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Assessing the Habitat Utilization, Occupancy, and Land Use Change for the Conservation of Elephants in Wilpattu National Park, Sri Lanka

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Abstract

Sri Lanka is renowned for its significant population of Sri Lankan elephants (*Elephas maximus maximus*), an endangered subspecies that represents a keystone component of both ecological systems and its ancient cultural heritage. The coexistence of humans and elephants in shared landscapes presents significant challenges, with conflicts arising due to habitat loss, competition for resources, and human-elephant interactions. The case study was conducted in and around the southern boundary of Wilpattu National Park (WNP) from September 2024 to August 2025 to examine the land use and cover (LULC) change, along with the spatiotemporal habitat use of Sri Lankan elephants. Trail cameras (n=34) equipped with passive infrared sensors were deployed systematically within 3×3 km^2 grids in the WNP. Visual encounter surveys were conducted outside the protected area. The Sentinel-2 satellite imagery from 2018 was obtained to evaluate the LULC and change using supervised classification. Ten covariates covering vegetation, physical, and food availability parameters at each camera station were obtained to assess the occupancy (ψ) of elephants within the park. The predicted hotspots and migration of elephants were analysed using the heat map developed by Empirical Bayesian Kriging (EBK) in ArcGIS Pro. A total of 81 footage of elephants was documented inside the park, and 102 sightings were recorded outside the southern boundary during the survey period. Interestingly, the elephants exhibited a higher preference (p) for the grassland (p=0.56±0.13), followed by scrubland and dry mixed evergreen forests inside the park, which satisfied their feeding ecology. The LULC change indicated that land encroachment in the protected corridors occurred moderately over the past years (r²=0.46). The occupancy analysis revealed a significant correlation with food availability parameters. The most important parameters for selecting a habitat for elephants were the distance to grasslands and crop fields, which may be correlated with their tendency to invade paddy crops.

Keywords: *Conflict, Elephant, Occupancy, Preference, Wilpattu*

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