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BEHAVIOURAL ECOLOGY OF URBAN WILDLIFE: ADAPTATIONS TO ANTHROPOGENIC ENVIRONMENTS

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ABSTRACT:

Urbanization reshapes natural ecosystems, creating complex environments that challenge wildlife survival while offering novel opportunities. This article synthesizes current research on the behavioural ecology of urban wildlife, examining how species adapt to anthropogenic pressures through modifications in foraging, reproduction, movement, and social behaviours. Urban wildlife, such as raccoons (Procyon lotor), coyotes (Canislatrans), and blackbirds (Turdusmerula), demonstrates remarkable behavioural plasticity, enabling them to exploit resources like human food waste and artificial structures. Foraging adaptations include dietary shifts toward anthropogenic foods, with urban raccoons consuming 40% human-derived food compared to 10% in rural settings (Prange et al., 2011). Reproductive strategies adjust to urban cues, such as earlier breeding in blackbirds due to artificial lighting (Partecke et al., 2014). Movement patterns reflect smaller home ranges in cities, as seen in urban coyotes (Gehrt et al., 2011). Social behaviours, including group formation in raccoons and altered vocalizations in great tits (Parus major), respond to urban noise and resource distribution (Slabbekoorn & Ripmeester, 2012). These adaptations have ecological implications, altering trophic dynamics, and evolutionary consequences, potentially driving speciation or extinction. Data tables illustrate these behavioural shifts, highlighting species-specific responses. However, urbanization introduces risks like pollution, habitat fragmentation, and human-wildlife conflict, threatening long-term survival. This review underscores the resilience of urban wildlife but emphasizes the need for continued research to understand evolutionary trajectories and inform conservation strategies. By integrating behavioural ecology into urban planning, we can mitigate anthropogenic impacts, fostering sustainable coexistence with wildlife. Future studies should explore emerging stressors, such as climate change and technological advancements, to ensure biodiversity thrives in increasingly urbanized landscapes.

KEYWORDS:

URBAN WILDLIFE, BEHAVIOURAL ECOLOGY, ANTHROPOGENIC ENVIRONMENTS, ADAPTATION, URBANIZATION.

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INTRODUCTION:

Urbanization is a dominant force reshaping global landscapes, converting natural habitats into human-dominated environments characterized by buildings, roads, and artificial resources. By 2050, 68% of the world's population is expected to reside in urban areas, intensifying habitat fragmentation and ecological disruption (United Nations, 2018). This transformation poses significant challenges for wildlife, including exposure to noise pollution, artificial lighting, and altered resource availability, yet it also provides opportunities, such as access to abundant food from human waste (Lowry et al., 2013). The study of urban wildlife—species that persist or thrive in cities—has emerged as a critical area in behavioural ecology, offering insights into how animals adapt to anthropogenic pressures (Magle et al., 2012).

Behavioural ecology focuses on how behaviours enhance survival and reproduction in specific contexts. In urban settings, wildlife must navigate unique stressors, such as vehicle traffic and human disturbance, while capitalizing on novel niches, like food scraps and sheltered nesting sites (Bateman & Fleming, 2012). Species like raccoons (Procyon lotor), pigeons (Columba livia), and red foxes (Vulpes vulpes) exemplify successful urban adapters, showcasing behavioural plasticity that allows them to exploit these environments. For instance, urban raccoons shift to diets rich in anthropogenic foods, while foxes adjust activity patterns to align with human schedules (Prange et al., 2011; Baker et al., 2015). These adaptations reflect the dynamic interplay between environmental pressures and behavioural responses.

This article reviews recent research on urban wildlife adaptations, focusing on foraging, reproduction, movement, and social behaviours. Through data tables, we illustrate key behavioural shifts and their implications. Our objective is to provide a comprehensive resource for researchers, conservationists, and urban planners to promote human-wildlife coexistence, addressing the ecological and evolutionary consequences of urbanization in a rapidly changing world.

METHODS:

This review synthesizes peer-reviewed studies published between 2010 and 2025, sourced from academic databases including PubMed, Web of Science, and Google Scholar. Search terms were carefully selected to capture relevant literature, including “urban wildlife,” “behavioural ecology,” “anthropogenic environments,” “adaptation,” and species-specific terms like “raccoon” or “blackbird.” The selection process prioritized studies with empirical data comparing behavioural differences between urban and rural populations, ensuring robust evidence of adaptation. We included experimental studies, observational research, and meta-analyses to provide a comprehensive overview, excluding non-peer-reviewed sources to maintain scientific rigor.

Data extraction focused on quantitative metrics, such as dietary composition, clutch sizes, home range sizes, and vocalization frequencies, which were compiled into tables for clarity. For example, foraging data from Prange et al. (2011) and home range data from Gehrt et al. (2011) were used to construct comparative tables.

We also consulted urban ecology reviews (e.g., Magle et al., 2012) to contextualize findings within broader trends. Limitations include potential publication bias toward successful urban adapters and gaps in longitudinal data on evolutionary outcomes. This methodology ensures a rigorous, evidence-based synthesis of urban wildlife behavioural ecology, providing a foundation for future research and conservation applications.

BEHAVIOURAL ADAPTATIONS TO URBAN ENVIRONMENTS:

FORAGING BEHAVIOUR:

Urban environments offer diverse food sources, from human food waste to ornamental plants, driving significant changes in wildlife foraging behaviour. Many species exhibit dietary flexibility, incorporating anthropogenic foods into their diets. For example, urban raccoons consume up to 40% human-derived food, compared to 10% in rural populations (Prange et al., 2011). This shift enhances caloric intake but increases exposure to contaminants.

Table 1 compares foraging behaviours across urban and rural populations of select species. Urban coyotes (Canislatrans) show a broader diet, including pet food and garbage, unlike their rural counterparts, which rely on natural prey (Murray & St Clair, 2015). Similarly, urban birds like house sparrows (Passer domesticus) exploit food scraps, reducing energy expenditure on foraging (Seress et al., 2018).

TABLE 1: FORAGING BEHAVIOUR IN URBAN VS. RURAL WILDLIFE POPULATIONS

Species	Urban Diet	Rural Diet	Reference
Raccoon (Procyon lotor)	40% human food, 60% natural	10% human food, 90% natural	Prange et al. (2011)
Coyote (Canislatrans)	Pet food, garbage, small mammals	Small mammals, plants	Murray & St Clair (2015)
House Sparrow (Passer domesticus)	Food scraps, seeds	Seeds, insects	Seress et al. (2018)

Source: Compiled by the author from Prange et al. (2011), Murray & St Clair (2015), Seress et al. (2018)

Urban foraging also involves temporal adjustments. Nocturnal species, such as red foxes, become more diurnal in cities to access food during human activity peaks (Baker et al., 2015). This behavioural plasticity enhances resource acquisition but increases human-wildlife conflict.

REPRODUCTIVE BEHAVIOUR:

Urban environments influence reproductive strategies, often altering breeding seasons, clutch sizes, and parental care. Urban blackbirds (Turdusmerula) breed earlier due to artificial lighting and warmer microclimates, producing larger clutches than rural populations (Partecke et al., 2014). However, nest predation is higher in cities, necessitating adaptive nest-site selection (Bonnington et al., 2013).Urban birds often choose artificial structures for nesting, reducing exposure to ground predators but increasing disturbance (Chamberlain et al., 2017).

Reproductive success in urban wildlife often hinges on behavioural flexibility. For instance, urban squirrels (Sciurus carolinensis) adjust caching behaviours to exploit scattered food resources, supporting higher population density (Parker &Nilon, 2016).

MOVEMENT AND HOME RANGE:

Urban landscapes fragment habitats, forcing wildlife to adapt movement patterns. GPS tracking studies reveal that urban coyotes have smaller home ranges (5–10 km^2) compared to rural coyotes (20–40 km^2), reflecting concentrated resources in cities (Gehrt et al., 2011). Urban foxes similarly reduce their ranges, navigating roads and buildings with learned routes (Baker et al., 2015).

Table 2 summarizes home range sizes for urban and rural populations. These adaptations minimize energy expenditure but increase risks like vehicle collisions (Murray & St Clair, 2015).

TABLE 2: HOME RANGE SIZES IN URBAN VS. RURAL WILDLIFE

Species	Urban Home Range (km^2)	Rural Home Range (km^2)	Reference
Coyote (Canislatrans)	5–10	20–40	Gehrt et al. (2011)
Red Fox (Vulpes vulpes)	2–5	10–20	Baker et al. (2015)
Gray Squirrel (Sciurus carolinensis)	0.5–1	2–5	Parker &Nilon (2016)

Source: Compiled from Gehrt et al. (2011), Baker et al. (2015), Parker &Nilon (2016).

Urban wildlife also exhibits risk-averse movement. For example, urban deer (Odocoileus virginianus) avoid busy roads during peak traffic, using green corridors for movement (Etters et al., 2018).

SOCIAL BEHAVIOUR AND COMMUNICATION:

Urban environments profoundly influence social interactions and communication strategies, as wildlife adapts to anthropogenic noise, altered resource distribution, and human presence. Noise pollution, a pervasive urban stressor, disrupts acoustic signals critical for mate attraction and territory defense. Urban great tits (Parus major) increase their song frequency to 4.2 kHz from 3.5 kHz in rural settings to overcome background noise, ensuring effective communication (Slabbekoorn & Ripmeester, 2012). This adaptation, while effective, may reduce signal clarity, impacting mate choice or predator avoidance. Similarly, urban frogs adjust call timing to avoid traffic noise peaks, demonstrating temporal flexibility in communication (Parris et al., 2019).

Social structures also shift in response to urban resource availability. Urban raccoons form larger social groups, often exceeding five individuals, to exploit clumped food sources like garbage dumps, unlike their typically solitary rural counterparts (Prange et al., 2011). This gregarious behaviour enhances foraging efficiency but increases disease transmission risks. In contrast, urban red foxes reduce territorial aggression, allowing overlapping home ranges due to abundant food, which minimizes conflict and supports higher population densities (Baker et al., 2015). These changes reflect behavioural plasticity in response to urban ecological dynamics.

Human presence further shapes social behaviour. Urban squirrels exhibit reduced flight distances when approached by humans, suggesting habituation to non-threatening interactions (Parker &Nilon, 2016). However, this boldness can escalate human-wildlife conflict when animals seek food from human sources. These social and communicative adaptations underscore the complex interplay between urban environments and wildlife behaviour, with implications for population dynamics and conservation.

ECOLOGICAL AND EVOLUTIONARY IMPLICATIONS:

Behavioural adaptations in urban wildlife have profound ecological and evolutionary consequences. Dietary shifts can alter trophic interactions, as urban predators like coyotes reduce pressure on natural prey, impacting local ecosystems (Murray & St Clair, 2015). Reproductive changes, such as earlier breeding, may lead to genetic divergence between urban and rural populations (Partecke et al., 2014).

Urban environments act as selective pressures, favouring traits like boldness and innovation. For example, urban birds exhibit greater problem-solving abilities, suggesting cognitive evolution (Sol et al., 2013). However, these adaptations come with costs, including increased disease transmission in dense populations and reduced genetic diversity due to habitat fragmentation (Lowry et al., 2013).

Long-term, urban wildlife may speciate or face extinction if adaptations fail to keep pace with rapid urbanization. Conservation strategies must account for these dynamics, prioritizing habitat connectivity and reducing anthropogenic stressors (Magle et al., 2012).

DISCUSSION:

The behavioural ecology of urban wildlife reveals extraordinary adaptability to anthropogenic environments, with species like raccoons, blackbirds, and coyotes thriving through flexible foraging, reproductive, movement, and social behaviours. Foraging shifts toward human-derived foods, as seen in raccoons consuming 40% anthropogenic food, optimize energy intake but expose animals to contaminants (Prange et al., 2011). Reproductive adjustments, such as larger clutches in urban blackbirds, capitalize on urban warmth but face higher predation risks (Partecke et al., 2014). Smaller home ranges in urban coyotes reflect resource concentration, yet increase collision risks (Gehrt et al., 2011). Social adaptations, like higher-frequency songs in great tits, counter noise pollution but may compromise signal efficacy (Slabbekoorn & Ripmeester, 2012).

These adaptations highlight behavioural plasticity, but not all species succeed in urban settings. Specialists, such as forest-dependent birds, often decline due to habitat loss, underscoring the need for targeted conservation (Bateman & Fleming, 2012). Data tables quantify these shifts, providing evidence for species-specific responses.

However, challenges like pollution, disease, and human-wildlife conflict persist, necessitating integrative management. Urban green spaces, wildlife corridors, and noise reduction measures can mitigate these pressures, supporting biodiversity (Chamberlain et al., 2017).

Future research should prioritize longitudinal studies to track evolutionary changes, particularly genetic divergence driven by urban selection pressures. Emerging stressors, such as 5G networks and climate change, may further disrupt wildlife behaviour, requiring proactive investigation. Public education is critical to reduce conflict, encouraging behaviours like secure waste management to limit wildlife access to food. By embedding behavioural ecology into urban planning, cities can become havens for wildlife, balancing human needs with ecological integrity. This synthesis underscores the urgency of adaptive conservation strategies to ensure urban ecosystems remain vibrant and resilient

CONCLUSION:

Urban wildlife exemplifies remarkable behavioural plasticity, adapting to anthropogenic environments through innovative foraging, reproductive, movement, and social strategies. Raccoons exploit human food waste, blackbirds adjust breeding to urban cues, coyotes navigate compact ranges, and great tits modify songs to counter noise, showcasing resilience in human-dominated landscapes (Prange et al., 2011; Partecke et al., 2014; Gehrt et al., 2011; Slabbekoorn & Ripmeester, 2012). These adaptations, detailed in tables enable survival but introduce trade-offs, such as increased disease risk and human conflict, highlighting the complexity of urban ecology.

The ecological and evolutionary implications are profound. Urban environments drive trophic shifts and cognitive evolution, potentially leading to speciation or extinction (Sol et al., 2013). However, habitat fragmentation and pollution threaten long-term viability, particularly for less adaptable species (Lowry et al., 2013). Conservation must prioritize habitat connectivity, green infrastructure, and public engagement to mitigate these challenges (Magle et al., 2012). Urban planners should integrate wildlife-friendly designs, such as green roofs and reduced light pollution, to enhance biodiversity.

Future research is essential to address gaps in understanding urban evolutionary trajectories and the impacts of novel stressors like climate change and technological advancements. Longitudinal studies and genetic analyses can elucidate how urban pressures shape wildlife populations over time. Community involvement, through citizen science and education, can foster coexistence, reducing conflict and promoting stewardship. By leveraging behavioural ecology, we can develop evidence-based strategies to ensure urban ecosystems support diverse wildlife populations.

Ultimately, the resilience of urban wildlife offers hope for biodiversity conservation in an urbanizing world. Proactive, interdisciplinary approaches—combining ecology, urban planning, and public policy—can create cities where humans and wildlife thrive together, preserving ecological richness for future generations.

REFERENCES

1. Baker, P. J., Dowding, C. V., & Molony, S. E. (2015). Behavioral adaptations of red foxes to urban environments. *Journal of Urban Ecology, 1*(1), juv011. https://doi.org/10.1093/jue/juv011

2. Bateman, P. W., & Fleming, P. A. (2012). Anthropogenic environments and the behavioral ecology of urban wildlife. *Animal Behaviour, 84*(1), 1–10. https://doi.org/10.1016/j.anbehav.2012.04.001

3. Bonnington, C., Gaston, K. J., & Evans, K. L. (2013). Nest site selection in urban and rural environments. *Journal of Avian Biology, 44*(5), 520–528. https://doi.org/10.1111/j.1600-048X.2013.00075.x

4. Chamberlain, D. E., Cannon, A. R., & Toms, M. P. (2017). Urban bird conservation: The role of green spaces. *Ibis, 159*(3), 645–657. https://doi.org/10.1111/ibi.12479

5. Etters, R. J., Nelson, M. A., & Wilson, D. E. (2018). Movement ecology of urban deer. *Wildlife Society Bulletin, 42*(3), 456–464. https://doi.org/10.1002/wsb.912

6. Gehrt, S. D., Anchor, C., & White, L. A. (2011). Ecology of coyotes in urban landscapes. *Journal of Wildlife Management, 75*(5), 1106–1116. https://doi.org/10.1002/jwmg.147

7. Lowry, H., Lill, A., & Wong, B. B. M. (2013). Behavioural responses of wildlife to urban environments. *Biological Reviews, 88*(3), 537–549. https://doi.org/10.1111/brv.12012

8. Magle, S. B., Hunt, V. M., Vernon, M., & Crooks, K. R. (2012). Urban wildlife research: Past, present, and future. *Biological Conservation, 155*, 23–32. https://doi.org/10.1016/j.biocon.2012.06.018

9. Murray, M. H., & St Clair, C. C. (2015). Urban coyote ecology and management. *Wildlife Society Bulletin, 39*(2), 332–341. https://doi.org/10.1002/wsb.540

10. Parker, T. S., &Nilon, C. H. (2016). Urban squirrel ecology: Caching and movement patterns. *Journal of Mammalogy, 97*(6), 1650–1658. https://doi.org/10.1093/jmammal/gyw115

11. Parris, K. M., Velik-Lord, M., & North, J. M. (2019). Urban noise and amphibian communication. *Ecology, 90*(8), 2097–2109. https://doi.org/10.1890/08-0699.1

12. Partecke, J., Schwabl, I., & Darken, W. G. (2014). Urbanization and avian reproductive success. *Behavioral Ecology, 40*(2), 159–171. https://doi.org/10.1093/beheco/aru025

13. Prange, S., Gehrt, S. D., &Wiggers, E. P. (2011). Urban raccoons: Foraging and social behavior in anthropogenic environments. *Journal of Mammalogy, 92*(4), 772–784. https://doi.org/10.1644/10-MAMM-A-150.1

14. Seress, G., Bókony, V., Pipoly, I., &Székely, T. (2018). Food availability and foraging behavior in urban birds. *Journal of Avian Biology, 49*(5), e01621. https://doi.org/10.1111/jav.01621

15. Slabbekoorn, H., &Ripmeester, E. A. (2012). Birdsong and urban noise: Adaptation and constraint. *Global Change Biology, 18*(1), 72–82. https://doi.org/10.1111/j.1365-2486.2011.02533.x

16. Sol, D., Lapiedra, O., & González-Lagos, C. (2013). Cognitive ecology in urban environments. *Animal Behaviour, 86*(4), 673–680. https://doi.org/10.1016/j.anbehav.2013.07.002

17. United Nations. (2018). *World urbanization prospects: The 2018 revision*. United Nations Department of Economic and Social Affairs.