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A preliminary assessment of faunal mortality on a road through Mannur Reserve Forest, Kanchipuram, Tamil Nadu, India

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Abstract

Many studies have shown that anthropological acts driven by human demands have led to the extinction of numerous plant and animal species, or have put them in danger of becoming extinct. Deforestation is a serious occurrence that damages the ecosystem permanently, reduces biodiversity, and interferes with an entire ecological niche's capacity to function. Evidence on the causes and impacts of vehicle mobility in a forest reserve area is provided by the present research. Animal mortality was shown to be higher during the lockdown with traffic relaxation and somewhat lower during the lockdown without relaxation. The present study shows how unregulated automobile access into the Mannur Protected Forest results in significant faunal fatalities. The state has to be persuaded to exclusively adopt Good Environmental Practices (GEP) while constructing roads through the forest, and the appropriate authorities must keep an eye on the movement of automobiles through the remote forest zone.

Keywords: road mortality, fauna, reserve forest, kanchipuram district, tamil nadu

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Mannur Rezerv Ormanı, Kanchipuram, Tamil Nadu, Hindistan'dan geçen bir yolda fauna ölümlerinin ön değerlendirmesi

Özet

Birçok araştırma, insan taleplerine dayalı antropolojik eylemlerin, çok sayıda bitki ve hayvan türünün yok olmasına veya yok olma tehlikesiyle karşı karşıya kalmasına yol açtığını göstermiştir. Ormansızlaşma, ekosisteme kalıcı olarak zarar veren, biyolojik çeşitliliği azaltan ve tüm ekolojik nişin işlev görme kapasitesine müdahale eden ciddi bir olaydır. Bir orman koruma alanındaki araç hareketliliğinin nedenleri ve etkilerine ilişkin kanıtlar bu araştırma tarafından sağlanmaktadır. Hayvan ölümlerinin, tecrit sırasında gevşeme ile daha yüksek ve gevşeme olmadan tecrit sırasında biraz daha düşük olduğu gösterildi. Bu çalışma, Mannur Koruma Altındaki Ormana düzensiz otomobil erişiminin nasıl önemli faunal ölümlere yol açtığını göstermektedir. Devlet, ormanın içinden yollar inşa ederken yalnızca İyi Çevresel Uygulamaları (GEP) benimsemeye ikna edilmeli ve ilgili makamlar, uzak orman bölgesinde otomobillerin hareketini kontrol etmelidir.

Anahtar kelimeler: karayolu ölümleri, fauna, rezerv ormanı, kanchipuram bölgesi, tamil nadu

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1. Introduction

One of the most complex obstacles that our planet is coping with at the present moment is the depletion of its biological diversity. Loss of biodiversity refers to the decline in the number and variety of living organisms on Earth, including plants, animals, and microorganisms. This loss is caused by a variety of factors, including habitat destruction, pollution, climate change, and over-exploitation of natural resources [1, 2]. Habitat destruction is one of the main causes of biodiversity loss, as it destroys the natural homes of many species, making it difficult for them to survive. Climate change is also a significant contributor to biodiversity loss, as it causes changes in temperature, precipitation, and sea level, which can affect the distribution of species. Additionally, pollution and over-exploitation of natural resources can damage ecosystems, making it difficult for many species to survive [3].

The loss of biodiversity has a number of negative consequences, including the loss of ecosystem services, the disruption of the delicate balance of ecosystems, and the extinction of many species. Additionally, the loss of biodiversity can also have negative effects on human well-being, as it can lead to the loss of important ecosystem services, such as pollination and pest control, and can also disrupt the delicate balance of ecosystems. Therefore, it is important to take action to protect biodiversity and to preserve the natural world for future generations [4].

It is well known that the global assessment of natural resources is not predictable. Fauna directly and indirectly plays a vital role in the ecosystem by being part of food webs and thereby influences the economic status of the country. Some examples include soil arthropods which enrich the texture and nutrition of soil in the forest ecosystem, agricultural fields and litter regions [5]. Insects serve as the backbone of any ecosystem as the entire vegetation depends on natural pollinators. Reserve forests are pockets of resources for faunal and floral diversity that help conserve and protect threatened species. Most nocturnal organisms in these forests are active during the night in search of potential mates, food, shelter and seasonal migration. All of these activities are disrupted by the noise caused by traffic, light and vibration caused by the motor vehicles that traverse the forests.

Faunal mortality on roads, also known as wildlife-vehicle collisions, is a significant problem that affects both wildlife and human populations [6, 7, 8, 9]. These collisions can result in the death or injury of both animals and people, as well as damage to vehicles and infrastructure. One of the main causes of faunal mortality on roads is habitat fragmentation. As human populations continue to expand and urban areas continue to grow, natural habitats are being destroyed and replaced with roads and other infrastructure. This fragmentation of habitats can lead to animals being forced to cross roads in order to find food, mates, or other resources. Additionally, many animals are attracted to the roadside vegetation, which can be more abundant and diverse than the surrounding habitat, further increasing the risk of collisions. Climate change also plays a role in faunal mortality on roads as it causes changes in temperature, precipitation, and sea level, which can affect the distribution of species. These changes can lead to animals moving to new areas in search of food or suitable habitats, which can increase the risk of collisions with vehicles.

The vehicular movement is a major cause of concern as it is the only reason for the increasing number of road kill in these forests. The present study aims to quantify the loss of biodiversity due to vehicular movement and road construction in the middle of Mannur Reserve Forest, Tamil Nadu. The study is significant as it highlights the negative impact of roads on wildlife and underscores the importance of conservation measures in mitigating such impacts. The study also provides valuable data that can be used to inform policy decisions and conservation strategies in the region.

2. Materials and methods

Mannur Reserve Forest (MRF) is located 39 km eastwards from the district headquarters in Kanchipuram and 13 km from Sriperumbudur and 37 km from the state Capital Chennai. Mannur is surrounded by Kadambathur block on the West, Poonamallee block towards the East, Tiruvallur block towards the North. Mannur junction is in the border of the Kanchipuram and Thiruvallur districts. Mannur is near from national highway (SH 116 - Kanchipuram - Vandavasi highway) of 8.5 km. Mannur Reserve forest is located between Thandalam road junctions (Thandalam Koot Road) to Mannur road junction (Kattu Koot Road). Mannur Reserve Forest (Figure 1) under Forest (Conservation) Act 1980, and norms is the forest area used by protected, nesting, foraging, over wintering, resting, migration, important or sensitive species of flora and fauna for breeding. MRF is a dense scrub forest with grass, herbs, scrub, bush and shrubs. Total forest area 7.38 Km2 and the road was constructed between forest of 1.6 km and width of the road is 24 ft. which is a two-way road without divider with rich vegetation along both sides of the road.

Motor cycles, Cars, Bikes, Scooters, Vans, Lorries, Buses, Heavy Duty Lorries, Trucks, Tractors and almost all type of petrol, diesel motor vehicles use this road. Vehicles move with a minimum of 40 kmph to a maximum speed of 100 kmph across this 1.68 km stretch running through MRF. Road kill data was obtained for 30 days, from mid-June to mid-July, 2020; the data includes periods before and after COVID-19 lockdown. The data was collected from 15th to 25th June, due to containment zones that were in district territories in Chennai, Kanchipuram, Chengalpattu and Thiruvallur districts by Tamil Nadu Government.

After 26th June 2020, the lockdown was further extended with some relaxations till 31st August, 2020. The roads were systematically surveyed in two sessions i.e. morning (6:00 am to 7:00 am) and evening (5:00 pm to 6:00 pm) throughout the study period. Line Transect sampling method (Karanth & Nichols, 2017) was followed in the present study and data was collected on both sides of the road and dead samples/species were observed, number of mortality was recorded and photograph were taken for identification. Pictorial handbooks and literatures were consulted to identify the species [10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21]. Overall percentage of mortality rate was calculated and reported using statistical tool/software.

Figure 1. A map of the study area and road through the Mannur Reserve Forest (Google Maps)

3. Results

Mannur Reserve Forest, characterized by its dense vegetation, hosts a diverse array of plant life, encompassing an abundance of herbs and shrubs. Within this lush environment, the "Gloriosa superba" plant, commonly referred to as the "flame lily" or the "glory lily," thrives in abundance. Notably, this plant holds significance as the state flower of Tamil Nadu and the national flower of Zimbabwe. The impact of vehicular encounters on the resident wildlife within the reserve forest is evident, as illustrated in Figure 2. Animals across various groups experienced direct collisions with vehicles while traversing roads within the forest, resulting in the loss of vital organs and, consequently, a substantial number of fatalities.

Table 1 provides a comprehensive overview of the common names, phyla, classes, and orders of species documented throughout the study. Among the diverse animal groups affected by mortality are Clitellata, Mollusca, Orthoptera, Blattodea, Lepidoptera, Odonata, Hymenoptera, Diptera, Coleoptera, Arachnida, Chilopoda, Diplopoda, Amphibia, Reptilia, Carnivora, Aves, and Mammalia. A total of 55 species, spanning various taxa, were identified and are enumerated below. The documentation of species mortality during the lockdown, both with and without relaxation, is detailed in Table 1. The distribution of mortality percentages during the lockdown without relaxation is visually represented in the pie diagrams (Figure 3, 4).

Table 1. List of species observed in the road mortality with thier common names and taxonomic position)

S. No.	Species Name	Common Name	
1.	*Eisenia fetida* (Savigny, 1826)	Earthworm	Mollusca
2.	*Achatina fulica* Bowdich, 1822	Giant African land snail	
3.	*Laevicaulis alte* (Férussac, 1822)	Leather-leaf slug	
4.	*Poekilocerus pictus* (Fabricius,1775)	Grasshopper	Arthropoda
5.	*Oxya hyla hyla* Serville, 1831		
6.	*Xylocopa violacea* (Linnaeus, 1758)	Violet Carpenter Bee	

Table 1. Continued

7.	*Chrysocoris stollii* (Wolff, 1801)	Beetles	
8.	*Sternocera chrysis* (Fabricius, 1775)		
9.	*Copris (Paracopris) cribratus* Gillet, 1927		
10.	*Onthophagus amphinasus* Arrow, 1931		
11.	*Hasora Chromus* (Cramer, 1782)	Butterflies	
12.	*Eurema brigitta* (Cramer, 1780)		
13.	*Hebomoia glaucippe* (Linnaeus, 1758)		
14.	*Danaus chrysippus* (Linnaeus, 1758)		
15.	*Junonia almanac* (Linnaeus, 1758)		
16.	*Junonia lemonias* (Linnaeus, 1758)		
17.	*Tirumala limniace* (Cramer, 1775)		
18.	*Euploea core* (Cramer, 1780)		
19.	*Pachiliopta aristolochiae* (Linnaeus, 1775)		
20.	*Pachliopta hector* (Linnaeus, 1758)		
21.	*Mycalesis subdita* (Moore, 1892)		
22.	*Papilio demoleus* Linnaeus, 1758		
23.	*Diplacodes trivialis* (Rambur, 1842)	Dragonfly	
24.	*Orthetrum sabina* (Drury, 1770)		
25.	*Trithemis pallidinervis* (Kirby, 1889)		
26.	*Apis mellifera* Linnaeus, 1758	Honey bees	
27.	*Apis cerana indica* (Fabricius, 1798)		
28.	*Musca domestica* Linnaeus, 1758	Housefly	
29.	*Periplaneta americana* (Linnaeus, 1758)	Cockroaches	
30.	*Periplaneta australasiae* (Fabricius, 1775)		
31.	*Blattella germanica* Linnaeus, 1767		
32.	*Therea petiveriana* (Linnaeus, 1758)		
33.	*Blatta orientalis* Linnaeus, 1758		
34.	*Rhysida nuda nuda* (Newport, 1845)	Centipedes	
35.	*Cormocephalus pygmaeus* Pocock, 1892		
36.	*Xenobolus carnifex* (Fabricius, 1775)	Millipede	
37.	*Anoplodesmus saussurii* (Humbert, 1865)		
38.	*Trigoniulus corallinus* (Gervais, 1847)		
39.	*Heterometrus flavimanus* (Pocock, 1900)	Scorpion	
40.	*Heterometrus madraspatensis* (Pocock 1900)		
41.	*Daboia russelii* (Shaw & Nodder, 1797)	Snakes	Reptilia
42.	*Bungarus caeruleus* (Schneider, 1801)		
43.	*Coluber naja* Linnaeus, 1758		
44.	*Enhydris enhydris* (Schneider, 1799)		

Table 1. Continued

45.	*Ptyas mucosa* (Linnaeus, 1758)		
46.	*Calotes versicolor* (Daudin, 1802)	Garden lizard	
47.	*Melanochelys trijuga* (Schweigger, 1812)	Indian black turtle	
48.	*Duttaphrynus melanostictus* (Schneider, 1799)	Frog	Amphibia
49.	*Duttaphrynus microtympanum* (Boulenger, 1882)		
50.	*Corvus splendens* Vieillot, 1817	House crow	Aves
51.	*Athene cunicularia* (Molina, 1782)	Burrowing owl	
52.	*Herpestes javanicus* (É. Geoffroy Saint-Hilaire, 1818)	Mongoose (small)	Mammalia
53.	*Funambulus palmarum* (Linnaeus, 1766)	Indian squirrel	
54.	*Bandicota bengalensis* Gray, 1835	Rat - Mammal	
55.	*Golunda ellioti* Gray, 1837		

Figure 2. Mortality of Higher taxa on Mannur RF road.
4A. *Funambulus palmarum* (Linnaeus, 1766), 4B. *Daboia russelii* (Shaw & Nodder, 1797), 4C. *Melanochelys trijuga* (Schweigger, 1812), 4D. *Athene cunicularia* (Molina, 1782), 4E. *Calotes versicolor* (Daudin, 1802), 4F. *Ptyas mucosa* (Linnaeus, 1758)

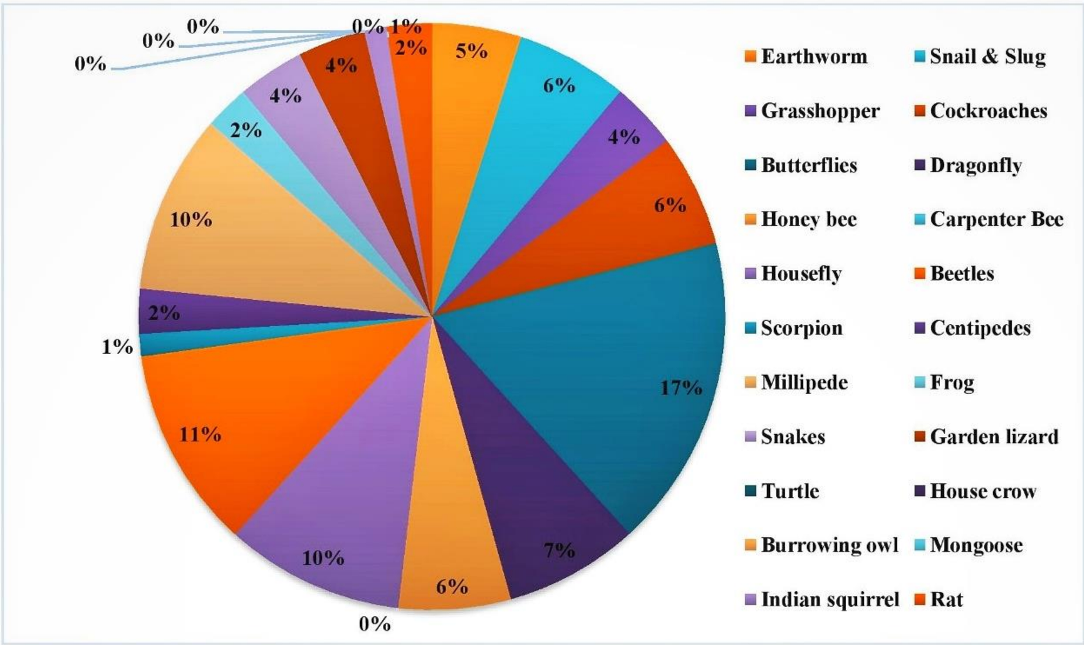

Figure 3. Pie diagram showing the percentage of casualties during Lockdown without traffic relaxation

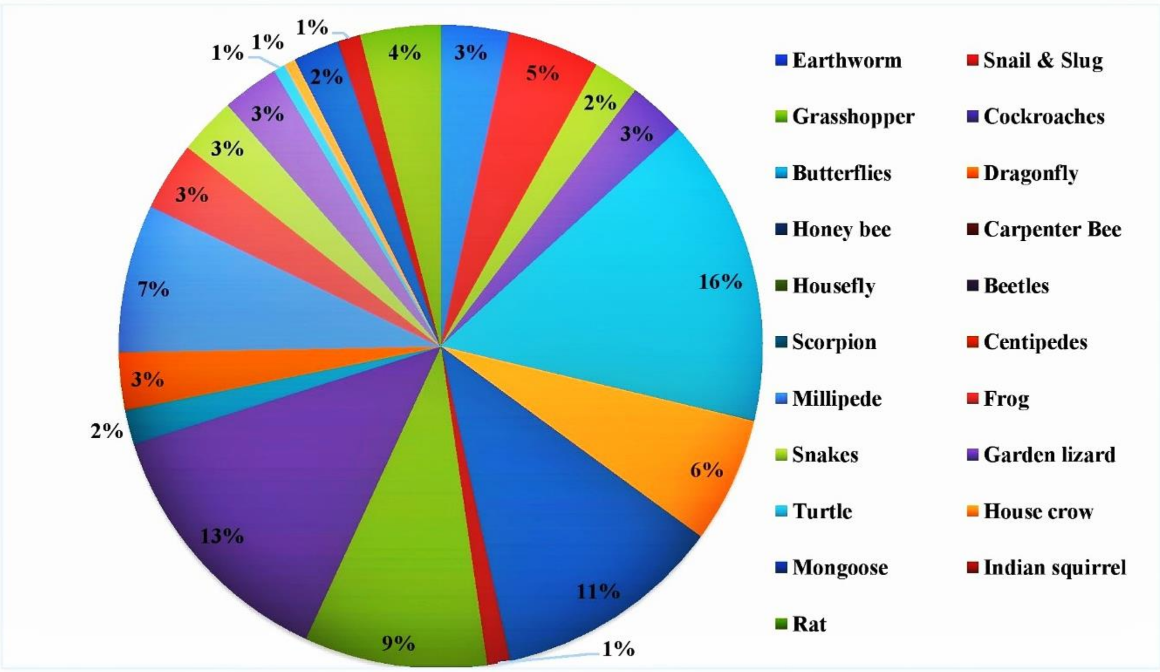

Figure 4. Pie diagram showing the percentage of casualties during Lockdown with traffic relaxation

4. Conclusions and discussion

Various factors have led to the loss of biodiversity in the reserved forest, the most significant being the laying of new roads, widening and repairing of the existing roads. This leads to unnecessary traffic wherein animals met with accidents and thus resulting in a severe diversity imbalance due to adverse decrease in population. Due to the unmonitored automobile activities which are steadily on the rise, there is loss of endangered/threatened species, endemic species, protected species, and a drastic drop in the reproductive capacity because of loss of mates and an increase in pollution of air, water and noise.

The study was undertaken to assess the extent of faunal mortality on a 7-kilometer stretch of a road that cuts through the forest. We surveyed the road twice a month for one month and recorded the number and species of animals that were killed by vehicles. We also collected data on the traffic density and speed of vehicles on the road. The results of the study showed that a total of 55 animal species, including mammals, birds, and reptiles, were killed during the survey period. The study also found that the highest number of fatalities occurred during the traffic relaxation, which corresponded to peak traffic hours.

In order to prevent such adverse effects from happening, it is mandatory to implement the Good Environmental Practices (EPI) as it will help in minimizing the direct impacts of faunal diversity as a result of road construction project. Incorporation of biodiversity conservation into the design and implementation of road projects is also a necessary strategy for environmentally sustainable development.

Results show that mortality is higher (182 casualties) during the lockdown period with traffic relaxation and comparatively less (82 casualties) during lockdown period without relaxation. Thus, the passage of vehicles within the secured forest area needs to be controlled by the traffic rules and regulations and Good Environmental Practices (EPI) has to be followed exclusively to develop roads for modern civilization.

In order to address faunal mortality on roads, a number of different strategies can be employed. These include wildlife crossings, such as underpasses and overpasses, which can provide safe passage for animals across busy roads. Additionally, wildlife warning signs and speed limits can be used to alert drivers to areas where collisions are more likely to occur. Habitat restoration and conservation efforts can also help to reduce the risk of collisions by providing animals with more suitable habitats and resources.

In conclusion, faunal mortality on roads is a significant problem that affects both wildlife and human populations. It is caused by a variety of factors, including habitat fragmentation, climate change, and human activity. To address this problem, a number of strategies can be employed, including wildlife crossings, warning signs, speed limits, and habitat restoration and conservation efforts. By taking action to protect wildlife and reduce the risk of collisions, we can help to preserve the natural world for future generations. The study underscores the need for conservation measures to mitigate the impact of roads on wildlife and provides valuable data that can be used to inform policy decisions and conservation strategies.

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