THE URBAN OPEN SPACE MANAGER

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Wetland Restoration

The Duwamish River estuary, in northwest Washington State, USA, has been extensively altered over the last 150 years with the development of the city of Seattle. Industrial and urban contaminants have been discharged into the estuary but since the 1950s, pollution discharges have been better addressed. The estuary remains classified as a federal "Superfund" site. By 1986, development reduced the original estuarine delta wetlands some 98%. From diversions, some 70% to 75% of the historic freshwater inflow has been lost.

Researcher Charles Simenstad of the University of Washington and four of his colleagues recently reported that 13 major restoration projects have been initiated in the estuary since 1988. A major goal of restoration is recovery of salmon populations and migration. Most habitat restoration efforts have dealt with creating or enhancing shallow-water habitat for juvenile Pacific salmon (*Oncorhynchus* spp.). Planting of riparian vegetation also has been done. Cost of such effort is high due largely to clean up of contaminated sediments, fill removal, and re-grading. Including land cost, restoration averages about $3 million/ha.

Vegetation characteristics at restoration sites are comparable to control sites, although heavy grazing pressure by resident Canada geese (*Branta canadensis*) has hampered vegetation establishment and development. Also, the prey base for juvenile salmon is different from control sites but the salmon apparently can switch to the different prey. The authors conclude it is: "our guardedly optimistic opinion that although rehabilitation must often be the acceptable substitute for restoration, there is much to gain by investing in restorative actions in urbanized estuaries."

Reference: Simenstad, C., C. Tanner, C. Crandell, J. White, and J. Cordell. 2005. Challenges of habitat restoration in a heavily urbanized estuary: evaluating the investment. *Journal of Coastal Research* 40:6-23.

Human Land Use and Chronic Wasting Disease

Is urban development associated with prevalence of Chronic Wasting Disease (CWD) in mule deer (*Odocoileus hemionus*)? This question was investigated recently by Matthew Farnsworth of Colorado State University and seven of his colleagues. These researchers studied the issue at three study sites in north-central Colorado, USA. Each site consisted of an "urban" zone, defined as at least one dwelling per 8 ha, surrounded by a larger "nonurban" zone. Presence or absence of CWD infection was determined 1997-2002 for deer in urban and nonurban areas of the study sites. Variables of interest were land use, sex, and study site.

Farnsworth and his colleagues reported that land use, sex, and site effects appeared to be important in predicting CWD prevalence. Deer in developed areas were almost twice as likely to test positive as deer in nonurban areas. Males were about 2.5 times as likely to test positive as females. And strong spatial heterogeneity was noted in prevalence across north-central Colorado. Factors responsible for these observations are not well understood and need further research. The authors concluded: "Based on our findings, it appears that mule deer wintering in developed locations need to be included in control efforts intended to reduce overall CWD prevalence in north-central Colorado. Modification of land use practices and other human activities that foster congregation or sedentary behavior in urban mule deer populations could have beneficial effects on reducing opportunities for CWD transmission...A better understanding of the specific features of urban landscapes that have the greatest potential influence on CWD transmission among mule deer should aid in further refining landscape-level control strategies."

Reference: Farnsworth, M. L., L. L. Wolfe, N. T. Hobbs, K. P. Burnham, E. S. Williams, D. M. Theobald, M. M. Conner, and M. W. Miller. 2005. Human land use influences chronic wasting disease prevalence in mule deer. *Ecological Applications* 15:119-126.

Comprehensive Planning for Beijing Province, China

A plan for future development of Beijing Province, China, was recently prepared by Feng Li, Rusong Wang, and Juergen Paulussen of the Chinese Academy of Sciences and Xusheng Liu of Beijing Forestry University for the Beijing Municipal Institute of City Planning and Design. The plan incorporated a conceptual ecological framework for greenspace at regional, city, and neighborhood levels of scale.

Beijing Province encompasses more than 16,000 km^2 in northern China and contains a human population of some 13.8 million. Most of the original natural vegetation has disappeared. During the past 10 years, urban development increased by 25% and agricultural land decreased by 32%, exceeding the 1992 urban master plan. Greenspace decreased and was not effectively protected.

The authors proposed an urban greenspace planning scheme based on landscape ecological principles and requirements. At the regional scale (Beijing Province), a large forested area (4,057 km^2) should be managed as a natural, self-sustaining ecosystem. The authors proposed two ecological buffer belts, one surrounding the city of Beijing and the other surrounding the city of Tianjin. Each buffer should be 5-10 km wide and consist of forest parks, nurseries, farmland, orchards, or similar land uses.

At the city scale, from suburbs to urban center, seven green wedges and eight green connecting corridors were proposed for the city of Beijing. These might consist of parks, gardens, forest patches, farmlands, rivers, or wetlands.

At the neighborhood scale in the city of Beijing, the authors proposed linking existing isolated residential greenspaces with public parks and other greenspaces. For example, riverside greenways might be used. Concreted banks should be removed and restored with vegetation. Street trees, emphasizing native species, could be better used. Public parks should strive to create natural forest structure. Finally, "vertical greening" could be more widely practiced. This might include wall, balcony, and windowsill greening as well as roof gardens. The authors point out that restraining development is difficult and financial resources are inadequate for creating and managing greenspace. Nonetheless, governmental authorities agreed that the strategy should be useful. Time will tell whether or not it is implemented.

Reference: Li, F., R. Wang, J. Paulussen, and X. Liu. 2005. Comprehensive concept planning of urban greening based on ecological principles: a case study in Beijing, China. *Landscape and Urban Planning* 72:325-336.

Open Space Conservation in Michigan

Many biologists, planners, and others note that clustering of residential houses on smaller lot sizes, with greater amounts of preserved open space, has many environmental benefits over traditional large lot development. The approach offers greater flexibility to the developer for preserving high-value features such as wetlands, forests, critical wildlife habitat, and cultural and historic sites, which can be built around rather than built over.

What do residents think about living in such areas? This question was of interest to Maureen Austin of Alaska Pacific University in Anchorage. She recently studied resident attitudes and perspectives in 13 open space communities in southeast Michigan. Her study area was in Hamburg Township where the planning commission adopted an open space ordinance in 1992. The ordinance provided an alternate to traditional large lot development by authorizing an open space-designed subdivision approach. As an incentive for developers to choose this optional approach, a density bonus is awarded whereby slightly more houses can be built on a site (compared to traditional lot development) but the amount of preserved open space also is greater. Residents are required to establish a homeowners' association and to manage the open space after it is transferred from the developer. Austin and her research team contacted 24 individuals, 15 of whom agreed to be interviewed. The interview followed a structured format with 13 open-ended questions.

A majority of residents interviewed (11 of 15) liked the "openness" of their neighborhood and eight liked the natural settings and access to nature from their homes. Availability of communal natural areas and recreational facilities were cited by eight individuals as benefits of living in an open space community. Nine residents liked the social or community aspects of living in an open space community. Families with small children liked having other families with small children nearby. Others felt the development offered a certain degree of cohesion of community-minded folks, somewhat like a small village. On the down side, five residents expressed frustration with the homeowners' association. Common complaints were that some people do not follow the rules

and some lack community commitment.

Residents had little understanding of the concept of using an open space conservation subdivision for land-habitat conservation as an alternative to traditional lot development. The author felt that planning officials and developers could do a better job of conveying this message to homebuyers. Better understanding by residents might result in more and stronger advocates for this type of land use planning technique. Austin concluded: "The open space conservation subdivision seems to provide the preservation of natural resources in the form of open space, while at the same time offering opportunities for residents to take a more active role in managing these resources. How this approach is applied, and how residents understand this approach, will have important ramifications for its future use, acceptance, and feasibility."

Reference: Austin, M. E. 2004. Resident perspectives of the open space conservation subdivision in Hamburg Township, Michigan. *Landscape and Urban Planning* 69:245-253.

Attitudes Toward Urban Wildlife in Norway

Researchers Tore Bjerke and Torbjørn Østdahl of the Norwegian Institute for Nature Research recently studied resident attitudes toward urban wildlife and animal-related activities of residents in the city of Trondheim, Norway. The human population of Trondheim at the time of the study was about 153,000.

The researchers sent a mail questionnaire to 1,500 adult residents living along a gradient from city center to the suburbs. The questionnaire was mailed in November 2001, with a follow up in January 2002. The response rate was 48%.

Human attitudes toward animals varied by species and groups of species. The most liked of 24 species or groups were small birds, squirrels, butterflies, and hedgehogs. Positive attitudes toward these exceeded positive attitudes toward cats and dogs. The most disliked animals were rats, mosquitoes, and mice. Women generally had higher scores than men for well-liked species and lower scores than men for less-liked species. A positive correlation was noted for most species and groups with level of education.

Forty-five percent of respondents reported some problems with animals. Cats and dogs were most frequently mentioned. Nineteen percent of respondents had cat/dog problems exclusively. Dog waste in the environment was of concern. For cats, a strong smell, feces, and night vocalizations were of concern. Also, some concern was expressed about cats killing birds and their potential for spreading disease. Eleven percent of respondents had problems with wild animals exclusively. Seagulls, badgers, crows, and magpies were most often mentioned.

Participation in wildlife activities focused mostly on bird watching around the home and watching nature programs on television. Forty-two percent of respondents reported that observing birds was important or very important when they walked or hiked outside. Bjerke and Østdahl concluded: "Urban residents in Trondheim, Norway, expressed considerable interest in urban wildlife, as shown by the extent to which they observed and fed wildlife, and by their affective ratings of animal groups or species. Relatively few residents reported problems with wildlife. It seems likely, then, that the existence of desirable animals positively contribute to people's well-being. Therefore, protection of these animals and their habitats should be attended to by urban planners and by urban environmental authorities. Simultaneously, the dislike expressed for animals of high ecological importance creates psychological barriers to efforts to protect their existence. More information about the ecological value of unpopular species should be considered."

Reference: Bjerke, T., and T. Østdahl. 2004. Animal-related attitudes and activities in an urban population. *Anthrozoös* 17:109-129.

Environmental Attitudes and Behaviors

Jaime Berenguer, José Corraliza, and Rocio Martin of the Free University of Madrid, Spain, recently studied the environmental attitudes and behaviors of urban and rural residents of that country. They surveyed 90 rural residents living in villages of less than 1,000 inhabitants in a mountainous region of central Spain and 95 urban residents from Madrid, a city of some 3 million people.

The investigators found a high level of concern for the environment in both groups. Urban residents tended to think that society is approaching the maximum number of people the earth can support. Rural residents tended to think that humans are here to dominate nature and that human ingenuity will avoid us making earth uninhabitable. Rural residents also

tended to think that the "ecological crisis" has been exaggerated and that earth has a sufficient quantity of natural resources if we know how to use them. Rural residents were more concerned than urban residents about shortage of water. Urban residents were more concerned about air pollution, exhaustion of natural resources, and climate change.

Eight specific environmental conservation behaviors were studied. No differences between urban and rural residents were noted for six. However, rural residents were significantly more likely than urban residents to switch off heating in unoccupied rooms and to save water. Other researchers have reported higher levels of pro-environmental behaviors in urban residents. Environmental beliefs and behaviors are, undoubtedly, shaped by many factors and more human dimensions research of this nature is warranted.

Reference: Berenguer, J., J. A. Corraliza, and R. Martin. 2005. Rural-urban differences in environmental concern, attitudes, and actions. *European Journal of Psychological Assessment* 21:128-138.

Lead Levels in House Sparrows

Richard Chandler, Allan Strong, and Carlin Kaufman of the University of Vermont recently studied lead levels in urban house sparrows (*Passer domesticus*) and potential threat of lead to sharp-shinned hawks (*Accipiter striatus*) and merlins (*Falco columbarius*), two predators of house sparrows. House sparrows were captured with mist nets at three locations in Vermont. Two urban sites were located in Burlington. One was in a high-density residential district, and the other one in a business district. The third site was a conventional dairy farm in a rural region about 55 km southeast of Burlington. Blood samples were taken from the birds and analyzed for lead content.

The abundance and annual population changes of sharp-shinned hawks, house sparrows, house finches (*Carpodacus mexicanus*), purple finches (*Carpodacus purpureus*), and black-capped chickadees (*Poecile atricapilla*) were determined using the National Audubon Society's Christmas Bird Count (CBC) data for 1970-2002. The researchers also were interested in merlin populations, but the species was too small to analyze using CBC data.

Wintering hawk populations showed significant increases at most sample sites 1970-2002. Hawk populations were positively related to mean abundance of house finches and house sparrows and to mean annual rate of change of house finches. No correlation was detected between hawks and purple finches or chickadees.

Lead levels in urban house sparrows were some 4.5 times higher than lead levels in the rural birds. Based on research of others, Chandler and his associates believed that the urban lead levels were probably not high enough to affect survival and reproductive rates of house sparrows negatively. They were unable to determine toxicity of lead to urban raptors. The authors concluded: "The degree to which the exposure to lead-laden House Sparrows threatens urban raptor populations is unclear, and we recommend a more detailed examination of the contaminant levels in urban-dwelling raptors."

Reference: Chandler, R. B., A. M. Strong, and C. C. Kaufman. 2004. Elevated lead levels in urban house sparrows: a threat to sharp-shinned hawks and merlins? *Journal of Raptor Research* 38:62-68.

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White-winged Doves in Waco, Texas

Historically, in the United States, white-winged doves (*Zenaida asiatica*) largely inhabited the lower Rio Grande Valley of Texas. Since the mid-1970s, however, the species has been expanding its range northward and large populations now reside in central Texas. Population numbers outside the lower Rio Grande Valley are increasing and are concentrated in urban areas, where birds tend to be year-round residents. Biologists are studying these populations in an effort to better understand this phenomenon.

Recently, Michael Small of Texas State University, San Marcos, Texas and three of his colleagues studied habitat use and productivity of white-winged doves in Waco, Texas. The birds were first recorded in the city in 1990 and breeding activity was first observed 3 years later. Currently, some 70,000 doves reside in Waco. Birds prefer older neighborhoods with mature ornamental trees—oaks (*Quercus* spp.) and pecan (*Carya illinoinensis*) tend to predominate.

Small and his colleagues live-trapped doves with standard walk-in wire funnel traps baited with a mixture of seeds. In June 2002, 39 birds were captured (16 males, 23 females) and fitted with surgically implanted subcutaneous transmitters designed to operate 50-80 days. In February and March 2003, another 40 birds (17 males, 17 females, 6 unknown sex) were captured and radio-marked. Birds were monitored 10 July to 4 September 2002 and 31 March to 18 June 2003 to document nesting biology.

Over the two nesting seasons, 35 nests were located in nine, mostly deciduous, tree species. Nests were predominantly located in pecan (48.5%) and sugarberry *Celtis laevigata* (17%) trees. Trees less than 3 m in height were rarely used for nesting. Nesting occurred before and after the typical season of May to mid-August and 23% of birds attempted more than one nest per season. For both years, nest success was 51.8%. Nest success reported by investigators for other Texas cities are 58% and 53% in Kingsville, and 39% to 73% in San Antonio. The range expansion, habitat use, and behavioral changes of white-winged doves continue to captivate biologists.

Reference: Small, M. F., C. L. Schaefer, J. T. Baccus, and J. A. Roberson. 2005. Breeding ecology of white-winged doves in a recently colonized urban environment. *Wilson Bulletin* 117:172-176.

Nest Predation and Exotic Shrubs

Nest predation is a powerful selective force confronting birds. Birds building nests that are better concealed from predators will be more successful. Conversely, birds building exposed nests will suffer increased predation and lower production. In nature, there is a constant battle between predator and prey to outwit the other.

There is some evidence that exotic shrubs (compared to native ones) negatively affect nest success of forest birds. Kathi Borgmann and Amanda Rodewald of the Ohio State University, Columbus recently studied the issue in riparian forests along the Scioto River in central Ohio. Each of their 12 study sites was a strip of mature forest habitat about 100-200 m wide and at least 250 m long. At least 2 km separated sites. The researchers focused on two land cover types, urban and rural, and three nest substrates, exotic honeysuckle (*Lonicera maackii, L. tatarica*), exotic multiflora rose (*Rosa multiflora*), and native species.

The investigators searched each site May-early August of 2001, 2002, and 2003 for northern cardinal (*Cardinalis cardinalis*) and American robin (*Turdus migratorius*) nests. Nests were monitored every 3-5 days and a successful nest was defined as one fledging at least one young.

Vegetation characteristics ("nest-patch" characteristics) were measured in 0.04-ha circular plots around nests. Measurements included the number and diameter of tree species, number of snags, amount of coarse woody debris, understory vegetation volume, and percent canopy cover. Also measured was distance of nest from the nearest forest edge. Nest placement characteristics included nest

height and nest substrate species, among other measurements.

To gain further insight into nest predation, Borgmann and Rodewald conducted an artificial nest experiment. They used old cardinal and robin nests and clay eggs formed to resemble cardinal eggs. Nests were placed in honeysuckle, rose, and native species along a transect 50 m from and running parallel to the river in a rural landscape. Nests were checked for depredation every 3 days for a 12-day period.

Daily mortality rates (DMR) of nests did not differ significantly based on land use or nest substrate alone. An interaction between land cover and nesting substrate emerged ($P = 0.052$), however, reflecting higher DMR in exotic shrubs in urban areas. Birds built nests in native species about 2.5 times higher from the ground than they did in rose and honeysuckle, and the authors speculated that ground-foraging mammals were likely to more easily find and depredate lower nests. The depredation rate was high on the artificial nests. After 12 days (average incubation period for northern cardinals) most nests had been depredated and no difference was detected among honeysuckle, rose, and native species. The authors concluded that cardinals and robins nesting in exotic shrubs were more vulnerable to predation in urban areas. They pointed out, however, that exotic shrubs also might provide positive effects, for example, food resources from fruit-producing plants. More research is needed to improve our understanding of this issue.

Reference: Borgmann, K. L., and A. D. Rodewald. 2004. Nest predation in an urbanizing landscape: the role of exotic shrubs. *Ecological Applications* 14:1757-1765.

Birds and Exurban Development in Colorado

Exurban development, defined as development occurring outside municipal boundaries, is expanding more rapidly than is urban or suburban development in Colorado. In that state, exurban housing developments often are situated near park, wilderness, or other protected lands. The impacts of such development on wildlife are not well understood.

Jennifer Fraterrigo and John Wiens recently studied bird communities of the Colorado Rocky Mountains along a gradient of exurban development. They selected 17 study sites on the eastern slope of the mountains in north-central Colorado. Six sites contained no development. Eleven sites contained development along a gradient of building density up to 1.1 buildings/ha.

Fixed-radius (70 m) point counts were used for surveying birds during the breeding season, 24 May – 19 July 1999. Point count locations were randomly placed within study sites and each was sampled twice in the early morning hours. Count time at each point was 5 minutes.

Land cover was classified as one of five types: dense conifer forest, sparse conifer forest, grass, aspen, or open water. Vegetation characteristics within a 10-m radius of sample points were recorded as percent canopy cover; percent subcanopy cover; percent ground cover; number of snags, stumps, and undisturbed down wood; and foliage height.

Fifty-nine bird species were recorded in the study. The most abundant and widespread were mountain chickadee (*Poecile gambeli*), broad-tailed hummingbird (*Selasphorous platycercus*), American robin (*Turdus migratorius*), and dark-eyed junco (*Junco hyemalis*). Bird abundance increased as development intensified, presumably because of increased environmental heterogeneity. Granivore abundance and richness in developed areas was higher than abundance and richness of insectivores, a pattern documented in other studies. Species that increased in abundance with development were brown-headed cowbird (*Molothrus ater*), Cassin's finch (*Carpodacus cassinii*), common grackle (*Quiscalus quiscula*), house sparrow (*Passer domesticus*), and white-crowned sparrow (*Zonotrichia leucophrys*). Species that decreased with development were black-headed grosbeak (*Pheucticus melanocephalus*), Hammond's flycatcher (*Empidonax hammondii*), northern flicker (*Colaptes auratus*), and warbling vireo (*Vireo gilvus*).

Species nesting on the ground, in snags, and in coniferous or deciduous trees were more prevalent in undeveloped sites. Snags, down wood, and stumps were negatively associated with building density. The authors concluded: "Overall, our results suggest that development at low densities can favor habitat generalists. Similar patterns have been observed in more urbanized areas. If exurban development persists as a popular form of settlement in the Rocky Mountains, a regional plan for protecting avian habitat and limiting development dispersion will be necessary to maintain native bird communities."

Reference: Fraterrigo, J. M., and J. A. Wiens. 2005. Bird communities of the Colorado Rocky Mountains along a gradient of exurban development. *Landscape and Urban*

Planning 71:263-275.

Movement of Green Frogs During the Breeding Season

Many amphibians need both water and terrestrial habitat for different stages of their growth and development. Breeding, egg-laying, and larval development occur in water but adults live in upland habitat. Animals must be able to move to and from water and uplands. Biologists know little about such movement.

Gayle Birchfield and Joseph Deters of the University of Missouri recently studied how northern green frogs (*Rana clamitans melanota*) move through upland habitats during the breeding season. Their work focused on the University of Missouri golf course pond (less than 0.1 ha in size) and a second pond located some 600 m away. Birchfield and Deters captured 27 adult frogs from the golf course pond and 9 frogs from the second pond and moved the animals individually to one of 14 release sites in nearby upland habitat. Release sites offered frogs a choice of movement through three habitat types: 1) short grass (maintained by mowing to about 8 cm), 2) tall grass/herbaceous vegetation (unmowed and averaging some 34 cm, and 3) forest (dominated by oaks). Average distance to pond of capture was 281 m and average distance to a stream was 313 m. The hindquarters of each frog were coated with a powdered fluorescent pigment and the frog was released following a procedure designed not to bias its direction of movement. The researchers returned to a release site 1-2 hours later to locate the trail with aid of a portable ultraviolet lamp. The fluorescent pigment typically produced a clear trail of 30-40 m in about 1-3 hours.

Seventy-four successful trials were conducted with the 36 frogs. Frogs clearly selected both grass habitats as movement corridors. They used short grass 40% more than expected and tall grass 19% more than expected based on habitat availability. Forest was used less than expected. On release, it appeared that frogs did not orient toward the source pond or nearby creeks. The authors concluded: "Northern Green Frogs migrating to potential breeding areas may benefit from patches or strips of more sheltered habitat (e.g., tall grasses and shrubs) between ponds and terrestrial activity sites, especially upland aquatic areas. Adjacent patches of tall vegetation such as perennial grasses would enable frogs to travel quickly through exposed areas while maintaining proximity to refuge in case of predator approach or extreme environmental conditions at daybreak."

Reference: Birchfield, G. L., and J. E. Deters. Movement paths of displaced northern green frogs (*Rana clamitans melanota*). *Southeastern Naturalist* 4:63-76.

Backyard Wildlife Management Practices

Many popular books are available that describe a variety of management techniques for homeowners interested in wildlife gardening in their backyards. Little experimental research has been carried out, however, testing the effectiveness of many recommended techniques.

Kevin Gaston of the University of Sheffield (UK) and three of his colleagues at that institution recently tested experimentally five recommended techniques. Their research was conducted in the city of Sheffield, in central England, where most work was carried out in 34 private gardens.

Gaston and his colleagues evaluated: 1) artificial nest sites for solitary bees and wasps, 2) artificial nest sites for bumblebees, 3) small ponds, 4) dead wood, and 5) patches of nettles (*Urtica dioica*) for butterfly larvae. For 1 and 2, the researchers evaluated a variety of designs recommended in popular educational literature involving tin cans, wooden blocks with drilled holes, plastic drainage pipe, terra cotta flowerpots, and small wooden boxes. Structures were placed in gardens March-April of 2000, 2001, and 2002, and assessments of use made the following autumn of each year.

Small ponds consisted of plastic planter troughs 700 mm by 300 mm, and 250 mm deep. The planters were not sunk into the ground, but a piece of stiff plastic mesh was used as a ramp for terrestrial organisms. A layer of horticultural grit sand was added to the bottom of ponds and they were filled with tap water. Four 150-mm lengths of Canadian waterweed (*Elodea canadensis*) and 300 water fleas (*Daphnia* sp.) were added to each pond (water fleas were added 1 week after filling with water). Ponds were established in July 2000.

Piles of freshly cut birch (*Betula pendula*) logs were placed in 20 gardens in November 2000. Piles consisted of six logs, each 600-800 mm long and 70-150 mm in diameter. They were evaluated in October 2002.

Nettle patches were created by planting nettle rhizomes in 0.02-m^3 tubs. One tub was placed in the garden border of each of 20 gardens in June 2000. In

2002, patch size was studied by grouping four tubs in half of the gardens.

Fourteen species of solitary bees and wasps used artificial nesting structures and some use occurred in all 20 gardens where structures were placed. Several species were of particular conservation interest. The ruby-tailed wasp (*Pseudomalus violaceus*) was the second record in Yorkshire, probably a reflection of range expansion. The insect is not rare. Another species, the red mason bee *Osmia rufa*, is being promoted as an important pollinator. Two nest types were most widely used. For one design, sections of bamboo were packed in plastic drainage pipe (110 mm diameter, 200 mm long) capped at one end. Bamboo sections had a 4-8 mm hole diameter and each section was about 180 mm long, resulting in 50-80 holes per drainage pipe unit. For the second design, 4-mm blind holes were drilled to a depth of about 90 mm in untreated sawn blocks of red pine 50 mm by 50 mm by 100 mm, resulting in 25 holes per block.

Artificial nest sites were not used by bumblebees even though bumblebees occurred widely in urban gardens in Sheffield. The authors speculated that nest sites for bumblebees may not be limited, or sites chosen for nest placement may have been inappropriate, or the artificial structures may have been unsuitable.

Chironomid midges and mosquitoes colonized ponds quickly but little use was noted by other species, even common ones in the area. Some frogs were attracted to the ponds and the authors concluded that the small water bodies were viable. Natural colonization appeared slow and the authors suggested that introductions of aquatic organisms (transfer of material between ponds) may be necessary to obtain a desired level of aquatic organism use. Also larger ponds might be better.

A wide variety of small organisms used the piles of dead wood, including earthworms, snails, slugs, springtails, and spiders. Without active management this type of habitat is probably missing from most gardens. According to the authors: "The tendency for municipal green spaces to be 'tidied up' means that this habitat is also much reduced in the wider urban environment."

The nettle patches were little used by butterfly caterpillars, perhaps because the nettles are not a limiting resource or the patch size tested was too small.

Gaston and his colleagues concluded that creating nettle patches and adding artificial bumblebee nests in gardens were not effective management practices. The artificial nests tested for solitary bees and wasps were, however, highly effective. They resulted in rapid and widespread use.

Reference: Gaston, K. J., R. M. Smith, K. Thompson, and P. H. Warren. 2005. Urban domestic gardens (II): experimental tests of methods for increasing biodiversity. *Biodiversity and Conservation* 14:395-413.

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Capturing Deer

Shawn Locke of Texas A & M University and eight of his colleagues recently described use of an effective, portable drive-net for capturing urban white-tailed deer (*Odocoileus virginianus*). These investigators used nylon nets 12-50 m long and 2-6 m high to capture one or two deer at a time. A nylon rope was threaded through the top of the net to aid in rapid deployment. Typically one end of the net was secured to a stationary object such as a fence post or tree. The net was extended perpendicular to the fence line or anticipated direction of deer and laid on the ground. The net was placed so that deer funneled into it by buildings, fence lines, waterways or some other physical structure. The capture location sometimes was baited with corn to enhance area use by deer. One person remained at the free end of the net to pull it up when deer, driven by 2-5 people, were 1-1.5 m from the net. When the deer hit the net the net handler pulled the net down and behind the deer. An alternative to this set up where a fence post or tree was not available was to have a net handler on each end of the net. Once a deer was in the net it was physically restrained and a hood placed over its head to reduce stress on the animal.

Net set up as described here generally took 5-10 minutes. The technique can be used to capture deer for immunocontraception, radiomarking, or other purposes. The authors used the technique for capturing white-tailed deer at NASA Johnson Space Center near Houston, Texas, and for Florida Key deer (*O. v. clavium*) on Big Pine Key, Florida. From 1998-2003, Locke and his colleagues captured 76 white-tailed deer with no mortalities or post-capture myopathy. Nor were non-target animals captured. The researchers concluded: "We found the portable drive-nets to be an inexpensive and safe alternative for capturing free-ranging white-tailed deer in urban environments."

Reference: Locke, S. L., M. F. Hess, B. G. Mosley, M. W. Cook, S. Hernandez, I. D. Parker, L. A. Harveson, R. R. Lopez, and N. J. Silvy. 2004. Portable drive-net for capturing urban white-tailed deer. *Wildlife Society Bulletin* 32:1093-1098.

Problem Black Bears

Black bears (*Ursus americanus*) can sometimes create problems for people at the urban-wildland interface, particularly where people feed bears either intentionally or unintentionally. Non-lethal techniques for dealing with so-called "nuisance" bears are generally more acceptable to residents than are lethal techniques. Little information is available, however, on the effectiveness of deterrent techniques on bear behavior. Do such techniques keep bears from areas where people do not want them?

This question was of interest to Jon Beckmann of the University of Nevada and two of his colleagues. Beckmann and his associates studied the effectiveness of the following six deterrent techniques used in combination for keeping bears from unwanted areas: 1) rubber buckshot, 2) rubber slugs, 3) pepper spray, 4) cracker shells, 5) dogs, and 6) loud noises. Work was conducted in the Lake Tahoe Basin of the Sierra Nevada range where 62 nuisance bears were trapped from 1 July 1997 to 1 April 2002, fitted with radiocollars, and moved 1-75 km away from the capture site for release.

Radiocollared bears were randomly assigned to one of three groups: 1) harassment without dogs, 2) harassment with dogs, and 3) control. Bears assigned to group 1 were exposed to five deterrent techniques (listed above) in combination at the release site. Bears assigned to group 2 received the same treatment as group 1 bears, plus were chased by dogs. Bears assigned to group 3 were released without harassment. Following release, bears were located regularly by use of aircraft.

Fifty-seven of the 62 bears returned to the urban patch where they were captured; 53% of them returned in less than 30 days. Bears assigned to group 2 returned in an average of 154 days. Bears assigned to group 1 returned in an average of 88.4 days, and control bears returned in an average of 64.6 days. Return rates among the three groups were not signifi-

cantly different because of considerable variation in the data. These researchers concluded: "Our study suggests that bears that were human-food (i.e., garbage) conditioned and habituated to living near or in urban-wildland interface areas were unlikely to alter their behavior in response to the deterrent techniques currently adopted by most state and federal agencies." In place of using these techniques, Beckmann and his colleagues recommended use of an aggressive public education campaign, along with promulgation of laws, ordinances, and regulations against feeding, and use of bear-proof garbage containers. The authors cited three cases where such efforts were effective in reducing bear-people conflicts.

Reference: Beckmann, J. P., C. W. Lackey, and J. Berger. 2004. Evaluation of deterrent techniques and dogs to alter behavior of "nuisance" black bears. *Wildlife Society Bulletin* 32:1141-1146.

Bird Conservation on Golf Courses

The summer 2005 issue of the Wildlife Society Bulletin (Volume 33, Number 2) contained a special section of 10 papers focused on bird conservation and golf courses. Six of the papers are briefly highlighted below. The first four focus on bird communities and the last two on individual species.

Birds of Conservation Concern in Virginia

Joshua LeClerc and Daniel Cristol of the College of William and Mary, Williamsburg, Virginia recently studied the importance of golf courses serving as habitat for birds of conservation concern in the state. These investigators surveyed breeding birds on 87 golf courses from the three major physiographic provinces of Virginia and compared results with reference landscapes most likely to have been present before golf-course construction. Bird data were collected 1-16 June 2002.

Relative abundance of birds of conservation concern was 50% higher for forested reference landscapes than for golf courses (a significant difference). Agriculture and residential reference landscapes also had higher mean abundances than golf courses but the differences were not significant. Based on these data, the researchers suggested that golf courses may have a negative overall effect on abundance of birds of conservation concern, even if golf courses replace agriculture on suburban residential areas. On a positive note, however, LeClerc and Cristol found wide variation in bird abundance among golf courses. They studied nine courses with highest bird conservation value and 15 courses with lowest bird conservation value and found that the best courses had about twice the proportion of forest cover of the poorest courses. Based on these data the researchers stated: "Thus, there is potential for new golf courses to play a larger role in regional bird conservation if they are designed to resemble the courses that did provide habitat for species of conservation concern." LeClerc and Cristol concluded: "Our results suggested that 1) regional planners should not expect typical golf courses to provide more habitat for birds of conservation concern than alternative land uses, including residential or agricultural uses; and 2) designers of golf courses in this region can increase the conservation value of courses by increasing the amount of forested land on the course."

Reference: LeClerc, J. E., and D. A. Cristol. 20005. Are golf courses providing habitat for birds of conservation concern in Virginia? *Wildlife Society Bulletin* 33:463-470.

Breeding Birds in South Carolina

Stephen Jones of Clemson University, Clemson, South Carolina and three of his colleagues recently studied breeding bird use of golf courses in the state. They focused on 24 golf courses, ranging from low to high landscape alteration, in the northern coastal plain of South Carolina. In addition to the golf course proper, they included associated development such as residential housing for each course resulting in study of 24 "golf course landscape units." Birds were surveyed during the breeding seasons of 2000 and 2001 using 50-m radius point counts, each count of 5-minute duration in the early morning hours.

Three bird measurements—total number of species, number of neotropical migrant species, and species of high conservation concern—declined as landscape alteration increased. Greater amounts of forest and "disturbance patches" (grassy openings and scrub-shrub patches) and less managed turfgrass resulted in greater numbers of species in all three measurements. The authors concluded: "Enhancement of avian habitat is possible through increasing the amount of forest and disturbance patches and reducing the amount of managed turfgrass."

Reference: Jones, S. G., D. H. Gordon, G. M. Phillips, and B. R. D. Richardson. 2005. Avian community response to a

golf-course landscape unit gradient. *Wildlife Society Bulletin* 33:422-434.

Waterbirds in Florida

Golf course ponds in Florida are created for irrigation purposes and to help control flooding. Researchers LeAnn White and Martin Main of the University of Florida recently studied the habitat value of such ponds for waterbirds. These investigators focused on 183 ponds on 12 golf courses in southwest Florida. Annual surveys of waterbirds were made near dawn and dusk January through April 2001 and 2002. A variety of habitat measurements also were made.

Forty-two species were recorded at the ponds. Foraging was the most common behavior noted and made up about 46% of all activity observations. Nesting was the least common activity observed. The five most abundant species observed were double-crested cormorant (*Phalacrocorax auritus*), anhinga (*Anhinga anhinga*), little blue heron (*Egretta caerulea*), great egret (*Ardea albus*), and snowy egret (*Egretta thula*).

Effective foraging area, defined as water not more than 40 cm deep, was an important habitat variable. This shallow-water area was used by waders such as the great egret and also by dabbling ducks such as the mottled duck (*Anas fulvigula*). The authors concluded: "Increasing the shallow littoral shelf on golf-course ponds, therefore, would increase foraging habitat for a diversity of species that require shallow water areas for feeding." Planting trees along shorelines would benefit herons, egrets, ibis, cormorants, anhingas, and wood ducks.

Reference: White, C. L., and M. B. Main. 2005. Waterbird use of created wetlands in golf-course landscapes. *Wildlife Society Bulletin* 33:411-421.

Birds in New Mexico

Some 95% of western riparian habitat has been lost or degraded over the past 100 years. Many bird species dependent on such habitat have been extirpated or reduced in number. Do golf courses in the region provide habitat characteristics that can substitute for natural riparian habitat for birds? This question was of recent interest to Michele Merola-Zwartjes and John DeLong of the U. S. Forest Service.

These investigators studied breeding birds on and off golf courses in the high desert region of Albuquerque, New Mexico. Birds were surveyed by 100-m radius point counts during the breeding season (mid-April through July) of 2001 and 2002. Each site (5 golf courses and 5 paired nearby natural desert reference sites) was surveyed 8 times. Counts began 15 minutes after sunrise and were completed by 1000 hours. Five minutes were spent at each point recording birds seen or heard. Various measurements of vegetation structure and composition also were recorded.

Bird abundance was greater on 4 of the 5 golf courses than on the reference sites. Also, species richness and species diversity were higher on 3 of 5 golf courses. Indigenous species richness was higher on all 5 golf courses. Most of these were relatively common generalist species. Some of the desert specialist species such as scaled quail (*Callipepla squamata*) and burrowing owl (*Athene cunicularia*) were not recorded on any of the golf courses. The authors concluded: "Our study and others suggest that the conservation value of golf courses in this desert region could be improved to support greater numbers of native birds and exclude more invasive exotics or pest species by increasing landscape complexity and vertical structure in the out-of-play areas on the courses, and by increasing the extent and usage of native plants."

Reference: Merola-Zwartjes, M., and J. P. DeLong. 2005. Avian species assemblages on New Mexico golf courses: surrogate riparian habitat for birds? *Wildlife Society Bulletin* 33:435-447.

Red-headed Woodpeckers in Ohio

Red-headed woodpeckers (*Melanerpes erythrocephalus*) have declined sharply throughout the central and eastern United States during the past century. Likely causes have been forest maturation, fire suppression, decline of oak savannahs and orchards, loss of the American chestnut (*Castanea dentata*), and clean farming. In urban areas, removal of dead limbs and trees are probable factors.

Because of their open, savannah-like appearance, can golf courses provide habitat for the species? This question was of interest to Paul Rodewald, Melissa Santiago, and Amanda Rodewald of the Ohio State University. During late spring and summer of 2002 and 2003, these investigators surveyed red-headed woodpeckers on 100 golf courses in northern and central Ohio. Pre-recorded calls and drums were used to increase detectability of the birds. Surveys were conducted from 6-11 am and each course was sam-

pled once.

One hundred fifty-eight red-headed woodpeckers were recorded on 26 golf courses. Courses used by the birds had trees that were 12% larger in diameter and about twice the number of hard-mast trees (oak, hickory, beech), snags, and dead limbs as courses where the birds were not detected. Forty-nine active nests were located on 17 courses. Most nests were in dead limbs of live trees (67%) with the remainder in snags (33%). Several species of trees were used for nests with maples (29%) and oaks (22%) most common.

Fledging rates of 1 or more young were similar for nests on golf courses (75%) and off golf courses (80%). The authors concluded: "Our findings illustrate that highly modified habitats, such as golf courses, could play a valuable role in the conservation of wildlife associated with open, disturbance-maintained woodlands, including the declining red-headed woodpecker." They caution, however, that pesticides used on golf courses may pose harm to the birds and pesticide safety should be evaluated.

Reference: Rodewald, P. G., M. J. Santiago, and A. D. Rodewald. 2005. Habitat use of breeding red-headed woodpeckers on golf courses in Ohio. *Wildlife Society Bulletin* 33:448-453.

Burrowing Owls in Washington

Burrowing owls (*Athene cunicularia*) are different from "typical" owls in that they nest underground and they are active during the day. They inhabit short-grass, open areas and most do not construct their own burrow, depending instead on burrows of other species such as prairie dogs (*Cynomys* spp.), badgers (*Taxidea taxus*), ground squirrels (*Spermophilus* spp.), and coyotes (*Canis latrans*). Burrowing owl populations have declined throughout much of their North American range and decline of available burrow sites may be a contributing factor. Artificial burrows can be constructed and several studies have shown that birds will use them.

Matthew Smith of the University of Arizona and two of his colleagues recently studied the potential of artificial nests on golf courses for assisting burrowing owls in south-central Washington. During 2001-2004, these investigators monitored more than 175 natural burrows off golf courses, 14 natural burrows on golf courses, 86 artificial burrows off golf courses, and 130 artificial burrows on golf courses.

Most artificial burrows on golf courses were not used. Two courses had owls nesting in natural burrows before the study and owls used artificial burrows only on those two courses. The authors concluded: "Hence, large-scale efforts to install artificial burrows on golf courses do not appear to be an efficient use of resources. Rather, installing artificial burrows on golf courses that have nesting owls nearby appears to be the only way that golf courses can help augment existing nesting opportunities." Specific recommendations for installing burrows on golf courses included: 1) install burrows at least 10 m from all maintained areas and more than 40 m from a sprinkler to avoid flooding of nests and only where nesting birds are within about 0.5 km, 2) use a larger chamber than the size used in the current study (22-liter bucket) and install multiple satellite burrows in the area rather than a single burrow, and 3) maintain the entrance hole so that it does not protrude from the ground and inhibit young birds from re-entering the nest burrow when they venture outside.

Reference: Smith, M. D., C. J. Conway, and L. A. Ellis. 2005. Burrowing owl nesting productivity: a comparison between artificial and natural burrows on and off golf courses. *Wildlife Society Bulletin* 33:454-462.

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Foraging Habitat of Indiana Bats

The Indiana bat (*Myotis sodalis*) is a federally listed endangered species. Biologists know more about its roosting site preferences than about foraging habitat. Dale Sparks of Indiana State University and three of his colleagues recently studied foraging behavior of this bat on lands managed by the local airport authority near the Indianapolis International Airport, Indiana. These investigators classified available habitat into eight categories: woodland, agricultural crops, pasture, open water, low-density residential housing, high-density residential housing, parks, and commercial areas.

Sparks and his colleagues captured 11 bats with mist nets and attached small transmitters to their backs with colostomy glue ("skinbond"). Bat foraging activity was monitored and habitats used for foraging compared with habitats available.

Bats showed a preference for woodlands as foraging habitat, using such habitat about twice as often as woodland availability would suggest. Agricultural fields also were important as bats spent about 50% of their time foraging over these lands. Bats avoided densely developed land and open water.

Three bats roosted in Pioneer Park in Mooresville, Indiana and bats did forage over low-density residential areas, leading the investigators to suggest: "Maintenance of suitable roost trees within parks and areas of low-density residential development may provide additional roosting and foraging habitat for this species in or near major metropolitan areas. As such, conservation value of these habitats is deserving of further study." Sparks and his colleagues concluded: "...conservation strategies of this, and probably other populations of bats near urban areas, must give serious consideration to the preservation of appropriate foraging grounds and wooded travel corridors in proximity to potential roost locations."

Reference: Sparks, D. W., C. M. Ritzi, J. E. Duchamp, and J. O. Whitaker, Jr. 2005. Foraging habitat of the Indiana bat (*Myotis sodalis*) at an urban-rural interface. *Journal of Mammalogy* 86:713-718.

Bats in Mexico City

Rafael Avila-Flores of York University, Toronto, Ontario, Canada and Brock Fenton of The University of Western Ontario, London, Ontario, Canada recently added to our knowledge base regarding bat use of urban habitats. These investigators studied insectivorous bat activity in various urban habitats in Mexico City and related use to insect abundance in the various habitats. Habitats studied included large parks (greater than 100 ha), small parks (less than 5 ha), open areas illuminated with white-light lamps, and highly populated concrete-dominated sites. Bat use of urban habitats was compared to bat use of natural forest habitat outside the city.

Avila-Flores and Fenton monitored study sites for bat activity every 2 weeks from late May to late August 2002. Echolocation calls were recorded during 5 min or 10 min surveys at a site. Insect relative abundance also was estimated at each site.

These investigators reported a reduction in species richness but an increase in abundance of some opportunistic species with urbanization. Molossids, particularly the Brazilian free-tailed bat (*Tadarida brasiliensis*) and the big free-tailed bat (*Nyctinomops macrotis*), may benefit most from urban features. Roost sites in created crevices of bridges and buildings may be particularly important. Vespertilionid bats, such as the big brown bat (*Eptesicus fuscus*) and mouse-eared bats (*Myotis* spp.), were found almost exclusively in large parks or natural forest. Insect abundance was higher in large parks and natural forest and was significantly correlated with bat activity and with the number of taxa recorded per site. The authors concluded: "Although some species successfully exploited highly urbanized sites, large areas with vegetation are needed to maintain the most diverse insectivorous bat fauna in Mexico City."

Reference: Avila-Flores, R., and M. B. Fenton. 2005. Use of spatial features by foraging insectivorous bats in a large urban landscape. *Journal of Mammalogy* 86:1193-1204.

Counting Suburban Deer

Forward-Looking Infrared (FLIR) cameras are heat-sensing devices that can differentiate warm objects from cooler surroundings. Aircraft-mounted FLIR cameras have been used in recent years to count deer in rural areas, but the technique has not been evaluated for use in suburban areas.

David Drake of Rutgers University, New Jersey, and two of his colleagues recently compared the FLIR technique with a road count survey in suburban New Jersey. The road count technique involves one or more individuals counting deer from a vehicle along assigned sections of road. The study was conducted on a 324-ha fenced parcel of the Duke Farms Foundation in Somerset County, New Jersey. For road counts, the study area was divided into five regions and two or three road sections (transects) were selected for deer counts per region. Each transect was 0.4 km long and vehicle speed along the transect was 8-16 km/hr. Starting time for the survey was 1 hr before sunset and each transect took about 20 minutes to complete. One observer was assigned to each region and all observers began counts at the same time. So, the complete count took about 40-60 minutes. Four counts were conducted between June 2001 and January 2002.

Three FLIR flights were conducted on 9 January 2002 between 2000 and 2330 hrs. Each flight took about 45 minutes to complete. A FLIR Series 2000F infrared camera was used at an altitude of 152 m and speed of 80 km/hr. Transect observation width was 129 m so a series of parallel lines 129 m apart were flown for complete coverage of the study area. A VHS videotape recorded data and was analyzed for deer after flights were completed.

Drake and his colleagues reported no significant difference in the number of deer counted with each technique. Road counts averaged 229 deer and FLIR 214 deer. The total number of deer on the study area was unknown and was not estimated, so it was unknown how well each technique represented the total population of deer on the area. Nonetheless, the investigators believed that FLIR surveys caused minimal disturbance to people and deer and aerial survey provided easy access to deer habitat, an important point in suburban areas with multiple small parcels under private ownership. On the downside, FLIR cost 8 times more than road counts. Visibility and temperature were more constraining for FLIR than for road counts and FLIR counts were only appropriate during winter when leaves were off deciduous trees. Scheduling of aircraft under the above constraints is not always easy. And fewer deer were counted as deer moved from open areas to forest cover during the course of an evening. Because of this movement pattern, Drake and his colleagues recommended that FLIR surveys be conducted shortly after sunset or just before sunrise, when deer are most active. The authors concluded: "We recommend using FLIR in suburban areas dominated by private property where ground access or site distances may be limited, or where conducting a road count at a slow rate of speed may cause traffic congestion."

Reference: Drake, D., C. Aquila, and G. Huntington. 2005. Counting a suburban deer population using Forward-Looking Infrared radar and road counts. *Wildlife Society Bulletin* 33:656-661.

Repelling Urban Mule Deer and Elk

Biologists continue to search for new, nonlethal tools and strategies for managing large ungulates in metropolitan areas where hunting is not safe, practical, or socially acceptable. Kurt VerCauteren, John Shivik, and Michael Lavelle of the U. S. Department of Agriculture recently tested The Critter Gitter™ for repelling mule deer and elk in Colorado. As advertised, The Critter Gitter™ is a battery-operated, motion-activated electronic frightening device that activates when animal movement or body heat is detected within 50 m of the unit. At that time, an alarm is sounded and a red light flashes.

VerCauteren and his colleagues conducted their study on a private ranch near residential areas of the city of Estes Park, Colorado. Each of five sites contained two bales of alfalfa 60 m apart. One bale at each site had either one Critter Gitter™ centered on top of the bale or two devices placed 2 m from each end of the bale. Every 2-3 days bales were checked for feeding activity by elk or mule deer (to a total of 10 check days). The researchers also randomly monitored sites with motion-activated video systems.

Study results showed that The Critter Gitter™ was not effective in repelling feeding activity by mule deer and elk. Animals had to approach to within 2 m of the bales before the devices triggered. For all video monitored events, elk and mule deer fed on the hay bales while the devices were activated. With regard to The Critter Gitter™, the authors concluded: "...because they failed to protect the hay, we speculate that they also would be ineffective in deterring

elk or mule deer from feeding in gardens, golf courses, ornamental plantings, fertilized lawns, or other similar areas."

Reference: VerCauteren, K. C., J. A. Shivik, and M. J. Lavelle. 2005. Efficacy of an animal-activated frightening device on urban elk and mule deer. *Wildlife Society Bulletin* 33:1282-1287.

Long-term Bird Study in Waco, Texas

Long-term wildlife studies are infrequent, often because of the difficulty of sustaining long-term funding for such work. Frederick Gehlbach recently reported results of such a study focused on birds in Woodway Ravine, a suburb of Waco, Texas. Over the years, the ravine was surrounded by suburban development and the rate of development was measured by the number of residential building permits issued by the city for the ravine-border area. Vegetation was quantified, and birds were spot-mapped in the early morning and late evening hours one or two times per week from late February to mid-June (mid-May after 1994), with two or three spot checks in early July from 1974-2003. Ten years (1964-1973) of pre-census data also were collected. Cats and dogs were counted in study plots during bird counts, and pets were surveyed in bordering households.

Over the 30-year census period, as the number of houses bordering the study plots increased, permanent resident species increased and summer resident species decreased. Of the eight species that showed stable populations, six were permanent residents. Two, the ruby-throated hummingbird (*Archilochus colubris*) and great crested flycatcher (*Myiarchus crinitus*) were marginally stable. Six species declined. Five of these were extirpated 14-19 years into the study and one (yellow-billed cuckoo, *Coccyzus americanus*) was still present after 30 years. Three of these six species were summer residents. Six species increased and four, downy woodpecker (*Picoides pubescens*), white-winged dove (*Zenaida asiatica*), Bewick's wren (*Thryomanes bewickii*), and house finch (*Carpodacus mexicanus*), were added as new species to the area. Only one of the latter 10 species was a summer resident (white-eyed vireo, *Vireo griseus*). Roaming cats, but not dogs, increased during suburban development. The author stated: "Thus, more permanent residents utilized or tolerated sewerline construction and reforestation, planted vegetation, dead trees, bird feeders, baths, boxes, and climatic warming; whereas, summer residents were depressed or deposed by reduced habitat area, sewerlines, novel predators, human intruders, and the warmer weather."

Gehlbach suggested a method for easily assessing the natural avifaunal value of an area. The process involves comparing the ratios of summer resident species to permanent resident species and open nesting species to all nesting species. Larger fractions of summer residents and open nesting species reflect more natural value and also greater vulnerability. Managers should place higher conservation priority on habitat sustaining more summer residents and open nesting species.

Reference: Gehlbach, F. R. 2005. Native Texas avifauna altered by suburban entrapment and method for easily assessing natural avifaunal value. *Bulletin of the Texas Ornithological Society* 38:35-47.

Bird Diversity

Does the uniformity of the urban environment result in similar bird species communities worldwide? This question is of interest to three European researchers who recently tested the effects of latitude and degree of urbanization on breeding bird communities. Philippe Clergeau of the National Agronomy Research Institute, Rennes, France and four of his colleagues studied bird communities of different towns in three European countries—Italy in the south (Mediterranean climate), France in the middle (temperate climate), and Finland in the north (boreal climate). Measures of bird community similarity and species richness were determined for town centers, suburbia, and periurban areas of the three countries. The researchers reviewed five to eight studies from each country and calculated similarity indices for pairwise comparison between sectors within each town and for different localities for the same sector. Birds also were grouped into three functional groups—diet, feeding habitats, and nesting height.

Species richness decreased from an average of 89.5 species in the periurban sector to 42.6 in suburbia to 24.8 in the town center sector. About 43% of species in the regional species pool (periurban sector) were found in town centers. Greatest similarity was between suburbia and town center. Greater similarity was found between periurban and suburbia than between periurban and town center sectors. The most common species in suburban and town center sectors were goldfinch (*Carduelis carduelis*), feral pigeon

(*Columba livia*), great tit (*Parus major*), and common swift (*Apus apus*).

Latitude had more effect on community composition in periurban sectors than in suburban or urban center sectors. Some 89% of differences in bird communities in periurban sectors among the three countries was explained by latitude. Latitude explained 71% of community differences in suburban sectors and 52% of differences in town center sectors. Four non-native species were recorded in Italy, one in France, and none in Finland.

Some differences were noted among functional groups. For all towns studied, species nesting on the ground were less abundant in town center than in suburban or periurban sectors. Also, fewer species feeding in bush-shrub habitat were found in town centers. The authors cautioned that similar habitats need to be compared across latitudes. They concluded: "Urbanisation appeared a cause of taxonomic homogenisation of the avifauna but the effects of latitude and urban habitat diversity may make generalisation difficult."

Reference: Clergeau, P., S. Croci, J. Jokimäki, M.-L. Kaisanlahti-Jokimäki, and M. Dinetti. 2006. Avifauna homogenisation by urbanisation: Analysis at different European latitudes. *Biological Conservation* 127:336-344.

Peregrine Falcons in New York City

Before the era of DDT (until 1946), peregrine falcons (*Falco peregrinus*) rarely nested in New York City, and nocturnal activity was not reported, although peregrines are known to hunt at night. By the mid-1990s, year-round resident peregrines in the city were not uncommon.

Robert DeCandido of Hawk Mountain Sanctuary, Orwigsburg, Pennsylvania, and Deborah Allen of Peter Stuyvesant Station, New York City recently studied nocturnal hunting by peregrine falcons in New York City. Most work was carried out between 4 August and 13 November 2004. Some observations also were made 8-15 May 2002 and 19 April-25 May 2004. Observations were made from the outside observation deck of the Empire State Building in midtown Manhattan.

During autumn 2004, bird migration generally began 30-90 minutes after sunset and observations continued until 10:45 p.m. during August-October and until 11:45 p.m. in November. During spring 2002, observations were made from 7:00 p.m. until 9:00 p.m., and in spring 2004, just before sunset until 10:45 p.m. Observers used 10X binoculars in the study.

In autumn 2004, peregrine falcons were seen hunting or flying at night on 53% of evenings that observers spent at the Empire State Building. Peregrines were significantly more likely to be present on evenings when more than 50 migrants were counted in migration. Peregrine hunting success rate was 33% and prey was in the warbler-to-oriole size class. Much less hunting activity was noted in the spring. In spring, fewer nocturnal migrants pass over the city and most pass higher above the city on warm air currents. The authors concluded: "Skyscrapers provide hunting perches at altitudes often flown by nocturnal migrants, and disorientation caused by the lights sometimes results in birds circling skyscrapers and possibly becoming more vulnerable to predation by falcons."

Reference: DeCandido, R., and D. Allen. 2006. Nocturnal hunting by peregrine falcons at the Empire State Building, New York City. *The Wilson Journal of Ornithology* 118:53-58.

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