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Habitat Suitability Of The Asiatic Elephants In Karbi Anglong District Of Assam, India

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Abstract

The sustainable management of natural habitats and animals is a critical concern in today's world, considering the increasing degradation of ecosystems attributable to human activities. This study focuses on an assessment of habitat suitability in Karbi Anglong utilizing the Analytical Hierarchy Process (AHP) approach and strives to present a thorough overview of the habitat suitability evaluation approach. The study used AHP to calculate the significance of each factor based on their ecological function and then categorized and ranked the factors to determine the outcome. The results showed that the areas where human occupancy is low and dense forest regions are areas of high suitability, while areas with agricultural expansion and built-up areas were less suitable or not suitable at all. This approach can help in identifying and prioritizing areas for elephant conservation and habitat management.

Keywords: Suitability, AHP, Karbi Anglong, Decision making, Forest fringe.

Introduction

Human-elephant conflict and its management is a significant issue in many countries (Hoare, 1999; Barnes, 1996). Each year, close to half a million Indian families experience conflicts with the elephants, and as marginalized communities have often been forced to live in forest fringe areas, the resulting impact of conflict with the elephants is high (Pandey et al., 2022; Gubbi, 2012).

The rate of loss of forest cover has been notably on the rise in the tropics in recent times (Ntukey et al., 2022; Saikia et al., 2013), and the expansion of human activities in forested regions has led to the depletion of elephant habitats, fragmentation, shrinkage, degradation, and loss of traditional movement paths, which has led to an increase in conflicts with the tuskers. (Sukumar 1994; G. Areendran et al. 2011). Human-elephant conflict has a significant impact on rural livelihoods, particularly in agricultural activities, and current mitigation approaches are ineffective in the long term. (Perera et al., 2022). Asian elephants (Elephas maximus) rank as one of the largest mammals in the Asian continent and due to necessitating expansive habitats, they require substantial dietary needs. Therefore, they stand first to experience the adversities of the depletion of forests (Chowdhury et al. 2008; Hazarika & Saikia, 2013). The preservation of ecosystems inside designated protected areas rests mainly on government activities. Conversely, ecosystems situated beyond these protected zones generally do not get the same amount of attention or relevance in conservation efforts and are often occupied by human settlements. Consequently, these non-protected habitats are more prone to encroachment and are experiencing rapid degradation owing to the rising human-elephant conflict (Talukdar et al., 2020). Elephant habitat suitability can be assessed using the Analytical Hierarchy Process (AHP) (Huang, Li, Khanal, & Jiang, 2019). According to the MoEF, (2017), Assam is home to 5719 elephants (Das et al., 2022). During the period from 2005 to 2017, a total of 32 causalities and 139 injuries were reported (Sarma et al., 2020). The region performs a significant role in the ecological balance as it offers a critical home for both indigenous and migratory species. However, the ever-increasing human pressures, including deforestation, urbanization, and industrialization, have resulted in habitat fragmentation and degradation, risking the very existence of different species (Choudhury & Sharma, 2017; Ahmad et al., 2018) and changes in local climate (Datta & Bose, 2020). Therefore, A habitat suitability assessment is being conducted in the Karbi Anglong district of Assam. The study will also identify key

challenges and propose suitable areas for mitigating human-elephant conflict while promoting coexistence.

Study area

Karbi Anglong is situated in northeastern India within the state of Assam. The district covers a geographical area of 10,434 square kilometers and consists of approximately 13% of the total population (Saikia, 2018). Nestled amidst the Eastern Himalayas, the district encompasses a fascinating blend of topographical features, including lush hills, dense forests, pristine rivers, and fertile plains. This unique geographical setting not only contributes to the district's natural beauty but also holds immense cultural and ecological significance. The region experiences a subtropical climate with distinct seasons. Summers are characterized by warmth and humidity. Monsoons, occurring from June to September, bring heavy rainfall that nourishes the district's lush vegetation. Winters are comparatively cooler and drier. This climatic diversity significantly influences both agricultural practices and ecological patterns within Karbi Anglong. The district is covered with a substantial portion of land with forest cover. The vegetation includes subtropical and tropical evergreen and semi-evergreen forests, supporting a wide array of plant species, including valuable timber trees, medicinal plants, and diverse wildlife habitats. Karbi Anglong forests provide a home to numerous wildlife species, including elephants, leopards, various deer species, and a rich assortment of birds and reptiles.

The landscape is interconnected by several rivers and streams, with the Dhansiri and Kopili rivers being the prominent ones. The fertile river valleys within Karbi Anglong are particularly conducive to rice cultivation, which is a staple crop in the region. The composition of soil in the district varies across different areas. Alluvial soil prevails in the plains and river valleys, making these regions highly suitable for agriculture. Conversely, the hilly terrains feature red laterite soils, which, although less fertile, are still utilized for the cultivation of crops like tea, rubber, and areca nut.

Database and Methodology

The study was developed mainly using secondary data available. The study undertook five parameters namely Land use and land cover (LULC), slope, distance to roads. distance to river and elevation. The satellite images were derived from the Landsat series from earthexplorer.usgs.gov. The Landsat map was geometrically and radiometrically corrected and supervised image was applied and four land use class categories were obtained namely dense forest, moderate forest open forest and non-forest. To create the elevation and slope map Cartosat DEM was acquired from the Bhuvan portal (http://bhuvan. nrsc.gov.in/). The road map was created using high-resolution Google Earth images and rivers were generated from the acquired DEM data. All the data sets were analyzed using the spatial analysis tool in ArcGIS 10.5.

AHP is widely used in multi-criteria decision models to understand and derive weightage for habitat parameters (Kushwaha and Roy, 2002). The AHP method as developed by Saaty (1977) was used to prepare the suitability map. A pairwise comparison matrix Table 1 was created, and relative weights were assigned to the criteria, with consistency ratio verified and to ensure the compatibility for analysis the data was standardized to a common scale by applying normalization techniques for generating a ranking of all the parameters. The derived weights were used to combine data layers and a habitat suitability map was created using the suitability scores. The habitat suitability map was validated using obtained field data from the human-elephant conflict areas and observed conditions from the ground.

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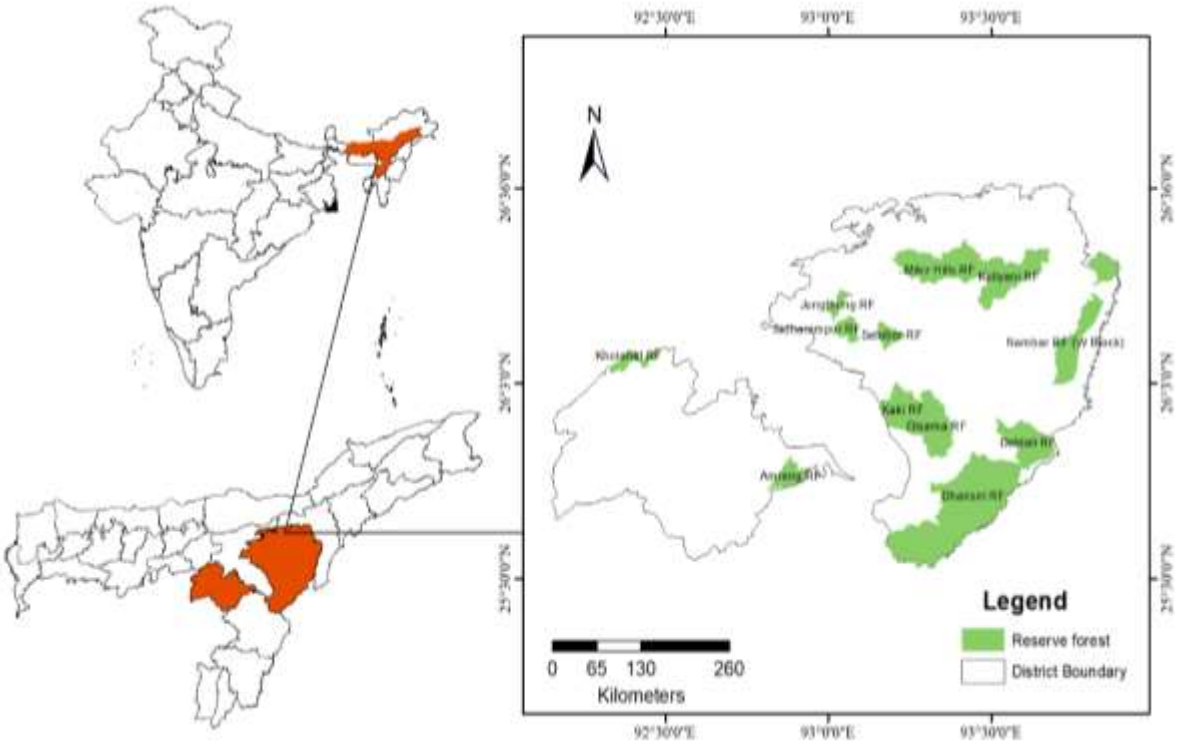

Fig 1: Location map of the study area

Table 1 Pairwise comparison matrix using analytical hierarchy procedure.

Parameters	LULC	Streams	Elevation	Slope	Roads	Weight
LULC	1	2	3	4	5	0.43
Streams	0.50	1.00	0.67	2.00	2.50	0.43
Elevation	0.33	0.67	1.00	1.33	1.67	0.49
Slope	0.25	0.50	0.75	1.00	1.25	0.43
Roads	0.20	0.40	0.60	0.80	1.00	0.43
Total	2.28	4.57	6.02	9.13	11.42	2.25

Number of comparisons = 10 Consistency Ratio CR = 3.5%

Principal eigenvalue = 5.158 Eigenvector solution: 4 iterations, delta =3.4E-8

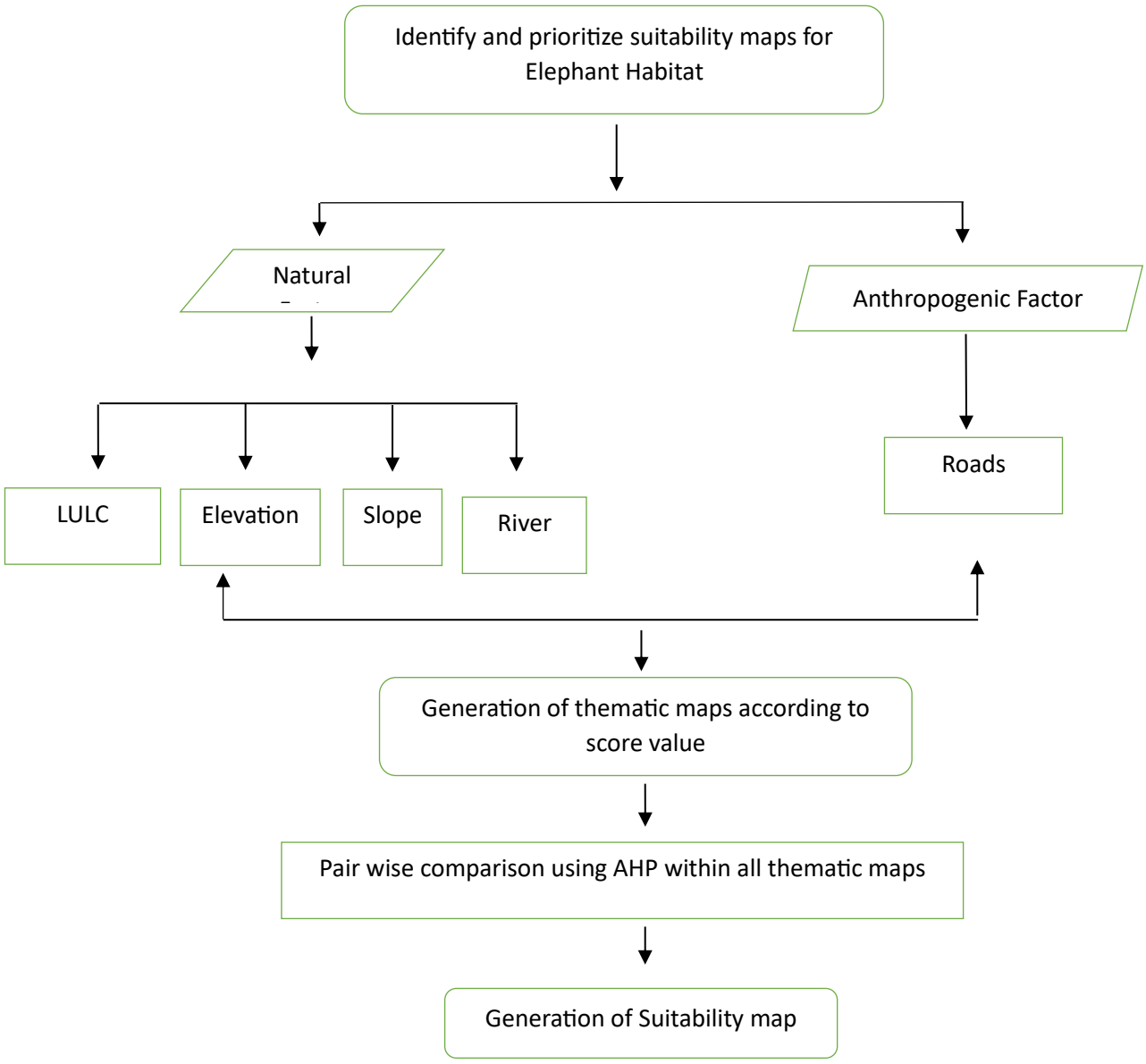

Fig 2 Flow chart of the methodology undertaken.

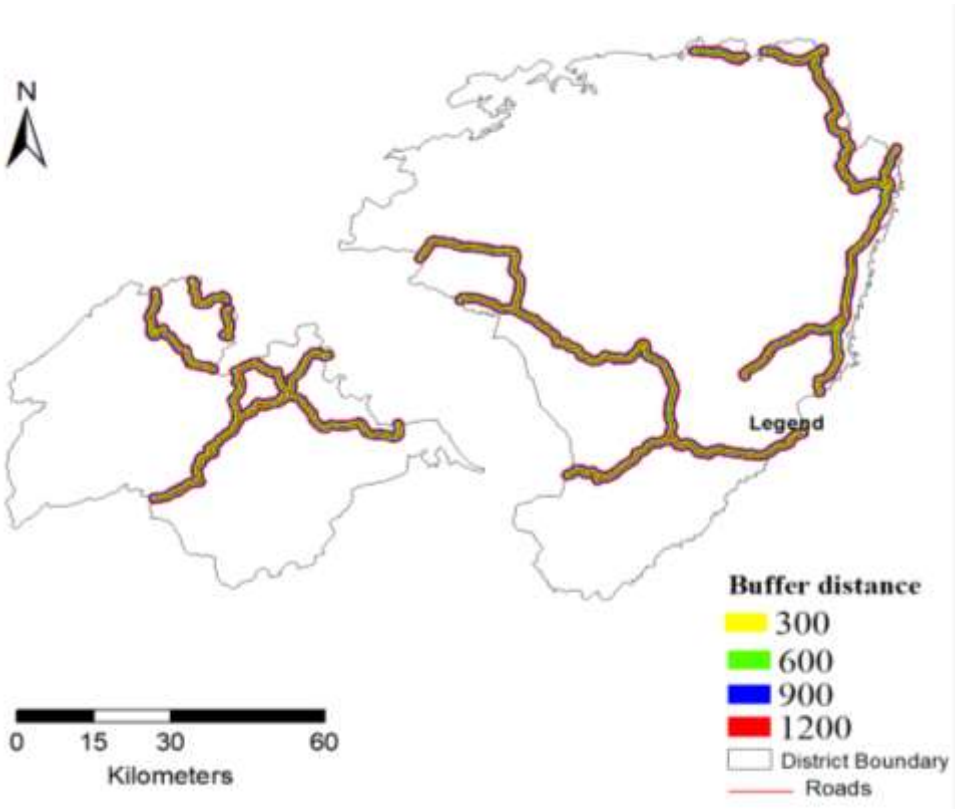

Fig 2 Roads and its buffer map

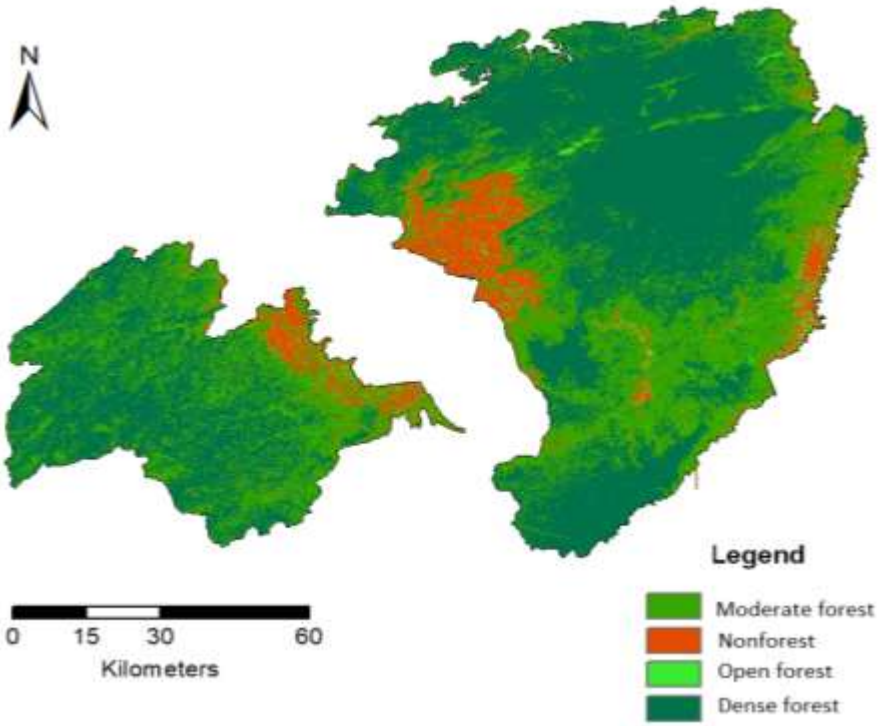

Fig 3 Land use and land cover map of 2022

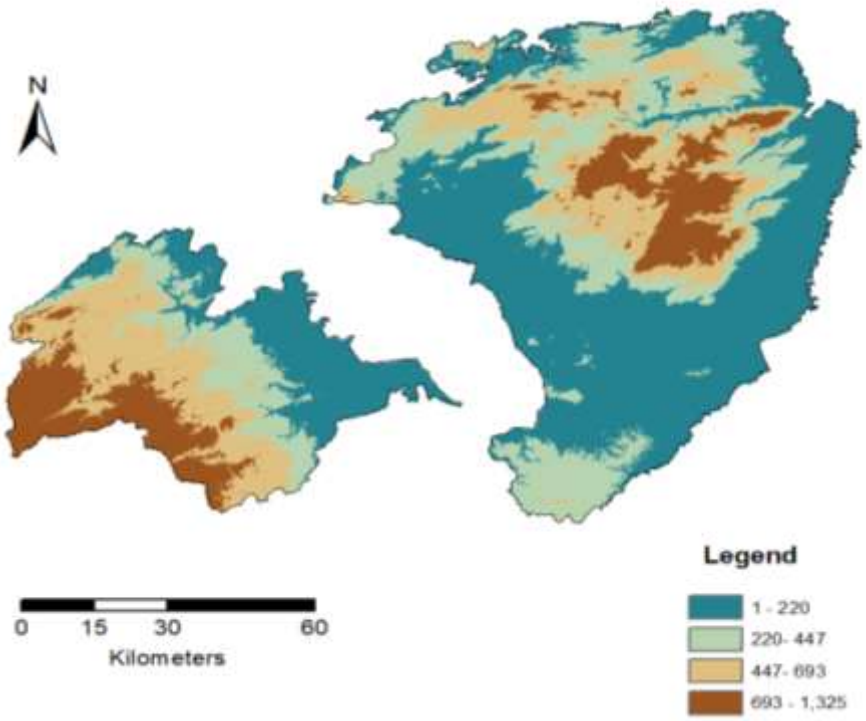

Fig 4 Elevation of the study area, 2022

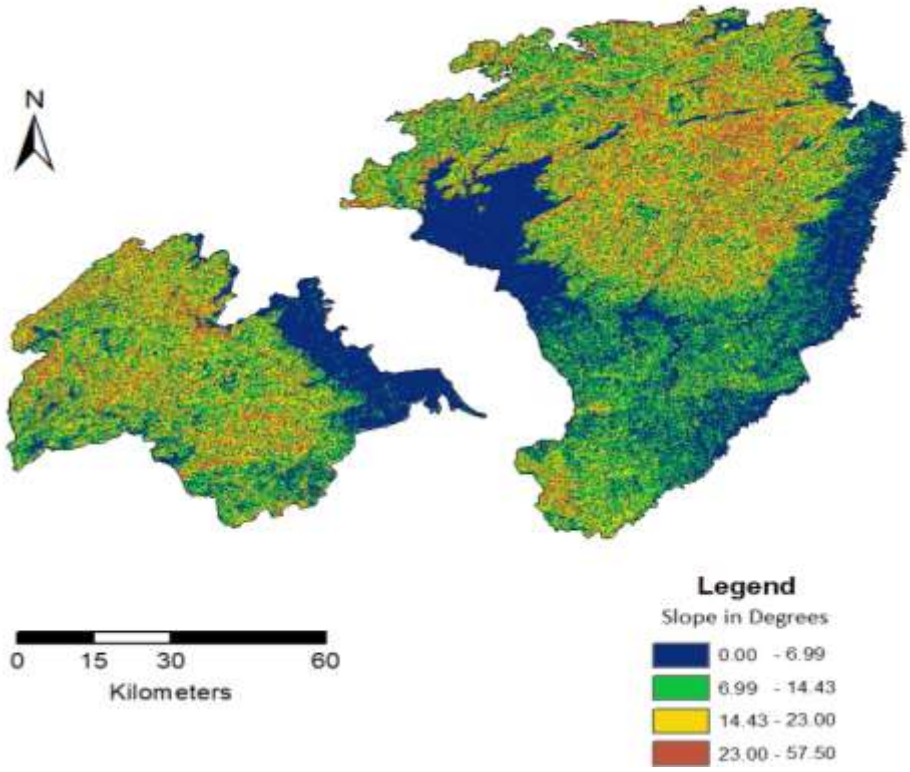

Fig 5 Slope of the study area, 2022

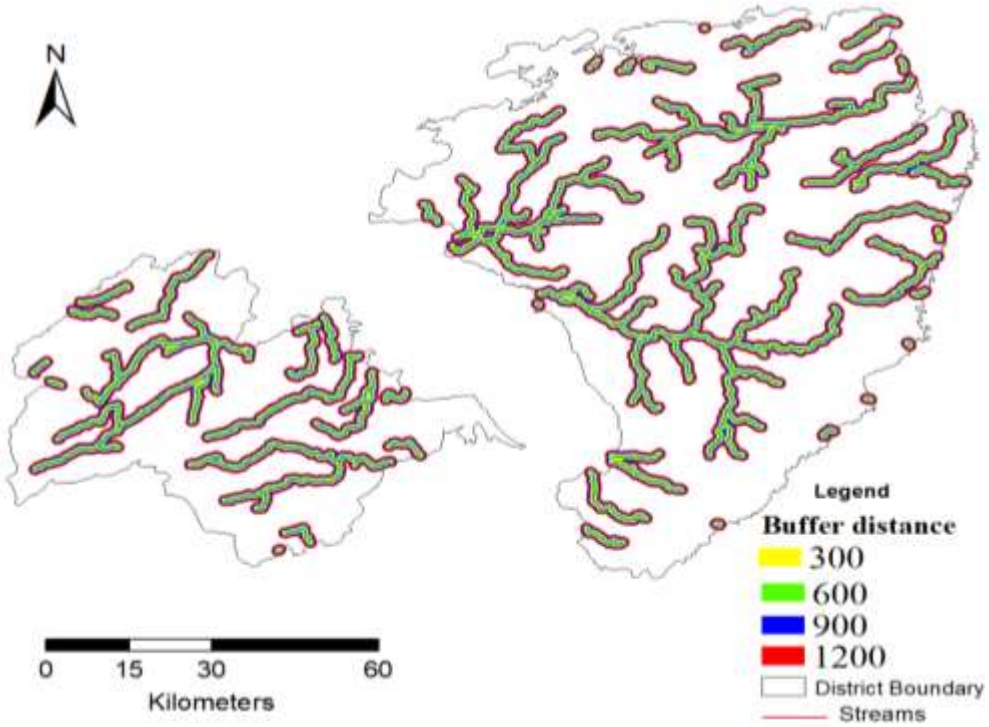

Fig 6 Streams and its buffer, 2022

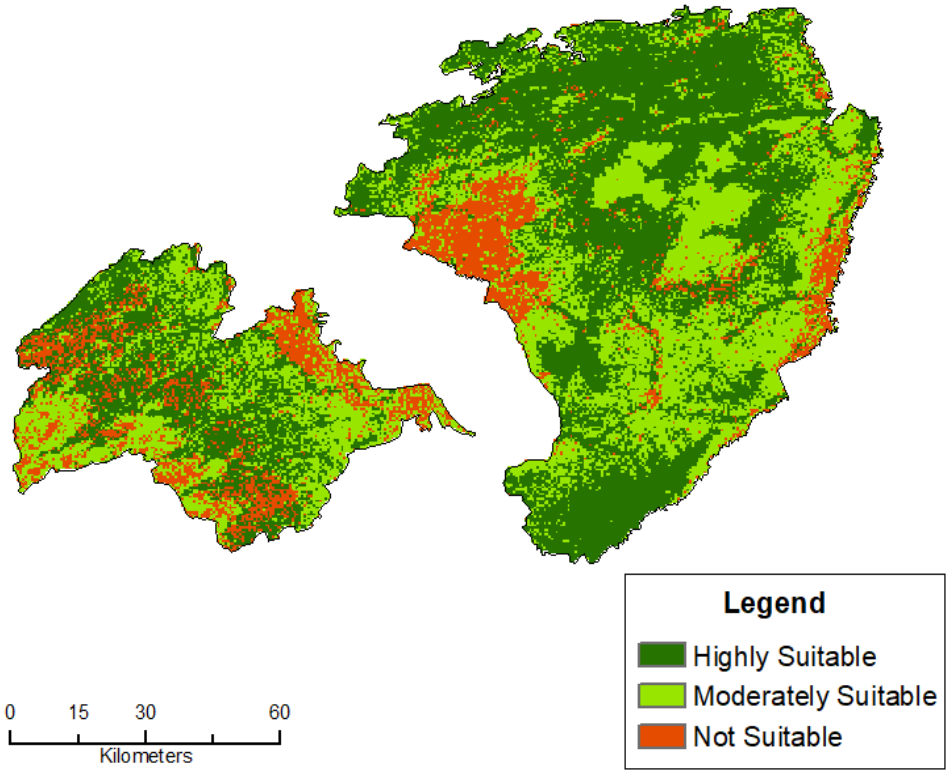

Fig 7 Habitat suitability of elephants in Karbi Anglong, 2022

Results

The figure7 illustrates habitat suitability through three distinct categories: High suitability, moderate suitability, and low suitability regions. The Highly suitable areas predominantly encompass the hilly terrain within the district, while the undulating plains primarily consist of forested areas. Additionally, regions exhibiting habitat suitability can be identified within the confines of the Amreng reserve of West Karbi Anglong and the areas bordering the Karbi Anglong and Meghalaya borders. In the eastern part of Karbi Anglong, this category extends to parts of the Dhansiri and Disama reserve forests of Karbi Anglong, as well as the hilly landscapes within the Karbi Anglong and Kairanga region. These areas also encompass numerous elephant corridors, particularly within the Kaziranga-Karbi Anglong elephant reserve. The Moderately suitable areas encompass the peripheries of the forested zones. Conversely, the most unsuitable areas are characterized by human settlements and agricultural land use. This includes regions like Dengaon, Dokmoka, Bokolia, and Langhin, where forest fragmentation rates are notably high.

Discussions

The study on habitat suitability of elephants reveals that suitable regions for elephant habitats are found in areas that are far from human-inhabited areas. The study also finds that the suitable regions include areas of dense forest regions and moderate forest regions. The mapping of habitat suitability in Karbi Anglong District is a multifaceted ecological challenge necessitating comprehensive investigation. This issue stems from escalating anthropogenic activities, such as habitat fragmentation, land use changes, and agricultural expansion, which have substantially altered traditional elephant habitats and migration routes. As a result, the once-continuous habitats vital for the survival of the Asiatic elephant are becoming increasingly fragmented and degraded, leading to critical concerns related to the persistence of elephant populations.

Furthermore, the encroachment of human settlements into these habitats has heightened human-elephant conflict, posing significant threats to both human communities and the elephants themselves. The conflict not only jeopardizes lives but also intensifies the pressure on already limited suitable habitats. Additionally, climate change-related factors, including altered rainfall patterns and temperature fluctuations, potentially affect the availability of essential resources like water and food, further exacerbating habitat suitability challenges for the Asiatic elephant.

Inadequate conservation policies, coupled with shortcomings in policy implementation and a lack of comprehensive, up-to-date data on elephant populations and their habitats, exacerbate the problem. Balancing the conservation of elephant habitats with the livelihoods of local communities presents a complex dilemma, necessitating sustainable solutions that address both ecological and socioeconomic considerations.

Conclusion

The study on habitat suitability provides valuable insights for policymakers and conservationists. The high, moderate and low suitable areas obtained from the study highlight the critical importance of preserving the hilly terrains, forested regions and elephant corridors. It also highlights the urgency to prioritize conversation initiatives for the protection and restoration of the forest fringe areas and promote collaborative efforts between government agencies, local communities and other non governmental organizations. Therefore, addressing the habitat suitability issue of elephants in Karbi Anglong is paramount, not only for the preservation of this iconic species but also for mitigating human-elephant conflict, maintaining biodiversity, and fostering sustainable coexistence between humans and elephants in the region.

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