

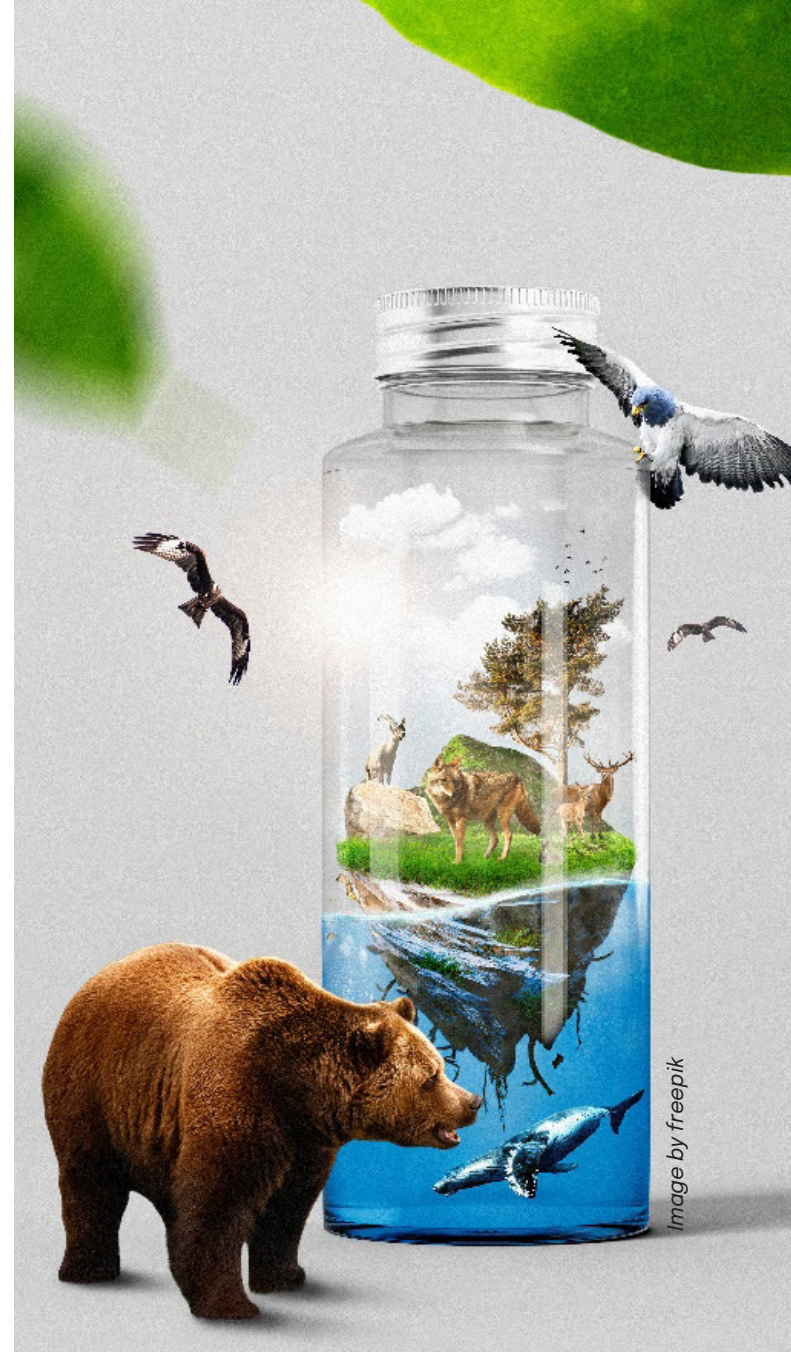
URBAN AREA DEVELOPMENT AND WILDLIFE CONSERVATION

Kannan Vaithianathan

URBAN areas are predicted to grow significantly in the foreseeable future because of increasing human population growth. Predicting the impact of urban development and expansion on wildlife populations is of considerable interest due to possible effects on biodiversity and human-wildlife conflict. With the growth and expansion of the human population and changes in sociological profiles, more natural and semi-natural habitats are being replaced to provide dwellings and associated infrastructure. Urban settlements, in particular, are expected to house increasing numbers of people at higher densities and straining limited resources. However, urban areas in developed countries typically contain remnant patches of semi-natural habitats and comprise substantial regions of private residential gardens and government lands, which provide habitats for a range of wildlife species. Such species' prevalence depends on their ability to survive and reproduce in extensively modified landscapes and is influenced by human tolerance and conflict patterns.

For example, urban wildlife can transmit diseases to humans and companion animals, damage structures, food supplies and ornamental vegetation, cause traffic accidents, attack companion animals and humans, and cause general nuisance by defecating, raiding rubbish bins and digging in lawns. The relative importance of these problems is likely to affect the willingness of householders to accept the proximity of a given species. For example, except for commensal rodents, urban wildlife in India poses few significant problems, and most urban residents highly value nature in their gardens through ornamental. Indeed, as urban areas expand in countries

The Indian government and many non-government organisations are increasingly emphasising the importance of urban wildlife to urban residents and the potential value of wildlife gardening.



like India, they will increasingly represent the day-to-day experiences of wildlife for the majority of the population and in line with this view, the Indian government and many non-government organisations are increasingly emphasising the importance of urban wildlife to urban residents and the potential value of wildlife gardening involving native species in attracting wild species into residential gardens.

There is substantial international variation in the definition of an urban area, arising principally from the density per sq km, given differences in the minimum number of inhabitants at a shared settlement land use and the thickness of houses/occupants. This article defines a metropolitan area as any area characterised by permanent structures like buildings and associated infrastructure, e.g. gardens, roads, waste ground, and parkland. This broad classification encompasses the full range of residential areas, from villages to cities.

Urban wildlife can be categorised as (i) commensal species, such as rats and mice, that actively benefit from a human-derived food supply and (ii) synanthropic species,

Urban wildlife conservation aims to create, conserve, and maintain places for species that people's use of the land would otherwise displace.

those that share and profit from the human ecotope but are not dependent on a human-derived food supply. Synanthropic species can be further divided into those that live and breed in conurbations (resident species) and those where individuals only temporarily move in from surrounding habitats, principally to forage on human food waste, but do not breed (vagrant species). The tendency for a species to form a breeding population in urban areas is heavily influenced by body size, with most weighing < 10 kg. This enables them to remain discreet and exploit small patches of natural or semi-natural habitats. These species also tend to be food and habitat generalists, controlling the wide range of foods in urban areas and travelling quickly through matrix habitats. Small resident synanthropic species include squirrels, insectivores and carnivores.

In developed countries, urban areas are highly fragmented, with roads separating blocks of industrial properties (shops, factories, leisure facilities, schools, offices) or residential buildings and associated gardens, but which also contain natural, semi-natural or open habitats (woodlands, scrub, sports fields, golf courses, parks, road verges, railway embankments, churchyards, cemeteries, waterways) and derelict areas that have previously been developed. Within a given urban area, the density of different habitat types and buildings varies spatially between, e.g. industrial, business and residential zones. However, there is also substantial variation in housing density.

Urban wildlife conservation aims to create, conserve, and maintain places for species that people's use of the land would otherwise displace. Here, we focus on preserving habitat for native urban avoiders — species that typically do not persist in urban and suburban environments — at the scale of cities and metropolitan areas. These species are usually associated with the vegetative communities present before the town's development. For some wildlife species, habitat conservation applied at the local or neighbourhood scale is sufficient. In the case of urban avoiders, where larger areas or the ability to move among areas of patchy habitat are required, planning and coordination are needed at the scale of landscapes covering entire cities or metropolitan areas.

Acting at a larger scale can also increase the effectiveness of backyard- and neighbourhood-scale activities by coordinating otherwise independent actions and creating ecological and social connections that can further improve conditions for wildlife. By determining in part *what* can be built *where* these planning tools profoundly shape urban landscapes for wildlife. Urban wildlife conservation will not happen unless wildlife professionals become familiar with these concepts and are involved in these processes.

Landscape ecology deals with heterogeneous and dynamic mixtures of different land cover types or ecosystems, focusing on their interactions. We can consider a landscape as the stage



Image by thongk8326

on which wildlife exists, comprising various habitat types. A *patch* is a relatively homogenous area that is different from its surroundings. Patches exist in a *matrix*, the area's dominant habitat type. A landscape may be called a mosaic if no dominant type exists. For example, forested patches can live in an urban matrix (predominantly urban with scattered forest areas) or forest-urban mosaic (forest and urban in approximately equal amounts). Long, linear *corridors* of similar habitat types can connect patches, such as a riparian forest bordering two larger patches of forest in an urban matrix.

Although the presence and abundance of wildlife species in patches of habitat are influenced by the structure, composition, and distribution of habitat elements within the patch (e.g. food, nest sites), the size and shape of the patch and the matrix in which it is embedded also are essential in determining the wildlife community within the patch. Patch size and the matrix surrounding a patch can interact as well. For example, increasingly larger forest patches are likely needed to conserve urban avoiders as the matrix becomes increasingly urban. The decline of urban avoiders in cities is caused by a series of associated mechanisms operating at various scales, which can be categorised broadly as degrading habitat conditions and disrupting connectivity. Direct loss or degradation of habitat during urbanisation can increase competition and depredation of urban avoiders by urban adapters or exploiters, and alteration of disturbance regimes can contribute to habitat degradation. Moreover, decreasing the permeability of the landscape for wildlife can disrupt connectivity among patches. If unchecked, the cumulative effect of these changes creates a landscape unsuitable for urban avoiders.

Worldwide, urbanisation has caused habitat changes, leading to biodiversity loss. As more land is developed, less remains in native vegetative communities, fundamentally altering available habitat. Large patches of remnant native vegetation can offer a mix of elements similar to the predevelopment habitat, provide interior conditions that may be different than conditions nearer to patch edges and buffer wildlife from potentially detrimental effects of areas adjacent to patches. The quality of urban habitat patches is also influenced by the amount of urban development surrounding the patch. For example, urban avoider bird species are more likely to

Direct loss or degradation of habitat during urbanisation can increase competition and depredation of urban avoiders by urban adapters or exploiters, and alteration of disturbance regimes can contribute to habitat degradation.

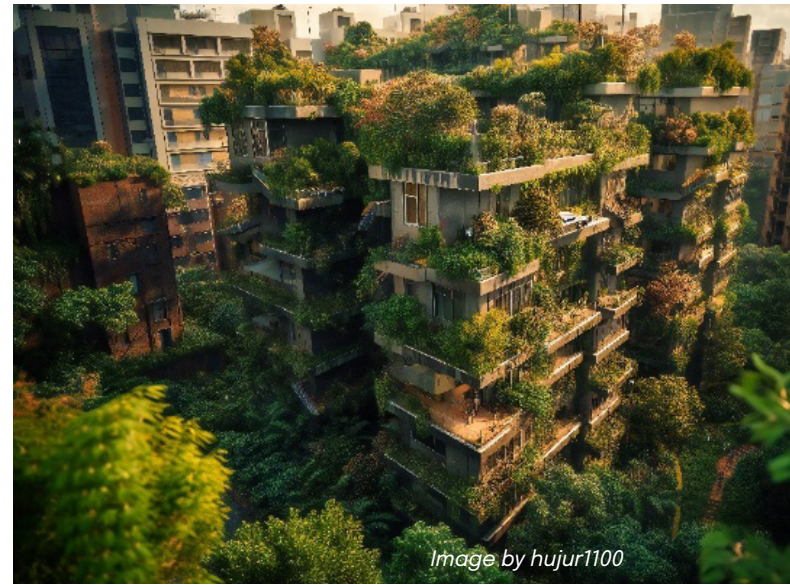
occur in larger patches further from high-density development and closer to other habitat patches or in landscapes with less urban cover. Similarly, the relative amount of forest and urban cover surrounding an urban wetland affects the likelihood of urban-avoiding amphibians in the swamp.

Habitat fragmentation from urbanisation and associated anthropogenic disturbance can affect the survival and reproduction of native wildlife in the urban setting. Urbanisation may increase the density of non-native predators and competitors. House cat (*Felis domesticus*) densities are greater near human development, and cats are significant predators of native wildlife. Similarly, densities of mesopredators may increase significantly in urbanised landscapes. These mesopredators commonly depredate urban avoiders or their young — particularly in small, narrow patches — and may contribute to the decline of these species in urban landscapes.

People also create new disturbances that can disrupt nutrient and water cycles in urban landscapes. For example, leaf litter is commonly removed in residential and commercial landscapes where some canopy trees remain. This interrupts the everyday cycling of nutrients from foliage back into the soil. In addition, removing litter eliminates microhabitats for many arthropods and the vertebrates that prey upon them (e.g. birds, shrews, small snakes).

The cumulative effect of these changes is a landscape in which urban avoiders face regional extinction because they can no longer survive in the remaining patches, move across the landscape to meet their needs, repopulate otherwise suitable patches, or reach patches to establish new territories. Species that are poor dispersers are especially susceptible as habitat patches shrink and the landscape becomes less porous. For example, pond-breeding amphibians tend to have high annual local extinction rates and depend on repopulation from nearby ponds. Most amphibian species are vulnerable to environmental changes that occur with urbanisation (e.g. loss of forest cover, road development) and disperse poorly through the urban matrix, commonly resulting in permanent, regional extinctions of these urban avoider species in many urban wetlands.

Wildlife conservation may be included under elements for conservation, habitat, natural resources, or open space. However, information on other features may have implications for conservation, particularly transportation (transportation corridors fragment habitat but also provide opportunities for connectivity, e.g. greenways), stormwater (streams and riparian areas are essential conservation corridors), recreation



(parks and greenways can be part of an open space network), and infrastructure (sanitary sewer lines often run along stream corridors).

Here, we consider how wildlife zoning may be integrated with the emerging framework of green infrastructure to address wildlife conservation in urban areas. Wildlife zoning organises landscapes in terms of use by wildlife rather than people. Because planners are already steeped in the nuances of zoning, using their language may improve chances for wildlife conservation — think “wildlife overlay zones”. In addition, terms like green infrastructure (network of green space conserving natural functions for the benefit of people in cities) can draw many ecologically friendly components, including wildlife conservation, into the machinery of urban infrastructure development, financing, and management. Although green infrastructure emphasises ecological function over recreational and other uses, open spaces in urban areas are often promoted as serving multiple benefits that may conflict with their function as wildlife habitat, including recreation, improving human health, and transportation. Despite these potential conflicts, the multiple-use aspects of green infrastructure are essential to building public support for investment in their acquisition and management.

Therefore, at a broad scale, the further loss and fragmentation of patches of natural and semi-natural habitats and the reduction in garden size likely to arise from future housing development would be predicted to negatively affect the use of gardens by virtually all mammal species in this country. However, we must exercise some caution in extrapolating these associations to effects on populations, as the pattern of use examined in this study may represent patterns of habitat selection rather than reflecting differences in distribution or abundance. Therefore, there is a need for further studies to explore the factors affecting the distribution of species within urban areas.

Dr Kannan Vaithianathan, Wildlife Researcher & Scientist, Gujarat Institute of Desert Ecology, Bhuj-Kachchh, Gujarat-370040. Email: kannan.vaithianathan@gmail.com