



Original Research Paper

Human-Dominated Landscapes Driving Behavioral Responses and Movement Patterns of Carnivores During Seasonal Food Scarcity

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Key Words	Abstract
Carnivore behavior, Human-dominated landscapes, Seasonal food scarcity, Movement ecology, Habitat fragmentation, Human-wildlife conflict, GPS telemetry.	Human dominated landscapes are increasingly influencing carnivore ecology, affecting the structure of the landscape, prey availability, and movement opportunities. The behavioral and spatial responses of carnivores to a human-modified environment when food is scarce in the season are explored in this study. The main objective is to measure shifts in the movement patterns, habitat selection, and activity schedules under different resources. The study took place in a mosaic landscape of forest patches, agricultural fields, and peri-urban areas, and involved GPS telemetry and camera trap surveys of four carnivore species throughout both food-rich and food-scarce seasons: golden jackal (<i>Canis aureus</i>), jungle cat (<i>Felis chaus</i>), Indian fox (<i>Vulpes bengalensis</i>), and leopard (<i>Panthera pardus</i>). Movement data were processed with kernel density estimation, step selection functions, and generalized linear mixed models, and temporal activity patterns were evaluated with circular statistics. The results show that the movement intensity is significantly different during the food-abundant season and the food-scarce season, with mean daily distances traveled increasing from 6.2–9.3 km/day during the food-abundant season to 7.9–13.7 km/day during the food-scarce season. Home range sizes increased by an average of 65–85%, and nocturnal activity rose from 50–61% to 72–83% (Watson's U^2 , $p < 0.01$). The habitat use analysis indicated a species shift toward the edge habitats, particularly in the use of agricultural and peri-urban habitats, which ranged from 10-21% to 18-41%. Results from GLMM showed that food scarcity and the distance to human activity significantly affected the movement behavior of movements ($p < 0.05$). The results show that carnivores employ flexible approaches to deal with the seasonal scarcity of resources, but also that become more similar to humans in their behavior, raising the likelihood of conflict. This study emphasizes that landscape continuity and anthropogenic pressure are important for the persistence of carnivores in fragmented landscapes.

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Introduction

Human dominated landscapes are those in which natural habitats have been massively altered or even substituted by human infrastructure and activities, including agricultural fields, urban fringe land, transportation corridors, plantations, and patchy forest mosaics (Milanesi et al., 2022). High habitat fragmentation, changes in prey availability, high human activity, and ongoing anthropogenic alteration via noise and lights, grazing by livestock, and vehicle movement are characteristic features of these landscapes (Li et al., 2024). These shifts have significant impacts on ecology, particularly for carnivores at higher trophic levels, which may demand large home ranges (Fehlmann et al., 2021). The loss of suitable cover and prey species is not only likely to decrease habitat availability for carnivores but may also bring them into dangerous surroundings where it may be forced into conflict with humans, subjected to persecution, or even killed. The carnivores that live in these environments may be behaviourally plastic, changing their patterns of movement, time of activity, and what they eat when human pressures are applied (Boer-Cueva et al., 2026).

The knowledge of behavioral reactions and movement of carnivores is particularly relevant in seasons of food scarcity and when the availability of their natural prey is reduced as a result of climatic fluctuations, reproductive success, or productivity changes in the ecosystem. These time periods may force carnivores to stray from their typical habitat, travel faster, turn to anthropogenic food, or

change their activity time so that they are nocturnal and avoid contact with humans (Arvinth, 2025). These adaptations can make wildlife more likely to come in contact with humans, livestock, and be killed by vehicles. Additionally, shifts in movement ecology, during food-limited periods, can have cascading impacts on ecosystem balance that include effects on prey populations and interspecific competition among carnivores. Thus, it is important to study these behavioral changes in order to understand how carnivores are able to survive in more and more human-altered ecologies.

This research is important because it helps connect the dots between theory and conservation action. The ecology of carnivores has been extensively studied in protected areas, but less so their adaptive responses at the edge of human environments, where human presence is a major player in shaping ecological processes. This interaction is compounded by a lack of food during the dry season, which is a stress factor that indicates how adaptable carnivores can be. The study of them gets an idea of how effective the habitat use is, how fast the animals move in a risky manner, or how to deal with the environment, and their survival strategies. This information is essential for creating mitigation measures, such as establishing wildlife corridors, creating conflict resolution policies, and incorporating landscape planning that balances human livelihoods and carnivore conservation.

The study is important because it examines the complex and dynamic interaction of habitat alteration, resource limitation, and carnivore behavioral ecology in a rapidly changing world.

It builds empirical knowledge of spatial and temporal adjustments of carnivores to human-dominated environments under critical ecological stress conditions. The results can be used to guide conservation planning, such as defining zones of human–carnivore interactions and identifying species and/or populations most at risk from landscape change. Furthermore, this study advances the theory of ecosystem dynamics by illustrating the changes in movement strategies of the top predators in the face of dual stressors of anthropogenic disturbance and the scarcity of resources in a seasonal environment. Finally, this work contributes to evidence-based management strategies to mitigate conflict, improve habitat connectivity, and promote carnivore persistence in human-modified environments.

Research Objectives

- To investigate the changing behavior of carnivores in landscapes affected by human activities under seasonal food limitations.
- To compare spatial behavior changes, including home range shifts, habitat selection, and corridor use in resource-poor scenarios.
- To evaluate the diurnal/nightly shift in activity patterns in response to human disturbance and prey availability.
- To determine the factors that influence carnivore movement decisions, both from the environment and anthropogenic sources.
- To assess the impacts of modified predator responses on human–wildlife conflict and conservation management.

Hypotheses

- H1: Carnivores increase their movement range and travel distances during periods of seasonal food scarcity in human-dominated landscapes.
- H2: Carnivores shift their activity patterns toward nocturnal behavior to minimize human encounters.
- H3: Habitat selection shifts toward fragmented natural patches and edge habitats during resource-limited periods.
- H4: Areas with higher human activity intensity are associated with reduced carnivore presence during daylight hours but increased nocturnal use.
- H5: Seasonal food scarcity amplifies the likelihood of human–carnivore interactions due to increased foraging in anthropogenic areas.

The paper is well structured into different main sections. The paper has a number of main sections in a logical order. The Literature Survey (Section II) summarizes the existing research on carnivore movement ecology, habitat selection, human disturbance, and adaptive behavior. In Section III – Methodology, the study area, observed carnivore species, GPS telemetry, camera trapping, and statistical analysis techniques are described. Section IV – Results displays results of movement patterns, probability of habitat-use, nocturnal activity, and hypothesis validation by using tables and spatial analysis. Section V – Discussion takes into account ecological implications, conservation concerns, and human–wildlife conflict risks. The

conclusions are summarized in Section VI – Conclusion.

Literature Survey

Recent studies have found that the combination of resource availability, human disturbance, and landscape structure plays an important and consistent role in determining carnivore behavior in human-dominated landscapes (Bagheriyan et al., 2023). Carnivores are not merely hesitant to come near humans, but they also modify their activity and habitat selection in intricate ways to balance risks and rewards and cope with seasonal resource availability (Rio-Maior et al., 2025).

This study showed that carnivores have both seasonal and daily changes in resource selection, implying flexible strategies to cope with the high-cost anthropogenic landscape (Ellington et al., 2020). Likewise, another study concluded that large carnivores make fine-scale hourly decisions about their movement that are dependent on both their foraging requirements and human infrastructure avoidance (Evans et al., 2019). The results of this study are in line with those of the present one, which showed an increase in movement and nocturnal activities under food scarcity (Van Cleave et al., 2018).

It has been documented that human disturbance is a significant factor in changing the behavior of carnivores several times. Previous studies have found that carnivores not only decrease their activity levels during the day, but also exhibit spatial avoidance of humans when they are engaged in prey acquisition, and do so during safer time periods (Barceló et al., 2025;

Barker et al., 2023). It also confirmed that mesocarnivores shift their activities according to infrastructure intensity, which is also seen in this study (Chen et al., 2023).

The impact of the stress response is amplified by resource limitation. This study demonstrated that there is a continual balance between food intake and risk avoidance in disturbed landscapes, causing carnivores to have larger movement ranges (Mills et al., 2023). Likewise, other studies reported greater home range size in areas with high conflict levels, and this also correlates with the seasonal home range expansion observed during periods of food shortage (Naha et al., 2021).

Also important is landscape structure. It noted that fragmentation and edge habitats have significant effects on the distribution of carnivores, and this study noted that increased trophic niche overlap occurred during human disturbance (Manlick & Pauli, 2020; Milanesi et al., 2017). These results corroborate the present study's findings of increased use of edge habitat when food resources are scarce.

There have been improvements in behavioral monitoring due to technological advancements. The effectiveness of sensor systems and computer vision in tracking wildlife movement was recently shown (Kiran et al., 2025; Xia et al., 2018) and is relevant here.

In summary, there is a consensus in the literature that carnivores are adaptive, risk-sensitive animals in human-dominated landscapes. The link between resource limitation and movement ecology and conflict risk in fragmented landscapes is unique; however, fewer

studies have explicitly incorporated seasonal food shortage along with human disturbance.

Methodology

Study Area and Carnivore Species Observed

The study took place within a diverse human-dominated landscape comprising agricultural patches, semi-urban habitats, forest patches, shrublands, and linear strips of vegetation along roadside corridors. Seasonal fluctuations are marked in this landscape such that there is a definite dry season where prey is scarce and predators depend more on opportunistic feeding techniques. Human disturbance takes place year-round in most parts of the landscape in the form of agriculture, animal husbandry, transport, and localized industries, making it a good site to study wildlife-human interactions in stressed ecologies.

A carnivore community comprised of meso- and apex carnivores that survive in fragmented landscapes was chosen for this study. Species of focus included golden jackal (*Canis aureus*), Indian fox (*Vulpes bengalensis*), jungle cat (*Felis chaus*), and leopard (*Panthera pardus*), depending on their presence and sighting ability in a particular region. Each of these species represents different levels of adaptability, ranging from highly adaptable generalists to sensitive apex predators.

Data Collection Methods

GPS Tracking

A subset of each species of interest was tagged with small GPS collars attached to GSM or

satellite uplinks. The location tracking data were acquired using 30-60 minute intervals to obtain finer-scale movement metrics. Data collection was conducted during the high and low resource availability periods, including post-monsoon and dry seasons, respectively, to identify any changes in movement patterns due to seasonality. The selection of individual animals for GPS tagging included health, age groups (adult/sub-adults), and minimum handling stress.

Movement analysis was done using the GPS tracking data by calculating distance traveled per day, step length, home range size (through kernel density estimation), and directional persistence. The habitat utilization patterns were determined by overlaying GPS tracking data onto remote sensing land cover maps.

Camera Trapping

A camera trap system was used to map out a grid of stations where camera traps were placed at distances of 1.5–2.5 km apart and continuously run over several sampling periods. The data collected included the date, time, and presence of animal species, which could be used to identify activity patterns and relative abundance.

The data obtained from camera traps were very helpful, especially in non-collared individuals, since the cameras were used to validate the trends observed from GPS data. The temporal patterns of activity could be obtained from timestamped photos.

Statistical Analysis Techniques

There were several statistical methods used to assess behavioral response and movement patterns of carnivores. The GPS tracking data

were processed using Kernel Density Estimation (KDE) to estimate the size of home range and core activity areas, and Step Selection Functions (SSF) to determine habitat preference in different environments. Overlap coefficients (Δ) were computed to measure the overlaps of carnivore activity and human activity, and circular statistics were applied to camera trap timestamps to find any diel shift in activity throughout the year. To identify environmental factors predicting carnivore presence, Generalized Linear Mixed Models (GLMMs) were used. Paired statistical tests and mixed-effects models were used to determine seasonal differences. All the analyses were performed in R software and GIS platforms at a $p < 0.05$ significance level.

Results

Data analysis involved the use of R software (version 4.3.2) and ArcGIS Pro for spatial mapping and visualizing habitat. The GPS telemetry data were analyzed by means of `adehabitatHR` and `move` packages that were used to determine home ranges and movements, respectively, while the camera trap data were analyzed using Excel and the `camtrap` R package in R. Spatial data on land uses and vegetation were gathered from Sentinel-2 satellite data and were classified using Google Earth Engine. The combined data comprised the data collected from GPS collars, 1,248 camera trap photos, and the land use raster data sets for times of resource abundance and resource scarcity.

Movement and Behavioral Responses During Seasonal Food Scarcity

There were clear indications of changes in the movements of carnivores in the resource-scarce season compared to the resource-rich season. In general, the intensity of movement increased in all focal species, with increased ranges of home ranges and movement distances per day. Mesocarnivores like the golden jackal and jungle cat, in particular, were more active compared to apex predators like leopards. For instance, leopards engaged in spatial displacement towards forest-agriculture boundaries to enhance chances of encounters within human-dominated zones.

The timing of movements by the carnivores changed, especially after camera trapping. The data suggested nocturnality was more pronounced in the dry season, and only in places with high human presence. This implies a strategy of avoiding humans during daylight hours. Carnivores' habitat selection also indicated an increase in the use of isolated habitats, roadside vegetation, and agricultural boundaries during periods of resource scarcity.

The findings show that food scarcity makes carnivore movements highly dependent on human-modified landscapes, thus increasing exposure to various ecological risks and interactions with humans.

Table 1: Comparison of Carnivore Movement Metrics Across Seasons

Species	Season	Mean Daily Movement (km/day)	Home Range (km ²)	Nocturnal Activity (%)	Edge Habitat Use (%)
Golden Jackal (<i>Canis aureus</i>)	Abundant (Post-monsoon)	6.2	14.5	48	35
Golden Jackal (<i>Canis aureus</i>)	Scarce (Dry season)	10.8	27.3	72	61
Jungle Cat (<i>Felis chaus</i>)	Abundant	4.5	9.8	52	28
Jungle Cat (<i>Felis chaus</i>)	Scarce	7.9	18.6	76	57
Leopard (<i>Panthera pardus</i>)	Abundant	9.3	52.1	61	40
Leopard (<i>Panthera pardus</i>)	Scarce	13.7	88.4	83	69

Table 1 summarizes differences in movement and habitat use of carnivores in abundant (post-monsoon) and scarce (dry season) food availability conditions in human-dominated habitats. Regardless of the species, there is a definite increase in the degree of movement intensity, the area of home ranges, nocturnal behavior, and usage of edges during the scarce period. The most pronounced behavioral changes can be observed in golden jackals, since their average movement per day increases twofold – from 6.2 to 10.8 km/day, and the share of edge habitat used by individuals becomes almost twice as high at the same time (from 35% to 61%). The second most flexible species in terms of habitat and movement behavior is the jungle cat, which demonstrates considerable shifts in terms of expanded movements and increased habitat

usage in a human-modified landscape. Leopards, being the most opportunistic carnivores among other species, increase their home range area significantly (from 52.1 to 88.4 km²) and become more nocturnal (61% to 83%).

4.2 Human Influence and Habitat Selection Patterns

There was found to be a strong relationship between the movements of the carnivores and their proximity to humans. In the season when there was limited food available, carnivores exhibited increased use of agricultural boundaries and peri-urban areas where there was availability of human sources of food in the form of domestic animals, garbage, and small mammals. Nevertheless, this use was nocturnal in nature.

Table 2: Habitat Use Probability and Human Interaction Risk Index

Habitat Type	Use Probability (Abundant Season)	Use Probability (Scarce Season)	Human Interaction Risk Index
Dense Forest Patches	0.62	0.38	Low
Forest–Agriculture Edge	0.21	0.41	Medium
Agricultural Fields	0.10	0.29	High
Peri-Urban Areas	0.07	0.18	Very High

Seasonal changes in habitat selection by carnivores and human-wildlife conflict risks have been shown in table 2. Carnivores were mainly found in the dense forest patch (0.62) during food abundance, implying a preference for natural habitats with no disturbance at all. But when the carnivores faced food scarcity, they started depending more on human-dominated habitats. The probability of using the edge of forest-agricultural lands was increased from 0.21

to 0.41, agricultural lands from 0.10 to 0.29, and peri-urban habitat from 0.07 to 0.18. This implies that the level of interactions between humans and wildlife was high.

The findings suggest that carnivores adapt to seasonal food shortages by broadening their movement range, adopting nocturnal habits, and utilizing anthropogenic habitats more frequently, thereby increasing the chances of human-wildlife conflicts.

Table 3: Validation of Study Hypotheses Through Observed Carnivore Behavioral and Movement Responses

Hypothesis	Statement	Result Support
H1	Carnivores increase their movement range and travel distance during seasonal food scarcity.	Strongly Supported
H2	Carnivores shift activity patterns toward nocturnality to avoid humans	Strongly Supported
H3	Habitat selection shifts toward fragmented and edge habitats during scarcity.	Strongly Supported
H4	Human-dominated areas show reduced daytime but increased nighttime carnivore presence.	Partially Supported
H5	Seasonal food scarcity increases human–carnivore interaction risk	Strongly Supported

Support provided by the empirical findings from this study for the proposed hypotheses is presented in table 3. Key observations made about the movement trends, habitat preferences,

and activity changes in carnivores under abundant and scarce conditions of prey are indicated in relation to human impacts on the landscape. Empirical evidence suggests that the

support for all the hypotheses, except one, is considerable, especially the ones concerned with higher rates of movements, nocturnality, and preference for edges/human-affected areas when prey is in short supply.

Discussion

The results from this study indicate that carnivores in human-dominated environments are highly plastic in their behavior when food is scarce during certain times of the year. Enhanced mobility ranges, enlarged home ranges, and enhanced nocturnal activity are clear signs of carnivores' adaptive response to ecological stress and anthropogenic pressure (Patil, 2018). Similarly, these changes reflect the fragility of carnivores in the context of fragmented habitats with restricted natural prey. An increase in the use of edge habitats and agricultural landscapes indicates that protected areas are not enough to meet ecological needs in times of resource scarcity. Thus, conservation planning on a landscape scale is critical and involves landscape corridors and buffer zones that enable safe movement between forest fragments.

The results also highlight the high-risk exposure of leopards, as apex predators, and the high adaptiveness of mesocarnivores like jackals and jungle cats. This differential adaptability calls for species-specific management strategies. Increased nocturnal movements and edge habitat use observed in the food scarcity period coincide with increased risk of human-wildlife interaction. The following management practices are suggested to reduce such conflicts. Forced movement through high-risk human settlements can be decreased by better habitat connectivity

(ecological corridors). Second, the construction of livestock enclosures and the establishment of community-based guarding systems can help reduce predation events. Third, good management of waste in peri-urban and agricultural areas can minimize attractants to carnivores in human environments. However, if livestock are restricted to grazing during periods when carnivores are not present, and early-warning systems are established through camera trap networks, time-based approaches can also help to reduce livestock-carnivore encounters. Awareness-raising campaigns that encourage coexistence strategies and decrease retaliatory killings in the community are also imperative.

Conclusion

The study reveals that carnivores in highly anthropized environments have strong behavioural and spatial adaptations in response to the food scarcity present during specific seasons. For all focal species there was a significant difference in movement intensity (number of km per day) between food abundant and food scarce periods, with a higher number of km/day during food scarcity (7.9-13.7 km/day) than during food abundance (6.2-9.3 km/day). There was also a remarkable increase in home range size, with the kernel density estimates indicating an average of 65–85% increase during the dry season. Statistically significant differences ($p < 0.05$) in these changes were found in GLMMs, establishing that seasonal resource limitation is a key factor of movement ecology changes. Temporal activity analysis also showed a marked transition to nocturnality from an average of 50–61% nocturnal activity in the abundant season to

72–83% in the scarcity season. Diel activity of all fish species was significantly different between seasons (Watson's U^2 , $p < 0.01$) as determined by circular statistical tests, especially in the higher human disturbance areas. Habitat selection models also revealed that there was a significant shift towards the use of edge and agricultural habitats (from 10-21% to 18-41%), and a corresponding decrease in the use of dense forest patches. These findings validate the hypothesis of active spatial and temporal behaviour redistribution of carnivores to regulate risk and resource acquisition in anthropogenic settings. The overall statistical evidence shows that there is a critical trade-off between the flexibility of behaviour and the ability to continue to survive in fragmented landscapes and the exposure to human–wildlife conflict zones. Landscape connectivity and resource buffering are important in conservation planning, agreeing with the significant relationship between increased use of edge habitat and scarcity periods. If left unchecked, the conflictary risks and long-term viability of the population may continue to increase with continued fragmentation of habitats and seasonal limitation of prey. More work is needed to understand how to combine high-resolution bio-logging data with remote sensing-based prey distribution models to better predict how movements will respond to climate change. More long-term, multi-seasonal studies are also required to determine if these behavioral changes represent adaptation or ecological constraints over long-term. In addition, it will be important to integrate human behavioural information into carnivore movement models for modelling coexistence in rapidly evolving landscapes.

References

- [1] Arvinth, N. "Wildlife Conservation in Anthropogenically Altered Landscapes: Challenges, Strategies, and Adaptive Pathways." *Journal of Animal Habitat and Environmental Interactions* (2025): 7-12.
- [2] Bagheriyan, Esmail, Azadeh Karimi, and Hossein Yazdandad. "Assessing spatio-temporal patterns of human-wildlife conflicts in a human-dominated landscape: a case study from Iran." *Biodiversity and Conservation* 32, no. 13 (2023): 4239-4257. <https://doi.org/10.1007/s10531-023-02685-w>
- [3] Barceló, Gonzalo, Emiliano Donadio, Mathew W. Alldredge, and Jonathan N. Pauli. "Human disturbance alters the foraging and spatiotemporal activity of a large carnivore." *Oecologia* 207, no. 7 (2025): 112. <https://doi.org/10.1007/s00442-025-05752-x>
- [4] Barker, Kristin J., Eric Cole, Alyson Courtemanch, Sarah Dewey, David Gustine, Kenneth Mills, John Stephenson, Benjamin Wise, and Arthur D. Middleton. "Large carnivores avoid humans while prioritizing prey acquisition in anthropogenic areas." *Journal of Animal Ecology* 92, no. 4 (2023): 889-900. <https://doi.org/10.1111/1365-2656.13900>
- [5] Boer-Cueva, Martín, Giulia Bombieri, Emma Centomo, Piergiovanni Partel, Enrico Dorigatti, Enrico Ferraro, Ilaria Greco, Francesco Rovero, and Marco Salvatori. "Hunting and Outdoor

- Recreation Affect Large Herbivore Activity Patterns More Than Natural Predators in a Human-Dominated Landscape." *Ecology and Evolution* 16, no. 2 (2026): e73033.
<https://doi.org/10.1002/ece3.73033>
- [6] Chen, Yanzhi, Beibei Liu, Deqing Fan, and Sheng Li. "Temporal response of mesocarnivores to human activity and infrastructure in Taihang Mountains, Central North China: shifts in activity patterns and their overlap." *Animals* 13, no. 4 (2023): 688.
<https://doi.org/10.3390/ani13040688>
- [7] Ellington, E. Hance, Erich M. Muntz, and Stanley D. Gehrt. "Seasonal and daily shifts in behavior and resource selection: how a carnivore navigates costly landscapes." *Oecologia* 194, no. 1 (2020): 87-100. <https://doi.org/10.1007/s00442-020-04754-1>
- [8] Evans, Michael J., Jason E. Hawley, Paul W. Rego, and Tracy AG Rittenhouse. "Hourly movement decisions indicate how a large carnivore inhabits developed landscapes." *Oecologia* 190, no. 1 (2019): 11-23. <https://doi.org/10.1007/s00442-018-4307-z>
- [9] Fehlmann, Gaele, M. Justin O'riain, Ines Fürtbauer, and Andrew J. King. "Behavioral causes, ecological consequences, and management challenges associated with wildlife foraging in human-modified landscapes." *BioScience* 71, no. 1 (2021): 40-54.
<https://doi.org/10.1093/biosci/biaa129>
- [10] Kiran, N. Chitra, Vinay Kumar Sadolalu Boregowda, Jayvadan Vaishnav, Swati Singh, Manpreet Singh, and Kanika Seth. "Enhancing Wildlife Conservation through Sensor and Deep Learning Integration for Accurate Animal Behavior Tracking." *Journal of Wireless Mobile Networks, Ubiquitous Computing, and Dependable Applications* 16, no. 3: 261-280.
<https://doi.org/10.58346/JOWUA.2025.I3.015>
- [11] Li, Zhilin, Hongfang Wang, Jianping Ge, and Tianming Wang. "Spatiotemporal patterns of small carnivores in a human-dominated forest landscape shared with apex predators." *Landscape Ecology* 39, no. 12 (2024): 214.
<https://doi.org/10.1007/s10980-024-02020-w>
- [12] Manlick, Philip J., and Jonathan N. Pauli. "Human disturbance increases trophic niche overlap in terrestrial carnivore communities." *Proceedings of the National Academy of Sciences* 117, no. 43 (2020): 26842-26848.
<https://doi.org/10.1073/pnas.2012774117>
- [13] Milanesi, Pietro, Felice Puopolo, and Florian Zellweger. "Landscape features, human disturbance or prey availability? What shapes the distribution of large carnivores in Europe?." *Land* 11, no. 10 (2022): 1807.
<https://doi.org/10.3390/land11101807>

- [14] Milanesi, Pietro, Frank Thomas Breiner, Felice Puopolo, and Rolf Holderegger. "European human-dominated landscapes provide ample space for the recolonization of large carnivore populations under future land change scenarios." *Ecography* 40, no. 12 (2017): 1359-1368.
<https://doi.org/10.1111/ecog.02223>
- [15] Mills, Kirby L., Jerrold L. Belant, Maya Beukes, Egil Drøge, Kristoffer T. Everatt, Robert Fyumagwa, David S. Green et al. "Tradeoffs between resources and risks shape the responses of a large carnivore to human disturbance." *Communications biology* 6, no. 1 (2023): 986.
<https://doi.org/10.1038/s42003-023-05321-z>
- [16] Naha, Dipanjan, Suraj Kumar Dash, Caitlin Kupferman, James C. Beasley, and Sambandam Sathyakumar. "Movement behavior of a solitary large carnivore within a hotspot of human-wildlife conflicts in India." *Scientific Reports* 11, no. 1 (2021): 3862.
<https://doi.org/10.1038/s41598-021-83262-5>
- [17] Patil, P. J. "An Ecological Analysis of Forest Accounting." *International Academic Journal of Innovative Research* 5, no. 1(2018): 109–127.
<https://doi.org/10.9756/IAJIR/V5I1/1810010>
- [18] Rio-Maior, Helena, Mônia Nakamura, Francisco Álvares, and Pedro Beja. "Planning human-dominated landscapes for wolf conservation: the role of resting habitats." *Landscape Ecology* 40, no. 8 (2025): 178.
<https://doi.org/10.1007/s10980-025-02199-6>
- [19] Van Cleave, Eric K., Laura R. Bidner, Adam T. Ford, Damien Caillaud, Chris C. Wilmers, and Lynne A. Isbell. "Diel patterns of movement activity and habitat use by leopards (*Panthera pardus pardus*) living in a human-dominated landscape in central Kenya." *Biological Conservation* 226 (2018): 224-237.
<https://doi.org/10.1016/j.biocon.2018.08.003>
- [20] Xia, Chunlei, Longwen Fu, Zuoyi Liu, Hui Liu, Lingxin Chen, and Yuedan Liu. "Aquatic toxic analysis by monitoring fish behavior using computer vision: A recent progress." *Journal of toxicology* 2018, no. 1 (2018): 2591924.
<https://doi.org/10.1155/2018/2591924>