



# Distribution and Habitat Use of Spotted Owlet *Athene brama* (Temminck, 1821) (Aves: Strigiformes: Strigidae) in Navsari Agricultural University, Gujarat, India

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**Abstract:** Present study assessed the habitat use and distribution of the spotted owl, *Athene brama* (Temminck 1821) in the Navsari Agricultural University campus. Data were collected from February to April 2024 through surveys conducted across 24 grids, covering a total distance of 85 kilometres. These surveys resulted in the encounter of 38 Spotted Owlets, yielding a naive occupancy rate of 0.56 and a mean encounter rate of 0.65 owlets per kilometre. The proportion of agricultural land significantly influences habitat use, exhibiting a curvilinear relationship. Encounter rates increased with the proportion of agricultural land up to 50-60%, followed by a decline at higher proportions ( $r^2=0.31$ ). Additionally, the presence of orchards negatively affected habitat uses, as indicated by polynomial regression analysis ( $r^2=0.13$ ). Built-up areas, water bodies, and roads did not show significant effects on the owl's habitat use.

**Keywords:** Spotted Owllet, *Athene brama*, Habitat use, Occupancy

Raptors, or birds of prey, are a diverse group of carnivorous birds known for their keen eyesight, sharp talons, and hooked beaks used for hunting and feeding on others. Among these, owlets, members of the Order Strigiformes, include around two hundred species of mainly solitary and nocturnal birds. They are characterized by binocular vision, binaural hearing, sharp talons, and specialized feathers that enable silent flight (Shanker et al., 2018). They range in size from small owlets to large owls and can rotate their heads and necks up to 270 degrees. Owls are divided into two families, the true owls (Strigidae) and the Barn Owls (Tytonidae) (Shanker 2018). The spotted owl (*Athene brama*, Strigidae) is a common raptor found throughout India. They measure about 21 cm in length (Grimmett et al., 2019), and weigh between range 235–245 grams (Yosef et al., 2011). They are highly adaptable and prefer open habitats such as farmland and urban areas. Their ecological adaptability allows them to persist in both rural and urban settings (Gaba and Vashishat 2019). In India, there are three subspecies of spotted owl: *Athene brama brama*, *A. brama indica*, and *A. brama ultra* (Santhanakrishnan 2011). The Spotted Owllet is commonly found in agricultural areas and human habitations, where it primarily preys on insects and rodents, making them important for maintaining ecological balance (Sunitha et al., 2022). In agricultural areas, they act as biocontrol agents by controlling pest populations, which significantly benefits farmers (Sunitha et al., 2022). Spotted Owlets usually nest in natural tree hollows, holes in dilapidated walls, and spaces between the

ceiling and roof of both abandoned and occupied buildings (Pande et al., 2007). They often roost and nest near human dwellings, utilizing trees, buildings, and electric poles as their sites (Sunitha et al., 2022).

Although the spotted owl is classified as a species of Least Concern by the International Union for Conservation of Nature (IUCN), superstitions pose a significant threat to Spotted Owlets well-being. In Indian, these superstitions often lead to illegal hunting and persecution of owls, stemming from misunderstandings of their behavior (Pande et al., 2007). Navsari Agricultural University campus provides an excellent setting to study spotted owlets within an agricultural landscape. The variety in vegetation, from dense tree canopies to open fields, offers ample nesting and roosting sites, as well as a rich prey base. Previous studies on spotted owlets have primarily focused on diet and nesting habits (Santhanakrishnan 2011, Sunitha 2022), but limited research exists on their distribution in agricultural landscapes. This study aims to bridge this gap by assessing the distribution and habitat use of spotted owlets on the NAU campus.

## MATERIAL AND METHODS

**Study area:** Navsari Agricultural University (NAU) is located in Navsari, Gujarat, India (20.9248°N, 72.9079°E) (Figure 1) and spans an area of 400 hectares, encompassing diverse habitat types. The university is situated at an elevation of 20 m above sea level, with a predominantly flat topography interspersed with slight undulations. The major habitats within the campus include agricultural fields, orchards,

experimental plots, and patches of natural vegetation. The soil composition varies, with alluvial soil being predominant, along with patches of sandy and loamy soils. Agricultural lands form a significant portion of the campus, primarily used for crop cultivation and research. The orchards mainly consist of fruit-bearing trees such as mango (*Mangifera indica*), sapota (*Manilkara zapota*), and banana (*Musa paradisiaca*). Pockets of natural vegetation are preserved across the campus, comprising native tree species such as neem (*Azadirachta indica*), banyan (*Ficus benghalensis*), and tamarind (*Tamarindus indica*). Additionally, the campus features small ponds and irrigation channels that support both agriculture and local wildlife.

**Data collection:** The study was conducted from 16 February 2024 to 10 April 2024, using systematic field surveys to document the presence of spotted owlets (*Athene brama*). Navsari Agricultural University (NAU) campus was divided into 24 square grids using Google Earth, each covering approximately 16.67 hectares (Fig. 1). Each grid was surveyed five times over a three-month period to record Spotted Owllet occurrences using a spot light. Surveys were conducted during night time and early morning hours to assess presence across different time periods. During each

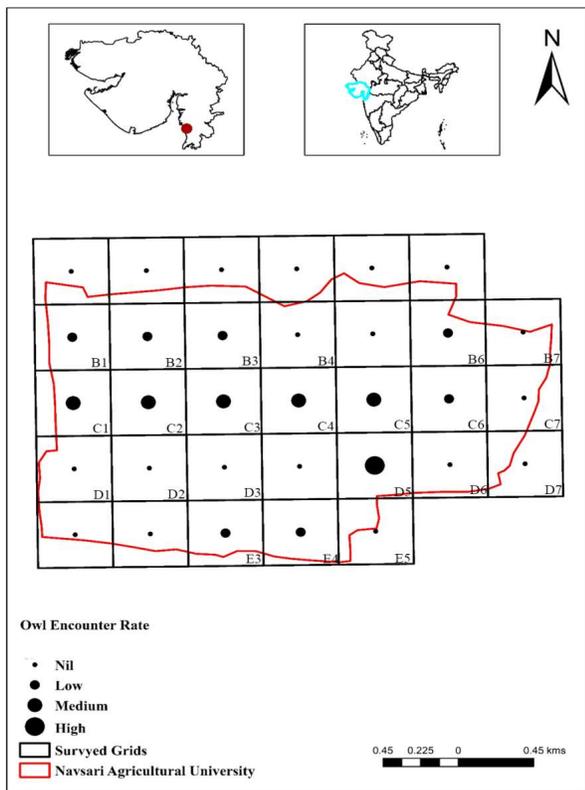
survey, grid number, occasion (day or night), date, number of individuals observed, latitude, longitude, habitat type, tree species or man-made structures used, and roosting height was recorded. The *Locus Map* application was used to record the distance travelled during each survey. Land use classification was conducted using Google Earth, where polygons were created and color-coded to represent different land use categories: agricultural land, horticultural land, human-built areas, water bodies, and roads. The percentage distribution of each land use category within the grids was calculated, and these values were later used as predictor variables to analyse spotted owllet habitat use.

**Data analysis:** To assess the distribution and status of spotted owllets, the number of grids with spotted owllets presence was divided by the total number of grids to determine the occupancy of spotted owllets. To evaluate the population status encounter rate index was used, calculated by dividing the total number of individuals encountered by the total area surveyed in each grid, along with overall encounter rates (MacKenzie et al., 2002). The relative encounter rates were mapped using GIS to visualize distribution patterns. Polynomial regression models was used to analyse habitat uses, with encounter rates as the dependent variable and habitat variables as independent variables (Zar, 1999). All statistical analyses were performed using R Studio 2023.12.1 (R Core Team, 2023).

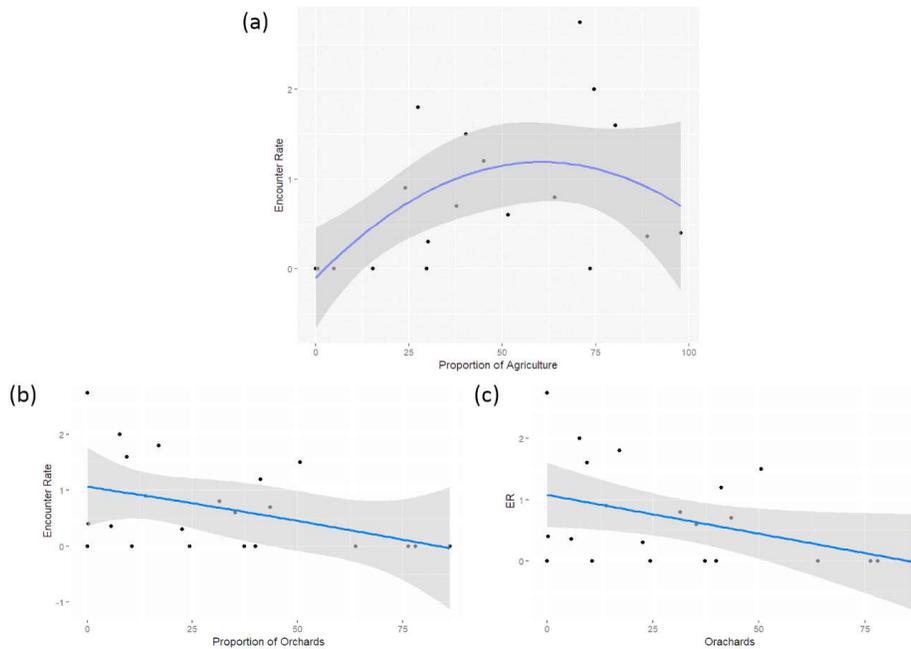
**RESULTS AND DISCUSSION**

A total of 22 grids were surveyed between February 2024 and April 2024, resulted in an effort of 85 km and yielding 38 encounters of spotted owllets. Owllets were recorded in 14 of the 22 grids, indicating a naive occupancy of 0.56 and suggesting a broader distribution across the Navsari Agricultural University campus. The mean±S.E. encounter rate of spotted owllet was  $0.65 \pm 0.007$  individuals per km, with spatial variation across grids. Eight grids exhibited higher-than-average encounter rates, while another eight recorded no detections (Fig. 1).

Among the five habitat variables assessed, agricultural land was the only significant predictor of Spotted Owllet encounter rates, following the relationship:  $-0.10 + 0.04*(agriculture\ proportion) - 0.0003*(agriculture\ proportion)^2$  ( $R^2 = 0.31$ ) ( $p < 0.05$ ). The linear coefficient was significant indicating a positive association with increasing agricultural land proportion, while the quadratic term suggested a threshold effect, with peak encounters occurring at 50-60% agricultural cover before declining (Fig. 2a). Khan et al. (2023) reported the species adaptability to modified habitats, moderate agriculture provides suitable foraging conditions, while intensive practices such as



**Fig. 1.** Map of the study area along with grid-wise owl encounter rate across the Navsari Agricultural University campus. Grid IDs (B1 to E5)



**Fig. 2.** a. shows a positive relationship between the proportion of agricultural land and encounter rate, b. indicates a non-significant negative association between the proportion of orchards and the encounter rate, while, c. reflects a negative relationship between orchards and encounter rate

**Table 1.** Proportional representation (%) of different land use types across sampling grids in the study area

Grids	Agriculture land	Horticulture land	Human built up	Water body	Roads
B1	64.02	31.47	1.81	1.91	0.77
B2	37.76	43.54	0.75	5.53	1.47
B3	51.56	35.23	3.03	4.8	2.2
B4	73.56	0.00	15.82	7.82	2.78
B6	30.16	22.58	35.14	0.00	0.52
B7	0.00	78.06	5.64	0.00	1.06
C1	80.4	9.43	2.86	0.00	1.5
C2	45.01	41.16	4.71	0.00	1.94
C3	40.38	50.59	6.55	0.00	1.65
C4	74.68	7.69	14.07	2.05	1.49
C5	27.48	17.06	27.49	4.28	2.39
C6	23.98	13.93	50.25	2.15	2.17
C7	0.00	39.95	45.09	1.31	3.36
D1	29.8	63.89	2.5	0.00	0.2
D2	4.96	76.38	9.26	1.59	1.89
D3	0.52	86.19	6.94	0.89	1.14
D5	70.92	0.00	12.21	0.00	2.84
D6	0.00	10.68	84.28	0.00	5.03
D7	0.00	24.34	56.13	0.00	1.97
E3	88.92	5.70	0.9	1.08	2.26
E4	97.93	0.23	3.61	0.00	3.05
E5	15.3	37.34	10.98	3.91	2.6

Grids represent fixed-area spatial units overlaid on the landscape, as shown in Figure 1. Values were derived from satellite imagery and verified through field surveys

mechanization and pesticide use up to a threshold, reduce habitat quality and prey availability.

Orchard proportion did not exhibited a significant effect on spotted owlet encounters (Fig. 2b),  $1.06 - 0.002*(orchards\ proportion) - 0.000005*(orchards\ proportion)^2$  ( $R^2 = 0.08$ ). Regression analysis ( $y = 0.20 - 0.01*proportion\ of\ orchards$ ,  $R^2 = 0.13$ ) ( $p < 0.05$ ) indicated a negative association between orchard cover and habitat use (Fig. 2c). At NAU, orchards are intensively managed, involving regular pruning, pesticide application, and frequent human activity, which is influencing spotted owlets occurrence. Intensive orchard management reduces structural complexity and foraging opportunities, negatively impacting avian habitat use (Myczko et al., 2013). Bouvier et al. (2011) found that insectivorous birds are more affected by intensive pest control strategies, due to reduced prey availability.

Other habitat variables, including built-up areas, water bodies and roads (Fig. 3a,b,c) did not significantly influence habitat use by spotted owlet, indicating a weak or no correlation between these features and owlet presence, Pande et al. (2011) and Gaba and Vashishat (2013) observed that the species tolerates urbanization and frequently roosts in old buildings, roadside trees, and fragmented green spaces. Recent studies conducted in rural and semi-urban landscapes of India have demonstrated that avian diversity and distribution



Plate 1. Photographic records of spotted owlets from Navsari Agricultural University

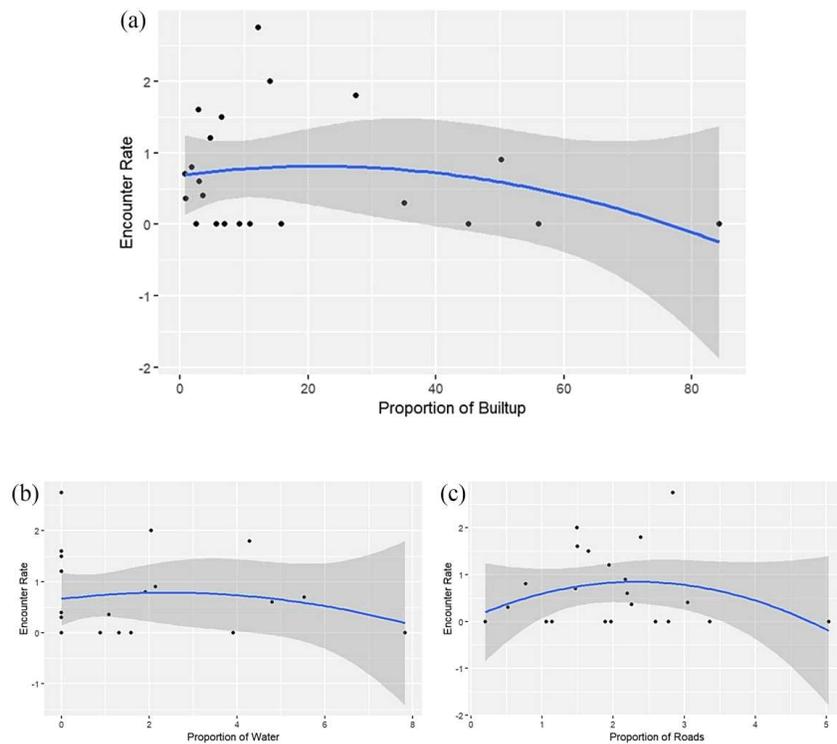


Fig. 3. a. shows the relationship with the proportion of human built-up areas, b. represents the relationship with the proportion of water bodies, and c. shows the relationship with the proportion of roads

are strongly shaped by land-use heterogeneity (Sharma and Tripathi, 2023, Braich et al., 2023). These studies included the spotted owl in their avifaunal checklists, further supporting its association with human-modified habitats such as agricultural and semi-urban areas. The weak relationship with built-up areas, water bodies, and roads suggests that spotted owlets can persist in altered landscapes as long as suitable nesting and foraging conditions are available.

### CONCLUSION

This study confirms that spotted owlets can persist in moderately disturbed agricultural landscapes, with encounter rates peaking at 50-60% agricultural land cover. The orchards negatively influence their habitat use, built-up areas, water bodies, and roads have no significant impact, reinforcing their adaptability to human-modified environments. These findings highlight the importance of maintaining habitat heterogeneity to support Spotted Owllet populations.

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