



## Mammalian Habitat Preservation In Innerline Reserve Forest, Cachar: A Conservation Perspective

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### Abstract

Mammalian habitat preservation in reserve forests is increasingly important for biodiversity conservation in human-dominated landscapes, with increased emphasis within global biodiversity hotspots. The present study assessed mammalian diversity, habitat characteristics, and conservation challenges in the Innerline Reserve Forest of Cachar District, Assam, located in the Indo-Burma biodiversity hotspot. A field-based ecological survey approach was adopted, integrating line transect surveys, indirect sign observations, vegetation assessment, and socio-ecological surveys. The study recorded diverse mammalian species representing multiple trophic guilds, including herbivores, carnivores, primates, and small mammals. Habitat-wise analysis revealed higher species richness and activity in dense forest patches and areas close to seasonal water sources, while degraded forest areas and forest fringes supported lower diversity. Vegetation structure and water availability were found to be the key determinants of habitat suitability, whereas logging, grazing, fuelwood collection, and encroachment negatively affected habitat quality and species occurrence. Socio-ecological findings highlighted the local dependence on forest resources and the prevalence of human–wildlife interactions near forest boundaries. The results bring forth the conservation importance of reserve forests as crucial habitats and ecological corridors outside the protected area network. Strengthening habitat protection, enhancing forest governance, and encouraging community participation are imperative for effective mammalian habitat preservation in the Innerline Reserve Forest.

**Keywords:** Mammalian diversity, Habitat quality, Reserve Forest conservation, Anthropogenic disturbance, Indo-Burma biodiversity hotspot

### Introduction

Forests are among the most biologically complex and ecologically significant ecosystems on Earth, with a wide array of flora and fauna coupled with many essential ecosystem services. Mammals contribute significantly to the integrity of forest systems by influencing vegetation structure, regulating prey populations, and maintaining ecological balance through multiple functional roles[1]. However, mammalian habitats across the world are increasingly threatened by anthropogenic pressures, including land-use change, habitat fragmentation, climate variability, and weak governance frameworks. These pressures are most pronounced in tropical and subtropical regions, where levels of biodiversity are high and human dependence upon forest resources remains substantial.

Change in LULC has now become one of the most potent drivers of habitat modification, with effects on microclimatic conditions, vegetation structure, and distribution of wildlife. In India, particularly in northern and Northeast India, land-use transformation is occurring rapidly, resulting in measurable increases in surface temperature and ecological stress, thereby affecting biodiversity [2]. Such changes in land use may change the suitability of habitats by modifying food availability, shelter, and pathways of movement for mammals. At a global scale, projections indicate substantial losses of mammalian habitat due to the combined effects of land-use change and climate change, posing severe challenges to long-term conservation efforts [3].

Habitat fragmentation further exacerbates the impacts of land-use change by isolating wildlife populations and reducing landscape permeability. Fragmented landscapes often limit dispersal opportunities, disrupt ecological processes, and increase extinction risk, particularly for medium and large-bodied mammals that have extensive spatial requirements. Empirical evidence from tropical savanna and forest ecosystems shows that fragmentation negatively affects mammalian species' persistence, especially those sensitive to habitat disturbance [4]. Besides fragmentation, edge effects at the interface between forests and non-forests greatly influence the distribution of species due to variations in microclimate, vegetation composition, and resource availability [5].

Landscape connectivity has become a core concept in modern conservation biology. Dynamic connectivity across heterogeneous landscapes is essential for facilitating wildlife movement, gene flow, and adaptation to environmental change. Connectivity is not constant but changes with time and space, especially within those landscapes undergoing rapid anthropogenic alteration [6]. In forested regions, the connectivity of reserve forests and non-protected areas between protected habitats makes such linkages particularly important in regional conservation planning.

Recognizing the importance of protected areas, on the other hand, a growing number of studies emphasize the conservation value of non-protected and multi-use forests. Non-protected areas often support significant biodiversity and maintain comparable populations of wildlife to those found within designated protected areas [7]. In India, reserve forests represent a high percentage of forested landscapes and serve an important function in biodiversity conservation, especially where

protected areas are scarce or spatially fragmented. These forests are often subject to intense anthropogenic pressures and receive lower conservation attention compared to protected areas.

The success of conservation in reserve forests is also dependent on forest governance, implementation, and monitoring. The weakness in enforcing forest law, lack of control over resource use, and intensity of monitoring are factors that facilitate degradation of the forests, hence the loss of biodiversity, mostly in India [8]. Improving forest governance, such as the use of ecological knowledge, is necessary for avoiding habitat degradation.

The Northeast part of India, which belongs to the Indo-Burma biodiversity hotspot, is known for its high biological diversity and endemism. The Barak Valley, which is in the southern part of Assam, has varied forests with different types of ecological gradients. Recent research in this part of India revealed large variations in tree species diversity and abundance, which are influenced by factors such as protection, topography, and human impact [9]. In spite of a rising number of studies on vegetation, there are still fewer studies on mammalian habitat use and conservation in the reserve forests of the Barak Valley.

In this background, the current research delves into habitat protection for mammalian species in the Inner line Reserve Forest, which is a part of the Cachar District of Assam. By exploring the availability of mammalian biodiversity, habitat, human-induced disturbances, and eco-social aspects, this research intends to fill some of the existing knowledge voids in order to support scientific habitat management practices in reserve forests such as the Inner line ones.

## Methodology

### 1. Study Area

In the current research, the location identified for studying the effect of infrastructure development on the habitat is the Innerline Reserve Forest, which is situated in the Cachar District of Assam, India. The Innerline Reserve Forest is a topographically varied area with moderately undulating terrain characterized by low hills, valleys, and plains, providing a heterogeneous environment in the topographic terms. The Innerline Reserve Forest is a part of a biodiversity hotspot, known as the Indo-Burma hotspot, which is one of the most biologically rich areas worldwide. In fact, the Indo-Burma biodiversity hotspot is regarded as one of the most diverse biodiversity hotspots because it has a diverse set of plant species that are geographically confined to a small area, mostly within mountainous ranges, making such areas rich in biodiversity. The study area contains seasonal streams and natural water depressions that act as temporary water sources for mammals, particularly during the monsoon period. The presence of these water sources increases the habitat suitability for different mammals. In climatic conditions, the area has a subtropical climate with high humidity, characterized by monsoonal rainfall, especially during the periods from May to September. The high rainfall has a significant effect on vegetation growth, food, and mammalian movement. The research location, with a mixture of climatic conditions, vegetation types, and availability of water sources, is vital for mammalian biodiversity habitats as well as a location for conducting ecological research aimed at conserving biodiversity.

### 2. Study Design

A field-based ecological survey design was implemented for the documentation of mammalian habitat conditions and the assessment of conservation challenges in the reserve forest. The study area was stratified to capture the ecological variability systematically into distinct habitat types for representative sampling: dense patches with minimal disturbance, moderately degraded forest areas, areas influenced by seasonal water availability, and forest fringe areas under the influence of proximal human habitations and agricultural sets.

The seasonal surveys were conducted in different times of the year, to capture temporal variations in mammalian activity, habitat use, and detectability. Seasonal sampling helped to capture differences in species movement, breeding activity, and resource utilization associated with changes in climate and vegetation cover. This stratified and seasonal design ensured comprehensive data collection and improved the reliability of findings related to habitat condition and species distribution.

### 3. Data Collection Methods

#### Mammalian Survey

The presence/absence and habitat use of mammalian species were recorded through a mixture of direct and indirect observation techniques. Line transects were laid out in the different types of habitats within the area of research. Line transects were traversed slowly, either in the early morning or late afternoon when mammalian activity is generally known to be high. Direct observation of mammalian species, when possible, was carried out, considering species, group size, activity, and habitat.

Besides conducting direct observation, there were also attempts to record indirectly the evidence of mammalian presence along the transect line. Indirect evidence of mammalian presence included pug marks, scats, burrows, scratch marks on trees, prey remains, animal trails, carcass remains, and vocalizations. The use of indirect indicators was essential, especially when dealing with mammals that are either elusive, nocturnal, or occur in low density, hence are less commonly observed directly. The species were identified with the aid of taxonomic keys.

### **Habitat Assessment**

Habitat characteristics have been evaluated using standard vegetation sampling techniques to evaluate the quality and suitability of habitats for mammalian species. Quadrat and plot-based methods were applied on several habitat types for documenting vegetation composition, species diversity, canopy cover, understory density, and ground vegetation. These parameters were adopted for assessing food availability, shelter, and cover for mammals.

Apart from vegetation structure, various habitat disturbance indicators were systematically recorded. These included indications of logging, grazing by domestic livestock, fuel-wood extraction and non-timber forest product gathering, encroachment for agriculture or settlements, and signs of roads or other infrastructure. The intensity and frequency of these disturbances were noted to assess the anthropogenic pressures and their consequences on mammalian habitats. The data on habitat assessment provide the essential context for interpreting species distribution patterns and conservation challenges within the reserve forest.

### **Socio-Ecological Survey**

In order to analyse human factors that affect habitats of mammals, a socio-ecological survey has been carried out along with the ecological surveys. The interviews were conducted with the locals living around the boundary of the forest as well as with the people from the forest department, who are actively involved in taking care of the forest.

The research targeted land use, dependence on forest resources, human-wildlife conflict, and community views on wildlife conservation. Details on damage caused to crops, predation of livestock, as well as community perceptions on conservation interventions, were sought. The socio-ecological information obtained enabled the interpretation of ecological results, thereby contributing to an understanding of the socio-economic factors that drive habitat degradation and conservation.

### **4. Tools and Instruments**

The research used diverse instruments to ensure that the collected information is precise. The use of Global Positioning System (GPS) equipment enabled the recording of geographic coordinates for line transects and wildlife sightings. The use of Geographic Information System (GIS) software offered a means to analyse species distribution, habitats, as well as human-induced disturbances.

### **5. Data Analysis**

The species diversity and distribution were quantified by applying common ecological indices, such as the Shannon-Wiener Diversity Index and Simpson's Diversity Index. The two indices were employed to quantify species richness and evenness within different habitats. The spatial data, which was derived from the use of GPS devices as well as observations, is quantitatively processed by applying GIS to examine the habitat utilization, hot spots, and habitats under human pressure.

Qualitative findings from the socio-ecological surveys were thematically analyzed to clarify the dominant issues, use patterns, and perceptions regarding habitat preservation. The use of a mix of quantitative ecological findings with socio-ecological findings portrays a complete picture of challenges in mammalian habitat preservation in the Inner Line Reserve Forest.

### **6. Ethical Considerations**

The surveys in the fields were carried out in a manner that is consistent with the ethics of wildlife research, ensuring that there was minimal disruption to the wild animals and their habitats. No wild animals were handled, harmed, or captured in the research. The use of the transects aimed at minimizing distress to the wild animals. The participation of local people in the socio-ecological surveys was voluntary, with consent from the respondents before conducting interviews. Activity patterns were inferred qualitatively based on the timing of direct sightings, freshness of indirect signs (such as pugmarks and scats), and local ecological knowledge obtained during field surveys.

## **Results**

The findings from the current research form a complete picture regarding the mammalian diversity, habitat, and conservation status in the Innerline Reserve Forest of Cachar District, Assam. The findings are obtained from a comprehensive survey, taking into consideration line transect surveys, sign surveys, habitat surveys, and eco-social surveys in different habitats. The findings are divided into themes, which include mammalian species, habitat-wise distribution, activity patterns, habitat, and extent of human-induced disturbances. Comparatives are used to compare species richness and habitat quality in dense forest areas, deforested areas and forest fringe habitats. The findings from the research make way for developing scientific understanding of the ecological importance of the Innerline Reserve Forest, which is further compared with different conservation priorities for management, as explained later.

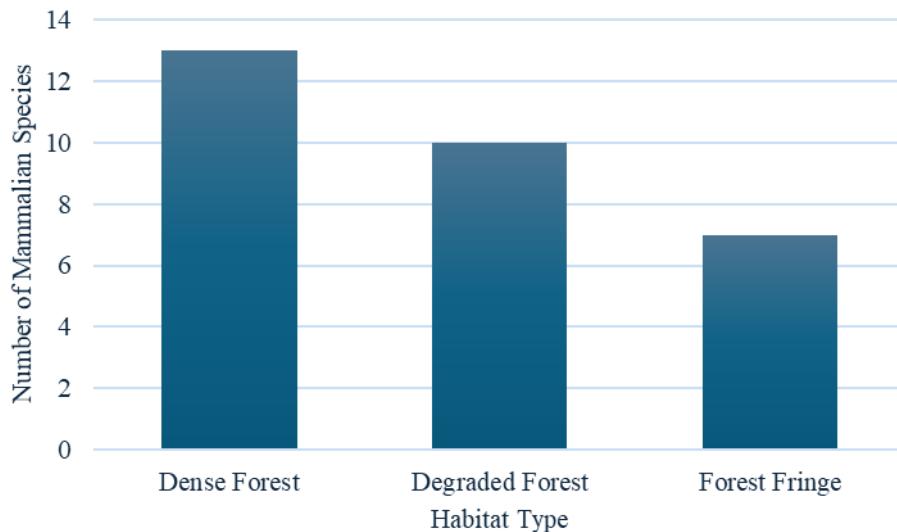
### **1. Mammalian Species Diversity and Composition**

The habitat surveys carried out in different habitats within the Innerline Reserve Forest revealed a significant level of mammalian diversity, which is a testimony to the importance of the habitat. The mammalian species that belong to various taxa were recorded through direct observation as well as indirect evidence.

Amongst the recorded species, there were herbivores, carnivores, omnivores, arboreal mammals, and small terrestrial species, which indicate that multiple feeding guilds are represented within the forest ecosystem.

Herbivorous mammals, such as various species of deer and wild boar, were regularly identified both by direct observation and presence indicators such as pugmarks, feeding, and trails. Carnivorous mammals which were identified by direct observation. The presence of meso-carnivores (medium-sized carnivorous mammals) and top predators indicates that the forest still supports conditions that are conducive to supporting functionally diverse mammalian assemblage.

The arboreal mammals, such as primates, small arboreal species, were documented mainly by sightings and calls, especially in dense forest patches. The small mammals, such as rodent species, insectivores, were assessed mainly from burrows, track analysis. In summary, species diversity is shown to differ in different habitat types, with species richness in dense forests being greater than that of degraded forests, as well as forest fringes. The species richness in the dense forest patches are greater than that in degraded forest patches and forest fringe habitats (Figure 1).



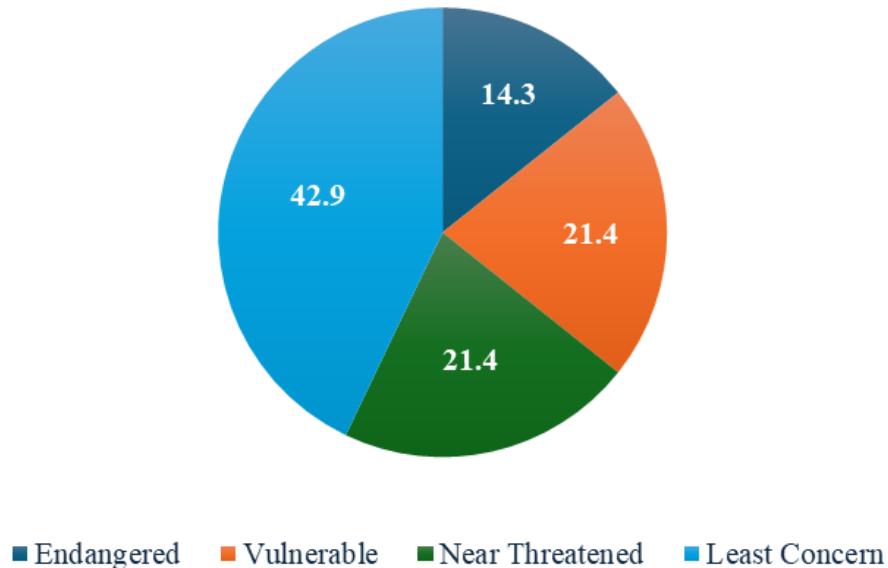
**Figure 1. Habitat-wise variation in mammalian species richness recorded in the Innerline Reserve Forest**

A comprehensive checklist of mammalian species recorded during the study, along with their mode of detection and conservation status, is presented in Table 1.

**Table 1. Mammalian species recorded in the Innerline Reserve Forest, Cachar District, Assam, with corresponding detection methods and conservation status**

S. No	Scientific Name	Common Name	Family	Order	Mode of Detection	IUCN Status
1	<i>Sus scrofa</i>	Wild Boar	Suidae	Artiodactyla	Direct sighting, Indirect signs	Least Concern
2	<i>Rusa unicolor</i>	Sambar Deer	Cervidae	Artiodactyla	Indirect signs	Vulnerable
3	<i>Axis axis</i>	Spotted Deer	Cervidae	Artiodactyla	Direct sighting	Least Concern
4	<i>Muntiacus muntjak</i>	Barking Deer	Cervidae	Artiodactyla	Indirect signs	Least Concern
5	<i>Capricornisrufidus</i>	Serow	Bovidae	Artiodactyla	Indirect signs	Near Threatened
6	<i>Hoolock hoolock</i>	Hoolock Gibbon	Hylobatidae	Primates	Direct sighting, calls	Endangered
7	<i>Trachypithecus phayrei</i>	Phayre's Leaf Monkey	Cercopithecidae	Primates	Direct sighting	Endangered
8	<i>Nycticebus bengalensis</i>	Slow Loris	Lorisidae	Primates	Nocturnal sighting	Vulnerable
9	<i>Ursus thibetanus</i>	Asiatic Black Bear	Ursidae	Carnivora	Indirect signs	Vulnerable
10	<i>Viverrazibetha</i>	Large Indian Civet	Viverridae	Carnivora	Direct and Indirect signs	Least Concern
11	<i>Herpestesedwar dsii</i>	Indian Grey Mongoose	Herpestidae	Carnivora	Direct sighting	Least Concern
12	<i>Hystrix indica</i>	Indian Crested Porcupine	Hystricidae	Rodentia	Indirect signs	Least Concern
13	<i>Ratufabicolor</i>	Malayan Giant Squirrel	Sciuridae	Rodentia	Direct sighting	Near Threatened

A considerable proportion of the recorded mammalian species, fall under threatened categories, including Endangered, Vulnerable, and Near Threatened, highlighting the conservation importance of the Innerline Reserve Forest (Figure 2).

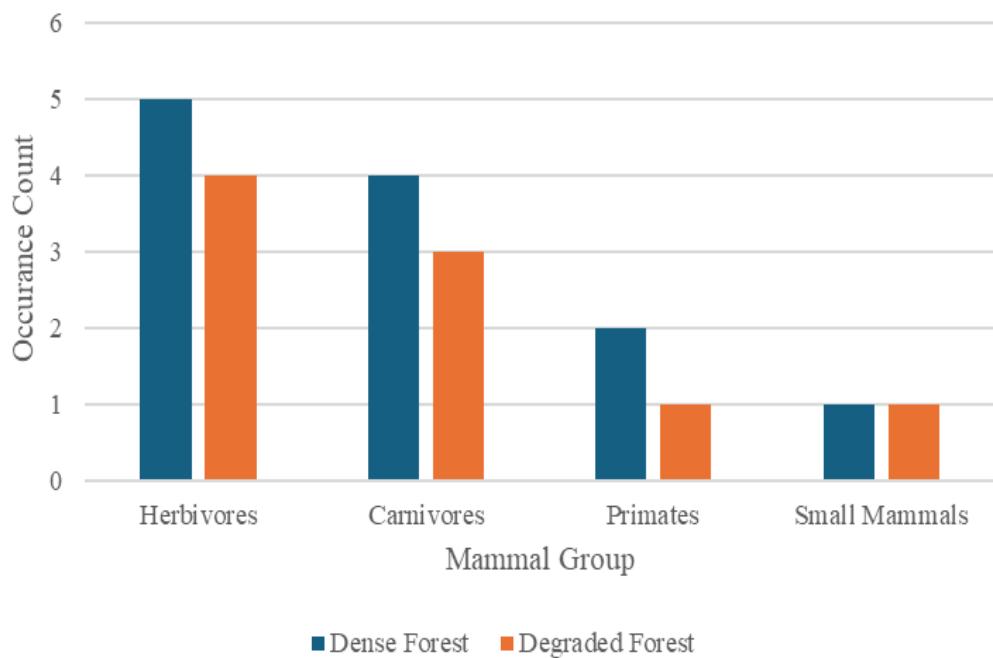


**Figure 2. Proportional representation of recorded mammalian species according to IUCN Red List conservation categories**

## 2. Habitat-wise Distribution Patterns

ANOVA on habitat-wise distribution showed that there were clear-cut differences in mammalian occurrence across the stratified habitat types. Patches of dense forest supported the highest diversity and abundance in mammals with frequent signs of herbivores, carnivores, and arboreal species. The areas manifested relatively low levels of anthropogenic disturbance with dense canopy cover and abundant food resources and hence were favourable habitat conditions for wildlife.

In the case of moderately degraded forest patches, species diversity was lower compared to dense forest patches. Common and adaptable species were frequently recorded; however, signs of sensitive or disturbance-averse species were relatively scarce. Mammalian diversity was lowest in forest fringe areas, dominated by observations of generalist species tolerant of human presence. The occurrence of major mammalian groups varied across habitat types, with herbivores and carnivores showing wider distribution compared to primates and small mammals (Figure 3).



**Figure 3. Habitat-wise occurrence of major mammalian groups in dense and degraded forest habitats of the Innerline Reserve Forest**

Distribution of mammalian species across different habitat types is presented in Table 2.

**Table 2. Habitat-wise occurrence of mammalian species across different habitat types in the Innerline Reserve Forest**

Species	Dense Forest	Degraded Forest	Forest Fringe
Wild Boar	Present	Present	Present
Sambar Deer	Present	Occasional	Rare
Spotted Deer	Occasional	Present	Present
Barking Deer	Present	Occasional	Rare
Serow	Present	Rare	Absent
Hoolock Gibbon	Present	Rare	Absent
Phayre's Leaf Monkey	Present	Rare	Absent
Slow Loris	Present	Rare	Rare
Asiatic Black Bear	Present	Rare	Absent
Large Indian Civet	Present	Present	Occasional
Indian Grey Mongoose	Occasional	Present	Present
Indian Crested Porcupine	Present	Present	Present
Malayan Giant Squirrel	Present	Rare	Absent

These areas showed significant influence of nearby settlements, agriculture, and human activity, limiting their suitability for many forest-dependent mammals.

### 3. Habitat Structure and Vegetation Characteristics

Amongst the recorded species, there were herbivores, carnivores, omnivores, arboreal mammals, and small terrestrial species, which indicate that the functional composition is relatively intact in the forest ecosystem.

Herbivorous mammals, such as various species of deer and wild boar, were regularly identified both by direct observation and presence indicators such as pugmarks, feeding, and trails. Carnivorous mammals were commonly identified by direct observation. The presence of meso-carnivores (medium-sized carnivores) and top predators indicates that the forest still supports conditions that are conducive to supporting feeding guilds.

The arboreal mammals, such as primates, small arboreal species, were documented mainly by sightings and calls, especially in dense forest patches. The small mammals, such as rodent species, insectivores, were assessed mainly from burrows, track analysis. In summary, species diversity is shown to differ in different habitat types, with species richness in dense forests being greater than that of degraded forests, as well as forest fringes. The species richness in the dense forest patches is greater than that in the degraded forest fringes.

### 4. Anthropogenic Disturbance and Habitat Degradation

Observations carried out in the Innerline Reserve Forest reported various types of human-induced disturbances. The presence of logging, fuel wood cutting, grazing, and encroachment was noticeable, especially in the degraded areas of the forest. Human trails, camp sites, and agricultural crops were common sightings along the forest boundaries.

Grazing pressure from domesticated animals was found to affect the vegetation growing beneath the canopy, which might reduce food sources for wild herbivores. The presence of logging, whether legal or illegal, led to canopy openings and fragmentation. Infiltration as a result of agricultural expansion threatened the integrity of the forest, especially at the edge. The areas which experienced high disturbance exhibited a decline in mammalian species richness as well as habitat use indicators. Sensitive species were mostly absent in highly disturbed areas, with generalized species being more tolerant of human presence. The results obtained confirm that human impact is a significant force that shapes mammalian habitat quality and availability within the reserve forest. The magnitude and coverage of major human impact indicators for various habitat types are illustrated in Table 3.

**Table 3. Anthropogenic disturbance indicators recorded across different habitat types in the Innerline Reserve Forest**

Habitat Type	Logging Activity	Grazing Pressure	Fuelwood Collection	Encroachment	Infrastructure Presence
Dense Forest	Low	Low	Low	Absent	Absent
Degraded Forest	Moderate	Moderate	High	Occasional	Low
Forest Fringe	High	High	High	Frequent	Moderate

### 5. Socio-Ecological Findings

The socio-ecological survey offered significant findings regarding interactions with wildlife, as well as perceptions concerning conservation. The nearby communities, which lived on the borders of the forest, are dependent on forest resources for fuel wood, fodder, and non-timber forest produce. This dependence generated constant pressure on the habitats within the forest.

Crop damage by wild herbivores and livestock predation were reported by local communities, resulting in negative attitudes toward certain wildlife species. On the other hand, certain individuals within the communities are aware of the importance of the forests and wildlife from the ecological perspective. The forest department officials spoke concerning difficulties experienced.

The socio-ecological results emphasized the importance of involving the community and awareness-driven conservation practices. The convergence of local means of living with conservation efforts played a significant role in suppressing habitat destruction as well as human-wildlife conflict.

## 6. Spatial Analysis of Mammalian Distribution

The use of GIS spatial analysis identified the distribution and use of mammals within the region of interest. The main species occurrence and activity were recorded within dense forest cores, but with a scarce distribution within degraded sites as well as peripheries. The overlap of high human pressure with a scarce presence of mammals in the region identified the effect of human activities on mammal habitats.

The mapping of habitat degradation indicators has revealed areas of high habitat degradation, especially around the edges of the forest as well as the routes of access.

Findings from this research confirm that the Innerline Reserve Forest is home to varied mammalian species, with habitat quality playing a significant role in species distribution and abundance. Forest patches are essential in conserving mammalian species, while human-induced disturbances are major threats to habitats. The ecological as well as the socio-ecological findings underscore the need for habitat conservation based on a multidisciplinary approach that considers ecological as well as human perspectives.

## Discussion

This study aptly shows that the Innerline Reserve Forest in the Cachar District is home to a significant assemblage of mammalian species, thus underscoring the significance of reserve forests with respect to biodiversity conservation in Northeast India. The components of herbivores, carnivores, primates, and small mammals surveyed in our study are well represented in the updated list of mammals from Northeast India, thus signifying that our area is still home to representative components of mammalian species in Northeast India [10,11]. The presence of globally threatened and near threatened species in our survey aptly indicates that the Innerline Reserve Forest has significant conservational importance as a refuge for species in a human-modified habitat.

The Innerline Reserve Forest is identified within the Indo-Burma biodiversity hotspot, playing an important role in biodiversity conservation at a landscape scale, extending beyond the protected areas. Such observations have been documented in other parts of the Indo-Burma biodiversity hotspot as well, where forests outside the protected areas, such as national parks and wildlife sanctuaries, are known to support a considerable amount of wildlife, thereby providing a connecting mechanism for the environment [12]. The results from this research support such findings, thereby identifying the importance of reserve forests acting as supplementary habitats within biodiversity hotspots, particularly when protected habitats are limited.

Habitat analysis revealed that mammalian species richness and activity were dominant in dense patches of forest, but degraded forest areas, as well as forest fringes, supported fewer species. The importance of habitat quality to mammalian habitat use has been underscored by this result because a high degree of canopy, habitat heterogeneity, as well as Food and habitat resources, within dense forest habitat support favourable conditions for forest dwellers. It is supported by the fact that habitat quality, rather than habitat amount, is revealed as an essential factor for mammalian habitat use within tropical habitats, as evidenced by various research works that showed habitat quality to be a significant factor for mammalian habitat use [13].

In contrast, degraded forest patches, as well as forest fringe areas, showed a decline in species richness as well as use of habitat indicators for sensitive mammals. The simplification of vegetation structure led to a decline in canopy cover, thereby making these habitats less suitable, possibly because of increased human-induced habitat disturbances. Vegetation structure complexity has been linked to mammalian species identity, as reported from tropical forests, which indicate that a greater measure of canopy and underlayer complexity is a fundamental habitat attribute that promotes overall biodiversity and species identity in mammals [14].

The use of a combination of different survey methods, such as line transects and recording of indirect sign worked well in obtaining a satisfactory inventory of mammalian species in the Innerline Reserve Forest. The use of indirect sign contributed significantly to the records of species, especially the cryptic ones, which are difficult to detect. This conforms to previous research, which shows that sighting rates alone tend to underestimate the abundance of felids, medium-sized carnivores, and nocturnal mammals in dense forest habitats [15].

Line transects surveys, supplemented with indirect sign evidence, are widely used methods for documenting wildlife distribution across habitats [16]. Even though direct observations are fewer in dense habitats, a diverse research approach has been adopted that covers various habitats, from mega-herbivores (large-bodied herbivores) to small land mammals. This helps in a research approach that is adopted in reserve forests, which are influenced by habitat variability and disturbance.

Field observations and indirect signs suggest increased nocturnal movement in several species, likely as an adaptive response to human disturbance. This is in line with other ecological findings that indicate an increase in nocturnal activity in wildlife, which is considered an attribute of adaptation to human disturbance in the environment [17]. Inferred nocturnal

movement patterns were more frequently suggested in areas with higher human presence, which may reflect behavioral adaptation to disturbance.

Diurnal activity patterns were more evident in some herbivores and primates, mostly in undisturbed areas of the forest where human impact was limited. The activity patterns of some species, which are crepuscular, indicate temporal niche partitioning, which facilitates species coexistence by reducing overlap in activity periods. The results show the adaptability of mammals in regard to ecological factors as well as human impact, with a need to take into consideration temporal activity patterns in conserving mammals. [18]

The distribution of human-induced disturbances such as logging, fuel-wood extraction, grazing, and encroachment remains skewed in the area, with the highest level of disturbing activity recorded in the fringe habitats and degraded sites. The relationship between mammalian species richness and disturbing activity, as reflected in our findings, agrees with documented evidence that habitat degradation is significantly impacted by human activity. The rarity or lack of occurrence of sensitive species in highly disturbed habitats indicates that further human impact might cause local extinctions [19]. Such patterns also occur in other forested ecosystems throughout the tropics, where fragmentation and human encroachment impact large-bodied, forest-dwelling mammals most. The need to address degraded areas via habitat management, resource use, and enforcement is thus underscored. The protection of forest cores is necessary to preserve mammalian populations.

The results from the socio-ecological survey identified that there is a great reliance on the forest for resources, which has led to the continued pressure on habitats. The cases of crop damage and livestock being predated reported by respondents are indicators that human-wildlife conflict is a problem that occurs in landscapes that are adjacent to forests. This has been identified to occur in other Himalayan/South-East Asian regions because of changes in land use, which affect human-wildlife interconnectivity.

Despite these challenges, awareness of the importance of forests from a biological perspective introduces opportunities for a community-based conservation initiative. The need to engage communities in a conservation plan, support the development of alternative means of living that are environmentally sustainable, and use conflict reduction approaches may mitigate the pressure on mammal habitats, in addition to enhancing the success rate of conservation.

The results of this research echo the significance of reserve forests as a unit of conservation in relation to other protected areas. The existence of similar nature forest reserves in other areas, such as Tanzania, has yielded evidence that reserve forests remain a pivotal component in the conservation of biodiversity in human-dominated environments. The Innerline Reserve Forest is a significant component contributing to the conservation of biodiversity within this region.

Although the study is a useful source of baseline data, certain drawbacks need to be considered. No abundance estimate of species has been calculated, and there may be changes with respect to the season, which might affect detection rates. Future research with a lengthy observation component, superior models of occupancy, along with the use of complementary methods such as passive acoustic sensing, would increase the potential for a better comprehension of mammalian biology within the area.

In conclusion, it is evident that habitat conservation in mammalian species is strongly interlinked with habitat quality, vegetation complexity, and human pressure in the Innerline Reserve Forest. This convergence of ecological and socio-ecological principles provides a comprehensive insight into habitat conservation challenges. Habitat conservation, increased community engagement, and acceptance of the importance of reserve forests in habitat conservation are necessary to maintain mammalian species in the Indo-Burma biodiversity hotspot.

## Conclusion

The current research work emphasizes the importance of the Innerline Reserve Forest of Cachar District as a significant habitat for mammalian diversity existing within the Indo-Burma biodiversity hotspot. The results clearly show that habitat quality, vegetation structure, and availability of water resources are critical factors that define the distribution and use of habitats by mammals. The presence of dense forest habitats and species activity were significantly richer in comparison to degraded habitats as well as habitats in the forest fringe, signifying the importance of undisturbed forest cover as a habitat requirement for mammalian species. Human-induced factors such as logging, fuel-wood extraction, grazing, and encroachment significantly reduced habitat quality and species occurrence, with the strongest impacts observed in forest fringe zones and degraded forest patches. The negative species richness impact of habitat disturbances correlates with the intensities of habitat modification, signifying the susceptibility of mammalian species to habitats modified by human activity. Observed patterns from indirect signs and occasional sightings indicate a possible shift towards increased nocturnal movement in some species. Integration of multiple survey approaches, including line transect surveys, indirect sign surveys and socio-ecological surveys, enhanced documentation of mammalian diversity. The current research work indicates the importance of reserve forests for biodiversity conservation, particularly in regions with high human activity presence where habitat connectivity plays a significant role. In a nutshell, the research findings indicate the importance of increased habitat protection, proper forest management, and community-participatory conservation approaches towards ensuring habitat preservation of mammalian species in the Innerline Reserve Forest.

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