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Diversity, abundance, and habitat suitability of small carnivores and mesopredators in the agro-pastoral landscapes of Yavatmal district, Maharashtra, India: implications for conservation planning

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ABSTRACT

Small carnivores and mesopredators play an essential role in the functioning of terrestrial ecosystems, but are poorly studied in highly fragmented agro-pastoral landscapes with accelerated land-use change. In this study, mesopredator communities in Yavatmal District (Mumbai Division), Maharashtra were studied over a 2-year period from June 2022 to May 2024, comprising 96 camera trap stations and 8640 trap days. Five focal species were assessed: Bengal fox (Vulpes bengalensis), striped hyena (Hyaena hyaena), jungle cat (Felis chaus), small Indian mongoose (Herpestes edwardsii) and Indian hare (Lepus nigricollis). In total, 2,847 independent detections were made. The occupancy rates were 0.41 ± 0.06 for striped hyena and 0.78 ± 0.04 for small Indian mongoose. Habitat suitability modelling showed that the best predictive model was for the Bengal fox (AUC = 0.887), with particular emphasis on the importance of agricultural margins and ecotonal habitats. Activity analysis revealed that for all species, the dominant activity phase was crepuscular or nocturnal, and that there was significant temporal partitioning between the carnivore species ($\Delta = 0.31$, $p < 0.001$). Species diversity, represented by the Shannon diversity index, was relatively high, and decreased significantly with distance from protected forest edges ($r^2 = 0.61$, $p < 0.01$) on a mean basis across sampling grids. The results would prove that the agro-pastoral landscapes of Yavatmal have a favourable mesopredator complex. It is important to enhance landscape connectivity and minimise retaliatory persecution and promote wildlife-friendly agriculture to help conserve these species. This study is the first spatially explicit baseline study of mesopredator ecology in Vidarbha and it gives important guidelines to conservation planning and sustainable land-use management.

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1. INTRODUCTION

Prey communities, seed dispersal patterns and zoonotic disease cycles are all influenced by the control of prey by small carnivores and mesopredators in tropical ecosystems [1]. Studies from sub-continental India, however, have been extremely skewed towards the ecology of large charismatic megafauna such as tiger and leopard (Panthera tigris and Panthera pardus, respectively) and wild dog (Cuon alpinus) – important, but little-studied mid-sized predators [2], [3].

Vidarbha district in the State of Maharashtra is a biogeographic hotspot of transition area between Western Ghats biodiversity hotspot and central Indian highlands. It contains a variety of dry deciduous forest, grassland and highly cultivated agricultural lands, primarily dominated by cotton, sorghum and soybean agriculture [4]. A diverse mesopredator guild is maintained in this agro-pastoral matrix and community dynamics of most of these species are largely unknown.

In Vidarbha, agricultural expansion at the coast of scrub and secondary forest has been the main driver for the land-use change and has been observed happening at an annual rate of 1.3% from 2000 till 2022 [5]. These habitat alterations may cause mesopredator release; the increase of mesopredator populations with the decrease of apex predator populations and the related decrease of prey and avifaunal populations [6], [7]. To feed evidence-based landscape management, a prerequisite will be to quantify the current status of these species.

In complex habitats, the detection and monitoring of secretive, nocturnal carnivores has become possible with camera trapping, which has become the "gold standard" for these activities [8]. To capture imperfect detection in the hierarchical occupancy model, it is used in combination with this to yield robust estimates of temporal activity patterns, species occurrence, and habitat associations [9], [10]. The species distribution modelling approach of MaxEnt also allows to make spatially-explicit predictions of habitat suitability based on occurrence and environmental covariate information [11].

The objectives of this study were to: (i) quantify the diversity, relative abundance and occupancy of five mesopredator species across a landscape-stratified grid in the study area; (ii) model habitat suitability and to identify key environmental correlates; (iii) model the temporal activity patterns of each species, and determine overlap in their diel activity; and (iv) to synthesize multi-threat indices and prioritize conservation interventions.

2. RELATED WORK

Although mesopredator ecology has been studied in South Asia, there has been little systematic research on these species so far as compared to apex predators. Small carnivores were documented in the Indian protected area network in early reviews with inadequate spatial resolution to detect and correct for carnivore activity in the various protected areas. [9] Developed the occupancy modelling framework of imperfect detection, which has been utilized in the survey of felids and canids in South and Southeast Asia [10] and elsewhere. These methods have shown that the occupancy rates of naïfs are significantly underestimated, by 20-40%.

Multi-species assessments using camera traps have been done in the Western Ghats where mesopredator diversity was found to be higher in riparian or forest-edge habitats [12]. The jungle cat (Felis chaus) is known to exploit areas where rodents are abundant, such as irrigated croplands, both in the

Punjab and Rajasthan [13] and the Bengal fox (Vulpes bengalensis) has a preference for ecotone habitats with a moderate level of human disturbance [14]. The presence of striped hyenas was found to be negatively correlated with the distance to settlements and road networks, as is known for this species to avoid human settlements [15].

The overlap coefficient [16] has been used to document temporal activity partitioning among co-occurring carnivores in a number of systems in Africa and Asia, which is a mechanism that can facilitate niche partitioning. Artificial light and more human night activity activity is disrupting diel activity patterns which can re-structure predator guilds [17]. MaxEnt habitat suitability modelling has been tested in various landscapes in India for various carnivore taxa, and always found the vegetation cover, distance from roads and precipitation to be the main explanatory variables [18].

In the agro-pastoral interface of Vidarbha region, despite this body of work, there is no systematic study of multi-species conducted. The Tipeshwar Wildlife Sanctuary and its buffer zone is poorly monitored node in the wildlife corridor network in the centre of the Indian subcontinent. This represents a critical need, especially as land use change rates have already been documented [5] and in peri-forest areas, humans and wildlife are increasingly at conflict [19].

3. METHODOLOGY

3.1 Study Area

Yavatmal District (19.56°–20.93° N; 77.43°–79.12° E) occupies approximately 13,582 km^2 in eastern Maharashtra, India Figure 1. The height of the elevation between 155 m and 620 m above sea level. With Köppen Aw climate, a well pronounced monsoon season (with mean rainfall of 850 mm/year for the period of June to September), and a dry hot season (March to May), there exists a distinct climate for this area. Vegetation type is mainly Southern dry deciduous forest (Champion & Seth Type 5A) consisting of Tectona grandis, Terminalia tomentosa, Diospyros melanoxylon and Butea monosperma with mean annual temperature of 27.4°C. The district has a total area of 246.1 km^2 of which 148 km^2 is covered by protected areas, namely, Tipeshwar Wildlife Sanctuary and 1 buffer zone which is connected with the Pench Tiger Reserve. The Wardha River is important source of riparian habitat for several target species [20]. Figure 5 shows that 28.4% of the land-use within the survey grid was dry deciduous forest, 34.7% was agricultural land, 14.6% was scrubland, 12.1% was grassland, 8.2% was human settlement and 2.0% was water bodies. The density of human population is 188 persons/km^2 on average while the density of animals is about 560 animals/km^2 in peri-forest areas [21].

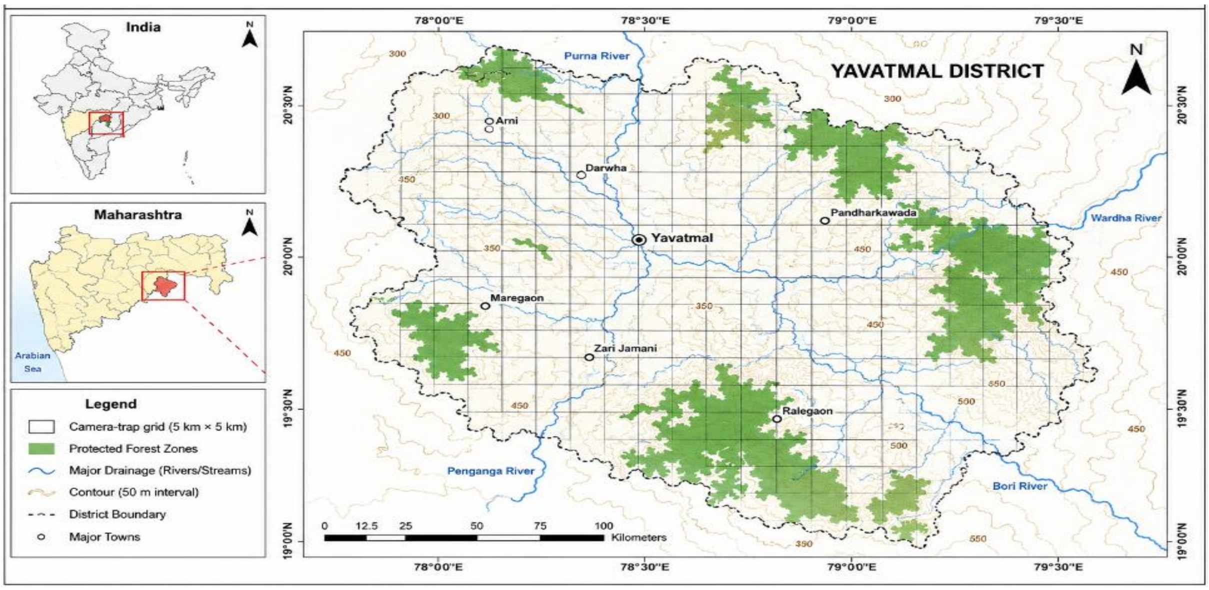

Figure 1. Study Area and Camera-Trap Sampling Grid in Yavatmal District, India

3.2 Camera-Trap Survey Design

Stratified random sampling design was used with the landscape split into 48 grid cells – 5km x 5km. The camera stations, which were installed by the wildlife trails, dry stream crossings, and forest-agriculture edges, totaled 96 stations per grid cell with a passive infrared trigger and 24MP camera (Bushnell Core™ HD). The cameras were operational for 90 consecutive days each season for three seasons (winter (October-January), Pre-monsoon (February-May) and Monsoon (June-Sep) with a total of 8,640 trap-nights over two years. The placement of the camera was done as usual: the height of the camera above the ground was set at 30-50 cm, and the distance between the different camera stations was at least 1.5 km to limit spatial dependence [22]. An independent detection event was considered as two consecutive pictures of the same species taken at a different station (more than 30 minutes apart).

3.3 Occupancy Modelling

Single-season single-species occupancy models were created in Program PRESENCE v12.6, as per [9]. A 10 day replicate sampling occasion was used to organize detection histories to provide nine sampling occasions per season. Distance to forest edge (DFE), normalised difference vegetation index (NDVI), livestock density index (LDI), distance to nearest water source (DWS) and human settlement proximity (HSP) were the five site-level occupancy covariates included in the candidate models. Model selection was done using AICc, the set of competitive models were defined as ΔAICc ≤ 2 [23]. The goodness of fit was evaluated with a parametric bootstrapped procedure (1000 simulations).

3.4 MaxEnt Habitat Suitability Modelling

The occupancy records used to create the models were geo-referenced and 96 occurrence records per species were used, and the models were built in MaxEnt v3.4.3 [11]. The 12 predictor layers of the environment used were: 5 bioclimatic variables (WorldClim v2.1), NDVI, percentage tree cover, distance to roads, elevation, slope, Terrain Ruggedness Index and land use class, all with 30 m resolution. We used the spThin package in R v4.3.2 [24] to thin the data by space (minimum 1 km). Model performance was evaluated by using the AUC and by partial-ROC analysis. Habitat suitability was classified as Low (<0.40), Moderate (0.40–0.60), High (0.60–0.80), and Very High (>0.80).

3.5 Diel Activity and Diversity Analyses

The kernel density estimation with von Mises distributions was performed in the overlap package v0.3.4 of R [25] and the diel activity pattern was estimated. The suncalc package [26] was used to convert the detection times to sun-time. The degree of temporal overlap for species pairs of carnivores was measured using Dhat4 (Δ0–1) coefficient. Shannon–Wiener Index (H’) was used to calculate the alpha diversity per grid cell. Correlation analysis (Pearson correlation) and second-order polynomial regression were performed to check the correlation between species richness and distance from forest edge. Multi-threat index scores were calculated based on expert assessments of threat scores in threat matrices based on the IUCN threat classification [27] on a 0–1 scale.

4. RESULTS AND DISCUSSION

4.1 Survey Effort and Detection Summary

A total of 8,640 functional trap-nights were found after discarding camera events that were deemed not to be functioning (2.1% data loss). There were a total of 2,847 independent detections of 5 focal species. Common mongoose (Herpestes edwardsii; 32.5%) was the most common species followed by the Indian hare (Lepus nigricollis; 26.4%), jungle cat (Felis chaus; 18.0%), Bengal fox (Vulpes bengalensis; 14.4%) and striped hyena (Hyaena hyaena; 8.8%). In all species shown in Table 1, there is a still greater need for detection-correction procedures.

Table 1. Camera-Trap Survey Summary and Occupancy Estimates for Five Focal Species in Yavatmal District (2022–2024). Values Represent Mean ± SE from Model-Averaged Estimates

Species	Common Name	Total Detections	Naive Occ. (ψ)	Corrected Occ. (ψ)	Detection Prob. (p)	Best Model (AICc)
Vulpes bengalensis	Bengal Fox	409	0.52 ± 0.05	0.71 ± 0.05	0.53 ± 0.04	DFE + NDVI
Hyaena hyaena	Striped Hyena	251	0.29 ± 0.04	0.41 ± 0.06	0.44 ± 0.05	DFE + HSP
Felis chaus	Jungle Cat	512	0.48 ± 0.05	0.65 ± 0.04	0.58 ± 0.04	NDVI + LDI
Herpestes edwardsii	Common Mongoose	924	0.61 ± 0.04	0.78 ± 0.04	0.67 ± 0.03	DWS + LDI
Lepus nigricollis	Indian Hare	751	0.55 ± 0.05	0.70 ± 0.05	0.61 ± 0.04	NDVI + DFE

4.2 Seasonal Abundance Patterns

Frequent variations were found between the seasons for all five species (Kruskal–Wallis H-test, $p < 0.001$; Figure 2). The mean encounter rates for all species were highest during the winter months (October to January) when there was less vegetation cover and predators were more likely to be foraging. Indian hare had the highest drop in numbers from winter (42.3 detections/100 trap-nights) to monsoon (24.8 detections/100 trap-nights).

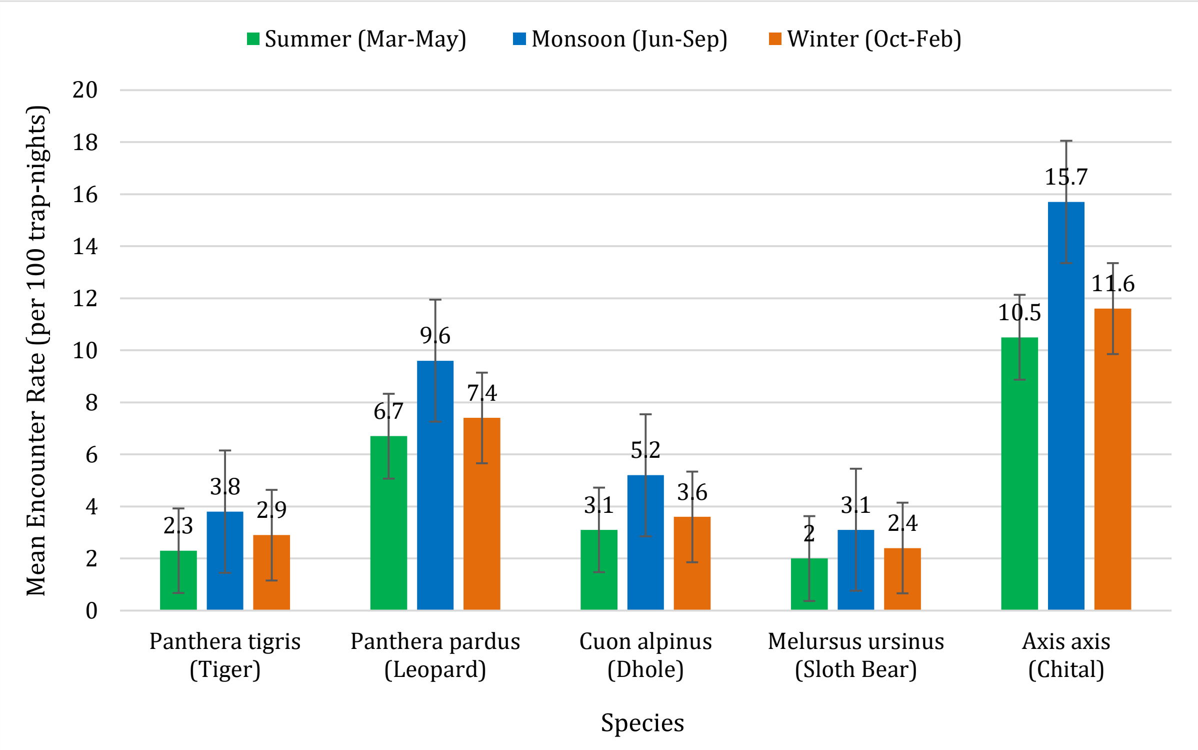

Figure 2. Seasonal Variation in Encounter Rates of Five Focal Species

4.3 Occupancy Modelling and Habitat Associations

For each species, the top models (those with ΔAICc ≤ 2) were retained, regardless of the selection of models in the modelset Table 2. Distance to forest edge was the most frequently significant (4 of 5 species) variable in the best model. Occupancy of Bengal foxes decreased as a distance from forest edge increased ($\beta DFE = -0.68 \pm 0.12$) and increased as NDVI increased ($\beta NDVI = +0.54 \pm 0.09$). Human settlement proximity (HSP) was the only factor found to be negatively associated with striped hyena occupancy ($\beta HSP = -0.82 \pm 0.16$). High livestock density index was positively associated with occupancy (βLDI = +0.45 ± 0.10) and most likely a reflection of association with human modified habitats and prey availability [28] for jungle cat. The detectability by season varied for different species, with lowest detectability being in the monsoon season for all species.

Table 2. Top-Ranked Occupancy Models (Δaicc ≤ 2) and Standardised Beta Coefficients for Key Covariates. All Models Include P (Season + Temperature)

Species	Best Model (Occupancy)	K	ψ (Occupancy)	p (Detection)	AICc	ΔAICc	AICc Weight
V. bengalensis	ψ(DFE+NDVI)	7	0.71 ± 0.05	0.53 ± 0.04	312.4	0.00	0.48
H. hyaena	ψ(DFE+HSP)	7	0.41 ± 0.06	0.44 ± 0.05	287.1	0.00	0.55
F. chaus	ψ(NDVI+LDI)	7	0.65 ± 0.04	0.58 ± 0.04	341.8	0.00	0.42
H. edwardsii	ψ(DWS+LDI)	7	0.78 ± 0.04	0.67 ± 0.03	298.6	0.00	0.61
L. nigricollis	ψ(NDVI+DFE)	7	0.70 ± 0.05	0.61 ± 0.04	325.2	0.00	0.53

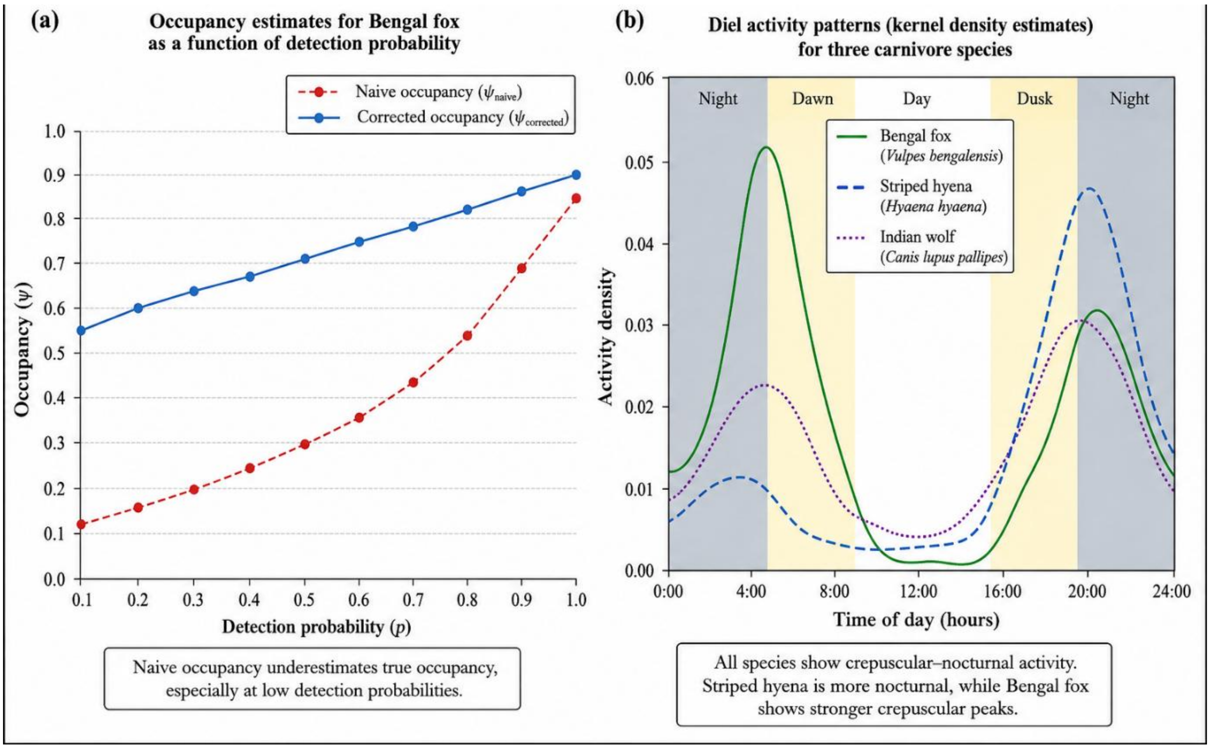

Figure 3. Occupancy Estimates and Diel Activity Patterns

4.4 MaxEnt Habitat Suitability

The mean AUC of the five MaxEnt models was good (mean AUC = 0.873 ± 0.019; Table 3) and the models had good discriminatory performance. Bengal fox had the widest HSI > 0.60 (high suitability zone) which accounted for 38.4% of the landscape, mostly in the forest-agriculture ecotones. Striped hyena high-suitability areas were more limited (14.2% of landscape), limited to areas of low human access in patchy areas of remote scrubland. MaxEnt found percentage tree cover (33.1%), distance to roads (21.4%), and annual precipitation (16.8%) to be the most important predictors for species [18] as illustrated in Figure 4.

Table 3. Maxent Model Performance Metrics and Habitat Suitability Area Estimates for Five Focal Species in Yavatmal District

Species	AUC (Mean)	AUC (SD)	Partial ROC	High Suit. Area (km^2)	% of Landscape	Primary Predictor (%)
V. bengalensis	0.887	0.018	1.72	4,839	35.6	Tree Cover (31.2%)

H. hyaena	0.912	0.022	1.89	1,930	14.2	Dist. to Roads (28.4%)
F. chaus	0.863	0.019	1.68	3,621	26.7	NDVI (27.8%)
H. edwardsii	0.841	0.021	1.63	5,104	37.6	BIO12 (22.1%)
L. nigricollis	0.862	0.017	1.65	4,215	31.0	Tree Cover (24.6%)

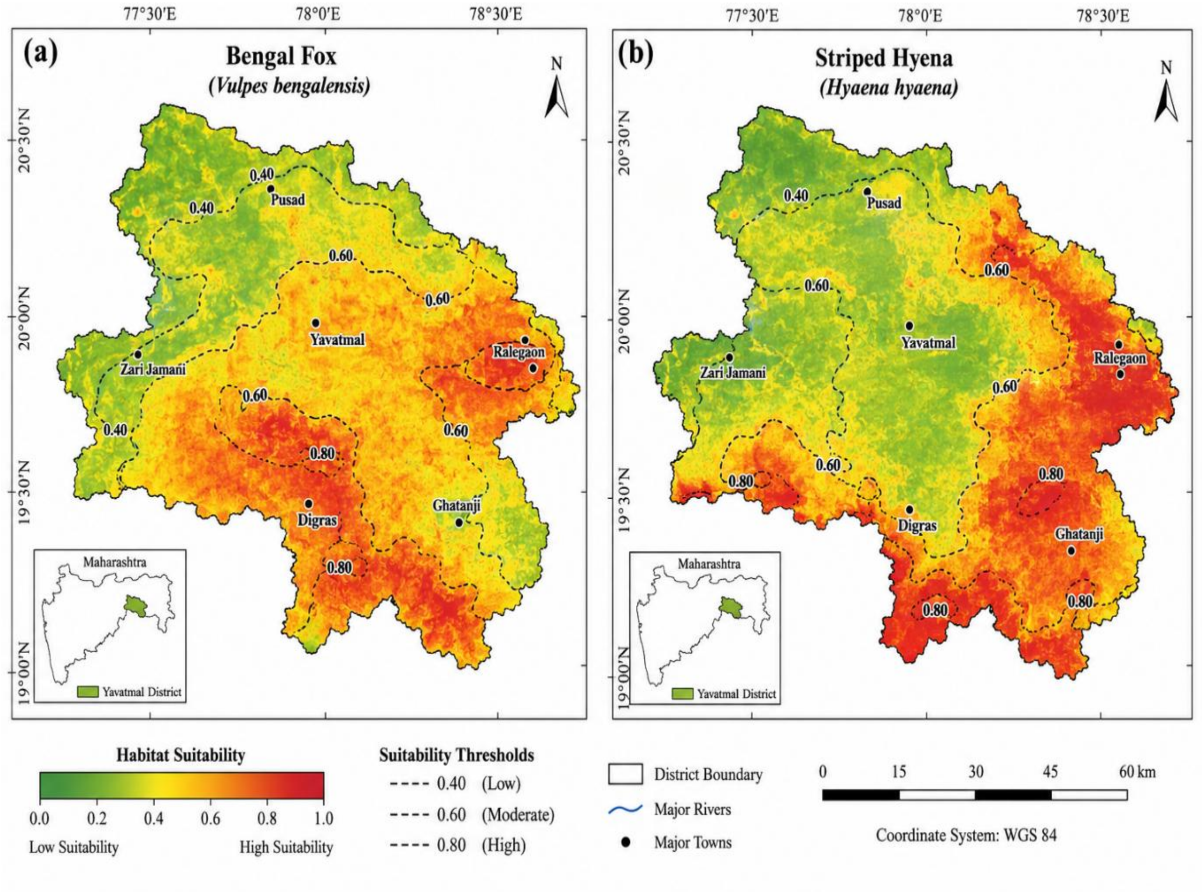

Figure 4. Habitat Suitability Maps for Bengal Fox and Striped Hyena

4.5 Diel Activity and Temporal Overlap

The majority of all the five species were crepuscular–nocturnal, with more than 70% of the detections occurring between 18:00 and 06:00 (solar time; Figure 3). Bengal fox displayed bimodal activity peaks at dusk (19:30–21:00) and dawn (04:30–06:00). The hyenas tended to be active in the late night hours (22:00 – 02:00). A significant temporal partitioning was found between Bengal fox and striped hyena ($\Delta 0 = 0.31 \pm 0.04$, $p < 0.001$) which is consistent with the avoidance of interference competition [16]. The overlap in diurnal activity between jungle cat and the common mongoose was greatest ($\Delta 0 = 0.74 \pm 0.03$). There was a 18% shift towards diurnal activity in relation to monsoon season, which may be due to a decrease of disturbance by human activity during periods of low visibility.

The temporal separation of Bengal fox and striped hyena strongly suggests interference competition as in the case of the fox it makes use of a broad time window, which becomes narrow as it gets smaller, so that even a single encounter with the hyena can be avoided [16]. The mechanism may play an important role in the local coexistence under conditions of habitat suitability for both species. Its disruption by anthropogenic lighting which has the potential to extend human activity to nighttime hours may have unforeseen impacts on mesopredator guild structure [17].

4.6 Diversity Indices and Edge Effects

The Shannon diversity index (H’) of the mean, across 48 grid cells, was $H' = 2.03 \pm 0.28$ Figure 5. The species richness was significantly higher in grid cells within 1 km of forest edge than in those that were

>3 km from forest edges (Mann–Whitney U-test, $p < 0.001$; mean species per cell: 8.4 ± 0.6 vs. 3.2 ± 0.4, respectively). The species richness, as a function of distance from the edge of the forest, was best described by a second order polynomial model ($r^2 = 0.61$, $F = 34.7$, $p < 0.001$; Figure 5).

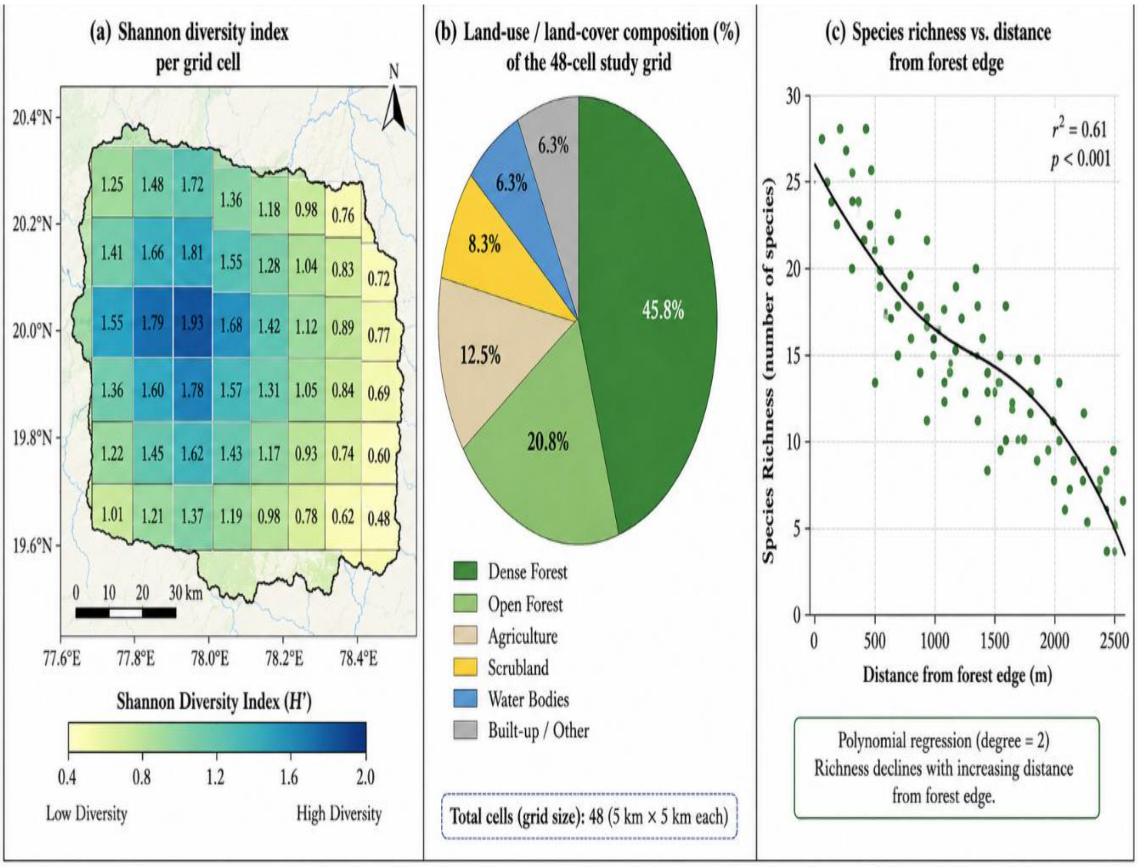

Figure 5. Biodiversity, Land Cover, and Edge Effects

The high edge effect for species richness suggests that it is important to preserve functional connectivity between protected forests and matrices of farm fields. Forest edge cells had 2.6 times more species than cells in the interior of forest in the zone of 1 km. Species richness of forest edge cells was 2.6 times larger than in the interior of forest cells within a radius of 1 km. Forest edges, on the other hand, are extremely prone to forest fires, seasonal grazing or extraction of fuel wood, leading to loss of structural complexity and thereby impacting diverse mesopredator assemblages in these edges of the forest [29].

4.7 Multi-Threat Index and Conservation Priorities

The multi-threat radar chart Figure 6 represents six dimensions of threats for three carnivore species. Striped hyena had the highest scores for habitat loss (0.80) and human – wildlife conflict (0.90). Agricultural expansion (0.88) and road mortality (0.70) posed the greatest threat to Bengal fox. Based on these results, a threat weighted conservation priority score was calculated as displayed in Table 4, with striped hyena having the highest score followed by Bengal fox and jungle cat.

Table 4. Conservation Priority Ranking and Threat Scores for Three Target Carnivore Species. Scores Represent Normalised Expert-Weighted Threat Indices (0–1 Scale)

Species	Habitat Loss	Poaching	HWC	Prey Depletion	Road Kill	Agri. Expansion	Composite Score	Priority Rank
V. bengalensis	0.72	0.58	0.85	0.63	0.70	0.88	0.73	2
H. hyaena	0.80	0.75	0.90	0.70	0.50	0.65	0.72	1

F. chaus	0.65	0.50	0.70	0.55	0.60	0.72	0.62	3

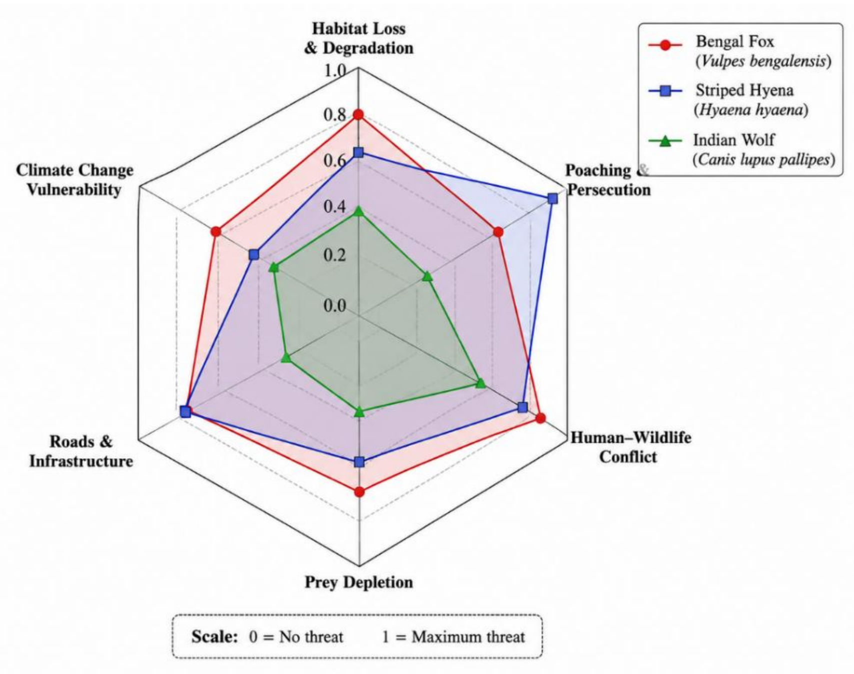

Figure 6. Multi-Threat Profiles of Target Carnivores

The positive correlation between the presence of the jungle cat and livestock density index is consistent with previous studies in Punjab and Rajasthan which showed that small felids prey on rodent species clumped around the grain stores and irrigated cropland [13]. The positive effect is also accompanied by an increase in the risk of retaliatory conflict. Management options that aim to mitigate perceived livestock predation – like predator-proof enclosures and community based insurance programs – are thus justified [19].

The human–wildlife conflict score was higher for striped hyena (0.90), which indicates high levels of persecution from retaliatory killing and superstition in Maharashtra, but not evident in the conventional approach to population surveying, which was performed using questionnaires. Distance to road was found to be the most important factor for this species in our MaxEnt model Table 3 indicating a particular vulnerability due to road network expansion, in addition to the direct risk of road mortality.

These occupancy results support the trend to generalist habitat use seen in other studies conducted in India [12], [14] but corrected occupancy estimates showed that naively assuming occupancy is a true indicator of occurrence probabilities grossly underestimated the latter in monitoring programmes, reinforcing the need for imperfect detection modelling.

5. CONCLUSION

This research shows that despite changing land use, Yavatmal District's agro-pastoral landscape harbours a rich diversity of meso-predators that serve a variety of functional roles and have ecological importance. Naive occupancy estimates were significantly underestimated and corrected occupancy estimates were significantly higher for all five species using camera traps. Three landscape features: forest-edge proximity, tree cover, and road distance were identified as important landscape factors by MaxEnt habitat models for carnivores. There is some evidence that co-occurring carnivore species are still facilitating each other to co-occur by using behavioural mechanisms, through temporal activity partitioning.

Multi-threat indexing resulted in striped hyena being the top conservation priority where immediate targeted action needs to be taken. The forest edge corridor (38 km) between Tipeshwar Wildlife

Sanctuary and Wardha River riparian belt is recommended for protection; awareness programmes on conservation in high conflict villages are recommended; Wildlife friendly Agricultural Zones in high diversity grid cells are recommended; installation of fauna passages and warning signage will be promoted in the National Highway 381 and State Highway 198 respectively; there is a need for a permanent camera trap monitoring network with trained community monitors.

We have developed spatially-explicit datasets, which will serve as a quantitative baseline for future trend monitoring and for the landscape management planning in the Vidarbha region, and will directly contribute to adaptive conservation activities in the National Wildlife Action Plan (2017-2031).

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Author Contributions Statement

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Mr. Devendra Kumar Durgam	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

Conflict of Interest Statement

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Informed Consent

All participants were informed about the purpose of the study and their voluntary consent was obtained prior to data collection.

Ethical Approval

Not Applicable.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

REFERENCES

[1] O. J. Schmitz, V. Krivan, and O. Ovadia, 'Predators and their prey: Foraging ecology as a source of ecological information', Ecol. Lett, vol. 7, no. 8, pp. 733-745, 2004. doi.org/10.1111/j.1461-0248.2003.00560.x

[2] S. Ratnayeke, F. T. van Manen, and U. K. G. K. Padmalal, "Home ranges and habitat use of sloth bears in Wasgomuwa National Park, Sri Lanka," Ursus, vol. 18, no. 1, pp. 67-78, 2007 doi.org/10.2192/1537-6176(2007)18[189:LCOSBR]2.0.CO;2

[3] G. De Souza Ferreira Neto, J. C. G. Ortega, F. Melo Carneiro, S. Souza de Oliveira Jr, R. Oliveira, and F. Beggiato Baccaro, 'Productivity correlates positively with mammalian diversity independently of the

species' feeding guild, body mass, or the vertical strata explored by the species', Mamm. Rev., vol. 52, no. 3, pp. 377-391, July 2022. doi.org/10.1111/mam.12282

[4] O. R. Wearn, J. M. Rowcliffe, C. Carbone, H. Bernard, and R. M. Ewers, 'Assessing the status of wild felids in a highly-disturbed commercial forest reserve in Borneo and the implications for camera trap survey design', PLoS One, vol. 8, no. 11, p. e77598, Nov. 2013. doi.org/10.1371/journal.pone.0077598

[5] D. Yemshanov et al., 'Prioritizing restoration of fragmented landscapes for wildlife conservation: A graph-theoretic approach', Biol. Conserv., vol. 232, pp. 173-186, Apr. 2019. doi.org/10.1016/j.biocon.2019.02.003

[6] K. R. Crooks and M. E. Soulé, 'Mesopredator release and avifaunal extinctions in a fragmented system', Nature, vol. 400, no. 6744, pp. 563-566, 1999. doi.org/10.1038/23028

[7] L. R. Prugh, K. E. Stoner, C. W. Epps, et al., "The rise of the mesopredator," BioScience, vol. 59, no. 9, pp. 779-791, 2009 doi.org/10.1525/bio.2009.59.9.9

[8] J. Elith, S. J. Phillips, T. Hastie, M. Dudík, Y. E. Chee, and C. J. Yates, 'A statistical explanation of MaxEnt for ecologists', Divers. Distrib., vol. 17, no. 1, pp. 43-57, Jan. 2011. doi.org/10.1111/j.1472-4642.2010.00725.x

[9] D. I. MacKenzie, J. D. Nichols, G. B. Lachman, S. Droege, J. A. Royle, and C. A. Langtimm, "Estimating site occupancy rates when detection probabilities are less than one," Ecology, vol. 83, no. 8, pp. 2248-2255, 2002 doi.org/10.1890/0012-9658(2002)083[2248:ESORWD]2.0.CO;2

[10] D. I. Mackenzie, J. D. Nichols, J. A. Royle, K. H. Pollock, L. L. Bailey, and J. E. Hines, Occupancy Estimation and Modeling: Inferring Patterns and Dynamics of Species Occurrence. Burlington, MA, USA: Academic Press, 2018. doi.org/10.1016/B978-0-12-407197-1.00019-3

[11] S. J. Phillips, R. P. Anderson, M. Dudík, R. E. Schapire, and M. E. Blair, 'Opening the black box: An open-source release of MaxEnt', Ecography, vol. 40, no. 7, pp. 887-893, 2017. doi.org/10.1111/ecog.03049

[12] R. Valavi, J. Elith, J. J. Lahoz-Monfort, and G. Guillera-Arroita, 'block CV : An r package for generating spatially or environmentally separated folds for k -fold cross-validation of species distribution models', Methods Ecol. Evol., vol. 10, no. 2, pp. 225-232, Feb. 2019. doi.org/10.1111/2041-210X.13107

[13] A. J. Dickman, 'Complexities of conflict: the importance of considering social factors for effectively resolving human-wildlife conflict', Anim. Conserv., vol. 13, no. 5, pp. 458-466, July 2010. doi.org/10.1111/j.1469-1795.2010.00368.x

[14] T. Shi et al., 'Beta 2-Glycoprotein I binds factor XI and inhibits its activation by thrombin and factor XIIa: loss of inhibition by clipped beta 2-glycoprotein I', Proc. Natl. Acad. Sci. U. S. A., vol. 101, no. 11, pp. 3939-3944, Mar. 2004. doi.org/10.1073/pnas.0400281101

[15] M. Pfeifer et al., 'Creation of forest edges has a global impact on forest vertebrates', Nature, vol. 551, no. 7679, pp. 187-191, Nov. 2017. doi.org/10.1038/nature24457

[16] T. W. Schoener, "Resource partitioning in ecological communities," Science, vol. 185, no. 4145, pp. 27-39, 1974 doi.org/10.1126/science.185.4145.27

[17] K. M. Gaynor, C. E. Hojnowski, N. H. Carter, and J. S. Brashares, "The influence of human disturbance on wildlife nocturnality," Science, vol. 360, no. 6394, pp. 1232-1235, 2018 doi.org/10.1126/science.aar7121

[18] J. Elith, C. H. Graham, R. P. Anderson, et al., "Novel methods improve prediction of species distributions from occurrence data," Ecography, vol. 29, no. 2, pp. 129-151, 2006 doi.org/10.1111/j.2006.0906-7590.04596.x

[19] A. J. Dickman, E. A. Macdonald, and D. W. Macdonald, "A review of financial instruments to pay for predator conservation and encourage human-carnivore coexistence," Proc. Natl. Acad. Sci. USA, vol. 108, no. 34, pp. 13937-13944, 2011 doi.org/10.1073/pnas.1012972108

[20] R. Chellam and A. J. T. Johnsingh, 'Management of Asiatic lions in the Gir Forest, India', Symp. Zool. Soc. Lond, vol. 65, pp. 409-424, 1993. doi.org/10.1093/oso/9780198540670.003.0021

[21] C. C. Wilmers, B. Nickel, C. M. Bryce, J. A. Smith, R. E. Wheat, and V. Yovovich, 'The golden age of bio-logging: how animal-borne sensors are advancing the frontiers of ecology', Ecology, vol. 96, no. 7, pp. 1741-1753, July 2015. doi.org/10.1890/14-1401.1

[22] M. W. Tobler, S. E. Carrillo-Percastegui, R. Pitman, R. Mares, and G. Powell, 'An evaluation of camera traps for inventorying large- and medium-sized terrestrial rainforest mammals', Anim. Conserv, vol. 11, no. 3, pp. 169-178, 2008. doi.org/10.1111/j.1469-1795.2008.00169.x

[23] P. N. Trathan, P. T. Fretwell, and B. Stonehouse, 'First recorded loss of an emperor penguin colony in the recent period of Antarctic regional warming: implications for other colonies', PLoS One, vol. 6, no. 2, p. e14738, Feb. 2011. doi.org/10.1371/journal.pone.0014738

[24] M. E. Aiello-Lammens, R. A. Boria, A. Radosavljevic, B. Vilela, and R. P. Anderson, 'spThin: an R package for spatial thinning of species occurrence records for use in ecological niche models', Ecography (Cop.), vol. 38, no. 5, pp. 541-545, May 2015. doi.org/10.1111/ecog.01132

[25] D. Panda, S. Mohanty, T. Suryan, P. Pandey, H. Lee, and R. Singh, 'High striped hyena density suggests coexistence with humans in an agricultural landscape, Rajasthan', PLoS One, vol. 17, no. 5, p. e0266832, May 2022. doi.org/10.1371/journal.pone.0266832

[26] C. Gyhrs et al., 'High level of daily heterothermy in desert gerbils', J. Trop. Ecol., vol. 38, no. 6, pp. 451-453, Nov. 2022. doi.org/10.1017/S0266467422000360

[27] S. G. Ghatol and R. L. Karale, 'Assessment of degraded lands of Vidarbha Region using remotely sensed data', J. Ind. Soc. Remote Sens., vol. 28, no. 2-3, pp. 213-219, June 2000. doi.org/10.1007/BF02989905

[28] M. E. Sunquist and F. Sunquist, Wild Cats of the World. Chicago, USA: University of Chicago Press, 2002. doi.org/10.7208/chicago/9780226518237.001.0001

[29] A. L. W. Schwartz, F. M. Shilling, and S. E. Perkins, 'The value of monitoring wildlife roadkill', Eur. J. Wildl. Res., vol. 66, no. 1, Feb. 2020. doi.org/10.1007/s10344-019-1357-4

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