities outside the reserve, impacting wildlife movement and habitat.</p> <p><b>Lack of Research:</b> Insufficient scientific research addressing critical issues like water management, weed invasion, and socio-economic impacts hinders effective management.</p> <p><b>Waste Management:</b> Pilgrimage-related waste poses a significant challenge, demanding a comprehensive waste management system similar to successful models in other reserves.</p> <p><b>Staff Vacancies:</b> More than 50% permanent staff vacancies, along with reliance on outsourced and contractual staff, compromise long-term protection efforts in STR.</p>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- a. It may be beneficial to prioritize the voluntary relocation of villages within and around the reserve to reduce instances of human-wildlife conflicts and mitigate habitat degradation.
- b. Consider investing in essential infrastructure upgrades, updating outdated equipment, and ensuring sufficient funds are allocated for maintenance and ongoing operations to enhance the reserve's effectiveness.
- c. Developing and implementing a systematic plan to eradicate invasive weeds like *Prosopis juliflora* and *Lantana camara* could significantly improve habitat quality within the reserve.
- d. It is advisable to implement stringent tourism management measures aimed at minimizing wildlife disturbances, especially in critical tiger habitats, to ensure their long-term conservation.
- e. Addressing the adverse effects of roads within the reserve by implementing measures to mitigate noise, pollution, and roadkill incidents could help preserve the integrity of the ecosystem.
- f. Expediting the declaration of the Eco-Sensitive Zone and regulating mining activities could be recommended to safeguard wildlife movement corridors and habitat integrity effectively.
- g. Prioritizing scientific research initiatives to tackle pressing issues such as water management, invasive weed invasion, and socio-economic impacts could provide valuable insights for informed decision-making and conservation planning.
- h. Addressing staff shortages by recruiting permanent personnel, offering comprehensive training programs, and enhancing overall staff morale could strengthen the reserve's management and protection efforts.
- i. It may be advisable to foster positive relations with local communities by increasing engagement, involving them in conservation activities, and addressing their concerns to garner their support for wildlife conservation.
- j. Enhancing connectivity with other tiger habitats to facilitate natural gene pool exchange and reduce the risks of inbreeding could be crucial for the long-term viability of tiger populations within the reserve.

#### 5. Conclusions

In conclusion, Sariska Tiger Reserve faces significant challenges such as human-wildlife conflicts, inadequate infrastructure, and ecological threats. Urgent actions are needed, including voluntary village relocation, improved infrastructure, invasive species eradication, and strict tourism management. Collaborative efforts involving various stakeholders are essential to ensure the conservation and sustainability of this vital ecosystem. The reserve's unique biodiversity and strategic opportunities for recovery highlight its potential for long-term success with the right interventions.



## KALAKAD MUNDANTHURAI TIGER RESERVE (KMTR)

### 1. Brief Description

Situated at 8° 41' 0" N, 77° 19' 0" in the Southern Western Ghats, Kalakkad Mundanthurai Tiger Reserve (KMTR) is an integral part of the interstate Agasthiyamalai Biosphere Reserve. Established as a Tiger Reserve in 1988, KMTR encompasses Kalakad Sanctuary, Mundanthurai Sanctuary, and a portion of Kanyakumari Sanctuary, spanning a total area of 895 square kilometers. The diverse forest types within KMTR include southern hilltop evergreen forests, west coast tropical wet evergreen forests, Tirunelveli semi-evergreen forests, southern moist mixed deciduous forests, tropical riparian fringing forests, dry teak forests, southern dry mixed deciduous forests, carnatic umbrella thorn forests, ochlandra reeds, and southern montane wet grassland, as documented by Champion and Seth in 1968. KMTR boasts a rich biodiversity with 77 mammal species, 33 fish species, 37 amphibian species, 81 reptile species, and 273 bird species. Among the flagship species are the tiger (*Panthera tigris*), elephant (*Elephas maximus*), and lion-tailed macaque (*Macaca Silenus*). Notable co-predators of the tiger include the dhole (*Cuon alpinus*) and leopard (*Panthera pardus*). The reserve is also home to significant ungulates such as wild pig (*Sus scrofa*), barking deer (*Muntiacus vaginalis*), mouse deer (*Moschiola indica*), gaur (*Bos gaurus*), chital (*Axis axis*), sambar (*Rusa unicolor*), and nilgiri tahr (*Nilgiritragus hylocrius*).

### 2. Tiger Population as per All India Tiger Estimation

In 2006, the tiger abundance in the Kalakad-Periyar complex was estimated at 32 (SE range: 28-38), which increased to 38 (SE range: 36-40) by 2010. However, from 2014 onwards, the abundance of Kalakad tigers was calculated separately, resulting in a count of 10 (SE range: 9-11) tigers. By 2018, only 8 (SE 1) tigers were identified within the tiger reserve, with a density of 0.43 (SE 0.17) tigers per 100 km<sup>2</sup>. In 2022, despite capturing 84 tiger images, only 5 individual tigers were identified, leading to an estimated tiger density of 0.27 tigers per 100 km<sup>2</sup> in KMTR. This data reflects a consistent trend of low tiger density in KMTR across multiple survey cycles, with previous estimates recorded at 0.88 tigers per 100 km<sup>2</sup> in 2014 and 0.43 tigers per 100 km<sup>2</sup> in 2018.

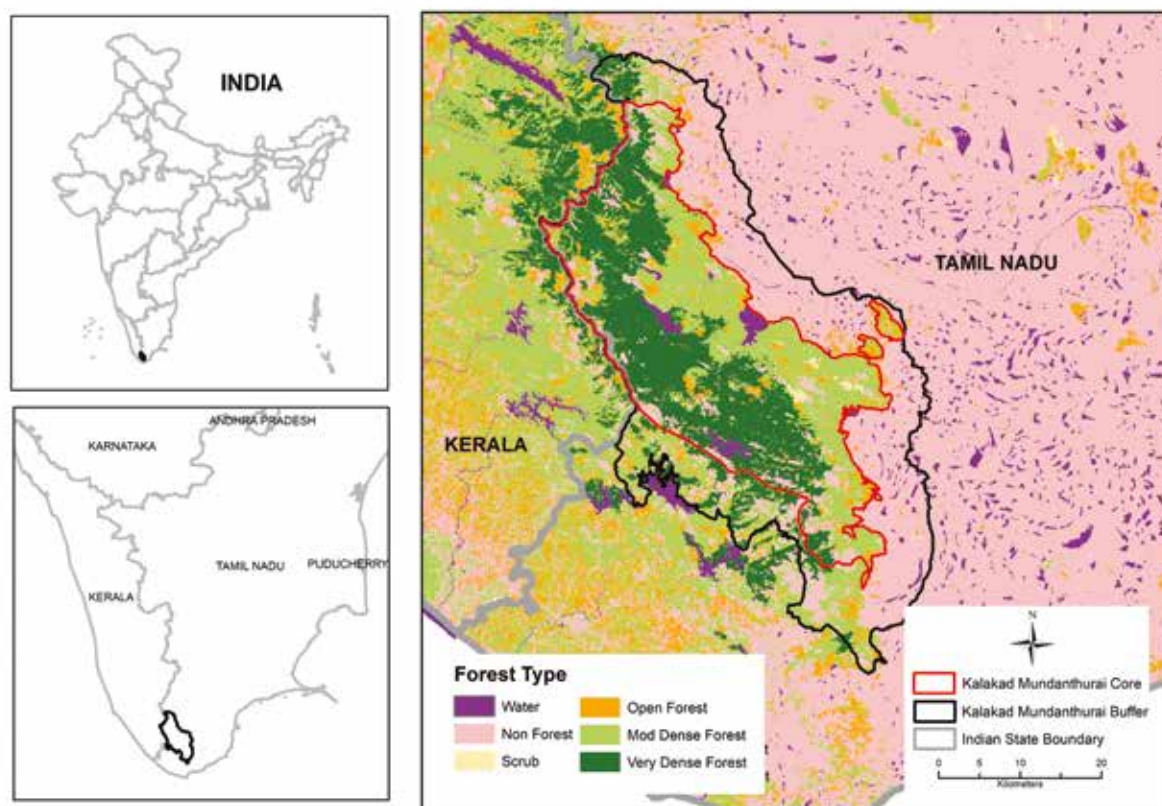


Figure 1: Map showing location of Kalakad Mundanthurai Tiger Reserve in the state of Tamil Nadu.

### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<p>To ensure ecological security, address enclaves, including eight encroachment areas, exerting persistent pressure. Evaluate the potential termination of long-term, extensive areas (e.g., B.B.T.) and consider the acquisition of private forest (Kattamalai). Grant “de jure” control of Singampatty reserve lands to the P.A. manager. Harmonize conservation goals with the genuine needs of residents within and around the core zone by designating it as a National Park and relocating existing habitations.</p> <p>Redefining the boundary including the buffer zone is essential along with increased influence in the administration of Reserve Forests.</p>	<p>Persistent issues with human settlements and encroachments within the tiger reserve boundaries, including enclaves and unauthorized colonies, threaten habitat integrity and wildlife conservation efforts. Legal complexities hinder timely removal of encroachments.</p> <p>Inadequate frontline staff and a lack of trained personnel pose challenges to effective management. High turnover rates and frequent changes in top-level management affect consistency in implementing conservation plans. Insufficient training in wildlife management</p>	<ul style="list-style-type: none"> <li>The water bodies within the reserve are being obstructed by dam construction carried out by the Tamil Nadu Electricity Board, which is part of an extensive effort aimed at hydro-power generation. Consequently, certain sections of the park are experiencing a noticeable shortage of water, impacting the local ecosystem and wildlife.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<p>Five Kani habitations, Electricity Board, Irrigation Staff Colony, and unauthorized labor shanties pose a threat unless curbed, while human pressures along the eastern boundary are almost under control with a massive Eco-development program.</p> <p>The draft management plan prepared by WII hasn't been approved by the authorities yet.</p> <p>Replacement of old vehicles is necessary.</p> <p>There is a need for improvement in the timely release and more efficient utilization of central assistance, as there has been meager utilization over the last two years.</p> <p>It is recommended to establish permanent anti-poaching camps.</p> <p>Regular units headed by a Research Officer need to be established.</p> <p>A stronger emphasis is needed to enhance nature education and ecotourism through EDCs.</p> <p>There should be increased focus on monitoring, extension, as well as environmental education and ecotourism.</p> <p>There is a necessity for conducting more scientific and regular wildlife estimation exercises.</p> <p>Permitting and regulating grazing in multiple-use areas can provide improved control over immunization measures.</p> <p>Introducing the concept of trained guides holds potential for improvement.</p>	<p>for field staff hampers conservation efforts.</p> <p>Delays and irregularities in funding allocation impact operational capabilities, hindering critical activities such as infrastructure development, vehicle replacement, and the establishment of anti-poaching camps. Inadequate infrastructure, including insufficient vehicles and anti-poaching camps, compromises wildlife protection efforts.</p> <p>Challenges persist in harmonizing conservation goals with the genuine needs of local residents. Relocating existing habitations, particularly those within core zones, remains a contentious issue. Effective implementation of eco-development programs and alternate livelihood initiatives is essential to address emerging conservation-related issues.</p> <p>Inadequate visitor facilities and infrastructure, coupled with concerns over the impact of religious pilgrimage activities, pose challenges to sustainable tourism management. Balancing the promotion of eco-tourism with conservation objectives requires careful planning and adherence to environmental norms.</p> <p>Invasion by invasive species, habitat degradation, and encroachment by forestry species threaten ecosystem stability and wildlife populations.</p>	<ul style="list-style-type: none"> <li>The area surrounding the reserve is witnessing significant alterations in land use patterns due to various factors, including densely populated human settlements, extensive tea and coffee plantations, and the development of linear infrastructure such as roads and railways. These changes are exerting pressure on the natural habitat and ecological balance of the region.</li> <li>Addressing these challenges requires focused protection and management initiatives aimed at mitigating the adverse effects of dam construction, human encroachment, and changes in land use. Preserving the critical habitat of the reserve necessitates immediate and concerted efforts to combat these threats and ensure the long-term sustainability of the ecosystem.</li> <li>Urgent measures are needed to restore the grasslands in the Mundanthurai Plateau, a vital component of the reserve's ecosystem. This restoration effort entails comprehensive weed removal activities and effective habitat management strategies aimed at revitalizing the grassland habitat and supporting the diverse wildlife populations dependent on it.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006		<p>Restoration efforts, including weed removal and habitat restoration, are hindered by inadequate resources and legal complexities.</p> <p>Inadequate patrolling in inaccessible areas lacking road networks leaves vulnerable regions susceptible to poaching and wildlife smuggling. Enhanced monitoring using modern technology tools such as drones and high-resolution cameras is necessary to strengthen protection efforts.</p> <p>Delayed approval of management plans and inconsistencies in policy implementation hinder effective conservation actions. A lack of mid-term reviews or revisions of conservation plans prolongs the execution of outdated strategies, impacting conservation outcomes.</p>	
2010	<p>The tiger reserve continues to face challenges with human settlements persisting within its boundaries, while the frontline staff is inadequately trained and understaffed.</p> <p>The ecodevelopment program requires ongoing support from the tiger reserve management to effectively address emerging issues related to the linkages between conservation efforts and community livelihoods.</p> <p>Inadequate visitor facilities and materials pose a hindrance to effective management and engagement within the tiger reserve.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<p>The presence of a temple inside the tiger reserve contributes to pilgrimage pressures, and there is a growing concern about increasing pilgrimage activities.</p> <p>Anticipated expansion of tourism in the vicinity of the tiger reserve raises concerns about potential impacts on the ecosystem and wildlife.</p> <p>Future projects planned around the tiger reserve and private plantation areas may introduce additional pressures, particularly from interstate borders, necessitating proactive management strategies.</p> <p>Local communities possess a substantial corpus, indicating potential financial resources for conservation initiatives.</p> <p>The recently established Tiger Foundation provides a dedicated platform for channeling resources and support toward tiger conservation efforts.</p> <p>There is a noticeable increase in research interest from both institutions and individuals, signifying a growing commitment to understanding and addressing conservation challenges.</p> <p>The potential for expanding awareness about conservation efforts in the area presents an opportunity to garner increased public support and participation in tiger conservation initiatives.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<p>The Tiger Reserve (TR) faces challenges due to insufficient staff, particularly a lack of supporting technical staff in the Field Director's Office.</p> <p>Reconstitute the State Level Steering Committee promptly and convene its inaugural meeting without delay.</p> <p>The existing staff members have not undergone formal training in wildlife management, highlighting a need for capacity-building efforts.</p> <p>Fill vacant staff positions immediately, selecting trained, motivated, and committed individuals for the TR's field staff. Develop and implement a staff development plan, reducing beat sizes to 10-15 km<sup>2</sup> and sanctioning additional posts accordingly.</p> <p>Prioritize capacity-building programs and short-term training courses in wildlife management for staff to enhance their technical knowledge.</p> <p>Lay bridle paths, establish anti-poaching camps, assess the need for permanent camps, and consider increasing their number for enhanced protection.</p> <p>Expedite the full functionality of the M-STriPES monitoring protocol and improve the implementation of Phase-IV daily monitoring following NTCA guidelines.</p> <p>Numerous settlements in the core area, including Kani and non-Kani forest dwellers' settlements, as well</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<p>as colonies of the Electricity Board and tea estates, contribute to continuous pressure on forest resources. Relocate settlements in the core area/critical tiger habitat within a defined timeframe, adhering to relevant wildlife and tribal rights acts.</p> <p>Temples within the reserve attract large numbers of pilgrims during festivals, leading to unavoidable pressure on natural resources. Establish an interpretation center for effective nature education and provide more tourism facilities within Supreme Court and NTCA guidelines.</p> <p>Form small teams from local villagers to act as leaders in wildlife protection, incentivizing them to report wildlife crimes.</p> <p>Ensure the availability of well-maintained vehicles for effective patrolling.</p> <p>The TR contends with grazing, illicit felling, and poaching pressures along the eastern boundary and the inter-state border with Kerala.</p> <p>Establish EDCs in villages lacking them and allocate additional resources for alternate livelihood programs.</p> <p>Visitor facilities are inadequate, and the absence of a comprehensive interpretation center with informative displays hinders the communication of conservation messages. Regulate the impact of religious tourism, and enhance record-keeping for executed works.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<p>The expansive size of the area and the presence of geographical features render many parts of the sanctuary inaccessible.</p> <p>Issue national-level guidelines for climate change issues, assess impacts, adopt adaptation measures, and integrate them with the TCP, focusing on reducing carbon loss and increasing carbon capture without compromising wildlife habitat conservation objectives.</p>		
2018	<p>The mountaineous and rugged terrain of KMTR, with an altitude range of 50-1850 m, poses challenges for patrolling due to its vastness and difficult geographical features.</p> <p>Inadequate frontline staff strength poses a challenge to effective management. Address the backlog of 20 unfilled Beat Forest Officer posts, expedite the replacement of old vehicles, and renovate existing infrastructure promptly.</p> <p>Develop a systematic HRD plan for capacity building, conducting short-term training courses in wildlife management for field staff to enhance their technical skills.</p> <p>A proposed road from Papanasam to Trivandrum, if realized, could significantly increase biotic pressure on the Tiger Reserve.</p> <p>Three major pilgrimage centers within the reserve—Nambikoil, Agasthiarkoil, and Gorakhanathar temple—draw large numbers of visitors, impacting the biological values of the reserve.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p>The 56 km Inter-State boundary with Kerala contributes to additional biotic pressure on KMTR.</p> <p>Improve ecotourism infrastructure in line with NTCA guidelines, focusing on enhanced facilities and adherence to environmental norms. Develop tourist facilities, including cottages, packages, an interpretation center, and informational materials, in accordance with NTCA guidelines to harness the reserve's tourism potential.</p> <p>Commend the eco-development activities led by EDC/VFC, especially those involving indigenous communities since 1995. Disseminate lessons learned in KMTR as a World Bank-chosen role model, focusing on sustainable ecological services, particularly water conservation.</p> <p>Levy a cess for access to religious pilgrimage places, directing the proceeds to relevant EDCs for community benefits.</p> <p>Incorporate innovative methods in the management policy of religious places, considering carrying capacity and ensuring sustainable practices.</p> <p>Continuous pressure on forest resources is exerted by four Kani tribal settlements, three non-Kani forest dwellers' settlements, two electricity board colonies, and several tea estates.</p>		



MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<p>The eastern periphery and adjoining villages are prone to human-wildlife conflicts, involving crop damage by elephants, wild boars, and other herbivores.</p> <p>Relocate settlements and enclaves in the core and critical wildlife habitat for a completely inviolate core area, emphasizing time-bound persuasion. Initiate a State-Level Steering Committee meeting promptly following the recent State Board of Wildlife meeting.</p> <p>While senior officials like the Field Director and Deputy Director have undergone capsule/short-term training at WII, none of them has completed a regular diploma course in wildlife.</p>		
2022	<p>The tiger reserve contends with human and biotic interference, featuring 13 uninhabited enclaves, four tribal settlements, three Electricity Board establishments, and one leased area within its boundaries. Legal complexities impede the removal of private enclaves and core area encroachments, causing delays. The expeditious resolution of legal cases for the removal of enclaves is crucial for habitat improvement. Special efforts by the state government are required to ensure swift disposal of court cases.</p> <p>Ensuring stability in management tenure at various levels, including Field Director, Deputy Director, and Range Officers, for a minimum of 3 years is essential for consistent direction and effective implementation of TCP prescriptions.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<p>Invasive species, particularly Lantana camara and Eupatorium, affect the Mundanthurai plateau's grasslands. The thick growth of lemon grass poses a restoration challenge for the grasslands.</p> <p>Encroachment by forestry species in Mundanthurai Plateau and Sengaltheri's lowest slopes compromises grasslands, impacting the populations of wildlife, including spotted deer.</p> <p>Urgent action is needed for the restoration of Mundanthurai plateau's grasslands, involving weed removal and preventing encroachment by trees. A detailed action plan for this should be incorporated into the revised Tiger Conservation Plan (TCP) for 2025-26 to 2034-35.</p> <p>The tiger population density remains low, with the 2010 estimation indicating <math>3.0 \pm 1.1</math> tigers/100 km<sup>2</sup>, significantly below the projected carrying capacity of approximately 12.61 tigers/100 km<sup>2</sup> in the KMTR habitat.</p> <p>Manpower stability issues, particularly at the top-level management, manifest as short tenures for Field Directors and frequent changes in Dy Directors, affecting the execution of Tiger Conservation Plan (TCP) prescriptions.</p> <p>Poor patrolling in inaccessible areas lacking road networks makes these regions vulnerable to poaching and wildlife smuggling within the tiger reserve.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<p>Inadequate training in wildlife management for most field staff members hinders effective conservation efforts.</p> <p>Monitoring of TCP implementation lacks mid-term reviews or initiation of the revision process, despite being in its eighth year of execution since 2015-16.</p> <p>Patrolling in inaccessible areas, lacking road networks, should be conducted on foot, with field staff camping in temporary establishments like tree-top machans or portable tents to enhance protection against poaching and smuggling.</p> <p>Modern technology tools, such as drones and high-resolution cameras, should be employed to monitor and improve habitats in inaccessible areas, strengthening protection efforts.</p> <p>The inadequate number of existing Anti-Poaching Camps (APCs) in the expansive Kalakad Mundanthurai Tiger Reserve necessitates the immediate establishment of more camps at strategic locations with sufficient infrastructure.</p> <p>Strengthening Eco-Development Committees (EDCs) across KMTR, with a focus on education and skill development, should be extended to other EDCs, especially in tribal settlements within the core area, aiming to reduce forest dependence.</p>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<p>Formal wildlife management training at the Wildlife Institute of India should be encouraged for at least one officer among the Field Director and Deputy Directors, as well as a field-level officer like a Range Officer or Forester within the tiger reserve.</p> <p>The tiger reserve management should reconsider its eco-tourism plan, focusing on adventure and nature tourism to encourage eco-friendly tourism with minimal vehicular movement.</p>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- a. The presence of human settlements and encroachments within the tiger reserve boundaries remains a concern, necessitating careful consideration and diplomatic approaches to address these challenges effectively. Efforts should be focused on evaluating and addressing enclaves and encroachment areas, while also exploring options such as acquiring private forests and harmonizing conservation goals with the genuine needs of local communities.
- b. The insufficient staff strength and training, especially the absence of formal wildlife management training for field staff, pose challenges to effective conservation management. To address this, it is recommended that the reconstitution of the State Level Steering Committee be prioritized, and the development of a comprehensive capacity-building plan aimed at enhancing the technical skills of field staff through short-term training courses in wildlife management be expedited.
- c. The lack of adequate visitor facilities, materials, and interpretative centers poses challenges to effectively communicating conservation messages and engaging visitors within the tiger reserve. To address this, it is recommended that the establishment of an interpretation center be prioritized and tourism facilities be enhanced within the guidelines set by the Supreme Court and NTCA.

- d. The persistent challenge of pilgrimage pressures resulting from the presence of temples inside the tiger reserve requires careful regulation to mitigate its impact on the ecosystem. It is recommended that focus be placed on enhancing record-keeping for executed works and implementing measures to regulate the impact of religious tourism effectively.

## 5. Conclusions

Despite its low tiger density compared to 2014, the Kalakad Mundanthurai Tiger Reserve (KMTR) holds significant potential for a healthy tiger population. However, crucial management interventions are needed. Resettlement of tribal settlements from the core area, as per NTCA guidelines, is essential. The proposed Papanasam-Trivandrum highway must be critically reevaluated to minimize its impact on tigers and biodiversity, with realignment and mitigation measures prioritized. As part of the Southern Western Ghats Tiger Conservation Priority Landscape, KMTR requires focused attention. Addressing water shortages caused by dams and hydropower projects is crucial. Additionally, combating changes in land use patterns due to human settlements, plantations, and infrastructure development is vital. Immediate restoration of grasslands in Mundanthurai Plateau through weed removal and habitat management is necessary. By taking prompt action on these critical issues, KMTR can become a haven for tigers and a vital contributor to tiger conservation in the region.



## MUDUMALAI TIGER RESERVE

### 1. Brief Description

The Mudumalai Tiger Reserve (MTR) is positioned at coordinates 11° 35' 0" N, 76° 33' 0" E, strategically situated at the meeting point of Tamil Nadu, Karnataka, and Kerala states. It shares borders with the Wayanad Wildlife Sanctuary to the northwest, Bandipur Tiger Reserve to the north, and is surrounded by the Singara and Sigur Reserved Forests, forming the remaining boundaries of the Nilgiri North Division. Additionally, Mudumalai is an integral part of the Nilgiri Biosphere Reserve, with a core area spanning 321 km<sup>2</sup> and a buffer zone covering 367.59 km<sup>2</sup>, resulting in a total area of approximately 688.59 km<sup>2</sup> for the tiger reserve.

The Tiger Reserve encompasses three primary forest types: tropical moist deciduous forests predominate in the western Benne Block, characterized by higher rainfall. The central part features tropical dry deciduous forests, while the eastern region is home to southern tropical dry thorn forests. Furthermore, there are scattered patches of tropical semi-evergreen forest in the southwest and western areas of Mudumalai. Within this protected region, numerous endangered and vulnerable species find refuge, including elephants (*Elephas maximus*), tigers (*Panthera tigris*), gaurs (*Bos gaurus*), and leopards (*Panthera pardus*). The carnivore population includes wild dogs (*Cuon alpinus*), sloth bears (*Melursus ursinus*), striped hyenas (*Hyena hyena*), jackals (*Canis aureus*), jungle cats (*Felis chaus*), rusty-spotted cats (*Prionailurus rubiginosus*), and leopard cats (*Prionailurus bengalensis*). The Mudumalai Tiger Reserve is also home to a variety of ungulate species, such as chowsingha (*Tetracerus quadricornis*), wild pigs (*Sus scrofa*), barking deer (*Muntiacus vaginalis*), mouse deer (*Moschiola indica*), chitals (*Axis axis*), sambars (*Rusa unicolor*), and blackbucks (*Antelope cervicapra*).

### 2. Tiger Population as per All India Tiger Estimation

In 2014, a total of 67 unique tigers were captured in Mudumalai Tiger Reserve, resulting in a density of 8.04 (1.03) tigers per 100 square kilometers. By 2018, the reserve saw 1,081 tiger detections, including 31 images of cubs, with 103 individual adult tigers identified, leading to a density estimate of 6.19 (SE 0.64) tigers per 100 square kilometers. In 2022, a comprehensive study yielded 2,889 tiger images, identifying 114 tiger individuals and estimating a density of 7.72 (SE 0.72) tigers per 100 square kilometers. With such high tiger density, Mudumalai Tiger Reserve plays a crucial role as a major source population in the Western Ghats landscape.

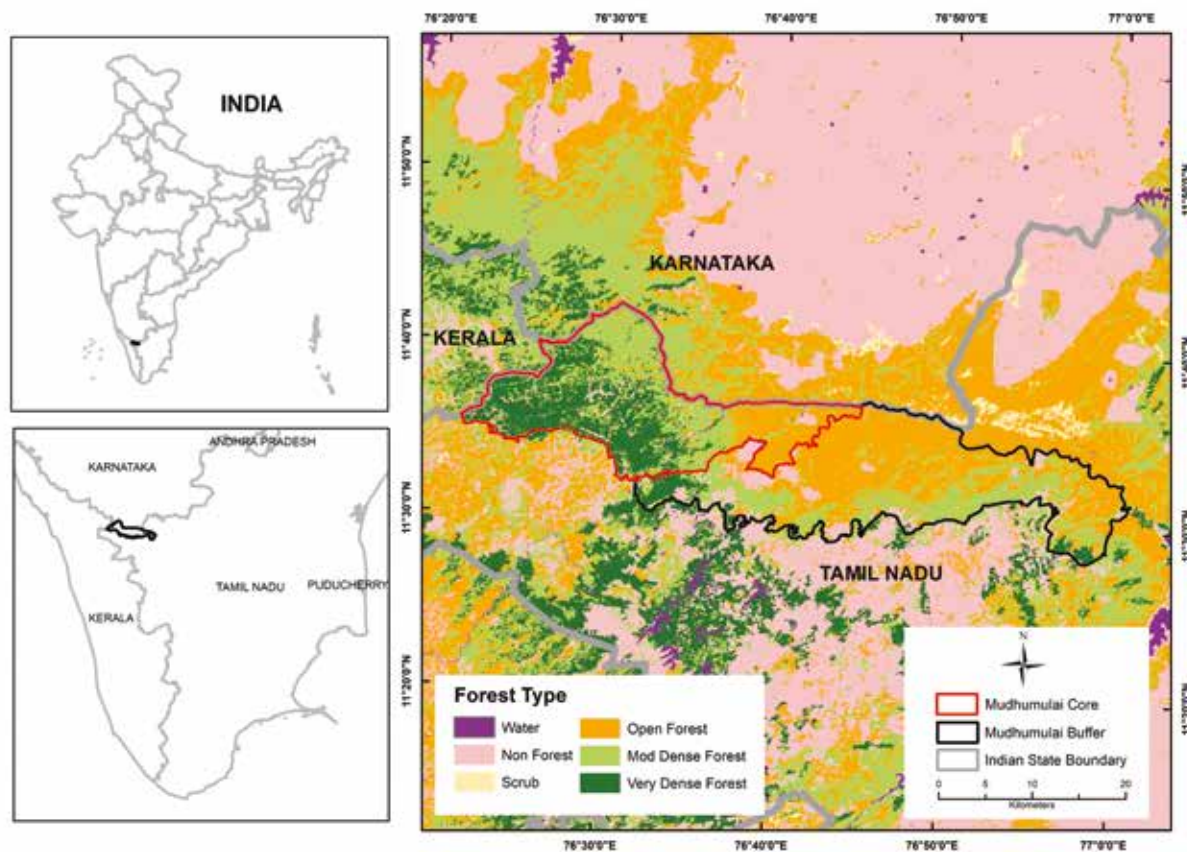


Figure 1: Map showing location of Mudumalai Tiger Reserve in the state of Tamil Nadu.

### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<ul style="list-style-type: none"> <li>The presence of human habitation within TR continues, leading to biotic pressures in specific pockets.</li> <li>The training component for staff is considered inadequate, posing a challenge to effective conservation efforts.</li> <li>Although some wildlife corridors have been identified, the process of acquiring them is still pending.</li> <li>The rise in the number of resorts and hotels in and around the Masanagudy area is exerting tourism pressures on the reserve.</li> </ul>	<ul style="list-style-type: none"> <li>Persistent human habitation within the TR continues, exerting biotic pressures in specific areas.</li> <li>Inadequate training for staff remains a consistent challenge, hindering effective conservation efforts.</li> <li>Unacquired wildlife corridors and increasing tourism pressures from resorts and hotels in specific areas pose ongoing threats.</li> </ul>	<ul style="list-style-type: none"> <li>The presence of 30 hamlets significantly disrupts wildlife habitat and movement. Prioritize relocating these communities outside the reserve to ensure their safety and protect the ecological integrity of the area.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<ul style="list-style-type: none"> <li>Visitor facilities within the reserve require further improvements.</li> <li>There is weak livelihood support for local communities through Ecodevelopment, resulting in their low level of participation in the protection of the Tiger Reserve.</li> <li>The increasing number of hotels around Mudumalai TR poses a threat to the ecological balance of the reserve.</li> <li>There is an escalating risk of conflicts with private hotels within the reserve.</li> <li>Proposed developmental projects around Mudumalai TR pose additional threats to its ecological integrity.</li> <li>There is a growing interest from research institutions in the Mudumalai area, providing an opportunity for scientific exploration and collaboration.</li> <li>The establishment of the TR Foundation, along with the support of the government and other agencies, presents an opportunity for enhanced conservation initiatives and sustainable management of the reserve.</li> </ul>	<ul style="list-style-type: none"> <li>Visitor facilities require continuous improvements, and weak livelihood support for local communities hampers their participation in TR protection.</li> <li>The high number of hotels poses a consistent threat to the ecological balance of Mudumalai TR.</li> <li>Conflicts with private hotels and proposed developmental projects remain persistent threats.</li> <li>Outdated technology contributes to inefficiencies in information handling and reporting within the reserve.</li> <li>Encroachment into elephant corridors by private resort owners remains an ongoing concern.</li> <li>The high pressure of tourism consistently challenges the TR, requiring a scientific examination of visitor limits.</li> <li>Weaknesses in communication technology, database management, and management information systems persist over the years.</li> </ul>	<ul style="list-style-type: none"> <li>Mitigate the impact of the Ooty-Mysuru highway: Implement effective measures to allow safe animal crossings and minimize disturbance on the highway passing through the reserve. Explore options like underpasses, overpasses, and animal corridors.</li> <li>Develop and enforce responsible tourism practices to minimize negative human-wildlife interactions. This could involve tourist education, restricting access to sensitive areas, and managing visitor numbers.</li> <li>Implement a comprehensive strategy to control and remove invasive plants like <i>Chromolaena odorata</i> and <i>Mikania micrantha</i>, which threaten native biodiversity.</li> <li>Collaborate with transportation authorities to find solutions for reducing traffic volume and noise pollution on the highways and state roads cutting through the reserve. Consider alternative routes, speed limits, and wildlife warning systems.</li> <li>Continue ongoing efforts with solar fences and de-weeding. These actions have proven effective in addressing specific threats and should be continued and expanded as needed.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>• Immediate action is recommended to bring the buffer area under the unified control of the Field Director.</li> <li>• The presence of 30 hamlets, including seven within the core Critical Tiger habitat, puts significant pressure on resources. Expedited relocation of villages from the core area is essential.</li> <li>• The Ecodevelopment Committee (EDC) programs must be actively implemented, as specified in section 7.2.1.1 and chapter 8 of the indicative plan for the buffer area, to address livelihood issues. EDCs should play a more prominent role in eco-tourism activities.</li> <li>• The dry summer months, occurring from February to May each year, worsen resource constraints, particularly in rain-deficient years, negatively affecting reserve management efficiency.</li> <li>• MTR grapples with challenges related to vehicular traffic, as the passage of one National Highway (Mysore-Ooty) and State Highways results in heavy traffic, with an average of 1000 vehicles passing through the reserve daily.</li> <li>• Ineffective management practices stem from inadequate intelligence and evidence gathering, coupled with the non-use of modern equipment due to a lack of young subordinate staff availability.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>• A manpower shortage exists, with approximately 40% of frontline staff positions, including 43% of Forest Guards, remaining vacant. Over-aged subordinates within the frontline protection staff exacerbate staffing issues. Urgent recruitment is needed for vacant posts, particularly Forest Guards (FGs) and Rangers</li> <li>• Concerns arise due to the absence of wildlife management training for senior officials and frontline staff members. Approval from the appropriate authority is necessary for the staff development plan. A detailed staff training program addressing gaps in wildlife management knowledge should be developed and implemented within a specific timeframe.</li> <li>• All values should be consolidated in the Tiger Conservation Plan (TCP), with provisions for periodic assessment and simultaneous determination of monitoring criteria.</li> <li>• Encroachment into the two main elephant corridors by private resort owners, facilitated by poor management control, jeopardizes the integrity of these critical passageways.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>The high pressure of tourism requires a scientific examination of the logic behind increasing visitor limits during vacation days above the Effective Permissible Carrying Capacity by deploying extra staff (10%).</li> <li>The increasing tourism infrastructure in the Sigur and Singara corridors poses a major threat to the Tiger Reserve (TR). Notifying an eco-sensitive zone around the TR is suggested to regulate tourism growth.</li> <li>Outdated technology, particularly in communication, database management, and the management information system, contributes to inefficiencies in information handling and reporting within the reserve.</li> <li>An institutionalized responsive system should be established to ensure regular maintenance of logs and processing of grievances, complaints, and feedback. A suitable mechanism for obtaining regular feedback, including through websites, should be introduced.</li> <li>Improvements are needed in maintaining records related to the execution of works under the Centrally Sponsored Scheme–Project Tiger (CSS-PT).</li> <li>Creation of water harvesting structures and water holes for wild animals during the pinch period, based on a survey, is recommended.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>National-level guidelines for climate change issues should be issued to assess impacts and adopt measures for adaptation, integrating them with the TCP. These guidelines should outline measures to reduce carbon loss and increase carbon capture without compromising the primary objectives of managing the wildlife habitat/TR, particularly the conservation of unique habitats and ecosystems, especially grasslands, for supporting wild fauna.</li> </ul>		
2018	<ul style="list-style-type: none"> <li>The initial 5-year plan (2012-2017) of the TCP has concluded, prompting the need for a renewed strategy. Expedite the completion and approval of TCP for the plan period 2017-2027.</li> <li>Relocation efforts for hamlets within the core area have commenced, but the slow pace hinders the alleviation of resource pressure caused by people and livestock in the TR. Urgently implement the proposed relocation of villages in three phases: Phase 1 (Bennai and Nellikarai), Phase 2 (Puliyalam, Mandakkarai, and Nagampally), and Phase 3 (Muduguli and Kundithazh).</li> <li>Approximately 40% of frontline staff positions are unfilled, resulting in the deployment of casual staff to anti-poaching camps. Insufficient augmentation of these camps further challenges wildlife protection efforts. Address frontline staff vacancies within the forest, ensuring essential positions are filled promptly.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Invasive species, including Lantana camara, Chromolaena odorata, Opuntia spp., and Parthenium spp., infest over 60% of MTR's core area, posing a threat to the native ecosystem. Initiate systematic mapping, planning, and implementation of a management plan to eradicate invasive alien species, particularly Lantana camara.</li> <li>MTR lacks a unified command structure for its core and buffer areas. Administrative control of Mukurthy National Park, housing a significant Nilgiri Tahr population, resides with MTR, despite not being part of the core area. Bring the buffer area under the unified control of the Field Directorate to enhance coordinated management efforts. Recognize Mukurthy National Park as a satellite core of Mudumalai Tiger Reserve (MTR) for improved conservation administration.</li> <li>Encouraging the use of materials and signage is essential to enhance awareness about MTR's prestigious designations, including Biosphere Reserve, World Heritage Site, Elephant Reserve, and Important Bird Area (IBA).</li> <li>The absence of reported elephant breeding in Theppakadu's elephant camp prompts the need for an investigation into the factors contributing to this phenomenon. Undertake non-invasive physiological/hormonal studies related to stress conditions in camp elephants to assess and address the issue of non-breeding.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>A significant portion of frontline protection staff consists of overaged subordinates, impacting their effectiveness in managing human-elephant conflicts, ensuring forest protection, and regulating traffic within MTR.</li> <li>Conduct ecological studies to comprehend the impact of forest fires and changes in microclimatic conditions contributing to the spread of invasive species.</li> </ul>		
2022	<ul style="list-style-type: none"> <li>The presence of 30 hamlets, housing around 2000 people and their livestock within the core area of MTR, hampers effective management efforts. Immediate relocation of the 30 hamlets within the core area is imperative, with the ongoing management efforts requiring swift implementation.</li> <li>The Chief Wildlife Warden should actively pursue approval for the Tiger Conservation Plan spanning 2020-21 to 2029-30, as submitted by the Field Director.</li> <li>Heavy traffic on the 15.55 km stretch of Mysore-Gudalur NH 766/NH 181 and the 14.3 km of state highways connecting Theppakadu, Masinagudi, and Ooty, passing through the tiger reserve, poses a significant disturbance and causes forest fragmentation, hindering wildlife movement. Constructing a road over-bridge is essential to mitigate disturbance, habitat fragmentation, and the risk of accidents.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>For the safety of wild animals, the electric line passing through the core area should be either taken underground or insulated.</li> <li>The dry conditions during the summer months (February-May), particularly in rain-deficient years, exacerbate challenges and adversely impact the overall management efficiency of the reserve.</li> <li>Remote areas, especially the tri-junction, are porous and vulnerable to poachers and smugglers, posing a threat to wildlife conservation efforts. Strengthen and organize nighttime patrolling to counter the constant threat of poaching and smuggling. Expedite the establishment of three additional anti-poaching camps on the interstate border for enhanced protection, as outlined in the TCP.</li> <li>Review the state government's staff transfer policy, extending the period beyond three years to retain experienced staff and enhance knowledge about the tiger reserve.</li> <li>Address the wage disparity among anti-poaching staff conducting joint patrolling with neighboring states; consider rationalizing wages to boost morale.</li> <li>Inordinate delays in the release of central funds, coupled with insufficient funds for habitat improvement, raise concerns about the adequacy of financial resources for effective reserve management.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>The TR is heavily infested with exotic/invasive weeds such as Lantana, Eupatorium, Opuntia, and now, Senna spectabilis, posing a threat to the native ecosystem. Prioritize the removal of invasive weeds with special attention to the court-mandated removal of Lantana and Senna spp.</li> <li>The proliferation of ecologically incompatible private resorts around MTR contributes to habitat degradation and disrupts the ecological balance. Check the proliferation of tourist hotels and resorts around the tiger reserve to maintain a disturbance-free wildlife corridor and reduce pressure on the reserve.</li> <li>Extensive TNEB infrastructure, including high-tension cables, flume channels originating from Singara, settlements, and power-generation units, serves as constant sources of disturbance within the tiger reserve.</li> <li>Ensure timely release of the Central Share of Project Tiger funds to guarantee timely wages for grassroots workers and the timely execution of planned activities.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- The presence of 30 villages within the core area is seen as a significant threat to wildlife habitat and movement. It is suggested that relocating these communities is of paramount importance to ensure their safety and preserve the ecological integrity of the reserve.



- b. Heavy traffic on the Mysuru-Ooty highway and state roads disrupts wildlife movement and raises the risk of accidents. Constructing road over-bridges along these critical stretches is considered essential to mitigate disturbance and habitat fragmentation.
- c. The proliferation of invasive species like Lantana and Senna spectabilis threatens the native ecosystem. Prioritizing the removal of these invasive weeds, with particular attention to court-mandated actions, is deemed crucial.
- d. Inadequate training for staff hinders effective conservation efforts. It is considered vital to invest in comprehensive training programs for frontline personnel to equip them with the necessary knowledge and skills.
- e. The high number of hotels and resorts surrounding the reserve exerts pressure on wildlife corridors and disrupts the ecological balance. Implementing stricter regulations and controls on tourism development is deemed necessary to safeguard the habitat and minimize disturbance.
- f. Outdated technology hampers efficient information management and reporting. It is considered crucial to upgrade communication systems, database management, and the management information system for improved data collection, analysis, and decision-making.
- g. Encroachment into elephant corridors by private resorts remains a concern. It is suggested that collaboration with relevant authorities be strengthened to address these issues and protect critical wildlife corridors.
- h. The high pressure of tourism necessitates a data-driven approach. It is recommended to conduct a scientific examination of visitor limits to ensure tourism remains sustainable and minimizes negative impacts on the reserve.
- i. Addressing these pressing issues through collaborative efforts and strategic investments is advised to ensure Mudumalai Tiger Reserve continues to thrive as a haven for wildlife and a vital component of India's biodiversity heritage.

## 5. Conclusions

Mudumalai Tiger Reserve stands as a crucial stronghold for the Western Ghats landscape, boasting a high tiger density that contributes significantly to the conservation of this iconic species. However, the reserve faces challenges exacerbated by heavy tourism, leading to heightened human-wildlife conflicts, and the proliferation of invasive species, posing threats to the delicate ecosystem. While commendable efforts such as the installation of solar fences and regular de-weeding have been undertaken by the forest department, urgent action is required to relocate the 30 hamlets within the core area to alleviate pressure on resources. Additionally, the presence of heavy traffic on key highways passing through the reserve disrupts wildlife movement and warrants appropriate mitigation measures. Despite these challenges, Mudumalai Tiger Reserve, along with Bandipur, Nagarhole, Wayanad, and Sathyamangalam, serves as a crucial habitat supporting the world's largest populations of wild tigers and elephants. Forest managers are urged to address these pressing issues while leveraging the reserve's significance in biodiversity conservation and ensuring the sustainable coexistence of wildlife and local communities.

# SATHYAMANGALAM TIGER RESERVE

## 1. Brief Description

The Sathyamangalam Tiger Reserve is situated at 11° 38' 24" N, 77° 13' 34" E, covering an extensive area of 1,411.6 km<sup>2</sup>. This reserve plays a crucial role as a wildlife corridor within the Nilgiri Biosphere Reserve, connecting the Western Ghats and the Eastern Ghats. It serves as a genetic link between neighboring protected areas, including the Billigiri Ranganatha Swamy Temple Wildlife Sanctuary, Sigur Plateau, Mudumalai National Park, and Bandipur National Park.

The Sathyamangalam forest primarily consists of tropical dry forest and belongs to the South Deccan Plateau dry deciduous forests ecoregion. Within this region, five distinct forest types are identified: tropical evergreen (Shola), semi-evergreen, mixed-deciduous, dry deciduous, and thorn forests.

Notable carnivores present in the reserve include the tiger (*Panthera tigris*), leopard (*Panthera pardus*), sloth bear (*Melursus ursinus*), and striped hyena (*Hyena hyena*). The diverse herbivore population features elephants (*Elephas maximus*), gaur (*Bos gaurus*), chital (*Axis axis*), blackbuck (*Antelope cervicapra*), sambar (*Rusa unicolor*), barking deer (*Muntiacus vaginalis*), four-horned antelope (*Tetracerus quadricornis*), and wild pig (*Sus scrofa*). The unique ecological composition and connectivity of SMTR contribute significantly to the biodiversity conservation efforts in the region.

## 2. Tiger Population as per All India Tiger Estimation

In 2014, a total of 52 unique tigers were captured in the Sathyamangalam Tiger Reserve, with a calculated density of 2.98 (0.38) tigers per 100 square kilometers. By 2018, the reserve recorded 709 tiger detections, including 35 cubs, leading to the identification of 83 individual tigers, and the tiger density was estimated to be 3.75 (SE 0.43) per 100 square kilometers. In the next comprehensive cycle of 2022, 1520 tiger images yielded identification of 85 individual tigers, resulting in a calculated tiger density of 4.24 (SE 0.46) tigers per 100 square kilometers.

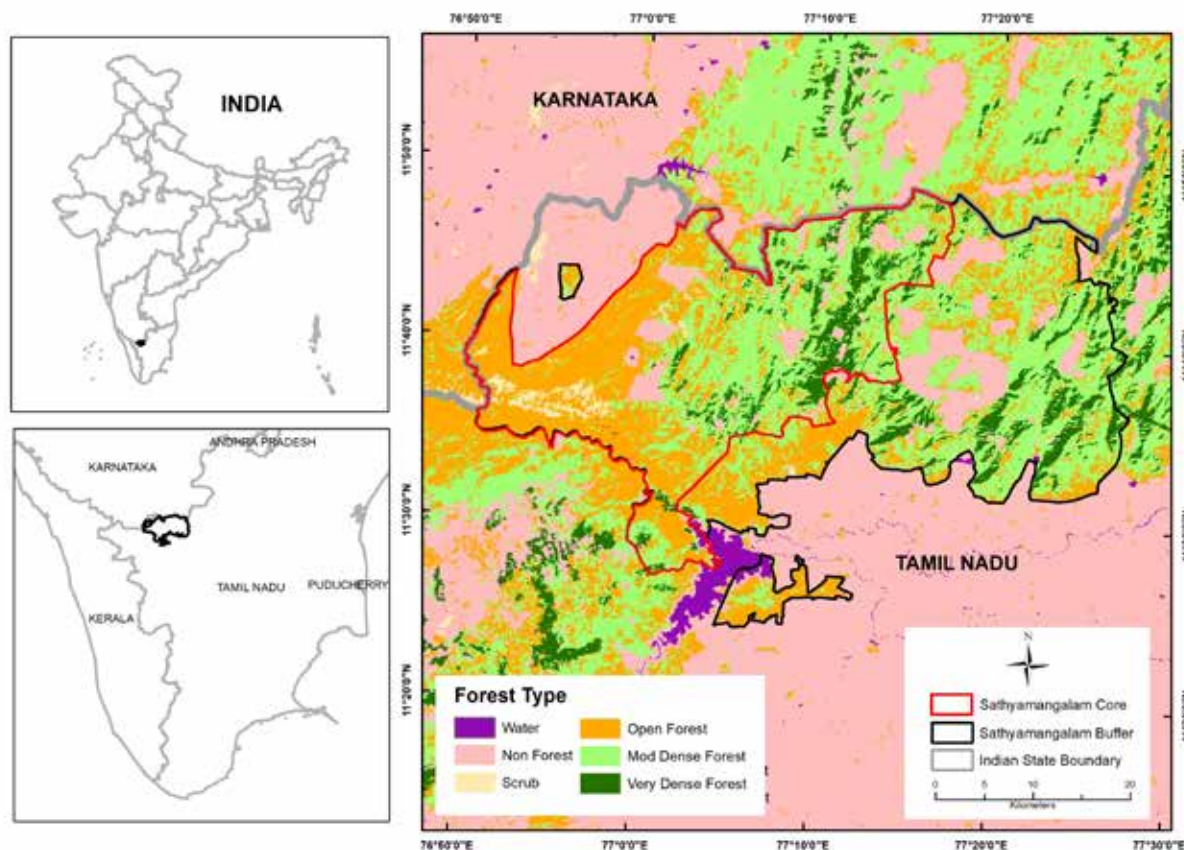


Figure 1: Map showing location of Sathyamangalam Tiger Reserve in the State of Tamil Nadu.

### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>None of the officers or subordinate staff in the reserve has received specialized training or holds degrees/diplomas in wildlife management.</li> <li>Approximately 41% of frontline staff positions, including Forest Guards and Forest Watchers, remain vacant, with a significant portion of the existing staff belonging to higher age groups. Fill the existing vacancies among frontline staff to address the severe shortage of wildlife-trained personnel.</li> </ul>	<ul style="list-style-type: none"> <li>Persistent weaknesses include the absence of specialized training for reserve staff, with 41% frontline vacancies and a higher age demographic.</li> <li>Ongoing delays in approving the revised TCP since January 2018 highlight a consistent issue of delayed state fund releases.</li> <li>The continuous presence of tribal settlements challenges the core area's inviolability, emphasizing the need for a voluntary relocation process.</li> </ul>	<ul style="list-style-type: none"> <li>The presence of developmental projects and mining activities within the Sathyamangalam landscape threatens the reserve's integrity. Implement stricter regulations and explore alternative locations to minimize their impact on the source value of the Tiger Reserve.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Develop and implement a training program for wildlife-trained staff, preceded by a thorough training needs assessment.</li> <li>Reinforce anti-poaching measures within the reserve to enhance wildlife protection efforts.</li> <li>Prioritize the preparation of the TCP, including the formulation of a security plan and staff development plan, ensuring approval from competent authorities and seamless integration with the TCP.</li> <li>There are nine tribal and 18 tribal revenue settlement enclaves within the core area, housing around 1705 families and occupying 12,800 hectares. While legally excluded from the core area, their presence compromises the inviolability of the core zone. Initiate a voluntary relocation process for human settlements within the core area, emphasizing increased livelihood activities through EDCs in the interim.</li> <li>Enhance the effectiveness of JFM institutions, including Village Forest Committees (VFCs) and EDCs, in the region.</li> <li>Sections of NH 209 and a State Highway, totaling 28 km and 22 km, respectively, pass through the Tiger Reserve. Heavy vehicular traffic on these roads poses threats such as poaching, road kills, and forest fires. The roads also facilitate the transportation of illegal timber and animal articles.</li> </ul>	<ul style="list-style-type: none"> <li>Invasive species infestations spanning 37,000 hectares persist as a recurring issue, requiring aggressive and time-bound eradication.</li> <li>Insufficient infrastructure development, especially poor road conditions, remains a consistent challenge affecting patrolling and communication.</li> <li>Human-elephant conflicts, exacerbated by late compensation payments, necessitate urgent fund allocations and anti-poaching measures.</li> <li>Challenges related to habitat degradation, water scarcity, and insufficient eco-tourism infrastructure have persisted over the years.</li> <li>Enclave villages, lack of comprehensive databases, and transfer policies affecting staff continuity are ongoing concerns.</li> <li>Religious activities causing disturbances, traffic on NH 209, and the impact of linear intrusions are consistent issues affecting wildlife.</li> <li>Encroachments under the Forest Rights Act and discrepancies in TCP need periodic reviews to address evolving challenges.</li> <li>Continuous cattle kills in specific ranges signal localized hotspots requiring targeted interventions.</li> <li>Conservation efforts hampered by inadequate financing for eco-development committees emphasize the need for augmented funding.</li> </ul>	<ul style="list-style-type: none"> <li>Numerous settlements reside within the reserve's boundaries, creating ecological disruptions. Offer community support and incentives for voluntary relocation, particularly in Tengumarahada village, a critical habitat for wildlife movement.</li> <li>The proliferation of invasive species like Lantana and Chromolaena odorata poses a major threat to native biodiversity. Implement a comprehensive eradication program, prioritizing areas with high ecological value.</li> <li>The heavy traffic volume on NH 209, passing directly through the core area, significantly disrupts wildlife movement. Explore alternative routes, construct wildlife corridors, or implement stricter speed limits to ensure animal safety and minimize disturbance.</li> <li>Manage and restore grassland habitats within the reserve, which are vital for herbivores and their predators. Implement controlled burning, remove invasive species, and promote native plant growth to create a healthier and more diverse ecosystem</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>There are 57 temples and places of worship inside the reserve, attracting a large number of visitors during periodic visits and annual festivals. This poses a serious concern for reserve management.</li> <li>Exercise caution in developing eco-tourism activities in STR, ensuring that such initiatives align with the approved TCP by the NTCA.</li> <li>Approximately 200 km of roads, crucial for patrolling, supplies, and communication, are in poor condition, affecting overall accessibility and management operations.</li> <li>A significant portion of the reserve, spanning 37,000 hectares, is infested with invasive alien species posing a threat to the native ecosystem. Integrate the regular removal of invasive alien species into habitat management activities, aligning with sound scientific principles during the TCP preparation.</li> <li>Strengthen the fire protection regime in STR, particularly given the generally dry conditions in the area.</li> <li>Funds from the state government are consistently released late, impacting the timely execution of crucial conservation and management activities within the reserve.</li> <li>Urgently reconstitute the State Level Steering Committee and convene its inaugural meeting promptly.</li> </ul>	<ul style="list-style-type: none"> <li>Waterspread areas providing scope for illegal cultivation in Bhavanisagar Dam underscore the ongoing threat.</li> <li>Insufficient attention to climate change impacts and integration into the TCP reveals a consistent gap in addressing emerging challenges.</li> <li>Regular monitoring and documentation of habitat management activities, including weed removal, are crucial for informed decision-making.</li> <li>Ongoing concerns regarding entry fees, time barriers, and the need for wildlife-friendly measures emphasize regulatory gaps.</li> <li>Lack of awareness among communities regarding protected area management remains a persistent challenge.</li> <li>The absence of a comprehensive wildlife dynamics database hinders effective management decisions over the years.</li> <li>Lack of infrastructure development and poor road conditions consistently hinder patrolling and communication within the reserve.</li> <li>The absence of timely fund releases from the state government has been a recurring issue impacting conservation activities.</li> </ul>	

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Address the high level of human-elephant conflict by implementing Electric Proof Trenches (EPTs) and installing solar-electric fences in sensitive areas, accompanied by inspection paths for regular maintenance.</li> <li>Re-examine the locations and proposed construction of check dams and percolation ponds based on scientific wildlife management principles, as reported in the "Developing Water Management Strategy and Action Plan" by Care Earth Trust.</li> <li>Issue national-level guidelines for assessing climate change impacts, adaptation measures, and their integration into the TCP, emphasizing carbon reduction and capture without compromising wildlife habitat conservation objectives.</li> </ul>		
2018	<ul style="list-style-type: none"> <li>The Bengaluru-Coimbatore highway, NH 209, passing through the park's core area, includes a challenging 20 km ghat road section with 27 sharp hairpin bends, leading to frequent road kills.</li> <li>Invasive species such as Lantana, Prosopis, Eupatorium, Parthenium, and Senna cover significant areas, with 25,000 ha of Lantana and 7,000 ha of Prosopis along the River Moyar's banks alone. Removal of invasive species, should be pursued aggressively and in a time-bound manner, necessitating additional funds for effective eradication.</li> <li>Nine pilgrimage sites (temples) are located inside the core area, with five attracting substantial visitor numbers, including two in high-density tiger habitats.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Although legally excluded, the presence of seven tribal villages and 11 revenue villages with nearly 1,700 families challenges the inviolability of the core area.</li> <li>Border villages, particularly Bhawanisagar, Talawady, and Kadambur, witness heightened human-wildlife conflicts, indicating a need for focused mitigation measures. Given that Sathyamangalam Tiger Reserve is primarily a human-dominated landscape, alternative livelihoods must be established for ethnic tribes in core and buffer areas through EDCs and VFCs, reducing dependency on forest resources.</li> <li>Augmenting financing for eco-development committees is imperative to strengthen their role in supporting conservation and community engagement initiatives.</li> <li>Engaging local communities in ecotourism management, particularly through programs like Vannapurni, can be instrumental in developing ecotourism activities in the nascent stages of Sathyamangalam Tiger Reserve.</li> <li>Immediate efforts are essential to fill existing vacancies, exceeding 50%, in frontline staff (Forest Guards and Forest Watchers) for enhanced park protection and management.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Adequate allocation of funds is crucial for swift compensation payments and the construction of effective barriers, such as EPT, to address human-elephant conflicts.</li> <li>Establishment of more anti-poaching camps with trained personnel is essential to fortify protection activities within the reserve.</li> <li>The positive implementation of the State Government-funded forest pond scheme, allocating Rs. 45.0 lakhs for developing nine ponds, especially crucial for the dry summer months, is an encouraging initiative.</li> <li>Talwady Range reports a significant number of cattle kills, indicating a localized hotspot for human-wildlife conflict, requiring targeted interventions.</li> <li>The revised TCP, updated following NTCA observations, awaits approval from the NTCA since January 2018, requiring swift action for clearance.</li> <li>The Tiger Reserve's human resource development plan should be diligently implemented to train staff at various levels, with the commendable performance-based reward system requiring continued reinforcement.</li> <li>Proper guidelines should be issued for quantifying the carbon stock in Sathyamangalam Tiger Reserve, which authorities estimate to be around 7.5 million tons.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>The 24 ongoing research programs in Sathyamangalam Tiger Reserve need meticulous monitoring, and research findings should be seamlessly integrated to enhance park management practices.</li> <li>Implementing entry fees or time barriers, such as limiting vehicles to 5000/day, can regulate linear intrusion and future expansion around the reserve.</li> </ul>		
2022	<ul style="list-style-type: none"> <li>Anthropogenic activities within the tiger reserve and resource dependence on the fringes present significant challenges. Initiate action for the relocation of 34 hamlets within the core area of the Sathyamangalam Tiger Reserve.</li> <li>Manage encroachments under the Forest Rights Act 1996 to ensure inviolate status of the core area.</li> <li>Address discrepancies in the TCP regarding core and buffer areas, total reserve area, and village counts during the mid-term plan review.</li> <li>Linear intrusions like National Highway 209, state highways, and major roads contribute to forest fragmentation and restrict the movement of wildlife within the tiger reserve. Cease traffic on NH 209 passing through the core area and implement wildlife-friendly measures like flyovers or underpasses, as directed by the Madras High Court.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>Allocate necessary resources for infrastructure development and habitat improvement in the Sathyamangalam Tiger Reserve, established in 2013.</li> <li>The need for wildlife-centric management infrastructure is emphasized in the Management Effectiveness Evaluation of Tiger Reserves in India - 5th Cycle.</li> <li>Concerns about land degradation and water scarcity within the tiger reserve warrant attention.</li> <li>Invasive weeds pose a threat to the wildlife habitat, affecting the natural ecosystem. Prioritize the removal of invasive weeds like Lantana, Eupatorium, and Senna spp. to enhance the habitat for wild animals. Monitor and document the removal of Senna spectabilis for at least 5 years to assess its impact on the habitat.</li> <li>Discourage and regulate commercial crop cultivation, such as banana and areca nut, within enclaved villages to prevent negative impacts on wildlife habitats.</li> <li>Lack of awareness among communities about protected area management aspects poses a challenge.</li> <li>Strengthen nighttime patrolling to counter constant threats of poaching and smuggling.</li> <li>Religious activities within the tiger reserve cause disturbances to wildlife and their habitats.</li> <li>Underground or insulate electric lines in the core area to prevent wildlife casualties, particularly among elephants.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>The long pinch period during summer weather impacts the tiger reserve's ecosystem.</li> <li>Inadequate databases on past wildlife interactions with habitats hinder effective management.</li> <li>Poor eco-tourism infrastructure needs improvement to enhance visitor experiences.</li> <li>The waterspread area of Bhavanisagar Dam provides opportunities for illegal cultivation, posing a threat.</li> <li>Vacancies in the cadre of frontline staff and a lack of a homogenous blend of experienced and young staff raise concerns for better protection and management. Review the state government's policy of transferring frontline staff every 3 years to retain experienced personnel and enhance reserve knowledge.</li> <li>A vacancy in the cadre of the Field Director, with the present official holding additional charges, affects constant presence and efficient management.</li> <li>The lack of a comprehensive database on wildlife dynamics, flora, and human dimensions hinders informed decision-making.</li> <li>The presence of a larger number of enclave villages poses challenges to effective tiger reserve management.</li> <li>Challenges related to NTFP collection and encroachment further complicate conservation efforts within the tiger reserve.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>Protect the germination of Cenchrus cilia grass near the Moyar River bank in Peerkadam Beat from deer grazing by using uprooted thorny Prosopis trees/shrubs as fencing to suppress possible regermination of Prosopis sp.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- It is recommended that the significant shortage of wildlife-trained personnel, with approximately 41% of frontline staff positions remaining vacant, be urgently addressed to enhance park protection and management.
- Another critical concern is the presence of invasive alien species infesting a significant portion of the reserve, spanning 37,000 hectares, posing a threat to the native ecosystem. It is recommended that the regular removal of these invasive species be integrated into habitat management activities, aligning with sound scientific principles.
- Additionally, the timely execution of crucial conservation and management activities within the reserve is consistently impacted by the delayed release of funds from the state government. It is essential that this issue be addressed, ensuring adequate and timely allocation of funds for effective reserve management.
- Furthermore, the inviolability of the core area is compromised by the continuous presence of tribal settlements within it. It is recommended that a voluntary relocation process for these settlements be initiated, coupled with increased livelihood activities through Economic Development Committees (EDCs) in the interim, to help mitigate this challenge and enhance reserve integrity.
- Lastly, the high level of human-elephant conflict can be addressed by implementing Electric Proof Trenches (EPTs) and installing solar-electric fences in sensitive areas, accompanied by inspection paths for regular maintenance, crucial for minimizing conflict incidents and ensuring wildlife protection.

## 5. Conclusions

The tiger population and density in Sathyamangalam Tiger Reserve have shown promising increases, indicating its crucial role as a source population in the landscape. However, the reserve faces significant challenges, including the prevalence of developmental projects and mining activities, which must be mitigated to preserve its source value. Human settlements within the reserve, though legally excluded, continue to impact biodiversity and necessitate community-supported voluntary relocation efforts, particularly in areas like Tengumarahada, vital for wildlife connectivity. The intrusion of invasive species and disturbances from traffic movements on NH 209 further threaten the reserve's ecological integrity. To address these issues, proactive habitat management strategies, especially for grasslands, are essential to enhance habitat quality. Forest managers must balance conservation efforts with sustainable development practices to ensure the long-term viability of the tiger reserve and its surrounding landscape.



## SRIVILLIPUTHUR-MEGAMALAI TIGER RESERVE

### 1. Brief Description

Srivilliputhur-Megamalai Tiger Reserve in Tamil Nadu, India, marked as the country's 51st tiger reserve, was officially designated through a notification in February 2021. Encompassing a sprawling area of 1016.57 square kilometers, it comprises a core region spanning 641.86 square kilometers and a buffer zone extending over 374.70 square kilometers. Positioned across the Virudhunagar, Theni, and Madurai districts, this reserve evolved by upgrading the Srivilliputhur Grizzled Giant Squirrel Wildlife Sanctuary and the Megamalai Wildlife Sanctuary, both forming the core expanse of the tiger reserve.

Nestled in the crucial southern-eastern projections of the Western Ghats, within south-central Tamil Nadu, the landscape of Srivilliputhur-Megamalai shares borders with Kerala's Periyar Tiger Reserve in the southwest. Furthermore, it establishes spatial connections with the Anamalai Tiger Landscape in the northwest and links to Tamil Nadu's Kalakadu Mundanthurai Tiger Reserve, extending to the Kanyakumari Hills in the southernmost part of the country.

The undulating terrain of Srivilliputhur and the hilly tracts of Megamalai serve as significant habitats, breeding grounds, and home ranges for tigers migrating from the neighboring Periyar Tiger Reserve and the nearby Anamalai Tiger Reserve. The forested habitats in the Srivilliputhur region, largely uninhabited and undisturbed, play a crucial role as effective buffer zones for the tigers of the Periyar Tiger Reserve. Additionally, they provide essential grounds for genetic exchange among the tiger populations in the Anamalai region.

### 2. Tiger Population as per All India Tiger Estimation

A total of 167 tiger images were captured during the survey, leading to the identification of 12 individual tigers. The estimated tiger density within the area stood at 1.05 tigers per 100 square kilometers, with a standard error of 0.31.

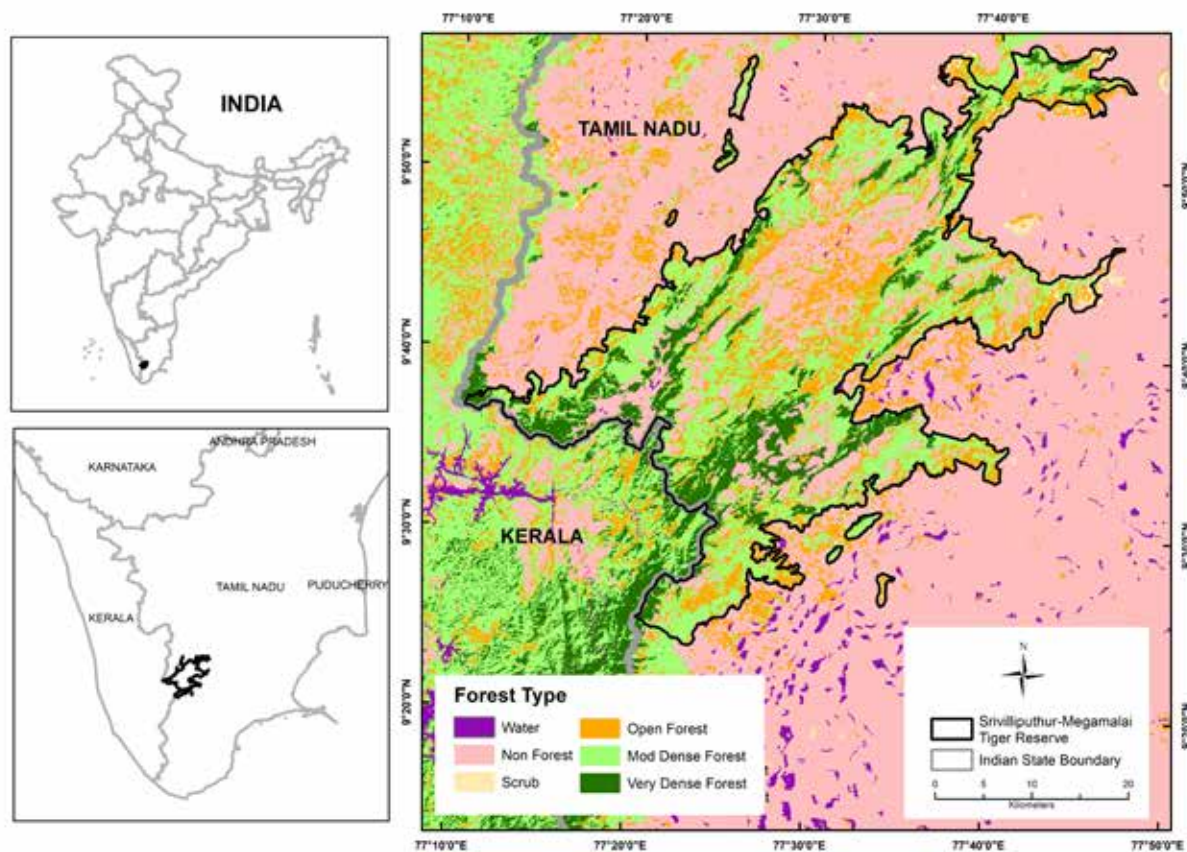


Figure 1: Map showing location of Srivilliputhur Megamalai Tiger Reserve in the state of Tamil Nadu.

### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>SMTR, established in February 2021 amid the COVID-19 peak, lacks essential infrastructure such as anti-poaching camps, roads, residential and office buildings, and a VHF network. Inadequate funds result in a shortage of staff, vehicles, and camera traps for regular wildlife monitoring.</li> </ul>		<ul style="list-style-type: none"> <li>It's crucial to note that SMTR, despite its current low tiger density, holds potential for sustaining a thriving resident tiger population through effective wildlife and habitat management strategies. Strengthening linkages with adjacent areas, particularly with the KMTR cluster, is imperative. This connectivity would facilitate tiger movement across extended habitats,</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Given SMTR's status as a new tiger reserve, focused attention is necessary, requiring an independent Field Director instead of the present additional charge arrangement. The government should expedite the acquisition of abandoned estates for a disturbance-free wildlife habitat.</li> <li>Considering the wildlife sanctuary status of the core area, declaring it a Critical Wildlife Habitat is recommended. Canceling community rights granted under the Forest Rights Act in the core area is essential.</li> <li>Due to a funding shortage and the absence of a Tiger Conservation Foundation, anti-poaching watchers lack adequate rations over the years. This financial support is vital for sustaining anti-poaching camp laborers and essential infrastructure in SMTR.</li> <li>Revisiting the sanctioned staff strength of SMTR is required to redefine and sanction the actual number of staff members needed for increased workload management.</li> <li>CWLW Tamil Nadu must take steps to establish a Tiger Conservation Foundation, securing funds from neighboring tiger reserves and the adjoining Eco Development Division.</li> </ul>		<p>fostering the establishment of new meta-populations. By implementing appropriate measures, SMTR can evolve into a significant contributor to tiger conservation efforts, ensuring the long-term viability of tiger populations in the region.</p>



MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Without a Tiger Conservation Plan, focused management efforts are hindered. Forest land encroachment by silk mafias from cities like Chennai and Madurai presents a major challenge. Urgent completion of the SMTR management plan by GTF experts is essential. On-site assessment and cooperation with field officers, along with stakeholder input, are crucial for a timely plan.</li> <li>Adequate funds from the state government and NTCA are crucial to strengthen TR management. The unavailability of the TCP should not hinder fund allocation.</li> <li>Extensive cultivation of cash crops like tea, coffee, and cardamom causes habitat fragmentation, especially affecting endemic species, leading to biodiversity loss. Rampant use of chemicals in tea estates is polluting water bodies and posing harm to wildlife. The tiger reserve management must intervene to halt the use of harmful chemicals.</li> <li>Widespread infestation of weeds like Lantana, Eupatorium, and Soma species adversely impacts the tiger reserve's ecological health.</li> <li>Among 53 EDCs, only four are active, indicating a gap in community engagement and participation in conservation initiatives. Activation of the 49 defunct eco-development committees is necessary to support management due to a shortage of field staff and APC laborers.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Grazing cattle owned by absentee landlords, along with prevalent ganja cultivation, pose serious threats within the tiger reserve.</li> <li>Tribal communities in hamlets, allocated 4955 ha of reserve forest, face challenges in collecting minor forest produce for their needs, as per the Forest Rights Act of 2006.</li> <li>Illegal pattas granted by the revenue department for forest land declared RF/RL under the Tamil Nadu Forest Act before 1980 need examination and cancellation. Actions under the Forest Conservation Act, 1980, should be initiated.</li> <li>With a notified ESZ in the core area, regulating destructive activities like grazing by absentee owners' sheep and goats is imperative.</li> <li>Due to a severe resource crunch, CWLW Tamil Nadu should arrange an adequate number of camera traps and smartphones for M-STRIPES patrolling in SMTR.</li> <li>Extensive road networks, including national, state highways, and the large penstocks of the hydroelectric power contribute to habitat fragmentation, disrupting wildlife due to vehicular movement. The power generation company, in consultation with the Field Director, should provide ramps across penstocks to facilitate safe wildlife movement.</li> </ul>		

#### 4. Suggested key management recommendations

- a. Critical infrastructure like anti-poaching camps, roads, and residential buildings is lacking in SMTR, exacerbated by inadequate funds leading to shortages of staff and equipment. Urgent allocation of funds to develop essential infrastructure, including anti-poaching camps, roads, and residential buildings, and ensuring adequate staffing and equipment provision for effective wildlife monitoring is recommended.
- b. Focused attention is hampered by the current arrangement of additional charge for the Field Director, while disturbance-free wildlife habitats are disrupted by the absence of acquired estates. It is recommended to appoint an independent Field Director for dedicated management. Furthermore, expediting the acquisition of abandoned estates is suggested to secure undisturbed wildlife habitats within SMTR.
- c. The wildlife sanctuary status of the core area necessitates its declaration as a Critical Wildlife Habitat, while conservation efforts are hindered by community rights granted under the Forest Rights Act. Declaration of the core area as a Critical Wildlife Habitat and cancellation of community rights granted under the Forest Rights Act are recommended to strengthen conservation efforts within SMTR.
- d. Focused management is impeded by the absence of a Tiger Conservation Foundation and plan, while forest land encroachment by silk mafias presents a significant challenge. Establishment of a Tiger Conservation Foundation and expedited initiation of the SMTR management plan by engaging expert assistance are recommended. Additionally, actions to combat forest land encroachment are advisable to ensure focused and effective management.
- e. Habitat fragmentation and chemical pollution, posing threats to endemic species and water bodies, are caused by extensive cash crop cultivation. Intervention to halt harmful chemical use in cash crop cultivation and implementation of measures to mitigate habitat fragmentation are recommended to safeguard endemic species and water ecosystems within SMTR.

#### 5. Conclusions

Srivilliputhur Megamalai Tiger Reserve (SMTR), though newly established and facing challenges like low tiger density and inadequate infrastructure, holds immense potential for becoming a thriving tiger habitat. By implementing effective wildlife and habitat management strategies, the reserve can nurture a healthy resident tiger population. Furthermore, strengthening linkages with the Kalakad Mundanthurai Tiger Reserve (KMTR) cluster will create a contiguous habitat, enabling tigers to move freely and establish new meta-populations. This will significantly contribute to tiger conservation efforts in the region and ensure the long-term viability of tiger.





MANOJ DHOLAKIA

## AMRABAD TIGER RESERVE

### 1. Brief Description

Nestled within the Nallamala hills of southern Telangana, India, Amrabad Tiger Reserve (ATR) sprawls across 2,611 square kilometers, encompassing both core and buffer areas. Geographically (78°40' N to 79°42' N and 16°00' E to 16°70' E), it is positioned approximately 150 km south of Hyderabad along the Krishna River's southern bank. Predominantly classified as southern tropical dry deciduous miscellaneous forest, the reserve boasts diverse flora, including majestic trees like Terminalia arjuna, Terminalia elliptica, Boswellia serrata, and Syzygium cumini as well as flourishing grasslands. The reserve fosters a remarkable assemblage of fauna, including apex predators such as tigers, leopards, and sloth bears alongside opportunistic feeders like wild dogs and striped hyenas. Additionally, it serves as a vital sustenance ground for a diverse array of herbivore species, viz. sambar, chital, chousingha, nilgai, mouse deer, wild pig, and chinkara. Beyond its ecological significance, Amrabad Tiger Reserve holds immense heritage value. Neighboring the Nagarjunasagar Srisailem Tiger Reserve of Andhra Pradesh, it boasts a tapestry of ancient temples, caves and sacred groves, making it a captivating blend of nature and heritage.

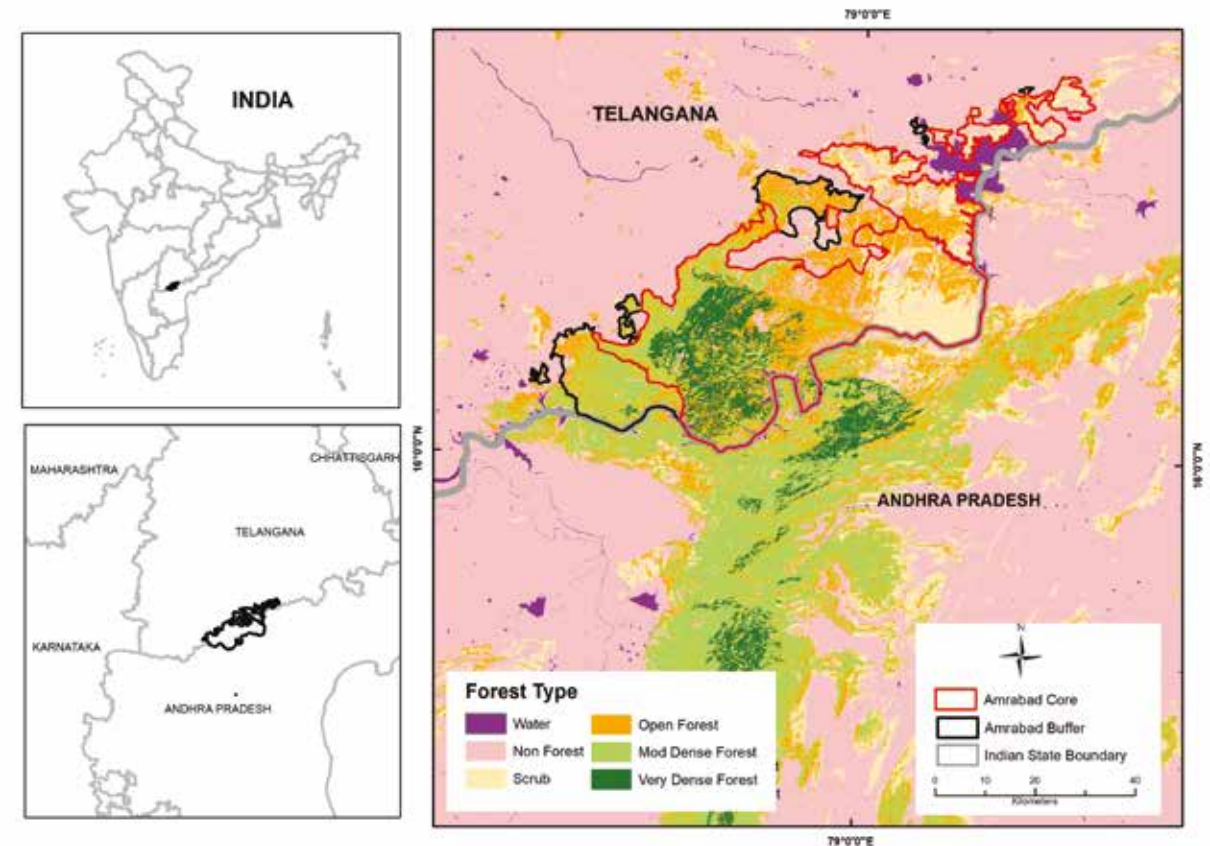


Figure 1: Location of Amrabad Tiger Reserve in the state of Telangana

## 2. Tiger Population as per All India Tiger Estimation

In 2018, camera traps within the reserve identified 7 unique tigers based on 37 usable images, estimating a density of 0.19 tigers per 100 km<sup>2</sup>. Four years later, 2022 surveys using camera traps captured 286 tiger photos, identifying 12 individuals over 1 year old, with a revised density estimate of 0.40 tigers per 100 km<sup>2</sup>. While density fluctuations are natural, continued monitoring remains crucial for understanding tiger population dynamics within the reserve.

## 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Eradicate unregulated fishing within the reserve and prioritize relocating fishermen communities with alternative livelihood options.</li> <li>Conduct a study to gauge relocation willingness and prioritize moving settlements like Kudichentalabailu and Saralapali to create an inviolate core area.</li> <li>Increase Chenchu participation in protection and ecotourism initiatives, transforming small hamlets into protection camps and establishing ecodevelopment activities outside the reserve.</li> <li>Implement measures to reduce disturbance caused by the national highway, address challenges from other infrastructure projects, and manage pilgrimage tourism effectively.</li> <li>Fill staff vacancies, upgrade patrolling equipment, and provide necessary technology like Android phones and GPS for effective protection.</li> </ul>	<ul style="list-style-type: none"> <li>Backwater fishing threatens aquatic life.</li> <li>Villages, hamlets, and high livestock numbers cause biotic stress.</li> <li>Invasive species, highway, power lines, tourism disrupt wildlife.</li> <li>Outdated methods, insufficient equipment, and understaffing hinder protection efforts.</li> <li>Temple visits cause habitat disturbance and wildlife conflict.</li> <li>Lack of Android phones impedes effective patrolling.</li> <li>Scenic rivers could offer sustainable tourism opportunities.</li> <li>Western boundary needs expansion, and eco-sensitive zone notification is crucial.</li> <li>Staff lack arms, facilities, and face shortages.</li> <li>Recruitment, redeployment, and specialized training needed.</li> <li>Mobile veterinary unit and strengthened fire protection measures are necessary.</li> </ul>	<ul style="list-style-type: none"> <li>Prioritize the removal of human settlements, including villages and Chenchu hamlets, from within the core area of the tiger reserve.</li> <li>Implement strategies to decrease livestock numbers within the reserve.</li> <li>Implement measures to increase the populations of prey species within the reserve.</li> <li>If necessary, evaluate the feasibility and sustainability of translocating tigers into the reserve, ensuring robust protection measures are in place beforehand.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Establish a mobile veterinary unit and conduct regular capacity-building programs for frontline staff to improve wildlife management skills.</li> <li>Develop ecotourism opportunities in collaboration with local communities while adhering to conservation guidelines.</li> <li>Extend the western boundary to encompass the entire Achampet Division for enhanced protection.</li> </ul>	<ul style="list-style-type: none"> <li>STPF needs to be operationalized.</li> <li>Requires review and potential adjustments.</li> </ul>	
2022	<ul style="list-style-type: none"> <li>Swiftly complete rehabilitation of existing villages and prioritize relocation of 10 identified villages in phases.</li> <li>Engage them in ecodevelopment and ecotourism, partnering with Tribal Development Department.</li> <li>Implement measures to curb illegal fishing in the remaining Krishna River stretch and strengthen River Patrol.</li> <li>Collaborate with authorities to control traffic, minimize roadkill, and address potential widening impact.</li> <li>Address concerns related to invasive species, hydroelectric project, power lines, and pilgrimage tourism.</li> <li>Increase number of base camps considering vast terrain.</li> <li>Fill vacancies, implement recruitment and training strategies, and provide specialized wildlife conservation courses.</li> <li>Address inadequacies by building facilities and providing arms for staff/officers.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>Establish a mobile veterinary unit.</li> <li>Revitalize eco-development committees in surrounding villages.</li> <li>Increase base camps to double as fire watch towers.</li> <li>Constitute and operationalize the Special Tiger Protection Force (STPF).</li> <li>Promote responsible ecotourism involving local communities.</li> <li>Extend western boundary to encompass Achampet Division.</li> <li>Collaborate with universities for enhanced monitoring and documentation.</li> <li>Revise website to comply with government guidelines and upload research studies/reports.</li> <li>Review and adjust compensation policy based on other state policies.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- MEE cycles offer many valuable insights. Prioritizing and enacting their recommendations would unlock a path towards successful management and conservation.
- Uncontrolled and illegal fishing in the backwaters of Srisailem and Nagarjunasagar dams threatens aquatic wildlife. Fishing within the Critical Tiger Habitat should be prohibited, fishermen relocated, and alternative livelihoods provided.
- Anthropogenic pressures from villages, Chenchu hamlets, and livestock cause biotic stress. Village and hamlet relocation should be prioritized, alongside strategies to decrease livestock numbers within the reserve.
- Invasive species, a national highway, a hydroelectric project, power lines, and pilgrimage

- tourism pose challenges. Invasive species control, responsible management of the national highway, and addressing concerns related to the hydroelectric project, power lines, and pilgrimage tourism are crucial.
- Outdated patrolling methods, lack of equipment, and insufficient infrastructure hamper protection efforts. Patrolling methods should be upgraded, necessary equipment provided, and additional base camps, strike forces, and check posts established.
- Temple visits disrupt wildlife and damage habitat. Measures to control pilgrim influx and minimize habitat disturbance should be implemented.
- Lack of Android phones hinders effective patrolling. Android phones should be provided for effective M-STriPES patrolling, and the M-STriPES register updated.
- Scenic river systems offer untapped ecotourism opportunities. Responsible and sustainable ecotourism involving local communities should be promoted.
- Western boundary needs expansion, and eco-sensitive zone notification is crucial. Hence, the western boundary should be extended to encompass the entire Achampet Division, and the eco-sensitive zone notified.
- Staff lack arms, facilities, and face shortages. Infrastructure inadequacies should be addressed by building facilities and providing arms to staff and officers.
- Recruitment, redeployment, and training for frontline staff are needed. Recruitment, redeployment, and specialized training programs for frontline staff should be implemented.
- Mobile veterinary service and strengthened fire protection measures are required. So, a mobile veterinary service unit should be established and fire protection measures enhanced.
- Special Protection Force should be constituted operationalized.
- Existing compensation policy is outdated. Periodic reviews of the compensation policy should be conducted, with adjustments based on changes in other states.

#### 5. Conclusions

As part of the largest tiger population within the Eastern Ghats landscape, Amrabad holds immense value for India's biodiversity. However, recent declines in tiger presence highlight the need for immediate and collaborative action. Augmenting the prey base and potentially supplementing the tiger population, while implementing robust protection measures, are crucial steps towards ensuring their long-term survival. Mitigating significant threats like poaching, mining operations, and linear infrastructure development requires a multi-pronged approach. Environmental protection measures, establishment of wildlife corridors, and promotion of environmentally friendly mining practices are essential components of this strategy. Safeguarding Telangana's tigers necessitates unwavering commitment from forest managers across the state. Concerted efforts in conservation, habitat protection, and collaboration with neighboring states will be instrumental in ensuring the continued presence and prosperity of these magnificent creatures within the region.

# KAWAL TIGER RESERVE

## 1. Brief Description

Kawal Tiger Reserve is a vast protected area spanning 2015 square kilometers across four districts in Telangana, India. It boasts a diverse landscape of southern tropical dry deciduous forests and harbors a rich variety of wildlife, including tigers, leopards, wild dogs, sloth bears, gaur, nilgai, and sambar. Positioned strategically within the Central Indian tiger landscape, Kawal Tiger Reserve acts as a crucial corridor, connecting with Tadoba-Andhari Tiger Reserve to the north and Indravati Tiger Reserve to the east, thus facilitating the dispersal of the tiger metapopulation. Conservation strategies, including incentivized human settlement relocation, MSTrIPES implementation for protection, and ecodevelopment initiatives for alternative livelihoods, are imperative for maximizing the reserve's ecological potential. Efforts to address factors like prey augmentation and minimizing disturbances are essential to further bolster its significance in tiger conservation efforts.

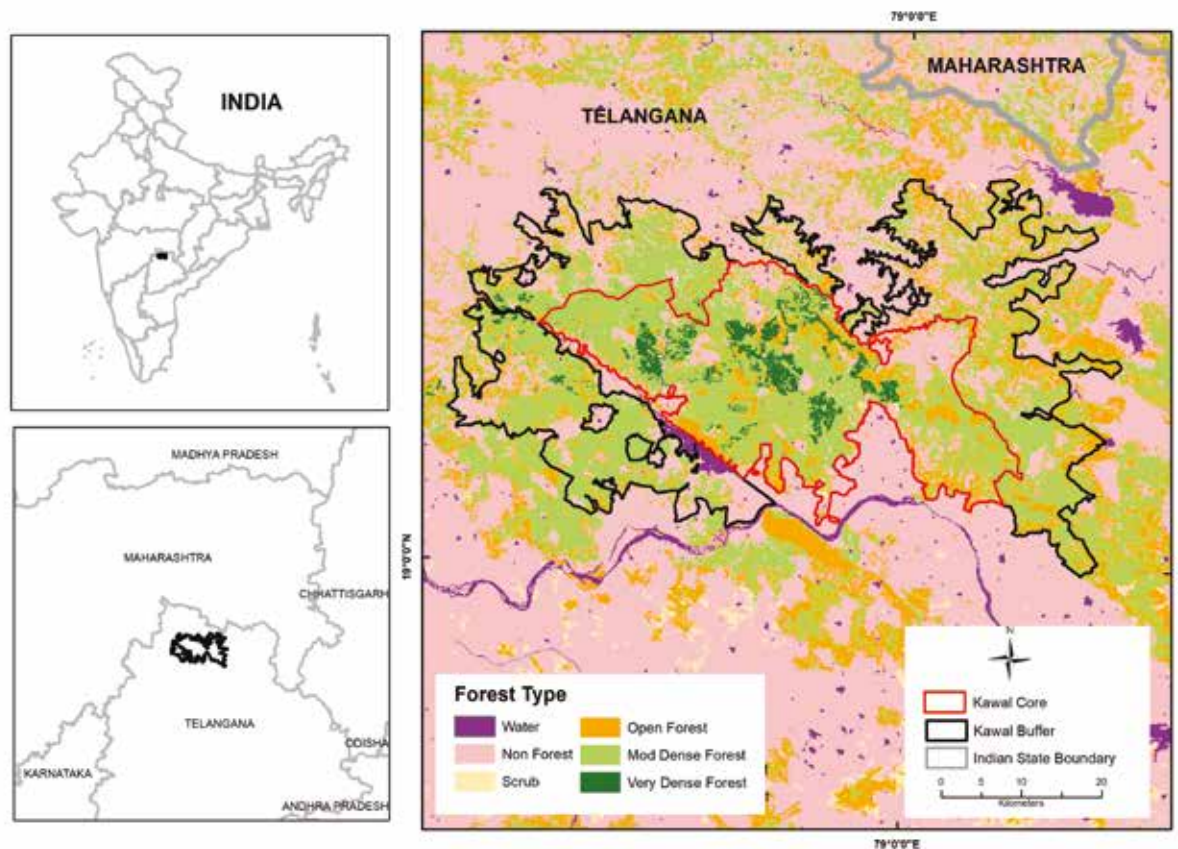


Figure 1: Location of Kawal Tiger Reserve within the state of Telangana

## 2. Tiger Population as per All India Tiger Estimation

Historical tiger populations thrived in Kawal and Eturnagarm forests, but sadly, no signs of tigers were detected during 2018 and 2022 surveys, highlighting the critical need for conservation efforts in these once vibrant habitats.

## 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Recognize Tadoba-Kawwal and Kawwal-Indravati corridors as crucial for tiger movement and connectivity.</li> <li>Increase Beat Officers (BOs) to 168 and ensure manageable patrol beats for effective protection.</li> <li>Establish 81 base camps with an additional strike force for Kadamb range for improved coverage.</li> <li>Connect all base camps to the wireless network for enhanced staff safety and communication.</li> <li>Provide official motorbikes for all BOs (phased rollout) to improve mobility and patrol efficiency.</li> <li>Create Eco-Development Committees (EDCs) in nearby villages to engage communities in conservation efforts.</li> <li>Relocate villages within the core area with an advanced timeline and financial support from NTCA.</li> <li>Implement a continuous weed eradication program for 3-4 years to control invasive species.</li> <li>Offer orientation and capacity-building courses for frontline staff to enhance wildlife management knowledge.</li> </ul>	<ul style="list-style-type: none"> <li>Vacant positions, insufficient staff for patrolling and management.</li> <li>Lack of wireless connectivity, essential equipment, and motorbikes for field staff.</li> <li>No dedicated veterinary services, limited capacity for rescue and conflict resolution.</li> <li>Villages within core area impact wildlife, need relocation.</li> <li>Inactive committees, limited participation in conservation and livelihood opportunities.</li> <li>Lack of collaboration with institutions, limited in-house research capabilities.</li> <li>Linear projects hinder movement, unclear corridor recognition.</li> <li>Insufficient eco-tourism potential, inadequate housing for frontline staff.</li> <li>Outdated Tiger Conservation Plan, lack of specialized protection force, insufficient anti-poaching efforts.</li> <li>Inadequate protection for Kagaznagar corridor.</li> </ul>	<p>Implement wildlife-friendly and permeable infrastructure within the low-density Telangana area, including Kawal Tiger Reserve, Adilabad, Chennur, and Kagaznagar, to facilitate safe tiger movement and accommodate Maharashtra's growing tiger population, contingent upon successful ungulate recovery and improved protection measures. This is crucial to mitigate threats posed by anthropogenic pressures like mining and expanding road/rail networks on the connecting corridor.</p>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Establish a mobile veterinary service unit to handle wildlife emergencies effectively.</li> </ul>		
2018	<ul style="list-style-type: none"> <li>Increase Beat Officers (BOs) to 429 for effective management of the reserve's vast area.</li> <li>Establish 43 additional base camps to improve coverage and facilitate patrolling.</li> <li>Equip all base camps with wireless connectivity to ensure efficient communication and emergency response.</li> <li>Revitalize Eco-Development Committees (EDCs) through wildlife orientation, define their roles, and involve them actively in planning.</li> <li>Prioritize the relocation of five identified villages within the core area with urgent action and NTCA support.</li> <li>Establish a mobile veterinary service unit to address wildlife emergencies and mitigate human-wildlife conflict.</li> <li>Unify control of all divisions under the Field Director for streamlined management.</li> <li>Equip field staff with essential gear like GPS, arms, and amenities to enhance their effectiveness.</li> <li>Clearly define EDCs' roles and actively involve them in planning conservation activities outside the reserve in consultation with villagers.</li> <li>Establish a mobile veterinary service unit to provide prompt care for wildlife in need.</li> <li>Protect the Kagaznagar corridor and consider proposing it as a satellite core area after a thorough survey.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Prepare a reintroduction plan for tigers and conduct a security audit once villages are relocated to create an inviolate area.</li> <li>Conduct landscape-level planning and implement proactive management strategies to mitigate anticipated pressure from future development.</li> </ul>		
2022	<ul style="list-style-type: none"> <li>Relocate villages Rampur and Maisampet by June 23rd and submit proposals for further relocations with NTCA support.</li> <li>Address dependence on forest resources by local communities to minimize habitat impact.</li> <li>Manage fire risks associated with teak dominance and leaf litter.</li> <li>Fill vacant Beat Officer positions to ensure adequate field staff.</li> <li>Encourage participation of eco-development committees in conservation activities.</li> <li>Implement mitigation measures for linear infrastructure projects like NH 44 and NH 63.</li> <li>Establish a mobile veterinary service unit and a wildlife rehabilitation center with dedicated staff.</li> <li>Enhance research capabilities and collaborate with institutions for research assessments.</li> <li>Expand and promote eco-tourism to involve local communities more broadly.</li> <li>Improve accommodation facilities for frontline staff.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Revise the Tiger Conservation Plan and constitute a Special Tiger Protection Force.</li> <li>Strengthen anti-poaching efforts, equip selected personnel with arms, and ensure wireless communication in all base camps.</li> <li>Secure continued funding for habitat improvement under CAMPA and expedite state funding support.</li> <li>Declare the identified active corridor in Sirpur Kagaznagar as a Protected Area and remove encroachments in phases.</li> <li>Denotify Bidi Patta units and pursue eco-sensitive zone notification with a Zonal Management Plan.</li> <li>Secure CSR funding for awareness programs and tiger conservation within the larger context of Central India's tiger landscapes.</li> <li>Prepare a tiger reintroduction plan in consultation with NTCA and WII.</li> <li>Update the KTR website with research studies, reports, and learning resources.</li> <li>Regularly review the compensation policy considering changes in other states.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- Recognizing the valuable insights gleaned from previous MEE cycles, it is recommended to prioritize and diligently implement the identified actionable points. This focused approach will significantly contribute to strengthened management and conservation efforts. By addressing the highlighted concerns through the suggested actions, the tiger reserve management can cultivate a more favorable environment for both wildlife and staff, ultimately ensuring the reserve's long-term prosperity and ecological well-being.
- An inadequate number of Beat Officers and Forest Guards hinders effective patrolling and management of the reserve. It is recommended that the appointment of existing vacant frontline staff positions be prioritized to ensure adequate staffing levels.
- Essential facilities at base camps, such as wireless connectivity and necessary equipment, are lacking. Providing essential field gear, including wireless equipment at every base camp, would enhance communication and operational efficiency.
- A shortage of resources like motorbikes for field officers limits their mobility and effectiveness. The gradual provision of motorbikes to field officers would improve their mobility and enable them to cover more ground during patrols.
- The absence of dedicated veterinary services makes it difficult to respond to wildlife emergencies and resolve conflicts. Establishing a mobile veterinary service unit would allow for a more prompt and effective response to wildlife emergencies and contribute to conflict resolution.
- Enhancing collaboration with research institutions for wildlife studies would provide valuable data and insights to inform management decisions.
- Expanding and promoting eco-tourism could generate additional revenue for the reserve and foster greater community engagement in conservation efforts.

#### 5. Conclusions

Despite harboring 24.7% forest cover and an estimated 21 tigers, Telangana faces a decline in tiger occupancy. Once vibrant habitats like Kawal and Eturnagarm no longer hold tiger presence. However, hope remains. The state's low-density areas, including Kawal Tiger Reserve, hold the potential to welcome Maharashtra's growing tiger population, contingent upon ungulate recovery and enhanced protection. Crucial to this is the secure passage through the connecting corridor, currently threatened by anthropogenic activities. Implementing wildlife-friendly infrastructure becomes paramount to ensure safe tiger movement and rekindle the lost roar in these forests. By prioritizing conservation efforts and fostering connectivity, Telangana can reclaim its role as a vital tiger habitat within the larger Central Indian landscape.





# DUDHWA TIGER RESERVE

## 1. Brief Description

Dudhwa Tiger Reserve comprises three main areas: Dudhwa national Park, kishanpur wildlife sanctuary and Katerniaghat wildlife sanctuary. Dudhwa National Park, situated in Lakhimpur Kheri District of Uttar Pradesh, spans 680 km<sup>2</sup> and features extensive Sal forests, wetlands, and grasslands. Notable for its diverse wildlife, including tigers, leopards, rhinoceros, and various herbivores, the park is renowned for its populations of barasingha, Bengal florican, and hispid hare. Nearby, Kishanpur Wildlife Sanctuary covers 227 km<sup>2</sup>, characterized by grasslands and Sal forests, hosting large herds of swamp deer along with other wildlife species. Further along the India-Nepal border lies Katerniaghat Wildlife Sanctuary, home to the unique Khata corridor facilitating wildlife movement between Bardia National Park and Katarniaghat. Despite facing threats such as cattle grazing and habitat disturbance, Katerniaghat remains crucial for the conservation of endangered species like the gharial, tiger, and Gangetic dolphin.

Noteworthy endangered species in Katerniaghat include the gharial, tiger, rhino, Gangetic dolphin, swamp deer, hispid hare, Bengal florican, white-backed, and long-billed vultures.

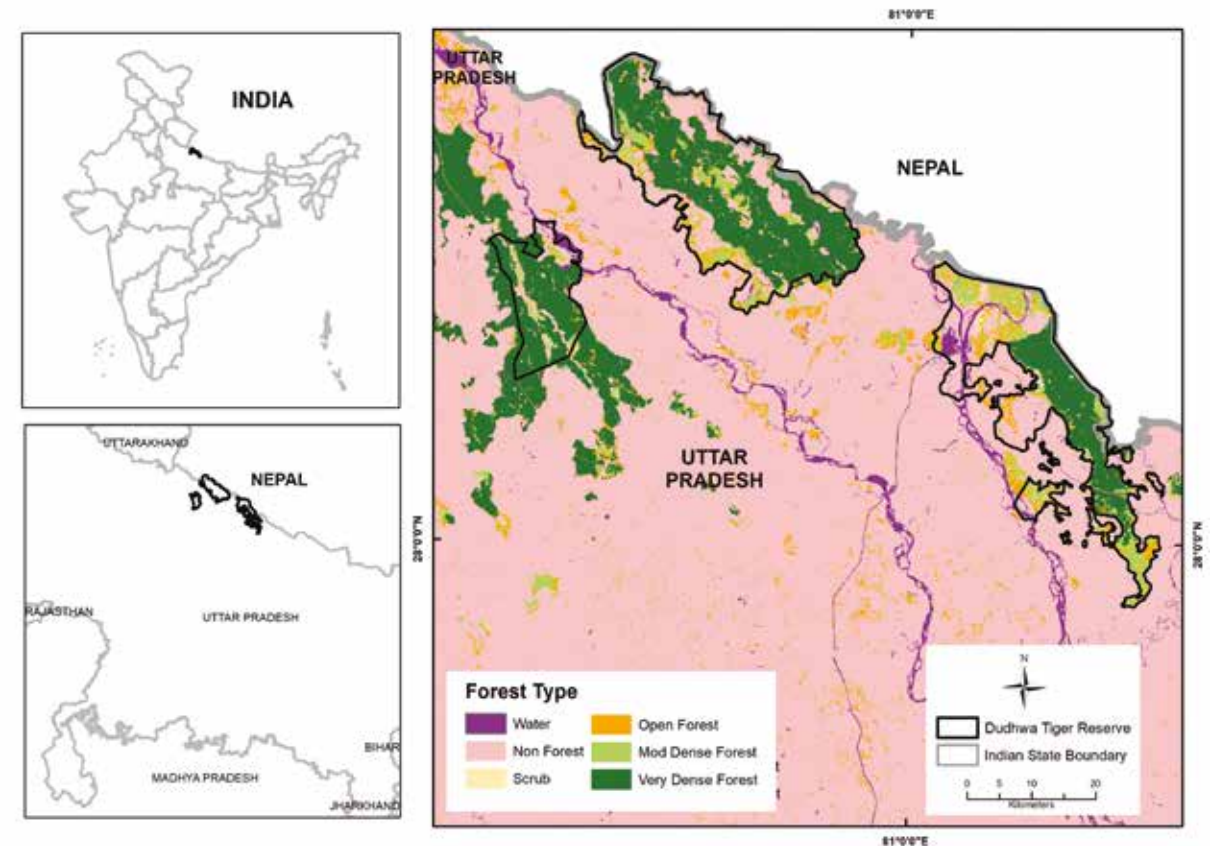


Figure 1: Location of Dudhwa Tiger Reserve in the state of Uttar Pradesh

## 2. Tiger Population as per All India Tiger Estimation

In 2014, Dudhwa National Park recorded the capture of 21 unique tigers, reflecting a calculated density of 2.06 tigers per 100 square kilometers (SE 0.46). Concurrently, in the same year, Kishanpur Wildlife Sanctuary captured 30 unique tigers, demonstrating a higher density of 8 tigers per 100 square kilometers (SE 1.48). During camera trapping activities in 2018, a comprehensive total of 2120 tiger images were obtained from Dudhwa Tiger Reserve, leading to the identification of 82 tigers with a density of 3.70 tigers per 100 square kilometers. Expanding the analysis to include the tiger population within Dudhwa Tiger Reserve and its surrounding areas, the estimated count in 2018 was 107 (SE 16). However, specifically within the tiger reserve, the count was 82 (SE 3.4). Subsequent camera trapping endeavors in this region resulted in 4778 tiger images, aiding the identification of 135 individual tigers and estimating a tiger density of 6.10 tigers per 100 square kilometers (SE 1.64). These detailed findings provide valuable insights for forest officials in understanding the dynamics of tiger presence, density, and population changes in Dudhwa National Park and Tiger Reserve, supporting informed conservation strategies.

## 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>The core area comprises only one region named 'Surma.' The Lucknow Bench of the Hon'ble High Court has issued its final order for eviction, and the implementation of this order is currently pending action from the District administration in accordance with the Court's directive.</li> <li>Encroachment is present in the core area in the form of agriculture.</li> <li>The reserve is traversed by a narrow-gauge (N.G.) railway line.</li> <li>The enhancement of equipment can be achieved by placing a greater emphasis on strengthening the communication network.</li> </ul>	<ul style="list-style-type: none"> <li>Encroachment in the form of agriculture persists in the core area.</li> <li>The tiger reserve faces challenges related to the porous international border with Nepal, leading to poaching and hunting.</li> <li>Inadequate equipment hampers conservation efforts, emphasizing the need for strengthening the communication network.</li> <li>Timely financial availability for the maintenance of an adequate quantity of vehicles is crucial.</li> <li>Settlements in both Core and Buffer zones need resettlement for conservation purposes.</li> </ul>	<ul style="list-style-type: none"> <li>The encroachment of sugarcane fields and rapid human habitation expansion around Kishanpur and Katarniaghat wildlife sanctuaries poses a significant conservation challenge as it leads to conflicts between tigers and the local population in the region.</li> <li><i>Ageratum conyzoides</i> needs to be removed systematically with utmost priority. <i>Chromolaena odorata</i> needs to be controlled before it becomes widespread.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>While there is an adequate quantity of vehicles, ensuring their timely maintenance necessitates consistent availability of financial resources.</li> <li>The release of the second CA installment has been delayed.</li> <li>Woody succession encroachment in various grasslands has been reported, prompting the practice of removing such encroachment to restore the original shape and area of the grasslands. The management plan's prescriptions are being followed diligently to ensure proper management of the grasslands.</li> <li>There is a need for further improvement in providing field staff with good accommodation and drinking water facilities to enhance their living conditions in the remote forest areas of the Protected Area.</li> <li>The appointment of a full-time wildlife-trained veterinarian is necessary.</li> </ul>	<ul style="list-style-type: none"> <li>Core areas face fragmentation due to agricultural lands, rivers, and encroachments, emphasizing the urgent need for landscape integrity.</li> <li>Roads and a railway line pose threats to wildlife movement, requiring assessment and mitigation planning.</li> <li>Inadequate research and monitoring efforts need improvement for science-based management.</li> <li>Limited community participation and untapped potential for tourism development require attention.</li> <li>Ecodevelopment initiatives face challenges due to manpower deficiencies, focusing on protection over EDC management.</li> <li>Dudhwa Tiger Reserve (DTR) holds significant conservation value, necessitating systematic understanding and monitoring.</li> <li>Legal challenges and high land prices hinder the relocation of villages within the core area.</li> <li>Inadequate staff and poorly equipped camps compromise effective wildlife monitoring.</li> </ul>	

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<ul style="list-style-type: none"> <li>Settlements exist in both Core and Buffer zones, necessitating resettlement for conservation purposes. Resettling the village within the core and addressing corridor encroachments is crucial for securing the TR and enhancing connectivity between the three Protected Areas</li> <li>Core areas (three PAs) face fragmentation due to agricultural lands, rivers, and encroachments in corridor areas, emphasizing the immediate need for landscape integrity.</li> <li>The porous international border with Nepal poses challenges of illegal entry, poaching, and wildlife trade, requiring intensified efforts for security. Due to the porous international border with Nepal, there's a heightened risk of wildlife trade, illegal intrusions, and the need for increased vigilance. Filling vacant staff positions, capacity building, and improved protection infrastructure are essential. Coordination between the three PAs must be strengthened.</li> <li>Human-wildlife conflict is a significant issue involving multiple species, urging the development of a comprehensive plan to address and mitigate conflicts. Human-wildlife conflict, exacerbated by migratory elephants, large carnivore kills of cattle, and wild pig depredations, requires resolution to garner support for conservation efforts.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Roads and a railway line within the Tiger Reserve present obstacles to wildlife movement, leading to increased mortality from accidents. A thorough assessment of current and potential threats is necessary, with mitigation planning.</li> <li>Staff shortages, both due to vacancies and insufficient sanctioned strength, hinder effective management. There is a need for adequately trained wildlife personnel.</li> <li>Research and monitoring efforts are inadequate given the diverse endangered species, infrastructural intrusions, and the porous international boundary. Swift improvements are necessary for science-based management.</li> <li>Limited community participation exists, although some livelihood needs are addressed through formed EDCs. There's untapped potential for tourism development to benefit local communities.</li> <li>Inadequate attention is given to research despite significant challenges, necessitating an upgrade in monitoring and research efforts through encouragement and funding.</li> <li>A comprehensive and systematic planning approach with clearly defined goals, proposed actions, and measurable targets is vital for effective implementation. A high-quality TCP is a priority.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>The porous international border with Nepal exposes the area to wildlife trade, making high-value animals like Tigers, Rhinoceros, and Elephants susceptible to poaching. Illegal felling of commercially important timbers, such as Sal, adds another layer of protection challenges.</li> <li>Fragmentation of Dudhwa Tiger Reserve (DTR) and disturbances from roads and railways complicate protection efforts, leading to wildlife accidents. Flooding during the monsoon further hinders travel within the park.</li> <li>With 25% vacancies in frontline staff positions and an aging workforce (average age 47), reluctance to be posted in DTR due to remoteness exacerbates staffing issues.</li> <li>Despite a protection-first approach, threats persist, and the existing apparatus, including manpower, protection camps, weapons, and patrolling vehicles, is insufficient to address challenges effectively.</li> <li>Opportunities for research and monitoring exist, but weak institutional arrangements hinder their realization.</li> <li>Presence of tribal villages in critical Tiger habitats highlights the importance of providing inviolate space for Tigers to function as source populations. Local communities, notably the Tharu tribes, play a vital role. Collaborative efforts between DTR, WWF-India, and neighboring forest divisions have focused on enhancing the livelihood opportunities of the Tharu communities.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Ecodevelopment initiatives, though initiated in the late 1990s, face challenges due to manpower deficiencies in DTR and a focus on protection over EDC management. However, operational EDCs with Community Development Funds still hold potential for success.</li> <li>Dudhwa Tiger Reserve (DTR) holds significant conservation value, necessitating a systematic understanding, documentation, and monitoring of ecological attributes, ecosystem processes, and human interactions. Academic institutions or a dedicated team of ecologists, sociologists, and data collectors could contribute to achieving these objectives.</li> <li>The establishment of the DTR Conservation Foundation is crucial for facilitating research, monitoring, and effective management decisions.</li> <li>The introduction of regulated gypsies, accompanied by local guides, has provided additional income to local communities. Encouraging this practice further can contribute to revenue options for local EDCs.</li> <li>Experiments with alternative energy sources to replace fuelwood from the forest have been initiated. Strengthening and expanding such initiatives across the entire buffer zone of DTR is necessary.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Existing EDCs should engage in dynamic action programs, utilizing available funds to garner greater support for park protection.</li> <li>Visitor regulations, such as mandatory gypsy use and guide accompaniment, contribute to both conservation and local economic benefits. This approach should be continued and promoted.</li> </ul>		
2018	<ul style="list-style-type: none"> <li>Dudhwa Tiger Reserve's three units—Dudhwa National Park, Kishanpur Wildlife Sanctuary, and Katarniaghat Wildlife Sanctuary—are managed independently, lacking consolidation as a cohesive entity. Take measures to secure connectivity between the three core units, involving inter-governmental agreements with India, Uttar Pradesh, and Nepal.</li> <li>Consider integrating Kishanpur Wildlife Sanctuary with Pilibhit Tiger Reserve for better connectivity.</li> <li>Manage the three core units and the buffer zone as a unified entity under the leadership of the Field Director.</li> <li>Restore the forest corridor between Dudhwa National Park and Kishanpur Wildlife Sanctuary, emphasizing the protection of natural water channels.</li> <li>Ensure a timely and sufficient budget allocation for the reserve.</li> <li>Register the Tiger Conservation Foundation to access additional funds.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Legal challenges and high land prices hinder the relocation of 34 villages within the core area, impacted by conflicts between the Forest Rights Act and the Wildlife Protection Act.</li> <li>Inadequate staff and poorly equipped camps inside the reserve compromise effective wildlife monitoring.</li> <li>Enhance awareness activities, involve villagers in surveillance, and train PRT members in conflict resolution and first aid.</li> <li>High staff vacancies contribute to operational challenges in the reserve. Expedite the filling of all vacant positions.</li> <li>Despite adequate roads, buildings, and habitat interventions, maintenance issues persist due to a lack of funds.</li> <li>Implement an annual training plan for officers and field personnel, covering core skills related to wildlife management.</li> <li>Limited adherence to scientific prescriptions in the Tiger Conservation Plan results in unplanned habitat management. Regular practices like harrowing and burning lack proper monitoring, and unique habitats remain uncharted.</li> <li>Absence of a dedicated Security Plan and effective mapping of vulnerable sites based on offence data pose challenges. Implementation of Protection and Intelligence Gathering theme from the Tiger Conservation Plan is lacking.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Critical areas for wildlife offences remain unidentified, frontline staff is unaware of NTCA SoPs, and patrolling is conducted by beat guards and daily wagers.</li> <li>Data over the last 3 years indicate an increase in poaching cases, marginal decline in illicit felling, but no incidences of fire and encroachment recorded. Wildlife crime investigations lack systematic planning.</li> <li>Efforts to revive defunct EDCs are absent, with no clear progress in buffer zone management. Crop damage and cattle killing compensation mechanisms are inadequate. Manage the buffer zone according to its objectives, reconstitute defunct EDCs transparently, and provide financial and skill training to staff.</li> <li>Livelihood, alternative resources, and protection aspects remain unaddressed, and buffer zone staff lack orientation towards crime investigation protocols.</li> <li>Roads and railway lines pose serious threats to wildlife, with incomplete records of train and road hits. Local NGOs' potential in wildlife conservation activities remains untapped. Implement safeguards before starting ecotourism train operations on the railway line through Dudhwa, following the court order.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Ineffective disposal of green and solid waste from tourist complexes and patrolling camps poses environmental challenges in the reserve.</li> <li>Regularly monitor water samples in wetlands and waterholes for arsenic contamination.</li> <li>Cease the illegal compounding of offence cases to meet revenue targets, as per section 51C of the Wildlife (Protection) Act.</li> <li>Provide camps in the Tiger Reserve with clean water, solar lights, and basic amenities, and conduct training on camp maintenance.</li> <li>Restore the transferred land of 38.42 sq. km. from the Central State Seed Farm to Katarniaghat Wildlife Sanctuary, converting it into grasslands.</li> <li>Monitor wildlife health, maintain vaccination records for livestock, and fill vacant veterinarian positions to enhance health-related tasks.</li> </ul>		
2022	<ul style="list-style-type: none"> <li>The northern boundaries of Pilibhit TR and Dudhwa TR face threats from the porous Nepal border, leading to poaching and hunting. Addressing the relocation of villages, controlling livestock grazing, and preventing poaching from the porous international boundary is crucial.</li> <li>Thirteen villages in Katarniaghat Sanctuary, one in Dudhwa NP, and two in Kisenpur WLS, lack connectivity, with a porous international border causing harm to flora and fauna.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>Persistent vacancies in Foresters and Forest Guards have not been adequately addressed, affecting the staff strength. Urgent state-led initiatives are needed for the recruitment and training of Foresters and Forest Guards to fill vacant positions in the tiger reserve.</li> <li>Of the 146 established EDCs in 2017, only 11 are fully functional, and 23 are under revival, essential for securing corridors between the three PAs. Making EDCs functional is essential, given the non-contiguous nature of the three PAs surrounded by villages, significantly impacting conservation efforts.</li> <li>Alarming uprooting of young sal trees in Dudhwa National Park's Badraula and Chhota Paha areas threatens habitat integrity.</li> <li>Poor demarcation of forest borders, especially in concave locations, allows agricultural encroachment.</li> <li>Roads and a railway line, lacking retrofitting measures, fragment habitats with no systematic record of road kills.</li> <li>Ecologists/foresters should conduct a study to determine the reasons for wind-falling sal trees, with necessary interventions to mitigate the issue.</li> <li>Institutionalizing transboundary coordination meetings with Nepal, following NTCA guidelines, is recommended.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- To address the fragmentation of the reserve caused by settlements, agricultural lands, and encroachments, it is advisable to prioritize the resettlement of villages within core areas. Additionally, efforts should be made to resolve corridor encroachments to improve connectivity between Dudhwa, Kishanpur, and Katarniaghat. Considering the integration of Kishanpur Wildlife Sanctuary with Pilibhit Tiger Reserve could further enhance landscape connectivity. Managing the core units and buffer zone as a unified entity under the Field Director's oversight would be beneficial, with a focus on restoring forest corridors and natural water channels.
- Ensuring consistent funding and addressing high staff vacancies, especially among Foresters and Forest Guards, is crucial for effective reserve management and protection. It is recommended to prioritize timely and sufficient budget allocation for the reserve and explore avenues such as registering the Tiger Conservation Foundation to access additional funds. Urgent state-led recruitment and training initiatives should be expedited to fill vacant positions. Improving camp facilities with essential amenities and conducting training on camp maintenance would boost staff morale and operational efficiency.
- The presence of villages within critical tiger habitats and inadequate compensation mechanisms for crop damage and cattle killing can lead to resentment among local communities. Addressing legal challenges and land price issues to facilitate village relocation from core areas is advisable. Strengthening and reforming EDCs in the buffer zone, providing financial and skill training to staff, and focusing on livelihood options and alternative resources are recommended. Implementing transparent reconstitution of defunct EDCs and managing the buffer zone according to its objectives would help foster community support for conservation efforts.
- The porous international border with Nepal poses poaching and wildlife trade threats, necessitating the implementation of a dedicated Security Plan. Effective mapping of vulnerable sites based on offense data and prioritizing the implementation of the Protection and Intelligence Gathering theme from the Tiger Conservation Plan is advisable. Training frontline staff on NTCA Standard Operating Procedures and institutionalizing transboundary coordination meetings with Nepal following NTCA guidelines would help address cross-border threats and improve security.
- Unplanned habitat management practices and insufficient data on wildlife health and disease surveillance require attention. Enhancing adherence to scientific prescriptions in the Tiger Conservation Plan, including proper monitoring of existing practices and research on unique habitats, is recommended. Filling vacant veterinarian positions and implementing systematic wildlife health monitoring, including vaccination records for livestock, would improve preventative and response measures. Conducting studies

to determine the reasons for wind-falling sal trees and implementing necessary interventions to mitigate the issue are advisable.

- f. Addressing threats posed by roads and the railway line through the reserve requires implementing retrofitting measures, systematically recording road kills, and exploring alternatives for ecotourism train operations.
- g. It is recommended to regularly monitor water samples in wetlands and waterholes for arsenic contamination.
- h. Ceasing the illegal compounding of offense cases to meet revenue targets is advisable.
- i. Preventing the uprooting of young sal trees and addressing poor demarcation of forest borders to minimize encroachment should be prioritized.
- j. Encouraging and involving local NGOs in wildlife conservation activities would foster community engagement and support for conservation efforts.

## 5. Conclusions

While tiger populations within Dudhwa have increased, empty pockets persist in the north due to insufficient prey and human pressures from encroaching sugarcane fields and settlements. This human-wildlife conflict presents a major challenge, requiring active management of both people and wildlife influences in the absence of a traditional buffer zone. Mosaic burning should be carefully managed to conserve long-term grassland fauna, while the one-horned rhino population, introduced in 1984, needs genetic diversity through strategic reintroductions from other regions. Stable barasingha populations require continued monitoring, and declining Bengal florican populations demand scientific assessment and ground-level interventions to ensure their survival.



## 1. Brief Description

Pilibhit Tiger Reserve, situated at 28°38'17.00"N 79°57'18.12"E, spans an area of 1074 km and is located in the Pilibhit District of Uttar Pradesh, India. It is contiguous with the terai-bhabar forests of the Surai range in the Terai East Forest Division to the north-west, and shares a connection with Kishanpur Wildlife Sanctuary in the south-east. The reserve facilitates connectivity to Shukla Phanta Wildlife Reserve in Nepal and Kishanpur Wildlife Sanctuary in India through the Lagga-Bagga forest block and the Tatarganj area of North Kheri Forest Division. The TR predominantly features *Shorea robusta* forests, supplemented by *Tectona grandis* plantations. The reserve encompasses a small yet significant grassland area, sustained by various canals, rivers, and a reservoir. Pilibhit Tiger Reserve boasts a diverse fauna, including large and small carnivores such as the tiger (*Panthera tigris*), leopard (*Panthera pardus*), fishing cat (*Prionailurus viverrinus*), jungle cat (*Felis chaus*), and rusty spotted cat (*Prionailurus rubiginosus*). Additionally, it is home to large Indian civet, small Indian civet, Asian palm civet, jackal, otters, and honey badger. The herbivore population includes rhinoceros (*Rhinoceros unicornis*), chital (*Axis axis*), barking deer (*Muntiacus vaginalis*), sambar (*Rusa unicolor*), barasingha (*Cervus duvaucelii duvaucelii*), hog deer (*Axis porcinus*), nilgai (*Boselaphus tragocamelus*), wild pig (*Sus scrofa*), and four-horned antelope (*Tetracerus quadricornis*).

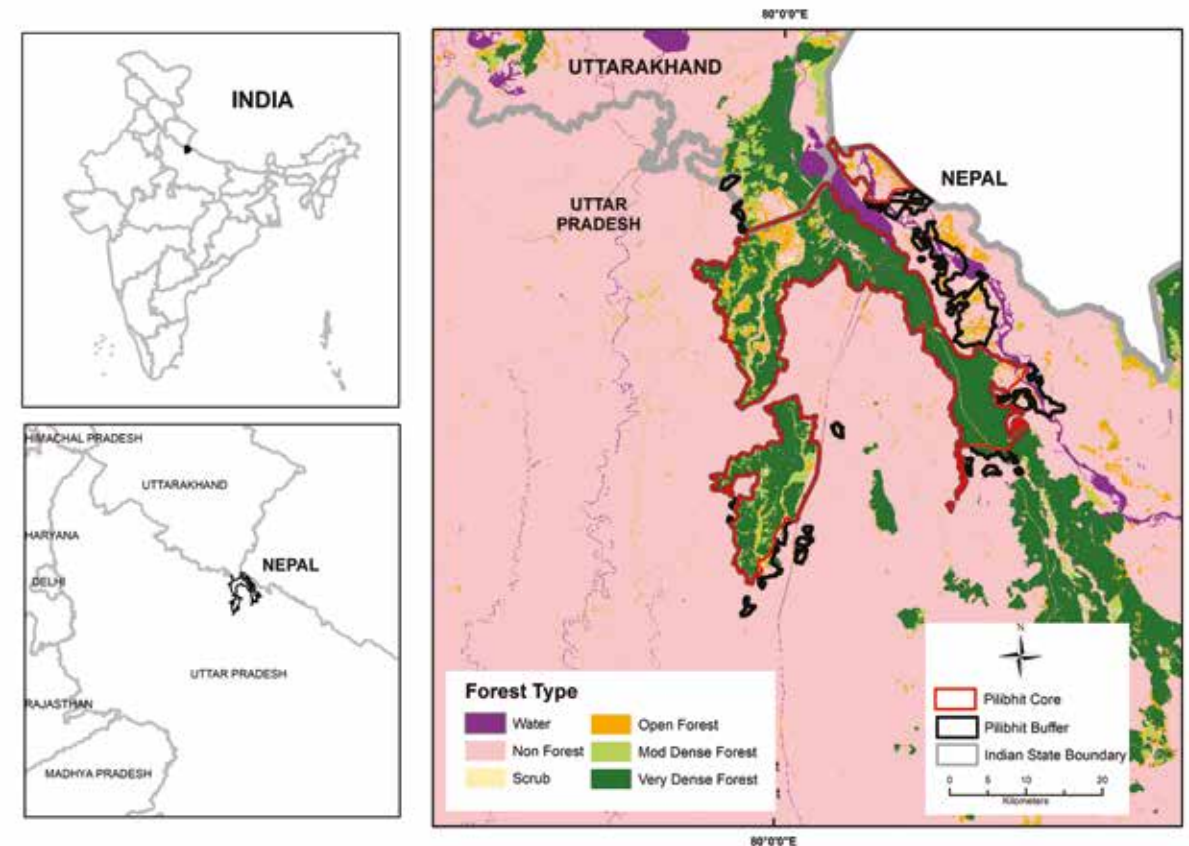


Figure 1: Location of Pilibhit Tiger Reserve in the state of Uttar Pradesh



## 2. Tiger Population as per All India Tiger Estimation

In 2014, the assessment of the tiger population in the specified reserve involved capturing 23 unique tigers, resulting in a calculated density of 2.6 tigers per 100 square kilometers (SE 0.55). Progressing to 2018, an extensive camera trapping effort generated 1,279 tiger images, enabling the identification of 57 individual tigers and the calculation of a density of 6.62 tigers per 100 square kilometers (SE 0.87). The overall tiger population, encompassing the tiger reserve and surrounding areas, was estimated at 65 (SE 3), while the count specifically within the tiger reserve was 57 (SE 0.3). In 2022, the camera trapping exercise yielded a total of 2,114 tiger images, revealing 63 individual tigers and estimating a tiger density of 5.84 tigers per 100 square kilometers (SE 0.75).

## 3. Management Weaknesses and Actionable Points identified in five cycles of MEE an AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>The horseshoe shape of the reserve, inadequate core width at various locations, human habitations, and farmlands surrounding the reserve, along with fragmented corridors and manmade habitats beyond the core, pose significant challenges and may negatively impact long-term tiger conservation. Land use outside the reserve, particularly year-round sugarcane cultivation, exacerbates human-tiger/leopard conflicts.</li> <li>Erect physical barriers, such as a 7-foot-high wall, in areas like Barhi and Mala ranges with extensive sugarcane cultivation, to prevent wildlife-human conflicts.</li> <li>Restore connectivity in the southern part of the left flank of the core, addressing farmlands and human habitations that pose potential human-tiger conflicts. Consider acquiring strips of farmland for re-vegetation and secure them with fences.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>The proposed road along the Indo-Nepal border could permanently damage the fragile corridor connecting the reserve with Suklaphanta National Park. Restore identified wildlife corridors, including the Garah-Lalpur-Deoria, Surai-Khatima-Kilpura, and Pilibhit-Tatarganj-Shuklaphanta corridors, for a contiguous forest habitat of over 3000 sq. km. Coordinate with the Uttarakhand Government for securing the Surai-Khatima-Kilpura corridor. Implement appropriate retrofitting measures for the proposed road along the India-Nepal border to facilitate unhindered wildlife movement.</li> <li>A portion of the notified buffer in Sahjahanpur Division (17.63 sq. km.) is not under the unified control of the Field Director of the reserve. Bring the 17.63 sq. km. buffer in Sahjahanpur Division under unified control of the Pilibhit Field Director.</li> <li>Despite submitting a draft TCP to NTCA in February 2016, the TCP has not been finalized and approved after two years due to the lack of incorporation of NTCA comments. Expedite the approval of the TCP.</li> <li>Large beat sizes (average size about 15 sq. km.), non-digitized beat maps, and a lack of information on unique habitats and vulnerable areas hamper effective wildlife management. Reorganize beats, increase beat guards, and address the large size of forest beats for effective protection.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>• Vacant field officer and frontline staff positions, including two Veterinary Officer posts, contribute to staff shortages. The average age of field staff is over 45 years, and there is a shortage of lady Forest Guards. Fill all vacant positions promptly to address staff shortages.</li> <li>• High levels of arsenic in groundwater pose health hazards to field staff using shallow-bore hand pumps.</li> <li>• Intense biotic pressure from approximately 350 villages within 3 km of the core area leads to continuous resource extraction, including fuelwood, grazing, thatch grass, mushrooms, and Grewia berries.</li> <li>• Lack of long-term planning and monitoring for grassland management interventions, encroachment by woody species and weeds, and inadequate addressing of these issues are prevalent.</li> <li>• An insufficient budget and delayed release of funds impact time-bound management activities. Ensure timely release of funds to avoid adverse impacts on time-bound management interventions. Secure funds, possibly from CAMPA or another State plan scheme, to relocate Musepur, the only human habitation inside the core area, addressing the issue of encroachment.</li> <li>• Poaching threats persist, with traditional poachers (Bawarias) operating around the reserve.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>• Field staff require training to enhance skills related to crime investigation, surveillance, wildlife monitoring, human-wildlife conflict management, and wildlife rescues, following the Standard Operating Procedure (SoP).</li> <li>• The international border with Nepal exposes the area to poaching and illicit activities. Institutionalize and systematize trans-boundary collaborative meetings with Uttarakhand and Nepal to address wildlife offenses and illegal trafficking.</li> <li>• Extensive burning of undergrowth in sal forests, particularly in Haripur Range, raises concerns, as this practice may not necessarily promote the growth of edible green grass species.</li> <li>• Public roads and traditional routes used by villagers are exploited by trespassers, and the presence of tar roads and a railway line poses threats from speeding vehicles and trains. Ineffectiveness of speed breakers and a lack of record-keeping for accidental deaths are additional concerns. Conduct a study to understand the impact of existing roads and railway tracks on wildlife, especially considering mortality cases.</li> <li>• Protection camps are inadequately equipped, and overall protection and monitoring infrastructure is insufficient.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Many Eco-development committees (EDCs) are defunct despite being established years ago. Build trust with villagers, revive dormant EDCs, and establish a fool-proof mechanism for immediate assistance and compensation in conflict cases.</li> <li>Study lesser-known species like otters, fishing cats, hispid hare, pangolin, and Bengal florican. Confirm the presence and assess the need for a recovery plan for the gharial.</li> <li>Investigate the impact of regular burning of grasslands.</li> <li>Develop a protocol to monitor the impacts of habitat management interventions prescribed in the TCP.</li> <li>Implement grassland management and monitoring protocols as outlined in the TCP.</li> <li>Strengthen efforts to make communities fully prepared to deal with human-wildlife conflicts through awareness programs and involvement in surveillance and interventions.</li> <li>Provide professional training to forest staff on physical and chemical capture, mob management, and precautions to strengthen the capacity to manage wildlife conflict situations.</li> <li>Implement measures to keep the core area free of human activities, acknowledging the challenge due to surrounding human habitations. Revise rules to consider compensation for cattle kills and human deaths or injuries caused by carnivores in the core area.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Revise Government Orders to include compensation for damage caused by scheduled wild animals, not limited to elephants and rhinos.</li> </ul>		
2022	<ul style="list-style-type: none"> <li>A scientific assessment is needed to verify the perception that the River Sharada has led to the reported loss of more than 45 sq. km of forest cover in the Tiger Reserve (TR) over the past decade, as indicated by the ISFR 2021 report.</li> <li>To maintain a balanced prey-predator relationship, acquisition of agricultural land in the Garah-Lalpur-Deoria corridor is essential, along with implementing agro-forestry practices and establishing barriers to prevent animal susceptibility to poaching in agricultural areas.</li> <li>Grassland management in PTR necessitates experimental trials to understand the effects of different burning regimes, along with recognizing the importance of grassland complexity for diverse faunal species.</li> <li>Managing specific habitats involves the removal or conversion of standing eucalyptus trees in wetlands/ grasslands to enhance wildlife habitat, and recognizing the ecological value of defective and dead wood.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>The absence or lack of regular maintenance of boundary pillars to demarcate the forests against agricultural fields has allowed encroachment by agriculturists on the periphery. This encroachment, contributing to the concave boundary, might be a significant factor in the reported loss of forest cover. The encroachment issue, particularly in Barahi Range, involving 25 families in the fourth MEE cycle and now reportedly 30 families, needs urgent attention. If complete removal is challenging, containment measures should be implemented.</li> <li>The prolonged vacancy in frontline staff positions, specifically Forest Guards and Foresters, remains unaddressed, despite previous observations in the fourth MEE cycle. The state should prioritize the recruitment and training of staff to fill these vacancies promptly.</li> <li>Tourism activities, including movements of safari vehicles and stays of tourists, continue to operate in the core area of the Tiger Reserve, contrary to the NTCA directive to phase out tourism from core areas. The management has not taken appropriate steps to align with this directive. Additionally, alleged irregularities in park management are sub-judice and, therefore, not discussed in detail.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Strengthening in-situ conservation across the trans-boundary landscape requires advocacy, policy interventions, and coordination meetings between officials of Pilibhit Tiger Reserve in India and Shukla Phanta Wildlife Reserve in Nepal.</li> <li>Feral cattle pose threats in PTR, and preventive measures should focus on improved disease surveillance, spatial location tracking, vector control, and restricting anthropogenic animal movement.</li> <li>Strengthening ecotourism with an emphasis on bird tourism can serve as a vehicle for community-based conservation, with the need for controlled expansion, educational initiatives, and infrastructure development at Chuka Ecotourism Centre. A birdwatching tourism checklist, equipment development, and a library at Chuka Centre are suggested initiatives.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- Considering the horseshoe shape of the reserve and its inadequate core width, along with the presence of surrounding human settlements, farmlands, and fragmented corridors, it is advisable to focus on restoring connectivity for long-term tiger conservation. One suggestion could be to initiate efforts to acquire farmland for re-vegetation and implement fencing measures in the southern part of the left flank. Additionally, prioritizing the security of the Surai-Khatima-Kilpura corridor and implementing necessary mitigation measures for the proposed Indo-Nepal border

road can facilitate smoother wildlife movement.

- b. To address the challenges posed by uncoordinated buffer zone control, vacant staff positions, budget constraints, and alleged management irregularities, it is recommended to take proactive steps. Bringing the Sahjahanpur buffer area under unified control, promptly filling all vacant positions, ensuring timely release of funds, and enhancing transparency in park management processes are vital suggestions. Collaboration with neighboring Nepal on trans-boundary wildlife issues could also yield significant benefits.
- c. Given the year-round sugarcane cultivation, lack of physical barriers, and intense biotic pressure from surrounding villages leading to human-wildlife conflicts, it is advisable to implement strategic interventions. Erecting barriers in critical areas like Barhi and Mala ranges, promoting agro-forestry practices in the Garah-Lalpur-Deoria corridor, and actively involving communities in conflict management through revived EDCs and conflict assistance mechanisms are recommended approaches.
- d. To address concerns related to insufficient protection infrastructure, inadequate equipment for camps, and poaching threats from traditional poachers and across the Nepal border, it is suggested to prioritize strengthening protection measures. This could involve procuring improved equipment and monitoring infrastructure, providing training to staff in crime investigation and conflict management, and fostering collaboration with law enforcement agencies for trans-boundary anti-poaching efforts.
- e. Given the challenges associated with the lack of long-term planning for grassland management, encroachment by woody species, and burning practices impacting habitat quality and lesser-known species, it is recommended to focus on research and strategic interventions. Conducting research on burning regimes and grassland complexity, removing invasive species like eucalyptus trees in wetlands/grasslands, and closely monitoring the impacts of habitat management interventions are advisable steps. Additionally, developing recovery plans for lesser-known species such as otters, fishing cats, and the gharial could contribute to their conservation.
- f. Investigating the perceived loss of forest cover due to the Sharda River is suggested to gain a better understanding of the situation and identify potential mitigation measures if necessary.
- g. Controlling feral cattle populations through disease surveillance and movement restrictions is advisable to mitigate their impact on the ecosystem.
- h. Developing sustainable ecotourism practices at Chuka Centre with a focus on birdwatching and community engagement could enhance both conservation efforts and local livelihoods.

## 5. Conclusions

Pilibhit Tiger Reserve plays a crucial role in tiger population connectivity within the Terai Arc Landscape. It is bordered by Terai East Wildlife Sanctuary, Nandhaur Wildlife Sanctuary, and Kishenpur Wildlife Sanctuary, and crucially connects to Shuklaphanta National Park in Nepal through the Lagga-Baggha grasslands and Sharda River floodplains. This corridor facilitates movement of tigers, rhinos, and even occasional elephants between the protected areas, highlighting the importance of designing border roads with appropriate animal passages to maintain this vital connectivity. Increasing tiger numbers within the reserve have led to more frequent straying into nearby areas, raising concerns about human-wildlife conflict. The dense human population surrounding the reserve, particularly those engaged in sugarcane cultivation, attracts wild pigs and hog deer – key tiger prey – further escalating conflict risks. The Lagga-Bagga area, a crucial link to Nepal and rich in grassland fauna, should be strictly protected from any development activities. To address human-wildlife conflict, forest managers can consider active management strategies such as translocating excess tigers to suitable habitats like Suhelwa or Ranipur Tiger Reserve, or even to Nepal. Implementing early warning systems and awareness programs for communities residing near the reserve can further mitigate conflict risks and foster coexistence between humans and tigers.





## CORBETT TIGER RESERVE

### 1. Brief Description

The Corbett Tiger Reserve, spanning diverse habitats in Uttarakhand's Nainital and Pauri Garhwal districts, covers 1288.32 km<sup>2</sup>, including Corbett National Park and a buffer zone. It serves as a primary source population for tigers in the Shivalik-Gangetic landscape, emphasizing the importance of corridor connectivity for their survival. The reserve features forests categorized into three primary types, dominated by *Shorea robusta* and various evergreen and deciduous species. It sustains a diverse array of wildlife, including tigers, leopards, jungle cats, sloth bears, elephants, sambar, and gharial. The Ramganga river system hosts a robust otter population, while the avifauna comprises over 549 species of resident and migratory birds.

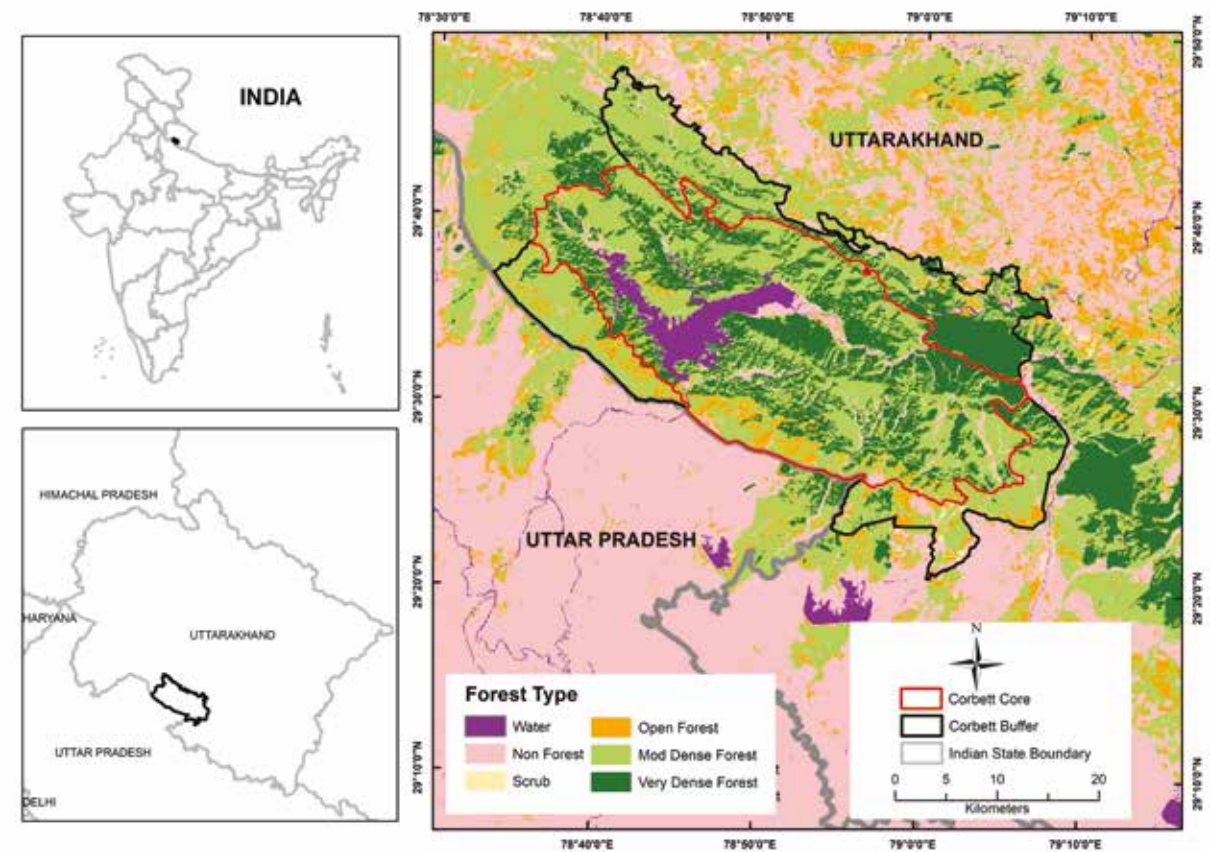


Figure 1: Location of Corbett Tiger Reserve in the state of Uttarakhand

## 2. Tiger Population as per All India Tiger Estimation

Corbett Tiger Reserve has played a substantial role in the recovery of the tiger population in the Shivalik hills and Gangetic plains landscape. In 2014, Corbett boasted the largest tiger population estimated at 215 (range 169-261) tigers, with a density of 11 (SE 0.8) tigers per 100 sq. km. This represented one of the world's highest density tiger populations, serving as a source for tigers in the broader landscape. By 2018, the tiger density increased to 14 (SE 0.91) tigers per 100 sq. km. The tiger population utilizing the reserve was 266 (SE 6), with 231 tigers present only within the tiger reserve. A total of 260 tigers were identified from 9961 tiger images, and the estimated tiger density was 14.65 (SE 0.92) tigers per 100 sq. km.

## 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>Livestock grazing pressure has been reported in narrow strips near fringe villages within the buffer zone a few patches of Sonanadi WLS where the Gujjars reside.</li> <li>The alarming spread of Lantana is primarily observed in the buffer area.</li> <li>There is a need for further improvement in providing good accommodation and drinking water facilities for individuals residing in the remotest areas of the protected area, enhancing their quality of life.</li> <li>Encourage the creation of more self-help groups</li> <li>Activation of the already constituted EDCs is necessary.</li> <li>There is a requirement for the appointment of a full-time veterinarian with wildlife training.</li> </ul>	<ul style="list-style-type: none"> <li>Livestock grazing pressure near fringe villages and Gujjar settlements in the buffer zone.</li> <li>Alarming spread of Lantana primarily observed in the buffer area.</li> <li>Anthropogenic pressures from settlements and Gujjar deras in the park and buffer.</li> <li>Resettlement of 181 Gujjar Dera families from the core area and addressing biotic pressures from 21 villages and 15 Gujjar Deras in the buffer.</li> <li>Severe human-wildlife conflict in the buffer, requiring a systematic resolution plan.</li> <li>Limited stakeholder involvement, especially in community-related tourism revenue.</li> <li>Inefficiency and poor functioning of EDCs and other community engagement methods.</li> </ul>	<ul style="list-style-type: none"> <li>The coexistence of tigers and humans in and around the tiger reserve has resulted in negative interactions, posing potential risks to both parties. In order to gain valuable insights into the behavior and movements of territorial large mammals, especially in areas of high density, the implementation of a radio collaring initiative for tigers within the reserve is strongly recommended. This strategic approach serves the dual purpose of understanding tiger behavior and providing an early warning system to alert nearby villages of tiger movements, ultimately fostering harmonious cohabitation.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006		<ul style="list-style-type: none"> <li>Opportunity to redirect tourist revenue towards community-based eco-tourism.</li> <li>Inadequate staff strength and the need for increased wildlife training.</li> <li>Excessive focus and manpower on managing tourism facilities.</li> <li>Insufficient engagement in planning or facilitating landscape-level conservation.</li> <li>Fragmentation of critical corridors at the landscape level.</li> <li>Insufficient investment in research despite wildlife population fluctuations and human-wildlife conflict.</li> <li>Special attention needed for ecodevelopment programs in the buffer zones.</li> <li>Effective use of E-Eye for monitoring the southern boundary is essential.</li> <li>Challenges with tourism, including delays in fund release and inadequate staff.</li> <li>Heavy traffic and pollution issues on roads around the reserve.</li> <li>Lack of research initiatives impacting wildlife ecology and habitat management.</li> <li>Minimal livelihood improvement in eco-development committees.</li> <li>Delay in phasing out tourism facilities within the core.</li> <li>Need for the establishment/ revival of a Local Advisory Committee (LAC).</li> </ul>	<ul style="list-style-type: none"> <li>Ageratina adenophora, Ageratum conyzoides need to be removed systematically with utmost priority. The limited invasion of Parthenium hysterophorus needs to be controlled before it becomes widespread.</li> <li>Highways, tourism infrastructure and private farms impede the movement of tigers and elephants through the corridors. Critical assessment of such projects along with restorative inputs, mitigation measures and control of encroachments for remaining linkages are essential for continued movement.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006		<ul style="list-style-type: none"> <li>Threats to corridors from rapid resort growth and human encroachments.</li> <li>Proposals impacting the southern boundary corridor adjoining Uttar Pradesh.</li> <li>Severe human-wildlife conflict along the southern border.</li> </ul>	
2010	<ul style="list-style-type: none"> <li>Anthropogenic pressures persist in the park and its buffer due to settlements and gujar deras. Resettlement of Gujar Deras (181 families) from the core area is essential, along with addressing the biotic pressures from 21 villages and 15 Gujar Deras in the Buffer.</li> <li>The buffer zone faces severe human-wildlife conflict, requiring a systematic plan for resolution.</li> <li>Limited stakeholder involvement in the protected area, especially in community-related tourism revenue.</li> <li>Inefficiency and poor functioning of EDCs and other community engagement methods.</li> <li>There is an opportunity to redirect a significant portion of tourist revenue towards community-based eco-tourism, as the current share is dominated by private enterprises.</li> <li>Inadequate staff strength; there is a need for increased wildlife training. Upgrading manpower, capacity, and resources is crucial, including increasing staff strength, wildlife-trained personnel, and supporting infrastructure.</li> <li>Weeds pose a significant problem in the area and needs meaningful intervention.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<ul style="list-style-type: none"> <li>Lack of long-term studies on key values/species.</li> <li>Limited research efforts in a tiger reserve of such significance.</li> <li>Excessive focus and manpower directed towards managing tourism and tourist facilities. Departmental involvement in tourism activities should be reduced to focus on protection and management.</li> <li>Insufficient engagement in planning or facilitating landscape-level conservation, including corridors.</li> <li>The reserve could contribute significantly to landscape-level goals through support for research, concept advocacy, and facilitation actions beyond its administrative boundary.</li> <li>Critical corridors at the landscape level are being fragmented, necessitating planning by the TR to secure and manage these corridors through state and interstate collaboration.</li> <li>Research investment is insufficient despite fluctuating wildlife populations, severe human-wildlife conflict, and the prevalence of anthropogenic and biotic pressures, highlighting the need for increased scientific research for effective management.</li> </ul>		
2014	<ul style="list-style-type: none"> <li>The core area of CTR experiences temporary occupation by 181 Gujar settlements from April to June each year, leading to significant ecological impacts. Speeding up the voluntary relocation process is crucial for the fair and just rehabilitation of Gujars.</li> </ul>		



MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>This occupation conflicts with the conservation goal of maintaining inviolate areas for tiger source populations.</li> <li>The buffer area has 20 villages, with an additional 70 villages within 5 km of the buffer zone boundary, posing resource use pressure on the CTR landscape. Villages on tiger movement paths require greater political and administrative support for relocation.</li> <li>Human and cattle casualties from wild animal attacks, particularly by tigers, remain a persistent issue, causing negative publicity despite compensation mechanisms.</li> <li>Strengthening engagement with local communities through ecodevelopment programs is crucial for revenue generation and their active participation in park protection.</li> <li>Special attention is needed for ecodevelopment programs in the buffer zones, emphasizing engagement with EDCs and innovative community-conservation linkages.</li> <li>The effective use of E-Eye for monitoring the southern boundary should be documented promptly, and its advantages and technical attributes widely shared.</li> <li>Given CTR's reputation and proximity to capital cities, tourism, while beneficial, can consume significant field manager time; improvements can be achieved through strengthened Internet-based visitor management services and standardized protocols for VIP visits.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>There are ample opportunities for further research on key species dynamics, ecological processes, and the interaction with human society in the CTR landscape.</li> <li>The engagement with academic institutions, NGOs, and civil society groups enhances CTR's strength; the role of the Tiger Conservation Foundation in fostering relationships and developing a comprehensive database on values, management, and monitoring is crucial for advancing scientific wildlife management in the country.</li> </ul>		
2018	<ul style="list-style-type: none"> <li>Delays in fund release impact timely managerial efforts, with watchers facing wage delays of 3-6 months, making them susceptible to external influences.</li> <li>Collaborate closely with the District Administration to implement court orders evacuating encroachers, eliminating incompatible land uses, and addressing pollution along the reserve's periphery. Urgently evacuate the Kalagarh Hydroelectric Project Colony for a human-free core.</li> <li>A substantial gap between demanded and allocated CAMPA funds hinders regular maintenance of protected area assets, necessitating increased funding support. Ensure timely fund release, critical for time-bound management inputs.</li> <li>Address the huge gap between CAMPA funds demanded and allocated for regular maintenance of protected area assets.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Develop a long-term project for maintaining and monitoring grasslands, allocating adequate funds.</li> <li>Redirect 100% of tourism revenue to the Tiger Conservation Foundation for fruitful ecodevelopment interventions and timely management inputs.</li> <li>Forest Guard vacancies disrupt beat reorganization, forcing many guards to manage multiple beats, affecting effective management.</li> <li>Corridors face threats from rapid resort growth and human encroachments, notably the disturbed Kosi corridor hindering wildlife movement.</li> <li>Proposed Kandi Road upgrade may impact the southern boundary corridor adjoining Uttar Pradesh, raising conservation concerns.</li> <li>Severe human-wildlife conflict, particularly along the southern, eastern, and northern borders, poses a continuous challenge.</li> <li>Persistent resource pressure along the southern border adjoining Uttar Pradesh demands attention for sustainable management. Address wildlife-crop raids along the 50 km boundary with Uttar Pradesh, reinstating compensation and engaging in dialogue to regain rapport with affected villagers.</li> <li>Institutionalize information-sharing and joint patrolling with Uttar Pradesh. Conduct quarterly review meetings at PCCF and CWLW levels and annual meetings at the Forest Secretary level to resolve inter-State issues.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Weeds infest Dhikala Chaur and other grasslands, shrinking them, emphasizing the need for controlled burning and monitoring.</li> <li>Full operationalization of the e-eye surveillance system is essential for effective management by the Tiger Reserve.</li> <li>Ongoing poaching outside and inside the reserve, including instances of tiger poaching, heightens vulnerability.</li> <li>Heavy traffic on Dhikuli-Dhangadhi road disrupts wildlife movement, causing frequent accidental animal deaths without meticulous recording.</li> <li>Air, noise, and solid waste pollution due to roadside eateries and commuters pose significant environmental challenges.</li> <li>Insufficient research initiatives on wildlife ecology, habitat management, and human-wildlife interactions hamper comprehensive understanding.</li> <li>Minimal livelihood improvement in eco-development committees and limited villagers' involvement in eco-tourism, especially in the buffer area, underscores the need for increased interventions.</li> <li>Delay in phasing out tourism facilities within the core, despite being part of the Tiger Conservation Plan, requires urgent attention and implementation.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Establish/revive a Local Advisory Committee (LAC) to curb incompatible tourism development outside the core. Develop standards and indicators for resort compliance, and periodically deploy an independent agency for monitoring.</li> <li>Conduct inter-divisional meetings to review protection and ecodevelopment issues at FD and CF/CCF levels, with periodic meetings convened by PCCF (HoFF).</li> <li>Intensely engage with revived EDCs to address human-wildlife conflict and livelihoods, initiate placement-based skill training, and address unemployment issues.</li> <li>Tackle speeding, honking, and littering on the Ramnagar-Mohan road with rigorous monitoring and legal action against violators.</li> <li>Enforce laws to prevent roadside littering.</li> <li>Address large-scale unemployment by involving villagers, especially youths, in ecotourism management activities in the buffer zone. Study and implement the Participatory Buffer Tourism Model.</li> <li>Ensure the Field Director has full control over the operation of the E-Eye System for surveillance.</li> <li>Expedite the formation of the Special Tiger Protection Force (STPF).</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Recent tiger poaching incidents within and around the reserve, serving as a habitat for Corbett's spillover population, highlight the need to protect dispersing tigers. Prioritize skill enhancement for staff and managers, reinforce infrastructure protection in adjacent territorial divisions, and empower personnel through diverse wildlife management disciplines, especially in monitoring and wildlife rescue.</li> <li>Promote or conduct in-house research to enhance reserve management. Research should focus on understanding the causes of local extinction for Barasingha and Wild Dog. Additionally, consider the reintroduction of Barasingha, given suitable habitats within the core area.</li> </ul>		
2022	<ul style="list-style-type: none"> <li>The ISFR 21 report notes changes in Corbett TR's forest cover since 2011, reporting a loss of 22 km<sup>2</sup>. The latest assessment indicates VDF of 437 km<sup>2</sup>, MDF of 693.67 km<sup>2</sup>, and ODF of 89.87 km<sup>2</sup>.</li> <li>The threat of tiger poaching is significant in the landscape, necessitating TR management to play a lead role in investigating cases like the recent tiger skin seizure in Haridwar. Concerns arise over perceived complacency in checking illegal activities on the northern periphery.</li> <li>Increasing human-tiger conflict in the landscape is linked to habitat loss due to reduced tree cover.</li> <li>Urgent filling of vacancies for RFOs and Forest Guards is needed.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>The absence of an ESZ notification for the TR requires regulation of activities in the deemed 10 km ESZ, including storing building materials for resort remodeling. The Ramnagar–Ranikhet highway acts as a barrier, necessitating eco-friendly measures, speed limits, and time restrictions. A study on infrastructure trends and mortality is needed, exploring options like overpasses and underpasses to reduce wildlife and human casualties.</li> <li>Despite a ban on grazing in the core area, 57 Gujjar families reside in the CTR buffer, with around 1000 livestock depending on forest grazing. Substantial grazing along the northern boundary may impact tiger behavior, warranting further investigation for better park management.</li> <li>The current management should address tree destruction in the TR, regenerate affected patches, and remove unsightly iron enclosures. The loss of 22 km<sup>2</sup> of forest cover reduces carbon sequestration potential, and studies on periodic monitoring should be initiated.</li> <li>Despite NTCA directives, there's reluctance to phase out tourism from the core area. Forest rest houses are allotted to tourists, and with Gujjar families remaining, the TR's inviolate status is not adequately pursued. The complete relocation of the Kalagarh irrigation colony is pending.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Logistical constraints prevented MEE team visits to the northern TR boundary. Vacancies in Range Officer positions suggest less intensive management, yet issues like conflict, poaching, and smuggling are reported in Adnalla, Plain, Mandal, and Maidawan ranges. Alleged irregularities in park management are sub judice and not discussed.</li> <li>Irregular elections, with one President holding office for 20 years, highlight the need for timely elections to ensure effective governance and financial support for EDCs.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- It is strongly recommended to give priority to addressing the 18 outstanding actionable points identified in the past three MEE cycles for the Corbett Tiger Reserve. Neglecting these points could have adverse effects on the reserve's success, potentially leading to increased human-wildlife conflicts, habitat degradation, and declines in tiger populations. Developing a well-defined plan with clear timelines and involving all stakeholders, including the forest department, relevant government agencies, and local communities, is advisable. Taking proactive measures now is crucial to ensure the long-term health and sustainability of the Reserve.
- Considering the escalating human-tiger conflict resulting from high traffic on roads and encroachment into wildlife corridors, it is advisable to consider implementing a radio collaring program for tigers. This initiative would enable the tracking of tiger movement patterns, providing early warnings and informing strategic conflict mitigation strategies.
- The impact of Gujjar settlements and cattle grazing on habitat quality and wildlife behavior in the buffer zone calls for immediate action. Strengthening infrastructure protection, enhancing patrolling efforts, installing wildlife crossings, and enforcing speed limits on roads are recommended measures to minimize disruptions.

- d. Addressing habitat fragmentation and corridor restoration, exacerbated by infrastructure development, resort growth, and poaching, is imperative. It is advisable to ensure sustainable development in buffer zones, control encroachments, and prioritize habitat connectivity initiatives.
- e. The presence of vacancies, particularly in RFO and Forest Guard positions, significantly hampers effective patrolling and monitoring efforts. Filling all vacant positions promptly, providing necessary training, and equipping staff with wildlife management skills for efficient field operations are recommended.
- f. To overcome the limitations posed by insufficient camera traps, communication devices, and patrol vehicles, upgrading facilities and technology is essential. This includes investing in advanced camera traps, communication equipment, and necessary vehicles to enhance field operations.
- g. Timely and adequate funding is crucial for critical management activities and maintenance. Advocating for increased CAMPA allocation, exploring alternative funding sources, and ensuring efficient fund utilization are recommended strategies to secure sufficient funding.
- h. Weak or inactive Eco-Development Committees hinder community engagement in conservation efforts. Revitalizing EDCs, empowering communities through livelihood opportunities, and fostering local participation in eco-development initiatives are recommended approaches.
- i. To preserve the inviolate status of the core area, it is advisable to phase out tourism facilities from the core area, implement the Tiger Conservation Plan, and expedite the relocation of remaining Gujjar settlements.
- j. Promoting responsible tourism practices is essential to mitigate disruptions caused by speeding on roads, honking, and littering. Encouraging eco-tourism initiatives, educating visitors, and enforcing strict regulations are recommended measures.
- k. Ensuring equitable distribution of tourism benefits and involving local communities in decision-making processes are crucial. Increasing transparency and revenue sharing will enhance community engagement and support sustainable conservation efforts.
- l. Recent tiger poaching incidents underscore the vulnerability of the reserve, particularly on the periphery. Establishing a Special Tiger Protection Force, strengthening collaboration, and conducting thorough investigations are recommended to intensify anti-poaching efforts.
- m. To address environmental challenges posed by air, noise, and solid waste pollution, rigorous pollution control measures are necessary. Enforcing regulations, promoting waste management initiatives, and raising awareness about responsible environmental practices are recommended strategies.
- n. Inadequate studies on wildlife ecology, human-wildlife interactions, and Barasingha reintroduction hinder effective management. Increasing research efforts, collaborating with academic institutions, and disseminating findings will enhance knowledge sharing and improve management strategies.

## 5. Conclusions

The western region of the Shivalik hills and Gangetic plains hosts two significant tiger reserves, Rajaji and Corbett. This area, characterized by high ungulate productivity, can sustain some of the world's highest tiger densities, playing a pivotal role in long-term tiger conservation. Corbett Tiger Reserve, with its abundant ungulate biomass, maintains a high tiger density, serving as a source for dispersing tigers into neighboring protected areas such as Lansdowne, Terai West, Amangarh, and Ramnagar forest division. However, connectivity to the east is constrained by the township of Ramnagar and linear development along National Highway 121, comprising resorts, townships, and private farms along the Kosi River. The loss of connectivity between Corbett and Ramnagar forest division necessitates urgent attention. While tiger movement between these areas was previously observed, in 2022, no common tigers were found between them. Tigers are now shifting from Amangarh to Terai West and then onward to Ramnagar forest division, potentially leading to negative interactions in densely populated areas with forest patches. The expansion of resorts and private farms in this area has created a hard boundary for wildlife movement, particularly for tigers and elephants. It is crucial to assess such projects critically, fostering the remaining linkages with restorative inputs. Infrastructural development must be accompanied by appropriate measures to control encroachment. Sensitizing resorts and private landowners to remove impermeable fences at critical points is essential to allow wildlife passage.



# RAJAJI TIGER RESERVE, UTTARAKHAND

## 1. Brief Description

Rajaji Tiger Reserve spans three districts in Uttarakhand: Haridwar, Dehradun, and Pauri Garhwal. Named after the renowned freedom activist and India's first Governor General, Shri Rajgopalachari, it officially gained tiger reserve status in April 2015, covering an area of approximately 1150 square kilometers.

The reserve is characterized by broadleaved deciduous forests featuring diverse flora, including *Malolotus philippinensis*, *Cassia fistula*, *Dalbergia sissoo*, *Shorea robusta*, *Butea monosperma*, *Terminalia arjuna*, *Acacia catechu*, *Dendrocalamus strictus*, *Bombax ceiba*, *Ougeinia oojeinensis*, *Embllica officinalis*, *Bauhienia variegata*, *Ziziphus mauritiana*, *Casearia tomentosa*, and *Aegle marmelos*. Other vegetation types within the reserve include riverine vegetation, scrubland, grasslands, and pine forests.

Notable carnivores in the reserve include tigers, leopards, striped hyenas, jackals, jungle cats (*Felis chaus*), leopard cats (*Prionailurus bengalensis*), rusty spotted cats (*Prionailurus rubiginosus*), occasional Himalayan black bears (*Ursus thibetanus*), and sloth bears (*Melursus ursinus*). Major herbivores encompass Asian elephants, chital, sambar, barking deer, goral, and wild pigs. The reserve boasts a rich biodiversity, hosting over 328 bird species, 49 freshwater fish species, 12 amphibian species, and more than 20 reptile species, according to the Management Plan of Rajaji National Park for the period 2012-13 to 2021-22.

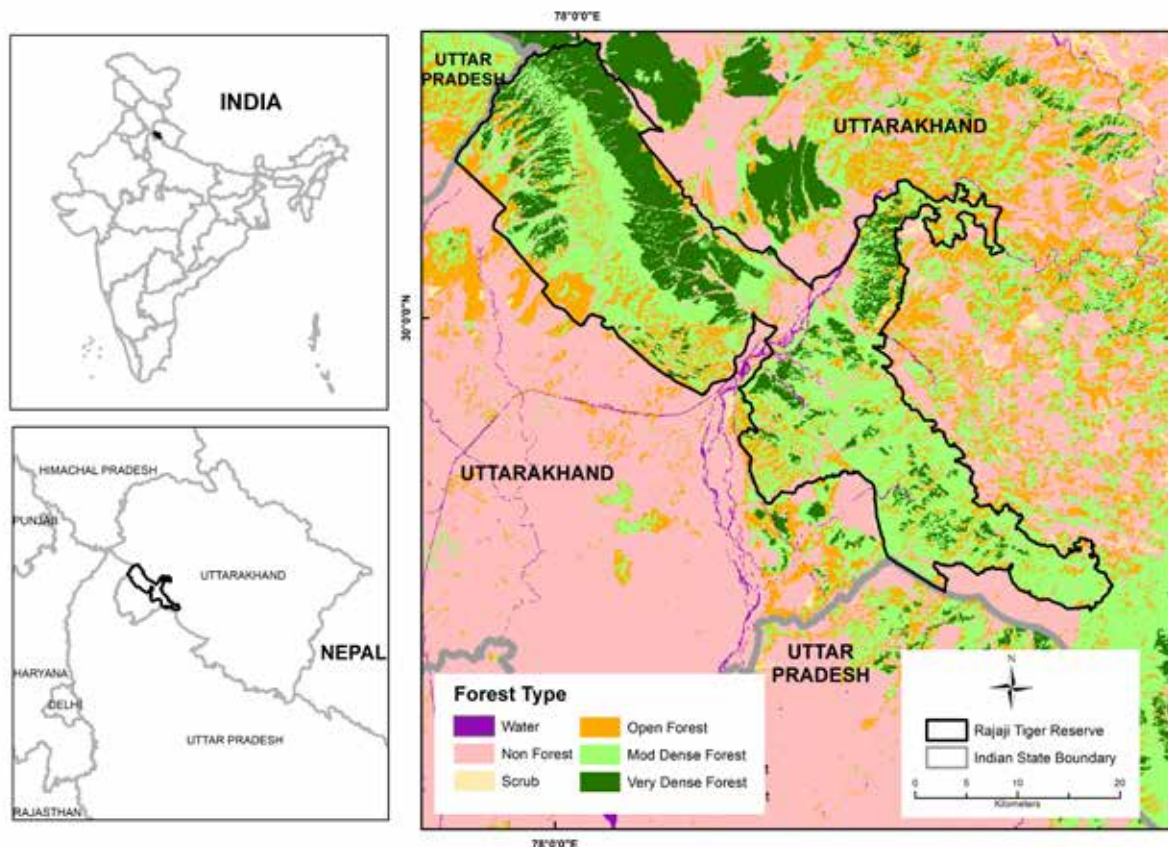


Figure 1: Location of Rajaji Tiger Reserve in the state of Uttarakhand

## 2. Tiger Population as per All India Tiger Estimation

Between 2014 and 2022, Rajaji has observed a significant increase in tiger numbers. In 2014, 13 unique tigers were identified, indicating a density of 2.90 tigers per 100 square kilometers (SE 0.87). The extensive camera trapping survey of 2018 yielded 1,279 tiger images and identified a total of 37 individual tigers, with the western sector capturing 43 photographs, revealing the presence of two female tigers. In 2018, a detailed analysis distinguished between the western and eastern regions, uncovering 35 individuals in the western part with a density of 8 tigers per 100 square kilometers (SE 1.4). The overall tiger population was estimated at 52 individuals (SE 5), and within the reserve boundaries, the count was 38 (SE 1). The 2022 monitoring efforts resulted in 1,106 tiger images, identifying 54 individual tigers, and focusing on the eastern section revealed 51 individuals, leading to a tiger density estimate of 8.15 tigers per 100 square kilometers (SE 1.25).

## 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Radio-collaring tigers in the western part may be unnecessary; focus on alternative techniques like camera trapping for monitoring.</li> <li>Inadequate participation of Deputy Directors and wardens in decision-making and implementation due to poor delegation from the Director. Vacant posts need urgent filling, and the buffer zone should be managed by two Deputy Directors for the east and west parts. Provide regular hands-on training for effective patrolling, surveillance, and crime detection for field personnel.</li> <li>Establish a criminal database, monitoring habitual offenders, and assign ACF-ranked officers to investigate Schedule-I poaching cases.</li> </ul>	<ul style="list-style-type: none"> <li>Ineffective delegation hampers decision-making, necessitating swift appointment to vacant posts and restructuring of buffer zone management involving two Deputy Directors.</li> <li>Absence of a criminal database and limited monitoring of habitual offenders necessitate assigning ACF-ranked officers to investigate Schedule-I poaching cases.</li> <li>Threats to wildlife persist due to challenges like linear infrastructure, corridor blockages, anthropogenic pressure, and poaching in the Tiger Reserve.</li> <li>Wildlife distribution imbalance results from restricted movement between eastern and western portions, exacerbated by human activities hindering the east-west corridor.</li> </ul>	<ul style="list-style-type: none"> <li>The limited invasion of <i>Xanthium strumarium</i>, <i>Prosopis juliflora</i>, <i>Parthenium hysterophorus</i> needs to be controlled before it becomes widespread.</li> <li>Connectivity challenges, particularly in East and West Rajaji, hinder the movement of tigers and elephants due to disruptions caused by various developmental projects, necessitating a critical assessment of these corridors, implementation of restorative measures, mitigation of infrastructural impacts, and the removal of impermeable fences at critical points by sensitizing resorts and private landowners to facilitate essential wildlife passage.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Challenges in the Tiger Reserve include linear infrastructure, corridor blockages, anthropogenic pressure, and poaching, posing threats to wildlife, particularly tigers and elephants.</li> <li>Create a well-equipped Rapid Response Team to handle human-carnivore and human-elephant conflicts.</li> <li>Limited wildlife movement between eastern and western portions leads to skewed tiger distribution. Expanding human activities along NH 74 obstruct the east-west corridor, creating barriers for wild animals.</li> <li>The buffer area faces anthropogenic pressures, and eateries along the east-west corridor dump waste, leading to wildlife scavenging and potential conflict.</li> <li>Resistance to unified control in the buffer, insufficient manpower, and resources hinder effective protection.</li> <li>Establishment of new unauthorized Gujjar deras increases anthropogenic pressure, leading to lopping and grazing, affecting the buffer. Following Gujjar relocation, Rajaji's recovery is underway, requiring immediate administrative restructuring.</li> <li>Interventions are needed to reduce Taungya village dependence on forest resources, with compensation for crop damage and cattle depredation.</li> </ul>	<ul style="list-style-type: none"> <li>Anthropogenic pressures, waste dumping, and potential conflict in the buffer area necessitate urgent attention.</li> <li>Hindered protection efforts result from resistance to unified control in the buffer, inadequate manpower, and resource constraints.</li> <li>Unauthorized Gujjar deras contribute to heightened anthropogenic pressure, leading to continued lopping and grazing despite relocation efforts.</li> <li>Ineffectual interventions in Taungya villages underscore the need for improved protection against crop damage and cattle depredation, reducing dependence on forest resources.</li> <li>Protection challenges persist due to delayed fund release and inadequate daily patrolling efforts in the Tiger Reserve.</li> <li>Ineffectual core security fails to address threats along the reserve's southern boundary, exacerbated by weak informer systems, internal conflicts, and strained NGO relationships.</li> <li>Challenges arise from the presence of a special economic zone (SIDCUL) and industrial areas, with associated pollution of the Susua River.</li> <li>Management challenges are evident in the Tiger Reserve due to inadequate daily monitoring and reporting of tigers, human settlements, and leopard attacks.</li> </ul>	

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Cases of tiger poaching in the buffer highlight inadequate protection measures.</li> <li>Delayed fund release and weak daily patrolling contribute to protection challenges.</li> <li>Vulnerability to fires, encroachments, and poaching persists in peripheral areas. Core security does not address threats to the reserve's southern boundary.</li> <li>Weak informer systems, intradepartmental conflicts, and strained relationships with NGOs hinder effective management.</li> <li>Presence of a special economic zone (SIDCUL) and industrial areas near the reserve's boundary contribute to challenges.</li> <li>Pollution of the Susua River with effluents from Dehradun and settlements poses a threat.</li> <li>Weak daily monitoring and reporting of tigers, human settlements in critical habitat, and leopard attacks indicate management challenges.</li> <li>Lack of mitigation measures for road hits causes wildlife fatalities in the buffer zone.</li> <li>Resurgence of elephant deaths due to train hits is a serious concern on the Haridwar-Dehradun railway line passing through the reserve. Address elephant threats from trains on the Haridwar-Kansrao railway line, with urgent action needed to mitigate risks.</li> </ul>	<ul style="list-style-type: none"> <li>Wildlife fatalities in the buffer zone result from the absence of effective mitigation measures against road hits.</li> <li>Urgent action is required to mitigate risks and prevent further elephant deaths from train hits on the Haridwar-Kansrao railway line and the Haridwar-Dehradun railway line.</li> <li>The absence of a comprehensive long-term awareness program for residents along the Haridwar-Dehradun highway hinders understanding of human-wildlife conflict issues.</li> <li>Human-wildlife accidents result from unregulated night traffic on the Chilla-Rishikesh power channel road.</li> <li>The delayed fulfillment of statutory requirements, such as establishing and registering the Tiger Conservation Foundation and gaining approval for the Tiger Conservation Plan, is a notable weakness.</li> <li>Ineffective management interaction with villagers hampers livelihood interventions and conflict management in EDCs.</li> <li>Absence of a master plan for managing traffic, littering, and noise around temples in the core/critical tiger habitat is a management gap.</li> </ul>	

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Launch a long-term awareness program for Haridwar-Dehradun highway residents, emphasizing human-wildlife conflict issues and distributing informative materials.</li> <li>Regulate night traffic on the Chilla-Rishikesh power channel road to prevent human-wildlife accidents.</li> <li>Fulfill statutory requirements promptly, including the constitution and registration of the Tiger Conservation Foundation and submission of the Tiger Conservation Plan to the NTCA for approval. Approve and implement the comprehensive TCP promptly. Implement prescriptions from the tiger conservation plan for monitoring changes and restoring areas freed of human habitations.</li> <li>Improve management interaction with villagers, focusing on livelihood interventions and conflict management in EDCs.</li> <li>Develop a master plan in consultation with District Administrations and EDCs for managing traffic, littering, and noise around temples in the core/critical tiger habitat.</li> <li>Address immediate issues: eviction of illegal dwellers, non-compliance with forest land diversion conditions, demolishing dilapidated houses, construction of wildlife bridges, completing pending flyovers, evacuating army ammunition dump and temple encroachment, and regulating crowds, eateries, and parking along roadsides.</li> </ul>	<ul style="list-style-type: none"> <li>The delayed response to immediate issues, such as illegal dwellers, non-compliance with forest land diversion conditions, and regulating crowds along roadsides, is a significant weakness.</li> </ul>	

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>The economic valuation of the tiger reserve's goods and services remains undocumented.</li> <li>Delays and insufficient fund releases by NTOA and the state government have been observed, requiring urgent attention.</li> <li>The tiger reserve lost approximately 30 km<sup>2</sup> of forest cover in the last decade, indicating increasing threats of encroachment and habitat loss. The ISFR 2021 report highlights a decline in carbon sequestration potential, necessitating immediate intervention from the management to reverse this trend.</li> <li>Rapid growth of 13 Gujjar families and two Taungya villages inside the reserve poses a significant threat, requiring proactive management efforts for relocation. Urgent efforts are needed to relocate over 50 Gujjar families, an increase from the initial 13. Enhanced compensation and swift relocation actions should be facilitated by the Government of Uttarakhand and the Tiger Reserve management.</li> <li>The TR management should have taken timely action to renew the expiring management plan and expedite the approval process. Swift action is required to finalize the Tiger Operation Plan.</li> </ul>		



MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>The absence of a Tiger Conservation Plan (TCP) and Tiger Foundation, along with fragmented control over the core and buffer areas, needs urgent attention. The establishment of the Tiger Foundation should be prioritized for early implementation.</li> <li>With 64 vacancies in Forest Guard positions out of a sanctioned strength of 144, there's a pressing need to fill these gaps for effective offense handling.</li> <li>The north-eastern part of the reserve has a poor tiger presence, disjointed due to linear infrastructure, posing a threat to the reserve's integrity.</li> <li>Night halts and safari vehicle movements in the core area should be phased out to minimize disturbances.</li> <li>Various disturbances in different parts of the reserve, including conflicts with villagers on the southern boundary, emphasize the need for effective management and mitigation strategies.</li> <li>Lands on the fringes of the tiger reserve near Haridwar town, within the Eco-Sensitive Zone (ESZ), are underutilized. Proposals to prohibit construction and promote tree growth should be considered for optimal land use.</li> <li>The BHEL lands in the ESZ near Haridwar remain underutilized. Imposing restrictions on building and infrastructure and promoting tree growth should be considered.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Following the seizure of two tiger skins near Gandikhata village, previously relocated Gujjar families, there is a need to investigate and compare seized tiger skin stripes with the TR's database. Addressing villagers' concerns is crucial to prevent potential collaboration in illegal activities.</li> <li>Invasive weed invasions pose a challenge, and the TR management should intensify efforts for weed removal and grassland restoration.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- Ineffective delegation due to vacant posts and a lack of buffer zone management structure. Appoint Deputy Directors to manage the eastern and western buffer zones, empowering them to make decisions and implement strategies.
- Inadequate monitoring and investigation, including weak informer systems, limited wildlife crime database, and insufficient patrolling. Establish a criminal database, assign ACF-ranked officers to investigate serious poaching cases, strengthen informer networks, and improve daily patrolling and reporting.
- Corridor blockages and disruptions due to infrastructure projects, encroaching settlements, and invasive plants like *Xanthium strumarium*, *Prosopis juliflora*, and *Parthenium hysterophorus*. Critically assess corridors, implement restoration measures, mitigate infrastructure impacts, remove barriers like impermeable fences, and control invasive plant species.
- Anthropogenic pressures including settlements, waste dumping, and Gujjar settlements within the reserve. Relocate illegal settlements and Gujjar families with enhanced compensation, develop a master plan for managing traffic, littering, and noise around temples, and improve management interaction with villagers through livelihood interventions and conflict management in EDCs.
- Delayed fund releases, declining forest cover, and lack of economic valuation for the reserve's services. Secure timely fund releases from NTOA and the state government, address encroachment and habitat loss, conduct an economic valuation study, and

- prioritize the establishment of the Tiger Foundation.
- f. Tiger Conservation Plan needs to be finalized and implemented.
- g. Poor tiger presence in the north-eastern part of the reserve requires special management attention.
- h. Disturbances should be minimized through phased out night halts and safari vehicle movements in the core area.
- i. Underutilized lands within the Eco-Sensitive Zone should be prioritized for tree growth and conservation purposes.
- j. Efforts for weed removal and grassland restoration should be intensified.

## 5. Conclusions

Rajaji Tiger Reserve's eastern zone has witnessed a significant rise in tiger density compared to 2014 estimates, while the western zone remains home to only two tigresses. This disparity highlights the success of active management efforts, including the 2020 reintroduction of three tigers from Corbett, in bolstering the western population. Notably, tigers from the east have expanded their range into Himachal Pradesh, offering promising signs for recolonization in the western Shivaliks, which historically hosted tigers until 2004. These developments necessitate continued active management, particularly in the west, to secure a long-term viable tiger population throughout the reserve and potentially re-establish connectivity across the broader Shivalik landscape.





## BUXA TIGER RESERVE

### 1. Brief Description

Buxa Tiger Reserve, spanning 757.9 km in West Bengal's Alipurduar district, is a vital biodiversity repository located in the Bengal Dooars, characterized by productive floodplains and foothills of the Eastern Himalayas. It shares its northern border with Bhutan, and the Sankosh River forms its eastern boundary, while tea estates, human habitation, and National Highway 31C mark the southern and western boundaries. Numerous rivers, including Rydak, Bala, and others, intersect the reserve.

The vegetation in Buxa Tiger Reserve primarily consists of Moist Tropical Forest, subdivided into eight types: Sal forest, Moist Mixed/Dry Mixed Forest, Wet Mixed Forest, Semi-evergreen Forest, Evergreen Forest, Hill Forest, Savannah Forest, and Riverine Forest. Dominant tree species include *Shorea robusta*, *Albizia lebbeck*, *Dalbergia sissoo*, *Acacia catechu*, *Careya arborea*, *Dillenia pentagyna*, and *Butea monosperma*.

The carnivore guild includes leopard (*Panthera pardus*), leopard cat (*Prionailurus bengalensis*), Asiatic golden cat (*Catopuma temminckii*), jungle cat (*Felis chaus*), dhole (*Cuon alpinus*), and common palm civet (*Paradoxurus hermaphroditus*), among others. Major herbivores found in the reserve are elephant (*Elephas maximus*), gaur (*Bos gaurus*), chital (*Axis axis*), sambar (*Rusa unicolor*), wild boar (*Sus scrofa*), hog deer (*Axis porcinus*), and serow (*Capricornis thar*).

### 2. Tiger Population as per All India Tiger Estimation

During the camera trapping exercise on 2022 in Buxa Tiger Reserve, a total of 162 camera stations were active for 13,734 trap nights. Only one tiger was photo-captured during this sampling period. Despite the substantial low tiger population in Buxa, tiger presence was confirmed through scat DNA analysis in 2014. However, no tiger sightings were reported in 2018. Although a tiger was photographed during the 2022 cycle of All India Tiger Estimation camera trapping exercise.

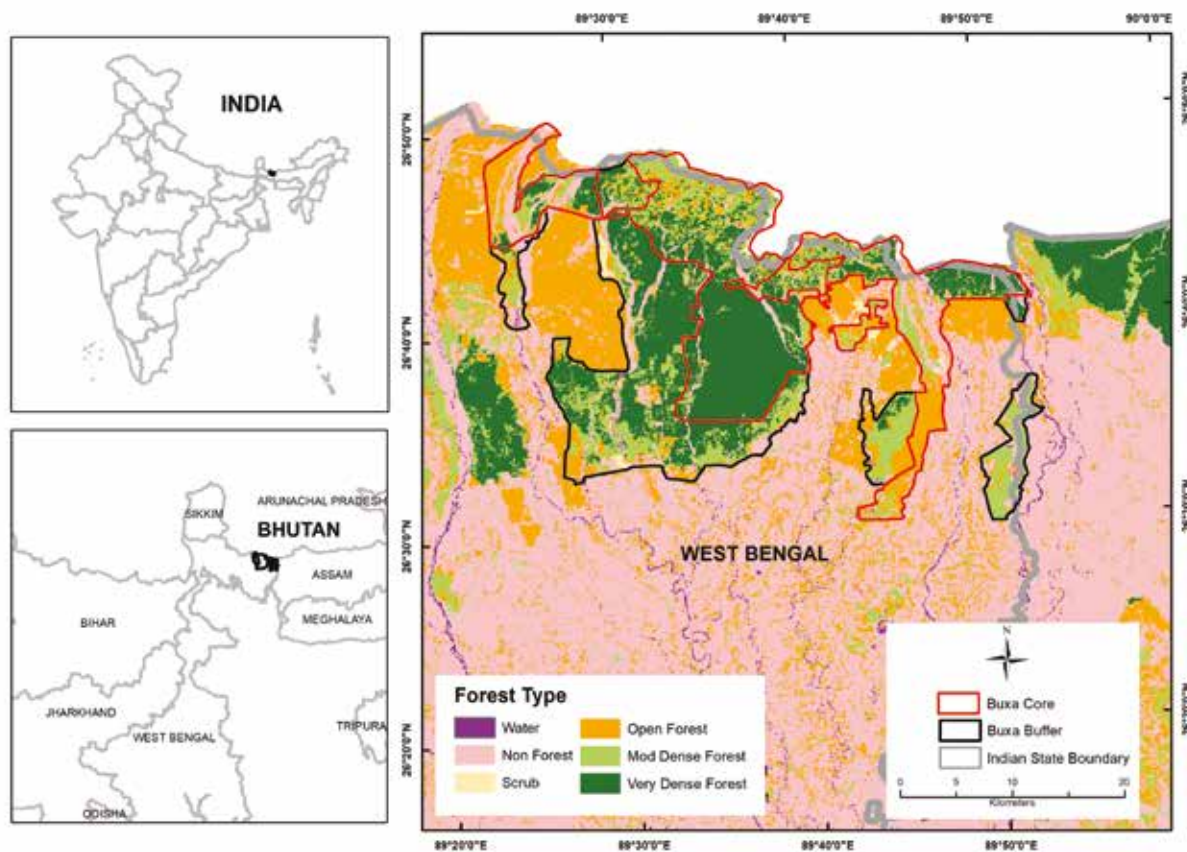


Figure 1: Map showing location of Buxa Tiger reserve in the state of West Bengal

### 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<ul style="list-style-type: none"> <li>Effective monitoring and enforcement efforts control livestock grazing, fuelwood, and non-timber forest product collection in the buffer zone, despite challenges posed by 30 revenue villages, 33 tea gardens, and an estimated 100,000 heads of cattle in fringe areas.</li> <li>There is a shortage of immobilization drugs from Nandankanan, and a request for GIS software has been submitted.</li> </ul>	<ul style="list-style-type: none"> <li>Inadequate and delayed release of funds under Project Tiger/State Development Plan has been a recurring issue, hampering timely management interventions.</li> <li>Persistent vacancies, especially in frontline staff positions, and a lack of special thematic in-house training modules contribute to an ongoing staff shortage and training deficiencies.</li> </ul>	

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<ul style="list-style-type: none"> <li>2-3 ranges possess only motorcycles, and field vehicles are rented when required.</li> <li>The allocation for TA is significantly insufficient.</li> <li>Inadequate transportation facilities exist in the identified eco-tourism activity zone.</li> <li>Various invasive species, including Eupatorium, Mikania, Lantana, Leea, Ageratum, and Clerodendrum, pose significant challenges, particularly in past plantation areas, prompting the implementation of five containment strategies.</li> <li>Efforts to address encroachment by woody species and weeds are ongoing, utilizing established practical techniques, while controlling livestock grazing through collaborative efforts with FPC/EDCs. Emphasis is required specifically on restoring degraded areas.</li> <li>Despite diligent efforts to expedite ex-gratia compensation payments, the insufficient funds allocated result in a backlog of pending cases.</li> <li>Balancing the presence of 33 tea estates and numerous villages, efforts are ongoing to identify and maintain dispersal corridors for wildlife.</li> </ul>	<ul style="list-style-type: none"> <li>Delays and challenges in the relocation of forest villages from the core area have been a recurring concern, impacting community development and eco-development initiatives.</li> <li>Continuous management weaknesses, such as the absence of data systems, vernacular language SOPs, disaster risk management plans, and an independent website, hinder effective administration.</li> <li>The ongoing challenge in identifying and maintaining dispersal corridors for wildlife, despite efforts, remains a consistent issue.</li> <li>Inadequate funds allocated for essential tourism infrastructure in the identified eco-tourism zone have been a recurring constraint.</li> <li>The recurring problem of invasive species, including Eupatorium, Mikania, Lantana, Leea, Ageratum, and Clerodendrum, poses significant challenges to habitat management.</li> <li>The inadequately defined core area and buffer notifications contribute to habitat management challenges and resource utilization issues in surrounding villages and tea gardens.</li> <li>Challenges related to socio-political issues, such as the inability to relocate villages from the core area, persist, affecting staff management and frontline jobs.</li> </ul>	

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010		<ul style="list-style-type: none"> <li>The non-integrated approach between timber management under the Working Plan and TCP results in inadequacies in conservation efforts and wildlife habitat management.</li> <li>The non-integrated approach between timber management under the Working Plan and TCP results in inadequacies in conservation efforts and wildlife habitat management.</li> <li>Inadequacy in transportation facilities and infrastructure in the eco-tourism activity zone poses ongoing challenges for tourism development.</li> <li>Despite the proximity of BTR to tea gardens, ongoing challenges persist in engaging with tea garden owners for initiatives such as fuel wood production and welfare accountability.</li> <li>Despite existing committees, the relationship between BTR management and local communities has not significantly improved, impacting resource use problems.</li> <li>Consistent efforts are required to control grazing, fuelwood collection and non-timber forest product collection in the buffer zone.</li> </ul>	

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014			

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>• Timber management in BTR operates under the prescriptions of the Working Plan, creating a non-integrated approach with the TCP, leading to inadequacies in conservation efforts and wildlife habitat management.</li> <li>• Habitat management in BTR, despite having water holes and artificial salt licks, lacks effective monitoring, evaluation protocols, and understanding of their impact on habitats.</li> <li>• Socio-political issues, such as the inability to relocate villages from the core area, affect BTR, leading to inadequacies in staff management and frontline jobs.</li> <li>• Prepare microplans for utilizing NREGS funds for watershed management, water harvesting, and pasture development, securing funds from local administration.</li> <li>• Inadequacy in staff amenities, including park-related allowances, field equipment, arms, and communication tools, lowers the morale of frontline staff.</li> <li>• The non-functional status of the Foundation in BTR, coupled with the lack of initiatives to generate funds or explore opportunities like ecotourism, hampers conservation efforts.</li> <li>• Inadequacy of training in wildlife management, especially at senior positions, creates a gap in leadership for effective management of a tiger reserve.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>• Encourage initiatives such as those by NGOs like NEWS to help villagers procure better breed cattle and practice stall feeding.</li> <li>• Develop ecotourism as a community-centric activity, training community members for its management.</li> <li>• Discuss with the State Government the imposition of an eco-development surcharge on vehicle and tourist entry, directing funds to the Foundation.</li> <li>• Seek services from nearby academia, research institutions, or NGOs to understand and monitor vegetation changes in opened areas or during weed eradication.</li> <li>• Shifting the focus from timber-oriented management to tiger habitat management and emphasizing the role of eco-development as an instrument for empowerment and good governance is essential for long-term conservation in BTR.</li> <li>• Systematically compile animal sighting records and develop occupancy maps for effective monitoring of wild animals, including tigers.</li> <li>• Finalize the deployment of the Special Tiger Protection Force (STPF) to aid management against illegal activities, particularly poaching.</li> <li>• Establish an institutionalized coordination mechanism with neighboring Bhutan for protection efforts.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>The core area of the park lacks ecological clarity, leaving out certain forest areas that could contribute to a more harmonious entity, and faces biotic pressures from villages within the core. Revisit core and buffer area notifications for ecologically relevant demarcation without altering the Tiger Reserve boundary.</li> <li>Fill the gap between sanctioned and actual frontline staff strength through local special recruitment to enhance goodwill and retention.</li> <li>Base APOs on TCPs, prioritize items, and monitor at the NTCA level.</li> <li>BTR has various natural and artificial water holes, with attempts to open up canopy areas for grass growth, but a lack of well-defined protocols and monitoring mechanisms has led to invasions by alien species. Strengthen habitat management and local livelihood enhancement efforts.</li> <li>Request tea gardens to supply coke briquettes or LPG for their laborers.</li> <li>Eradicate invasive species in new plantations near villages through effective participatory approaches with EDCs/ JFMCs.</li> <li>Despite the existence of JFM and EDCs, their working and interface with park management are suboptimal, similar to the case with eco-tourism, which has room for improvement.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Continuous attention is needed for staff training and orientation toward wildlife management, and facilities at anti-poaching camps should be upgraded to maintain high staff morale.</li> <li>Systematically maintain records of animal sightings and develop occupancy maps for effective wildlife monitoring.</li> <li>Develop an institutional mechanism to coordinate with officials in Bhutan, Assam, and SSB to control illegal activities around the park.</li> <li>Merge and match crime map spots at beat, range, and forest department levels for monitoring and controlling crimes, establishing/shifting patrolling camps.</li> <li>Develop eco-tourism as a community-centric activity and prepare community members for management.</li> <li>Obtain services from research organizations/universities/ NGOs to monitor vegetation changes in opened-up areas.</li> <li>Make efforts to relocate villages from the core area.</li> <li>Rejuvenate JFMCs/EDCs and bring tea gardens under the Joint Forest Management (JFM) system.</li> <li>The functioning of the Tiger Foundation can be enhanced for better effectiveness. Review and enhance the effectiveness of the State Level Steering Committee and the Tiger Reserve Foundation.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Forests in the landscape face biotic pressure from numerous villages, tea estates, and tribal communities, with families engaging in timber smuggling, resulting in an average annual seizure of 1800 cubic meters.</li> <li>Four villages are identified for relocation, requiring an urgent development of a relocation package through community consultations.</li> <li>Field visits indicate low ungulate sightings, and recent census data reveals a marginal decline in the elephant population in north Bengal.</li> <li>Clearing undergrowth and weeds along patrolling footpaths is essential to facilitate efficient and rapid patrolling.</li> <li>The State Government should prioritize the recruitment and training of frontline staff, particularly forest guards, to intensify forest patrolling and control timber smuggling.</li> <li>Enhance the efficiency of the elephant movement warning system near the railway track by verifying information before conveying it to prevent false alarms.</li> <li>Evict old orange orchards encroaching on forest land in hilly tracts through negotiation and consultation.</li> <li>Despite NTCA guidelines restricting tourist visits to designated zones and prohibiting infrastructure in the core area, West Bengal Tourism Development Corporation has constructed lodges within the core area at Jayanti.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Frontline staff vacancies, especially at the forest guard level, significantly impact forest and wildlife protection. Urgently fill vacancies in frontline staff to enhance protection within the Reserve.</li> <li>The railway line between Alipurduar and Siliguri through Rajabhatkhawa poses a threat to wild elephants, with inadequate safety measures in place.</li> <li>Wild animals moving through tea gardens create conflicts, with tribal workers often becoming victims.</li> <li>Explore alternative alignments for the proposed Tala Rydak road to Pepping in Bhutan to avoid disturbance to the Sankosh River and the Tiger Reserve.</li> <li>Utilize the elephant movement warning system to inform tea gardens, preventing conflicts with tribal workers in the area.</li> <li>Assess the prey base in the Tiger Reserve before proceeding with the reintroduction of tigers.</li> <li>Initiate consultation with the Railways for mitigation measures to prevent elephant mortality on the broad gauge Railway line between Alipurduar and Siliguri.</li> <li>Conduct regular monitoring of tiger, co-predator, and prey populations due to the low tiger density in the Tiger Reserve.</li> <li>Strictly prohibit the construction of tourism facilities in the core area to adhere to guidelines and prevent detrimental impacts on tiger reintroduction efforts.</li> </ul>		



MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>The proximity of Buxa Tiger Reserve (BTR) to international borders with Bhutan, Nepal, and Bangladesh makes it highly susceptible to poaching routes and destinations, compounded by insurgency problems and developmental activities like forest concessions, industrial pollution, and highway development.</li> <li>Until late 2021, no tigers were detected by camera traps in BTR, suggesting a small, non-viable tiger population. Despite an adult male tiger recorded in December 2021, the current tiger abundance is considerably below BTR's carrying capacity.</li> <li>BTR is surrounded by 46 fringe villages, 34 tea gardens, 37 forest villages, and 4 Fixed Demand holdings, creating challenges due to fuelwood dependency, encroachment, hunting, and poaching, posing significant threats to the prey base.</li> <li>Inconsistent fund release under the Project Tiger for three consecutive years has led to delays in essential activities such as maintaining watch towers, plantation, and staff wages, resulting in partial fund utilization. There is an observed delay in the release of funds under the Project Tiger/State Development Plan, necessitating a mechanism to ensure timely submission, release, and utilization of funds, for effective management interventions and seasonal activities.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>Funds allotment should align with micro-plans, ensuring the implementation of programs identified in these plans for effective conservation efforts.</li> <li>The formation and operationalization of Local Advisory Committees (LAC), as per NTCA guidelines, are crucial for proper implementation of eco-tourism initiatives.</li> <li>With a sanctioned strength of 481 permanent staff in BTR, 56% of positions are vacant, and the front-line cadre faces a severe staff shortage with a 93% vacancy for Forest Guards to Forest Ranger positions. Immediate state-level action is imperative to recruit personnel and address the precarious situation.</li> <li>The absence of special thematic in-house training modules, a lack of training records, a missing Staff Development Plan, and exclusion of casual workers from essential schemes like e-Ashram and Ayushman Yojana contribute to a lack of staff development.</li> <li>Despite having 15 forest villages in the core of Buxa Tiger Reserve, no relocation has taken place, and Community Development and Eco-Development have been sidelined without budgetary allotments in the past three years. The relocation proposals need to be expedited, as exemplified in Bhutia Basti and Canasta.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>Various management weaknesses include a lack of data on the complaint disposal system, absence of TCP and SOPs in vernacular language, missing disaster risk management and fire management plans, the absence of an independent website for BTR, and the non-existence of online booking facilities and Security Audits.</li> <li>While Joint Forest Management Committees (JFMCs) are established, micro-planning and execution of Eco-Development Programs in all 63 JFMCs need urgent attention, with JFMC members potentially contributing to regular patrolling and management activities.</li> <li>Priority action plans for securing Bun-Iti and Rydak-Jayanti corridors, facilitating elephant movement without causing harm to villages, and linking protected areas need expedited approval and fund allocation.</li> <li>The proposal for special protection and research on the clouded leopard, a key species in BTR, should be fast-tracked, encompassing habitat improvement, water hole creation, and infrastructure for monitoring and research.</li> <li>The tourism property handed over to BTR by West Bengal Tourism Development Corporation should be optimally utilized for effective management of Buxa Tiger Reserve.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2022	<ul style="list-style-type: none"> <li>Prioritizing internal training, maintaining training records, developing staff development plans, and including casual workers in schemes like e-shram and Ayushman yojana are essential actions within the purview of BTR authorities.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

While acknowledging the progress made, it's crucial to highlight that several key action points identified in previous MEE cycles remain unaddressed. Prioritizing and implementing these recommendations is essential to ensure the continued success of the tiger reserve management and conservation efforts.

- The invasion of *Chromolaena odorata* and *Mikania micrantha* in grasslands and watershed areas is posing a significant threat to the ecosystem's integrity. It is recommended that invasive species be addressed, and habitat restoration strategies be implemented to maintain ecological balance. Prioritizing invasive species eradication efforts and implementing habitat restoration measures to address the spread in grasslands and watershed areas, collaborating with local communities and relevant stakeholders, is advisable.
- Substantially low prey abundance is experienced in the tiger reserve, impacting the overall ecosystem health and the survival of the tiger population. Implementing prey augmentation strategies is deemed essential to address this issue effectively. Developing and implementing prey augmentation programs to improve prey abundance within the tiger reserve, focusing on enhancing habitat quality and implementing sustainable wildlife management practices, is recommended.
- Ongoing staff shortages and training deficiencies are contributed to by persistent vacancies in frontline staff positions and a lack of specialized thematic training modules, compromising effective management and enforcement efforts. Expediting the recruitment process to fill vacant frontline staff positions and developing specialized thematic training modules to enhance staff capacity in wildlife management, enforcement, and conservation is advisable.

- d. A mechanism should be established to ensure the timely submission, release, and utilization of funds under Project Tiger/State Development Plan, aligning fund allocation with micro-plans and prioritizing essential conservation activities.
- e. The village relocation process from core areas should be expedited, collaborating with district administration, local Panchayats, and community members to develop relocation packages and address socio-economic concerns effectively.

## 5. Conclusions

Buxa Tiger Reserve's historical exploitation, evident in cleared lands and past hunting practices, has resulted in a critically low tiger population. While a recent camera trap sighting offers hope, sustained conservation efforts are crucial. The reserve's location within a mosaic of tea gardens and human settlements necessitates immediate action to secure private forested lands through legal means. Additionally, addressing invasive species like *Chromolaena odorata* and *Mikania micrantha* in grasslands and watersheds is essential. Considering the low prey abundance, adaptive management strategies focused on habitat restoration and prey augmentation are paramount before considering tiger relocation. By prioritizing these actions, Buxa Tiger Reserve can move towards a brighter future for its tigers and the entire ecosystem.



SHIBU NAIR

## SUNDARBAN TIGER RESERVE

### 1. Brief Description

The Sundarbans, spanning 10,000 square kilometers across Bangladesh and India, is the world's largest mangrove habitat and a UNESCO World Heritage Site. Shaped by orogenesis and tidal rivers, it comprises islands, estuaries, and creeks. With unique vegetation influenced by salinity levels, it hosts approximately 35 true mangrove species and 117 halophytic associates. Dominated by *Avicennia* and *Rhizophora* species, it supports diverse fauna, including tigers, prey species, estuarine crocodiles, and rare dolphins. Management approaches differ between India and Bangladesh, with the former under strict protection and the latter open to harvesting. Despite tidal variations, the Sundarbans acts as a coastal bio-shield and provides livelihoods to local communities. It holds conservation importance for its tiger population, rich biodiversity, and role in environmental sustainability.

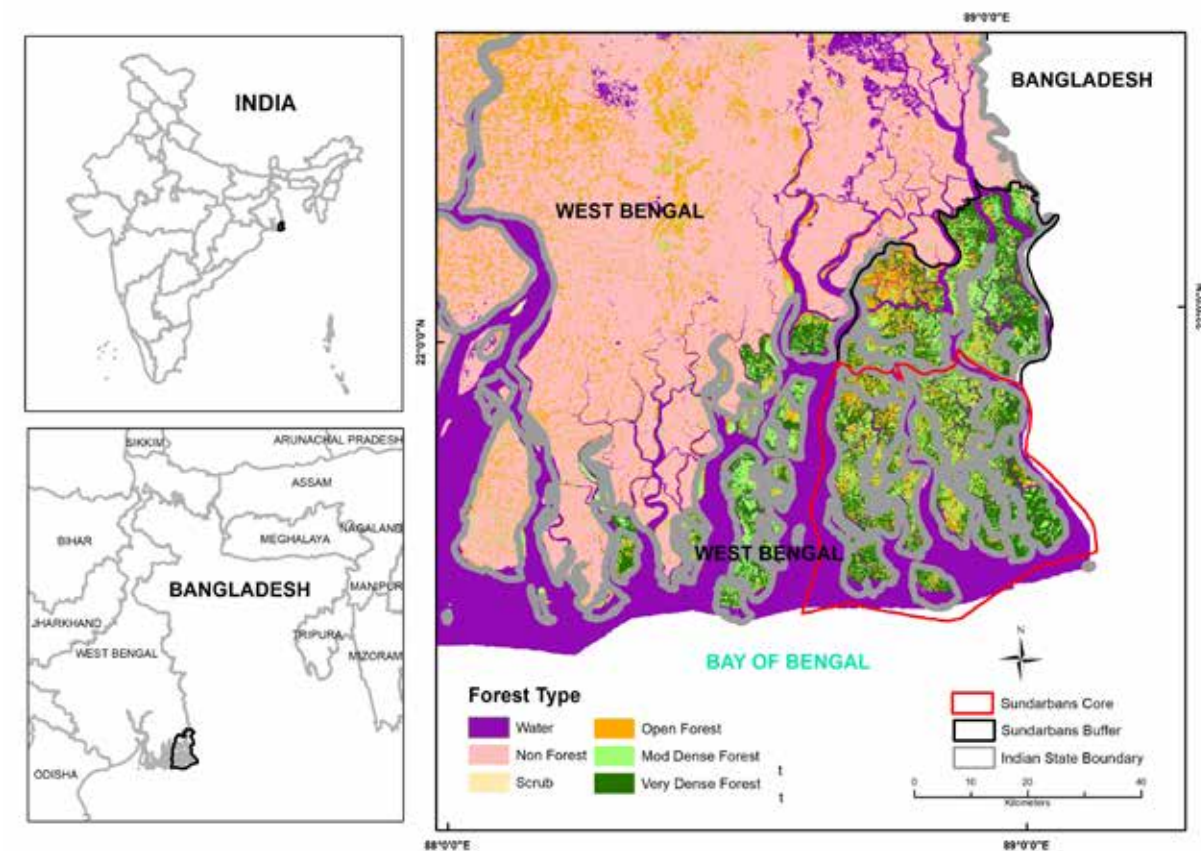


Figure 1: Map showing the location of Sundarbans Tiger Reserve in the state of West Bengal.

## 2. Tiger Population as per All India Tiger Estimation

In 2014, the unique tiger population was surveyed across various regions, revealing 14 individuals captured in Basirhat, 5 in Ramganga, and 20 in the National Park. The estimated tiger densities, represented as tigers per 100 km<sup>2</sup> with their respective standard errors (SE), were 3.43 (0.99) for Basirhat, 1.57 (0.74) for Ramganga, and 3.77 (1.03) for the National Park. In 2018, a comprehensive photo-capture survey resulted in the identification of 85 individual tigers. The estimated tiger density for this year was calculated at 3.6 tigers per 100 km<sup>2</sup>, with a standard error of 0.38, based on the analysis of 849 tiger photographs, from which 100 individual tigers were identified. In 2022, the photo-capture survey in the Sundarban Tiger Reserve and adjoining South 24 Parganas revealed the presence of 81 tigers and 20 tigers, respectively. The estimated tiger density for the Sundarban Tiger Reserve in 2022 was determined as 4.27 tigers per 100 km<sup>2</sup>, with a standard error of 0.43. These findings provide valuable insights into the dynamics of tiger populations within the Sundarbans region, facilitating informed conservation and management strategies for the preservation of this endangered species and its habitat.

## 3. Management Weaknesses and Actionable Points identified in five cycles of MEE and AITE since 2006

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>Although acquisition proceedings are unnecessary, issuing a final notification would be beneficial.</li> <li>The region has a dense population, and there is limited opportunity to alter the land-use.</li> <li>Illegal fishing and unauthorized honey collection activities are occurring within the core area.</li> <li>An additional fiberglass speed boat is needed.</li> <li>Insufficient funds are available to fulfill the TA claims.</li> <li>There is an opportunity to broaden the scope of the data being collected.</li> <li>There is room for implementing additional programs for staff training</li> </ul>	<ul style="list-style-type: none"> <li>Inadequate staffing remains a persistent issue, with over 50% of sanctioned posts vacant, especially at the forest guard level.</li> <li>The lack of comprehensive records and databases for training programs and staff information hampers effective management.</li> <li>Weaknesses in archiving and analyzing detailed threat assessments, scorecards, and mapping hinder continuous improvement.</li> <li>Despite measures, tiger straying incidents persist, causing panic; comprehensive analysis and mitigation strategies are needed.</li> </ul>	<ul style="list-style-type: none"> <li>Include tiger-bearing mangrove habitats under the jurisdiction of Sundarban Tiger Reserve for enhanced protection and resource allocation.</li> <li>Address growing biotic interference such as livelihood forest exploitation, fishing, palm, and timber extractions, along with increasing national and international waterways.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006	<ul style="list-style-type: none"> <li>The staff families currently lack comprehensive medical coverage, and the working conditions are challenging. Improved amenities are essential to mitigate these conditions. The Forest Department has put forth some proposals to address these concerns.</li> <li>There is a slight delay in providing ex-gratia compensation for cattle kills, and in the case of human deaths, there is a delay of 2-3 months.</li> <li>There is an opportunity to enhance the facilities at Sajnekhali managed by the tourism department.</li> <li>Irregular and incomplete cattle immunization.</li> <li>There is currently some host community involvement, but it is crucial for this to progress significantly, ideally expanding as part of an enlargement of eco-development activities.</li> </ul>	<ul style="list-style-type: none"> <li>Limited coordination between forest departments of India and Bangladesh affects effective cross-border forest and wildlife protection.</li> <li>Joint Management Committees (JMCs) lack microplans, impacting holistic conservation efforts and community support.</li> <li>Inadequate measures for retrieving and disposing of worn-out nylon nets contribute to pollution threats to aquatic/marine fauna.</li> <li>Patrolling efficiency needs enhancement through increased base camps, boats, and the use of drones for monitoring/mapping.</li> <li>Lack of a multidisciplinary framework hampers monitoring various ecological parameters in the STR landscape.</li> <li>The current system for public complaints lacks responsiveness, hindering effective management.</li> <li>Private resorts lack eco-friendly practices; linking access to eco-tourism with compliance is essential.</li> <li>Staff recruitment challenges persist; prioritizing existing vacancies is crucial for effective reserve management.</li> <li>Regular contacts/meetings between Forest Departments of India and Bangladesh are needed for improved cross-border collaboration.</li> </ul>	<ul style="list-style-type: none"> <li>Establish joint management activities between forest departments of India and Bangladesh for the transboundary tiger population. Facilitate trans-boundary cooperation and knowledge sharing between India and Bangladesh to maintain ecological integrity.</li> <li>Initiate joint patrolling efforts to ensure effective management of the shared tiger population.</li> <li>Explore options for tiger relocation and prey augmentation within India and Bangladesh due to nearing carrying capacity of current prey density.</li> <li>Recognize the importance of mangrove habitat protection, highlighted by the 1979 initiative by the Government of India.</li> <li>Support the Mangrove Initiative for Shoreline Habitats &amp; Tangible Income (MISHTI) launched on June 5th, 2023, focusing on plantation techniques, conservation measures, and resource mobilization through Public Private Partnership.</li> <li>Prioritize conservation efforts to prevent waterways from becoming barriers to tiger and other wildlife dispersal during economic transportation activities.</li> </ul>

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2006		<ul style="list-style-type: none"> <li>The impact of forest department interventions in JMCs and SHGs requires attention based on survey findings.</li> <li>Continuous data updates on the official website are crucial for transparency and public awareness.</li> <li>Sustained efforts are needed to address these consistent weaknesses and improve overall reserve management.</li> </ul>	
2010	<ul style="list-style-type: none"> <li>The international border with Bangladesh is porous, posing challenges for effective management. Work towards finalizing a MoU with Bangladesh to prevent smuggling of timber, NTFPs, and wildlife articles.</li> <li>Establish an institutionalized mechanism for bi-annual meetings with officials of adjoining countries to facilitate the exchange of information.</li> <li>Secure Memoranda of Understanding (MoUs) with the Sashastra Seema Bal (SSB) and National Tiger Conservation Authority (NTCA) to control trafficking from Bangladesh, Bhutan, and Myanmar.</li> <li>Provide more inputs to make the Tiger Reserve Foundation functional.</li> <li>Establish mechanisms in states (except West Bengal) for timely fund releases to the TRs and conduct a review of the functioning of the State-level Steering Committee.</li> <li>Critically assess TCPs to formulate a proper plan for implementation.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<ul style="list-style-type: none"> <li>Ensure close monitoring and technical assistance by NTCA for TCP implementation, forming a compatible team depending on the area and reporting to NTCA, including expert and capable NGO representatives.</li> <li>Organize regional-level meetings of TR managers to exchange ideas and discuss problems, with one TR Director coordinating and an observer from NTCA.</li> <li>Initiate Ecodevelopment activities involving partner NGOs for better planning, implementation, and reciprocal commitment support.</li> <li>Include selected stakeholders in planning and implementation to mitigate threats effectively.</li> <li>Establish monitoring mechanisms for selected indicator species and habitats, with technical support provided by NTCA when necessary.</li> <li>Conduct crash training programs (site-level/state-level/regional) on various aspects, especially for senior and field-level managers.</li> <li>Consider a special recruitment drive for the TR (exclusive with no transfer), preferably from the local/regional areas with experience in Dampa, to foster goodwill and commitment.</li> <li>Manage Tiger Reserves with multiple statuses (Biosphere Reserve, Elephant Reserve, and World Heritage Site) under one composite plan with different budget provisions.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<ul style="list-style-type: none"> <li>• Treat landscapes comprising more than one Tiger Reserve and several Forest areas with different statuses and connectivity as a unified entity, implementing a common management strategy and action plan (e.g., Manes, Buxa, and the adjoining forests).</li> <li>• Upload a copy of the TCP on the website for improved transparency.</li> <li>• Transform daily wildlife sighting records into occupancy statements using elementary statistics for improved record-keeping.</li> <li>• Enhance monitoring of vegetation changes, particularly in grassy blanks, and focus on the release of spotted deer.</li> <li>• Implement mechanisms to foster effective collaboration with rural development, revenue, and tourism departments to boost development in surrounding villages.</li> <li>• Upscale livelihood security programs into integrated area development initiatives, involving inter-agency coordination and support from professionals with a sociology background.</li> <li>• Encourage research and monitoring by local institutes, particularly in the areas of climate change, sea-level rise, and habitat changes.</li> <li>• The fringe areas exhibit high population density and face poor socio-economic conditions, coupled with a lack of proper infrastructure, leading to a high dependence on natural resources.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2010	<ul style="list-style-type: none"> <li>• Strategic locations suffer from an inadequate number of protection camps, equipped with old weapons and slow-moving boats.</li> <li>• Many areas experience a scarcity of drinking water.</li> <li>• Insufficient research and monitoring efforts are dedicated to understanding the ecological processes and population dynamics of key species.</li> <li>• Inter-agency coordination is lacking, contributing to operational challenges.</li> <li>• The presence of an unrestricted number of tourists, coupled with the unplanned growth of tourist lodges and the absence of waste management guidelines, poses environmental concerns. Establish a registration system for private tourist boats to track their numbers and movements within the Reserve.</li> <li>• Increase the number of interpretation centers to effectively engage the large volume of tourists visiting the Reserve.</li> <li>• Strengthen conservation awareness efforts among fringe populations and tourists visiting the area.</li> <li>• The forest areas within the vicinity are marked by the man-eating propensity of tigers, adding to the complexity of managing wildlife and ensuring human safety.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>The international border with Bangladesh is extensive and open, highlighting the necessity for further strengthening of patrolling facilities to enhance security measures.</li> <li>Improvement in monitoring vegetational changes in open areas is crucial for effective conservation efforts.</li> <li>The reserve is surrounded by a large human population, facing poor socio-economic conditions and high population density, resulting in significant resource dependence. Increased conservation awareness among fringe village populations, school children, and tourists is necessary for promoting environmental stewardship.</li> <li>The absence of high-speed boats for staff use hinders fast and effective patrolling efforts, impacting the ability to deter potential threats. Allocating two fast-moving boats to each range for patrolling, health, and rescue purposes is essential.</li> <li>Conversion of daily sighting reports into occupancy maps would enhance the interpretability of wildlife data.</li> <li>Merging offense spots into the map of the larger landscape is vital for efficient monitoring and control, based on monthly exercises and reports from Beat Officers to Range Officers/Field Director.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>Inadequate drinking water facilities and the absence of tide warning information in patrol camps make life challenging for personnel stationed in the interior. Providing patrolling camps with desalination plants for sweet drinking water and promoting rainwater harvesting are crucial for improving living conditions.</li> <li>The lack of systematic research on the evolving ecological processes and population dynamics of key species underscores the need for focused scientific investigations.</li> <li>The uncontrolled and unregulated growth of tourist lodges, motor launches, and freighters in the vicinity poses a challenge, with no guidelines or parameters for managing the waste generated by tourists and shipping activities. Strict enforcement and rationalization of the system for registering private boats, including the fitting of GPS tracker devices, are essential for controlled and regulated movements.</li> <li>There is a need to establish monitoring mechanisms for tourist activities and freighters carrying ores/coal to Bangladesh, emphasizing the importance of regulatory measures for environmental conservation.</li> <li>Establishing an institutionalized mechanism for coordination with BSF and Bangladesh officials is necessary to prevent smuggling of timber, NTFP, wildlife articles, and derivatives, as well as illegal fishing.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2014	<ul style="list-style-type: none"> <li>A review of the State Level Steering Committee and Tiger Reserve Foundation is required for more effective functioning.</li> <li>Annual Performance Objectives (APOs) should align with Tiger Conservation Plans (TCPs), with prioritized items monitored at the NTCA level.</li> <li>Upgrading present livelihood security programs into Integrated Area Development Programs will facilitate marketable products and skill enhancement.</li> <li>Constructing family quarters at suitable locations and providing special allowances for difficult areas should be considered as part of staff welfare measures.</li> <li>Filling the gap between sanctioned and position strength of field staff, especially in frontline positions, through a special recruitment drive for the Tiger Reserve, preferably from local or regional areas, is recommended.</li> <li>Installing E-eye or compatible devices at major channel junctions to prevent unauthorized entry and using CCTV cameras at watchtowers with observation paths for recording wildlife movements can enhance security.</li> <li>Issuing a notification for the Tiger reserve under Section 38w of the Wildlife Protection Act is a legal step for formal recognition and protection.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>There is a shortage of frontline staff, with over 50% of the sanctioned posts, particularly at the forest guard level, remaining vacant.</li> <li>Although a sufficient number of anti-poaching camps have been established on the northern islands, additional camps are needed on the southern islands.</li> <li>The collection of honey in the summer months by villagers residing in the border areas of Bangladesh and local Indian villages poses a serious threat.</li> <li>More research is required in the landscape, focusing on subjects such as climate change and carbon sequestration.</li> <li>Incidences of illegal drone use have been observed, leading to interceptions and seizures.</li> <li>There is a bilateral protocol for discussing all border issues between the BSF and their counterparts in Bangladesh. The NTCA has moved the Ministry of Home Affairs to make arrangements for consultations between the respective Forest Departments of the two countries on matters relating to conservation and wildlife trade, and this should be followed up.</li> <li>The establishment of additional anti-poaching camps on the southern islands is recommended.</li> </ul>		



MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
2018	<ul style="list-style-type: none"> <li>Recruitment of staff members is crucial for protection, especially considering that over 50% of the staff positions, particularly at the forest guard level, are currently vacant. The average age of 60% of the staff is over 50 years, emphasizing the need to fill vacant positions without further delay. The Police Recruitment Board has been entrusted with the task of recruiting forest guards, and they should expedite the process.</li> <li>The long, porous international border with Bangladesh necessitates strengthening patrolling efforts and acquiring high-speed boats for the quick deployment of staff. Incidents of illicit tree felling, poaching, illegal fishing, crab collection, and honey collection require immediate attention.</li> <li>Strong enforcement measures across the border by the Bangladesh Forest Department against poachers have proven effective and should be continued without complacency.</li> </ul>		
2022	<ul style="list-style-type: none"> <li>More than 50% of staff vacancies persist, and the age distribution indicates that over 50% of the staff are aged 50 years or above. Special recruitment is urgently needed due to the challenging working conditions in the STR.</li> <li>Detailed information on training and staff records is not available, necessitating the immediate creation of a staff-wise database for all training programs conducted in the TR.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>Records on the detailed assessment of threats, preparation of scorecards, and mapping require proper archiving and continuous analysis.</li> <li>Despite human-tiger conflict mitigation measures, incidents of tiger straying continue, causing panic among local residents. Analyzing the causes of each incident is essential.</li> <li>While coordination exists between paramilitary forces of India and Bangladesh on international boundary matters, a similar arrangement is needed between the forest departments of both sides for issues related to forest and wildlife protection.</li> <li>The 26 Joint Management Committees (JMCs) in villages abutting the buffer area lack microplans. Creating or revising microplans, involving line departments and village panchayats, can holistically address local community interests and garner their support for conservation.</li> <li>The life of nylon nets used for fencing along interface areas of Human-Wildlife Conflict (HWC) is reported to be three years. Establishing a system for retrieving and disposing of worn-out nylon nets is crucial to prevent pollution and threats to aquatic/marine fauna.</li> <li>Patrolling efficiency of frontline staff should be enhanced by increasing base camps and providing boats. Infrastructure in sensitive areas should be strengthened, and drones may be used for monitoring/mapping.</li> </ul>		

MEE Year	Weaknesses/Actionable Points Identified	Subsequent Non-compliance over the Years till 2022	Recommendations from AITE
	<ul style="list-style-type: none"> <li>• Lack of a multidisciplinary institutional framework hampers monitoring and evaluation of various climatic, morphological, and ecological parameters in the STR landscape. Establishing such a framework is essential.</li> <li>• The current system of complaints and their processing in the public domain needs to be more responsive to achieve management objectives.</li> <li>• Private resorts around the STR should be encouraged to adopt eco-friendly and community-friendly practices. Access to eco-tourism in STR can be linked to compliance with such practices.</li> <li>• Staff recruitment remains a major issue and should be prioritized for existing vacancies in the STR.</li> <li>• Establishing regular contacts/ meetings between the Forest Departments of India and Bangladesh will strengthen existing measures for the protection of forests and wildlife.</li> <li>• A survey on the socioeconomic impact of interventions by the forest department in Joint Management Committees (JMCs) and Self-Help Groups (SHGs) under the STR should be acted upon based on the findings and recommendations.</li> <li>• Uploading current data and continuous updating of information on the official website of the STR, including cases, seizures, and other relevant data, is crucial for transparency and public awareness.</li> </ul>		

**Synthesizing the key observations and recommendations made by subsequent cycles of Management Effective Evaluation and All India tiger estimation exercises, some of the action portfolios have been identified for the Tiger Reserve (as below) for an earliest compliance.**

#### 4. Suggested key management recommendations

- a. It is advisable to prioritize the recruitment of staff, particularly focusing on local and regional candidates with experience in Dampa. Considering the severity of the situation, a special recruitment drive exclusive to the reserve may prove beneficial in expediting the process and filling vacancies efficiently.
- b. To address the issue of an ageing workforce, it is recommended to expedite recruitment efforts to fill vacancies promptly. This proactive approach will help mitigate the challenges posed by an ageing workforce and ensure the continued effectiveness of the reserve's operations.
- c. Establishing a staff-wise database for all training programs and maintaining detailed records on threat assessments, scorecards, and mapping is crucial for effective management. This initiative will enable continuous analysis and informed decision-making to enhance operational efficiency.
- d. Addressing the inadequate infrastructure and equipment for patrolling requires immediate attention. Increasing the number of base camps and providing boats for frontline staff will strengthen patrolling efforts. Additionally, exploring the use of drones for monitoring and mapping can further enhance surveillance capabilities in sensitive areas.
- e. To address tiger straying incidents effectively, it is recommended to conduct a thorough analysis of the causes of each incident. This will facilitate the development of targeted mitigation strategies tailored to the specific factors contributing to straying incidents, thereby minimizing their occurrence.
- f. Strengthening cross-border collaboration with Bangladesh is essential for effective forest and wildlife protection. Establishing regular contacts and meetings between the Forest Departments of India and Bangladesh, along with considering a joint patrolling protocol, can significantly enhance cooperation and coordination efforts.
- g. To curb illegal activities within the core area, such as fishing and honey collection, it is advisable to strengthen patrolling efforts and address the porous international border with Bangladesh. Implementing stricter enforcement measures on both sides will be critical in deterring illegal activities and safeguarding wildlife.
- h. Establishing a multidisciplinary institutional framework for comprehensive monitoring and evaluation is recommended to address the lack of a multidisciplinary framework for monitoring various ecological parameters in the STR landscape. This framework will facilitate holistic monitoring efforts and enable informed decision-making for effective conservation management.
- i. To address conflicts arising from high population density and poor socio-economic conditions in fringe areas, it is recommended to uplift livelihood security programs

and integrate them into area development initiatives with inter-agency coordination. Increasing conservation awareness among fringe communities and tourists can also help mitigate conflicts and promote harmonious coexistence.

- j. Establishing a system for retrieving and disposing of worn-out nylon nets is crucial to prevent environmental damage caused by pollution and threats to aquatic fauna. This initiative will contribute to environmental conservation efforts and ensure sustainable management of natural resources.
- k. Creating or revising microplans for Joint Management Committees (JMCs) in collaboration with line departments and village panchayats is recommended to enhance effective engagement with local communities. These microplans should address community needs and garner support for conservation initiatives, thereby strengthening community participation in conservation efforts.
- l. Encouraging research and monitoring efforts by local institutes, with a focus on climate change, sea-level rise, and habitat changes, is crucial to address insufficient research and monitoring efforts on ecological processes and key species populations. This collaboration will contribute to a better understanding of the ecosystem and inform evidence-based conservation strategies.
- m. Providing desalination plants for sweet drinking water and promoting rainwater harvesting in patrol camps can address the issue of limited access to clean drinking water. Installing tide warning systems for staff safety will further enhance the safety and well-being of patrol staff, ensuring their effectiveness in conservation efforts.
- n. Establishing a registration system for private tourist boats and increasing the number of interpretation centers are recommended measures to manage the uncontrolled growth of tourism and unregulated waste management effectively. Implementing strict regulations and waste management guidelines for tourism and shipping activities will contribute to environmental conservation and sustainable tourism practices.

## 5. Conclusions

The Sundarban landscape, shared between India and Bangladesh, hosts approximately 200 tigers with unique adaptations to mangrove forests, making them globally significant. Efforts to manage this transboundary tiger population jointly between the two countries are yet to be fully realized, highlighting the need for coordinated patrols and management activities. However, the southern part of Sajnekhali wildlife sanctuary and sections of National Park East and West ranges exhibit high tiger density, contrasting with moderate densities in the northern part of South 24 Parganas forest division and Basirhat range. Human habitation bordering three sides of this landscape restricts tiger expansion, primarily towards the east, into Bangladesh's Sundarbans. Challenges such as increasing human activities like livelihood forest exploitation, fishing, and waterway development threaten the habitat and tiger population, necessitating cross-border cooperation for

landscape integrity and exploring relocation and prey augmentation strategies to manage the nearing carrying capacity.

In Bangladesh's Sundarbans, the 2018 estimation recorded a tiger population of 114 with an overall density of 2.55 tigers per 100 km<sup>2</sup>. As the geographical extent of the tiger population is constrained by available mangrove habitat, integrating tiger-bearing mangrove habitats under the jurisdiction of Sundarban Tiger Reserve is essential for enhanced protection and resource allocation. Furthermore, the Mangrove Initiative for Shoreline Habitats & Tangible Income (MISHTI), launched by the Government of India in 2023, aims to explore and develop mangrove habitats, emphasizing collaboration through Public-Private Partnerships. Despite these initiatives, the overarching threat of climate change looms over Sundarbans, necessitating urgent adaptation strategies by forest managers to mitigate its impacts on this critical tiger habitat and its surrounding ecosystem.





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