Assessment of Ecotourism and Biodiversity in Nagarahole National Park: A Study on Species Richness, Stakeholder Participation, and Conservation Strategies

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Abstract—**Nagarahole National Park in Kodagu, India, is a major tropical forest reserve of high conservation value and an important ecotourism destination. This study assesses the ecological status and sustainability of ecotourism in the park by examining species richness, tourist participation, local community involvement, and management perspectives within an environmental science framework. Floral and faunal diversity were quantified in both Tourist and Core zones using belt transect and transect line methods, while structured interviews were undertaken with tourists, the indigenous Jhenu Kuruba community, and forest department officials. Results indicate high overall biodiversity with distinct spatial variation: the Core zone supports greater plant diversity and carnivore presence, whereas the Tourist zone sustains higher herbivore abundance and greater human–wildlife interaction. Tourists are predominantly young and demonstrate strong pro-conservation attitudes, while local communities' express interest in increased participation in ecotourism-linked livelihoods. Despite generating revenue and environmental awareness, ecotourism currently provides limited direct benefits to local residents, and concerns persist regarding monoculture plantations and infrastructure quality. The findings emphasise the need for regulated tourism intensity, stronger benefit-sharing mechanisms, and conservation-oriented management to minimize ecological disturbance. Enhancing community participation while safeguarding biodiversity is essential to ensuring environmentally sustainable and socially equitable ecotourism in Nagarahole National Park.**

Index Terms—**Ecotourism, Nagarahole National Park, Species richness, Community participation, Sustainable tourism.**

I. INTRODUCTION

Protected areas play a central role in conserving biological diversity while supporting nature-based tourism activities that increasingly contribute to rural livelihoods and national economies. In recent decades, ecotourism has gained prominence as a conservation-oriented tourism model that promotes environmental protection, interpretation, and responsible travel while generating socio-economic benefits for local communities and park managers. Global studies indicate that when carefully planned and regulated, ecotourism can enhance visitor awareness of conservation values, strengthen institutional support for protected area management, and create economic incentives that reinforce biodiversity protection [1]. International agencies such as UNEP-WCMC and UNWTO further recognize ecotourism as a strategic pathway for aligning environmental sustainability objectives with tourism-driven development, particularly in biodiversity-rich landscapes.

India, one of the world's mega-diverse nations, has increasingly adopted ecotourism as a complementary strategy to protected area management. Among its most ecologically significant landscapes is Nagarahole National Park, located in the Western Ghats–Nilgiris Biosphere Reserve — a global biodiversity hotspot. The park supports a mosaic of semi-evergreen and moist deciduous forests harboring keystone fauna such as the tiger, Asian elephant, gaur, and diverse avifauna. The ecological sensitivity of the region underscores the importance of sustainable visitation practices that minimize anthropogenic pressures while

maintaining the integrity of wildlife habitats. Recent scholarship highlights that ecotourism, when implemented through participatory governance and strong regulatory frameworks, has the potential to contribute to conservation outcomes and community development in protected areas [2], [10].

At the same time, Indian case-study research — including prior ecotourism assessments in protected and reserve forests across Karnataka — demonstrates that sustainable outcomes depend heavily on community engagement, institutional capacity, and scientific monitoring of ecological conditions. Studies conducted in Bisle Reserve Forest, Yaana Reserve Forest, Brahmagiri Wildlife Sanctuary, and Talacauvery Wildlife Sanctuary emphasize the central role of local participation, stakeholder collaboration, and management commitment in determining ecotourism success and conservation effectiveness [4], [5], [6], [7]. These findings provide an important contextual foundation for evaluating ecotourism dynamics within Nagarahole National Park.

Given the park's ecological significance, tourism growth, and community presence, there is a clear need for empirical assessments that integrate biodiversity monitoring, tourist perception analysis, and community and management perspectives. Such interdisciplinary approaches contribute to global discourse on how ecotourism can be aligned with conservation ethics, socio-economic equity, and long-term ecosystem resilience. Therefore, the present study examines ecotourism potential and conservation interactions in Nagarahole National Park through a combined ecological and socio-economic framework, providing evidence to inform sustainable ecotourism planning and protected area management strategies [9].

II. METHODOLOGY

A. Study Area

Nagarahole National Park, presently notified as Nagarahole Tiger Reserve, is one of the most important protected areas in the Western Ghats biodiversity hotspot of southern India. The reserve extends over 643.39 km², forming part of an extensive network of forests supporting globally significant populations of large mammals, including the Asian elephant (*Elephas maximus*) and Tiger (*Panthera tigris*). The park lies within the districts of Kodagu and Mysuru in Karnataka, between 11°51′–12°15′ N latitude and 76°00′–76°17′ E longitude, with altitudes ranging from 700 to 975 m above mean sea level, the highest point being Masalbetta in the south. The landscape is gently undulating, intersected by several perennial rivers including the Nagarahole, Kabini, and Lakshmanathirtha, which play a major role in sustaining the region's tropical deciduous and riparian forest ecosystems. The climate is moderate, with temperatures varying between 14–33°C and mean annual rainfall ranging from 1,778 mm in the west to 1,270 mm in the east, reflecting a distinct west–east rainfall gradient.

The park derives its name from the Nagarahole River—literally meaning "snake stream" in Kannada—owing to its winding course through the central region of the reserve. The river eventually drains into the Taraka Reservoir before joining the Kabini River, which delineates much of the park's southern boundary. The Kabini Reservoir, created by a dam downstream, also marks the administrative boundary between Nagarahole and Bandipur National Parks. To the southwest, the park is contiguous with Wayanad Wildlife Sanctuary (Kerala), and together with Mudumalai Wildlife Sanctuary (Tamil Nadu) and Silent Valley National Park (Kerala), forms part of the Nilgiri Biosphere Reserve, India's first designated biosphere reserve and among the largest continuous tracts of wildlife habitat in the country.

The conservation history of Nagarahole dates back to 1955, when approximately 284–285 km² of forest in the erstwhile Kodagu district of Karnataka State was declared a Wildlife Sanctuary. The area was subsequently upgraded to Nagarahole National Park in 1983, with an expanded area of 571.55 km², and formally incorporated into the Nilgiri Biosphere Reserve in 1986. Owing to its high density of elephants, the park was brought under Project Elephant in 2000, forming part of the Mysore Elephant Reserve. In 2003, an additional 71.84 km² was notified, bringing the National Park to its present extent of 643.39 km².

In the same year, Nagarahole was included under Project Tiger, initially as an extension of Bandipur Tiger Reserve. This arrangement was revised in 2007, when the area was notified as an independent Tiger Reserve, with 643.39 km² designated as Core/Critical Tiger Habitat. In 2012, a Tourist Zone/Buffer Zone of 204.589 km² comprising adjoining reserved forests was notified, expanding the administrative landscape of Nagarahole Tiger Reserve to 843.96 km².

Today, Nagarahole forms a keystone component of one of the world's most important tropical forest–savannah ecosystems. Its mosaic of riverine forests, moist and dry deciduous woodlands, and grasslands—combined with perennial water availability and secure protection status—supports exceptionally high faunal diversity, making it a critical stronghold for long-term wildlife conservation in India.

Figure 1: Study area map

B. Biodiversity Assessment

Species richness was assessed using the belt transect method. 16 transects were laid in Nagarahole:

- Tourist Zone: Transect lines 1 to 8
- Core Zone: Transect lines 9 to 16

Each transect measured 1 km in length and 10 m in width. Observations were conducted mainly during morning hours to maximize wildlife sightings.

C. Socio-economic Survey

Structured questionnaires and interviews were administered to:

- Tourists (age, category, perception of conservation, facility needs)
- Local communities (future expectations, livelihood issues)
- Forest Department officials (management perspectives, challenges).

III. RESULTS AND DISCUSSION

Species richness was measured using belt transects (1 km length x 10 m width) across different zones.

A. Species richness

1. Tourist Zone (Transect Lines 1 to 8)

- Canopy & Habitat: This zone has less canopy cover compared to the core zone, and human settlements were observed here.
- Flora:
  - Dominant Species: *Tectona grandis, Melia dubia, Dalbergia latifolia, Terminalia alata*, and *Acacia catechu*.
  - Rare Species: *Bauhinia racemosa, Ficus racemosa, Mangifera indica*, and *Pterocarpus marsupium*.
  - Observation: Transect 1, 2, 6, 7 and 8 showed dominance of monocultured trees like *Acacia catechu*.
- Fauna:

- Animals: Rich in herbivorous diversity. Sightings included Spotted Deer (most abundant here), Wild Gaur, and Wild Boar.
- Birds: *Pavo cristatus, Merops orientalis, Acridotheres tristis* and *Gallus gallus*.

• Conservation Status: The tourist zone is rich in herbivorous animal diversity and some measures has to be taken by forest department to support ecotourism activities.

2. Core Zone (Transect Lines 9 to 16)

• Canopy & Habitat: This zone features very thick canopy cover and is noted for its high plant diversity.

• Flora:

- Dominant Species: *Acacia catechu, Terminalia alata, Anogeissus latifolia, Syzygium cumini,* and *Phyllanthus emblica*.
- Rare Species: *Buchanania lanzan, Acacia latronum*, and *Terminalia bellirica*.

• Fauna:

- Key Sightings: A Tiger was spotted in Transect 11, indicating this zone is critical for the tiger population and carnivorous animals.
- Birds: *Dryocopus javensis, Nisaetus cirrhatus, Chloropsis aurifrons* and *Dicrurus paradiseus*

• Conservation Status: The core zone is rich in animal diversity and should remain undisturbed to protect high-value species like the Tiger.

Transect	Shannon Index	Simpson Index	Evenness
Tourist Zone	1.89	0.79	0.76
Core Zone	2.67	0.91	0.89

Table 1: Diversity Indices for Nagarahole National Park

The above table indicates that core zones support richer and more complex vegetation communities compared to tourist zones.

B. Socio-economic survey

1. Tourist Participation

1.1 Demographics

• Age: The majority of tourists (53.30%) were between 20–40 years old. 40% were below 20 years, and only 6.7% were above 40.

• Category: Students made up the largest group (56.60%), followed by "Others" (20%), Businessmen (16.60%), and Government employees (10%).

1.2 Feedback on Conservation & Facilities

• Conservation Rating: 50% of visitors rated nature conservation as "Good," while 10% rated it as "Poor," citing uncleared litter as a primary concern.

• Demands:

- 37% suggested constructing hotels.
- 33% requested camping sites.
- 17% wanted a Museum of Nature.
- 13% suggested an Information Center.

• Specific Suggestions: Tourists recommended minimizing vehicle frequency inside the forest, encouraging elephant rides instead, improving road quality, and providing food near lodges.

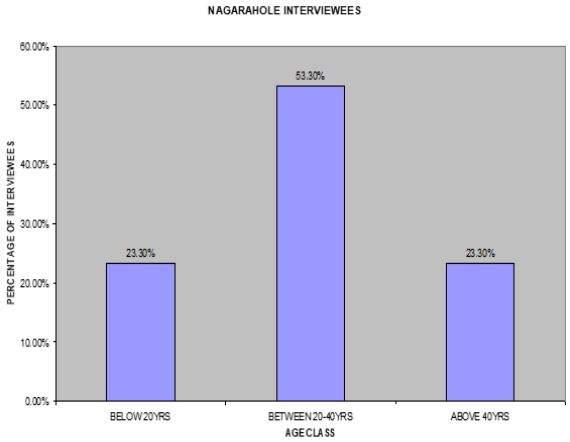

Figure 2: Age class of the Nagarahole Tourist Interviewees

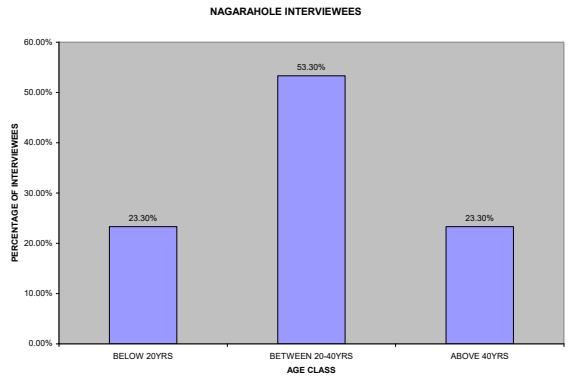

Figure 3: Category of visitors to Nagarahole

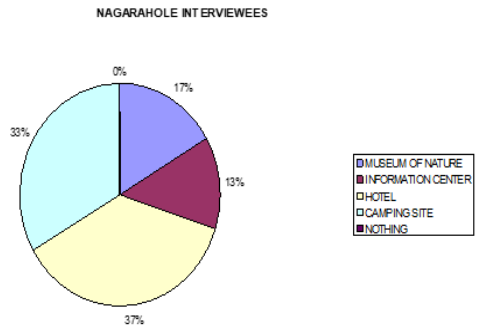

Figure 4: Demands of the visitors in Nagarahole

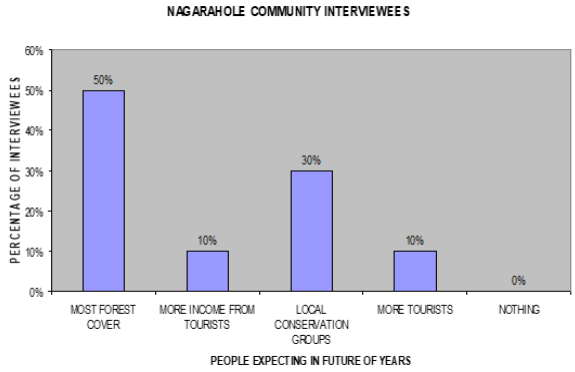

Figure 5: Views of Nagarahole community

2. Community Participation

Interviews were conducted with the local forest community, comprising approximately 60 families living in and around the park.

2.1 Socio-Economic Status

- Community members primarily work as laborers in coffee estates or in agriculture/cattle rearing.
- Relationship with Forest Department: They reported receiving some support or encouragement from the Forest Department which they expect to be more.

2.2 Ecological Knowledge & Concerns

- Extinct Species: Medicinal grass species like *Cynodon dactylon* and *Cymbopogon* have gone extinct.
- Endangered Flora: Trees such as *Bauhinia malabarica, Gmelina arborea*, and *Melastoma malabathricum* are becoming endangered. Specifically, they estimated very less *Bauhinia malabarica* trees remain in the range of their neighborhoods.
- Conservation Views: The community opposes monoculture (to preserve native species) and believes strict rules are necessary for better conservation.

2.3 Aspirations

- Future Outlook: 50% of the community wants to see more forest cover in the future, while 30% want to see local conservation groups established.
- Requests: They desire involvement in eco-tourism (e.g., exhibiting handicrafts, Ayurveda etc.,) and request support from the Forest Department to help in preserving the nature.

3. Management Participation

3.1 Current Management & Statistics

- Visitation & Revenue: The park attracts 25,000–35,000 visitors annually. The annual income is better compared to other National Parks in Karnataka state.
- Activities: Current recreational activities include nature watch, trekking, safari, and elephant rides.
- Endangered Species List: Includes Wild Gaur, Tiger, Panther, Wild Dog, Common Mongoose, and floral species like *Tectona grandis* and *Holigarna sp*.

3.2 Infrastructure & Challenges

- Priorities: 60% of committee members prioritized road improvement, while 20% focused on toilet facilities.
- Staffing: Guards emphasized the need for more personnel to adequately look after the sanctuary.
- Philosophy: Forest staff believe tourist activities should be minimized to ensure nature conservation and that education is key to preservation or conservation.

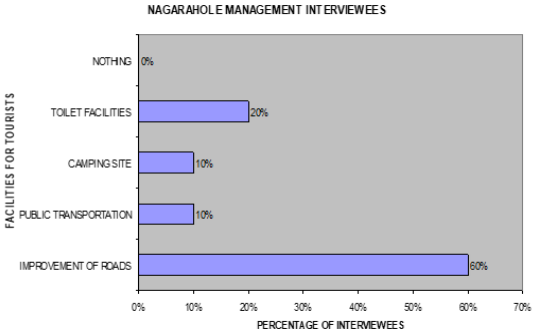

Figure 6: Improving facilities for tourists in Nagarahole

IV. CONCLUSION

Nagarahole National Park represents a critical ecotourism landscape where biodiversity conservation and tourism coexist. While the tourist zone supports visitor engagement and herbivore abundance, the core zone remains vital for carnivore conservation and plant diversity. Integrating community participation, improving management practices, and regulating tourism intensity are essential for long-term sustainability. Ecotourism in Nagarahole can serve as a model for protected area management if conservation priorities remain central to tourism development.

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