CHAPTER 8

Red-Shouldered Hawks: Adaptable Denizens of the Suburbs

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WITH ITS BEAUTIFUL BLACK-AND-WHITE WINGS and tail contrasting with a richly rusty body and its insistent "kee-kee-kee" calls, the red-shouldered hawk (*Buteo lineatus*) is a welcome neighbor for many suburban residents—a little bit of wilderness that inserts itself into everyday life. That it eats mainly rodents, snakes, and other species perceived as "pests" endears it to some suburbanites, while its young entertain others with their antics in the nest and their first, clumsy attempts at flight. But as with all complex relationships, the association between humans and red-shouldered hawks is not uniformly benign; hawks defending their nests may injure humans on the ground, and human activities, such as the use of rodenticides and continued development, may threaten red-shouldered hawk success in cities and suburbs.

In some ways, the red-shouldered hawk is an ideal candidate for inhabiting urban areas (a term we use broadly in this chapter to include the full gradient of urban to suburban environments). Successful urban species are often generalists with small area requirements,[1,2] and some behavioral flexibility.[2,3,4,5] The red-shouldered hawk is a medium-sized *Buteo* (with a mean wing chord of 282–345 mm and a mass of 486–774 g)[6] and is smaller than the red-tailed

hawk (*Buteo jamaicensis*) and Swainson's hawk (*Buteo swainsoni*), both of which inhabit urban areas in some situations. It is a dietary generalist, capturing and consuming a variety of prey, including rodents, reptiles, amphibians, birds, fish, and invertebrates.[6] Red-shoulders nest in many tree species[6] and have relatively small home ranges, from 100 to 200 ha in natural habitats.[7,8,10]

Conversely, some life history traits of red-shoulders might suggest that they would not thrive in urban areas. Published accounts, particularly from the eastern half of North America, document a strong affinity of red-shouldered hawks for bottomlands, wetlands, and riparian areas,[10,11,12,13,14,15,16,17] a habitat association that might be limiting in urban areas. Indeed, some earlier reports indicate that red-shouldered hawks often nest in remote locations, away from human residences and disturbances such as roads.[12,18,19]

However, evidence from the field clearly shows that red-shouldered hawks have found ways to inhabit suburban areas in many parts of their range (figures 8.1, 8.2). Suburban red-shoulders have been deliberately studied in three locations: southern California,[9,20,21] central California,[22] and southwestern Ohio (figure 8.3, color plate 3, color plate 4).[14,15,23,24,25,26] Red-shouldered hawk nests

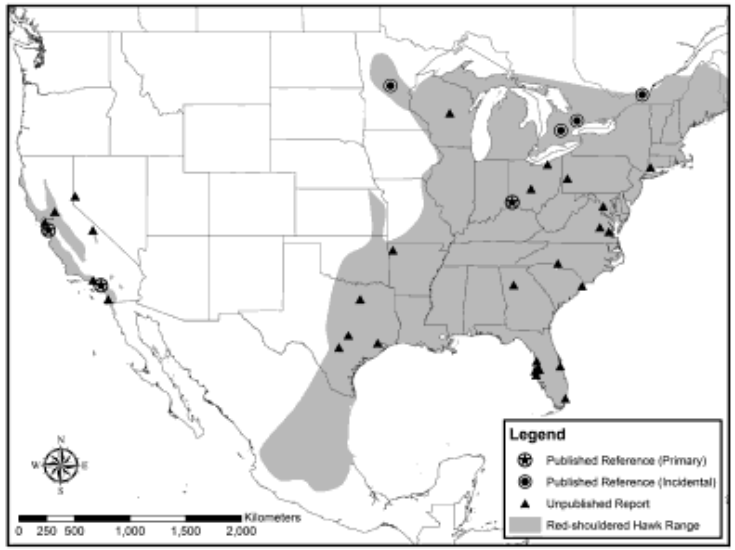

Figure 8.1. Locations of urban and suburban red-shouldered hawk populations.

Figure 8.2. Red-shouldered hawks in suburban areas around Cincinnati, Ohio, use residential areas for nesting and foraging. Photo by Sara Miller.

Figure 8.3. Colored plastic leg bands on suburban hawks provide opportunities for learning about survival and movements. Local residents often assist researchers by sending photographs of banded birds in their neighborhoods. Photo by Ruhikant Meetei.

near residences and other human activity also are mentioned in the context of other studies in primarily rural areas.[27,28,29,30] However, raptor researchers and other sources indicate that red-shouldered hawks are present in many urban areas, and the geographic spread of these anecdotal reports suggests that red-shoulders may use these areas in most parts of their range, given suitable habitat, particularly in the southeastern United States (figure 8.1).[31]

Long-term studies of urban red-shouldered hawks, conducted with different subspecies in different parts of the United States, offer the opportunity to investigate this species' urban adaptability. Here, we review the life history of red-shouldered hawks, focusing on two overarching questions:

1. What traits allow red-shouldered hawks to inhabit urban areas?
2. How do urban red-shouldered hawks differ from those in more natural sites?

Behavioral Ecology

Broadly defined, "behavior" covers most aspects of a bird's life, from selecting habitat to foraging, brooding and feeding its young, and defending its territory and nest. Our discussion of red-shouldered hawk behavior therefore addresses habitat selection, foraging ecology, and nest defense.

Selecting Habitat

Red-shouldered hawks' flexibility and ability to adapt to different landscapes, essentially variations on the structure of woodlands, have allowed them to inhabit urban environs. In eastern North America, red-shoulders use both bottomland hardwood riparian areas and wooded swamps and also upland mixed deciduous-coniferous or deciduous forests, and their habitats are often described as extensive stands of mature forest.[28,30,32,33,34] In south-central Florida, red-shouldered hawks inhabit areas that are primarily grasslands and wetlands with limited forest (approximately 6 percent).[35] In the suburbs of Cincinnati in southwestern Ohio, red-shouldered hawks nest in residential areas that are interspersed with small pockets of native oak-hickory (*Quercus* spp., *Carya* spp.) and beech-maple (*Fagus grandifolia*, *Acer saccharum*) forests, with riparian areas characterized by sycamore (*Platanus occidentalis*). Compared to nest sites in a nearby rural forested area (Hocking Hills region in southeastern Ohio), nest sites in suburban Cincinnati differed very little, except that the nest trees were

closer to houses (75 m on average) and were more likely to be surrounded by lawn (one-third of all nests).[14]

Hawks at both the suburban and rural sites chose mostly native nest trees that were taller and had larger diameters than what was randomly available in the area and were closer to water (33 m and 27 m, respectively) than randomly located trees.[14] Abundance of red-shouldered hawks in suburban and rural areas was positively correlated to the number of small ponds within the survey area,[15] suggesting an association with water also shown in studies of eastern red-shoulders in more natural areas.[18,32,36,37] Annual home ranges of suburban hawks consisted of 41 percent native forest and 50 percent suburban development, and breeding home ranges (90 ha) contained an average of 169 human residences.[23]

The western red-shouldered hawk (*B. lineatus elegans*), a bird of more arid habitats, lives in areas that are much less forested and have much less standing water than those used in eastern North America. This subspecies occupies riparian zones and oak woodlands but also residential areas in southern[20] and central California.[22] In southern California, areas used by urban red-shoulders included nonnative vegetation (particularly *Eucalyptus* spp., pine [*Pinus*] spp., and fan palms [*Washingtonia filifera*]), lawns, athletic fields, parking lots, buildings, and roads, and also a portion of natural habitat, where coast live oak (*Quercus agrifolia*), western sycamore (*Platanus racemosa*), and Goodding's black willow (*Salix gooddingii*) dominated.[20] Annual home ranges of these urban birds contained 54 percent urban woodland (mostly exotics) and another 20–25 percent buildings, roads, and water.[9,20] In the residential and industrial areas of the Santa Clara Valley in central California, red-shoulders nested in riparian zones dominated by Fremont cottonwood (*Populus fremontii*), western sycamore, and willows (*Salix* spp.) and also in the associated uplands, which contained sparse nonnative trees, including *Eucalyptus*, palms, and conifers.[22]

Nest tree species selected by urban red-shoulders vary by location (figure 8.4). In southern California, 38 percent of nest trees were nonnative species, primarily *Eucalyptus*, a tall species that provides a stable location for a nest.[20] Similarly, red-shoulders in central California built in nonnatives trees, primarily *Eucalyptus*.[22] Windbreaks of nonnative *Eucalyptus* that were planted in areas that previously lacked large trees expanded the available suitable breeding habitat for red-shoulders in California.[20,22] In contrast, suburban red-shouldered hawks in southwestern Ohio nested mainly in native species, including planted trees in yards. Rural-nesting red-shoulders in a comparison site nearby also used mainly native species, although a few nested in pines in a plantation in a national forest.[14] Two suburban pairs nested on the rooftops of residential

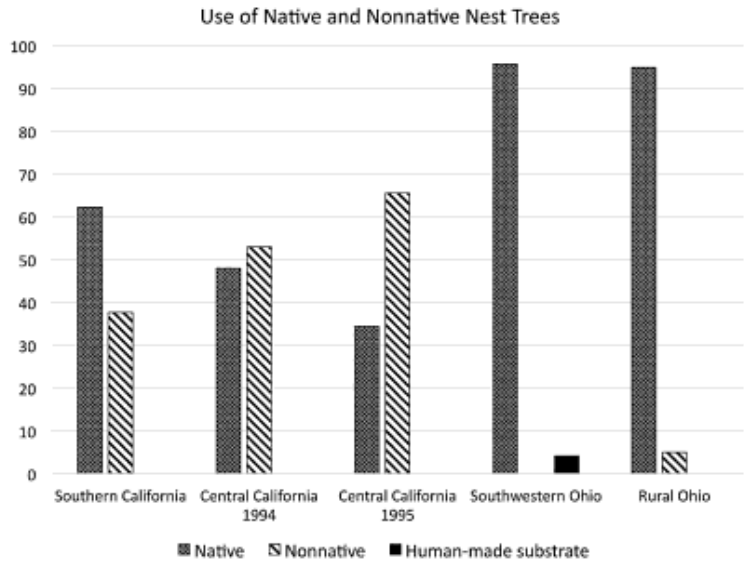

Figure 8.4. Use of native and nonnative nest trees (percent of total) by red-shouldered hawks in Ohio and California.

buildings (color plate 5) and one pair nested on a gas grill located on the deck of a home,[23,38] underscoring the adaptability of the species. Of hundreds of western territories, only one pair of the western subspecies also nested on an artificial structure, the lower crossmember of a high-tension power tower in Long Beach, California.

Home ranges of urban red-shoulders tend to be smaller than those of birds nesting in more natural areas, suggesting that urban areas provided abundant prey. Four urban birds in southern California had annual home ranges averaging 50 ha, compared to 113 ha for 12 birds in more natural habitat in the same region.[9] In suburban southwestern Ohio, annual home ranges averaged 165 ± 24 ha, and breeding birds occupied 90 ± 11 ha (n = 9 and 11, respectively),[23] which is considerably smaller than breeding home ranges measured for red-shoulders in more natural habitats of eastern North America.[7,8,10,23] Radio-tagged suburban birds used human-made structures within their home ranges, perching on utility poles, rooftops, and lawn furniture, and hunting at ornamental ponds and bird feeders.[20,23] Combined with the hawks' flexibility in using anthropogenic

landscapes and nonnative trees, small home ranges probably contribute substantively to the species' ability to inhabit and thrive in urban areas.

Foraging Behavior

Red-shouldered hawks have catholic tastes and eat a variety of taxa, including small mammals (mice, voles, shrews), amphibians (primarily frogs in most areas), and reptiles (especially snakes), as well as occasional birds, fish, and invertebrates (mostly crayfish and earthworms).[6] This generalist diet is likely an important determinant of their ability to use our urban landscapes. Populations in the northern part of the range eat more small mammals, whereas those in the southern part tend to feed on amphibians and reptiles,[6,39] and local diets may shift from year to year, depending on availability.[40] Suburban red-shouldered hawks apparently capture typical prey for their latitude, although no direct comparisons of suburban and nearby rural populations have been undertaken. Diet of Cincinnati birds determined by direct observations included 32 percent small mammals, 23 percent reptiles, 19 percent invertebrates, 18 percent amphibians, 6.9 percent birds, and 2.5 percent fish.[25]

Anecdotal evidence indicates that urban red-shoulders scavenge human-provided food on occasion. Suburban birds have been observed eating waste food around buildings and athletic fields[20] and on an open compost pile, as well as cat food (tuna) placed by a building. They've also feasted on pizza, beans or chili, and koi from ornamental ponds. One indulgent landowner regularly provided raw chicken for "her" nesting pair, one of which was among the longest-lived, most productive females in the Cincinnati study. Another creative landowner regularly attached meat to a fishing line (without a hook), cast it into his yard, then reeled it in, with the resident red-shoulders following the treat almost to his feet before claiming it.

Nest Defense and Other Behaviors

One important criterion for the successful occupation of urban environments is the ability to adapt to the close proximity of humans,[1] which implies a certain amount of behavioral flexibility, as described in chapter 2.[3,4,5] Urban red-shouldered hawks behave rather differently than their rural counterparts. Individuals tolerate human disturbances around their nests, ranging from athletic competitions to walkers/runners and to homeowners mowing lawns. Researchers on foot often can approach suburban birds to within 25 m, close

enough to read color-bands using binoculars.[20] Incubating or brooding birds only rarely flushed from a suburban nest in response to a researcher walking up to the nest tree, whereas in the rural comparison area, approximately one-third of birds flushed silently and flew away from the observer.

As illustrated in a case study in chapter 17, urban red-shoulders occasionally become defensive of their nests, diving at or hitting residents on the ground or researchers climbing to nests. Such attacks can cause injuries but most often are simply startling, as when defensive hawks snatched and carried off a baseball cap and a child's sequined headband directly from their owners' heads. Defensive diving behavior is rare at rural nests; researchers climbing to suburban nests in Cincinnati were hit by hawks on 11 percent of 166 climbs but only approximately 2 percent of more than 200 climbs to rural nests. Most suburban residents near aggressive hawks tolerated them and coped by avoiding the nest area (figure 8.5), wearing a helmet or hard hat, or carrying an umbrella. In a few cases, where hawks repeatedly injured residents, particularly children or the elderly, we removed nests before egg laying, removed the young and fostered them in other nests (with appropriate permits), or captured and relocated the adults.[20]

Figure 8.5. Warning sign posted by apartment management near an aggressive red-shouldered hawk's nest in Cincinnati, Ohio. Photo by Melinda Simon.

Population Ecology

Reproduction

Urban red-shouldered hawks reproduce at rates similar to those of individuals nesting in more natural areas. In a large 19-year study, Cincinnati red-shoulders produced 1.55 ± 0.04 young per active nest (i.e., nest with eggs), compared to 1.54 ± 0.08 young per active nest in the nearby rural Hocking Hills study area; similarly, suburban birds also did not differ from rural ones in terms of the number of young produced per successful nest (i.e., nest where at least one young fledged; 2.59 ± 0.04 vs. 2.61 ± 0.06, respectively; average of annual means, 1997–2015).[6,14,24] Reproductive rates varied significantly among the suburban nesting territories, with the most productive 25 percent of the territories producing 44 percent of the nestlings and the least productive 25 percent producing only 7 percent of the young, suggesting some inherent variability in the habitat quality, likely attributable to prey abundance, predator density, or both.[24] When compared to the reproductive rates measured in natural areas across the red-shouldered hawk's range,[6] the reproductive rates of Ohio birds were representative. Comparisons among studies should be made with caution, however, as researchers measure and report productivity in slightly different ways, and environmental, habitat, and interannual variability also likely affect productivity.[35]

In southern California, urban red-shouldered hawks produced 1.80 young per nesting attempt or 2.50 young per successful nest.[20] This rate was greater than that measured by another researcher in the same area,[41] although methods were not entirely comparable.

In central California, reproduction of urban red-shouldered hawks averaged 1.6–1.8 young fledged per nest (not defined) and 2.0–2.3 young fledged per successful nest. Hawks nesting in exotic tree species raised significantly more young per nest than those using native species in the first year of the study but not in the second.[22]

Survival

Urban red-shouldered hawks fall victim to a variety of predators and to human-made hazards such as collisions with cars and electric lines, as discussed in chapters 4 and 14. Great horned owls (*Bubo virginianus*) are the most important predators in suburban southwestern Ohio, where they killed 14 of 28 nestlings

that died. Raccoons (*Procyon lotor*) killed some nestlings, and others simply fell from their nests.[42] Somewhat surprisingly, eastern gray squirrels (*Sciurus carolinensis*) contesting red-shoulders for possession of the nest were responsible for some nest failures. One squirrel attacked a brooding female, causing her to abruptly spring up and one nestling to be ejected from the nest.[42] Great horned owls also can kill incubating females.[42] In natural areas, great horned owls and raccoons also are blamed for predation of nestlings, but in most cases, predation events were not observed or filmed, and evidence was circumstantial.[43,44]

For some small raptors, the risk of predation is reduced in urban habitats compared to more natural habitats.[2] However, because the great horned owl is a generalist predator that is apparently thriving in some urban areas[2,45] and raccoon populations may actually increase in urban settings,[46] release from predation pressure seems unlikely, at least in suburban southwestern Ohio. Conversely, despite entry into several hundred great horned owl nests in coastal southern California, no evidence of predation by this species on red-shouldered hawks has been observed there.

It is not clear whether urban red-shouldered hawks suffer higher mortality than those inhabiting more natural areas. Limited evidence from banding data (recoveries) suggests survival is similar. In both suburban and rural areas of Ohio, the mean age at death was about 2 years old; 50 percent of hawks banded as nestlings were dead by age 1.1–1.2 years, and 95 percent by age 5 years old.[26]

The North American longevity record for a red-shouldered hawk is that of a female banded as a nestling, recaptured when 10 years of age, and resighted often. During her 26 years, she had at least two long-term mates and at least one extra-pair copulation.[47] She nested in coast live oak, black willow, western sycamore, and a California fan palm, all while thousands of United State Marines trained throughout her territory and under her nest trees.

Humans and human-made structures may be significant causes of mortality for urban raptors,[48] as shown in chapter 14. Analysis of banding recoveries for suburban red-shoulders indicated that, of the birds for whom cause of death was known, 38 percent were killed by collision with motor vehicles and 31 percent by electrocution on power lines or electric fences, although sample sizes were small ($n = 13$ with known cause of death).[26] Two hawks, a male and a female, were found electrocuted together beneath a utility pole, where they were probably copulating or at least touching each other; their electrocutions caused a local power outage. In southern California, the majority (64 percent) were killed by collision with motor vehicles, with one being poisoned and another oiled ($n = 11$ with known cause of death).

Dispersal

Raptors may become urban by at least two different paths: they may persist in a rural area that is overtaken by suburban sprawl, or they may colonize an urban area that has become suitable, particularly if new habitat is created there.[2,20] Further, the ability to colonize new areas may be influenced by the extent to which a species is able to disperse.[4]

Generally, red-shouldered hawks do not disperse very far. Mean distance of banded red-shouldered hawks from their natal nest when found was 39 km in southwestern Ohio[26] and 55 km in southern California. A few individuals in each area traveled more than 100 km. In southwestern Ohio, five red-shoulders were found 103–500 km from their nests, whereas in southern California, 10 were found 111–843 km from their nests (color plate 6).[21] The three southern California birds that traveled farthest (374, 804, and 843 km) were considered vagrants because they were found outside the known range of the species.[21] The ability to disperse relatively long distances in some cases and the potential for vagrancy may allow red-shouldered hawks to colonize new areas, including urban areas, and be successful there. This may be an especially important trait as natural habitat continues to be lost to urbanization or shifts due to a changing climate.

Conservation and Management

Behavioral flexibility and several life history traits have allowed red-shouldered hawks to inhabit urban areas in many parts of their distribution. Rangewide, their populations have tended to increase or remain stable over recent decades.[49,50] Yet due to the limited number of studies in urban areas and the diversity of habitats and cities in which red-shoulders live, their overall conservation status in cities remains unclear. Because of the broad latitudinal and longitudinal distribution of red-shouldered hawks, the cities within their range vary widely in native habitat type, prey abundance, predator density, and anthropogenic threats; thus, we expect that red-shoulder population trends in those cities may vary also.

In suburban southwestern Ohio, red-shouldered hawks are thriving. They are as successful as the nearby rural hawks, choosing equivalent nest trees, reproducing at the same rate, and finding typical prey species. Yet some territories have been lost to continued suburban sprawl: of a sample of 22 territories where red-shouldered hawk nestlings were banded in 1963–77, only 10 still contained hawks by 1997–98.[14] It is possible that these losses may be offset by ongoing adaptation by the hawks, possibly resulting in previously unsuitable sites becoming usable.

In southern California, the number of occupied red-shouldered hawk breeding territories, both rural and urban, has plummeted over the last decade. The severity of an extended drought may be playing a role, but evidence also suggests secondary poisoning by anticoagulants (rodent poison) and West Nile virus may have contributed to the decline.

Recommendations for conservation of red-shouldered hawks in urban areas differ little from general strategies for conserving wildlife in cities. We recommend preserving natural areas that produce prey and allow for nesting, including forests, old fields, and wild edges around streams, ponds, and other wetlands. Likewise, we recommend eliminating use of chemicals that reduce prey abundance or directly or indirectly threaten top-level predators. Importantly, as demonstrated in chapters 15 and 17, continuing education of residents will both help reduce human-hawk conflicts and facilitate an appreciation for wildlife in general.

Additional research is needed to better understand the ecology of urban red-shouldered hawks, particularly in little-studied portions of the species' range, such as southern Florida, the northern edge of the range, and newly colonized areas. Fortunately, compared to many raptors, urban red-shouldered hawks are conveniently easy to study due to their noisy courtship, visible nests, and relatively high densities. As a generalist species living in suburban regions across many areas of North America, the red-shouldered hawk is an excellent adaptable top predator model on which to study the effects of human-dominated environments. Finally, as an added bonus, this highly charismatic species provides numerous opportunities for researchers to interact with local residents and provide accurate information about the ecology of native wildlife, a key component in urban conservation efforts.

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